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Subtasks 3.1, 3.2, 3.13: Flood Resiliency Blueprint Tool Recommendations

North Carolina Flood Resiliency Blueprint

Prepared for the North Carolina Department of Environmental Quality by AECOM

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Definitions

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

Common Acronyms

GIS	Geographic Information System
HB	House Bill
NC	North Carolina
NCDEQ	North Carolina Department of Environmental Quality
REST	Representational State Transfer
US	United States

1 Introduction

This report provides recommendations for the following subtasks under Phase 1 for the development of the North Carolina (NC) Flood Resiliency Blueprint (Blueprint):

- **Subtask 3.1** - Recommendations on developing, implementing, and maintaining multi-scale risk decision-making tools.
- **Subtask 3.2** - Recommendations for linking solutions identified in the toolbox and beyond to identify regional and local flooding issues within the Blueprint online tools. The result will be the ability for decision makers to link their flooding issue to the flood resiliency options, including approximate costs and funding options, to make informed decisions.
- **Subtask 3.13** - Recommendations for administering the online decision-making tool to meet the goals of the Blueprint.

1.1 The Flood Resiliency Blueprint Tool

The Blueprint's actionable, decision-support tool will be named the Flood Resiliency Blueprint Tool (also referred to as the Blueprint Tool or Tool throughout this report). The software system will seamlessly guide state, county, municipal, and other jurisdictions to identify and select flood mitigation strategies responsibly, systematically, equitably, and transparently. The Tool, building off the tasks in Phase I (research, gap analysis, recommendations, and draft Blueprint documents), will include flood risk planning capabilities along with a set of actions (projects) that the State and other government entities can implement to reduce flooding and reduce the impacts of flooding. The Tool will also match resiliency actions with potential funding sources. By making impacts from mitigation and resilience strategies clear, the Blueprint will help decision-makers from the State level to individual communities make more informed choices when dealing with flooding. The Blueprint Tool shall be an online, publicly accessible, data- and model-driven, Geographic Information System (GIS)-enabled web application.

The Flood Resiliency Blueprint Tool will be a dynamic tool that can be iterative and flexible to incorporate new data and information as they become available based on identified gaps and advances in science and technology. The Tool will be interactive, easy to understand and use, and will be developed to support all basins statewide. End users include decision-makers within state, regional, tribal, and local governments, as well as businesses and members of communities affected by recurring and excessive flooding.

This document will outline recommendations for how the Blueprint Tool will be developed, implemented, and maintained. Recommendations will include how the Tool should be designed to allow decision-makers to address their specific flooding issues with the most effective flood resiliency options and how the Tool will be administered. The Tool recommendations outlined in this document are designed to fulfill the requirements of Session Law 2021-180 Senate Bill 105 and 2022-75 House Bill (HB) 911 (sections 22.a.3; 22.b.2).

2 Subtask 3.2: Recommendations for Linking Tool Solutions to Identified Regional and Local Flooding Issues

This section will outline recommendations for linking flood resiliency solutions with regional and local flooding issues within the Blueprint Tool. The result will be the ability for decision makers to input and link their flooding issue to the flood resiliency options, including approximate costs, benefits, and funding options, to make informed decisions. *Additional details and Tool functionality will be developed during the Phase II Tool development.*

- The Blueprint Tool system should provide the functionality to:
    - Select jurisdictions, basins, and areas of interest.
    - View visualized flood risk areas through various map spatial data layers and provide quantitative summaries and downloadable output.
    - Identify and select priority high-hazard areas for resiliency actions such as:
        - Individual or groups of structures, including those with repetitive losses
        - Roadways
        - Critical facilities and infrastructure
        - Historic properties
        - Socially vulnerable communities
    - Adjust flood hazard settings such as:
        - Flood frequencies
        - Future risk scenarios
        - Climate forecast scenarios
    - View estimated impacts based on user-adjusted flood hazard settings, including:
        - Loss of human life
        - Building Flood Depth (depth of flooding in a building)
        - Structural Damages (in dollars)
        - Agricultural and/or business loss or damage
        - Damage Percentage
        - Content Losses (in dollars)
        - Number of People losing access to home and employment
        - Water volume stored or slowed
        - Reductions in peak flow

- Develop and view recommendations for and select from the most effective mitigating strategies for avoiding loss, along with the following information about each:
  - Monetary cost for implementation and maintenance.
  - Benefits of the resiliency action such as:
    - Return on investments
    - Losses avoided
    - Number of people or structures affected
    - Serves socially vulnerable populations
  - Added value that may include:
    - Addition of public lands, such as parks
    - Water quality and ecosystem improvements (through nature-based solutions)
- View potential sources of funding for selected mitigation actions.
- Conduct scenario analysis to guide users in selecting the best resiliency/mitigation option.
- Include additional analysis functions as needed to support community resiliency planning.

3 Subtask 3.1: Recommendations for Developing, Implementing, and Maintaining Decision-Making Tools

This section outlines recommendations on developing, implementing, and maintaining a multi-scale risk decision-making tool for the Blueprint. The Tool will reside within a workflow, a series of steps where the North Carolina Department of Environmental Quality (NCDEQ), stakeholders, communities, and other interested parties go through a process to analyze and understand flood risk and vulnerability, identify potential actions (projects), and rank the actions at multiple scales (i.e., locally, regionally, and basin-wide). The Blueprint Tool will include both regional and community actions. *Additional details and Tool functionality will be developed during the Phase II Tool development.*

3.1 Development

3.1.1 General Tool Recommendations

- The Blueprint Tool should be readily available to the public and not require software installation to access data or tools.
- Users from state, regional, tribal, and local governments should be able to log into the Tool.
- Members of the public should be able to access the Tool with no login.
- Authenticated users should have a User Role.
- All Tool components should include interactive, searchable, and filterable:
    - Tables and/or lists
    - Maps

3.1.2 Data and Database Development

- The Flood Resiliency Blueprint Database should be architecturally designed and constructed to be a scalable system that supports the ingestion of additional datasets as the Blueprint process moves forward and the ability to make modifications based on basin needs.
- Phase II data should be populated with the following considerations:
    - Data should first be applied to the Neuse River Basin.
    - Data available statewide should be included as part of Phase II.
    - Data sets to include 2D modeling and flood risk data, among other data sets necessary to support the planning capabilities of the Tool.
- The Blueprint Tool should use Representational State Transfer (REST) services (a software style or approach used for creating web services) of authoritative sources whenever appropriate, and Phase I data source recommendations do not indicate otherwise. Examples of these services may include:
    - Building Footprints from the NC Flood Risk Information System REST services

- United States (US) Census Blocks from the US Census Bureau's TIGERweb services.

3.1.3 User Interface

- A module should be provided for state, regional, and local government officials to:
  - View a Community and Basin Action Plan – unique report documents for each.
  - Create or change an Action (project) within the Tool.
  - Review identified resiliency actions that have and have not yet been funded.
  - View flood hazard areas, critical infrastructure, environmentally sensitive areas, and socially vulnerable areas, among others.
  - View types and sources of flooding and select from existing flood frequencies and future hazard scenarios.
  - View impacts based on selected flood hazards, including, but not limited to, structural damages, content losses, human impacts, and economic and agricultural losses.
  - Create new resiliency actions to include the following mitigation types:
    - Structural solutions related to buildings (e.g., elevations, removals)
    - Solutions such as floodwalls, floodgates, etc.
    - Non-structural
    - Nature-based (rain gardens, natural or engineered wetlands, etc.)
    - Gray infrastructure (e.g., stormwater drainage infrastructure.)
    - Other solution types as identified during Tool development
  - Request new mitigation or modeling studies.
  - Recommend policy changes.
  - Evaluate and compare potential resiliency actions and adjust weighting factors.
  - Generate data-driven digital and printable report output.
- A module should be provided for NCDEQ officials and members of selected representative organizations to:
  - View all action plans in list and map view.
  - View prioritized resiliency actions and adjust weighting factors.
  - View a map and summary of submitted resiliency actions to include:
    - Return on Investment or Losses Avoided.
    - Before and After Impacts.
    - Costs.

        - Potential funding sources.
    - View complete details of individual resiliency actions.
    - Select which resiliency actions will be packaged and provided for export to support the River Basin Flood Resiliency Action Strategy (from now on called River Basin Action Strategy).

3.1.4 Ranking of Action Strategies

- A decision support tool should be included in the Blueprint Tool to perform prioritization analysis on resiliency actions included in all Action Strategies.
- The decision support tool shall analyze and score based on several factors that may include:
    - Complexity
    - Capital, Operations, and Maintenance Cost
    - Added Value, such as water quality improvement
    - Funding Strategy
    - Return on Investment
    - Performance
    - Basin-wide and community priority
    - Social Vulnerability Score
    - Nature-Based Solution
    - Additional factors will be determined during Tool development in Phase II.
- The Tool shall allow for adjustable weighting for selected factors based on community or basin priorities.

3.1.5 Funding Sources

- The Blueprint Tool should include a module to match resiliency actions to potential funding sources to support risk reduction and resilience actions/projects.
- Potential funding sources should include, but not be limited to:
    - Federal and State Appropriations
    - Federal Emergency Management Agency Programs (e.g., Building Resilient Infrastructure and Communities, etc.)
    - Other State Funding Programs
    - Federal Infrastructure Investment and Jobs Act
    - American Rescue Plan Act

- Inflation Reduction Act
- Water Infrastructure Finance and Innovation Act
- Water Resources Development Act – US Army Corps of Engineers
- Public Private Partnerships
- Non-Profit Trusts

3.1.6 Data Repository

In accordance with Legislation (Session Law 2022-75; HB 911), the Blueprint Tool should include a publicly accessible repository for data and modeling outputs and technical reports to allow local government units and other organizations to access the information.

- Stored data should be tagged with metadata including:
  - Geographical area(s) such as County Federal Information Processing Standards or major basins.
  - Data category (technical, governance, quality, etc.).
- The repository should not require the user to install additional software.
- All data and modeling included in the repository should be open source. One option to be further explored is the use of NC OneMap Standard database practices to guarantee proper metadata, maintenance, and open data standards.
- Large datasets should be packaged in a manageable way by the user.

3.2 Implementation

3.2.1 Blueprint Tool System and Platform

- The Blueprint Tool System should be developed as a web application that is:
  - Publicly accessible
  - Data- and model-driven
  - GIS-enabled
  - Able to support authentication using North Carolina Identity Management, ensuring low-speed internet access does not create a challenge.
- The Blueprint Tool system should be hosted in a cloud environment that is secure and scalable.
- Environments should be provided for:
  - Development environment to test new code, code changes, and database updates before release.
  - Staging/Test to deploy application and database releases.

  - Production to host live web application and database.

- Each environment should include the following:
  - A Structured Query Language server
  - A virtual machine for running helper apps or scripts
  - A file repository

3.2.2 Documentation

- The Tool should include comprehensive documentation that may include:
  - User guides, manuals, and/or videos
  - Architectural and Technical stack diagrams (a visual representation of memory contents)
  - Database architecture and entity relationship diagrams
  - Deployment instructions
  - Maintenance tasks and schedules
  - Troubleshooting procedures
  - System upgrade and patching instructions
  - Backup and recovery procedures
  - Security guidelines and best practices
  - User profile maintenance (addition, deletion, and modification of system users)
  - Application Protocol Interfaces to any other software systems

3.2.3 Training

- Training should be provided to help NCDEQ, regional entities, other state agencies, and other officials to do the following:
  - Understand the prioritization process and how to adjust the weighting to best align with community priorities.
  - Select resiliency actions to package for the Legislature.
  - Create the prioritized actions that will go into the Basin Action Strategy.
  - Present the application to NCDEQ executives, the Legislature, and stakeholders.
- Training outreach should be provided for communities in the Neuse Basin as part of Phase II to help them use the Tool and understand how to create a Blueprint plan. The outreach should be expanded to other basins over time. That outreach should be conducted as follows:
  - A series of twenty training sessions should be held in communities throughout the Neuse Basin.

- Trainers should be made up of planning professionals as well as a member of the software development team. 2-3 trainers should conduct every session.

3.3 Maintenance

3.3.1 Data Updates

- The Blueprint Tool's source data and models should be updated with regularly scheduled maintenance and updates to the database and should include the following:
  - Input from local, county, and state data.
  - New or updated data should be validated to ensure data aligns with the schema, units, and coordinate system.
  - Scheduled tasks should be utilized as appropriate to assist with data maintenance.
  - Metadata should be added to all new and updated data to identify information, including data source and age of data.
  - A subject matter expert should review new datasets to ensure quality.

3.3.2 Maintaining User Roles/Users

- The Blueprint Tool system should include user maintenance functionality to allow jurisdiction or decision authority officials to:
  - Add or remove users from the system.
  - Apply or change a user's role.
  - Add or remove users from a community.
  - Allow a user to request access to the Tool.

4 Subtask 3.13: Recommendations for Administering the Online Decision-Making Tool

This section outlines recommendations for administering the online decision-making tool to meet the goals of the Blueprint. *Additional details and Tool functionality will be developed during the Phase II Tool development.*

4.1 Types of Administration

Administration is needed for the following:

4.1.1 Application Administration

- Log and resolve bugs and errors.
- Monitor the Azure environment and address any issues.
- Provide user support through a phone number and an email address posted on the site.

4.1.2 Database Administration

- Implement data policies, procedures, and standards.
- Plan and develop data model and schema.
- Resolve data conflicts.
- Maintain and ensure the data integrity of the public data repository.
- Schedule and run background data processing tasks.

4.1.3 User Administration

- Add and remove users.
- Assign and maintain user roles and responsibilities.

4.1.4 Data Maintenance

- Input new or updated local, county, and state data.
- Validate new and updated data to ensure schema, units, and coordinate system alignment.
- Tag with metadata to identify information, including data source and age of data.
- Coordinate subject matter expert review of datasets to ensure quality.

4.1.5 Community Feedback Management

- Collect, sort, and analyze publicly provided feedback from Community Stakeholders.
- Respond to stakeholders as needed.

4.2 Application Administrator

The following Application Administrator role should be created for sitewide administration functions:

4.2.1 NCDEQ Application Administrator

4.2.1.1 Role Description

Responsible for Application Administration, Database Administration, and User Authorization Administration for all user and administrator roles.

4.2.1.2 Administrative Responsibilities

- Application administration.
- Database administration.
- User administration for all user roles.
- Data maintenance.
- Community feedback management.

4.3 Other Administrative Roles

The following administrative roles should be created to provide other types of administration:

4.3.1 NCDEQ Program Manager

4.3.1.1 Role Description

Oversee all NCDEQ Project Analysists and river basin project activities.

4.3.1.2 Administrative Responsibilities

- User Administration for the following roles:
    - NCDEQ Project Analysts.
    - Representative organization roles such as Contractors & Subconsultants.
    - General Assembly.
    - All local government and delegated authority roles.
- Community Feedback Management.
- Data Maintenance.

4.3.2 NCDEQ Program Analyst

4.3.2.1 Role Description

Oversee and serve as a point of contact for all activities within assigned river basin(s), including data collection, meetings, action status tracking, and response to inquiries and concerns.

4.3.2.2 Administrative Responsibilities

- User Administration for all local government and delegated authority roles.
- Community Feedback Management.

4.3.3 Local Government or Delegated Authority Administrator

4.3.3.1 Role Description

Provide user administration within their agency.

4.3.3.2 Administrative Responsibilities

- User Administration for user roles within their agency only.

Table 1: Flood Resiliency Blueprint Tool Administrator Roles and Responsibilities

Administrator	Application Administration	Database Administration	User Administration	Data Maintenance	Community Feedback Management
NCDEQ Application Administrator	✓	✓	All Users	✓	✓
NCDEQ Program Manager	-	-	• NCDEQ Project Analysts • Contractors & Subconsultants • Decision Authority • General Assembly • All local government and delegated authority roles	✓	✓
NCDEQ Program Analyst	-	-	• All state and local government roles	-	✓
Local Government or Delegated Authority Administrator	-	-	• Users within Agency Only	-	-

The following organizational chart (Figure 1) shows the user administration hierarchy by role. Each role in this organization chart has the authority to add or remove users from any of the roles listed below. Local Government or Delegated Authority Administrators may administer users within their organization only. *Additional details and Tool functionality will be developed during the Phase II Tool development.*

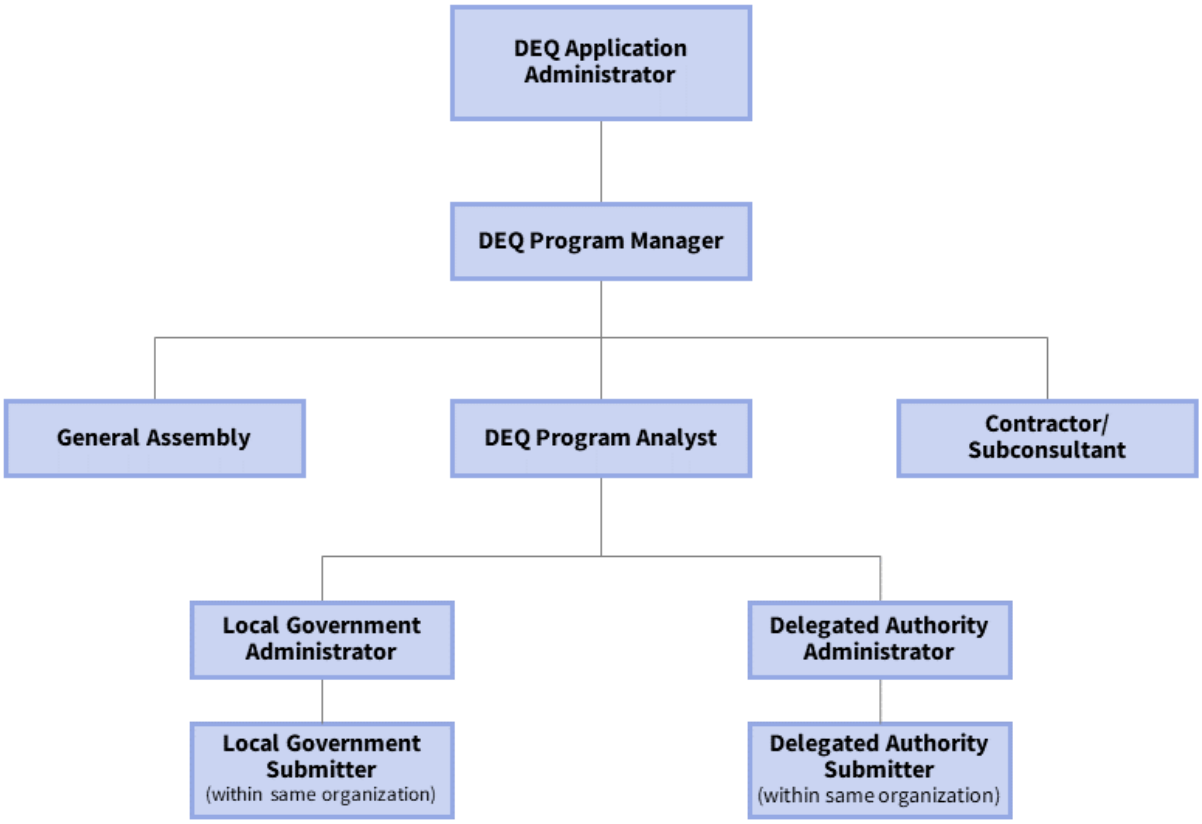

Figure 1: Flood Resiliency Blueprint Tool User Administration Hierarchy