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Subtask 1.7: Statewide Planning Efforts with Flood Resilience Recommendations

North Carolina Flood Resiliency Blueprint

Prepared for the North Carolina Department of Environmental Quality by AECOM

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Table of Contents

Definitions

A comprehensive list of definitions applicable to multiple Flood Resiliency Blueprint documents is provided in a separate document.

Acronyms

BRIC – Building Resilient Infrastructure and Communities

CAMA – Coastal Area Management Act

CCAP – Coastal Change Analysis Program

CDBG-DR – Community Development Block Grant-Disaster Recovery

CDBG-MIT – Community Development Block Grant-Mitigation

CHPP – Coastal Habitat Protection Plan

DEMLR – Division of Energy, Mineral, and Land Resources

DMF – NC Division of Marine Fisheries

DOT – Department of Transportation

DPR - Division of Parks and Recreation

DWR – Division of Water Resources

EO – Executive Order

ESHPF – Emergency Supplemental Historic Preservation Fund

FAIR data – data which meet principles of Findability, Accessibility, Interoperability, and Reusability

FEMA – Federal Emergency Management Agency

FIMAN – Flood Inundation Mapping and Alert Network

FIMAN-T – Flood Inundation Mapping and Alert Network-Transportation

FY – Fiscal Year

GIS – Geographic Information System

IRT – Interagency Resilience Team

IT – Information Technology

LEED – Leadership in Energy and Environmental Design

NAP – Noninsured Crop Disaster Assistance Program

NC – North Carolina

NCCF – North Carolina Coastal Federation

NCCSR – North Carolina Climate Science Report

NCDA&CS – North Carolina Department of Agriculture and Consumer Service

NCDEQ – North Carolina Department of Environmental Quality

NCDEQ-DWI – North Carolina Department of Environmental Quality-Division of Water Infrastructure

NCDHHS - North Carolina Department of Health and Human Services

NCDIT – North Carolina Department of Information Technology

NCDMVA – North Carolina Department of Military and Veterans Affairs

NCDNCR – North Carolina Department of Natural and Cultural Resources

NCDOA – North Carolina Department of Administration

NCDOC – North Carolina Department of Commerce

NCDOR – North Carolina Department of Revenue

NCDOT – North Carolina Department of Transportation

NCDPS – North Carolina Department of Public Safety

NCEM – North Carolina Emergency Management

NCORR – North Carolina Office of Resilience and Recovery

NERR – National Estuarine Research Reserve

NFIP – National Flood Insurance Program

NGO – Non-Government Organization

NOAA – National Oceanic and Atmospheric Administration

NWL – Natural and Working Lands

OSA – Office of State Archaeology

RAPT – Resilience Analysis and Planning Tool

RCCP – Resilient Coastal Communities Program

RISE – Regions Innovating for Strong Economies and Environment

RSF – Recovery Support Function

SAV – Submerged Aquatic Vegetation

SCM – Stormwater Control Measure

SDRTF – State Disaster Recovery Task Force

SERA – State Emergency Response Application

SHPO – State Historic Preservation Office

TAG – Technical Advisory Group

TBD – To Be Determined

UNC – University of North Carolina

USACE – United States Army Corps of Engineers

1 Introduction

1.1 Purpose of Statewide Planning Efforts with Flood Resilience Recommendations

The purpose of this Statewide Planning Efforts with Flood Resilience Recommendations Review is to document identified specific recommendations from existing statewide planning efforts that correspond with flood resilience strategies, and to provide an understanding of completed and ongoing statewide efforts related to watershed and resiliency planning. This review will build an awareness of existing efforts to meet the intent of the North Carolina (NC) Flood Resiliency Blueprint (Blueprint). The Blueprint is a statewide watershed planning effort to establish a framework and tools to assist local communities in decision-making related to reducing flood risk and increasing resilience.

Reviewed materials are organized by purpose in the sections listed below.

- Plans and Strategies
- Technical Reports
- Research Studies
- Programs
- Data Tools

For each source, the report includes the identified flood resiliency strategies and recommendations on how to use existing work. Assessment parameters, including relevance to the Blueprint, year published, and update cycle, are summarized in the Index. Identification of existing recommendations including possible applicability to the Blueprint in is presented in this document as well as a spreadsheet format in Subtask 2.10 so users can navigate listed actions.

1.2 Overview and Organization of Recommendations on How to Use Existing Work

Establishing how to use the flood resiliency recommendations included in the many hundreds of pages of relevant documentation is a key part to setting a basis for understanding. This process acknowledges the extensive efforts from diverse cross-sector stakeholders across North Carolina while presenting recommendations for how this content can strategically inform the Blueprint development. The recommendation areas included in this report refer to the recommendations/strategies identified in these statewide planning efforts. This document cites reports and their associated recommendations. The intent is not to alter a report's recommendations, but to leverage those recommendations for further development in informing the Blueprint.

The Principal Advisory Group, Core Advisory Group, Technical Advisory Groups (TAGs) and other stakeholders may use these documents and the identified recommendations to enhance and complement their participation in the Blueprint development.

1.3 Inclusion Criteria

Inclusion criteria for resources listed in this literature review and data inventory are listed below.

- Statewide geographic scope. The geographic scope for this inventory is the State of North Carolina; materials included have statewide considerations and/or applicability.
- Credible and vetted. Resources have state or agency support or have been reviewed by subject matter experts.
- Up-to-date, latest version. Generally, resources are published in 2019 or later, responsive to Governor Roy Cooper's Executive Order 80 that was signed in late 2018. If annual updates are available, only the latest are reviewed (but earlier versions may be mentioned and/or links included).

1.4 Connections to Other North Carolina Flood Resiliency Blueprint Tasks

It is important to note that many of the reviewed materials for flood resilience strategies are listed in full in the *Statewide Planning Efforts with the Literature Review* in fulfilment of Subtask 1.1 and the identification of existing recommendations including possible applicability to the Blueprint in fulfillment of Subtask 2.10.

2 Plans Review

2.1 Plans and strategies

The Plans and Strategies section includes state level plans that include the background, summary of efforts, and recommendations that are included in the listed planning efforts. Subtask 2.10 will include the recommendations for NC Blueprint from the existing plans. The recommendations are from the reviewed plans and are not specific for inclusion into Blueprint. Plans will need to be included in the action strategy review for each basin to ascertain if recommendations have been completed or if the recommendations should be updated with the Basin Strategy.

2.1.1 North Carolina Climate Risk Assessment and Resilience Plan (2020)

(https://files.nc.gov/ncdeq/climate-change/resilience-plan/2020-Climate-Risk-Assessment-and-Resilience-Plan.pdf)

2.1.1.1 Background

The North Carolina Climate Risk Assessment and Resilience Plan (2020 Resilience Plan) was released in June 2020. The development of the 2020 Resilience Plan, led by the North Carolina Department of Environmental Quality (NCDEQ) with interagency collaboration and stakeholder support, was a key action directed by Governors Cooper's Executive Order 80 (EO 80), signed in October 2018. The plan's purpose is to guide state action, engage policymakers and stakeholders, and facilitate collaboration among many partners to protect the state against high-impact, low-frequency weather events.

2.1.1.2 Summary of Efforts

The 2020 Resilience Plan also establishes the North Carolina Resilience Strategy, formed by four component documents:

1. North Carolina Climate Science Report
2. State Agency Resilience Strategies
3. Statewide Vulnerability Assessment and Resilience Strategies
4. State of North Carolina Enhanced Hazard Mitigation Plan

The 2020 Resilience Plan provided the following information:

- Our best understanding of the projected change in the climate.
- Climate justice considerations.
- State infrastructure, assets, programs, and services within 11 critical sectors vulnerable to climate and non-climate stressors.
- Preliminary actions currently underway or which could be taken to reduce the risk for at least three example vulnerability areas.
- Recommendations for nature-based solutions to enhance ecosystem resiliency and sequester carbon in the state's natural and working lands (NWL).

The 2020 Resilience Plan also establishes Cross-Cutting Resilience Strategies:

- Consider resilience criteria in making state investments
- Update plans, standards, and design values
- Increase resilience capacity in state agencies

- Identify sustainable funding sources for resilience
- Increase communication and outreach on climate change

2.1.1.3 Recommendations for Flood Resiliency Identified in the Climate and Risk Assessment Resilience Plan

Recommendations from the Flood Resiliency Identified in the Climate and Risk Assessment Resilience Plan include:

- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Coordinate state agencies' annual Climate Strategy Reports.
- Facilitate stream management and flooding reduction working group.
- Facilitate interagency communication on resilience topics projects.
- Facilitate the State Disaster Recovery Task Force (SDRTF) to coordinate efforts and advise state government as needed on recovery and resilience.
- Support the development of an update to the NC Uniform Floodplain Management Policy for State Construction.
- Conduct building vulnerability assessments and identify mitigation strategies for areas impacted by riverine flooding from Hurricanes Matthew and Florence. https://flood.nc.gov/advisoryflood/)
- Conduct flood mitigation studies.
- Begin administering the Building Resilient Infrastructure and Communities Program.
- Develop an online resilience resource center for local governments and community leaders.
- Purchase homes in the floodplain.
- Repair and elevate storm-damaged homes.
- Support nine regions in the eastern half of the state to complete climate vulnerability assessments and develop implementation pathways for 5 to 10 priority projects.
- Work with local governments affected by Hurricane Matthew to restore damaged critical infrastructure.
- Develop a climate resilience planning guide for local leaders.
- Account for climate change in the State Hazard Mitigation Plan.
- Conduct a dam breach analysis on intermediate and high hazard dams.
- Improve data collection at sites where flooding is expected. https://fiman.nc.gov/)
- Pilot a flood insurance program.
- Support updating and modeling NC climate impacts, local capacity building, and planning for nature-based solutions to flooding impacts.

2.1.2 State of North Carolina Enhanced Hazard Mitigation Plan (2023)

(https://www.ncdps.gov/our-organization/emergency-management/hazard-mitigation/enhanced-hazard-mitigation-plan)

2.1.2.1 Background

The Federal Emergency Management Agency (FEMA) requires state and local governments to develop and adopt hazard mitigation plans to receive certain types of non-emergency disaster funds. North Carolina's Enhanced Hazard Mitigation Plan makes the state eligible for more funds to prevent future damage. Due to the enhanced plan status, North Carolina qualifies for 20 percent (as opposed to 15 percent) of the total federal recovery assistance funds (i.e., what has been paid out through the

combined individual and public assistance programs). These funds can be used on projects to minimize the impact of future storms. The State of North Carolina Enhanced Hazard Mitigation Plan is referenced in the 2020 Climate Risk Assessment and Resilience Plan and is considered a North Carolina Resilience Strategy component. It is listed as a standalone source for this literature review.

2.1.2.2 Summary of Efforts

The Enhanced Hazard Mitigation Plan includes a Risk Identification and Vulnerability Assessment considering natural and technological hazards, corresponding vulnerabilities, and critical asset inventory. Statewide mitigation capabilities, including North Carolina Emergency Management (NCEM) functions, state agency roles, mitigation programs and funding, local and tribal capabilities, mitigation planning, and mitigation grants management are identified and summarized. The mitigation strategy section identifies goals, objectives, and actions.

2.1.2.3 Recommendations for Flood Resiliency Identified in the Enhanced Hazard Mitigation Plan

Recommendations for the Flood Resiliency Identified in the Enhanced Hazard Mitigation Plan include:

- The repetitive loss and severe repetitive loss strategy for North Carolina is geared towards encouraging local communities to prioritize mitigation of repetitive loss and severe repetitive loss properties and removing the financial strain imposed upon the National Flood Insurance Program (NFIP) for claims that compensate homeowners who have suffered repeatedly from flood losses.
- Develop a robust network of tools and systems throughout the state to help local and state officials better prepare for and respond to flooding events. This would include the following:
    - Increasing the number of stream-flow gauges and dam impoundment water level gauges statewide
    - Collecting stream gauge data, rainfall data, and high-water mark data regularly
    - Providing information to communities on real-time flood inundation
- Develop flood warning and alert system.
- Acquire or elevate properties that are in areas vulnerable to flooding.
- Analyze building stock to identify potential structures that could be mitigated.
- Provide funds to purchase conservation easements or land within the floodplain.
- Identify properties to be acquired that will support mitigation by coordinating with other entities (such as the Clean Water Task Force) to leverage other funding sources for acquisition to support additional state mandated goals.
- Develop and conduct county-wide educational programs for local officials on wildfire programs such as Firewise Communities, “Ready, Set, Go!” and Fire Adapted Communities, and on flood risk including flood mapping, new Digital Flood Insurance Rate Maps, flood insurance.
- Promote the benefits of adopting higher standards in local Flood Damage Prevention Ordinances.
- Promote river basin wide planning of flood hazards.
- Promote consideration of future build-out conditions when establishing land use and floodplain management regulations.
- Promote and support recognition programs, such as the Community Rating System.
- Promote improvement of storm drainage systems.
- Promote full funding of NC Flood Mapping Program to complete new Flood Insurance Studies for the entire state.

- Produce future volumes of NC measuring success publications documenting losses avoided quantitatively and qualitatively.
- Work with the NCDEQ Division of Coastal Management in developing the hazard mitigation portion of the revised planning guidelines under the Coastal Area Management Act (CAMA).
- Continued strategic growth of the NC ECONet, with new stations installed in areas that lack adequate climate and weather data.
- Meet annually with NC Housing Finance Agency to identify available funding that could be used for mitigation and discuss opportunities to collaborate.
- Directly integrate mitigation actions from the state hazard mitigation plan into the Risk MAP program to ensure progress is tracked and recognized.
- Improve Coordination/Education/Outreach to identify better and assist underserved communities as identified in the FEMA Strategic Plan 2022-26.

2.1.3 North Carolina Department of Transportation Resiliency Strategy Report (2021)

(2021: https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-report.pdf)

(2022: https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-report.pdf)

2.1.3.1 Background

The first North Carolina Department of Transportation (NCDOT) Resilience Strategy Report published in 2021 aligns agency goals and objectives. It serves as the guiding document for agency activities, policy and practice improvements, and decision-making moving forward.

2.1.3.2 Summary of Efforts

The NCDOT Strategy includes a review of completed and ongoing agency activities, studies, plans, and state and national tools for use in contextualizing the recommended strategies. A peer review of three other state departments of transportation (DOTs) has found relevant practices that help to inform NCDOT as it pursues future resilience-related actions, such as vulnerability assessments or pilot studies. The NCDOT 2022 Resilience Strategy Report supplies a status update and progress report on agency actions.

2.1.3.3 Recommendations for Flood Resiliency Identified in the NCDOT Resiliency Strategy Report

Recommendations for Flood Resiliency Identified in the NCDOT Resiliency Strategy Report include:

- Application for Site-Specific Information Storage and Tracking (ASSIST).
- Address gaps in ferry planning and standards - Assess the vulnerability of all the Ferry Division's infrastructure assets, including waterway channels, with respect to natural hazards.
- Continue to pilot and assess risk and vulnerability studies: Future I-87 corridor in eastern NC and I-40 and I-26 in the west.
- Incorporate resilience planning into the Statewide Multimodal Freight Plan.
- Continue incorporating risk and resilience considerations into the Transportation Asset Management Plan. Continue building and improving storm operation tools (Flood Inundation Mapping and Alert Network -Transportation [FIMAN-T], FIMAN-T Surge, and Bridge Watch).

- Incorporate resilience assessments in long range plans.
- I-95/I-40 Flood Resilience Study complete.
- Statewide Roadway Inundation Analysis complete. Upload to the NCDOT geographic information system (GIS) platform early 2022.
- Rail Strategic Transportation Corridors inundation analysis complete. Uploaded to NCDOT GIS platform early 2022.
- Coastal Roadway Inundation Tool complete.
- US-70 vulnerability assessment pilot from Raleigh to Morehead scoped and started. Anticipated completion summer 2022.
- US-74 vulnerability assessment pilot from Charlotte to Wilmington scoped and started. Anticipated completion spring 2022.
- Future Precipitation for Resilient Design Applied Research – Future rainfall distributions for modeling.

2.1.4 North Carolina Department of Administration Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdoa-climate-strategy-report-fy22/download?attachment)

2.1.4.1 Background

The Climate Strategy Report released in October 2022 by the North Carolina Department of Administration (NCDOA) establishes a framework to the vulnerabilities to climate change. This document provides approaches for the NCDOA to implement improvements and use for decision-making.

2.1.4.2 Summary of Efforts

The NCDOA advocates for many programs that have the goals to support populations that have been underserved. The report aligns with these objections through multi-pronged approach of participating in updating the NC uniform floodplain management policy for state construction, and invest in historically underserved communities as well as, reduce greenhouse gas emissions.

2.1.4.3 Recommendations for Flood Resiliency Identified in the NCDOA Climate Strategy Report

Recommendations for the Flood Resiliency Identified in the NCDOA Climate Strategy Report include:

- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.

Other resiliency efforts are mentioned although the report does not provide actionable items to mitigate the climate change vulnerabilities.

2.1.5 North Carolina Department of Agriculture and Consumer Service Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdacs-climate-strategy-report-fy22pdf/download?attachment)

2.1.5.1 Background

In 2022, the North Carolina Department of Agriculture and Consumer Services published a report about the Departments Climate Strategies. The intent of this document is to identify the latest climate vulnerabilities and provide actionable efforts that make the divisions with the North Carolina Department of Agriculture and Consumer Service (NCDA&CS) prepared.

2.1.5.2 Summary of Efforts

The NCDA&CS Report includes review of completed and ongoing agency strategies to promote the purpose of this document. The latest climate vulnerabilities are identified by divisions within NCDA&CS, as well as an overview of the Department's response and preparedness efforts. The NCDA&CS 2022 Climate Strategy Report supplies a status update and progress report on agency actions.

2.1.5.3 Recommendations for Flood Resiliency Identified in the NCDA&CS Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDA&CS Climate Strategy Report include:

- Preserving upriver farms to reduce flooding in North Carolina.
- Provides education and implementation of cover crop, conservation tillage, and cropland conversion programs for stormwater management leading to increased rainfall infiltration and decreased soil erosion and runoff.
- Educational resources and examples are provided to farmers to use Noninsured Crop Disaster Assistance Program (NAP) Insurance programs, along with resources for cost share and disaster assistance programs to prepare and recover following weather disaster events.
- The Plant Conservation Program has secured funding to address existing culvert and road wash-out concerns at coastal plain preserves.

2.1.6 North Carolina Department of Commerce Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdoc-climate-strategy-report-fy22pdf/download?attachment)

2.1.6.1 No flood resiliency strategies identified.

2.1.7 North Carolina Department of Environmental Quality Climate Strategy Report (2022)

(2022:https://www.deq.nc.gov/climate/ncdeq-climate-strategy-report-fy22pdf/download?attachment)

2.1.7.1 Background

The NCDEQ is an agency that supports the North Carolina ecosystem and is a steward of the environment. The agency and the 2022 Climate Strategy Report provides the framework for the 2022 through 2024 Strategic Plan which works towards the vision of the NCDEQ being a leader in using collaborative, inclusive processes to solve pressing environmental issues.

2.1.7.2 Summary of Efforts

The mission of NCDEQ is to provide science-based environmental stewardship which is provided by the seven key goals outlined in the 2022-2024 Strategic Plan. The goals set aim to promote, create, streamline, protect, and strengthen the communities and infrastructure within North Carolina. To track the progress on goals, objects, and key results of the strategic plan the NCDEQ has assembled implementation teams to address any obstacles. To help formalize the Climate Risk Assessment Plan, a cross-divisional team within NCDEQ was created and tasked with incorporating resiliency planning into agency programming and decision-making. Above approaches should assist the NCDEQ goals of progress being easier to track internally.

2.1.7.3 Recommendations for Flood Resiliency Identified in the NCDEQ Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDEQ Climate Strategy Report include:

- Environmental justice was included in the scope of work for the Statewide Flood Resiliency Blueprint and in the priority rating system for the Water Resources 319 grant.
- In addition, environmental justice was incorporated into NCDEQ's formal recommendations for updates to the Enhanced Hazard Mitigation Plan.
- Evaluate air monitoring site locations located in low drainage and flood-prone areas.
- Conduct hydrologic and hydraulic capacity study of dams in the Neuse and Lumber River Basins.
- Complete dam breach modeling.
- Implement strategies for enhanced waste management storm preparedness.
- Execute Scuppernong River Study.
- Add to the NC Flood Inundation Mapping and Alert Network.
- Recalculate flow statistic methods.
- Secure Funding for Natural Infrastructure Flood Mitigation Program.
- Increase resiliency of dams during storms.
- Continue coastal habitat restoration at Cedar Island.
- Coordinate water resources rules revisions that support EO 80.
- Include climate change impacts in basin watershed action plans.
- Rachel Carson National Estuarine Research Reserve (NERR) Habitat Resilience Plan that identifies and priorities areas for resilience projects based on known vulnerabilities and hazards.
- Develop Statewide Flood Resiliency Blueprint.
- Create resilience tools and resources for local governments.
- Implement Phase 2 of Tribal Coastal Resilience Connection Project.
- Implement Phases 3 and 4 of Resilient Coastal Communities Program.
- Implement Phases 1 and 2 of Resilient Coastal Communities Round 2.
- Deliver Coastal Training Program to coastal decision-makers on nature-based strategies to reduce coastal hazards, barrier island development, and low-impact development basics for water quality protection.
- Launch Technical Assistance Grant for Stormwater Infrastructure.

2.1.8 North Carolina Department of Health and Human Services Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdhhs-climate-strategy-report-fy22pdf/download?attachment)

2.1.8.1 Background

The North Carolina Department of Health and Human Services (NCDHHS) published a unique Climate Strategy Report in 2022 that highlights the Department's strengths and vulnerabilities when discussing climate change. The vision for the NCDHHS is to foster innovative solutions to build resilience, improve health, and promote well-being for all residents of North Carolina.

2.1.8.2 Summary of Efforts

There are 33 divisions of NCDHHS that fall within one of the six categories- Health, Opportunity and Well-Being, Medicaid, Operational Excellence, Policy and Communications, and Health Equity. These categories underwent a peer review to find applicable practices that help inform NCDHHS as it pursues future resilience-related actions, such as risk assessments, evaluations, plans, and other state tools that respond to the NCDHHS goals and objectives. For clear progress report on agency actions, the NCDHHS 2022 Climate Strategy provides status update.

2.1.8.3 Recommendations for Flood Resiliency Identified in the NCDHHS Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDHHS Climate Strategy Report include:

- Complete a flood survey assessment and develop adaptation strategies to promote environmental justice and equity by including input from community leaders who can advocate for the needs of their community and mitigate the risk of isolation during flooding after a hurricane.
- Continue Black River Flooding Forecast Initiative that address the public health impacts of climate change by alerting residents that are most vulnerable to flood risks so they can make actionable steps.

2.1.9 North Carolina Department of Information Technology Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdhhs-climate-strategy-report-fy22pdf/download?attachment)

2.1.9.1 Background

The environmental justice lead at North Carolina Department of Information Technology (NCDIT) has committed to work towards the Climate Strategy Report that was published in 2022. This document gives an overview of what that framework is for the department along with progress, and actionable steps being made that align with the NCDIT mission statement. This document provides approaches for the NCDIT to implement improvements and use for decision-making.

2.1.9.2 Summary of Efforts

The NCDIT acknowledges that information technology (IT) systems are vulnerable to climate changes and in the 2022 Climate Strategy Report, the Department reviews completed and ongoing agency activities, studies and plans that are recommended within the document. To perform a climate risk assessment and resilience plan the NCDIT has taken a two-pronged approach. The first is the Department has internally set to improve and modernize information technology and data center services to increase resiliency against severe weather events as they grow stronger. The second approach is to externally promote climate risk and resilience information to other state, county, and local government agencies. As the NCDIT continues to develop resilient policies, expand outreach,

and budget to include strategies for improving climate change, the 2022 Climate Strategy Report provides a status update and progress report.

2.1.9.3 Recommendations for Flood Resiliency Identified in the NCDIT Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDIT Climate Strategy Report include:

Send teams to meet with county, city, and town IT leaders to brainstorm ideas for improving and adapting resiliency planning ideas Continue Black River Flooding Forecast Initiative that address the public health impacts of climate change by alerting residents that are most vulnerable to flood risks so they can take actionable steps.

2.1.10 North Carolina Department of Military and Veterans Affairs Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdmva-climate-strategy-report-fy22pdf/download?attachment)

2.1.10.1 Background

The North Carolina Department of Military and Veterans Affairs (NCDMVA) is committed to ensuring that all those who served, and their loved ones, are made aware of and maximize all the benefits and resources available. NCDMVA manages the state veterans' homes and state veterans' cemeteries.

2.1.10.2 Summary of Efforts

North Carolina is a geographically and climatically diverse state with a climate already defined by extreme and changeable weather. As natural and climate disasters increase in frequency, magnitude, and duration, the NCDMVA has identified the following vulnerabilities and risks to its services: a. Hurricanes and other severe weather events may impact personnel transportation to and from the place of business for the primary workforce. NCVMVA structures are primarily leased, and our workforce, other than cemetery staff, is office-based with little outdoor or off-site requirements. b. Extreme heat and extreme cold damages the state veterans' cemeteries, both facilities and the burial sites. Primarily these conditions generate additional personnel requirements to manage additional watering of lawns and repair and replace grave markers. Extreme weather may damage existing Department facilities, such as state veterans' homes, more frequently. Power outages may become more frequent, affecting communications systems and facility operations. Some events may generate major repair and renovation requirements at the homes. Flooding may be a concern at some locations.

2.1.10.3 Recommendations for Flood Resiliency Identified in the NCDMVA Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDMVA Climate Strategy Report include:

- Evaluate the impacts of climate change on cabinet agencies' programs and operations.
- Understand and address the effect of climate change on state veterans' cemeteries. Completion date: summer 2022. The maintenance and landscaping of the state veterans' cemeteries has become increasingly more complex with the temperature and rainfall changes during the seasons. Maintaining a lush, attractive plot of land requires innovation and skill to coordinate fertilization,

installation, mowing, and mulching in the peak growing seasons. This will minimize the wasted efforts during non-optimal growing seasons.

- Coordinate with facility owners of leased property supporting Veteran Service Centers to ensure the facilities are prepared for natural disasters. Planned expected completion date: To be determined (TBD). NCDMVA plans to review contracts for all leased facilities to ensure they include owner's responsibility reference care for facility in the case of a natural disaster.
- Protect the state veterans' homes from flooding. Propose evaluation of any additional protective measures that should be taken if a flooding incident takes place near the facility.
- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Adopt best practices for the state veterans' cemeteries. Proposed expected completion date: June 30, 2030. The department will integrate any appropriate climate change adaptation practices and resiliency planning into the policies and operations of the state veterans' cemeteries as required and as identified by the NCDEQ.
- Develop and distribute a contacts list to keep necessary services up and running before, during, and after a disaster. Planned expected completion date: TBD. The NCDMVA plans to develop and internally distribute a local, state, and federal contacts list to facilitate disaster preparedness and response.

2.1.11 North Carolina Department of Natural and Cultural Resources Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdncr-climate-strategy-report-fy22pdf/download?attachment)

2.1.11.1 Background

The North Carolina Department of Natural and Cultural Resources (NCDNCR) considers how it manages specific assets under its stewardship, like public lands and facilities, state historic sites, and public records, accounting for the growing impacts of climate change. The department uses its educational and regulatory programs to encourage broader adoption of best practices for addressing climate change and implementing resilience strategies among its partners and the public. These programs range from inventories of natural and cultural resources, to administering grant funding to protect important resources, to educational programs aimed at specific constituents (local planners, public records administrators, etc.) and the public at large through activities at NCDNCR's many facilities.

2.1.11.2 Summary of Efforts

Two such examples are new climate change education signs at 80 NCDNCR sites and the expansion of a citizen science project using Chronology photographic technology to collect data and document ecosystem change, spearheaded by NC State Parks in partnership with NC State University. Another approach to fulfilling the strategies in the Climate Risk Assessment and Resilience Plan is the creation and fulfillment of a sustainability coordinator position.

2.1.11.3 Recommendations for Flood Resiliency Identified in the NCDNCR Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDNCR Climate Strategy Report include:

- Increase statewide resilience to the impacts of climate change.
- NCDNCR Strategic Plan is underway and expected completion date: June 2023. Floodplain and wetland acquisition and restoration.
- Conduct environmental reviews and help constituents for disaster recovery, response, and mitigation for future events. During the next twelve months, NCDNCR will continue to provide support for planning and resiliency initiatives underway, and initiate planning, resiliency, and construction repair projects for historic resources. This work will take place under the Emergency Supplemental Historic Preservation Fund (ESHPF) Disaster Assistance grant projects for Hurricanes Florence and Michael recovery. In addition, the Environmental Review branch of the State Historic Preservation Office continues to work expeditiously to review all disaster-related and resiliency-oriented projects within a 30-day turnaround schedule. Finally, five members of the State Historic Preservation Office staff have completed or will complete Floodplain Management training sponsored by the NC Department of Public Safety by the end of calendar year 2022.
- NC Museum of Art: Complete bridge, culvert, path repairs and replacement and stream restoration.
- Evaluate off site storage solutions for collections at risk from the triple threats of flooding, heavy precipitation, and sea level rise climate risks across the department.
- Consider climate-related hazards when developing master plans for natural areas, parks, and nature preserves. Expected completion date: June 2023. The Division of Parks and Recreation (DPR) will begin to develop a protocol for resiliency and climate related mitigation methods to implement into both the General Management Plan development and future Master Plans.
- Assessment of the Imperilment of plants and animal species is underway. Expected completion date: December 2022. The Natural Heritage Program is working to update the statewide lists of rare plant and animal species of North Carolina. These reports, which are updated every two years, provide a list of all the plant and animal species that are listed as Endangered, Threatened, or of Special Concern as well as all Significantly Rare species that are not formally protected but are imperiled enough to warrant tracking and monitoring to prevent extirpation. Habitat information and counties of occurrence are also included. The Natural Heritage Program is currently coordinating with the NC Wildlife Resources Commission and NC Plant Conservation Program to add state Threatened, Endangered, and Special Concern plant species to the State Wildlife Action Plan Species of Greatest Conservation Need. The proposal has been submitted to the United States (US) Fish and Wildlife Service and a decision is expected before the end of 2022. In late 2021, the Natural Heritage Program launched range-wide status surveys of Carolina Hemlock and Mountain Purple Pitcher Plant, assessing threats from all sources including climate change, habitat fragmentation, and invasive species.
- Inventorying and monitoring of state nature preserves is ongoing. Expected completion date: N/A. Field biologists monitor rare species as they conduct biological inventories of lands under consideration for protection as state nature preserves. Special attention is paid to species and habitats that are most vulnerable to a changing climate and natural disasters such as hurricanes, floods, and landslides. During the field season of 2022, Natural Heritage Program staff worked closely with the North Carolina Department of Public Safety (NCDPS) to survey natural areas at prisons and propose new state nature preserves on state-owned land. During the upcoming year, the Natural Heritage Program plans to survey lands along the Waccamaw River (Columbus County), Pond Mountain (Ashe County), and Chowan River (Bertie County), as well as many additional sites.
- Participation in the Recovery Support Functions of the State Disaster Recovery Task Force is ongoing. Expected completion date: N/A. NC Natural Heritage Program and NC Land and Water

Fund staff participate in the Environmental Recovery Support Function of the State Disaster Recovery Task Force, as does the State Historic Preservation Office (SHPO) in the Cultural Resources Recovery Support Function, contributing map data and recommendations for the upcoming Disaster Recovery Framework update. The SHPO will participate in all update work as invited by the Emergency Management divisions of the NCDPS.

- Participation in the US Army Corps of Engineers (USACE) South Atlantic Coastal Study At-Risk Cultural Resources Analysis is underway. Expected completion date: Unknown. For this project, the Office of State Archaeology and NC SHPO are consulting with USACE to identify cultural resources (historic and archaeological sites, historic districts, and other historic resources) vulnerable to coastal storm damage and sea level rise. This analysis is part of a multi-state effort throughout the southeastern US and Caribbean. GIS and archaeological and architectural survey data along with staff expertise are all proving crucial to informing this effort. Many of the places identified are federal and state historic assets open to the public. Both the North Carolina Office of State Archaeology as well as NC SHPO will continue to work with the USACE as the progress proceeds per USACE timelines.
- Complete the NC Shorescape Archaeological Survey. Expected completion date: Unknown. In fiscal year (FY) 2022-2023, the Office of State Archaeology (OSA) will undertake a North Carolina Shorescape Survey to identify and document archeological resources associated with coastal communities that are most at risk of being damaged by storm events. The focus is on identifying and documenting sites within 200 feet (60 meters) of the shoreline. The focus is on identifying and documenting sites within 200 feet (60 meters) of the shoreline, including into the submerged lands. Survey projects will go out for proposal and fieldwork will be completed over the next 12 months. These surveys will allow OSA to determine the location and extent of shoreline archaeological resources, the conditions of these sites and their associated shorelines, the historical significance of these resources, and management strategies to preserve these shoreline archaeological resources.
- Monitoring of wildlife and plants for Climate Change Impacts is ongoing. Expected completion date: N/A. The NCDNCR is identifying potential impacts of climate change on plants and animals in North Carolina. Over time, scientists will be able to correlate data with changes in weather patterns and sea levels. The NCDNCR is monitoring the following species and animal groups: Sand tiger sharks, Sea turtles (all species), Crystal skipper butterfly, Gopher frogs – two populations at Pine Knoll Shores, least tern colony at Pine Knoll Shores, stranded marine mammals (all species) along the northern NC coastline, and lionfish on offshore shipwrecks.
- Conduct Teddy Roosevelt Natural Area Biodiversity Surveys. NC Aquariums conducted two biodiversity surveys in the Teddy Roosevelt Natural Area, adjacent to the Pine Knoll Shores Aquarium, 40 years apart. This long-term monitoring data could be tied to climate change. This project has been completed.
- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Hire a Sustainability Coordinator in the NCDNCR. Completion date: September 2022. The NCDNCR developed a new sustainability coordinator position and hired the successful candidate in September 2022. This position supports the development and implementation of actions, policy, and program decisions to ensure the NCDNCR is a leader among state agencies in addressing environmental sustainability, including but not limited to: assistance to divisions in the development of resilience and adaptation strategies for the effects of a changing climate; the creation of departmental strategies, goals, and benchmarks for mitigating carbon emissions in

response to objectives and priorities set by the Governor and Secretary; and the development and implementation of educational materials and programs that capitalize on the potential of the NCDNCR's public-facing sites and programs to raise awareness among North Carolinians about environmental sustainability and science.

- Help libraries contribute to community disaster preparedness. Expected completion date: December 2023. For this project, the State Library will collaborate with the NC Public Library Directors Association to recognize and support the role that libraries play in disaster preparedness and recovery efforts more formally. Planning will begin the winter/spring of 2022-23 by forming a committee and creating an action plan for 2023. The project team will assess the types of support the State Library can offer libraries for this role.
- Manage state parks with prescribed fire as method to increase ecosystem resilience is ongoing. Expected completion date: N/A. The NCDNCR runs an active prescribed fire program to maintain natural communities in an ecologically healthy condition. A healthy habitat is one better suited to adapting to whatever climatic condition it faces. State Parks has performed 70 separate prescribed fires on 15 of its properties in the past year totaling 5,708 acres. The Divisions of Parks and Recreation and Land and Water Stewardship are jointly working with NC Forest Service to share information about nature preserves with sensitive natural areas that should be given special consideration during fire suppression and management activities. The Prescribed Fire Branch of the Natural Resources Program aims to consistently conduct 50 to 70 prescribed fires on a yearly basis statewide. This is accomplished through internal efforts and the collaborations established with assisting partners. The recent historic accomplishments of between 6,000 and 7,000 acres is profound within the agency yet continues to fall short of the need of 15,0000 to 20,000 acres annually. The NC General Assembly has provided funding to the NCDNCR through the FY 2022- FY 2023 budget for two regional "Burn Bosses" to coordinate prescribed fires throughout the state park system. Funds have also been provided for firefighting equipment and personal protective equipment. Staffing expansions aim to increase the recent successes, though none of this is accomplished without partner assistance due to the complex nature of an ever-increasing wildland urban interface in North Carolina.
- Management of land restoration is ongoing. Expected completion date: N/A. The DPR is actively restoring lands and waters that have been damaged from past land activities. Actions on lands include conversion of pine plantations and abandoned agricultural fields to a more natural condition. Streams and wetlands are being restored by re-creating natural channels and removing artificial structures such as dams and culverts. Examples of DPR's restoration work include:
    - Phase 2 of the pine plantation conversion at the Deep River-Justice restoration project area continues with the treatment of invasive species, the reintroduction of prescribed fire, and the enhancement and monitoring of groundcover species appropriate to the site.
    - Dam removal at the Deep River Justice tract is scheduled to begin by the end of 2022.
    - Invasive species treatments continue at the Lake James State Park 126 restoration area, a prior eastern white pine plantation. A successful prescribed fire in spring 2022 was conducted jointly between DPR, North Carolina Forest Service, US Forest Service, and The Nature Conservancy staff members. This fire has facilitated the augmentation planting of shortleaf pine, Table Mountain pine, pitch pine, and additional fire appropriate white and red oak species.
    - DPR Natural Resources and Operation staffs are working collaboratively with Coastal Federation on the shoreline resiliency projects at Carolina Beach State Park, Hammocks Beach State Park, Theodore Roosevelt State Natural Area, Fort Macon State Park, and Jockey's Ridge State Park.

- The pine plantation conversion project at Carvers Creek State Park will begin in FY23 (Phase 1).
- Phase 3 prescribed fires and monitoring are planned for the Goose Creek restoration area in FY23. Groundcover and longleaf pine reintroductions, as well as initial prescribed fires have been completed to date.
- DPR continues to work with the Eno River Hydrilla Task Force to control this aquatic invasive species within the upper Neuse River basin. New, though patchy, populations of hydrilla were detected by DPR staff in August 2023.
- Groundcover augmentation, mid-story control work, and prescribed fires are scheduled for FY23 at Weymouth Woods State Natural Area at the Boyd Tract, home to the oldest known longleaf pine in the US. This is to correct historic negative impacts.
- Natural Resource staff are collaborating with University of North Carolina (UNC)-Wilmington on a dendrochronological study at Weymouth Woods State Natural Area, Carvers Creek State Park, and Cliffs of the Neuse State Park to provide historical fire regime insight and inform future decisions.
- Natural Resources staff are collaborating with the Southern Appalachian Spruce Restoration Initiative and the NC Natural Heritage Program to augment red spruce and Frasier fir populations on Mount Mitchell and Grandfather Mountain State Parks, which have been historically impacted by past land-use, wildfires, invasive species, and now changing climatic conditions that effect the microhabitats and associated species. In collaboration with the Bog Learning Network, Natural Resource Program staff are continuing shrub control and invasive species management work at Pineola, Sugar Mountain, and Beech Creek bogs to protect several federal and state significant species.

2.1.12 North Carolina Department of Public Safety Climate Strategy Report (2022)

(https://www.deq.nc.gov/climate/ncdps-climate-strategy-report-fy22pdf/download?attachment)

2.1.12.1 Background

The NCDPS is the primary state agency affected by and responsible for addressing climate-related impacts to the public safety sector. NCDPS serves as the state's chief protector and defender of the public and is the statewide public safety and homeland security agency.

2.1.12.2 Summary of Efforts

The NCDPS focuses citizen and legislative attention on law enforcement and public safety issues, such as the supervision of offenders in prison or under Community Corrections supervision, justice reinvestment, reentry planning, highway safety, crime prevention, victim services, and homeland security. Through its Emergency Management Division and Office of Recovery and Resiliency, NCDPS is also responsible for preparation for, response to, and recovery from natural and man-made disasters, as well as coordinating and providing the public face of North Carolina's resiliency efforts.

2.1.12.3 Recommendations for Flood Resiliency Identified in the NCDPS Climate Strategy Report

Recommendations for Flood Resiliency Identified in the NCDPS Climate Strategy Report include:

- Increase statewide resilience to the impacts of climate change.
- Evaluate the impact of climate change on cabinet agencies' programs and operations.

- Conduct a vulnerability assessment of facilities within the Division of Adult Corrections. Expected completion date: December 2024. Funding in the amount of $3 million was approved to begin Phase I of a Comprehensive Facility Strategy for our Prison Facilities. The funding is an initial step of a $25 million effort to develop an operational strategy and model for the prison system. It will include a vulnerability review NC DPS 12 as part of a Facility Condition Index for all prison locations. The Condition Index will be coupled with operational data to determine the most efficient usage of all resources for the custody management of inmates.
- Conduct a vulnerability assessment of National Guard facilities and relocate buildings as needed. Expected completion date: January 2040. The NC National Guard is shifting to a "Hub and Spoke" model of a few large Regional Readiness Centers with a network of smaller Readiness Centers surrounding them strategically. The Guard's Construction and Facility Maintenance Office is applying data on sea level rise and other resilience information to determine which current facilities are not sustainable given current climate projections. With that information, the Guard will prioritize new construction projects and decide what properties can be retired. This process is expected to be ongoing over a period of decades as Congress makes more funds available to re-envision how the National Guard operates from a structural standpoint. Climate resilience will always be a critical element of decision making.
- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Coordinate state agencies' annual Climate Strategy Reports. Expected completion date: Annually: October 2022. In 2022, the Governor's Office issued a memo requesting that all state agencies annually report their progress on implementing the actions in the 2020 Climate Risk Assessment and Resilience Plan, EO 80, and EO 246 in one report – the Climate Strategy Report, due each October. Previously state agencies reported progress on the Resilience Plan and Executive Order 80 in separate documents; this is the first time state agencies will report on EO 246, announced in January 2022. The North Carolina Office of Recovery and Resilience (NCORR), in partnership with NCDEQ, developed a template and created a process for each agency to submit their accomplishments to the Governor's Office, the NC Climate Change Interagency Council, and the public. NCORR will continue coordinating and advising state agencies on this reporting process in 2023.Facilitate a stream management and flooding reduction working group. Expected completion date: N/A. NCORR has established an intergovernmental working group comprising representatives from the NCDEQ, Transportation, Agriculture and Consumer Services, and Natural and Cultural Resources, among others and is conducting outreach to other stakeholders outside of state government to recruit for membership. NCORR has submitted two reports to the Joint Legislative Commission on Governmental Operations and NCDPS and the Fiscal Research Division regarding the findings and recommendations of the working group. Thus far, the working group has identified several issues for further discussion and recommendation, including (among others):
    - The need for restricting development in the floodplain and expanding the requirements for floodproofing.
    - The need for land conservation along the coast and within floodplains, and the need to reinstate NC's land conservation tax credit to incentivize keeping people and development out of areas vulnerable to flooding. The need for ongoing outreach and education regarding what can be accomplished through various flood reduction methods to improve public and private decision making. The working group will further refine and develop these and other recommendations for the legislature. In the short term, the working group intends to focus its

efforts on analyzing the 2021 Flood Resilience Study by the UNC Policy Collaboratory, which was submitted to the state legislature.

- Facilitate interagency communication on resilience topics projects. Expected completion date: N/A. NCORR facilitates the Interagency Resilience Team (IRT), as called for in Chapter 7 of the 2020 Climate Risk Assessment and Resilience Plan, to provide a structure for state staff to coordinate resilience projects and to support the development of annual Climate Strategy Reports. The IRT includes at least one resilience lead from each state cabinet agency, as well as the Department of Agriculture and Consumer Affairs and the Wildlife Resources Commission. This team meets monthly.
- Facilitate the State Disaster Recovery Task Force to coordinate efforts and advise state government as needed on recovery and resilience is ongoing. Expected completion date: N/A. NCORR manages the SDRTF, which supports and advises state agencies as they address long-term recovery and undertake resilience-building initiatives statewide. The SDRTF is made up of 12 committees called Recovery Support Functions (RSFs). Since the start of this year, the Environmental Preservation RSF has held several meetings to update members on ongoing resilience efforts across state agencies, including rainfall modeling and data gathering, local capacity building, and nature-based flood reduction planning efforts for which NCDEQ has received funding through NCORR's Community Development Block Grant-Mitigation (CDBG-MIT) program. The Nonprofit and Volunteerism RSF worked on its first set of recommendations on improving diversity, equity, and inclusivity in disaster recovery and resilience. Two overarching themes of the recommendation document are to strengthen relationships between NCEM and nonprofits with strong ties to Black and Latino populations, and to allocate disaster resources in a way that reduces equity gaps. The Housing RSF discussed NCDPS and how the American Rescue Plan Act programs can work together to support North Carolina residents to obtain and stay in safe, secure, and affordable housing across income spectrums. Housing instability and housing cost burden are strong drivers of household-level vulnerability to climate change. NCORR has made significant strides toward implementing the recommendation of the Housing RSF to increase production of affordable, accessible housing by leveraging Community Development Block Grant-Disaster Recovery (CDBG-DR) funds.
- Support the development of an update to the NC Uniform Floodplain Management Policy for State Construction. Expected completion date: December 2023. NCORR, in partnership with NCEM and the NCDOA, worked with the Governor's Office to develop Executive Order 266, which Governor Cooper signed. The EO directs NCDOA to update the state's requirements for construction on state land subject to flooding. A direct outgrowth of NCORR's work with the IRT, the EO will result in increased resilience for state assets by both updating the requirements for such construction (which requirements had last been updated in 1990) and by expanding the scope of projects subject to such requirements by implementing a flood risk management process beyond application of the previous 100-year floodplain standard. NCORR will assist NCDOA with developing the new requirements and flood risk management standard. EO 266 provides an 18-month deadline for NCDOA's adoption of the new policy.
- Conduct building vulnerability assessments and identify mitigation strategies for areas impacted by riverine flooding from Hurricanes Matthew and Florence. Completion date: fall 2022. In 2020, NCEM began a building level risk assessment and mitigation strategy development process for approximately 12,000 square miles of unstudied streams heavily impacted by riverine flooding from Hurricanes Matthew and Florence. Flood risk analyses and building level flood damages and mitigation alternatives assessments were completed in the Summer of 2022 and NCEM recently

launched the NCEM Advisory Flood Data viewer (https://flood.nc.gov/advisoryflood/) to disseminate study reports, flood analyses boundaries and building-level risk assessment data to local communities, state agencies, and the public.

- Conduct flood mitigation studies. Expected completion date: Fall 2022. In 2020, NCEM initiated new flood mitigation studies for the Northeast Cape Fear River, Cape Fear River, Little River, and Cashier River Basins. NCEM completed flood and mitigation alternatives analyses in the summer of 2022 in in the process of completing final reports for the project. Final reports will be complete and loaded to the Rebuild NC website (https://www.rebuild.nc.gov/resiliency/river-basin-studies) to share with the public in the fall of 2022.
- Begin administering the Building Resilient Infrastructure and Communities (BRIC) program. Expected completion date: N/A. In 2020, the federal government released its pre-disaster mitigation program, NCEM launched BRIC, which aims to shift the focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. In the 2020 BRIC application, 32 projects were submitted for the competitive evaluation by FEMA and five were selected for award worth approximately $30M. The state is currently waiting for these projects to receive an award letter and begin work. In the 2021 BRIC application, 49 projects totaling approximately $167M were submitted for the competitive evaluation by FEMA. FEMA review of all submitted projects is ongoing with expected notification date of selection in July 21.
- Develop an online resilience resource center for local governments and community leaders Underway Expected Completion Date: December 2023 NCORR, in partnership with the NCDEQ and several North Carolina environmental nonprofits and universities, has hired a consultant to begin the initial stages of developing an online climate resilience clearinghouse for local governments and community leaders. The tool is called for in the 2020 North Carolina Climate Risk Assessment and Resilience Plan (2020 Plan) and in the North Carolina Natural and Working Lands Action Plan. The resource will “point users to relevant climate data and best practices for building resilience in an equitable way” (p. 7-15, 2020 Plan). The project is supported by funding from the US Climate Alliance.
- Purchase homes in the floodplain. Expected completion date: April 2026. NCORR administers the ReBuild NC Strategic Buyout Program, which is a voluntary program that purchases properties that are at-risk for flooding and turns them into deed-restricted greenspace. The Strategic Buyout Program engages closely with local governments and communities to identify contiguous areas that are good fits for the program, and the program offers generous financial incentives to encourage applicants to move to places that are less at risk for flooding. The program has received 230 applications since the program opened in January 2020 and has received 23 applications since March 2022. The program has undergone significant streamlining efforts in the last several months, which has resulted in a 937% increase in movement toward project completion. The program made its first three offers to applicants in July 2022. The program expects to onboard state staff to facilitate applicant progression, begin purchasing homes, and expand to additional areas. NCORR intends to continue to identify areas in which the program can be simplified.
- Repair and elevate storm-damaged homes is ongoing. Expected completion date: N/A. NCORR administers the ReBuild NC Homeowner Recovery Program, North Carolina’s long-term disaster recovery program, to repair and elevate storm-damaged homes. Between March and August 2022, NCORR completed 35 repair and elevation projects despite facing challenges from the nationwide material delays, labor shortages and a significant increase in material pricing. Those 35 projects consist of manufactured housing replacements, reconstruction of single-family residences and rehabilitation of single-family residences. Since March 2022, NCORR has made a series of

enhancements to the Rebuild program. NCORR transitioned from a construction management vendor to a state-run residential construction management program. In addition to the overhaul of construction management, NCORR has begun to post procurements to the state's Interactive Purchasing System. Due to these changes, NCORR expects to complete over 200 manufactured home replacements and reconstruction, rehabilitation, and elevation projects by the end of December 2022. ReBuild NC is made possible through US Department of Housing and Urban Development Community Development Block Grant – Disaster Recovery and Community Development Block Grant – Mitigation funding.

- Support nine regions in the eastern half of the state to complete climate vulnerability assessments and develop implementation pathways for 5-10 priority projects. Expected Completion Date: December 2022. Since the program's launch in fall 2021, NCORR, in partnership with NC Rural Center, has continued working with consultants and local stakeholders to develop a vulnerability assessment and a portfolio of five to 10 regional resilience projects in each of the nine multi-county regions. As of September 2022, all nine vulnerability assessments have received public comments and are in the final stages of completion. In addition, all nine regions have developed a draft list of projects that are under review by local stakeholders. Over the next three months, NCORR will work with project partners to develop an implementation pathway for each resilience project, to include a project lead, potential funding opportunities, implementation steps, and more. By December 2022, both documents– the vulnerability assessment and the portfolio of projects – in each region will be finalized and released the public. In early 2023, NCORR will work with each region to submit one project to the Duke Energy Foundation for full or partial funding. The Duke Energy Foundation has committed $600,000 total to aid the implementation of the Regions Innovating for Strong Economies and Environment (RISE) Regional Resilience Portfolios. The project is part of the RISE program, which aims to address the need for local capacity building around long-term disaster recovery and resilience planning and implementation. RISE is part of the North Carolina Resilience Communities program, run in partnership with the NCDEQ. Funding from the Economic Development Administration and US Department of Housing and Urban Development supports this project.
- Work with local governments impacted by Hurricane Matthew to restore damaged critical infrastructure. Expected completion date: August 2024. NCORR's Infrastructure Program is currently developing community infrastructure projects in Bladen, Duplin, Hyde, and Robeson Counties, the City of Lumberton, and in the towns of St. Paul and Princeville. These projects include a range of critical infrastructure and technical assistance for subrecipient projects as varied as drainage studies, stormwater drainage, development of potable water sources, sewer improvements, demolition of dangerous building ruins, and rehabilitation of buildings to be used for critical community services. In addition, the Infrastructure Program is lending assistance in the construction of infrastructure to build flood-safe communities, most notably in the Town of Princeville, and is currently monitoring the development and construction of a homeless-services building in the City of Fayetteville, which is forecasted to be completed in the early summer of 2023. During the past year, the program has assisted subrecipients in completing the construction of stormwater infrastructure in Nash County and the ongoing, aforementioned facility in Fayetteville, assisted subrecipients with procurement of nine architectural-engineering firms for design of infrastructure improvements, and closely followed the completion of a countywide stormwater drainage study that includes hydrological and hydraulic calculations that will inform the county as they develop feasible and cost-effective designs to address extensive stormwater drainage problem throughout the county. The program's subrecipients plan to construct

approximately 15 projects. The program is closely monitoring contracted scoping tasks and accompanying timelines for design, and is proactively advising subrecipients on next steps, leading toward construction and successful completion.

- Develop a climate resilience planning guide for local leaders. Expected completion date: December 2022. NCORR is working with a consultant to develop a resilient community planning guide for North Carolina's local governments. The guide will empower local and regional leaders to understand their climate vulnerabilities and develop shared priorities for action. The guide will have two components: A playbook and an idea book. The playbook will guide users through the process of building a team, analyzing vulnerabilities and assets, brainstorming, prioritizing actions, and identifying implementation steps. The idea book will provide examples of projects, programs, and policies that improve resilience across social, economic, and environmental domains. The planning guide is supported by funding from the Economic Development Administration. It is being developed as a component of RISE in conjunction with the North Carolina Resilience Communities program, run in partnership with NCDEQ. Both components of the guide should be released in 2022.
- Account for climate change in the State Hazard Mitigation Plan. Expected completion date: Fall 2022. Ensure the Enhanced State Hazard Mitigation Plan includes an emphasis on addressing the projected impacts of climate change and on protecting, communicating with, and serving marginalized populations NCEM has integrated climate change and the North Carolina Climate Risk Assessment and Resilience Plan into the Enhanced State Hazard Mitigation Plan update to the extent feasible. New FEMA guidance comes into play in April of 2023 that includes specific considerations for climate change in the risk analysis as well as an expansion of outreach to underserved populations. Current update is expected to be completed and approved before the new guidance comes into play, but NCEM did, at the suggestion of the Resilience Plan, begin to address some specific impacts of climate change in the hazard analysis, specifically regarding heat and flooding, addressing anticipated changes in frequency/intensity of drought and flood conditions and the impacts of same on wildfire and landslide hazards. NCEM put the draft up for public comment from September 22 to October 14, 2022.
- Conduct a dam breach analysis on intermediate and high hazard dams. Expected completion date: Spring 2023 In 2020, NCEM began conducting dam breach analyses on the remaining 859 intermediate and high hazard dams in NC that currently do not have dam failure inundation boundaries or building and road risk information. The agency is developing rainfall runoff hydrological modeling for 287 dams, installing gauges to monitor for dam failure at 130 critical state and locally owned dams, and integrating all data into a secure monitoring, alert, and warning system. NCEM has completed analysis of all intermediate and high hazard dams and this information was loaded into the State Emergency Response Application (SERA) and the dam warning and alert application. NCEM has also completed rainfall runoff modeling for 287 dam and has loaded this data into the dam alert and monitoring software. Finally, NCDEQ Dam Safety has secured long-term funding for annual software fees to continue the dam alert and warning application. NCEM has recently awarded a contract to install 34 remaining ultrasonic water level sensors and anticipates having these installed by early 2023. Also, NCEM plans to award a contract to install 29 remaining pressure transducer water level gauges at dams and install those by early spring 2023. These water level gauges will be integrated into the dam alert and warning application once installation is complete.
- Improve data collection at sites where flooding is common. Completion date: fall 2022. To improve the data collection capabilities of the State Emergency Response Team purchased and is installing

river gauges at 71 additional sites statewide and updated flood inundation libraries and risk assessments for these additional sites beginning in 2020. NCEM completed installing these 71 new radar gauges in May of 2022 and all data was loaded to and is being shared through the Flood Inundation Mapping and Alert Network (FIMAN) application (https://fiman.nc.gov/)

- Pilot a flood insurance program. Expected completion date: TBD. The North Carolina Office of Recovery and Resiliency and North Carolina Emergency Management are working towards piloting a flood insurance program. The initiative is in the process of being integrated into the existing ReBuild NC Homeowner Recovery Program supporting communities significantly impacted by Hurricanes Matthew and Florence. Currently, NCORR continues to refine program policies, procedures, and system of record business requirements. NCORR has discussed flood insurance purchase requirements with FEMA and NFIP generally and as it relates to newly constructed structures. Flood insurance policies cannot be transferred from building-to-building, but rather are transferred from owner-to-owner. Hence, an eligible applicant's existing flood insurance policy on the old structure would need to be cancelled and a new flood insurance policy would need to be purchased for the new replacement structure. NCORR was informed by FEMA that 2-year flood insurance policies may not be pre-purchased, and it takes 30-days for a flood insurance policy to be in effect. NCORR is developing procedures with all of FEMA's requirements in mind to ensure there are no lapses in flood insurance for eligible applicants. NCORR is also reviewing FEMA's risk rating for NC as those impacts flood insurance premiums. The NFIP State Coordinator (NCEM) facilitated a meeting on June 14, 2022, between NCORR and FEMA Region IV Flood Insurance Liaison to discuss providing NCORR with direct access to NFIP Insurance Data.
- Support the update and modeling of NC climate impacts, local capacity building, and planning for nature-based solutions to flooding impacts. Expected completion date: N/A. Through its administration of the CDBG - MIT program, NCORR is funding several planning efforts by other state agencies that increase statewide resilience to climate change impacts. These projects update the state's data and modeling of climate impacts including rainfall and drought, build local capacity to design solutions to climate vulnerabilities, and develop a natural infrastructure flood mitigation program. Thus far, NCORR has entered into four funding agreements with NCDEQ and one with NCDOT to support these important efforts:
    - NC Resilient Coastal Communities Program. NCDEQ, Division of Coastal Management. $500,000 CDBG-MIT.
    - Statewide Probable Maximum Precipitation Study. NCDEQ, Division of Energy, Mineral, and Land Resources. $500,000 CDBG-MIT.
    - Low Flow Statistics Re-Evaluation and Public Water Supply Boundary Area Assessment. NCDEQ, Division of Water Resources. $740,700 CDBG-MIT.
    - Development of the Natural Infrastructure Flood Mitigation Program and Modeling of Nature-Based Solutions for Flooding. NCDEQ, Division of Mitigation Services. $340,800 CDBG-MIT.
    - Updating the Precipitation Frequency Estimates for North Carolina, the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, NCDOT, $237,120 CDBG-MIT Over the next year, NCORR will continue to partner with NCDEQ and NCDOT to monitor progress on these efforts. NCORR is also in the process of entering into a similar agreement with the State Climate Office, NC State University, to fund a project to incorporate climate data into the state's precipitation statistics and create a publicly available, user-friendly interface for this information.
- Create an affordable housing strategy in partnership with the UNC Development Finance Initiative. Expected completion date: October 2022. NCORR has leveraged the experience of the UNC

Development Finance Initiative to build a strategy for the development and preservation of rental housing in the 23 counties most impacted and distressed by Hurricanes Matthew and Florence. The planning study has identified the types of affordable and resilient housing, including multi-family dwellings, single family homes, and other housing types most needed by those counties. Further, the study evaluates the availability of suitable properties, the development community's capacity, and the financial feasibility of the housing types needed. The plan is intended to inform the allocation of recovery funds through NCORR's affordable housing development fund to create new affordable housing that is safer, more resilient, and better matched with the needs of each impacted area. The bulk of the analysis, completed in June 2022, includes final strategic recommendations and tools. The final written report is expected in October 2022. In addition, NCORR will use the planning data to produce county-specific analysis and reporting for each of the 23 counties by March 2023.

2.1.13 North Carolina Department of Revenue Climate Strategy Report (2022)

(2022: https://www.deq.nc.gov/climate/ncdor-climate-strategy-report-fy22pdf/download?attachment)

2.1.13.1 No flood resiliency strategies identified.

2.1.14 Action Plan for Nature-Based Stormwater Strategies (2021)

(https://www.nccoast.org/2021/08/progress-with-the-nature-based-stormwater-action-plan/)

2.1.14.1 Background

Across North Carolina, leaders are using nature-based stormwater strategies to take on the persistent challenges of stormwater flooding. To combat this, the North Carolina Coastal Federation (NCCF) released the Action Plan for Nature-Based Stormwater Strategies on March 3rd, 2021. This roadmap, developed alongside The Pew Charitable Trusts, provides a guide for incorporating nature-based strategies into mainstream stormwater management. The goal of this plan is to increase the state's resiliency by using nature-based solutions to decrease flood risks and contamination from polluted water runoff. While the historical approach to stormwater management largely ignored natural processes, this approach embraces them. Development of the plan was informed by participation of numerous private and public sector stakeholders engaged professionally in stormwater management that served on four stakeholder work groups: New Development, Stormwater Retrofits, Roadways and Working Lands.

2.1.14.2 Summary of Efforts

When the Action Plan was released, the goal was to implement it statewide. The Full Work Group Meeting showed that this goal can be realized. Nature-based stormwater strategies are being supported and discussed in the General Assembly. "Cities are finding success with the guidance of the plan. Agencies and researchers are discovering how useful and effective mimicking nature can be. Through these and other efforts, nature-based stormwater strategies are positively contributing to resilience. The NCCF will continue to work with partners to implement the plan. The hope is to make these techniques mainstream and implemented where feasible on all fronts."

2.1.14.3 Recommendations for Flood Resiliency Identified in the Nature Based Stormwater Action Plan

Recommendations for Flood Resiliency Identified in the Nature Based Stormwater Action Plan include:

- State and local governments need to lead by example by encouraging the use of nature-based stormwater strategies and implementing them widely.
- Increase education, outreach and professional training for nature-based stormwater and watershed management strategies.
- Create a Nature-Based Stormwater Steering Committee to ensure continued stakeholder engagement and leadership in support of long-term, meaningful progress.
- Expedite permit applications that are designed to achieve runoff volume matching specifications in the state's stormwater design manual.
- Secure additional funding to support technical specialist(s) in NCDEQ, associated with NCORR's Resilient Communities Program or within other agencies and organizations, including universities and non-government organizations (NGOs), and through private-public partnerships who can meet with project designers and developers in early stages of the design phase to evaluate, advise and provide technical assistance on site suitability for nature-based stormwater strategies. Specialists should also assist local permitting authorities.
- Develop detailed informational maps to assist with watershed management plan development and guide where and what types of nature-based stormwater strategies are most practical and economical for potential new development sites, including land acquisition strategies, stormwater mitigation banks, etc. Obtain site characteristics necessary for these maps by relying upon existing GIS databases.
- Train industry and trade professionals, government staff and decision-makers so that they understand the benefits and limitations of nature-based stormwater strategies. Elements of this training need to include continuing education credits for training courses that review permitting procedures; design criteria for individual measures and practices; operation and maintenance requirements, including lifecycle costs compared to conventional treatment systems; benefits of nature-based systems; and legal instruments used to ensure permit compliance with permittees. ii Workforce training: Promote skills training on construction and maintenance of low-impact development to employees of landscape and maintenance firms. iii Peer-to-peer forums and trade shows: Create and facilitate regular opportunities for practitioners, including private business sector as well as public entities, to share experiences, collaborate and inspire each other to expand the use of nature-based stormwater strategies. This initiative includes biannual trade show with conference and training workshops; list-serve that convenes the community of practice online; and periodic luncheons, gatherings, and webinars that provide formal and informal opportunities to discuss experiences and ideas.
- Facilitate local government review of development codes and ordinances for potential inclusion of nature-based solutions. State agencies, nonprofits and academic partners should work together to assist local officials in an organized and consistent approach, including community outreach and technical assistance, to highlight nature-based strategies as a priority resilience measure.
- The NC General Assembly requests a study to determine the degree to which promoting nature-based solutions saves the state money in addressing flooding and water quality concerns, and an economic impact analysis of jobs created, improved property values and other benefits because of applying nature-based solutions. Evaluate how these cost savings and economic benefits, if found,

can be used to provide, and inform financial incentives such as tax breaks, design/planning assistance, to promote the use of nature-based stormwater strategies. This study should include state-funded institutions of higher learning.

- Establish a standardized life-cycle cost analysis for disclosure, as is currently being documented in research at NC State University and include these costs for operating and maintaining permitted stormwater systems as an update to the state's stormwater design manual. Update periodically to ensure accuracy of cost estimates.
- Ensure that maintenance plans prepared as a requirement of state and locally issued stormwater permits include an estimated budget of lifecycle costs for operating and maintaining the authorized stormwater system. This critical information will disclose these costs to current and future permit holders so that they can budget each year to fulfill their long-term financial responsibilities. In many places, systems that use nature-based stormwater strategies will be more cost-effective to operate and maintain.
- Create a state-sponsored awards program administered by NCDEQ and/or NCORR that recognizes notable low-impact development projects and communities leading in applying nature-based stormwater strategies each year. These awards may highlight creative approaches to coordinating, funding, and designing nature-based stormwater strategies, and could highlight the successes of the NC Resilient Communities Program and other state technical assistance offerings.
- Issue appropriate executive orders and policies that promote the use of nature-based stormwater strategies by the governor's cabinet agencies to the extent allowed by existing laws and rules. For certain defined projects, nature-based stormwater strategies should be the default and must be demonstrated to be impracticable before using conventional methods.
- Request that the NC. General Assembly evaluate if it should encourage the use of nature-based stormwater strategies by enacting a state law that includes provisions like those in the Federal Energy Independence and Security Act Section 438. This federal law requires large construction projects financed by the federal government to "maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property regarding the temperature, rate, volume, and duration of flow.
- Develop model policies, incentives, and ordinances that local governments can adopt that promote the use of nature-based stormwater strategies for local government construction projects.
- The steering committee will organize local stakeholders to approach local governments to seek adoption of model incentives, policies and/ or ordinances. State agency technical specialists will support communities in developing and implementing these changes.
- Use nature-based stormwater strategies to bring failing stormwater systems into regulatory compliance. Devise a streamlined process for modifications of existing state and local permit requirements so that nature-based stormwater strategies can be used to obtain regulatory compliance.
- Add a new chapter to the NCDEQ Stormwater Design Manual to provide guidance on the appropriate uses of nature-based strategies to address compliance issues with its existing permits. This promotes practices that mimic "hydrologic matching" as already defined in the manual. This guidance should be written with the intention to simplify the review process.
- Add a new chapter to the NCDEQ Stormwater Design Manual to include guidance on how best to use nature-based stormwater strategies to retrofit existing land uses that may or may not have existing stormwater permits. The chapter needs to explain how these measures can be adapted so

that they are cost-effective to use even when site limitations constrain the ability to meet all optimal design specifications.

- Enact new state legislation to resolve out of compliance stormwater permits that no longer have an identifiable party responsible for maintaining their compliance. The law needs to outline procedures and provide funding opportunities or incentives to fix these compliance issues and should explicitly encourage the use of cost-effective nature-based stormwater strategies to fix and upgrade failing systems. Local governments should establish a program or mechanism to absorb financial risk and use collective funds to fix noncompliant systems.
- Consider nature-based approaches first when upgrading, updating, or redeveloping existing government facilities.
- Educate the public about nature-based stormwater strategies by incorporating these practices into facilities that are frequently visited by the public, such as government office buildings, parks, boat ramps, schools, and beach access areas. Include educational signage and exhibits in these retrofit projects to spread public awareness and use of these strategies.
- Develop and identify significant new sources of federal, state, and local funding to support retrofit projects that reduce flooding, improve water quality, and reduce economic disruptions by achieving "hydrologic matching."
- Direct federal and state disaster mitigation funding to plan, design and install nature-based stormwater strategies as part of recovery programs.
- Adopt policies within all state-administered financial assistance grant and loan programs used to acquire and retrofit public lands and infrastructure that promote the use of nature-based stormwater strategies.
- Develop a guidance manual for transportation planners that illustrates effective incorporation of nature-based stormwater strategies into transportation planning and project development decision making processes. Action Plan for Nature-based Stormwater Strategies: Promoting Natural Designs that Reduce Flooding and Improve Water Quality 18
- Develop a list of nature-based environmental impact avoidance and minimization actions which can be evaluated as agencies comply with federal and state environmental review (NEPA/SEPA) processes.
- Develop roadway typical sections that illustrate nature-based stormwater solutions in the design context to guide comprehensive transportation planning, project planning and project design.
- Develop technical guidance tailored for roadside operations personnel on techniques for optimizing the infiltration and evapotranspiration capacity of the roadside environment.
- Include more information and technical guidance on nature-based stormwater strategies that are appropriate for the transportation system in the NCDOT best management practices toolbox and share that information with municipal transportation agencies.
- Based on this review, recommend changes to existing laws, rules, ordinances, policies, funding sources and procedures that facilitate the use of nature-based stormwater strategies.
- Revise NCDOT's qualification standards for designers, engineers, contractors, and other professional consultants to include demonstrated training and experience in nature-based stormwater strategies.
- In addition, NCDOT should ensure contract awardees are trained in nature-based design strategies and are committed to receiving continuing education on these design options annually. NCDOT may consider making this a new prequalification code or an amended one, and these trainings may be developed in partnership with the education programs proposed in the "New Development" recommendations.

- Provide agency leadership with briefings and supportive materials necessary to secure their support and guidance on how best to promote the use of these strategies as part of their decision-making.
- Formalize policies and internal guidance as needed to institutionalize agency leadership support for prioritizing the use of nature-based stormwater strategies.
- Engage transportation agencies, who are among the largest landowners in the state, as major partners in the proposed watershed planning effort. Seek to incorporate stormwater strategies for roadways into overall watershed management strategies recommended in the plans. Explore opportunities that exist beyond the established right-of-way for cost-effective use of nature-based stormwater strategies.
- Coordinate agreements between transportation agencies and disaster recovery programs that expand opportunities to rely on nature-based stormwater strategies to promote the agency missions of all parties. Seek to direct hazard mitigation investments so that stormwater needs of transportation agencies are achieved whenever possible.
- Promote the use of forest and agricultural products grown in NC to maintain and expand these markets so that landowners have strong economic returns from their working lands. Develop a partnership between trade organizations, conservation interests and academic institutions to help with this outreach effort. Work with the Leadership in Energy and Environmental Design (LEED) standard to enable forest products from smaller forest landowners to be used in LEED certified buildings, further promoting the use of these products.
- Increase economic incentives from local, state, and federal sources to landowners, including industrial owners, to preserve wetlands within forest lands, and to preserve forested and agricultural floodplains. Support ongoing efforts to identify forest lands that are a high priority to maintain and determine financial assistance or economic incentives needed to keep these lands working.
- Integrate efforts to maintain working lands into a state watershed management program. Secure additional funds to support technical, legal, and financial assistance to integrate efforts to maintain working lands through watershed management strategies designed to reduce flooding and improve water quality.
- Mount a coordinated campaign that works with state leaders, the NC Congressional delegation and engaged stakeholders to pursue substantially increased financial resources from the federal Farm Bill and other programs for conservation. Financial parity with other states could finance wetland restoration, conservation easements and large-scale hydrologic restoration projects in North Carolina.
- Direct more federal funds, including disaster mitigation program funding, to support consistent staffing capacity at the state, regional and local levels to help identify, plan, design, fund, and construct projects that protect, restore, or replicate natural hydrology. Partner with the Natural Resources Conservation Service to increase the staffing capacity of federal, state, local and nonprofit organizations to plan and execute nature-based stormwater strategies on working lands.
- Work with NCORR, N.C. Department of Agriculture and Consumer Services, and other agencies that administer disaster mitigation funding that is available to enhance staffing levels and consulting services to aid in the developing and administering hydrology-related projects.
- Continue and expand watershed level initiatives to identify and maximize strategic opportunities that provide water quality and flood reduction benefits to local and downstream communities. Seek to incorporate watershed initiatives with other ongoing landscape level programs that have different but compatible benefits including:

  - Coordinate with a new landscape initiative work group comprised of private and public stakeholders with funding from US Fish and Wildlife Service to identify locations in coastal NC where private and public funds can be focused on large-scale hydrologic restoration projects.
  - Work with military stakeholders to identify target properties that are essential for military training where hydrologic restoration projects are also feasible. The operations of the Department of Defense collectively constitute NC's second largest industry. Preserving working lands is critical to the military's ability to function, and the Sentinel Landscapes Partnership is an important vehicle to facilitate preservation of working lands. It should become an active partner in implementing this work group's strategy.
  - Implement the Lake Mattamuskeet Watershed Management Plan working with private landowners, US Fish and Wildlife Service, N.C. Wildlife Resources Commission, Hyde County, and N.C. Coastal Federation. Identify existing and emerging regional conservation partnership opportunities outside the coastal counties that provide opportunities for hydrologic restoration and management.

- Create opportunities to hold more water on working lands to provide downstream benefits while compensating for potential crop loss due to the additional water being held on these lands.
- Using the most up-to-date projections available, determine where production zones for working lands may change due to climate change to inform agricultural management, land use and conservation decisions.
- Obtain commitments to move forward with comprehensive watershed management framework. State leaders will devise and fund a multi-year planning framework that encourages watershed management to reduce flooding and enhance water quality concurrently. This will be supported and informed by relevant stakeholders drawing on the work group attendees.
- Economic study on costs and benefits of nature-based stormwater strategies. The NC General Assembly will be encouraged to request a study to prepare an economic analysis that details the cost savings associated with using nature-based stormwater strategies to mitigate flooding. This research may be carried out by a private consultant in partnership with NC experts such as those at (universities, stakeholders, and other interests).
- Promote demonstration projects. Identify and implement projects (new development, retrofits, roadways and working lands) that demonstrate the value of nature-based stormwater strategies with real world projects.
- Provide accurate information on maintenance cost for nature-based stormwater strategies. The steering committee will work with state officials and stakeholders to amend the stormwater design manual to include this data so that users are able to budget for life-cycle costs of these measures and learn about the savings regular maintenance can provide over time.
- Streamline modifications to existing stormwater permits to encourage use of nature-based stormwater strategies. Secure a commitment from NCDEQ to evaluate processes and work with stakeholders to devise standard operating procedures that provide a streamlined process for modifications of existing permit requirements so that nature-based stormwater strategies can be used to achieve regulatory compliance.
- Advance state and local policies promoting nature-based stormwater strategies. The steering committee and its various stakeholders will engage with key state and local leadership to promote recommendations in this plan and seek adoption of formal policies that enable the government to lead by example.

- Form the Action Plan Steering Committee. This leadership group of dedicated individuals from various stakeholder interests should spearhead implementation of recommendations in the plan. The group will meet periodically to set priorities and oversee accomplishments.
- Establish a consistent mechanism for continuing education and outreach. A work group will be organized to coordinate future planning for education and outreach. The group will seek the necessary financial resources support regularly scheduled, targeted programming and provide the necessary training and awareness building to advance action plan priorities.
- Organize DOT work group. The steering committee will work to assist DOT leadership and staff in putting together a work group to tackle DOT's highest priority recommendations including updating its toolbox to include nature-based stormwater strategies and reviewing regulatory constraints that discourage the use of these measures more fully.
- Congressional education on working land opportunities: Form a work group of stakeholders to develop components of a coordinated campaign that works with state leaders, the US Congressional delegation and engaged stakeholders to substantially increase the number of financial resources for conservation coming from the federal Farm Bill and other federal programs.

2.1.15 North Carolina Natural and Working Lands Action Plan (2020)

(https://files.nc.gov/ncdeq/climate-change/natural-working-lands/NWL-Action-Plan-FINAL---Copy.pdf)

2.1.15.1 Background

The North Carolina Natural and Working Lands Action Plan (NWL Action Plan) released in June 2020 with the help of partners such as the Carolina Wetlands Association for working on all the subcommittees, providing much-needed cohesion for the plan, and assisting on writing and editing the document. In addition, we thank the Environmental Policy Solutions - Ecosystem Services Program for developing much of the data used in the plan and the StoryMaps. as well as the US Climate Alliance and its partners for providing a peer review of the draft plan.

The NWL Action Plan is integrated into other key state level plans as a summary section in the 2020 Climate Risk Assessment and Resilience Plan and included in its entirety as a part of the North Carolina Resilience Strategy. It is listed as a standalone source for this literature review.

2.1.15.2 Summary of Efforts

The purpose of the North Carolina NWL Action Plan is to find and create opportunities and outline specific projects for North Carolina's NWLs that sequester carbon, build ecosystem and community resilience, provide ecosystem benefits, and enhance our economy. The plan is intended for various stakeholders including public and private landowners; universities; NGOs (non-government organizations); federal, state, and local planners; and policymakers to collectively work towards the presented goals. The NWL Action Plan addresses the following issues:

- Define the stakeholders' shared goals developed for the NWL Action Plan.
- Present the current state of our NWL.
- Quantify the potential impact of various actions.
- Recommend specific actions that help to meet shared goals.
- Identify implementation pathways, partners, and funding to facilitate action.
- Discuss roadblocks currently preventing the use of certain action pathways.

- Encourage working on broad policy initiatives that would greatly enhance meeting the goals outlined in the NWL Action Plan.

The NWL Action Plan includes some long-term, high-impact and short-term and cost-effective actions. The recommendations presented are clustered in the following areas: Transformative Recommendations, Recommendations for Forest Lands, Floodplains and Wetlands, Pocosins, Coastal Habitats, Urban Lands, and Agriculture. It is intended to be a living document with periodic changes and status updates.

2.1.15.3 Recommendations for Flood Resiliency Identified in Natural and Working Lands Action Plan

Recommendations for Flood Resiliency Identified in Natural and Working Lands Action Plan include:

- Protect and restore forests and wetlands within flood prone areas.
- Integrate climate adaptation and resiliency strategies into comprehensive local plans.
- Coordinate the state's floodplain buyout and restoration program to increase resilience.
- Implement targeted interventions to protect peatlands from sea level rise and saltwater intrusion guided by scenario-based modeling.
- Supply incentives to stakeholders for coastal habitat protection.
- Facilitate the migration of coastal habitats through the protection of migration corridors.
- Prioritize climate change and sea level rise in coastal habitat restoration planning.

2.1.16 North Carolina Coastal Habitat Protection Plan: Amendment (2021)

(https://deq.nc.gov/media/26810/open)

2.1.16.1 Background

The need for a coastwide habitat plan(s) originated in the 1990s when fish populations, habitat, and water quality concerns were becoming increasingly clear. Development of Coastal Habitat Protection Plans (CHPPs) were required in the Fisheries Reform Act of 1997(FRA; G.S. 143B-279.8). Development and implementation of the Coastal Habitat Protection Plan is a NCDEQ effort. The legislative goal of the CHPP is the long-term enhancement of coastal fisheries associated with coastal habitats. The law specifies that the CHPP finds threats and recommends management actions to protect and restore coastal habitats critical to NC's coastal fishery resources.

2.1.16.2 Summary of Efforts

The CHPP has four fundamental goals to protect coastal habitats in North Carolina: (1) Improve effectiveness of existing rules and programs protecting coastal habitats, (2) Identify and delineate strategic coastal habitats, (3) Enhance coastal habitat and protect it from physical impacts, (4) Enhance and protect water quality. The CHPP was previously updated in 2016. To simplify the CHPP process in 2021, the CHPP Steering Committee chose to develop an amendment to the 2016 CHPP Source Document and selected five priority issues to pursue:

1. Submerged aquatic vegetation protection and restoration through water quality improvements
2. Wetland protection and restoration through nature-based solutions
3. Environmental rule compliance to protect coastal habitats
4. Wastewater infrastructure solutions for water quality improvement
5. Coastal habitat mapping and monitoring to assess status and trends

For each priority issue area, the CHPP supplies background information, proposed strategies, and details recommended actions. The CHPP also outlines implementation progress on the earlier priority habitat issues found in the 2016 CHPP: Oyster Reef Habitat Restoration, Encourage Use of Living Shorelines, Sedimentation in Estuarine Creeks, and Generating Metrics on Management Success and Habitat Trends, along with progress on other coastal habitat protection plan recommendations.

2.1.16.3 Recommendations for Flood Resiliency Identified in the Coastal Habitat Protection Plan: Amendment 2021

Recommendations for Flood Resiliency Identified in the Coastal Habitat Protection Plan: Amendment 2021 include:

- By 2022, NCDEQ will form an interagency workgroup with non-government organizations and local governments to inform and guide development of watershed restoration plans to protect, restore, or replicate natural habitats (i.e., submerged aquatic vegetation (SAV), water quality, coastal habitats) and hydrology through natural and nature-based solutions.
- By 2023, NCDEQ will develop and implement a full-scale assessment program to conduct coastwide SAV mapping and monitoring at regular intervals (≤ 5 years).
- By 2023, Division of Water Resources (DWR) will evaluate and prioritize the incorporation of shallow water sites (< 1m mean lower low water) that currently or historically have SAV into the statewide Ambient Monitoring System.
- By 2023, NCDEQ will obtain state matching funds for the NOAA Coastal Change Analysis Program (CCAP) program to map NC's Coastal Plain at 1m resolution and added funding to expand wetland monitoring conducted by DWR and other state agencies.
- By 2024, NCDEQ will pursue the use of emerging technologies such as data fusion or deep learning neural networks, that rely on a combination of satellite imagery, drone imagery, and field verification for Coastal Plain wetland mapping and change analyses.
- By 2022, NCDEQ will form an interagency workgroup to develop a Coastal Plain wetland mapping and monitoring plan, including a minimum set of standardized metrics and a potential centralized location to store relevant reports and information.
- By 2026, NCDEQ will find the status and trends of Coastal Plain wetland acreage, condition, and function, based on the added mapping and monitoring data obtained.
- By 2022, the NC Division of Marine Fisheries (DMF) will decide potential mechanisms to prevent harvesting from living shorelines constructed with oysters.
- By 2025, NCDEQ will decide if living shoreline projects can be built in a manner that qualifies for salt marsh or nutrient mitigation credits.
- By 2025, the Division of Energy, Mineral, and Land Resources (DEMLR) and other divisions should increase education, outreach, and training to consultants, local government, and landowners for nature-based stormwater and watershed management strategies.
- By 2022, DEMLR will start and continue outreach to stormwater permit holders on rules and required maintenance of stormwater control measures and structures.

2.2 Technical Reports

2.2.1 North Carolina Climate Science Report (2020)

(https://ncics.org/wp-content/uploads/2020/06/NC_Climate_Science_Report_FullReport_Final_revised_May2020.pdf)

2.2.1.1 Background

The 2020 North Carolina Climate Science Report (NCCSR) supplies a rigorous, comprehensive, peer reviewed assessment of the weather and climate future of North Carolina. The NCCSR was developed by North Carolina-based climate experts with review by an expert climate advisory panel from state and federal research and science positions along with a rigorous peer review process. The report underwent several rounds of review and revision, including an anonymous peer review organized by NOAA's National Centers for Environmental Information. The report is available via ncics.org/NCCSR. It is informed by the latest climate science produced at the federal and international level, including the United States Fourth National Climate Assessment, the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, and details included in the North Carolina State Summary. The 2020 North Carolina Climate Science Report summary and findings are included within the 2020 Climate Risk Assessment and Resilience Plan (page 4) and is considered a part of the North Carolina Resilience Strategy.

2.2.1.2 Summary of Efforts

The NCCSR presents key findings of observed changes in North Carolina's climate and projected changes and associated likelihood for the states' climate future through the end of the century. Analyses included are informed by vetted, well-established observational and modeling datasets, climate assessments at the nationwide and global scale, and peer-reviewed scientific literature. Key findings for observed and projected changes are presented for: temperature, precipitation, sea level, hurricanes, storms, floods, droughts, and wildfire; other compound events; and engineering design standards. The NCCSR offers findings for the state and region - specific findings for the Western Mountains, the Piedmont, and the Coastal Plain. An overview of the findings can be found in the NCCSR Report Findings and Executive Summary.

2.2.1.3 Recommendations for Flood Resiliency Identified in Climate Science Report

The 2020 North Carolina Climate Science Report summary and findings are included within the 2020 Climate Risk Assessment and Resilience Plan (page 10).

- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Coordinate state agencies' annual Climate Strategy Reports.
- Facilitate stream management and flooding reduction working group.
- Facilitate interagency communication on resilience topics projects.
- Facilitate the State Disaster Recovery Task Force SDRTF to coordinate efforts and advise state government as needed on recovery and resilience.
- Support the development of an update to the NC Uniform Floodplain Management Policy for State Construction.
- Conduct building vulnerability assessments and identify mitigation strategies for areas impacted by riverine flooding from Hurricanes Matthew and Florence. https://flood.nc.gov/advisoryflood/)
- Conduct flood mitigation studies (https://www.rebuild.nc.gov/resiliency/river-basin-studies).
- Begin administering the Building Resilient Infrastructure and Communities Program.
- Develop an online resilience resource center for local governments and community leaders.
- Purchase homes in the floodplain.
- Repair and elevate storm-damaged homes.
- Support nine regions in the eastern half of the state to complete climate vulnerability assessments and develop implementation pathways for 5-10 priority projects.

- Work with local governments affected by Hurricane Matthew to restore damaged critical infrastructure.
- Develop a climate resilience planning guide for local leaders.
- Account for climate change in the State Hazard Mitigation Plan Conduct a dam breach analysis on intermediate and high hazard dams.
- Improve data collection at sites where flooding is common. https://fiman.nc.gov/)
- Pilot a flood insurance program.
- Support the update and modeling of NC climate impacts, local capacity building, and planning for nature-based solutions to flooding impacts.

2.3 Studies

2.3.1 Collaboratory Flood Resiliency Study (2021)

(https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/06/flood-resiliency-report.pdf)

2.3.1.1 Background

In September 2019, the North Carolina General Assembly passed Senate Bill 429, the "Disaster Recovery Act," (Session Law 2019- 224) into law. Among its many provisions, the bill appropriated $2,000,000 to the North Carolina Policy Collaboratory to conduct research related to flood resiliency in eastern North Carolina. The legislation called for submittal of the final report by December of 2020.

2.3.1.2 Summary of Efforts

A research team formed of experts in a wide range of fields was developed to evaluate flood resiliency from a comprehensive perspective. The flood resiliency study focused on five specific topics:

- Floodplain Buyouts
- Financial Risk
- Natural Systems
- Infrastructure
- Public Health

The study was a collaboration of many projects and researchers from the University of North Carolina at Chapel Hill and North Carolina State University. Using research designed by leading experts, the study's goal was to generate the latest information to inform decisions around flooding and storms. The various lenses through which inland flood resiliency was analyzed on the shared goals of keeping North Carolinians healthy and safe, and improving the state's planning for, and response to, flood and storm events. Identified information users included governments, non-governmental organizations, private organizations, and individuals.

2.3.1.3 Recommendations for Flood Resiliency Identified in the Collaboratory Flood Resiliency Study

Recommendations for Flood Resiliency Identified in the Collaboratory Flood Resiliency Study include:

- Accuracy Assessment for IoT (Internet of Things) Stream Gauges Data: The project aimed to evaluate the accuracy/precision of low-cost stream gauges in different environmental conditions during a one-year period. This is to ensure that the gauges used for the expansion of FIMAN coverage provide exact and precise information.

- Flood Resilience: Data Collection and Data Analytic in support of Flood Management. The project aimed to expand gauge testing by including low-cost radar sensors and rain gauges and developing water gauge reading method.
- The State of North Carolina should explore a wide variety of funding mechanisms that could smooth and speed up buyout processes, including municipal/green bonds, revolving loan funds, local option sales taxes, and stormwater utility fees. Special attention should be paid to the inclusive and equitable use of these funding mechanisms on the state and local scale.
- The transaction costs associated with buyouts vary widely across the state and around the United States, but they can be substantial. These costs are likely absorbed by municipalities and landowners under current buyout processes. The NCORR could help limit these costs, along with efforts to prioritize and plan for future buyouts across the state.
- More work needs to explore the legal hurdles to implementing alternative buyout processes and evaluate how those processes would ensure stronger equitable and environmental outcomes.
- As part of exploring alternative buyout processes, the state should find improved methods of calculating avoided loss that include aggregate risk (beyond project itself, e.g., downstream impacts) to decide whether buyouts lower flooding risk and damage elsewhere nearby.
- The state should incentivize communities that receive federal or state grants for buyouts to restrict future residential development in flood hazard areas. The state should take measures to improve its hazard mitigation data collection, management, and dissemination infrastructure. This will 1) help evaluations of mitigation outcomes, 2) improve targeting of public investments to areas of greatest need, and 3) increase transparency and reduce demands on staff time. Researchers at UNC can help the state create database tools to accomplish this function.
- The state should prioritize and fund establishment of FAIR data standards – ensuring data is Findable, Accessible, Inter-operable, and Reusable – for all buyout- and hazard mitigation-related data, creating policies and data use agreements to standardize and curate metadata, streamline researcher and community group access, and enhance accessibility to the public. As part of this, buyouts- and hazard-related data should be stored in a publicly accessible data repository (e.g., UNC Dataverse) that facilitates good user experiences, and easy and effective data dissemination. Ultimately, these actions will save staff time and dramatically lower costs in response to data requests.
- Adopt policies that prevent future development and redevelopment within the 100-year floodplain and that severely restrict development in the 500-year floodplain. It should be noted that all encroachment into the floodplain (i.e., elevated structures) reduces the water storage capacity of the floodplain during extreme events.
- Continue to pursue buyout and elevation of structures and infrastructure found within the 100-year floodplain to avoid inevitable repeat loss of these structures.
- Invest in improving resilience of all critical infrastructure that is vulnerable to flooding (roads, bridges, stormwater systems, reservoirs, water and wastewater treatment facilities and networks, energy supply) to minimize loss of life, emergency rescue, loss of use and negative impacts to commerce and economic impacts during future extreme storm events.
- Develop a pilot flood mitigation program for a targeted sub watershed with documented flooding issues. The program would allow the ecological restoration industry to implement flood mitigation projects.
- Flood storage benefits could be estimated by comparing model results of the peak flow reduction, peak flow delay and volume of water stored for existing and proposed condition during the several

return intervals storms (e.g., 50-, 100-year storm). Track the economic and employment impacts of this program.

- Invest in research to develop and monitor a pilot water farming project. The research should focus on evaluating water management systems, storage, and peak flow reductions, impacts to soils and crops and other agricultural management processes and associated economic factors.
- Sponsor research to examine similar flood mitigation potential on other watersheds, and with other measures, and estimate flood and damage reduction impacts at the farm to local to community scales.
- Economic impact analyses – including investigations of the extent to which NC is producing a "home grown" ecological restoration industry – should be conducted as part of the evaluation of State Natural Infrastructure programs, including those currently administered by NC Division of Mitigation Services.
- Investigate other conservation-based flood mitigation programs (e.g., Iowa, Minnesota) to find and evaluate program scope, authority, funding, management, intergovernmental agreements, streamlined permitting processes, and implementation options.
- Assemble a team of scientists/engineers and stakeholders to develop a state-run implementation program. The program must include a process for involving landowners early in the program design stage, supplying multiple ways to give input and feedback to the program design and implementation.
- Increase funds for the NC Forest Service's Forest Development Program to convert lower productivity and other open lands to forests in target flood-prone river basins, and their most often flooded areas.
- The state should target communities at risk to encourage insurance uptake through both education and provision of incentives, such as funding to help property owners in paying NFIP premiums to cover future damages. The analysis described in this work can inform which counties, neighborhoods, or even individual properties should be targeted to affect the area's most at risk, allowing for a more effective use of state funds.
- The state should start renewed efforts to develop pre-disaster mitigation plans via a "portfolio" approach that includes multiple strategies, including infrastructure (e.g., flood control, property elevation), buyouts of at-risk properties, zoning policy and financial instruments (e.g., flood insurance, disaster-based reinsurance). This planning process will benefit significantly from more highly resolved estimates of flood-related financial risk, including who bears the risk and where they are located.
- A rigorous and detailed assessment of neighborhoods at highest risk of flood-related mortgage default should be conducted to show which areas and lenders are most threated, and to inform actions designed to mitigate this risk (e.g., property buyouts, lines of credit to vulnerable banks).
- Planning efforts that reduce development in areas most at risk of flooding (e.g., flood plains) that decrease the financial risk of these events should be pursued at the local, county, and state level.
- The state should increase efforts to find areas and parties at greatest risk from flooding and sets up systems to collect and rapidly give post-flood damage information to inform targeted resiliency efforts.
- Maintaining existing protections for wetlands and streams is a critical first step to enhancing natural systems for flood mitigation, particularly as North Carolina lawmakers seek cost effective strategies to improve the state's resilience to major storms. NCDEQ's proposed temporary permitting rule would achieve that goal in the near term.

- Supply Funding for Flood Storage Capacity Projects Authorized in the 2020 Water/Wastewater Public Enterprise Reform Act (House Bill 1087).
- Expand opportunities for landowners and local governments to protect natural systems that contribute to flood mitigation.
- Provide local governments with capacity building and coordination support.
- Coastal flood hazard estimates should consider the interactions between storm surge and rainfall-runoff. There are not fully coupled inland and coastal models that can capture both inland and coastal flood processes, and questions remain as to how to represent compound flood events using existing models efficiently and accurately. More research is needed to investigate the influence of the model boundary location and connection on the propagation of surge and streamflow. In addition, we recommend using gauge data and basin and river network characteristics to decide the watershed response (e.g., time-lag between rainfall and peak streamflow) to understand the frequency at which the models should pass information to each other.
- Continued effort should be pursued to use coastal flood models (ADCIRC) and hydrological models (LISFLOOD-FP) to model compound flood hazards throughout eastern North Carolina.
- There is no integrated database that contains information on channel properties and surrounding floodplain topography that can be used to configure coastal and hydrological flood hazard models, particularly for smaller tributaries and channel reaches in the North Carolina coastal plain. Future work should leverage existing statewide datasets of surveyed channel data and high-resolution LiDAR to create a single, integrated geospatial database that can be used to incorporate channels and their associated floodplains into flood hazard models. Gaps in the existing datasets, particularly where cross-sectional surveys may be outdated or lack resolution, should be identified and filled.
- The state should identify coastal communities where compound flooding is likely to result in hazards different from those shown on FEMA floodplain maps.
- Use improved coastal hazard estimates to support cost-benefit analyses of both structural and nonstructural flood mitigation alternatives at household and community scales over the short- and long-term.
- To foster resilience, it is recommended that (1) every jurisdiction employs an active inspection and maintenance program and (2) a process is established by jurisdictions to educate owners of stormwater control measures (SCMs) every time the property (and therefore SCM) is sold or conveyed.
- The state should convene a small working group or task force to:
    - find the communities and sections of the grid in eastern NC most at risk of prolonged electric outages due to flooding
    - prioritize the need for protective intervention based on likelihood of occurrence and potential for negative consequences
    - gain knowledge about grid operators' contingency plans before and during severe, localized flooding events.
- The state should use the research team's model of the NC power grid to evaluate flooding and other resiliency impacts on the grid in connection with natural disasters such as hurricanes.
- The state should consider water holistically, thinking about the connectedness of water resources when making legislative changes related to flood resilience.

- The state should work to improve workforce development within the water and wastewater sector, especially as the current workforce ages and the new workforce dwindles in size.
- The state should consider launching a bridge funding/financing program that allows utilities to borrow money to repair/replace critical infrastructure while waiting for FEMA money.
- The state should work to operationalize "resilience" planning for water and wastewater utilities, supplying a clear definition and actionable steps for utilities to become more resilient.
- Recommend a stratified random sampling approach to characterize floodwaters and non-flood affected waters with priority devoted to assessing the relative impact of sewage and hog fecal material on relevant systems.
- Engagement with relevant stakeholders, including municipal wastewater utilities, hog and livestock farming operations, and county health departments will allow a further assessment of the risks posed by floodwaters.

2.4 Programs

2.4.1 Regions Innovating for Strong Economies and Environment Program (2020)

(RISE and Environment Program | ReBuild NC)

2.4.1.1 Background

The RISE Program was developed by a partnership between NCORR and the NC Rural Center. RISE aims to support resilience primarily in the storm-impacted regions of North Carolina. RISE is promoting statewide resiliency by supplying support and tools to regional partners. RISE supports resilience efforts in eastern North Carolina regions that have been affected by recent storms.

2.4.1.2 Summary of Efforts

RISE is a multi-phase effort that includes a forward-looking vulnerability assessment, the identification of 5-10 high-priority projects and a list of the actions needed to implement each proposed project for participating regions. A diverse stakeholder partnership is guiding the project to ensure that the scope of work reflects local priorities. The RISE Program aims to support resilience primarily in the storm-impacted regions of eastern North Carolina using three key methods:

1. RISE will be supplying coaching and technical assistance to regional partners to support community vulnerability assessments, find priority actions to reduce risk and enhance resilience in their region, and develop paths to implementation.
2. Developing the North Carolina Resilient Communities Guide, as a statewide resource that supplies tools, guidance, and opportunities for building community resiliency.
3. Hosting regional leadership training workshops that emphasize resilience as a tool for community economic development.

2.4.1.2.1 PHASE 1: COMMUNITY ENGAGEMENT and RISK/VULNERABILITY ASSESSMENT

The first phase of the project includes performing risk and vulnerability assessments, developing community action teams, and engaging with the public. These analyses bring together science and local knowledge to paint a picture of hazards in the regions and how they may change in the future.

2.4.1.2.2 PHASE 2: PLANNING, PROJECT IDENTIFICATION, and PRIORITIZATION

Phase 2 of the program involves a community- and data-driven process to find priority actions that can be taken to adapt to short- and long-term hazards. This phase of the project includes the development of a portfolio of several projects that have regional benefits for resilience. Proposed projects include construction projects, nature-based solutions, outreach, and capacity building activities, or planning and policy developments. The regional benefits come in many forms, such as reducing downstream flooding, offering a resource to multiple local governments, or crafting a pilot project that may be replicated in other places. A critical part of developing the portfolios is finding achievable paths to implementation, including funding sources and capacity considerations. Regions have the opportunity to select a project for seed funding from the Duke Energy Foundation RISE Accelerator Grant Program.

2.4.1.2.3 PHASE 3: ENGINEERING and DESIGN

Phase 3 is the engineering, design, and permitting of the prioritized projects. A critical part of developing the portfolios is finding achievable paths to implementation, including funding sources and capacity considerations. Grants will be available for communities who successfully completed Phases 1 and 2 to develop projects that are shovel ready.

2.4.1.2.4 PHASE 4: PROJECT IMPLEMENTATION

Phase 4 grants will be available for communities who successfully completed Phases 1, 2, and 3 for implementation of a shovel-ready project(s) and must include a natural or nature-based part.

There will be two final products for each region: a vulnerability assessment that stands alone but is also right for integration into regional and local plans, grant applications, public presentations, and other planning tools; and the regional resilience portfolio, which will include goals, a summary of the vulnerability assessment, selected priority projects, and the implementation plans for the priority projects.

RISE is building a foundation for a more resilient future in North Carolina. At the end of the program, 200 emergent leaders in eastern North Carolina will have the tools to incorporate resilience in community and economic development. Communities statewide will be able to use the North Carolina Resilient Communities Guide to enhance their resilience, and storm-impacted regions will be prepared to implement priority resilience activities. These activities will support existing efforts such as regional hazard mitigation planning and strategizing for comprehensive economic development. Over time, and as ability increases with staff and funding, the NC Resilient Communities Program expects to supply opportunities across North Carolina.

The Duke Energy Foundation has committed $600,000 in grant funding to support the RISE Regional Resilience Portfolio Program through accelerator grants. The grants are being made available to support the implementation of priority projects found in each RISE region's portfolio. The grant program will allow each region to kick-start all or part of a project. The project and applicant eligibility will be evaluated by a committee of representatives from the Duke Energy Foundation and NCORR. The goal is to fund at least one project in each RISE region, but funding isn't guaranteed in each region. The state is helping to fund the RISE program. RISE is funded by a $1.1 million US Economic Development Administration grant, with support from both NCORR and the NC Rural Center.

2.4.1.3 Recommendations for Flood Resiliency Identified in the RISE Program

Recommendations for Flood Resiliency Identified in the RISE Program include:

- RISE will be supplying coaching and technical assistance to regional partners to support community vulnerability assessments, find priority actions to reduce risk and enhance resilience in their region, and develop paths to implementation.
- Developing the North Carolina Resilient Communities Guide, as a statewide resource that supplies tools, guidance, and opportunities for building community resiliency.
- Hosting regional leadership training workshops that emphasize resilience as a tool for community economic development.

2.4.2 North Carolina Resilient Coastal Communities Program (2020)

(NC Resilient Coastal Communities Program | NC DEQ)

2.4.2.1 Background

The NC Resilient Coastal Communities Program (RCCP) under the NC Division of Coastal Management supplies financial grants and technical assistance to support a proactive, locally driven, and equitable approach to coastal resilience planning and project implementation.

2.4.2.2 Summary of Efforts

The NC Resilient Coastal Communities Program aims to facilitate a community-driven process for setting coastal resilience goals, assessing existing and needed local capacity, and identifying and prioritizing projects to enhance community resilience to coastal hazards. Participating communities will walk through a framework leading to the development of "shovel-ready" projects. Local governments throughout the 20 coastal counties will be eligible to apply for direct technical help to complete a community engagement process, risk, and vulnerability assessment, and develop a resilience project portfolio.

The four phases of the program include:

- Phase 1: Community Engagement and Risk and Vulnerability Assessment
- Phase 2: Planning, Project Selection, and Prioritization
- Phase 3: Engineering and Design
- Phase 4: Implementation

This initiative, funded through the NC State Legislature and the National Fish and Wildlife Foundation, will supply funding to local governments to help overcome barriers in coastal resilience and adaptation planning, boost local government ability, and support a proactive, sustainable, and equitable approach to coastal resilience planning and project implementation.

2.4.2.3 Recommendations for Flood Resiliency Identified in the Resilient Coastal Communities Program

Recommendations for Flood Resiliency Identified in the Resilient Coastal Communities Program Include:

- The primary objective of Phase 3 of the RCCP is to provide funding to assist communities with the engineering and design of a prioritized project identified in their RCCP Resilience Strategy or other existing plans that meet the RCCP's Phases 1 and 2 planning criteria.
- Some communities will also receive funds to develop or amend ordinances that improve their resilience to flooding and other coastal hazards or to otherwise take steps to manage stormwater and flooding.

- Most of the engineering and design projects feature natural and nature-based elements such as wetland restoration and living shoreline design.

2.4.3 North Carolina Resilient Coastal Communities Program (2020)

(https://www.rebuild.nc.gov/resiliency/resilient-communities)

2.4.3.1 Background

The RCCP supplies financial grants and technical assistance to support a proactive, locally driven, and equitable approach to coastal resilience planning and project implementation.

2.4.3.2 Summary of Efforts

Communities across North Carolina are on the frontlines of flooding, extreme storms, record temperatures and landslides. A resilient North Carolina depends on our communities, economies and ecosystems being able to rebound, positively adapt to, and thrive amid changing conditions and challenges. Community leaders and residents agree that improving local resilience requires access to ability, technical support for analysis and planning, and funding to implement measures that advance long-term resilience. The NC Resilient Coastal Communities Program responds to these needs through two distinct agency-led programs: RISE, led by the NCORR, and the Resilient Coastal Communities Program, led by the North Carolina Department of Environmental Quality's Division of Coastal Management.

2.4.3.3 Recommendations for Flood Resiliency Identified in the Resilient Communities Program

Recommendations for Flood Resiliency Identified in the Resilient Communities Program Include:

The Funding Forum held in February 2023, aimed to address the obstacle of funding resiliency projects by introducing community leaders, policymakers, and other stakeholders to federal, state, and nonprofit funding opportunities for resilience-related projects. The free, one-day event allowed attendees to engage with potential funders, who supplied presentations and answered project-specific questions during break-out sessions. Attendees also had the opportunity to take part in a grant writing session to take their project one step closer to reality.

2.4.4 Flood Risk Reduction Grant Program (2022)

(https://nclwf.nc.gov/grants/apply-grant/flood-risk-reduction-grant-program)

2.4.4.1 Background

The North Carolina Land and Water Fund was appropriated $15 million in the FY 2021-22 state budget for projects that protect and restore floodplains and wetlands for the purpose of storing water, reducing flooding, improving water quality, providing wildlife and aquatic habitat, and providing recreational opportunities.

2.4.4.2 Summary of Efforts

The primary purpose of the program is to reduce flood risks through the design, implementation, and preservation of nature-based infrastructure. Additional consideration will be given to projects that also deliver other ecosystem services or public benefits, demonstrate readiness to begin implementation, and benefit economically distressed communities.

2.4.4.3 Recommendations for Flood Resiliency Identified in the Flood Risk Reduction Grant Program

Recommendations for Flood Resiliency Identified in the Flood Risk Reduction Grant Program Include:

- Acquiring land, or an interest in land, for purposes including:
  - Enhancing or restoring the flood attenuation capacity of floodplains, wetlands, and areas of the natural landscape that contribute to their function.
  - Storing flood waters through long-term land management agreements, such as water farming.
  - Participating in floodplain buyout programs as a first step in enhancing ecosystem services.
- Restoring, enhancing, constructing, or repairing floodplains, shorelines, or wetlands including:
  - Design and construction of nature-based infrastructure to retain and/or detain flood waters.
  - Design and construction of projects to reconnect streams to the full extent of their original floodplains.
  - Restoration of previously converted or developed land back to a natural land cover.
  - Redevelopment of developed floodplains into waterfront parks or open spaces that are compatible with flooding and flood water storage, and that provide opportunities for community engagement, recreation and/or river access.

2.4.5 North Carolina Division of Water Infrastructure Stormwater Funding Program (2022)

https://www.deq.nc.gov/about/divisions/water-infrastructure/stormwater-funding-program

2.4.5.1 Background

The North Carolina Department of Environmental Quality's (NCDEQ's) Division of Water Infrastructure (DWI) will award approximately $82 million in American Rescue Plan Act funding for stormwater projects through its competitive funding process from the newly created Local Assistance for Stormwater Infrastructure Investments program. Funds are available for cities, counties, regional councils of government and nonprofit partners for construction and planning projects that will improve or create infrastructure for controlling stormwater quantity and quality.

2.4.5.2 Summary of Efforts

NCDEQ-DWI will administer approximately $100.5 million for stormwater projects in the Local Assistance for Stormwater Infrastructure Investments fund, which excludes three percent of the appropriated amounts that may be used for administrative costs. The fund amounts, following statutory and budgetary requirements, are shown in the table listed on page 1 of the North Carolina Division of Water Infrastructure Stormwater Funding Program plan. In addition, federal requirements for the use of American Rescue Plan Act appropriations will apply. All funds must be expended by December 31, 2026.

2.4.5.3 Recommendations for Flood Resiliency Identified in the Stormwater Funding Program

No flood resiliency strategies identified.

2.5 Data Tools

2.5.1 North Carolina Resilience Clearinghouse (2022)

(Climate Resilience Toolkit & Clearinghouse User Research (usmangroup.com))

2.5.1.1 Background

In the wake of 2018's devastating Hurricane Florence, North Carolina Governor Roy Cooper set up the NCORR to lead the state's efforts in rebuilding smarter and stronger. At that time, many eastern North Carolina counties had yet to recover from two storms in two years, which brought flooding and extensive damage to many of the same communities. NCORR, in partnership with the Department of Environmental Quality and several North Carolina environmental nonprofits and universities, has begun a project to develop an online climate resilience clearinghouse for local governments and community leaders. The Clearinghouse will include:

- A comprehensive final report including process, complete transcripts and summaries of stakeholder interviews, and content recommendations.
- More than a dozen wireframes to help client envision the structure, content organization and user experience of the Clearinghouse website.
- A comprehensive, detailed Request for Proposal to solicit appropriate web vendors following NCORR's template and preferred language / terminology.

2.5.1.2 Summary of Efforts

To develop an online resilience resource center for local governments and community leaders. NCORR plans to launch an online Climate Resilience Clearinghouse to address climate-related risks in all communities across the state—especially those that are most vulnerable—as well as provide local governments and community leaders with solutions that mitigate and safeguard against the hazardous effects of climate change.

2.5.1.3 Potential Recommendations in the Resilience Clearinghouse

Potential Recommendations in the Resilience Clearinghouse include:

- Leveraging simple, geospatial climate-change resilience maps specific to North Carolina that live on the Clearinghouse site rather than third-party platforms could help curate hyperlocal data specific to North Carolina.
- When completed, the Clearinghouse will supply key information to inform equitable resilience building.

2.5.2 Resilience Analysis and Planning Tool (2020)

(https://www.fema.gov/node/resilience-analysis-and-planning-tool-rapt)

2.5.2.1 Background

Developed by FEMA, the Resilience Analysis and Planning Tool (RAPT) is a free GIS web map that allows federal, state, local, tribal, and territorial emergency managers and other community leaders to examine the interplay of census data, infrastructure locations, and hazards, including real-time weather forecasts, historic disasters and estimated annualized frequency of hazard risk.

2.5.2.2 Summary of Efforts

RAPT is a combination of over 20 community resilience indicators with correlation analysis. Users can combine layers for analysis and use RAPT to inform decision making.

2.5.2.3 Potential Recommendations in the Resilience Analysis and Planning Tool

Potential Recommendations in the Resilience Analysis and Planning Tool include:

- Data included in RAPT, and the RAPT user experience may inform NC Flood Resiliency Blueprint development.
- RAPT and the incorporation of DSS-WISETM are examples of decision support tools.
- RAPT incorporates layers related to equity, including NFIP (National Flood Insurance Program) policy penetration rates and broadband description.

3 Recommendations with Applicability to Blueprint

The purpose of this Statewide Planning Efforts with Flood Resilience Recommendations Review is to document identified specific recommendations from existing statewide planning efforts that correspond with flood resilience strategies, and to supply a basis of understanding for completed and ongoing statewide efforts related to watershed and resiliency planning. This will enable all those involved to build upon awareness of existing efforts to meet the intent of the NC Flood Resiliency Blueprint. The sources included in the Review met the resource inclusion criteria and were reviewed and considered against key assessment parameters to focus efforts on resources of highest applicability, relevance, ease of use, and foundational nature to NC Flood Resiliency Blueprint. However, there are many other resources that may be valuable for awareness and reference. A summary of the recommendations from each resource is provide below.

3.1 Climate and Risk Assessment Plan

- Facilitate interagency communication on resilience topics projects.
- Conduct building vulnerability assessments and find mitigation strategies for areas affected by riverine flooding from Hurricanes Matthew and Florence.
- Conduct flood mitigation studies.
- Begin administering the Building Resilient Infrastructure and Communities program.
- Develop an online resilience resource center for local governments and community leaders.
- Support nine regions in the eastern half of the state to complete climate vulnerability assessments and develop implementation pathways for 5 to 10 priority projects.
- Work with governments affected by Hurricane Matthew to restore critical infrastructure.
- Develop a climate resilience planning guide for local leaders.
- Conduct a dam breach analysis on intermediate and high hazard dams.
- Improve data collection at sites where flooding is common.
- Support the update and modeling of NC climate impacts, local capacity building, and planning for nature-based solutions to flooding impacts.

3.2 State Enhanced Hazard Mitigation Plan

- Develop a robust network of tools and systems throughout the state to help local and state officials better prepare for and respond to flooding events. This would include increasing the number of stream-flow gauges and dam impoundment water level gauges statewide and collecting stream gauge data, rainfall data, and high-water mark data regularly.
- Supply information to communities on real time flood inundation.
- Acquire or elevate properties that are in areas vulnerable to flooding.
- Analyze building stock to find potential structures that could be mitigated.
- Supply funds for purchase of conservation easements or land within flood hazard areas.
- Promote benefits of adopting higher standards in local Flood Damage Prevention Ordinances.
- Promote river basin wide planning of flood hazard.
- Promote consideration of future build-out conditions when setting up land use and floodplain management regulations.
- Promote and support recognition programs, such as the Community Rating System.
- Promote improvement of storm drainage systems.

- Promote full funding of NC Flood Mapping Program to complete new Flood Insurance Studies for entire state.
- Produce future volumes of NC measuring success publications documenting losses avoided quantitatively and qualitatively.
- Work with the NCDEQ Division of Coastal Management in developing the hazard mitigation part of the revised planning guidelines under the CAMA.
- Continued strategic growth of the NC ECONet, with new stations installed in areas that are lacking adequate climate and weather data.
- Directly integrate mitigation actions from state hazard mitigation plan into Risk MAP program to ensure progress is being tracked and recognized.
- Improve Coordination/Education/Outreach to better find and help underserved communities as identified in the FEMA Strategic Plan 2022-26.

3.3 NCDOT Resiliency Strategy

- Incorporate resilience assessments in long range plans.
- Production of Coastal Roadway Inundation Tool.
- Future Precipitation for Resilient Design Applied Research – Future rainfall distributions for modeling.

3.4 North Carolina Department of Administration Climate Strategy Report (2022)

- Preserving upriver farms to reduce flooding in North Carolina.
- Provides education and implementation of cover crop, conservation tillage, and cropland conversion programs for stormwater management leading to increased rainfall infiltration and decreased soil erosion and runoff.
- Educational resources and examples are provided to farmers to utilize NAP Insurance programs, along with resources for cost share and disaster assistance programs to prepare and recover following weather disaster events.
- The Plant Conservation Program has secured funding to address existing culvert and road wash-out concerns at coastal plain preserves.

3.5 North Carolina Department of Environmental Quality Climate Strategy Report (2022)

- Environmental justice was included in the scope of work for the Statewide Flood Resiliency Blueprint and in the priority rating system for the Water Resources 319 grant.
- In addition, environmental justice was incorporated into NCDEQ's formal recommendations for updates to the Enhanced Hazard Mitigation plan.
- Evaluate air monitoring site locations located in low drainage and flood-prone areas.
- Conduct hydrologic and hydraulic capacity study of dams in the Neuse and Lumber River Basins.
- Complete dam breach modeling.
- Implement strategies for enhanced waste management storm preparedness.
- Execute Scuppernong River Study.
- Add to the NC Flood Inundation Mapping and Alert Network.

- Recalculate flow statistic methods.
- Secure Funding for Natural Infrastructure Flood Mitigation Program.
- Increase resiliency of dams during storms.
- Continue coastal habitat restoration at Cedar Island.
- Coordinate water resources rules revisions that support EO 80.
- Include climate change impacts in basin watershed action plans.
- Rachel Carson National Estuarine Research Reserve (NERR) Habitat Resilience Plan that identifies and priorities areas for resilience projects based on known vulnerabilities and hazards.
- Develop Statewide Flood Resiliency Blueprint.
- Create resilience tools and resources for local governments.
- Implement Phase 2 of Tribal Coastal Resilience Connection Project.
- Implement Phase 3 and 4 of Resilient Coastal Communities Program.
- Implement Phase 1 and 2 of Resilient Coastal Communities Round 2.
- Deliver Coastal Training Program to coastal decision-makers on nature-based strategies to reduce coastal hazards, barrier island development, and low-impact development basics for water quality protection.
- Launch Technical Assistance Grant for Stormwater Infrastructure.

3.6 North Carolina Department of Health and Human Services Climate Strategy Report (2022)

- Complete a flood survey assessment and develop adaptation strategies to promote environmental justice and equity by including input from community leaders who can advocate for the needs of their community and mitigate the risk of isolation during flooding after a hurricane.
- Continue Black River Flooding Forecast Initiative that addresses the public health impacts of climate change by alerting residents that are most vulnerable to flood risks so they can make actionable steps.

3.7 North Carolina Department of Information Technology Climate Strategy Report (2022)

- Send teams to meet with county, city, and town IT leaders to brainstorm ideas for improving and adapting resiliency planning ideas Continue Black River Flooding Forecast Initiative that address the public health impacts of climate change by alerting residents that are most vulnerable to flood risks so they can make actionable steps.

3.8 North Carolina Department of Military and Veterans Affairs Climate Strategy Report (2022)

- Protect the state veterans' homes from flooding. Propose evaluation of any additional protective measures that should be taken if a flooding incident takes place near the facility.
- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Adopt best practices for the state veterans' cemeteries. Proposed expected completion date: June 30, 2030. The department will integrate any appropriate climate change adaptation practices and

resiliency planning into the policies and operations of the state veterans' cemeteries as required and as identified by NCDEQ.

3.9 North Carolina Department of Natural and Cultural Resources Climate Strategy Report (2022)

- The NCDNCR Strategic Plan is underway and expected completion date: June 2023. Floodplain and wetland acquisition and restoration.
- Conduct environmental reviews and help constituents for disaster recovery, response, and mitigation for future events. The NCDNCR will provide support for planning and resiliency initiatives and initiate planning, resiliency, and construction repair projects for historic resources. This work will take place under the ESHPF Disaster Assistance grant projects for Hurricane Florence and Michael recovery. In addition, the Environmental Review branch of the SHPO continues to work expeditiously to review all disaster-related and resiliency-oriented projects within a 30-day turnaround schedule. Finally, five members of the SHPO staff have completed or will complete Floodplain Management training sponsored by the NCDPS by the end of calendar year 2022.
- NC Museum of Art: Complete bridge, culvert, path repairs and replacement and stream restoration
- Evaluate off site storage solutions for collections at risk from the triple threats of flooding, heavy precipitation, and sea level rise climate risks across the department.
- Consider climate-related hazards when developing master plans for natural areas, parks, and nature preserves. Expected completion date: June 2023. DPR will begin to develop a protocol for resiliency and climate related mitigation methods to implement into both the General Management Plan development and future Master Plans.
- Inventory and Monitor State Nature Preserves is ongoing. Expected completion date: N/A. Field biologists monitor rare species as they conduct biological inventories of lands under consideration for protection as state nature preserves. Special attention is paid to species and habitats that are most vulnerable to a changing climate and natural disasters such as hurricanes, floods, and landslides. During the field season of 2022, Natural Heritage Program staff worked closely with NCDPS to survey natural areas at prisons and propose new state nature preserves on state-owned land. During the upcoming year, the Natural Heritage Program plans to survey lands along the Waccamaw River (Columbus County), Pond Mountain (Ashe County), and Chowan River (Bertie County), as well as many additional sites.
- Participate in the USACE South Atlantic Coastal Study At-Risk Cultural Resources Analysis is underway. Expected completion date: Unknown. For this project, the OSA and NC SHPO are consulting with USACE to identify cultural resources (historic and archaeological sites, historic districts, and other historic resources) vulnerable to coastal storm damage and sea level rise. This analysis is part of a multi-state effort throughout the southeastern United States and Caribbean. GIS and archaeological and architectural survey data along with staff expertise are all proving crucial to informing this effort. Many of the places identified are federal and state historic assets open to the public. Both the OSA as well as SHPO will continue to work with the USACE as the progress proceeds per USACE timelines.
- Complete the NC Shorescape Archaeological Survey. Expected completion date: Unknown. In FY2022-2023, the OSA will undertake a NC Shorescape Survey to identify and document archeological resources associated with coastal communities that are most at risk of being damaged by storm events. The focus is on identifying and documenting sites within 200 feet (60 meters) of the shoreline. The focus is on identifying and documenting sites within 200 feet (60

meters) of the shoreline, including into the submerged lands. Survey projects will go out for proposal and fieldwork will be completed over the next twelve months. These surveys will allow OSA to determine the location and extent of shoreline archaeological resources, the conditions of these sites and their associated shorelines, the historical significance of these resources, and management strategies to preserve these shoreline archaeological resources.

- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Hire a Sustainability Coordinator in the NCDNCR. Completion date: September 2022. The NCDNCR developed a new sustainability coordinator position and hired the successful candidate in September 2022. This position supports the development and implementation of actions, policy, and program decisions to ensure the NCDNCR is a leader among state agencies in addressing environmental sustainability, including but not limited to: assistance to divisions in the development of resilience and adaptation strategies for the effects of a changing climate; the creation of departmental strategies, goals, and benchmarks for mitigating carbon emissions in response to objectives and priorities set by the Governor and Secretary; and the development and implementation of educational materials and programs that capitalize on the potential of the NCDNCR's public-facing sites and programs to raise awareness among North Carolinians about environmental sustainability and science.

3.10 North Carolina Department of Public Safety Climate Strategy Report (2022)

- Evaluate the impacts of climate change on cabinet agencies' programs and operations.
- Conduct a vulnerability assessment of National Guard facilities and relocate buildings as needed. Expected completion date: January 2040. The NC National Guard is shifting to a "Hub and Spoke" model of a few large Regional Readiness Centers with a network of smaller Readiness Centers surrounding them strategically. The Guard's Construction and Facility Maintenance Office is applying data on sea level rise and other resilience information to determine which current facilities are not sustainable given current climate projections. With that information, the Guard will prioritize new construction projects and decide what properties can be retired. This process is expected to be ongoing over a period of decades as Congress makes more funds available to re-envision how the National Guard operates from a structural standpoint. Climate resilience will always be a critical element of decision making.
- Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations.
- Coordinate state agencies' annual Climate Strategy Reports. Expected completion date: Annually: October 2022. In 2022, the Governor's Office issued a memo requesting that all state agencies annually report their progress on implementing the actions in the 2020 Climate Risk Assessment and Resilience Plan, EO 80, and EO 246 in one report – the Climate Strategy Report, due each October. Previously state agencies reported progress on the Resilience Plan and EO 80 in separate documents; this is the first time state agencies will report on EO 246, announced in January 2022. NCORR, in partnership with NCDEQ, developed a template and created a process for each agency to submit their accomplishments to the Governor's Office, the NC Climate Change Interagency Council, and the public. NCORR will continue coordinating and advising state agencies on this reporting process in 2023.Facilitate a stream management and flooding reduction working group. Expected completion date: N/A. NCORR has established an intergovernmental working group

comprising representatives from the NCDEQ, Transportation, Agriculture and Consumer Services, and Natural and Cultural Resources, among others and is conducting outreach to other stakeholders outside of state government to recruit for membership. NCORR has submitted two reports to the Joint Legislative Commission on Governmental Operations and NCDPS and the Fiscal Research Division regarding the findings and recommendations of the working group. Thus far, the working group has identified several issues for further discussion and recommendation, including (among others):

  - The need for restricting development in the floodplain and expanding the requirements for floodproofing.
  - The need for land conservation along the coast and within floodplains, and the need to reinstate NC's land conservation tax credit to incentivize keeping people and development out of areas vulnerable to flooding.
  - The need for ongoing outreach and education regarding what can be accomplished through various flood reduction methods to improve public and private decision making. Over the course of the next 12 months, the working group will further refine and develop these and other recommendations for the legislature. In the short term, the working group intends to focus its efforts on analyzing the 2021 Flood Resilience Study by the UNC Policy Collaboratory, which was submitted to the state legislature.

- Facilitate interagency communication on resilience topics projects. Expected completion date: N/A. NCORR facilitates the IRT, as called for in Chapter 7 of the 2020 Climate Risk Assessment and Resilience Plan, to provide a structure for state staff to coordinate resilience projects and to support the development of annual Climate Strategy Reports. The IRT includes at least one resilience lead from each state cabinet agency, as well as the Department of Agriculture and Consumer Affairs and the Wildlife Resources Commission. This team meets monthly.
- Facilitate the State Disaster Recovery Task Force to coordinate efforts and advise state government as needed on recovery and resilience is ongoing. Expected completion date: N/A. NCORR manages the SDRTF, which supports and advises state agencies as they address long-term recovery and undertake resilience-building initiatives statewide. The SDRTF is made up of 12 committees called Recovery Support Functions (RSFs). Since the start of this year, the Environmental Preservation RSF has held several meetings to update members on ongoing resilience efforts across state agencies, including rainfall modeling and data gathering, local capacity building, and nature-based flood reduction planning efforts for which NCDEQ has received funding through NCORR's CDBG-MIT program. The Nonprofit and Volunteerism RSF worked on its first set of recommendations on improving diversity, equity, and inclusivity in disaster recovery and resilience. Two overarching themes of the recommendation document are to strengthen relationships between NCEM and nonprofits with strong ties to Black and Latino populations, and to allocate disaster resources in a way that reduces equity gaps. The Housing RSF discussed NCDPS and how the American Rescue Plan Act programs can work together to support North Carolina residents to obtain and stay in safe, secure, and affordable housing across income spectrums. Housing instability and housing cost burden are strong drivers of household-level vulnerability to climate change. NCORR has made significant strides toward implementing the recommendation of the Housing RSF to increase production of affordable, accessible housing by leveraging CDBG-DR funds.
- Support the development of an update to the NC Uniform Floodplain Management Policy for State Construction. Expected completion date: December 2023. NCORR, in partnership with NCEM and

the NCDOA, worked with the Governor's Office to develop EO 266, which Governor Cooper signed. The EO directs NCDOA to update the state's requirements for construction on state land subject to flooding. A direct outgrowth of NCORR's work with the IRT, the EO will result in increased resilience for state assets by both updating the requirements for such construction (which requirements had last been updated in 1990) and by expanding the scope of projects subject to such requirements by implementing a flood risk management process beyond application of the previous 100-year floodplain standard. NCORR will assist NCDOA with developing the new requirements and flood risk management standard. EO 266 provides an 18-month deadline for NCDOA's adoption of the new policy.

- Conduct building vulnerability assessments and identify mitigation strategies for areas impacted by riverine flooding from Hurricanes Matthew and Florence. Completion date: fall 2022. In 2020, NCEM began a building level risk assessment and mitigation strategy development process for approximately 12,000 square miles of unstudied streams heavily impacted by riverine flooding from Hurricanes Matthew and Florence. Flood risk analyses and building level flood damages and mitigation alternatives assessments were completed in the summer of 2022 and NCEM recently launched the NCEM Advisory Flood Data viewer (https://flood.nc.gov/advisoryflood/) to disseminate study reports, flood analyses boundaries and building-level risk assessment data to local communities, state agencies and the public.
- Conduct flood mitigation studies. Expected completion date: Fall 2022. In 2020, NCEM initiated new flood mitigation studies for the Northeast Cape Fear River, Cape Fear River, Little River, and Cashier River Basins. NCEM completed flood and mitigation alternatives analyses in the Summer of 2022 in in the process of completing final reports for the project. Final reports will be complete and loaded to the Rebuild NC website (https://www.rebuild.nc.gov/resiliency/river-basin-studies) to share with the public in the fall of 2022.
- Begin administering the BRIC program. Expected completion date: N/A. In 2020, the federal government released its pre-disaster mitigation program, NCEM launched BRIC, which aims to shift the focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. In the 2020 BRIC application, 32 projects were submitted for the competitive evaluation by FEMA and five were selected for award worth approximately $30M. The state is currently waiting for these projects to receive an award letter and begin work. In the 2021 BRIC application, 49 projects totaling approximately $167M were submitted for the competitive evaluation by FEMA. FEMA reviewed of all submitted projects is ongoing with expected notification date of selection in July 2021.
- Develop an online resilience resource center for local governments and community leaders Underway Expected Completion Date: December 2023 NCORR, in partnership with the NCDEQ and several North Carolina environmental nonprofits and universities, has hired a consultant to begin the initial stages of developing an online climate resilience clearinghouse for local governments and community leaders. The tool is called for in the 2020 North Carolina Climate Risk Assessment and Resilience Plan (2020 Plan) and in the North Carolina Natural and Working Lands Action Plan. The resource will "point users to relevant climate data and best practices for building resilience in an equitable way" (p. 7-15, 2020 Plan). The project is supported by funding from the US Climate Alliance.
- Purchase homes in the floodplain. Expected completion date: April 2026. NCORR administers the ReBuild NC Strategic Buyout Program, which is a voluntary program that purchases properties that are at-risk for flooding and turns them into deed-restricted greenspace. The Strategic Buyout Program engages closely with local governments and communities to identify contiguous areas

that are good fits for the program, and the program offers generous financial incentives to encourage applicants to move to places that are less at risk for flooding. The program has received 230 applications since the program opened in January 2020 and has received 23 applications since March 2022. The program has undergone significant streamlining efforts in the last several months, which has resulted in a 937% increase in movement toward project completion. The program made its first three offers to applicants in July 2022. For the next 12 months, the program expects to onboard state staff to facilitate applicant progression, begin purchasing homes, and expand to additional areas. NCORR intends to continue to identify areas in which the program can be simplified and will be making additional changes throughout the next year.

- Repair and elevate storm-damaged homes is ongoing. Expected completion date: N/A. NCORR administers the ReBuild NC Homeowner Recovery Program, North Carolina's long-term disaster recovery program, to repair and elevate storm-damaged homes. Between March and August 2022, NCORR completed 35 repair and elevation projects despite facing challenges from the nationwide material delays, labor shortages and a significant increase in material pricing. Those 35 projects consist of manufactured housing replacements, reconstruction of single-family residences and rehabilitation of single-family residences. Since March 2022, NCORR has made a series of enhancements to the ReBuild program. NCORR transitioned from a construction management vendor to a state-run residential construction management program. In addition to the overhaul of construction management, NCORR has begun to post procurements to the state's Interactive Purchasing System. Due to these changes, NCORR expects to complete over 200 manufactured home replacements and reconstruction, rehabilitation, and elevation projects by the end of December 2022. ReBuild NC is made possible through US Department of Housing and Urban Development Community Development Block Grant – Disaster Recovery and Community Development Block Grant – Mitigation funding.
- Support nine regions in the eastern half of the state to complete climate vulnerability assessments and develop implementation pathways for 5-10 priority projects. Expected completion date: December 2022 Since the program's launch in fall 2021, NCORR, in partnership with NC Rural Center, has continued working with consultants and local stakeholders to develop a vulnerability assessment and a portfolio of five to 10 regional resilience projects in each of the nine multi-county regions. As of September 2022, all nine vulnerability assessments have received public comments and are in the final stages of completion. In addition, all nine regions have developed a draft list of projects that are under review by local stakeholders. Over the next three months, NCORR will work with project partners to develop an implementation pathway for each resilience project, to include a project lead, potential funding opportunities, implementation steps, and more. By December 2022, both documents– the vulnerability assessment and the portfolio of projects – in each region will be finalized and released the public. In early 2023, NCORR will work with each region to submit one project to the Duke Energy Foundation for full or partial funding. The Duke Energy Foundation has committed $600,000 total to aid the implementation of the RISE Regional Resilience Portfolios. The project is part of the RISE program, which aims to address the need for local capacity building around long-term disaster recovery and resilience planning and implementation. RISE is part of the North Carolina Resilience Communities program, run in partnership with the NCDEQ. Funding from the Economic Development Administration and US Department of Housing and Urban Development supports this project.
- Work with local governments impacted by Hurricane Matthew to restore damaged critical infrastructure. Expected completion date: August 2024. NCORR's Infrastructure Program is currently developing community infrastructure projects in Bladen, Duplin, Hyde, and Robeson

Counties, the City of Lumberton, and in the Towns of St. Paul's and Princeville. These projects include a range of critical infrastructure and technical assistance for subrecipient projects as varied as drainage studies, stormwater drainage, development of potable water sources, sewer improvements, demolition of dangerous building ruins, and rehabilitation of buildings to be used for critical community services. In addition, the Infrastructure Program is lending assistance in the construction of infrastructure to build flood-safe communities, most notably in the Town of Princeville, and is currently monitoring the development and construction of a homeless-services building in the City of Fayetteville, which is forecasted to be completed in the early summer of 2023. During the past year, the program has assisted subrecipients in completing the construction of stormwater infrastructure in Nash County and the ongoing, aforementioned facility in Fayetteville, assisted subrecipients with procurement of nine architectural-engineering firms for design of infrastructure improvements, and closely followed the completion of a countywide stormwater drainage study that includes hydrological and hydraulic calculations that will inform the county as they develop feasible and cost-effective designs to address extensive stormwater drainage problem throughout the county. Over the next 12 months, the program's subrecipients plan to construct approximately 15 projects. The program is closely monitoring contracted scoping tasks and accompanying timelines for design, and is proactively advising subrecipients on next steps, leading toward construction and successful completion.

- Develop a climate resilience planning guide for local leaders. Expected completion date: December 2022 NCORR is working with a consultant to develop a resilient community planning guide for North Carolina's local governments. The guide will empower local and regional leaders to understand their climate vulnerabilities and develop shared priorities for action. The guide will have two components: A playbook and an idea book. The playbook will guide users through the process of building a team, analyzing vulnerabilities and assets, brainstorming, prioritizing actions, and identifying implementation steps. The idea book will provide examples of projects, programs, and policies that improve resilience across social, economic, and environmental domains. The planning guide is supported by funding from the Economic Development Administration. It is being developed as a component of RISE in conjunction with the North Carolina Resilience Communities program, run in partnership with NCDEQ. Both components of the guide should be released in 2022.
- Account for climate change in the State Hazard Mitigation Plan. Expected completion date: Fall 2022. Ensure the Enhanced State Hazard Mitigation Plan includes an emphasis on addressing the projected impacts of climate change and on protecting, communicating with, and serving marginalized populations NCEM has integrated climate change and the North Carolina Climate Risk Assessment and Resilience Plan into the Enhanced State Hazard Mitigation Plan update to the extent feasible. New FEMA guidance comes into play in April of 2023 that includes specific considerations for climate change in the risk analysis as well as an expansion of outreach to underserved populations. Current update is expected to be completed and approved before the new guidance comes into play, but NCEM did, at the suggestion of the Resilience Plan, begin to address some specific impacts of climate change in the hazard analysis, specifically regarding heat and flooding, addressing anticipated changes in frequency/intensity of drought and flood conditions and the impacts of same on wildfire and landslide hazards. NCEM put the draft up for public comment from September 22 to October 14, 2022.
- Conduct a dam breach analysis on intermediate and high hazard dams. Expected completion date: Spring 2023. In 2020, NCEM began conducting dam breach analyses on the remaining 859 intermediate and high hazard dams in NC that currently do not have dam failure inundation

boundaries or building and road risk information. The agency is developing rainfall runoff hydrological modeling for 287 dams, installing gauges to monitor for dam failure at 130 critical state and locally owned dams, and integrating all data into a secure monitoring, alert, and warning system. NCEM has completed analysis of all intermediate and high hazard dams and this information was loaded into the SERA and the dam warning and alert application. NCEM has also completed rainfall runoff modeling for 287 dam and has loaded this data into the dam alert and monitoring software. Finally, NCDEQ Dam Safety has secured long-term funding for annual software fees to continue the dam alert and warning application. NCEM has recently awarded a contract to install 34 remaining ultrasonic water level sensors and anticipates having these installed by early 2023. Also, NCEM plans to award a contract to install 29 remaining pressure transducer water level gauges at dams and install those by early spring 2023. These water level gauges will be integrated into the dam alert and warning application once installation is complete.

- Improve data collection at sites where flooding is common. Completion date: Fall 2022. To improve the data collection capabilities of the State Emergency Response Team purchased and is installing river gauges at 71 additional sites statewide and updated flood inundation libraries and risk assessments for these additional sites beginning in 2020. NCEM completed installing these 71 new radar gauges in May of 2022 and all data was loaded to and is being shared through the FIMAN application (https://fiman.nc.gov/)
- Pilot a flood insurance program. Expected completion date: TBD. The North Carolina Office of Recovery and Resiliency and North Carolina Emergency Management are working towards piloting a flood insurance program. The initiative is in the process of being integrated into the existing ReBuild NC Homeowner Recovery Program supporting communities significantly impacted by Hurricanes Matthew and Florence. Currently, NCORR continues to refine program policies, procedures, and system of record business requirements. NCORR has discussed flood insurance purchase requirements with FEMA and NFIP generally and as it relates to newly constructed structures. Flood insurance policies cannot be transferred from building-to-building, but rather are transferred from owner-to-owner. Hence, an eligible applicant's existing flood insurance policy on the old structure would need to be cancelled and a new flood insurance policy would need to be purchased for the new replacement structure. NCORR was informed by FEMA that two-year flood insurance policies may not be pre-purchased, and it takes 30-days for a flood insurance policy to be in effect. NCORR is developing procedures with all of FEMA's requirements in mind to ensure there are no lapses in flood insurance for eligible applicants. NCORR is also reviewing FEMA's risk rating for NC as those impacts flood insurance premiums. The NFIP State Coordinator (NCEM) facilitated a meeting on June 14, 2022, between NCORR and FEMA Region IV Flood Insurance Liaison to discuss providing NCORR with direct access to NFIP Insurance Data.
- Support the update and modeling of NC climate impacts, local capacity building, and planning for nature-based solutions to flooding impacts. Expected completion date: N/A. Through its administration of the Community Development Block Grant - Mitigation program, NCORR is funding several planning efforts by other state agencies that increase statewide resilience to climate change impacts. These projects update the state's data and modeling of climate impacts including rainfall and drought, build local capacity to design solutions to climate vulnerabilities, and develop a natural infrastructure flood mitigation program. Thus far, NCORR has entered into four funding agreements with NCDEQ and one with NCDOT to support these important efforts:
    - NC Resilient Coastal Communities Program. NCDEQ, Division of Coastal Management. $500,000 CDBG-MIT.

- Statewide Probable Maximum Precipitation Study. NCDEQ, Division of Energy, Mineral, and Land Resources. $500,000 CDBG-MIT.
- Low Flow Statistics Re-Evaluation and Public Water Supply Boundary Area Assessment. NCDEQ, Division of Water Resources. $740,700 CDBG-MIT.
- Development of the Natural Infrastructure Flood Mitigation Program and Modeling of Nature-Based Solutions for Flooding. NCDEQ, Division of Mitigation Services. $340,800 CDBG-MIT.
- Updating the Precipitation Frequency Estimates for North Carolina, NOAA Atlas 14, NCDOT, $237,120 CDBG-MIT Over the next year, NCORR will continue to partner with NCDEQ and NCDOT to monitor progress on these efforts. NCORR is also in the process of entering into a similar agreement with the State Climate Office, NC State University, to fund a project to incorporate climate data into the state's precipitation statistics and create a publicly available, user-friendly interface for this information.

3.11 Action Plan for Nature-Based Stormwater Strategies (2021)

- Create a Nature-Based Stormwater Steering Committee to ensure continued stakeholder engagement and leadership in support of long-term, meaningful progress.
- Expedite permit applications that are designed to achieve runoff volume matching as specified in the state's stormwater design manual.
- Secure additional funding to support technical specialist(s) in NCDEQ, associated with NCORR's Resilient Communities Program or within other agencies and organizations, including universities and NGOs, and through private-public partnerships who can meet with project designers and developers in early stages of the design phase to evaluate, advise and provide technical assistance on site suitability for nature-based stormwater strategies. Specialists should also assist local permitting authorities.
- Develop detailed informational maps to assist with watershed management plan development and guide where and what types of nature-based stormwater strategies are most practical and economical for potential new development sites, including land acquisition strategies, stormwater mitigation banks, etc. Obtain site characteristics necessary for these maps by relying upon existing geographic information system databases.
- Train industry and trade professionals, government staff and decision-makers so that they understand the benefits and limitations of nature-based stormwater strategies. Elements of this training need to include:
  - Continuing education credits for training courses that review: permitting procedures; design criteria for individual measures and practices; operation and maintenance requirements, including lifecycle costs compared to conventional treatment systems; benefits of nature-based systems; and legal instruments used to ensure permit compliance with permittees.
  - Workforce training: Promote skills training on construction and maintenance of low-impact development to employees of landscape and maintenance firms.
  - Peer-to-peer forums and trade shows: Create and facilitate regular opportunities for practitioners, including private business sector as well as public entities, to share experiences, collaborate and inspire each other to expand the use of nature-based stormwater strategies. This initiative includes biannual trade show with conference and training workshops; list-serve that convenes the community of practice online; and periodic luncheons, gatherings, and webinars that provide formal and informal opportunities to discuss experiences and ideas.

- Facilitate local government review of development codes and ordinances for potential inclusion of nature-based solutions. State agencies, nonprofits and academic partners should work together to assist local officials in an organized and consistent approach, including community outreach and technical assistance, to highlight nature-based strategies as a priority resilience measure.
- The NC General Assembly requests a study to determine the degree to which promoting nature-based solutions saves the state money in addressing flooding and water quality concerns, and an economic impact analysis of jobs created, improved property values and other benefits because of applying nature-based solutions. Evaluate how these cost savings and economic benefits, if found, can be used to provide, and inform financial incentives such as tax breaks, design/planning assistance, to promote the use of nature-based stormwater strategies. This study should include state-funded institutions of higher learning.
- Establish a standardized life-cycle cost analysis for disclosure, as is currently being documented in research at NC State University and include these costs for operating and maintaining permitted stormwater systems as an update to the state's stormwater design manual. Update periodically to ensure accuracy of cost estimates.
- Ensure that maintenance plans prepared as a requirement of state and locally issued stormwater permits include an estimated budget of lifecycle costs for operating and maintaining the authorized stormwater system. This critical information will disclose these costs to current and future permit holders so that they can budget each year to fulfill their long-term financial responsibilities. In many places, systems that use nature-based stormwater strategies will be more cost-effective to operate and maintain.
- Create a state-sponsored awards program administered by NCDEQ and/or NCORR that recognizes notable low-impact development projects and communities leading in applying nature-based stormwater strategies each year. These awards may highlight creative approaches to coordinating, funding, and designing nature-based stormwater strategies, and could highlight the successes of the NC Resilient Communities Program and other state technical assistance offerings.
- Issue appropriate executive orders and policies that promote the use of nature-based stormwater strategies by the governor's cabinet agencies to the extent allowed by existing laws and rules. For certain defined projects, nature-based stormwater strategies should be the default and must be demonstrated to be impracticable before using conventional methods.
- Request that the NC General Assembly evaluate if it should encourage the use of nature-based stormwater strategies by enacting a state law that includes provisions like those in the Federal Energy Independence and Security Act Section 438. This federal law requires large construction projects financed by the federal government to "maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property regarding the temperature, rate, volume, and duration of flow
- Develop model policies, incentives, and ordinances that local governments can adopt that promote the use of nature-based stormwater strategies for local government construction projects.
- The steering committee will organize local stakeholders to approach local governments to seek adoption of model incentives, policies and/ or ordinances. State agency technical specialists will support communities in developing and implementing these changes.
- Use nature-based stormwater strategies to bring failing stormwater systems into regulatory compliance. Devise a streamlined process for modifications of existing state and local permit requirements so that nature-based stormwater strategies can be used to obtain regulatory compliance.

- Add a new chapter to the NCDEQ Stormwater Design Manual to provide guidance on the appropriate uses of nature-based strategies to address compliance issues with its existing permits. This promotes practices that mimic "hydrologic matching" as already defined in the manual. This guidance should be written with the intention to simplify the review process.
- Add a new chapter to the NCDEQ Stormwater Design Manual to include guidance on how best to use nature-based stormwater strategies to retrofit existing land uses that may or may not have existing stormwater permits. The chapter needs to explain how these measures can be adapted so that they are cost-effective to use even when site limitations constrain the ability to meet all optimal design specifications.
- Enact new state legislation to resolve out of compliance stormwater permits that no longer have an identifiable party responsible for maintaining their compliance. The law needs to outline procedures and provide funding opportunities or incentives to fix these compliance issues and should explicitly encourage the use of cost-effective nature-based stormwater strategies to fix and upgrade failing systems. Local governments should establish a program or mechanism to absorb financial risk and use collective funds to fix noncompliant systems.
- Consider nature-based approaches first when upgrading, updating, or redeveloping existing government facilities.
- Educate the public about nature-based stormwater strategies by incorporating these practices into facilities that are frequently visited by the public, such as government office buildings, parks, boat ramps, schools, and beach access areas. Include educational signage and exhibits in these retrofit projects to spread public awareness and use of these strategies.
- Develop and identify significant new sources of federal, state, and local funding to support retrofit projects that reduce flooding, improve water quality, and reduce economic disruptions by achieving "hydrologic matching."
- Direct federal and state disaster mitigation funding to plan, design and install nature-based stormwater strategies as part of recovery programs.
- Adopt policies within all state-administered financial assistance grant and loan programs used to acquire and retrofit public lands and infrastructure that promote the use of nature-based stormwater strategies.
- Develop a guidance manual for transportation planners that illustrates effective incorporation of nature-based stormwater strategies into transportation planning and project development decision making processes. Action Plan for Nature-based Stormwater Strategies: Promoting Natural Designs that Reduce Flooding and Improve Water Quality.
- Develop roadway typical sections that illustrate nature-based stormwater solutions in the design context to guide comprehensive transportation planning, project planning and project design.
- Develop technical guidance tailored for roadside operations personnel on techniques for optimizing the infiltration and evapotranspiration capacity of the roadside environment.
- Include more information and technical guidance on nature-based stormwater strategies that are appropriate for the transportation system in the NCDOT best management practices toolbox and share that information with municipal transportation agencies.
- Based on this review, recommend changes to existing laws, rules, ordinances, policies, funding sources and procedures that facilitate the use of nature-based stormwater strategies.
- Revise NCDOT's qualification standards for designers, engineers, contractors, and other professional consultants to include demonstrated training and experience in nature-based stormwater strategies.

- In addition, NCDOT should ensure contract awardees are trained in nature-based design strategies and are committed to receiving continuing education on these design options annually. NCDOT may consider making this a new prequalification code or an amended one, and these trainings may be developed in partnership with the education programs proposed in the "New Development" recommendations.
- Provide agency leadership with briefings and supportive materials necessary to secure their support and guidance on how best to promote the use of these strategies as part of their decision-making.
- Formalize policies and internal guidance as needed to institutionalize agency leadership support for prioritizing the use of nature-based stormwater strategies.
- Engage transportation agencies, who are among the largest landowners in the state, as major partners in the proposed watershed planning effort. Seek to incorporate stormwater strategies for roadways into overall watershed management strategies recommended in the plans. Explore opportunities that exist beyond the established right-of-way for cost-effective use of nature-based stormwater strategies.
- Coordinate agreements between transportation agencies and disaster recovery programs that expand opportunities to rely on nature-based stormwater strategies to promote the agency missions of all parties. Seek to direct hazard mitigation investments so that stormwater needs of transportation agencies are achieved whenever possible.
- Increase economic incentives from local, state, and federal sources to landowners, including industrial owners, to preserve wetlands within forest lands, and to preserve forested and agricultural floodplains. Support ongoing efforts to identify forest lands that are a high priority to maintain and determine financial assistance or economic incentives needed to keep these lands working.
- Integrate efforts to maintain working lands into a state watershed management program. Secure additional funds to support technical, legal, and financial assistance to integrate efforts to maintain working lands through watershed management strategies designed to reduce flooding and improve water quality.
- Mount a coordinated campaign that works with state leaders, the NC Congressional delegation and engaged stakeholders to pursue substantially increased financial resources from the federal Farm Bill and other programs for conservation. Financial parity with other states could finance wetland restoration, conservation easements and large-scale hydrologic restoration projects in NC.
- Direct more federal funds, including disaster mitigation program funding, to support consistent staffing capacity at the state, regional and local levels to help identify, plan, design, fund, and construct projects that protect, restore, or replicate natural hydrology. Partner with the Natural Resources Conservation Service to increase the staffing capacity of federal, state, local and nonprofit organizations to plan and execute nature-based stormwater strategies on working lands.
- Work with NCORR, NC Department of Agriculture and Consumer Services, and other agencies that administer disaster mitigation funding that is available to enhance staffing levels and consulting services to aid in the developing and administering hydrology-related projects.
- Continue and expand watershed level initiatives to identify and maximize strategic opportunities that provide water quality and flood reduction benefits to local and downstream communities. Seek to incorporate watershed initiatives with other ongoing landscape level programs that have different but compatible benefits including:

  - Coordinate with a new landscape initiative work group comprised of private and public stakeholders with funding from US Fish and Wildlife Service to identify locations in coastal NC where private and public funds can be focused on large-scale hydrologic restoration projects.
  - Work with military stakeholders to identify target properties that are essential for military training where hydrologic restoration projects are also feasible. The operations of the Department of Defense (DoD) collectively constitute North Carolina's second largest industry. Preserving working lands is critical to the military's ability to function, and the Sentinel Landscapes Partnership is an important vehicle to facilitate preservation of working lands. It should become an active partner in implementing this work group's strategy.
  - Implement the Lake Mattamuskeet Watershed Management Plan working with private landowners, US Fish and Wildlife Service, NC Wildlife Resources Commission, Hyde County and NC Coastal Federation.
  - Identify existing and emerging regional conservation partnership opportunities outside the coastal counties that provide opportunities for hydrologic restoration and management.

- Create opportunities to hold more water on working lands to provide downstream benefits while compensating for potential crop loss due to the additional water being held on these lands.
- Using the most up-to-date projections available, determine where production zones for working lands may change due to climate change to inform agricultural management, land use and conservation decisions.
- Obtain commitments to move forward with comprehensive watershed management framework. State leaders will devise and fund a multi-year planning framework that encourages watershed management to reduce flooding and enhance water quality concurrently. This will be supported and informed by relevant stakeholders drawing on the work group attendees.
- Economic study on costs and benefits of nature-based stormwater strategies. The NC General Assembly will be encouraged to request a study to prepare an economic analysis that details the cost savings associated with using nature-based stormwater strategies to mitigate flooding. This research may be carried out by a private consultant in partnership with NC experts such as those at (universities, stakeholders, and other interests).
- Promote demonstration projects. Identify and implement projects (new development, retrofits, roadways and working lands) that demonstrate the value of nature-based stormwater strategies with real world projects.
- Provide accurate information on maintenance cost for nature-based stormwater strategies. The steering committee will work with state officials and stakeholders to amend the stormwater design manual to include this data so that users are able to budget for life-cycle costs of these measures and learn about the savings regular maintenance can provide over time.
- Streamline modifications to existing stormwater permits to encourage use of nature-based stormwater strategies. Secure a commitment from NCDEQ to evaluate processes and work with stakeholders to devise standard operating procedures that provide a streamlined process for modifications of existing permit requirements so that nature-based stormwater strategies can be used to achieve regulatory compliance.
- Advance state and local policies promoting nature-based stormwater strategies. The steering committee and its various stakeholders will engage with key state and local leadership to promote recommendations in this plan and seek adoption of formal policies that enable the government to lead by example.

- Form the Action Plan Steering Committee. This leadership group of dedicated individuals from various stakeholder interests should spearhead implementation of recommendations in the plan. The group will meet periodically to set priorities and oversee accomplishments.
- Establish a consistent mechanism for continuing education and outreach. A work group will be organized to coordinate future planning for education and outreach. The group will seek the necessary financial resources support regularly scheduled, targeted programming and provide the necessary training and awareness building to advance action plan priorities.
- Organize DOT work group. The steering committee will work to assist DOT leadership and staff in putting together a work group to tackle DOT's highest priority recommendations including updating its toolbox to include nature-based stormwater strategies and reviewing regulatory constraints that discourage the use of these measures more fully.

3.12 Natural and Working Lands Assessment Plan

- Protect and restore forests and wetlands within flood prone areas.
- Integrate climate adaptation and resiliency strategies into comprehensive local plans.
- Coordinate the state's floodplain buyout and restoration program to increase resilience.
- Implement targeted interventions to protect peatlands from sea level rise and saltwater intrusion guided by scenario-based modeling.
- Supply incentives to stakeholders for coastal habitat protection.
- Facilitate migration of coastal habitats through protection of migration corridors.
- Prioritize climate change and sea level rise in coastal habitat restoration planning.

3.13 Coastal Habitat Protection Plan: Amendment 2021

- By 2022, NCDEQ will form an interagency workgroup with NGOs, and local governments to inform and guide development of watershed restoration plans to protect, restore, or replicate natural habitats (i.e., SAV, water quality, coastal habitats) and hydrology through natural and nature-based solutions.
- By 2023, NCDEQ will develop and implement a full-scale assessment program to conduct coastwide SAV mapping and monitoring at regular intervals (≤ 5 years).
- By 2023, NCDEQ will obtain state matching funds for the NOAA CCAP program to map NC's Coastal Plain at 1m resolution and added funding to expand wetland monitoring conducted by DWR and other state agencies.
- By 2024, NCDEQ will pursue the use of emerging technologies such as data fusion or deep learning neural networks, that rely on a combination of satellite imagery, drone imagery, and field verification for Coastal Plain wetland mapping and change analyses.
- By 2026, NCDEQ will determine the status and trends of Coastal Plain wetland acreage, condition, and function, based on the added mapping and monitoring data obtained
- By 2022, the NC DMF will decide potential mechanisms to prevent harvesting from living shorelines constructed with oysters.
- By 2025, DEMLR and other divisions should increase education, outreach, and training to consultants, local government, and landowners for nature-based stormwater and watershed management strategies.
- By 2022, NCDEQ will form an interagency workgroup with NGOs, and local governments to inform and guide development of watershed restoration plans to protect, restore, or replicate natural

habitats (i.e., SAV, water quality, coastal habitats) and hydrology through natural and nature-based solutions.

- By 2022, NCDEQ will form a workgroup with the DWR, DEMLR, Division of Soil and Water Conservation, local governments, and other partners to increase BMPs related to water quality within the SAV waterbody regions to the extent possible, consistent with current funding level, and request increased state cost-share funding.

3.14 Collaboratory Flood Resiliency Study

- Flood Resilience: Data Collection and Data Analytic in support of Flood Management. The project aimed to expand gauge testing by including low-cost radar sensors and rain gauges and developing a water gauge reading method.
- The State of North Carolina should explore a wide variety of funding mechanisms that could smooth and speed buyout processes, including municipal/green bonds, revolving loan funds, local option sales taxes, and stormwater utility fees. Special attention should be paid to the inclusive and equitable use of these funding mechanisms on the state and local scale.
- As part of exploring alternative buyout processes, the state should identify improved methods of calculating avoided loss that include aggregate risk (beyond project itself, e.g., downstream impacts) to determine whether buyouts lower flooding risk and damage elsewhere nearby.
- The state should prioritize and fund establishment of FAIR data standards – ensuring data is Findable, Accessible, Inter-operable, and Reusable – for all buyout- and hazard mitigation-related data, creating policies and data use agreements to standardize and curate metadata, streamline researcher and community group access, and enhance accessibility to the public. As part of this, buyouts- and hazard-related data should be stored in a publicly accessible data repository (e.g., UNC Dataverse) that facilitates good user experiences, and easy and effective data dissemination. Ultimately, these actions will save staff time and dramatically lower costs in response to data requests.
- Adopt policies that prevent future development and redevelopment within the 100-year floodplain and that severely restricts development in the 500-year floodplain. It should be noted that all encroachment into the floodplain (i.e., elevated structures) reduces the water storage capacity of the floodplain during extreme events.
- Invest in improving resilience of all critical infrastructure that is vulnerable to flooding (roads, bridges, stormwater systems, reservoirs, water and wastewater treatment facilities and networks, energy supply) to minimize loss of life, emergency rescue, loss of use and negative impacts to commerce and economic impacts during future extreme storm events.
- Invest in research to develop and monitor a pilot water farming project. The research should focus on evaluating water management systems, storage, and peak flow reductions, impacts to soils and crops and other agricultural management processes and associated economic factors.
- There is no integrated database that contains information on channel properties and surrounding floodplain topography that can be used to configure coastal and hydrological flood hazard models, particularly for smaller tributaries and channel reaches in the North Carolina coastal plain. Future work should leverage existing statewide datasets of surveyed channel data and high-resolution LiDAR to create a single, integrated geospatial database that can be used to incorporate channels and their associated floodplains into flood hazard models. Gaps in the existing datasets, particularly where cross-sectional surveys may be outdated or lack resolution, should be identified, and filled.

3.15 Recommendations for Flood Resiliency Identified in the RISE Program

- Developing the North Carolina Resilient Communities Guide, as a statewide resource that supplies tools, guidance, and opportunities for building community resiliency.

3.16 Resilient Coastal Communities Program

- The primary objective of Phase 3 of the RCCP is to provide funding to assist communities with the engineering and design of a prioritized project identified in their RCCP Resilience Strategy or other existing plans that meet the RCCP's Phases 1 and 2 planning criteria.
- Most of the engineering and design projects feature natural and nature-based elements such as wetland restoration and living shoreline design.

3.17 Resilient Communities Program

The Funding Forum held in February 2023, aimed to address the obstacle of funding resiliency projects by introducing community leaders, policymakers, and other stakeholders to federal, state, and nonprofit funding opportunities for resilience-related projects. The free, one-day event allowed attendees to engage with potential funders, who supplied presentations and answered project-specific questions during break-out sessions. Attendees also had the opportunity to take part in a grant writing session to take their project one step closer to reality.

3.18 Flood Risk Reduction Grant Program (2022)

- Acquiring land, or an interest in land, for purposes including:
    - Enhancing or restoring the flood attenuation capacity of floodplains, wetlands, and areas of the natural landscape that contribute to their function.
    - Storing flood waters through long-term land management agreements, such as water farming.
    - Participating in floodplain buyout programs as a first step in enhancing ecosystem services.
- Restoring, enhancing, constructing, or repairing floodplains, shorelines, or wetlands including:
    - Design and construction of nature-based infrastructure to retain and/or detain flood waters.
    - Design and construction of projects to reconnect streams to the full extent of their original floodplains.
    - Restoration of previously converted or developed land back to a natural land cover.
    - Redevelopment of developed floodplains into waterfront parks or open spaces that are compatible with flooding and flood water storage, and that provide opportunities for community engagement, recreation, and/or river access.

4 Concluding Remarks

The first draft of this Statewide Planning Efforts with Resilience Strategies report and inventory was prepared in March 2023. This document may be updated as reports, plans, studies, and other relevant resources are published and with input from the Blueprint TAGs. An index with links to all resources reviewed is included in the next section.

5 Index

5.1 Parameter Assessment Overview

Assessment parameters described below along with included options.

- Applicability to NC Flood Resiliency Blueprint
  - **Low**: Somewhat relevant sources but supplying foundational context.
  - **Medium**: Highly relevant sources; often secondary (i.e., found within highly relevant documents).
  - **High**: Highly relevant documents; foundational in content or function.
- Ease of Use
  - **Low**: Long and/or highly technical document.
  - **Medium**: Possibly technical but well-organized and clear.
  - **High**: Effectively summarized and easily understandable.
- Age and Update Cycle: Narrative form that includes the year it was published or released along with any known information on the update cycle.

5.2 Index Summary Table

Resource	Parameter Assessment			
Title and Link	**Year Published**	**Update Cycle**	**Applicability to Blueprint**	**Ease of Use**
North Carolina Climate Risk Assessment and Resilience Plan https://files.nc.gov/ncdeq/climate-change/resilience-plan/2020-Climate-Risk-Assessment-and-Resilience-Plan.pdf	2020	State will support and update	High	Medium
State of North Carolina 2023 Hazard Mitigation Plan[1] https://www.ncdps.gov/our-organization/emergency-management/hazard-mitigation/enhanced-hazard-mitigation-plan	2023	Every 5 years	High	Medium
NCDOT 2021 Resiliency Strategy Report https://files.nc.gov/ncdeq/climate-change/resilience-plan/agency-reports/Department-of-Transportation-2021-Resilient-Strategy-Report.pdf NCDOT 2022 Resiliency Strategy Report https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-report.pdf	2021; 2022	Annual	High	High
NCDOA Climate Strategy Report **https://www.deq.nc.gov/climate/ncdoa-climate-strategy-report-fy22/download?attachment**	2022	Annual	High	High

[1] Component of the North Carolina Risk Assessment and Resilience Plan.

Resource	Parameter Assessment			
Title and Link	**Year Published**	**Update Cycle**	**Applicability to Blueprint**	**Ease of Use**
NCDA&CS Climate Strategy Report https://www.deq.nc.gov/climate/ncdacs-climate-strategy-report-fy22pdf/download?attachment	2022	Annual	High	High
NCDOC Climate Strategy Report https://www.deq.nc.gov/climate/ncdoc-climate-strategy-report-fy22pdf/download?attachment	2022	No flood resiliency strategies identified		
NCDEQ Climate Strategy Report https://www.deq.nc.gov/climate/ncdeq-climate-strategy-report-fy22pdf/download?attachment	2022	Annual	High	High
NCDHHS Climate Strategy Report https://www.deq.nc.gov/climate/ncdhhs-climate-strategy-report-fy22pdf/download?attachment	2022	Annual	High	High
NCDIT Climate Strategy Report https://www.deq.nc.gov/climate/ncdhhs-climate-strategy-report-fy22pdf/download?attachment	2022	Annual	High	High
NCDMVA Climate Strategy Report https://www.deq.nc.gov/climate/ncdmva-climate-strategy-report-fy22pdf/download?attachment	2022	Annual	High	High
NCDNCR Climate Strategy Report https://www.deq.nc.gov/climate/ncdncr-climate-strategy-report-fy22pdf/download?attachment	2022	Annual	High	High

Resource	Parameter Assessment			
Title and Link	**Year Published**	**Update Cycle**	**Applicability to Blueprint**	**Ease of Use**
NCDPS Climate Strategy Report **download (nc.gov)**	2022	Annual	High	High
NCDOR Climate Strategy Report **https://www.deq.nc.gov/climate/ncdor-climate-strategy-report-fy22pdf/download?attachment**	2022	No flood resiliency strategies identified		
Action Plan for Nature-Based Stormwater Strategies **https://www.nccoast.org/2021/08/progress-with-the-nature-based-stormwater-action-plan/**	2021	Annual	High	High
North Carolina Natural and Working Lands Action Plan[2] https://files.nc.gov/ncdeq/climate-change/natural-working-lands/NWL-Action-Plan-FINAL---Copy.pdf	2020	A living document with no prescribed update schedule	High	High
North Carolina Coastal Habitat Protection Plan: 2021 Amendment https://deq.nc.gov/media/26810/open	2021	Every 5 years	High	High
North Carolina Climate Science Report [3] https://ncics.org/wp-content/uploads/2020/10/NC_Climate_Science_Report_FullReport_Final_revised_September2020.pdf	2020	Updated as needed to incorporate new decision-relevant information	High	Medium

[2] Component of the North Carolina Risk Assessment and Resilience Plan.
[3] Component of the North Carolina Risk Assessment and Resilience Plan.

Resource	Parameter Assessment			
Title and Link	**Year Published**	**Update Cycle**	**Applicability to Blueprint**	**Ease of Use**
Collaboratory Flood Resilience Study https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/06/flood-resiliency-report.pdf	2021	N/A	High	High
Regions Innovating for Strong Economies and Environment Program RISE and Environment Program | ReBuild NC	2021	N/A	High	
North Carolina Resilient Coastal Communities Program NC Resilient Coastal Communities Program | NC DEQ	2020	N/A	High	Medium
North Carolina Resilient Communities Program https://www.rebuild.nc.gov/resiliency/resilient-communities	2020	N/A	High	Medium
Flood Risk Reduction Grant Program https://nclwf.nc.gov/grants/apply-grant/flood-risk-reduction-grant-program	2022	N/A	High	Medium
Stormwater Funding Program https://www.deq.nc.gov/about/divisions/water-infrastructure/stormwater-funding-program	2022	N/A	High	Medium
North Carolina Resilience Clearinghouse https://www.usmangroup.com/experience/north-carolina/	Not Listed	Unknown	High	TBD
Resilience Analysis and Planning Tool (RAPT) https://www.fema.gov/node/resilience-analysis-and-planning-tool-rapt	2020	Not specified	High	Medium