Wake County
One Water Plan

December 30, 2025

ONEWATER
WAKE COUNTY

Acknowledgments

The Wake County One Water Team includes staff from Wake County and Tetra Tech, in collaboration with Hazen and Sawyer and Research Triangle Institute.

The Wake County One Water Team thanks all the stakeholders and partners for their support, collaboration and contributions to the development of the One Water Plan. The Team solicited a wide range of perspectives for the development of the Plan and received valuable feedback through two public surveys and multiple workshops and stakeholder meetings. The Wake County Water Partnership is the foundation of Wake One Water. The Water Partnership has a mission "*To facilitate collaboration to promote leadership in water management and sustainability and promote health by providing high quality water throughout Wake County*." Through its diverse representation, the Wake County Water Partnership offered valuable insights that helped shape the Plan's vision and goals, fine-tune the strategies, and prioritize implementation actions.

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- Public Health
- Social Services
- Soil and Water Conservation District

Consultant Team

- Tetra Tech
- Hazen and Sawyer
- Research Triangle Institute

Wake County Water Partnership.

Wake County Water Partnership Membership

- Municipalities
  - Town of Apex
  - Town of Cary
  - Town of Fuquay
  - Town of Garner
  - Town of Holly Springs
  - Town of Knightdale
  - Town of Morrisville
  - City of Raleigh
  - Town of Rolesville
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  - Town of Wendell
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- Home Builders Association of Raleigh and Wake County
- Environmental Advocacy Group
- Community Representatives
  - Citizen Appointees
  - Private Well Owner
  - Agricultural Representative
- Private Water Provider
- Wake County Planning and Development Services

Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
BMPs	best management practices
CRS	Community Rating System
ETJ	extraterritorial jurisdiction
FEMA	Federal Emergency Management Agency
FUTURES®	Future Urban-Regional Environment Simulation
GIS	geographic information system
GSI	green stormwater infrastructure
H&H	hydrologic and hydraulic
HOA	homeowner associations
HUC	hydrologic unit code
IAIA	Interim Alternative Implementation Approach
JLOW	Jordan Lake One Water
lbs/yr	pounds per year
MG	million gallons
mgd	million gallons per day
MGY	million gallons per year
mi^2	square miles
MS4	municipal separate storm sewer systems
MWS	municipal water supply systems
NBS	nature-based solutions
NC DEQ	North Carolina Department of Environmental Quality
NCDOT	North Carolina Department of Transportation
NC DPS	North Carolina Department of Public Safety
NCSU	North Carolina State University
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PCWS	privately owned community water system

Acronym/ Abbreviation	Definition
PDWW	private drinking water wells
Plan	the One Water Plan
PROS	Wake County Parks, Recreation and Open Space
Raleigh Chamber	Greater Raleigh Chamber of Commerce
SA	service area
SCM	stormwater control measures
SDWIS	Safe Drinking Water Information System
SFDU	single-family dwelling unit
SFHA	Special Flood Hazard Area
SWCD	Wake County Soil and Water Conservation District
TBL	triple bottom line
UNRBA	Upper Neuse River Basin Association
USGS	U.S. Geological Survey
Water Partnership	Wake County Water Partnership
WaterFALL®	Watershed Flow and Allocation [model]
WWTP	wastewater treatment plant

Contents

Tables

Figures

Constructed wetland at Beech Bluff County Park

Executive Summary

Wake One Water

Wake County, with assistance from municipalities, residents and other partners, developed the **Wake One Water Plan to support equal access to clean and abundant water for the next 50 years and beyond** (Figure i). Efforts will support a growing population while preserving and protecting limited natural resources. The Plan identifies One Water practices that align the County's One Water and PLANWake goals, with proven strategies **to protect the water supply, reduce nutrient pollution, mitigate flooding and promote equal access to these benefits**.

One Water is an emerging concept that values all forms of water as a resource, including stormwater and wastewater. The Wake One Water Plan provides an integrated framework for managing finite water resources through collaborative, multi-benefit projects and policies. This approach combines water resource planning with development and transportation planning.

Figure i. Wake One Water integrated water management framework.
(Source: Wake County 2023)

By guiding holistic and resilient water and land management, the Wake One Water Plan will help meet public and environmental needs, support local economies and enhance the County's quality of life.

What is the One Water Plan?

The One Water Plan (Plan) is a 50-year water plan that supports long-term water security and complements PLANWake, the County's comprehensive growth plan. The Plan provides the vision, goals and strategies to guide growth and development, project implementation and measure success. The Plan promotes coordination and cooperation among County departments, municipalities and community partners.

Population Increase

The population of Wake County is projected to grow from more than 1.1 million residents in 2024 to **over 2 million residents by 2070** (Wake County 2021).

Why Do We Need a One Water Plan?

The Wake One Water Plan helps address the challenges of rapid population growth and climate extremes through collaborative solutions. Water resources—drinking water, surface water, groundwater, wastewater, stormwater—are traditionally managed by separate entities with varying priorities. Ensuring a resilient water future requires a holistic One Water approach that promotes collaboration and innovation.

Climate Variability

Global climate models indicate that Wake County can expect higher temperatures and more variable precipitation, with increasing storm intensities and longer drought periods.

Key Water Sources

Drinking water supply needs for County residents and businesses are met through both surface water and groundwater sources. The County's population is primarily served through one of three system types: municipal water supply systems (1 million people), private drinking water wells (90,000 people) or privately owned community water systems (85,000 people). Assuming present-day projections of growth are reasonably correct, all of the municipal systems serving Wake County residents will require some form of water supply or water treatment expansion or an agreement with another system to provide treatment during the 50-year planning horizon (Tetra Tech and Hazen 2023a). Strong

Increased Water Demand

Across five water utilities, water demand is projected to increase from 85 million gallons per day (mgd) in 2021 to 195 mgd in 2070, more than doubling the **water demand** (Tetra Tech and Hazen 2024b).

regional partnerships among municipal water systems are helping advance water supply plans that support future growth and increase resiliency, but additional community action will be needed to reduce potable water demand and protect groundwater supplies.

Increased Groundwater Vulnerability

Future growth and climate conditions are projected to increase groundwater vulnerability.

Wastewater treatment in Wake County is provided by both centralized and decentralized systems. Wake County has approximately 80,000 permitted septic systems. The majority of residents are served by public, centralized sewer collection and wastewater treatment plant (WWTP) systems. These systems face challenges in future expansion, including limits on NPDES wastewater discharges and maintenance requirements associated with older and expansive infrastructure.

Stormwater, which is water from precipitation that falls on the ground's surface, either infiltrates the soil and replenishes groundwater or runs off into surface waters. Similarly, wastewater is discharged to surface water or groundwater after being cleaned. Therefore, the amount (volume) and cleanliness (quality) of stormwater and wastewater directly affects the volume and quality of local drinking water supplies.

Water Trends

Modeling results suggest land use changes and extreme weather events will decrease infiltration and increase stormwater-runoff volume, flooding frequency, pollution, and water demand (Figure ii).

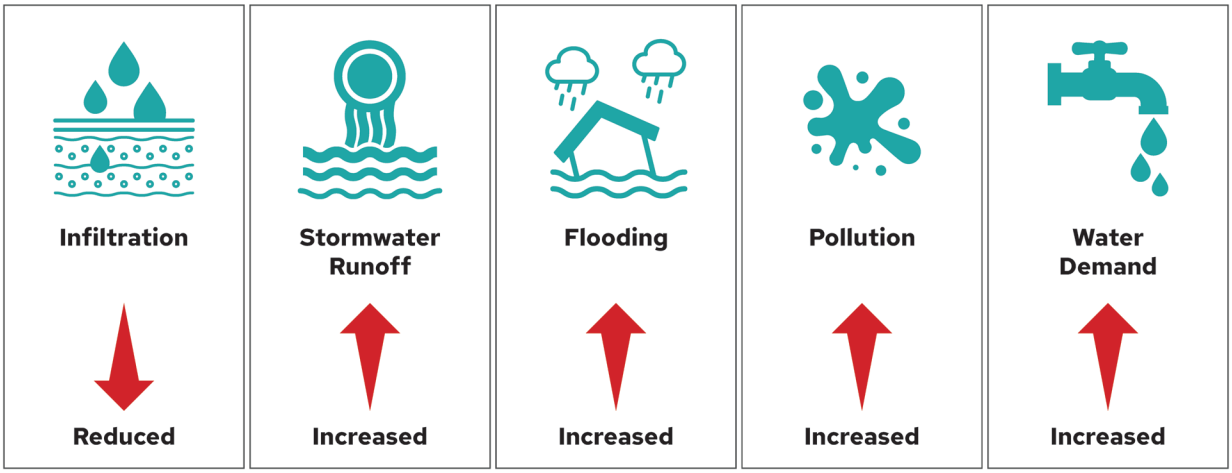


Figure ii. Summary of future water trends.
(Source: Tetra Tech; generated with data from Tetra Tech and RTI 2025)

Bringing it Together

Wake County created the One Water Plan in three phases: (1) Visioning, (2) Assessment and (3) Plan Development. Throughout the process, Wake County engaged with the public through online and in-person events and surveys.

Based on the input received from the community, the County developed a Vision, Goals and Outcomes document that outlines five major goals:

1. Build knowledge, collaboration and partnerships.
2. Increase community resilience to climate extremes.
3. Cultivate community support.
4. Advance access to clean water for all.
5. Support local economy and fiscal accountability.

Implementation Roadmap

During the stakeholder input process, residents, businesses and local officials identified a series of actions they would be willing to implement. The strategies are classified as short-, medium- or long-term and are grouped into four interconnected "focus areas" of One Water practices that align with the County's One Water and PLANWake goals:

- **Focus Area 1: Optimized Water Supply.** Managing the County's water supply by protecting groundwater resources, conserving and reusing water and strategically expanding water resources. This supports a sustainable water supply to promote business growth and protect residents' health and well-being.
- **Focus Area 2: Site-Specific Strategies to Improve Water Quality and Hydrology.** Implementing green and blue infrastructure, nature-based solutions and a range of alternative nutrient-reduction strategies. This can provide broad benefits that will minimize water pollution in the County's waterways and mitigate high-flow events that lead to localized flooding.
- **Focus Area 3: Land Conservation and Preservation.** Preserving undeveloped, natural open spaces and agricultural land. This helps sustain important ecosystem services, such as floodwater absorption and groundwater infiltration and recharge, and provides opportunities for recreation and connection with nature.
- **Focus Area 4: Flood Resilience.** Mitigating flooding and protecting public safety through infrastructure solutions that provide more storage, conveyance and/or protection.

Plan Benefits and Measuring Success

The impacts of the One Water practices identified through the four focus areas are estimated in two ways: (1) changes in key water quality and quantity metrics from the modeled baseline future conditions and (2) a triple bottom line (TBL) evaluation to assess the economic, social and environmental outcomes of the focus area implementation.

Focus Area 1: Optimized Water Supply

TBL: Overall **Positive** outcomes

- **Economic:** ↑ return on investment in water reuse through avoided infrastructure and water costs.
- **Social:** ↑ community resilience by augmenting the drinking water supply, particularly during drought-related shortages.
- **Environmental:** ↓ stormwater runoff volume and ↑ infiltration; stored stormwater can be used to irrigate green stormwater infrastructure (GSI) and other landscaped areas—enhancing local soil health and habitat.

Model results show that stormwater and greywater reuse provide a buffer against projected stormwater increases due to land use change.

- ↑ stormwater runoff stored for reuse (3,700 million gallons per year).
- ↓ frequency of peak flow events in 7 of 12 subbasins.
- ↓ nutrients and sediments entering waterbodies (down 4%–6%).

Focus Area 2: Site-Specific Strategies to Improve Water Quality and Hydrology

TBL: Overall **Positive** outcomes

- **Economic:** ↑ benefits for local farmers via agricultural BMPs and programs to support the County's agricultural economy.
- **Social:** ↑ engagement of the community, providing public health and recreation benefits.
- **Environmental:** ↓ stormwater runoff resulting in ↓ peaks flows, ↑ water quality, ↓ water demand, ↑ groundwater recharge, ↓ nutrient loads and ↑ flood mitigation benefits.

Model results show that GSI, alternative landscaping and agricultural practices provide a buffer against the projected stormwater increases due to land use change.

- ↓ annual mean total runoff (down 63%).
- ↓ frequency of peak flow events in 8 of 12 subbasins.
- ↓ nutrients and sediments entering waterbodies (down 14%–22%).

Focus Area 3: Land Conservation and Preservation

TBL: Overall **Positive** outcomes

- **Economic:** ↑ property values, ↑ local food system support and ↑ tourism, via related projects supporting parks and recreation, greenways, heritage sites and eco- and agritourism.

- **Social:** ↑ educational opportunities and ↑ public access to natural areas and gathering spaces for community events.
- **Environmental:** ↑ protection of critical habitat, healthy soils and ecosystem services, enhanced water quality benefits and flood mitigation.

Model results show that agricultural and natural land conservation provides a buffer against projected stormwater increases due to land use change.

- ↓ annual mean total runoff (down 29%).
- ↓ frequency of peak flow events in 7 of 12 subbasins.
- ↓ nutrients and sediments entering waterbodies (down 2%–8%).

Focus Area 4: Flood Resilience

TBL: Overall **Positive** outcomes

- Economic: ↓ costs from flooding, realized through reduced/avoided costs from flood damage and potential savings through lower flood insurance premiums.
- Social: ↑ awareness from holding emergency preparedness exercises and developing educational resources.
- Environmental: ↑ natural floodplain areas restored and ↑ ecosystem services (urban heat island mitigation, biodiversity and water quality).

Model results show that GSI provides a buffer against the projected stormwater runoff increases from land use change.

- ↓ annual mean total runoff (down 25%).
- ↓ frequency of peak flow events in 7 of 12 subbasins.
- ↓ nutrients and sediments entering waterbodies (down 4%–6%).

Adaptive Management

Achieving the future that Wake County envisions will require ongoing implementation and adjustments to account for potential setbacks and new information or technologies. This adaptive approach can be achieved by:

- Identifying and documenting the responsible parties
- Refining resource needs for strategy implementation
- Developing annual reports that summarize progress toward identified metrics for individual strategies
- Reviewing progress and updating strategies every 5 years

Early implementation will focus on organizational strategies and building support for practices like stormwater and greywater reuse, GSI, composting and alternative landscaping. As climate and land use patterns shift, the County will reevaluate data and revise its strategies and actions as needed.

Northern Cricket Frog (*Acris crepitans*)

1. State of Water in Wake County

The Importance of Water in Wake County

The Wake County 50-year One Water Plan aims to integrate water planning (water supply, wastewater treatment, stormwater and flood management, and groundwater protection) with County and municipal development and transportation planning to support all aspects of the County's growing population and preserve its limited natural resources.

Water is the lifeblood of Wake County—essential to the economic, social and environmental well-being of its residents, businesses, industries and institutions. More than 1 million people living in the County rely on water for their daily needs, such as drinking, bathing, laundry, toilet flushing, landscape irrigation and more. Agricultural, commercial and industrial users also need a clean, stable water supply. Wake County residents and visitors frequently enjoy the benefits of water-based recreation. In short, water is connected to almost every aspect of County life. Therefore, maintaining an abundant supply of clean water is critical for the County now and in the future.

Falls Lake is the primary surface water supply for many Wake County residents.

Public Concerns Regarding Water in Wake County

Community and stakeholder engagement has been an integral part of developing the Plan. During the visioning phase of Plan development, Wake County conducted a public survey and received over 1,600 responses. Sixty percent of respondents indicated they were concerned with having enough water in the next 50 years (Figure 1). Respondents also identified providing equal access to safe drinking water and protecting groundwater as their top priorities to address in the plan (Figure 2).

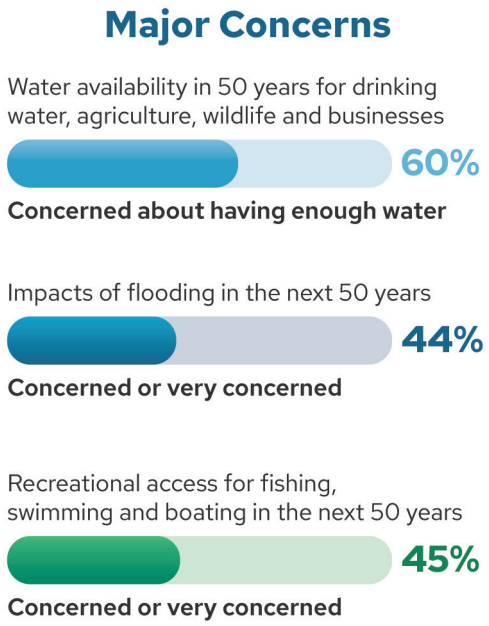


Figure 1. Major concerns identified in Wake County One Water 2023 public survey. (Source: Tetra Tech; generated with data from Tetra Tech and P3 2023)

Defining the Types of Water

The One Water concept treats all water as having value: surface water, groundwater, stormwater and wastewater. The Wake One Water Plan provides a management framework to ensure the County has the water it needs to support Wake County's future growth and development. Each water type is described in more detail below.

Water Supply

County residents and businesses receive water through three types of drinking water supply systems:

- Municipal water supply systems (MWSs): Publicly owned water supply systems (85% of Wake County residents).
- Privately owned community water systems (PCWSs): PCWSs serve at least 25 people or 15 connections (7% of Wake County residents).
- Private drinking water wells (PDWWs): Wells serving fewer than 25 people or 15 connections (homes) (8% of Wake County residents).

Surface Water

Surface water refers to open water bodies, including lakes, creeks, streams and rivers, as well as wetlands and manmade water bodies like wet ponds. Most Wake County residents (85% or nearly 1 million people) receive their water supply from a surface water source, such as Falls Lake or Jordan Lake. Surface water bodies support outdoor recreation and are a visible

connection to the overall state of water resources. Water quality affects how the waters are perceived and enjoyed (Tetra Tech and Hazen 2023b). The cleanliness of surface waters also affects the amount of treatment required to ensure they remain safe for drinking and other uses.

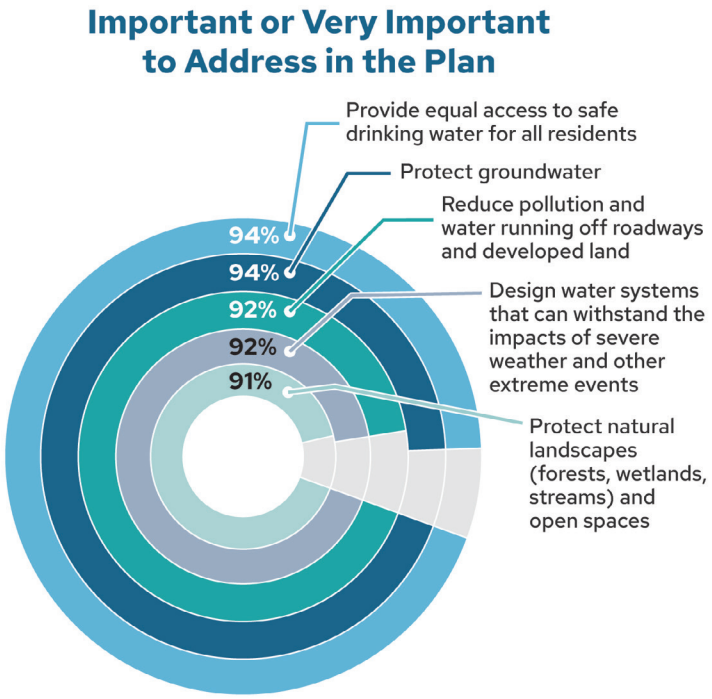


Figure 2. Important or very important items to address in the One Water Plan, based on the 2023 public survey. (Source: Tetra Tech; generated with data from Tetra Tech and P3 2023)

Eight MWSs serve residents of Wake County. Five of these systems are municipally owned and operated and are primarily located within Wake County (Raleigh, Cary, Apex, Holly Springs and Fuquay-Varina). Two others have service areas primarily in Harnett County, and one is mainly in Johnston County. These three "outside" systems directly serve some Wake County residents. The eight MWSs in Wake County draw exclusively from surface water sources, treat and disinfect them, and provide clean drinking water to nearly one million residents. Assuming the present-day projections of growth are reasonably correct, all the municipal systems serving Wake County residents will require some form of water supply or water treatment expansion over the planning horizon. However, each utility has particular challenges (Tetra Tech and Hazen 2023b).

In addition to the need for expanded supply capacity, a growing understanding of the existence and risks presented by contaminants, such as per- and polyfluoroalkyl substances (PFAS), will likely result in new regulatory requirements that drive the need for water treatment system upgrades. PFAS have been detected in waters across the nation and have been linked to increased adverse health outcomes even at low exposure levels (Tetra Tech and Hazen 2023a).

Groundwater

Groundwater is water found beneath the land surface. It is replenished by rainfall that soaks into the ground and filters through the soil until it reaches fractures or pore spaces in underground rock. Wake County's groundwater collects in networks of cracks within the underlying non-porous bedrock aquifers, so groundwater availability varies by location (Figure 3).

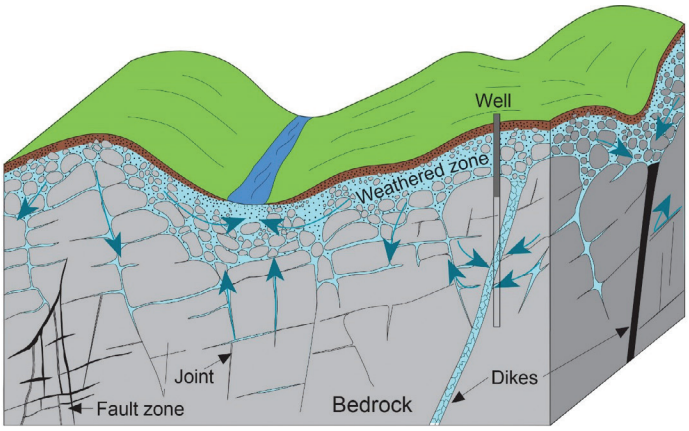


Figure 3. Fractured-rock aquifer groundwater flow diagram. (Source: USGS, n.d.)

Groundwater is an important source of drinking water, particularly in areas outside the service area of the County's MWSs. Approximately 15% of the population in Wake County relies on groundwater for drinking water. Groundwater also supplies water for agricultural and recreational activities (indirectly through baseflow) (Tetra Tech and Hazen 2023b).

Groundwater is typically cleaner than surface water and requires less treatment because natural filtration occurs in the soil layers before the water reaches the aquifer. However, because groundwater is stored in fractured bedrock, minerals and other contaminants can be present in dissolved forms.

Eastern Wake County's bedrock contains naturally occurring uranium and other radionuclides that can contaminate groundwater (Figure 4). As a result, additional treatment might be required for PDWWs and PCWSs with radionuclide contamination. New PDWWs must be permitted, inspected and tested by the County before a certificate of occupancy can be issued for new homes.

Focus Point

In Eastern Wake County, all wells are considered at risk of radionuclide contamination. An estimated one in five private wells has unsafe levels of contamination.

Privately Owned Water Systems

Based on estimates from the U.S. Environmental Protection Agency's Safe Drinking Water Information System (SDWIS) data, privately owned water systems collectively serve about 85,000 people across the County. The 197 systems reporting to the Division of Water Resources Water Withdrawal and Transfer Registry withdrew, on average, about 4.3 million gallons per day (mgd) from the County's groundwater resources spread across over 400 wells.

Private Drinking Water Wells

Based on the total estimated County population, and by deducting the populations served by the large publicly operated systems described in Section 2 and the Community Water Systems described in Section 3.1, PDWWs are estimated to serve approximately 90,000 people.

The current challenges for groundwater-supplied users fall into three categories. The first is well contamination from naturally occurring minerals in the ground. The second challenge is contamination from human-caused sources. The final challenge relates to groundwater depletion. Depletion can occur when too many wells are drilled in an area with limited hydraulic conductivity or limited aquifer storage and may be exacerbated when larger community systems are installed near homes with private wells (Tetra Tech and Hazen 2023a and 2023b).

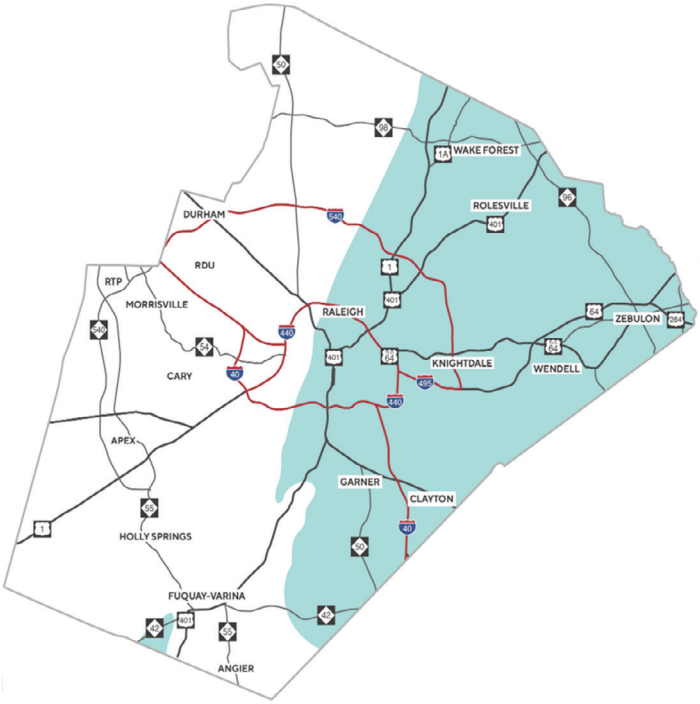


Figure 4. Wake County suggested radionuclide testing area. (Source: Wake County 2025)

Stormwater

Stormwater is precipitation that reaches the ground. Stormwater can follow many paths: soaking into the ground (infiltration), evaporating back into the atmosphere (evaporation), being absorbed and released by plants (transpiration), flowing over the surface to a storm drain or a waterway (runoff), or temporarily collecting on low-lying areas (flooding).

Land surface elevation determines the direction of stormwater runoff; in short, surface water flows downhill. Land areas can be divided into geographic drainage basins, where all water that falls on the ground will flow to the same outlet point. Wake County has 13 major subbasins (Figure 5). These natural boundaries do not follow County or municipal borders. Therefore, water management is not something accomplished by a single entity. It must be a collaborative effort.

Watershed-scale stormwater management can be greatly improved by having strong hydrologic modeling tools to support assessment and master planning (Tetra Tech 2024).

Partners working with the shared vision and approach envisioned by this Plan will achieve the best outcomes (Tetra Tech et al. 2025b).

Stormwater is inextricably linked with drinking water, so the amount (volume) and cleanliness (quality) of stormwater is important. Whether percolating down to the groundwater or flowing into a stream, stormwater can enter County residents' drinking water supplies. Water quality managers must consider pollutants that might enter waterways from other, indirectly regulated sources, like stormwater.

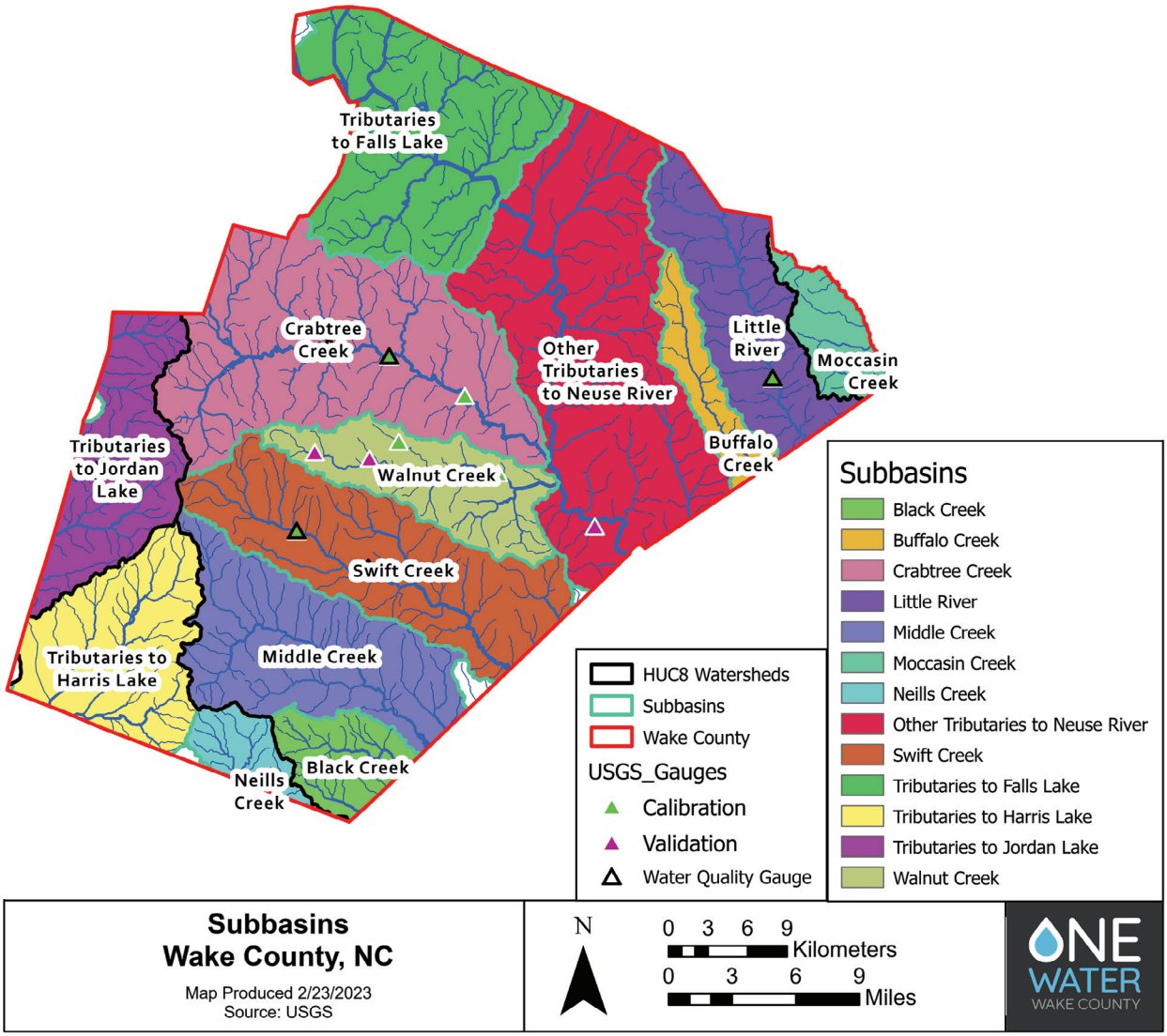


Figure 5. Subbasins in Wake County. (Source: Tetra Tech and RTI 2025)

Wastewater

Wastewater is water that has been used in homes for washing, bathing, preparing food and flushing toilets or by businesses for processing, heating and cooling. Wastewater must be treated before it is released to the environment.

Three types of wastewater management systems serve Wake County residents and businesses:

- Decentralized systems
- Privately owned centralized systems
- Public centralized systems

A resident's location in the County determines which type of wastewater management system is available.

Decentralized Systems

In septic systems, also known as on-site or decentralized wastewater systems, pipes carry wastewater a short distance to a system, which may include some pretreatment. The wastewater enters the main septic tank and then disperses into the ground, where it filters slowly through the soil. Wake County has 80,000 permitted septic systems (Tetra Tech and Hazen 2024b).

As rural areas are converted to urban or suburban land uses, the sites most suitable for development are typically targeted first for cost-benefit reasons. In locations where sewer extension is not an option at the time of development, the most suitable sites are those with native soils that can support individual, conventional septic systems. As suitable soil sites become more limited, the remaining undeveloped soils will likely require more expensive treatment and dispersal technologies than conventional, gravity septic systems (Tetra Tech and Hazen 2024b).

Centralized Systems

In privately and publicly owned centralized systems, a series of pipes carries the wastewater to a centralized wastewater treatment plant. There, the wastewater is treated and discharged through a pipe to a local surface water body. Federal and state water quality regulations define the allowable levels of common pollutants in treated wastewater. All wastewater discharges to surface waters are regulated under the National Pollutant Discharge Elimination System (NPDES) permitting program, which is managed by the North Carolina Department of Environmental Quality (NC DEQ). NPDES-permitted systems comprise most of the wastewater treatment systems in Wake County (Tetra Tech and Hazen 2024b).

NPDES Permit Program

The NPDES Permit Program is a federal regulatory program established under the Clean Water Act. It is administered by delegated state, tribal and territorial governments with U.S. Environmental Protection Agency oversight. The program protects aquatic ecosystems, water quality and public health by regulating discharges to surface waters from municipal and industrial wastewater treatment plants, municipal separate storm sewer systems (MS4s) and other sources (USEPA 2025).

The NPDES stormwater program regulates some stormwater discharges from three potential sources: MS4s, construction activities, and industrial activities. It is implemented in two phases:

1. The Phase I Stormwater Rule uses permit coverage to address stormwater runoff from MS4s serving populations of 100,000 or more, construction activities disturbing areas of five acres or more, and certain industrial activities.
2. The Phase II Stormwater Rule uses permit coverage to address stormwater runoff from MS4s serving populations of 50,000 or more and construction activities disturbing areas one to five acres (USEPA 2023).

North Carolina Session Law 2006-246 built upon the initial Phase I and Phase II NPDES regulations, establishing municipal spheres of influence around Phase II MS4 communities and expanding the area where permits are required for development (NC DEQ, n.d.). Municipalities may transition to either Phase I or Phase II MS4 communities if they meet specific criteria (NC DEQ 2022a).

Privately Owned Centralized Systems

Privately owned (non-governmental) wastewater treatment and disposal systems serve residential neighborhoods, large commercial or industrial facilities, or mixed-use communities in the County. The NC DEQ Geographic Information System (GIS) NPDES permitting database lists 44 privately owned wastewater treatment systems in Wake County, 21 of which serve more than one household. Privately owned centralized systems in Wake County discharge 1.6 mgd of treated wastewater (Tetra Tech and Hazen 2024b).

Public Centralized Systems

Wake County has five municipally owned and operated centralized wastewater treatment systems: the City of Raleigh and the towns of Cary, Apex, Holly Springs and Fuquay-Varina. Raleigh's system serves Garner, Knightdale, Rolesville, Wake Forest, Wendell and Zebulon, while Cary serves Morrisville, Raleigh-Durham International Airport and Research Triangle Park (Figures 6 and 7). The NPDES permitting database lists 11 publicly owned wastewater treatment systems in Wake County that discharge approximately 146 mgd of treated wastewater (Tetra Tech and Hazen 2024b). Assuming that present-day growth projections are reasonably correct, Angier, Apex, Fuquay-Varina, Holly Springs, and Raleigh will require either some degree of wastewater treatment expansion or an agreement with another system to provide treatment over the near-term planning horizon (Tetra Tech and Hazen 2024b).

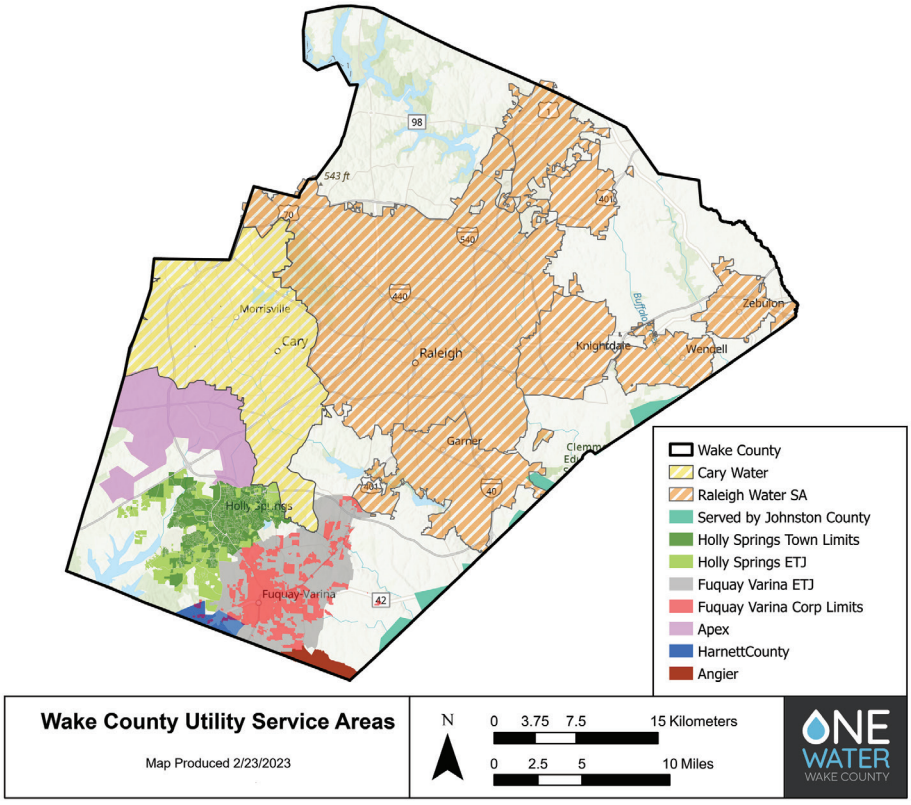


Figure 6. Wake County utilities service area map. (Source: Tetra Tech and Hazen 2023b)

Flood Insurance and the Community Rating System

The Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) Community Rating System (CRS) is a voluntary incentive program providing discounted flood insurance premium rates for communities that exceed the minimum requirements for NFIP. Each community choosing to participate in CRS is evaluated and awarded points from several categories that educate people, promote flood safety, implement higher regulatory standards and provide flood mapping. These points translate into flood insurance premium discounts of 0%–45% (FEMA 2025).

The CRS program discounts address the three goals of the program:

1. Reduce and avoid flood damage to insurable property.
2. Strengthen and support the insurance aspects of the NFIP.
3. Foster comprehensive floodplain management.

Wake County, the City of Raleigh, and the Town of Cary participate in the CRS program; as of July 2025, Wake County has a class rating of 10, which translates to a 0% discount on flood insurance premiums in both the Special Flood Hazard Area (SFHA) and areas outside the SFHA. Raleigh has a CRS Rating of 5 which provides a 25% discount on insurance rates) (Raleigh Stormwater, personal communication, August 1, 2025). Cary has a CRS Rating of 7 corresponding to a 15% discount on insurance rates (Town of Cary, personal communication, August 1, 2025). Each community provides flood protection to residents and structures through ordinances, regulations and education. The CRS class rating affects the financial benefits provided to residents required to purchase flood insurance.

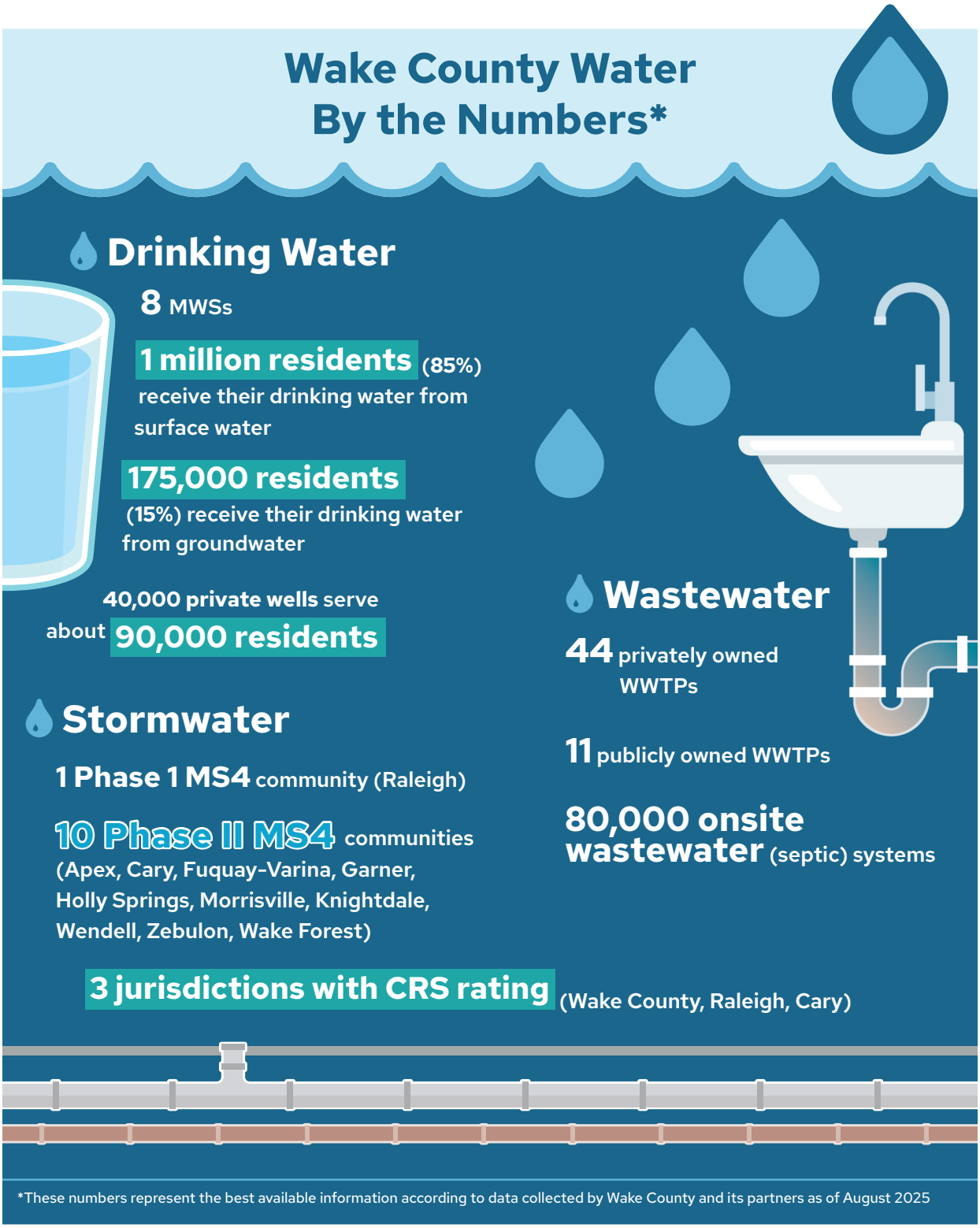


Figure 7. Summary of Wake County water data.
(Source: Tetra Tech; generated with data from Tetra Tech and Hazen 2023b)

Existing centralized sewer collection and wastewater treatment plant (WWTP) systems face challenges in future expansion, including limits on NPDES wastewater discharges and maintenance requirements associated with older and expansive infrastructure. Total maximum daily loads include waste load allocations to receiving water bodies, which is starting to challenge many municipal facilities under high development pressures. As a result, centralized utilities must use more complicated and expensive treatment alternatives to continue to accommodate growth where feasible (Tetra Tech and Hazen 2024b).

Drivers of Change

Many complex factors influence the quality and quantity of water resources. In Wake County, the key drivers of change in water resources are population growth, land use changes made to accommodate population growth, and increasing extreme weather events.

Population Growth

Wake County had 1.1 million residents in 2024. Each year, the County gains another 25,000 residents, or about 60 people per day—one of the highest population growth rates in the nation. These growth trends are expected to continue, with another 250,000 new residents added to Wake County over the next decade. In the next 50 years, by 2075, Wake County's population is expected to more than double, to well over 2 million residents (Wake County 2021).

The County must manage this growth carefully. Under current growth rates, another 28,000 acres of new development could occur within 25–50 years, potentially converting all remaining unprotected farmland, rural areas and forest land in the County to housing and commercial development. Local travel would become very challenging due to traffic congestion (Wake County 2021).

To address these concerns, the Wake County Board of Commissioners adopted PLANWake, the County's comprehensive plan, on April 5, 2021. PLANWake directs growth to existing towns, supports the development of connected and walkable transit-supportive centers, and works with rural landowners to protect important open spaces, farms and forests.

The community contributed to PLANWake, helping to establish a vision and set priorities for Wake County. Over the next decade, PLANWake seeks to create a county that is participatory and opportunity rich, healthy and active, sustainable and vibrant. Integrating PLANWake with the County's One Water vision is a necessary and crucial step to producing feasible and comprehensive strategies to help manage water.

Land Use Change

As the population grows, more homes and businesses are needed to provide services and products. This growth, in turn, attracts more growth. These changes require new infrastructure, roads and buildings, resulting in newly developed areas and increased density within existing developed areas. Converting natural land to developed land adds impervious surfaces like concrete and asphalt, preventing water from soaking into the ground and recharging the groundwater. Instead, the water runs off (Figure 8).

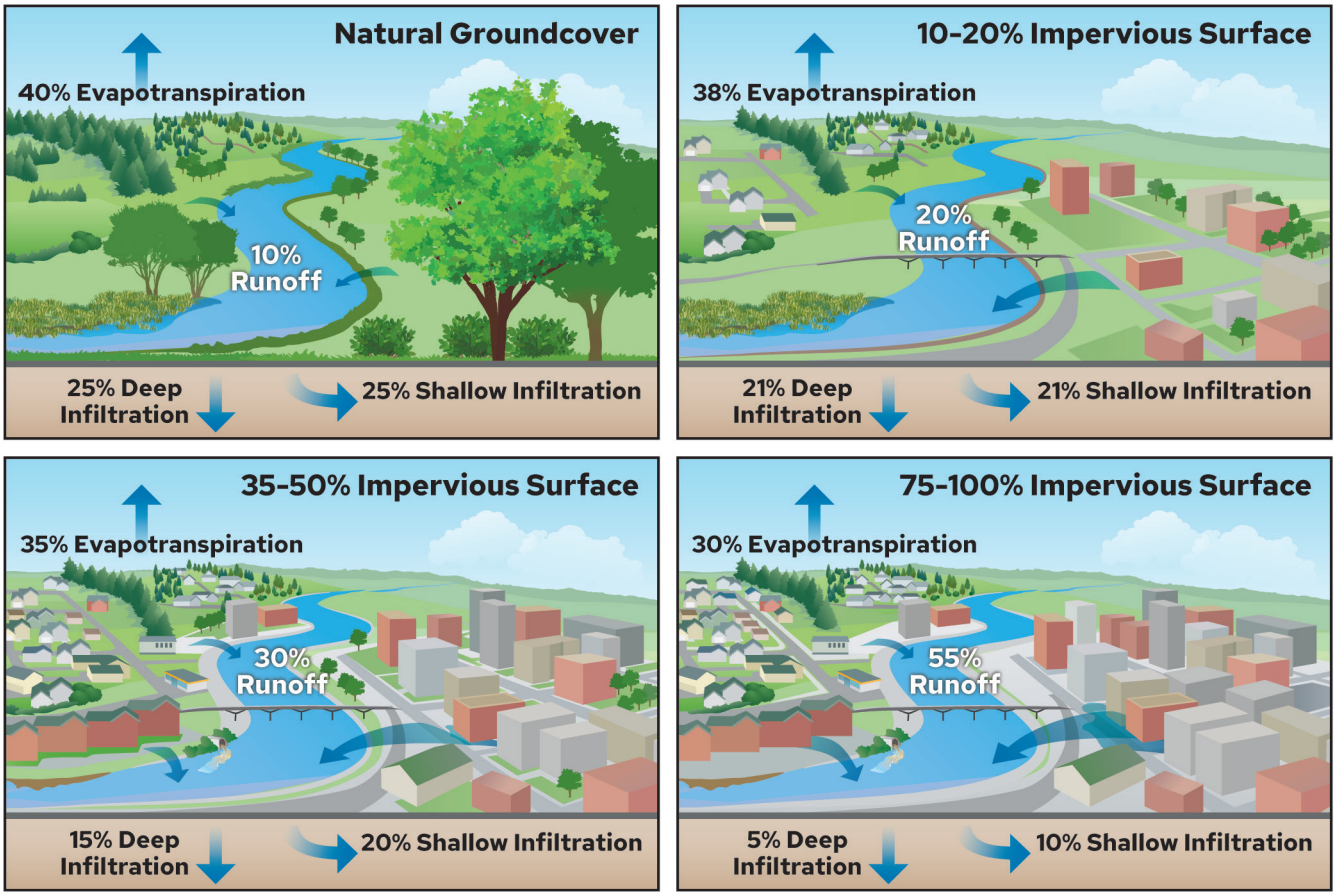


Figure 8. Comparison of impervious surface coverage to water infiltration and surface runoff. (Source: Tetra Tech; generated with data from FISRWG 2001)

Traditionally, stormwater management directs runoff from newly developed land into pipes that quickly convey and discharge it to streams. These discharges create fast and intense water flows that erode streambeds and streambanks and cause downstream flooding. Furthermore, runoff often picks up pollution from impervious surfaces and carries it directly to surface water bodies, upsetting the chemical and biological balance and worsening the water quality.

In recent decades, stormwater management has shifted toward incorporating low impact development practices that emphasize using different types of infrastructure, namely green stormwater infrastructure (GSI), alongside traditional stormwater pipes (grey infrastructure) to capture, slow and filter stormwater to prevent these negative effects. Plus, current stormwater regulations require that developers meet performance standards to manage stormwater volume and minimize pollutant discharge. Despite these new approaches and regulations, opportunities exist to strengthen stormwater management across Wake County.

Wake County is currently guiding growth over the next 10 years using the PLANWake Development Framework, which identifies the future vision for land use and character. As shown in the map in Figure 9, PLANWake established five land use classifications with policy goals and expectations:

1. **Transit Focus:** The most intensively developed areas; dense urban (i.e., impervious) centers (approximately 2% of Wake County)
2. **Walkable Center:** Suburban, commercial, employment centers and transportation hubs (dense, mixed-use areas); includes locations for redevelopment or new development (approximately 10% of Wake County)
3. **Community:** Townhomes, apartments, single and multifamily homes, and neighborhood-scale businesses (suburban) (approximately 55% of Wake County)
4. **Community Reserve:** Low-density areas with conservation-oriented residential subdivisions, forests and farms; not currently served by public utilities (approximately 4% of Wake County)
5. **Rural:** Least developed, low-density residential and natural lands (forest and agricultural activity); marked by extensive forest coverage and agricultural activity; provides important ecosystem services (approximately 29% of Wake County)

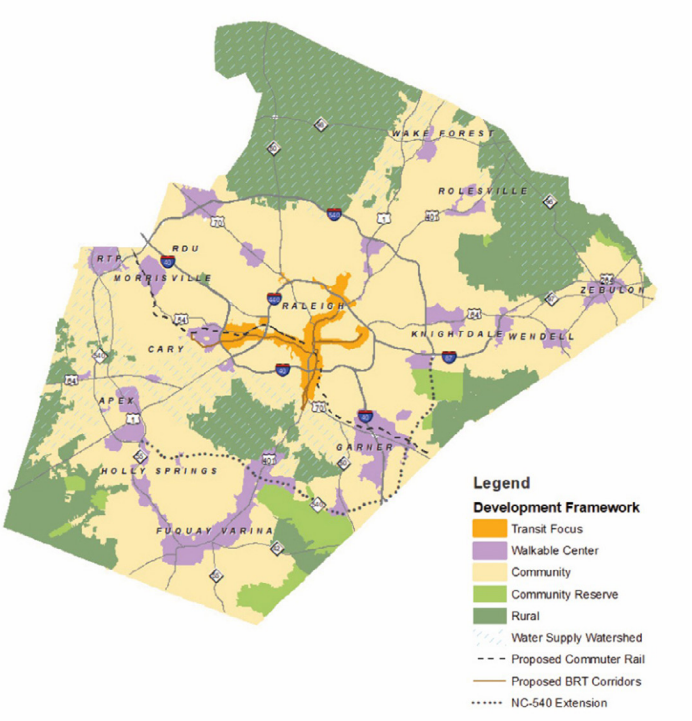


Figure 9. Wake County PLANWake Development Framework land use classifications. (Source: Wake County 2021)

These five land use classifications, designated for intentional growth within the County boundaries, provide a generalized spatial approach to guide future land use/land cover change.

Integrating PLANWake with the County's One Water vision enabled the Team to assess the current and projected future conditions of hydrology and water quality in the County's subbasins. The assessments provide a baseline understanding of the existing streamflow and water quality conditions and what changes might occur if current development patterns proceed without achieving PLANWake's vision and development framework. To understand the impacts of the County's continued growth, the Wake County One Water Team used models to construct a 50-year future projection of land use/land cover (Figure 10). The models predict that urban areas will grow at the expense of natural and agricultural areas (Tetra Tech et al. 2025b).

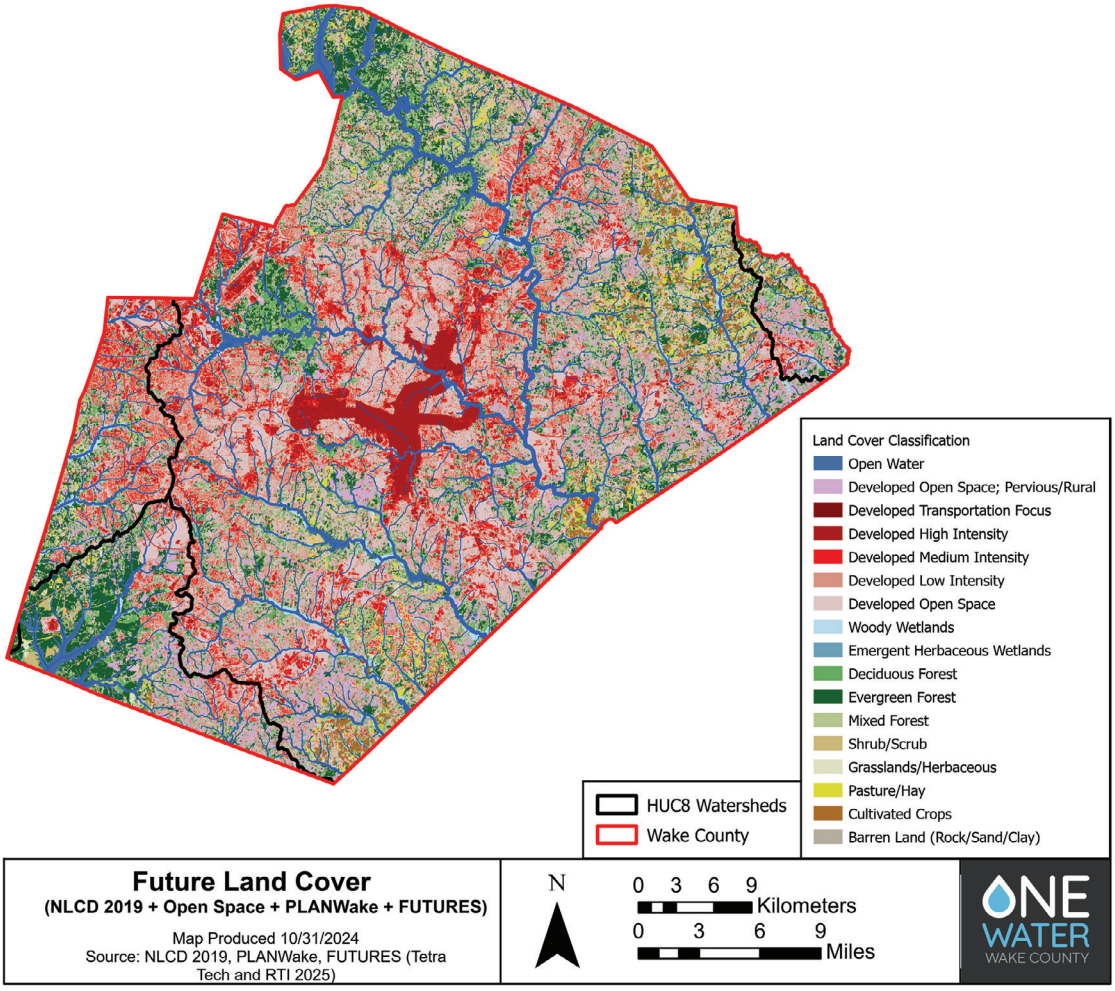


Figure 10. The 50-year future land use scenario. (Source: Tetra Tech and RTI 2025)

The modeled projections show significant increases in developed land uses of various intensities and corresponding declines in agricultural and natural land areas, including forest, grass and shrub lands (Table 1).

Table 1. Current and projected land use in the County and the percent change. (Tetra Tech et al. 2025b)

Land Use/ Land Cover Category	Current (mi^2)	Future[b] (mi^2)	Change (%)
Open Water	25.4	25.4	0%
Developed, Open Space; Pervious/Rural[a]	0.0	50.3	100%
Developed, Open Space	150.8	210.9	40%
Developed, Low Intensity	112.0	120.7	8%
Developed, Medium Intensity	77.1	83.9	9%
Developed, High Intensity	19.9	38.8	95%
Developed, Transportation Focus[a]	0.0	0.1	100%
Barren Land (Rock/Sand/Clay)	2.5	0.6	-74%
Deciduous Forest	77.4	60.0	-23%
Evergreen Forest	115.4	94.2	-18%
Mixed Forest	115.2	90.8	-21%
Shrub/Scrub	9.6	3.8	-60%
Grasslands/Herbaceous	20.4	6.2	-70%
Pasture/Hay	55.2	18.7	-66%
Cultivated Crops	39.3	15.8	-60%
Woody Wetlands	34.8	34.8	0%
Emergent Herbaceous Wetlands	2.1	2.1	0%

Notes:

mi^2 = square miles

[a] This is a new land use/land cover classification created based on PLANWake (developed in 2021) land use types; therefore, the current amount is 0.0, and the percent change is 100%.

[b] The One Water Team used PLANWake and FUTURES model to quantify land use changes in 50 years.

Changing Climate

A 2018 Intergovernmental Panel on Climate Change report predicted that communities in the southeastern United States might experience higher temperatures, extreme weather events, and increasingly volatile direct and secondary threats (IPCC 2018). The Fourth National Climate Assessment Report also characterizes potential climate-related impacts and risks to the Southeast. The report states that Earth's climate is now changing faster than at any point in the history of modern civilization (USGCRP 2017).

Historical weather data from National Oceanic and Atmospheric Administration (NOAA) and the Raleigh-Durham Airport (NOAA Climate Data Online [Station 317069] and Global Hydrologic Climate Network Daily Station) since 2000 shows that extreme storm events in the County increased over the past decade, including more precipitation falling over shorter periods (e.g., 6 inches of rain falling in 2 hours instead of 4 inches falling in 24 hours) (NOAA, n.d.-a, n.d.-b). These changing precipitation patterns can increase flooding, erosion, water pollution and other problems. In developing this Plan, models were used to project weather conditions in 50 years (Tetra Tech and RTI 2025).

All models include uncertainty; however, looking at multiple models helps define a range of possible futures to make more informed water management decisions. The One Water Team used three models to predict future climate conditions in Wake County. The future effects of a changing climate on water resources will vary by location and sector. The models projected the following future conditions, which will depend on complex interactions between precipitation frequency, precipitation intensity and increased evaporation due to warmer temperatures:

More variable precipitation with intense downpours and longer drought periods. Model projections assessed for this Plan indicated greater variability, with some months experiencing increased precipitation and extreme weather events and others experiencing decreased precipitation. Climate scenarios show a reduction in the frequency of high-flow events. However, they also show increased magnitudes within precipitation events that would be considered extreme. Therefore, the risk of flooding increases (Tetra Tech and RTI 2025).

Higher temperatures. Models predict air temperatures increasing between 2.5 and 5.8 degrees Fahrenheit, with the fluctuations depending on the time of year and other drivers. Higher temperatures allow the atmosphere to hold more water. This water can be released quickly in high-intensity, short-duration cloudburst storms, running off rather than slowly soaking into the ground. Higher temperatures also lead to more evaporation from surface water bodies. Combined with longer drought periods, this can strain surface and groundwater supplies (Tetra Tech and RTI 2025).

Wake County Future Water Trends

Modeled projections in the County show reduced infiltration, increased stormwater runoff volume, increased frequency of flooding and high-flow events, increased pollution and increased demand for water (Figure 11).

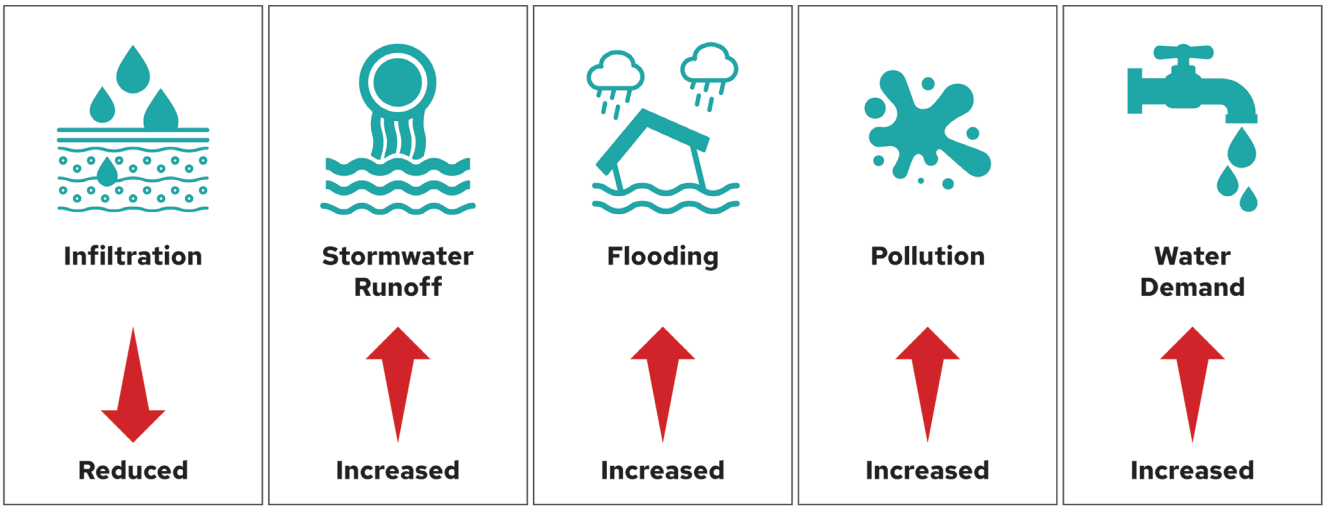


Figure 11. Summary of future water trends.
(Source: Tetra Tech; generated with data from Tetra Tech and RTI 2025)

Reduced Infiltration

With higher temperatures and more variable precipitation, models predict increases in runoff, which will result in decreased groundwater recharge. More urban areas of the County will receive less infiltration as a larger portion of rainfall enters the stream through runoff rather than groundwater flow. Groundwater recharge is expected to broadly decrease due to increased runoff, a decreased number of days with precipitation and increased evapotranspiration. As a result, water supply vulnerability is likely to increase in the County (Tetra Tech and RTI 2025).

The One Water Team conducted a groundwater vulnerability analysis for the rural growth areas of the County that reflect future reliance on groundwater. Figure 12 shows the County's future groundwater vulnerability with the projected single-family residential population from the high-growth CommunityViz scenario model. Watersheds are ranked based upon future groundwater vulnerability. Lower ranks denote watersheds with both projected population growth with potential reliance on groundwater for water supply, and substantial declines in net infiltration, indicating areas that may become increasingly stressed due to reduced net infiltration. The analysis identified several areas in Wake County, specifically in the northeastern, northwestern and southeastern regions, that are particularly vulnerable to reduced groundwater recharge (Tetra Tech and Hazen 2025a).

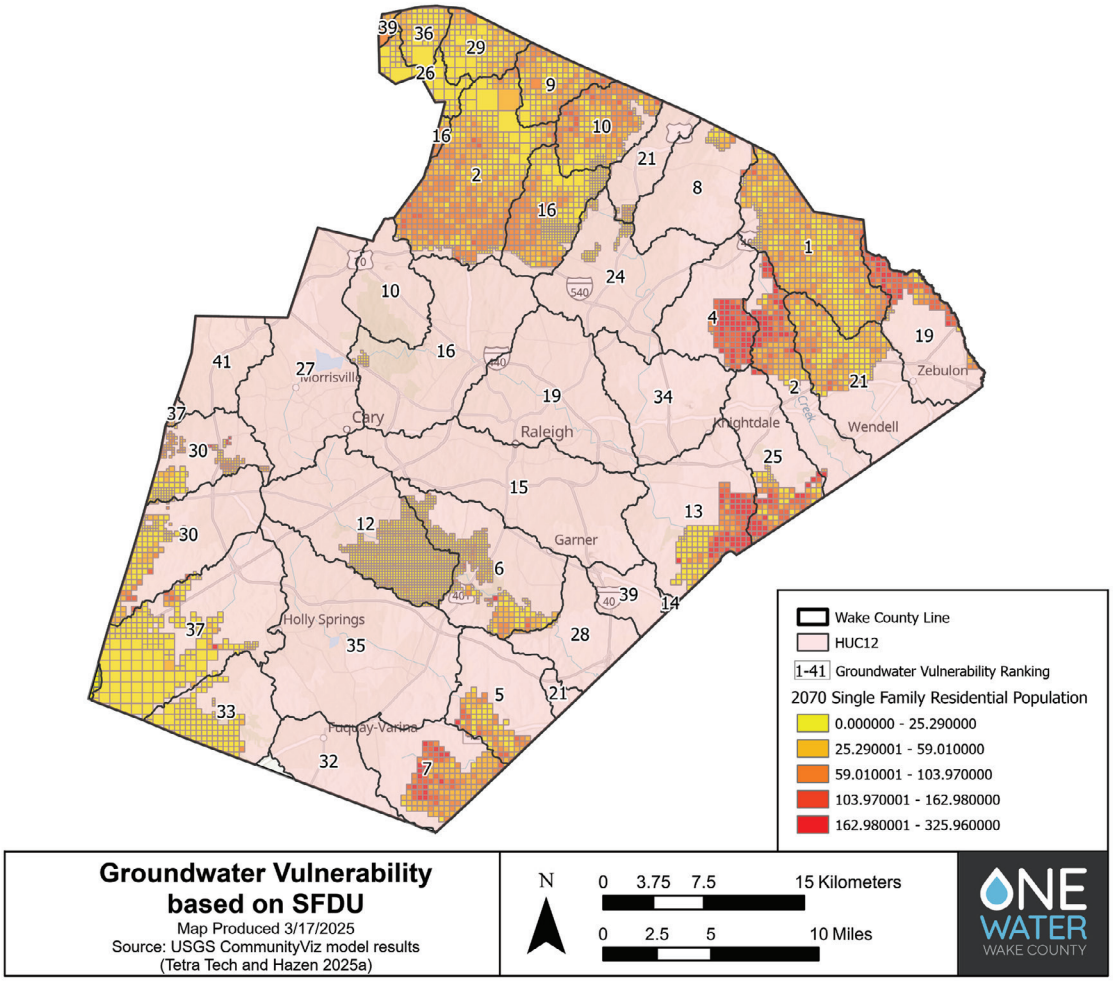


Figure 12. Groundwater vulnerability based on projected single family residential population from the high-growth CommunityViz scenario model. (Source: Tetra Tech and Hazen 2025a)

Increased Stormwater Runoff

The One Water Team used hydrology and water quality metrics to describe the County's hydrologic (the effects of water on land) and water quality characteristics under current and future conditions (Figure 13). In the developed high-runoff areas, there is more urban ground cover and less infiltration, indicating that a larger portion of rainfall enters the stream through runoff rather than groundwater flow. The greatest increases in mean daily runoff (>30%) correspond to the Transit Focus and Walkable Center land use classifications under PLANWake. These two areas are focused on more dense development with assumed high percentages of impervious area. The future is uncertain, but the models illustrate a range of risks. Major observations across Wake County include (Tetra Tech and RTI 2025):

- The long-term daily average runoff will increase, along with the sediment and nutrient loadings associated with the volume of water coming off the land surface.

- Increased runoff volumes will increase the likelihood of localized flooding.
- More extreme low flows will occur in high-runoff areas.

Based on the One Water Team's assessment, the following is expected in specific areas of Wake County (Tetra Tech and RTI 2025):

- Higher frequency of high-flow events will occur in the headwaters of Crabtree Creek.
- Runoff will be greater in the County's urban areas, along its western border in the headwaters of Crabtree Creek, in the tributaries to Jordan Lake and in the center of the County around Raleigh.
- High-runoff areas will correspond to areas with lower groundwater recharge rates and lower baseflow ratios.

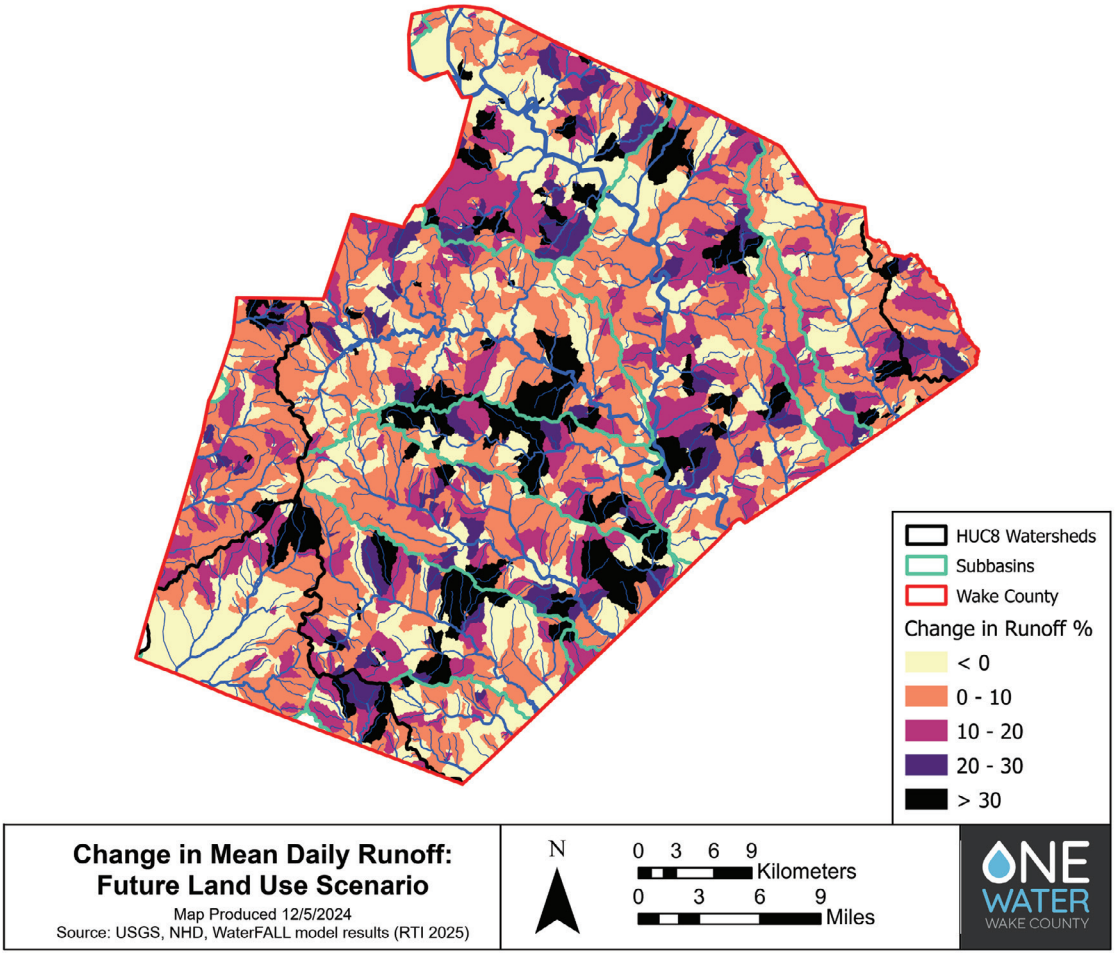


Figure 13. Changes in mean daily runoff from current conditions due to future land use change. (Source: Tetra Tech and RTI 2025)

Increased Flooding

Modeled projections show increased flooding from extreme weather events, which could put communities at risk for flooding, infrastructure damage (e.g., water supply reservoir dams) and loss of life. In addition, land use changes that create more impervious surfaces are also projected to lead to more flooding events in Wake County (Tetra Tech and RTI 2025).

Future land use projections show that although the frequency of high-flow events throughout the County increases due to widespread land use changes, there is little change in the duration of events (Figure 14) (Tetra Tech and RTI 2025).

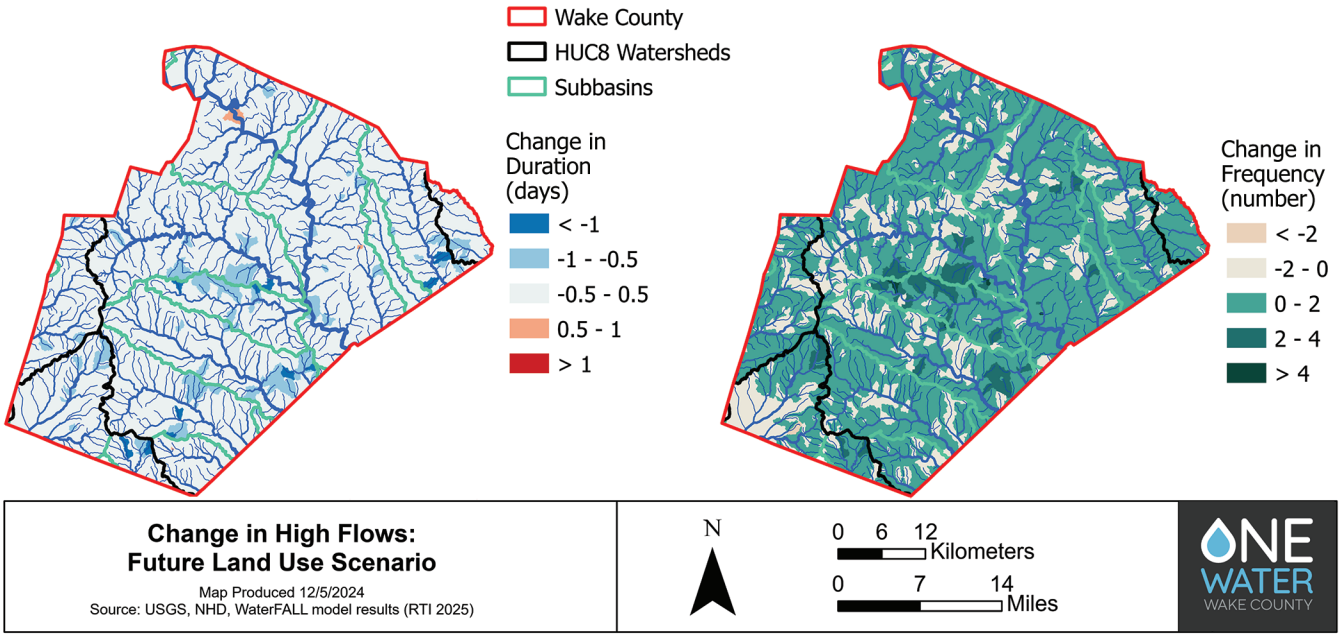


Figure 14. Change in high-flow characteristics from current conditions due to future land use change. (Source: Tetra Tech and RTI 2025)

Increased Pollution

Figures 15, 16 and 17 show the future projections of increased surface runoff loads of sediment, nitrogen and phosphorus throughout the County in all but a few localized areas. The predicted water quality impacts of future land use changes include (Tetra Tech and RTI 2025):

- Large increases will occur in high-flow pollutant loads except for some smaller subbasins converted to agricultural lands.
- Surface loadings will increase for sediment, nitrogen and phosphorus in all but a few localized areas where agricultural land is converted to low-density urban.

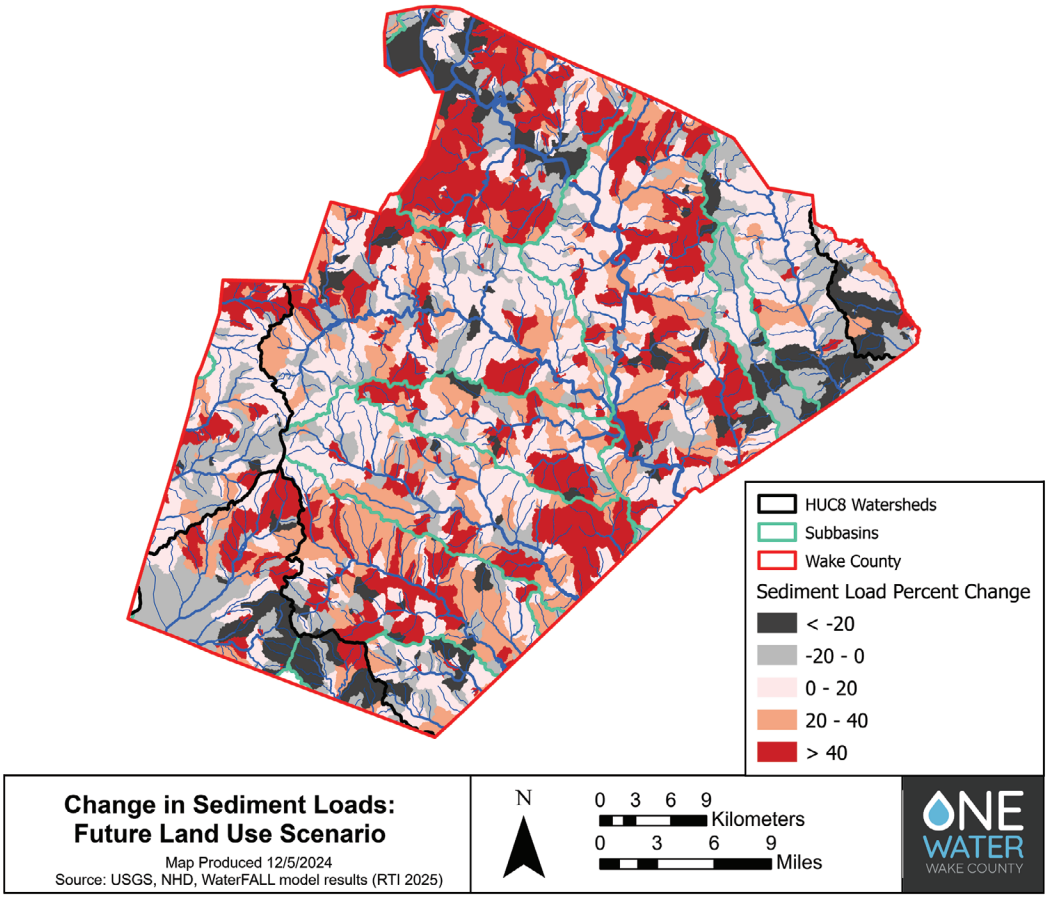


Figure 15. Change in surface runoff sediment loads from current conditions due to future land use change. (Source: Tetra Tech and RTI 2025)

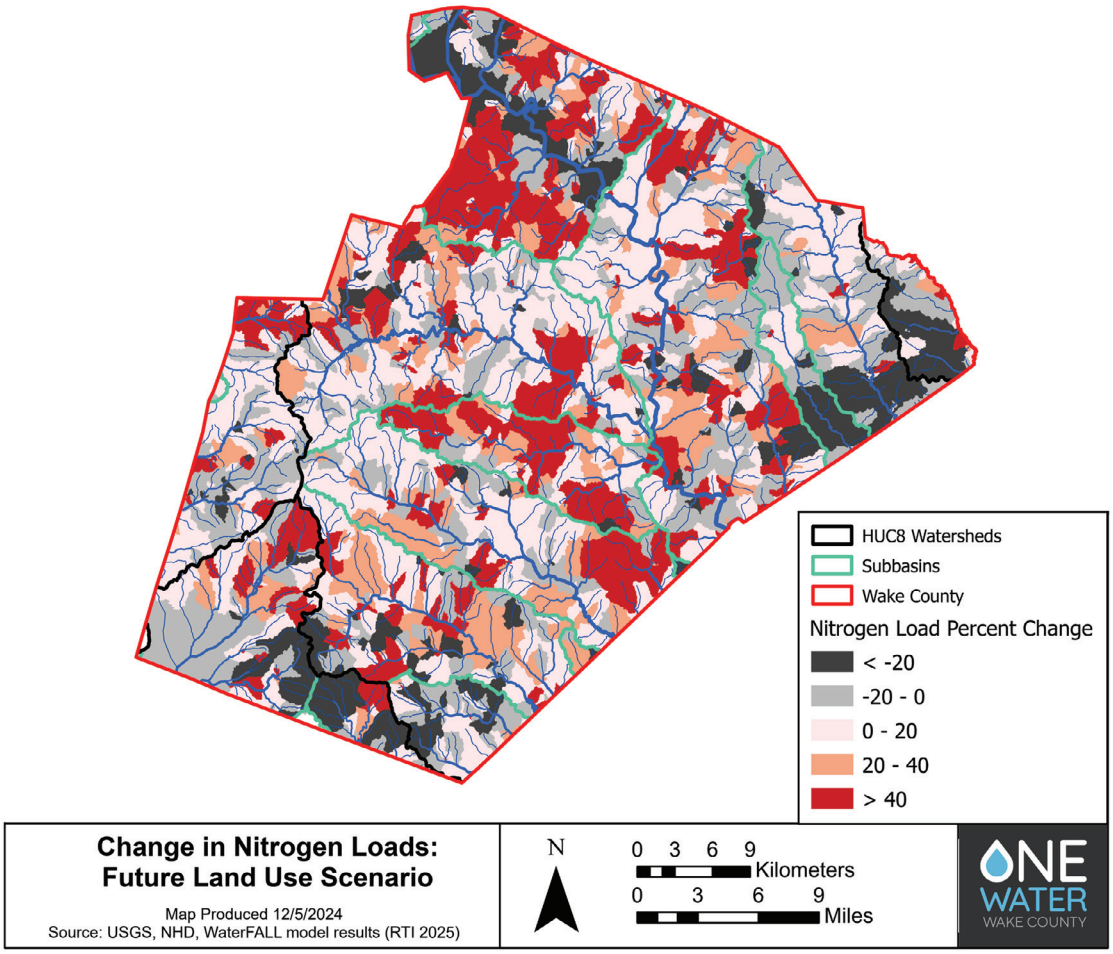


Figure 16. Change in surface runoff nitrogen loads from current conditions due to future land use change. (Source: Tetra Tech and RTI 2025)

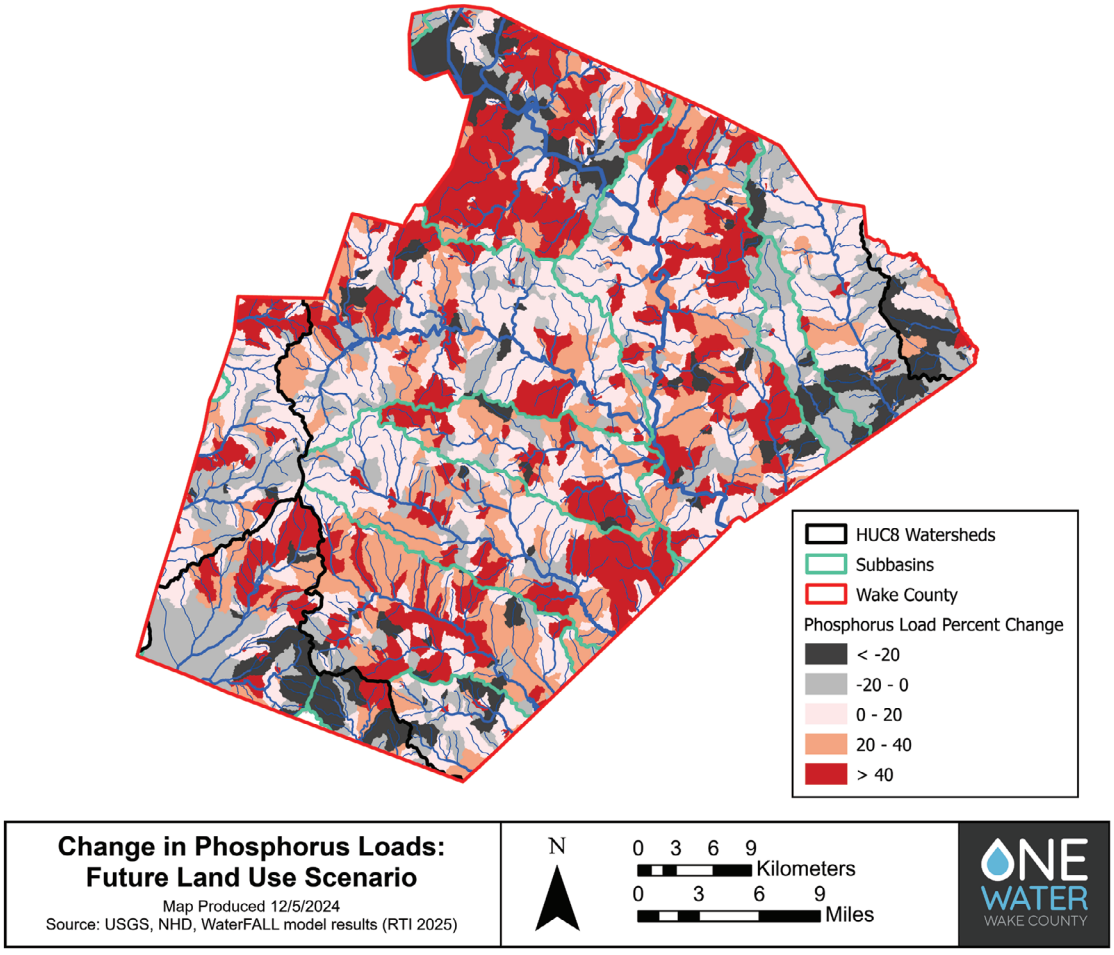


Figure 17. Change in surface runoff phosphorus loads from current conditions due to future land use change. (Source: Tetra Tech and RTI 2025)

Increased Water Demand

Significant growth is expected within MWS service areas, with some utilities expected to see their population more than double (Table 2). All MWSs will experience some level of growth that will require water supply or water treatment expansion over the next 50 years to meet anticipated demand (Table 3).

Table 2. Population comparison between 2021 and projected population data for each water utility in the County. (Source: NC DEQ 2022b)

Water Utility	Population	
	2021	2070
Raleigh Water	610,000	1,514,000
Town of Cary and Town of Morrisville	212,109	242,554
Town of Apex	71,988	182,000
Town of Holly Springs	45,058	117,000
Town of Fuquay-Varina	34,152	126,000

Table 3. Water demand comparison between 2021 and projected water demand for each water utility in the County. (Source: NC DEQ 2022b)

Water Utility	Water Demand (mgd)	
	2021	2070
Raleigh Water	53.0	124.4
Town of Cary and Town of Morrisville	20.2	34.4
Town of Apex	5.6	14.4
Town of Holly Springs*	3.2	11.1
Town of Fuquay-Varina	2.8	10.7

* According to communications with Holly Springs in 2021, the projected 2070 water demand for Holly Springs was derived from the UCWRF Expansion Master Plan (Hazen and Sawyer, July 2021).

The Neuse River

2. One Water Approach for Wake County

What is One Water?

Wake County is not alone in seeking to manage its water resources to address the challenges posed by changing population, land use and climate. For more than a decade, the One Water Approach concept has evolved through collaborative research, analysis, dialogue, planning, implementation and outreach by many organizations, including the U.S. Water Alliance and the Water Research Foundation, as a cost-effective and resilient way to meet water resource management needs. The One Water concept views all forms of water as interconnected, whether from the tap, a stream or a stormwater or wastewater system.

A one-size-fits-all One Water approach does not exist. One Water is a collection of principles for a water resources management framework that integrates multiple water and non-water programs. Over the past several years, Wake County has combined its ideas with those emerging elsewhere to tailor a County-specific One Water Plan (the Plan) that aligns with the following principles:

- Recognize that all water has value.

Key Tenets of One Water

Water plays a crucial role in supporting thriving communities, sustainable and competitive business and industry, regenerative agricultural systems and healthy watersheds. Some key tenets of One Water include:

- Value water at every stage and in every form
- Focus on achieving social, economic, environmental benefits
- Use watershed-scale thinking and action
- Rely on partnerships and collaboration
- Account for climate action urgency and opportunities

(Source: Tetra Tech; with text generated from U.S. Water Alliance, n.d.)

- Seek water solutions that provide economic, environmental and social co-benefits.
- Advance regional collaboration.
- Support access to clean and abundant water for all.

In implementing these One Water principles, Wake County will be an effective steward of natural resources by identifying and leveraging the potential of all waters, including stormwater and wastewater, to help meet the increasing needs of residents, visitors and businesses. The County seeks to support the local economy, improve residents' quality of life and maintain a healthy environment that sustains natural resources for future generations.

Why One Water for Wake County?

Wake County believes that everyone should have access to clean, safe and affordable water. This goal can be reached through community-coordinated integrated water management (Figure 18). The many diverse communities stretching across County and municipal jurisdictional boundaries include residential, commercial, industrial and farming areas with varying water supply needs. To be successful, a comprehensive water management plan must consider and address these differences. Through One Water, the County integrates water management across water programs and within economic and transportation planning to realize economic, social and environmental benefits.

Figure 18. Wake One Water integrated water management framework.
(Source: Wake County 2023)

Alignment with PLANWake

PLANWake guides economic development towards the vision that stakeholders (County residents, businesses, government and nongovernment organizations) have for managing County growth. It outlines a comprehensive strategy for intentional growth to achieve the County's goals of improved resident health and activity and a more sustainable and vibrant environment.

The core foundation of PLANWake is its Development Framework, which outlines a set of policy goals and expectations for five different development classes:

1. Transit Focus
2. Walkable Center
3. Community
4. Community Reserve
5. Rural

The County's One Water Plan complements PLANWake by providing strong water management guidance across the five development classes to support the overarching economic development vision while addressing other economic, social and environmental concerns (Figure 19). Water is vital for all five classes, but each development class has specific water management needs that a tailored One Water approach can help address.

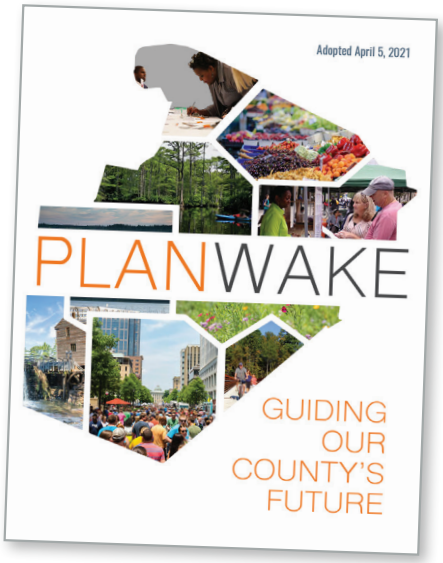


Figure 19. PLANWake document. (Source: Wake County 2021)

One Water Plan Development and Engagement

Wake County created its One Water Plan in three phases: (1) Visioning, (2) Assessment and (3) Plan Development. Throughout the process, Wake County engaged with the public, providing stakeholders with:

- Information about the Plan and how it will affect residents.
- More awareness of water's value and how it intersects with daily life.
- Opportunities to share input on the Plan.
- Knowledge of how public input will be factored into Plan-related decisions and recommendations.

The engagement process included online and in-person events and relied on community partner feedback to accommodate preferences for outreach. The goals for ensuring successful and meaningful community outreach included:

- Establishing and advertising frequent public participation opportunities.
- Providing multiple methods for residents to share input on their values and needs and promote an open, inclusive and transparent public involvement process.
- Disseminating easy-to-understand and consistent information to increase the public's knowledge and participation.
- Implementing measures for accommodating and seeking input from traditionally hard to reach community members, such as low-income, minority, disabled and limited-English-speaking individuals.

Stakeholder groups included:

- Community members
  - Community-based organizations and nonprofit organizations
  - Limited-English-proficiency groups
  - Agriculture/community representatives
  - Rural septic/well users
- Local business assemblies
  - Greater Raleigh Chamber of Commerce (Raleigh Chamber)
- Special interest parties
  - Developers/homebuilders associations
  - Private utility providers
  - Environmental groups
- Government agency partners
  - Surrounding municipalities (12)
  - Wake County water utilities
  - Wake County Soil and Water Conservation District (SWCD)

These groups were integrated within three phases of the Plan's development, as follows:

Phase 1: Visioning

This phase involved reviewing existing County and municipal programs and plans, interviewing County program staff, hosting a summit for water professionals from the County and several partner agencies and organizations, holding stakeholder meetings for key interests in the County (business, academic, environmental and community organizations) and surveying more than 1,600 members of the public.

These Phase 1 efforts generated a preliminary understanding of why water is important to various sectors in the County, which existing programs and efforts support a One Water Plan, the types of challenges the Plan would need to address and the prioritization of these challenges in the Plan. The most significant outcome of Phase 1 was the 2024 publication of an initial Wake County One Water Vision, Goals and Outcomes document that informed the Plan development process. The document was updated following completion of the stakeholder engagement process and public draft distribution of the Plan (Figure 20) (Wake County 2025).

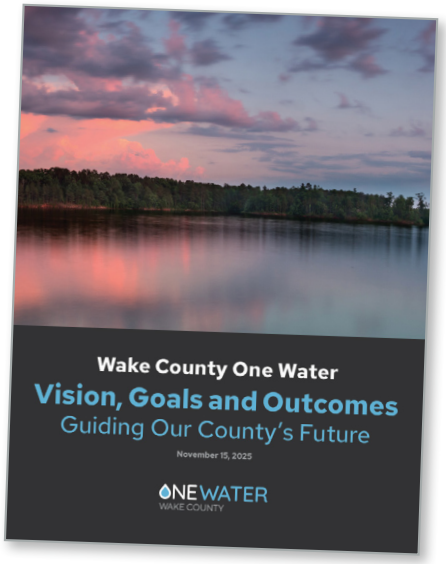


Figure 20. Wake County Vision, Goals and Outcomes document. (Source: Wake County 2025)

One Water Vision

The 2025 vision document focuses on four key areas: community, economy, environment and governance.

- **Community.** The vision for the community is to value water while improving and innovating water management to sustain a resilient community. Actions support public safety, a strong economy, environmental protection, provision of healthy food for all, aesthetically pleasing and affordable neighborhoods, outdoor recreation, improved transportation and robust water-related infrastructure.
- **Economy.** The vision for the economy reflects an abundance of diverse jobs and prosperity for all, supporting a high level of entrepreneurial capacity for advancing green approaches and clean technologies that boost environmental stewardship while growing the economy and supporting an exceptional quality of life.
- **Environment.** The vision for the environment reflects the desire to live in a community that supports the conservation and preservation of rural open space that is balanced and integrated with urban landscapes to achieve clean air and water resources, healthy soil and whole ecological systems.

- **Governance.** The vision for governance invokes trust and public support for policies, including those related to water management, that are dynamic, adaptable and supportive of other community objectives.

Attendees at the Wake County One Water Vision Summit.

One Water Goals and Outcomes

Building on the community's comprehensive vision statement, Wake County established five goals with envisioned outcomes to guide the Wake One Water Plan development efforts. Working towards each goal, described below, will help the County and its partners develop specific strategies to achieve the vision and outcomes.

1. Build Knowledge, Collaboration and Partnerships. One Water unites governments, schools and businesses. Wake County and its 12 municipalities plan and deliver water supply and treatment, flood control and water quality protection. These efforts link to the County's growth, housing, transportation and land use goals. Wake County helps schools integrate One Water practices into teaching and learning, while

One Water Plan Goals

1. Build knowledge collaboration and partnerships.
2. Increase community resilience.
3. Cultivate community support.
4. Advance equal access to clean and abundant water for all.
5. Support local economy and fiscal accountability.

colleges and universities support private-well users and pilot projects. One Water also forms public-private partnerships and drives green infrastructure and water-reuse projects. Wake County's One Water strategies empower advocates and invite public input.

2. Increase Community Resilience. Wake County boosts climate resilience. It embraces climate-smart design and integrates water planning, economic development and land conservation. One Water strategies protect aquifers, expand green infrastructure and develop alternative water supplies. This approach conserves potable water. In addition, farms adopt practices that balance ecosystem health with food production. Hazard mitigation plans reduce flood risks and ensure clean water access when systems fail. Residents and businesses adopt water-saving practices that strengthen community resilience.

3. Cultivate Community Support. Wake County's One Water strategies connect community voices, businesses and civic groups. To accelerate progress, the County expands partnerships, mobilizes volunteers and streamlines resources. Financial tools that empower residents to lead local efforts are offered. Developers and institutions adopt One Water practices, and community outreach increases awareness and engagement. Educational materials and events spark public interest, deepen understanding and drive action.

4. Advance Equal Access to Clean and Abundant Water for All. Wake County's One Water strategies ensure all residents can access clean water, healthy food and safe environments. The County aligns policies to support vulnerable communities, expands access to parks and recreation, and invests in community leaders to guide inclusive planning. Public outreach strengthens understanding, while staff and residents co-design strategies that address climate impacts and community needs.

5. Support Local Economy and Fiscal Accountability. Wake County's One Water strategies drive economic growth and fiscal accountability. These strategies deliver environmental, social and financial benefits. They attract businesses, increase local revenue and protect property values without displacing vulnerable residents. To support long-term community prosperity, the County invests in workforce development, youth education and job creation.

Kayakers at Harris Lake boat launch in New Hill, N.C.

Phase 2: Assessment

Phase 2 began in parallel with Phase 1 and included detailed investigations into key water resources areas, including:

- Stormwater and flood management programs
- Surface water supply needs, sources and concerns
- Groundwater supply needs, sources and concerns
- Wastewater treatment systems in municipal and rural portions of the County
- Hydrology and water quality under existing and projected future conditions

See the Appendix: Supplemental Project Documents for the list of Technical Memorandums that were developed to assess the key water resources areas. The Technical Memorandums and assessment results helped the County and engaged stakeholders better understand and frame the water management needs projected for the next 50 years. The County and stakeholders provided input on water quantity and quality issues, helping to identify the information gaps, challenges and management strategies to consider when developing the Plan.

Phase 3: One Water Plan Development

Phase 3 brought together County staff, partner organizations and the public with a team of subject matter experts helping to develop the Plan. In late 2024 and early 2025, the One Water Team conducted the following technical strategy workshops, where they presented the results of technical assessments and preliminary strategies:

- Stormwater and Flood Resilience Strategy Development (November 19, 2024), with the following breakout sessions:
  - Stormwater – Green Stormwater Infrastructure (GSI)
  - Stormwater – Resilience
  - Stormwater – Reuse
  - Flood Resilience
- Nutrient Reduction Strategy Development (December 9, 2024), with the following breakout sessions:
  - Onsite/Decentralized Opportunities
  - Municipal Wastewater Opportunities
  - Alternative Investment Opportunities
- Surface Water and Groundwater Protection Strategy Development (January 15, 2025), with the following breakout sessions:
  - Surface Water Supply

  - Groundwater Supply
  - Water Quality
- Climate Strategies (February 18, 2025), with the following breakout sessions:
  - Wastewater
  - Drinking Water
  - Stormwater/Flood

Using the strategy workshop results, the Team developed, consolidated and summarized draft strategies and action steps to inform sector-specific stakeholder meetings and the strategy prioritization public survey. Beginning in March 2025, Wake County held public meetings to raise awareness of the Plan and gather feedback on the strategies being considered. The meetings engaged the following sectors:

- **Public:** Wake County Eastern Regional Center, Wake County Northern Regional Center, Wake County Southern Regional Center and Partners for Environmental Justice
- **Agriculture:** Keeping the Farm Workshop hosted by the Wake County SWCD
- **Businesses:** Raleigh Chamber Business Sustainability Roundtable
- **Developers:** Raleigh-Wake County Homebuilders Association
- **Government partners:** Wake County Water Partnership (Water Partnership) Comprehensive Planning Subcommittee

Each sector demonstrated a strong interest in addressing water management challenges through collaboration, education and the implementation of sustainable practices. Common themes across sectors included concerns about water quality, the need for technical assistance and the importance of partnerships to achieve effective and sustainable water management solutions.

The One Water Team conducted another countywide survey in April and May 2025 to collect feedback from residents about the draft One Water Plan strategies, receiving more than 1,200 responses. Survey respondents communicated support for a variety of One Water strategies including green streets (Figure 21), green stormwater

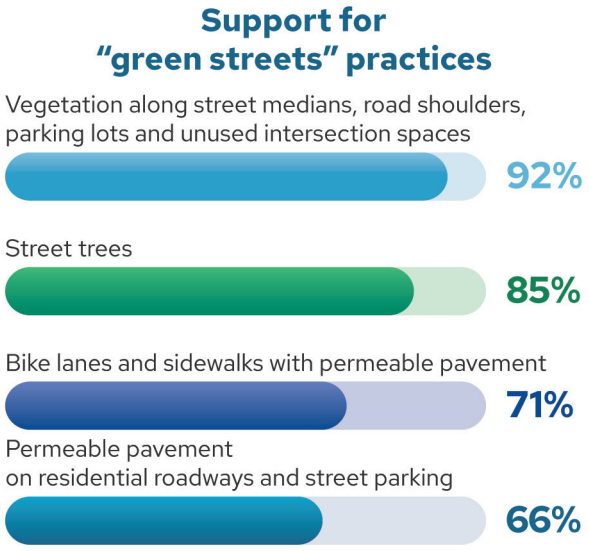


Figure 21. Support for "green streets" practices based upon the 2025 public survey. (Source: Tetra Tech 2025)

infrastructure (Figure 22) and water quality testing resources (Figure 23). Together, the stakeholder meetings and survey responses augmented the Plan by helping refine focus areas and priorities. This public feedback also informed the level of effort and timeframe needed to implement the recommended action steps.

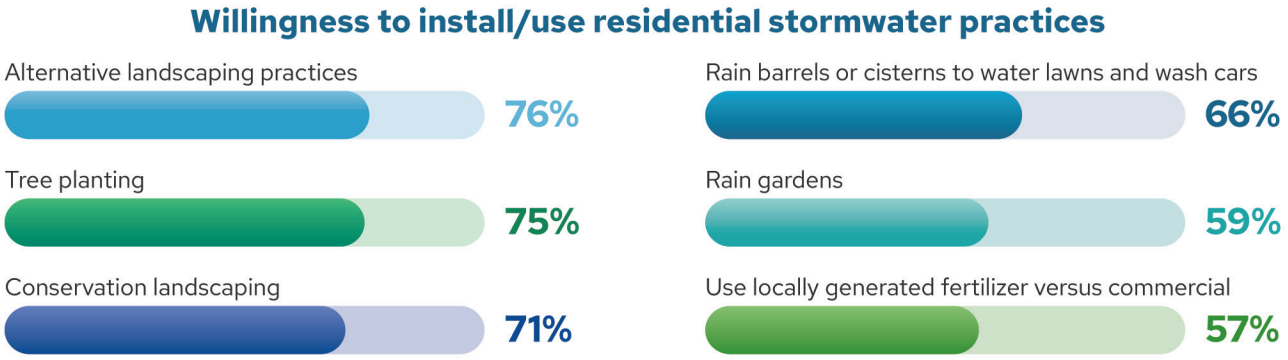


Figure 22. Willingness to install/use residential stormwater practices based upon the 2025 public survey. (Source: Tetra Tech 2025)

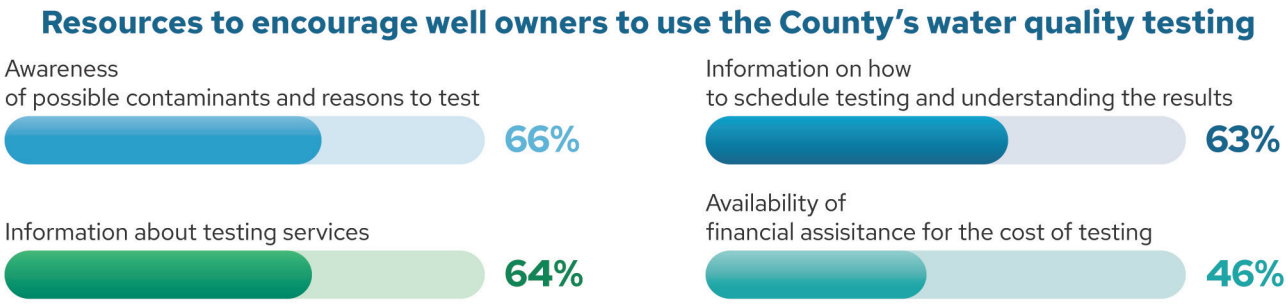


Figure 23. Preferred resources to encourage use of Wake County private well testing services based upon the 2025 public survey. (Source: Tetra Tech 2025)

Tree-lined street in downtown Wake Forest, N.C.

3. Wake's One Water Toolbox

To implement change and achieve Wake County's One Water vision, the County will use various organizational tools, technical tools, and implementation tools. Together, these tools form the *One Water Toolbox*.

Organizational Tools

Wake County Water Partnership

The Water Partnership played an integral role in developing the Wake One Water Plan and will serve as the foundation for moving the Plan forward. Established as an advisory group by the Wake County Board of Commissioners in 2016, the Water Partnership includes representatives from County-wide municipalities, well owners, water providers, agriculture, academics, environmental groups and the home building industry.

Wake One Water seeks to build on the success of the Water Partnership and strengthen its ability to implement the Plan by enhancing collaboration and strategically aligning workgroups to actions. The Water Partnership will play a key role in (more broadly):

- Leading and implementing the actions in alignment with Wake Board of Commissioner goals.
- Guiding the future of One Water in Wake County and provide adaptive management as the Plan is implemented.

- Coordinating with other partners, like the Triangle Water Partnership, Upper Neuse River Basin Association (UNRBA), Jordan Lake One Water (JLOW) Coalition and Wake County Public Schools (Figure 24).

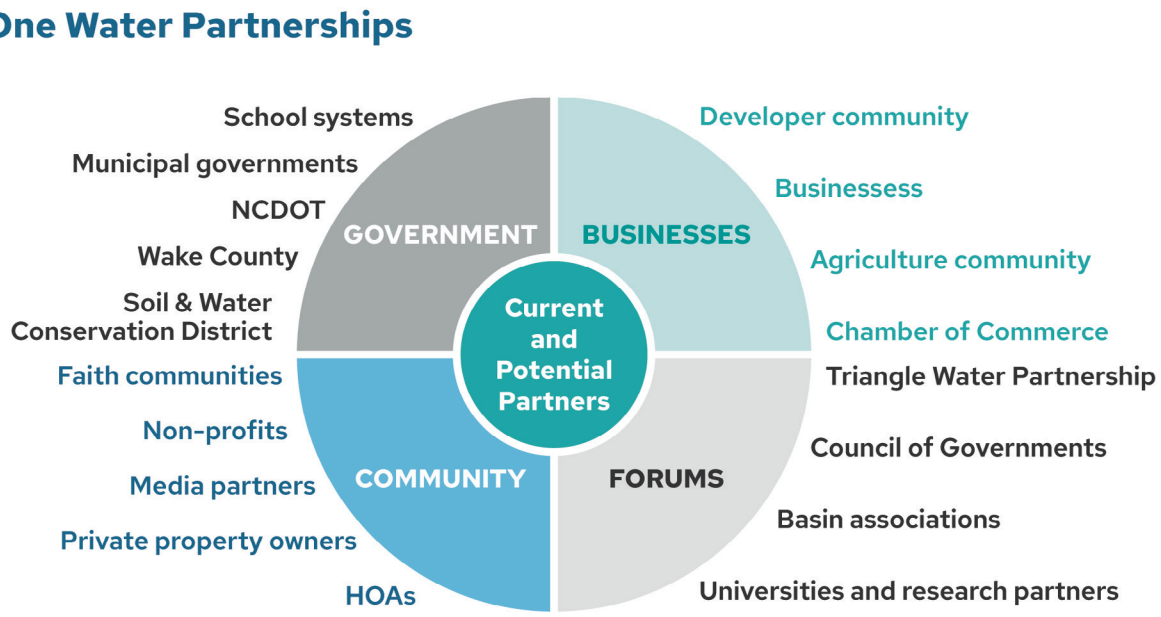


Figure 24. Current and potential One Water partnerships.

Short-term actions for the Water Partnership include:

- Develop an **Organizational Plan** with operational procedures that complement rather than duplicate water management initiatives undertaken by existing forums, such as the Triangle Water Partnership, UNRBA and the JLOW.
- Create an **ambassador network** to facilitate communication between the Water Partnership and key stakeholder groups in the County.
- Establish **working group(s)** that align with strategy recommendations.
- Identify potential **funding sources** for the Water Partnership's organizational activities and the development of technical tools by the working group(s).

The organizational structure will evolve as the County completes short-term initiatives, develops projects and, with stakeholders, refines medium- and long-term priorities. Therefore, the Water Partnership's Organizational Plan will include procedures to evaluate and assess the program's progress toward its metrics and the overall Vision and Goals described in Section 2.

Technical Tools

Technical tools are the actions and resources used to build more organizational capacity, garner public support and develop plans for implementing One Water practices (Figure 25). In many cases, the One Water Plan will build on existing programs, plans and structures (highlighted further in Section 4).

Figure 25. Technical tools used to implement One Water practices.

Data collection and organization. A strong program needs relevant and timely data that informs decisions and evaluates success. A significant amount of water data already exists and is collected, maintained and stored by Wake County and its One Water partners. Data-related technical tools may be used to:

- Coordinate and consolidate existing data into accessible formats, such as dashboards that technical stakeholders and the public may view.
- Standardize existing data to be used in future analysis.
- Collect new data through surveys, monitoring initiatives or inventories.
- Compile information on current regulations and policies.
- Learn about programs and initiatives that may be used as models or lessons to inform Wake's One Water efforts.

Policy changes. In some cases, implementing Wake County's One Water vision will require policy changes at the local and potentially state level to overcome barriers (see Section 4). At a minimum, policy changes will entail advocating for the proposed change, coordinating within the municipal or County organization and engaging with management and leadership. Policy changes at the state level will require broader advocacy and engagement, including with state elected officials and state agencies, and will be closely coordinated with County leadership.

Standards and resource guides. Resources, such as templates, toolkits, standards and guidelines, help ensure the consistent implementation of One Water programs. The resources will build on local and national best practices and programs, reflect a shared approach identified by the Water Partnership and incorporate local knowledge and conditions.

Education and outreach. Education and outreach will build understanding and support of the One Water Plan. Developing fact sheets, presentations and other information explaining One Water concepts and their applicability to various stakeholders will be a key to the Wake One Water Plan's success. At a minimum, One Water resources should be tailored to the following audiences:

- Water managers (e.g., technical stakeholders in governmental organizations)
- Development review staff in governmental organizations
- Elected officials and/or local government management
- Residential development community (e.g., realtors, homebuilders, homeowners associations [HOAs])
- Major classes of water users (e.g., residents, businesses, landscapers)
- Relevant professional classes (e.g., maintenance professionals, engineers, academics)

Outreach will include technical assistance and training programs that allow for direct interaction between the above audiences and Wake County and its One Water partners.

Implementation Tools

Implementation tools use the technical tools described above to complete on-the-ground projects or introduce progressive changes that directly affect water management in Wake County. Examples of implementation tools include:

- Using technical toolkits for designing and/or planning
- Forming and implementing workforce development programs for green/blue infrastructure
- Implementing new ordinances or program structures
- Completing construction and/or restoration projects
- Ensuring adaptive management through ongoing analyses, monitoring and plan refinement

The implementation tools will be described in more detail as part of the **Implementation Roadmap** in Section 4.

Lake Crabtree boathouse in Morrisville, N.C.

4. Implementation Roadmap

The roadmap to realizing Wake County's 50-year One Water vision translates community members' aspirations for the future state of water—and its social, economic and environmental value—into actionable strategies. This section describes the implementation framework used to achieve the One Water Plan's goals. A detailed Implementation Plan is available as a companion document to this plan. Section 5 then details the various benefits of the strategies.

Defining the Future

As described in Section 2, the future envisioned for the County includes communities that value water and support conservation, a prosperous economy that supports green approaches and environmental stewardship and governance that invokes trust and public support. However, as future models show, the consequences of projected growth combined with climate uncertainty could hinder the County from achieving its goals.

Water Partnership

The Water Partnership is the foundation of Wake One Water and will be integral to its successful implementation. An overarching recommendation of the Wake One Water Plan is to strengthen the Water Partnership's ability to implement the Plan by identifying workgroups that strategically align with recommended actions.

Focus Areas

To balance the County's anticipated growth and development with these priorities, this Plan defines the following four "focus areas" of One Water practices.

- **Focus Area 1: Optimized Water Supply.** Protecting groundwater and surface water resources, conserving and reusing water, and strategically expanding water infrastructure supports a sustainable water supply to promote business growth and protect the health and well-being of residents.
- **Focus Area 2: Site-Specific Strategies to Improve Water Quality and Hydrology.** Implementing green and blue infrastructure, nature-based solutions (NBS), and a range of alternative nutrient-reduction strategies provides broad benefits that will reduce water pollution in the County's waterways and lessen the likelihood and frequency of high-flow events that contribute to flooding.
- **Focus Area 3: Land Conservation and Preservation.** Strategic growth incorporates the intentional preservation of rural, open and natural spaces in urban and rural environments. Strategic growth helps sustain important ecosystem services, such as floodwater absorption, groundwater infiltration and recharge, and opportunities for recreation and connection with nature.
- **Focus Area 4: Flood Resilience.** Planning efforts help identify system weaknesses as well as opportunities for adding infrastructure to provide more storage, conveyance and/or protection throughout the County.

The four focus areas are meant to be implemented together to provide maximum benefits for County communities. This approach will combine ongoing water resource planning with land use planning and leverage many existing efforts and tools already available to support water supply (surface water and groundwater) and key pollution and water quantity concerns (wastewater, nutrients, stormwater, flooding and climate) (Figure 26). Implementing the One Water Plan will require overcoming challenges, such as data gaps and implementation barriers. Focus area-specific opportunities and gaps and barriers are discussed later in each section and summarized in Figures 26 and 27.

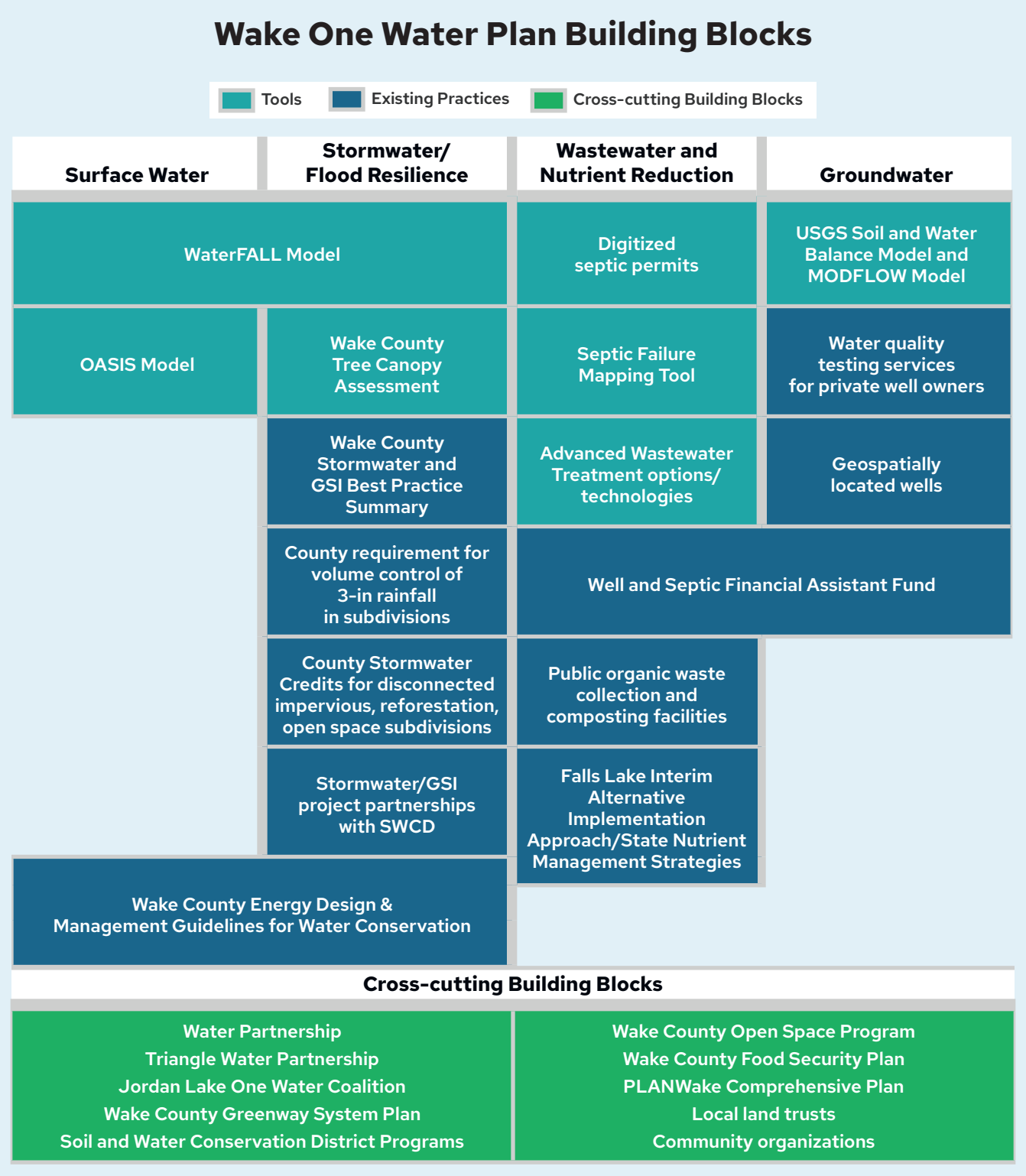


Figure 26. Existing efforts and tools available to support Wake One Water Plan implementation.

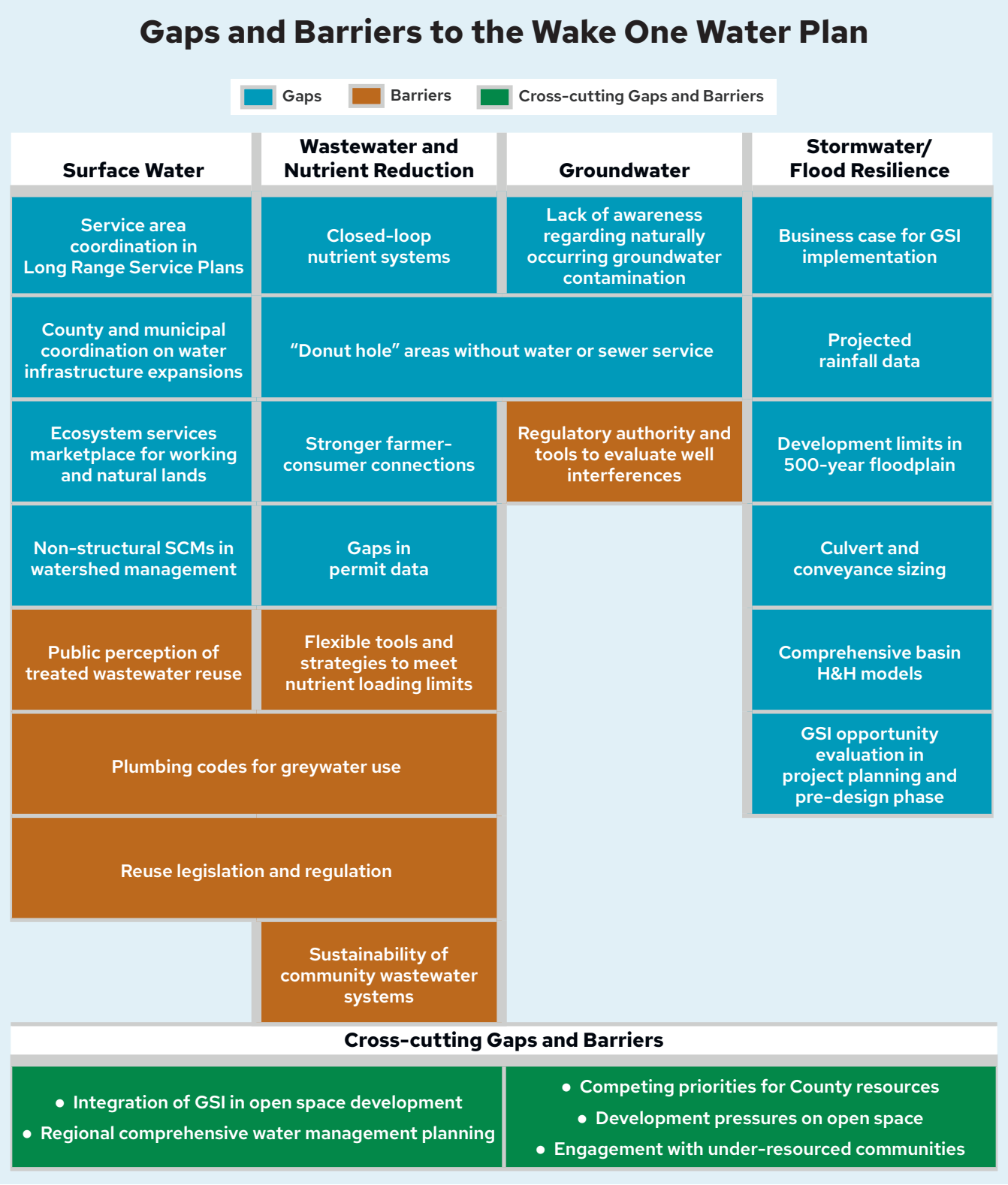


Figure 27. Data gaps and barriers to One Water Plan implementation.

Finding the Path

The extensive stakeholder input process identified a broad range of individual actions that residents, businesses and community members are willing to implement and contribute to the One Water future. Individual actions were aligned with the Plan Vision and Goals and then grouped into a series of strategies, forming the roadmap for implementing each focus area. For each strategy, the Plan includes a timeframe, level of required resources and key partners to move initiative forward. A detailed Implementation Plan that includes performance metrics and potential funding sources is available as a companion document to this plan. These strategies and metrics are a direct result of a series of workshops held in early 2025.

- **Timeframe:** Refers to the time the strategy can begin and its general duration. In some cases, strategies can be started early and continue in perpetuity. These timeframes, which are noted in the strategy summary tables for each focus area, include:
  - **Short:** Short-term (1–5 yrs)
  - **Medium:** Medium-term (1–10 yrs)
  - **Long:** Long-term (1–20+ yrs)
- **Resources required:** Refers to the financial and staff resources needed to implement the strategy. These resource needs, which range from relatively low to significant, are represented by symbols (Table 4) in the strategy summary tables for each focus area.
- **Key partners:** Refers to the categories of partners that should be involved. These partners include organizations and entities that should participate in the development and implementation of new initiatives, policies and programs.

Table 4. Resources required to implement the strategy.

Resources Required Key		
Relative Scale Narrative	**Cost Symbols**	**Staff Needed Symbols**
Relatively low	$	👤
Moderate	$$	👤👤
Significant	$$$	👤👤👤

Key Drivers and Strategies Common to all Focus Areas

While the four focus areas cover distinct water concerns, some issues are common to all four areas, including two key drivers of change and four cross-cutting strategies. After a short discussion of these general topics, the remainder of Section 4 discusses the focus area-specific key drivers and strategies.

Key Drivers

Population Growth. Wake County's significant projected population growth over the next 50 years is expected to put increased stress on the area's source waters, water supply and wastewater treatment systems, and stormwater drainage systems, while driving urbanization and land use changes.

Climate. The County is expected to continue to experience hotter average temperatures and more frequent and intense extreme weather events, such as storms and droughts. Precipitation patterns are expected to be increasingly variable and less predictable, with some regions experiencing more frequent and intense storms while others experience longer dry periods. Finally, the timing and duration of rainy and dry seasons may shift, disrupting traditional weather cycles.

Strategies Summary

Four strategies apply to all four focus areas (Table 5). The most impactful cross-cutting strategy is the proposed reorganization of the Water Partnership to align with the focus areas to create a better framework to implement the Plan. Three other strategies—education and outreach materials, workforce development and policy updates—are also important strategies that apply to all four focus areas. Details, including action steps, level of effort and metrics, will be included in a separate Implementation Plan.

Table 5. Strategies that apply to all focus areas.

Strategy	Timeframe	Resources Required	Key Partners
Reorganize the Water Partnership to align with focus areas	Short	$ 👤	Wake County; Water Partnership
Create Engagement Plan for Wake One Water education and outreach strategies	Short	$ 👤	Wake County; Water Partnership; universities and schools; community organizations; agriculture organizations
Workforce development and mentorship	Short-to-Medium	$$ 👤 👤	Wake County; Water Partnership; Capital Area Workforce Development; Water Pollution Control System Operators Certification Commission; North Carolina State University (NCSU) Wastewater Management Program; NCSU Green Schools Partnership; Wake Tech Community College; Wake County Public School System
Policy, ordinance and regulation updates	Short	$$ 👤	Wake County; Water Partnership (with input from local and regional water groups, municipalities, businesses, industries, development community, and residents)

Focus Area 1: Optimized Water Supply

Water is essential for life and industry. Therefore, Wake's future prosperity depends on access to a clean and sustainable supply of water from surface and groundwater sources, both of which are important parts of the water supply system for residents and businesses.

Key Drivers

Population Growth. Water demand is projected to double within the County's municipal water supply systems over the next 50 years (Tetra Tech and Hazen 2023). Assuming the growth projections are reasonably correct, all the municipal systems serving Wake County residents will require some form of water supply or water treatment expansion.

In rural areas, higher demand may increase the potential for groundwater well interference and lower yields, particularly in areas already identified as vulnerable to groundwater impacts. Strain on groundwater resources will worsen as the number of impervious surfaces (paved areas, etc.) continue to grow, reducing stormwater infiltration and increasing flooding potential.

Climate. Combined with population growth, climate trends will reduce water supply during drought periods and trigger drought restrictions more often. Longer drought periods also put groundwater aquifers at an increased risk of being depleted due to a lack of recharge.

Cistern at Beech Bluff County Park in Willow Spring, N.C.

Focus Area Overview

Greywater Reuse

Greywater reuse refers to the capture, treatment and recirculation of wastewater from specific sources (e.g., laundry) for limited types of reuses that do not require water treated to drinking water standards (e.g., toilet flush water).

Stormwater Reuse

Stormwater reuse refers to the capture and use of stormwater, typically from rooftop areas. Common uses for harvested rainwater are irrigation, filling outdoor ponds and car washing.

Groundwater Protection

Groundwater protection strategies inform well users and the County about water quality and quantity concerns, expand monitoring efforts and increase public awareness of groundwater resources.

Water Supply Protection

Water supply protection includes coordinated action during drought periods and ongoing planning related to well locations, yields and interference as growth and climate conditions change.

Strategies Summary

Table 6 includes the strategies for the Optimized Water Supply Focus Area.

Table 6. Strategies for Focus Area #1: Optimized Water Supply.

Strategy	Timeframe	Resources Required	Key Partners
Coordinate on current and future water connections	Short-to-Medium	$$ 👤	Wake County (Onsite Water Protection, Planning); Triangle Water Partnership; relevant advocacy groups; Water Partnership; home builders associations; NC Department of Environmental Quality (DEQ)
Integrate water shortage response plans with regional triggers for activation and response	Short	$ 👤	Wake County (Water Resources, Planning, Onsite Water Protection); Triangle Water Partnership; NC DEQ
Participate and represent Wake County at the Triangle Water Supply Partnership	Short	$ 👤	Wake County (Water Resources, Onsite Water Protection)
Expand data collection and the public communication of groundwater levels	Short	$$$ 👤 👤	Wake County (Onsite Water Protection, Planning, Water Resources); Water Partnership
Sustain the Pilot Well and Septic Assistance Fund as a permanent program	Long	$$ 👤	Wake County (Onsite Water Protection, Soil and Water Conservation, Water Resources, Housing Affordabilty and Community Revitalzation); NC Septic Tank Association; private contractors
Fund a study to identify the impacts of greywater reuse	Short	$ 👤	Wake County; Triangle Water Partnership; university and research partners
Create a countywide stormwater reuse master plan	Short	$$ 👤 👤	Wake County (Watershed Management, Planning, Facilities, Design and Construction, General Services Administration); municipal partners; Wake County Economic Development; development community; residents
Develop regional water supply guidance for the development of data centers	Medium	$ 👤 👤	Wake County (Water Resources, Planning, Onsite Water Protection); municipal water supply systems; Raleigh Chamber; NC DEQ; Central Pines Regional Council
Expand the wastewater recovery and reuse network	Long	$$$ 👤 👤 👤	Wake County (Onsite Water Protection, Water Resources, Planning, Solid Waste); municipal public works; private sector; landscapers

Building Blocks and Barriers

Building Blocks

The Optimized Water Supply Focus Area will build on and enhance the existing efforts of the following:

- The coordination efforts of the **Triangle Water Partnership**, including its use of the **OASIS** model to evaluate potential strategies to address water supply issues and its role as a forum for collaborative planning among the County's water utilities.
- Wake County's **well water quality testing program**, which provides testing services for key classes of contaminants found in Wake County groundwater, such as bacteria, nitrates, organic compounds, radionuclides and lead.
- Wake County's **Well and Septic Financial Assistance Program**, which provides financial assistance to repair well and septic systems for qualifying residents.
- Groundwater data and **modeling from the U.S. Geological Survey**, including **MODFLOW** and the **Soil-Water-Balance model** results, which would increase the County's understanding of and capacity to analyze interactions between surface and groundwater sources.

Survey respondents identified awareness of possible contaminants and information about testing services as the top two motivators to use the County's well water testing program.

Barriers

Based on public surveys and community input sessions, key barriers that must be overcome for this focus area to succeed include current plumbing codes and regulations, which either restrict the use of reused water or do not address it, and the negative perceptions by some about the cleanliness of reused water and its use in public and private spaces.

78% of the respondents to the 2025 countywide survey expressed a willingness to try grey water or rainwater to water non-food garden plants and lawns.

Focus Area 2: Site-Specific Strategies to Improve Water Quality and Hydrology

Site-specific strategies can improve water quality and hydrology in the County's waterways. Changes made across the upland portions of a watershed can improve and protect the waterways that supply drinking water, receive and absorb discharges from wastewater treatment plants, and support the local commercial, industrial and agricultural economy.

Key Drivers

Population Growth. Population growth will drive more development of natural land and increase impervious surfaces, such as roofs, roads and parking lots, that contribute polluted runoff to local waterbodies. Removing tree canopy and native vegetation compounds the negative stormwater and groundwater impacts.

Development will increase the demands on wastewater treatment plants and septic systems. Failing septic systems and malfunctioning wastewater treatment systems can allow nutrient and bacterial pollution to reach waterways.

Lastly, population growth will increase the County's food demands. A "closed nutrient cycle" is needed, where consuming locally grown food and using locally generated fertilizers can reduce the amount of new nutrients entering waterways.

Climate. More extreme rainfall events increase stormwater runoff and the associated pollutant loads during and after storm events. In addition, when a large volume of precipitation occurs in a short period, it does not have time to soak into the ground before becoming runoff, further reducing the infiltration and groundwater recharge.

Composting and Purchasing Local Food

The 2025 Public Survey indicated that 89% of those surveyed in Wake County are willing to purchase local food (which uses less fertilizer, chemicals, water and energy than imported food) if available. The survey also showed that more than 70% are willing to try composting, are already composting, or are participating in a compost collection program (Tetra Tech 2025).

Focus Area Overview

GSI and NBS

GSI and NBS refer to a suite of engineered systems intended to mimic the function of natural systems. Common examples of GSI include bioretention systems, permeable pavement, tree planting in engineered systems that allow root growth in urban settings and constructed wetlands. NBS examples include riparian buffers and stream restoration.

Agricultural BMPs

Agricultural BMPs include built systems (structural) and practices (non-structural) that reduce the pollution from agricultural areas. Examples are buffers (non-structural), stream exclusion (structural) and cover crops (non-structural).

Alternative Landscaping

Alternative landscaping is the replacement of managed turf lawns and gardens with native vegetation, meadow-style plantings or xeriscaping to reduce water demand, provide pollinator habitat, and promote healthy soils and infiltration.

Septic System Management

Septic system management strategies promote regular maintenance of septic systems, routine inspections to promptly identify and perform repairs, and technical and financial resources to facilitate these activities.

Strategies Summary

Table 7 includes the strategies for the Site-Specific Strategies to Improve Water Quality and Hydrology Focus Area.

Table 7. Strategies for Focus Area #2: Site-Specific Strategies to Improve Water Quality and Hydrology.

Strategy	Timeframe	Resources Required	Key Partners
Create a toolbox that supports the agriculture community in the expansion of local food systems in alignment with Wake One Water and Wake County Food Security Plan recommendations	Short	$$	Wake County (Cooperative Extension, Water Resources, Planning, Public Health); Capital Area Food Network; Wake County Farm Bureau; NC Conservation and Land Trust; NC Conservation Network; USDA; NC Department of Health and Human Services
Launch a countywide Watershed Improvement Investment Approach modeled after the Falls Lake Interim Alternative Implementation Approach	Long	$$$	Wake County (Onsite Water Protection, Soil and Water Conservation, Watershed Management, Water Resources); watershed associations (Jordan Lake One Water, Upper Neuse River Basin Association)
Develop and operate regional compost centers	Long	$$$	Wake County (Cooperative Extension, Soil and Water Conservation, Solid Waste, Water Resources, Parks, Recreation and Open Space); municipalities; NC Compost Council; NC DEQ; environmental organizations; private businesses
Inventory failing septic systems	Short	$	Wake County (Onsite Water Protection, Housing Affordablity and Community Revitalization); community organizations; private contractors; municipalities; residents
Create incentives for repairing distributed wastewater management systems and establishing responsible management entities	Medium	$$	Wake County (Onsite Water Protection, General Services Administration); NC Septic Tank Association; NC DEQ; community groups; private wastewater operators and inspectors
Establish a countywide onsite system for monitoring and reporting	Short	$	Wake County (Onsite Water Protection, Planning, Water Resources, Information Services); private contractors; residents
Establish a program and funding for GSI infrastructure on private property	Medium	$$	Wake County; municipalities; community organizations

Strategy	Timeframe	Resources Required	Key Partners
Develop a grey and green infrastructure cost-benefit analysis worksheet	Medium	$	Wake County; municipalities; university and research partners; technical providers
Conduct cost-benefit analyses of different design standards in response to Atlas 15 rainfall data	Short	$	University and research partners; technical providers
Create an inventory of GSI sites to model benefits	Short	$	Wake County (Planning, Water Resources, Watershed Management); Water Partnership
Develop a multi-jurisdiction stormwater data management system that includes impervious surface coverage, SCM locations, GSI and reuse projects	Medium	$$	Wake County (Watershed Management, Water Resources, GIS, Information Services)
Support Wake County Cooperative Extension's creation of Watershed Ambassador Network	Medium	$	Wake County (Extension, Emergency Management, Water Resources, Watershed Management, Onsite Water Protection); North Carolina Central Pines Regional Council; NC Department of Public Safety (DPS) Emergency Management; NC DEQ; Partners for Environmental Justice

Building Blocks and Barriers

Building Blocks

The Site-Specific Strategies Focus Area will build on and enhance the existing efforts of:

- The Water Partnership's GSI Subcommittee.
- Financial assistance programs, such as the **Wake County Well and Septic Financial Assistance Program**, which provides financial assistance to repair well and septic systems for qualifying residents, and the **Raleigh Rainwater Rewards** and **Cary GSI Grant Program**, which fund GSI installation on private property.
- Programs that incentivize the use of GSI and the designation of protected open spaces, such as the **open space subdivisions** and **stormwater credit programs** provided by the County and individual municipalities.

76% of the respondents to the 2025 countywide survey expressed a willingness to try install/use at least one residential stormwater practice.

- Existing GSI design resources, such as the **Wake County Stormwater and GSI Best Practices Summary**.
- Resources and technical assistance provided by the **SWCD** to design and implement stormwater and agricultural BMPs.
- Digitized septic system permit and failure locations (**Septic Failure Mapping Tool**), which provides geospatial data about many of the County's existing septic systems.
- **Municipal and commercial organic waste collection** and composting facilities that promote recycling food waste for beneficial uses.

Barriers

Based on public surveys and community input sessions, Wake County residents support many site-specific strategies to protect water, but several key barriers must be overcome for this focus area to succeed. When addressing wastewater, for instance, residents may require financial assistance to maintain or upgrade septic systems. Developers sometimes hesitate to embrace community-based decentralized wastewater systems due to concerns about their reliability and resilience during extreme events.

The most supported "green streets" practices in the 2025 countywide survey were vegetation on street medians, road shoulders and parking lots (**92%**) and street trees (**85%**).

Key barriers for locally grown food and composting include people's lack of access to composting and local food sources, farmers' ongoing challenges with the seasonality of local products, and the cost competitiveness with outside products.

Finally, key GSI barriers that must be overcome include concerns about technical and regulatory challenges faced when designing and installing GSI, such as space limitations associated with urban street trees. The costs for implementing and maintaining GSI, and the possible lack of return on the investment in GSI practices are additional barriers to overcome.

Autumn roadside market in Wake County provides local foods.

Focus Area 3: Land Conservation and Preservation

Undisturbed and preserved natural lands inherently provide many of the same benefits that engineered systems, such as GSI and NBS, seek to reproduce. Therefore, the strategic conservation of natural areas or the restoration of open space in flood-prone or low-lying areas can provide many One Water benefits for infiltration, groundwater recharge, water quality and limited flood protection. Land conservation also preserves green space, which may be used for recreation, and agricultural land, which is an important component of Wake County's economic and cultural fabric. Together, land conservation and preservation can sustain the unique history and character of Wake County's rural areas and protect land through strategic acquisition and easements.

Key Drivers

Population Growth. In many cases, as population increases, natural lands are purchased and developed to meet the growing community's needs. This growth pattern is projected to significantly decrease the amount of undisturbed open space and agricultural lands in Wake County over the next 50 years.

Climate. The projected impacts of changing weather patterns, such as high temperatures and floods, can be buffered by the presence of natural lands. These vegetated lands stay cooler, absorb flood waters through infiltration, and reduce peak flows by slowing stormwater runoff before it reaches streams and rivers.

The 265-acre Turnipseed Nature Preserve protects water quality, wildlife and natural lands through conservation easements and open space protection managed by Wake County

Focus Area Overview

GSI and NBS

GSI and NBS refer to a suite of engineered systems intended to mimic the function of natural systems. In the context of land conservation, GSI and NBS can be constructed to restore or enhance the environmental and community benefits of preserved parcels.

Passive Conservation

Passive land conservation refers to natural land that is acquired to remain in an undisturbed condition with limited management and restoration. It requires less maintenance but may also provide fewer ancillary benefits, such as open space for recreation.

Tree Canopy Protection

Trees are an environmental workhorse. They promote infiltration, absorb nutrients, intercept rainfall, shade impervious surfaces, reduce erosion and remove carbon from the air. Efforts to protect mature trees and plant new trees sustain these vital functions.

Agricultural Protection

BMPs on agricultural lands help lower pollutant loads and support a local food system and closed nutrient loops.

Strategies Summary

Table 8 includes the strategies for the Land Conservation and Preservation Focus Area.

Table 8. Strategies for Focus Area #3: Land Conservation and Preservation.

Strategy	Timeframe	Resources Required	Key Partners
Expand open space and agricultural preservation by supporting existing Open Space and Farmland Preservation Programs, aligning initiatives and leveraging resources	Long	$$$ 👤👤	Wake County (Cooperative Extension, Water Resources, Parks, Recreation and Open Space, Planning, Soil and Water Conservation); Capital Area Food Network; Wake County Farm Bureau; NC Conservation Fund; Triangle Land Conservancy; NC Conservation Network; NC Farm Bureau
Implement incentives to encourage tree conservation	Short	$$ 👤	Wake County (Planning, Water Resources, Parks, Recreation and Open Space, Facilities, Design and Construction, Soil and Water Conservation); municipalities; environmental nonprofits; community groups
Identify sites for land conservation, riparian buffer protection and NBS located at or upstream of identified flooding hot spots	Long	$$$ 👤👤👤	Wake County (Planning and Development Services, Watershed Management, Soil and Water Conservation, Emergency Management, Parks, Recreation and Open Space); municipalities; Water Partnership; NC Department of Transportation; Triangle Land Conservancy

Building Blocks and Barriers

Building Blocks

The Land Conservation and Preservation Focus Area will build on and enhance the existing efforts of:

- The **Wake County Parks, Recreation, and Open Space (PROS)** program supporting purchasing and preserving additional open space throughout the County.
- Wake County's expansive and connected network of parks and greenways, managed through the **Wake County Greenway System Plan** and municipal partners.
- Development practices that incentivize and promote the incorporation of green space, including **open space subdivisions**.
- Initiatives to protect farmland, including the **Wake County Farmland Preservation Program** authorized by the Farmland Preservation Program Ordinance, which provides for three different programs to protect agricultural land: Voluntary Agricultural District Program, Enhanced Voluntary Agricultural District Program and the Agricultural Conservation Easement Program.

- Existing floodplain and buffer requirements that protect riparian areas.
- Data on existing tree canopy and priority planting areas, as defined through the **Wake County Tree Canopy Assessment**.
- The **stormwater, GSI and NBS building blocks** that were reviewed in the Site-Specific Strategies Focus Area.

Barriers

Based on public surveys and the input received at the Keeping the Farm Workshop, farmers face many ongoing challenges, including operation costs, an aging population and impacts from development pressures. Farmers' most-cited barriers to adopting One Water practices include technical knowledge gaps, funding and labor constraints.

Another key barrier is the high cost of land and funding needed for land preservation and open space land purchase.

Focus Area 4: Flood Resilience

Floods can pose a serious risk to life, property and cultural and heritage sites—key parts of the County's identity that hold significant community value and contribute to a shared legacy. This Plan takes a two-pronged approach to flood resilience: improving infrastructure (making changes to the built environment) and implementing planning efforts (improving education, emergency response plans and community capacity).

Key Drivers

Population Growth. Development inevitably changes how water moves in built and natural drainage systems, which can result in flooding. In some cases, population growth creates pressure to build in areas that once may have been considered undesirable due to the potential for flooding. Also, without careful evaluation, changes in the hydrology due to development in one part of the watershed can unintentionally lead to flooding in another area that has not historically flooded. Lastly, because development typically increases the amount of impervious surface, it reduces the ground's capacity to absorb floodwaters, worsening the severity and duration of flooding.

Climate. Increasing magnitudes of precipitation within storm events lead to an increased risk of flooding from both stormwater runoff and high water levels in lakes, streams and rivers during and after storms. More water can, in turn, place increasing pressure on grey infrastructure, including culverts, pipes and impoundments.

Focus Area Overview

Dam Safety

Dams and impoundments hold back large volumes of water, so the consequences of failure can be catastrophic. To avoid this, planners and engineers regularly inspect and maintain dams, prepare plans for what to do if a failure is anticipated, and share resources and information with the public.

Grey Infrastructure

Grey infrastructure includes traditional flood protection measures like floodwalls, levees, armored channels and stream beds, and large pipes. While these have fewer One Water benefits than green and blue infrastructure, they are a valuable tool for flood resilience.

Green and Blue Infrastructure

Green and blue infrastructure provides co-benefits for flood resilience and includes practices that store and infiltrate stormwater, such as bioretention practices, wet ponds and constructed wetlands.

Floodplain Management

Floodplain management refers to the suite of policies and practices used to manage flood-prone areas around waterways. Through the NFIP, floodplain management is directly tied to flood insurance premiums in participating communities.

Strategies Summary

Table 9 includes the strategies for the Flood Resilience Focus Area.

Table 9. Strategies for Focus Area #4: Flood Resilience.

Strategy	Timeframe	Resources Required	Key Partners
Develop a multi-jurisdiction flood gauge data platform	Short	$$ 👤👤	Wake County (Emergency Management, Watershed Management, General Services Administration); municipalities (flood management programs); NC DPS (Emergency Management); FEMA; USGS; NC DEQ Division of Energy, Mineral and Land Resources (DEMLR) Dam Safety
Conduct annual flood and dam tabletop emergency exercises	Short	$ 👤	Wake County (Emergency Management); municipalities; NC DPS (Emergency Management); NC DEQ DEMLR (Dam Safety); FEMA; NC Association of Floodplain Managers; American Public Works Association (NC Chapter); Association of State Dam Safety Officials; U.S. Society on Dams
Increase regional participation in FEMA's National Flood Insurance Program Community Rating System (CRS)	Medium	$$ 👤	Wake County (Emergency Management, Watershed Management); municipalities; NC DPS (Emergency Management); FEMA
Develop detailed flood mapping	Medium	$$ 👤👤	Wake County (Emergency Management, Watershed Management, Water Resources); municipalities; FEMA; NC DPS (Emergency Management)
Develop watershed-specific master plans	Medium	$$ 👤👤	Wake County (Watershed Management, Planning, Water Resources, Soil and Water Conservation District)
Conduct dam retrofits and grey infrastructure improvements at identified hot spot areas	Long	$$$ 👤👤👤	Wake County (Stormwater Management, Emergency Management, Water Resources, Soil and Water Conservation); NC Department of Public Safety (Emergency Management); NC DEQ DEMLR (Dam Safety); FEMA; municipalities; NC Department of Transportation
Expand the installation of flood gauges on major streams and dams	Short	$$ 👤👤	Wake County (Emergency Management, Floodplain Management, General Services Administration); municipalities (flood management programs); NC DPS (Emergency Management); FEMA; USGS; NC DEQ DEMLR (Dam Safety)

Aerial view of Walnut Creek and its surrounding floodplain in Wake County.

Building Blocks and Barriers

Building Blocks

The Flood Resilience Focus Area will build on and enhance the existing efforts of:

- **Municipal floodplain management** and **Raleigh Flood Early Warning System**, flood gauges and monitoring networks.
- Past and ongoing **watershed studies** in Wake County.
- The **stormwater, GSI and NBS building blocks** that were reviewed in the Site-Specific Strategies Focus Area.
- The current conditions and baseline analysis developed by the **WaterFALL model** for this Plan.

Barriers

Public survey and community input sessions indicate that residents support efforts to increase flood resilience in Wake County. However, a lack of comprehensive basin hydrologic and hydraulic (H&H) models limits the ability to develop master flood plans to increase resilience. Another gap is the lack of protection of the 500-year future floodplain from development. Key barriers cited during the stakeholder meetings and public survey include the limitations of the existing practices and policies to address increasing runoff and tree loss associated with development and land use change. Other barriers include the concerns about the GSI listed above in Focus Area #2 subsection on barriers.

Vegetated swale at Beech Bluff County Park

5. Future Implementation Scenario and Benefits Analysis

One Water practices seek to provide environmental, social and economic co-benefits. Wake One Water used multiple approaches to evaluate the potential benefits of recommended action strategies. The baseline and projected future conditions produced by WaterFALL provided information on water quality and hydrologic conditions if growth and climate projections proceed without any additional water quality or hydrologic improvement practices. The One Water Team then evaluated the potential benefits of recommended action strategies in each of the four focus areas through two primary approaches:

1. Assessing the changes in key water quality and quantity metrics compared to the baseline future conditions, as modeled in WaterFALL.
2. Conducting a triple bottom line (TBL) evaluation to assess the economic, social and environmental outcomes of the focus area implementation.

WaterFALL Model

WaterFALL is a semi-distributed watershed modeling tool and decision-support platform that simulates daily hydrologic processes and water quality at multiple geographic scales based on land cover, climate and soil conditions as well as human impacts on the hydrologic network. This allows for the evaluation of management efforts under current and future scenarios. The model was built using local expertise and a County dataset, then calibrated with observed streamflow and water quality data (Tetra Tech, RTI, and Hazen 2025a). Models are inherently

uncertain because they rely on assumptions and sometimes limited data. Uncertainty in this effort was reduced through model calibration to available data.

The One Water Team used WaterFALL to measure the potential benefits of strategies on future long-term daily water quantity and quality relative to baseline conditions. The model results help to identify where to focus water management strategies, such as land conservation or green infrastructure, so they have the biggest impact. For the ease of interpretation and comparison, the benefits of water management strategies are summarized at the subbasin scale in this Plan; however, the benefits as determined by WaterFALL are quantified at the stream-reach scale in the underlying data. These insights guide watershed management and support a more resilient future (Tetra Tech and RTI 2025).

The One Water Team considered the types and locations of growth expected under the PLANWake Development Framework (discussed in Section 2 of this Plan) to identify locations to implement action strategies. As guided by PLANWake, development will be generally limited within the Rural land classification areas of the County, while varying levels of development intensity are expected for the other four land classifications. Therefore, little future land change is expected in areas designated as Rural. For example, PLANWake classified almost all of the Tributaries to Falls Lake subbasin as Rural; therefore, future modeling scenarios did not incorporate water management strategies into this subbasin. Note that any future development proceeding within areas classified as Rural should be examined for water management strategy options. Development within these lands is likely to have an outsized impact without management actions compared to the more developed areas of the County.

The One Water Team examined all four focus areas against future growth as quantified by land use changes. These benefits are compared to the baseline future conditions. A secondary analysis considered the same water management strategies under the combination of future growth and climate to give context on the resilience of such strategies under a changing climate. The summarized benefits of the water management strategies against future growth are provided for several measures at the subbasin scale. The strategies' resilience to climate conditions, which varies based on the strategy, type of growth occurring, and overlying temperature and precipitation changes for the location, is described using specific examples following the subbasin growth impacts. The impacts evaluated to estimate benefits are as follows:

- **Stormwater runoff**
  - **Stormwater runoff reduction (% change):** The percent reduction in the increased runoff volume projected to occur under future conditions without this implementation strategy (primary metric used). This volume reduction represents the overland flow that might otherwise cause localized flooding and/or contribute to peak streamflows and streambank erosion during precipitation events.

  - **Stormwater runoff stored for reuse (millions of gallons):** The additional volume of stormwater stored in cisterns installed under this implementation strategy. This water would then be available for other uses, including indoor activities like fire suppression and boiler water or outdoor uses like car washing and irrigation.

- **Water demand**
  - **Reduced drinking water demand (millions of gallons):** The volume of groundwater and municipal system water demand avoided through reuse strategies for stormwater and greywater for non-drinking water purposes.
  - **Groundwater recharge (millions of gallons):** The volume of stormwater available to infiltrate and potentially recharge groundwater aquifers that would have been lost without this implementation strategy. This volume recharges the groundwater that supplies both private community water systems and private drinking water wells.

- **Flood impacts (peak flow events):** The changes in the number of events (i.e., consecutive days) on average each year where the flow volume in downstream waterways is in the top 10% of flow events, as evaluated from long-term conditions. Each basin is evaluated at its outlet for the frequency of peak flow events compared to the number of events projected under future conditions without this implementation strategy. Therefore, this metric indicates the number of basins where the frequency of peak flow events has decreased on average each year.
- **Nutrient and sediment reductions:** The percent changes in the mass of nitrogen, phosphorus and suspended solids transported through the County's waterways compared to the projected loading that considers future conditions without this implementation strategy.

Triple Bottom Line Evaluation

One Water recognizes the interconnections between water management and other important community priorities, such as the health of the local economy and communities. The One Water team used professional expertise and stakeholder input to highlight each strategy's strengths and challenges and estimate the economic, social and environmental outcomes of the focus areas in relative terms across multiple categories. Figure 28 summarizes the different considerations incorporated in the TBL evaluation for each focus area.

Figure 28. Triple Bottom Line evaluation factors.

The results of the TBL evaluation are rated from Very Negative to Very Positive. However, because of the thorough review of potential strategies through the stakeholder engagement process, which also assessed the unintended consequences of the proposed action, strategies that might result in Very Negative or Negative outcomes were screened out from future consideration. As a result, the impacts of the strategies are generally rated from Neutral to Very Positive. The full documentation of the TBL evaluation methodology and results is provided as a supplement to this Plan.

Potential Benefits of Action Implementation

According to the results of the WaterFALL modeling and TBL evaluation efforts, implementing the action steps under each focus area will yield direct environmental benefits and wider TBL outcomes for Wake County. The values are estimates based on the WaterFALL model and represent mean annual predictions.

Focus Area 1: Optimized Water Supply

Water is essential for life and industry. Therefore, Wake County's future prosperity depends on access to a clean and sustainable supply of water from surface and groundwater sources.

Implementation Scenarios

Future scenario analyses within the WaterFALL model evaluated the potential benefits of water supply optimization projects through the following scenarios:

Using stormwater cisterns for irrigation, water storage and reuse

Installing 139 million gallons (MG) of cistern storage within and downstream of PLANWake Walkable Centers, where large increases in runoff are projected:

- Small cisterns (500 gallons) for medium-sized lots; assumed to serve smaller businesses and homes

- Medium cisterns (1,200 gallons) for large lots; assumed to serve larger homes or areas with a greater development density
- Large cisterns (5,000 gallons) for high-density development
- Very large cisterns (10,000 gallons) in Transit Focus areas

Potential Benefits

Direct Environmental Benefits

The following water quantity and quality metrics represent the potential water supply optimization benefits of capturing and reusing stormwater and greywater as compared to future development without this strategy implementation. These estimates are derived from the WaterFALL model and represent mean annual predictions for the future land use change scenario.

- **Stormwater Runoff**
  - **15% ↓** in maximum annual daily runoff and **25% ↓** in annual mean total runoff (800 MG).
  - **3,700 MGY** of stormwater runoff stored for reuse.
- **Groundwater Recharge**
  - **6% ↓** in the projected infiltration loss (200 MGY).
- **Flood Impacts**
  - **↓ frequency of peak flow** (highest 10% of flows) events in **7 of 12 subbasins**:
    - Buffalo Creek
    - Crabtree Creek
    - Little River
    - Middle Creek
    - Walnut Creek
    - Other Tributaries to Neuse River
    - Tributaries to Harris Lake
- **Nutrient and Sediment Reductions**
  - Nitrogen: Additional **4% ↓** (460,000 lbs/yr) in mean annual loads.
  - Phosphorus: Additional **4% ↓** (30,000 lbs/yr) in mean annual loads.
  - Sediment: Additional **6% ↓** (36.5 million lbs/yr) in mean annual loads.

    Note: Results are mixed across subbasins for annual average nutrient and sediment load changes, with an overall combined decrease. However, daily and annual maximum loads increase.

Triple Bottom Line Outcomes

A TBL evaluation of Focus Area 1, Optimized Water Supply, showed overall **Positive** outcomes, as shown in Figure 29.

Figure 29. TBL outcomes for Focus Area 1.

These outcomes include:

- **Economic:** Reuse systems require significant upfront cost to install and implement; however, over this Plan's 50-year horizon, this cost can be mitigated by reducing the costs associated with future water supply and infrastructure investments.
- **Social:** An optimized water supply builds community resilience by augmenting the drinking water supply, particularly during drought-related shortages, with stored stormwater and greywater for activities such as irrigation, boiler water or vehicle wash-water.
- **Environmental:** Practices to capture and store stormwater intercept the water that would otherwise run off during storm events. As a result, stormwater runoff volumes decrease and infiltration increases. Furthermore, stored stormwater can be used to irrigate green infrastructure and other landscaped areas, which can enhance local soil health and habitat.

Additional Benefits to Using Greywater Systems in Residential, Commercial, Industrial and Institutional Settings

It is expected to take up to 20 years before the recommended ordinances, programs and policies are in place to support greywater reuse as envisioned by this focus area and before the development community embraces the use of greywater reuse systems in its designs. Providing steady outreach on the why, what and how of greywater reuse and harvested stormwater will be essential in building public support. Therefore, the broadscale implementation of greywater systems in residential, commercial, industrial and institutional buildings is assumed to begin in 2045. Outside the WaterFALL model, the One Water Team evaluated the potential potable water savings two different ways: (1)

Focus Points

By reusing water from showers, sinks and laundry for non-drinking purposes like irrigation and toilet flushing, the County can reduce strain on groundwater and delay expensive infrastructure expansions. Although policy and plumbing updates take time, investing in greywater systems now will set the stage for sustainable growth later.

on a percentage basis assuming a high of 40% potable water saved for new users and a low of 20%, and (2) assuming a reduction in the gallon per capita day usage for residential use and gallon per employee day for non-residential use (e.g., commercial, industrial and institutional use). Although it is anticipated to take years to establish policy and programs to support widespread greywater use, this strategy does have the potential to meaningfully impact future water demand. Based upon the greywater analysis, the County could potentially offset between 10 MGD and over 20 MGD of potable use by 2070, which could amount to 5%-10% of total potable need (Tetra Tech and Hazen 2025b).

Focus Area 2: Site-Specific Strategies to Improve Water Quality and Hydrology

Site-specific strategies can improve water quality and hydrology in the County's waterways. Changes made across a watershed's upland portions can improve and protect the waterways that supply drinking water, provide green spaces that enhance communities, and support the local economy.

Focus Points

Across the County, the WaterFALL results indicate that the greatest opportunity for implementation and the resulting water quality benefit is in the following subbasins: Other Tributaries to the Neuse River, Little River, Crabtree Creek and Swift Creek.

Implementation Scenarios

Future scenario analyses within the WaterFALL model evaluated how site-specific practices would impact water quality and quantity in Wake County. This implementation included the following scenarios:

Applying compost on residential land to improve soil health, reduce nutrient pollution and mitigate erosion

Compost is applied to 7.4 square miles (mi^2) of residential lawns and gardens. This represents 15% of developed open space and pervious/rural land as a conservative implementation goal.

Using compost on agricultural land to improve soil health, reduce nutrient pollution and mitigate erosion

Compost is applied to 44 mi^2 of agricultural land used for cultivated crops. This represents 50% of the projected land area used for cultivated crops.

Using alternative landscaping to improve water quality and hydrology by improving the function of managed landscaped areas

Alternative landscaping is implemented on 63 mi^2 of developed lands, including road rights-of-way, urban parks and commercial landscaped areas.

Installing bioretention, permeable pavement and green roofs on developing areas.
GSI is installed across the County in developed areas. The level of implementation is based on GSI type and land use. The modeled GSI practices are designed to treat the first 1.5 inches of rainfall.

Potential Benefits

Direct Environmental Benefits

The following metrics represent the potential benefits of applying compost and installing alternative landscaping and GSI for improving water quality and hydrology under this focus area's strategies for future developed land. These estimates are derived from the WaterFALL model and represent mean annual predictions.

- **Stormwater Runoff**
  - **49%** ↓ in maximum annual daily runoff from projected increases and **63%** ↓ in annual mean total runoff (3,700 MGY).
  - **1,300 MGY** of stormwater runoff stored for reuse.
- **Groundwater Recharge**
  - **69%** ↓ in the projected infiltration loss (2,900 MGY).
- **Flood Impacts**
  - ↓ **frequency of peak flow** in **8 of 12 subbasins**:
    - Black Creek
    - Little River
    - Middle Creek
    - Moccasin Creek
    - Swift Creek
    - Other tributaries to the Neuse River
    - Tributaries to Harris Lake
    - Tributaries to Jordan Lake
- **Nutrient and Sediment Reductions**
  - Nitrogen: Additional **16%** ↓ (1.7 million lbs/yr) in mean annual loads.
  - Phosphorus: Additional **14%** ↓ (110,000 lbs/yr) in mean annual loads.
  - Sediment: Additional **22%** ↓ (137 million lbs/yr) in mean annual loads.

    Note: Predictions indicate mixed results by subbasin for annual average nutrient and sediment load changes, with an overall combined decrease. However, daily and annual maximum loads increase.

Focus Points

Opportunities in the Crabtree Creek subbasin alone provide 564 MG of additional groundwater recharge per year by implementing these practices.

Triple Bottom Line Outcomes

A TBL evaluation of Focus Area 2, Site-Specific Strategies, showed overall **Positive/Very Positive** outcomes, as shown in Figure 30.

Figure 30. TBL outcomes for Focus Area 2.

These outcomes include:

- **Economic:** Site-specific strategies are typically designed to directly benefit a smaller area and require regular maintenance to sustain performance; however, they provide added benefits relative to the more traditional grey infrastructure solutions. Site-specific strategies filter and store water, which lowers water treatment costs by improving water quality, mitigates localized flooding and enhances property values through secondary benefits. Furthermore, agricultural BMPs and programs that benefit local farmers support the County's agricultural economy.
- **Social:** Site-specific strategies engage the community in sustainable water and wastewater practices that provide benefits for public health and recreation. By conducting intentional outreach, these strategies can further enhance communities disproportionately impacted by localized flooding and lacking green space.
- **Environmental:** Site-level practices are projected to provide watershed-scale benefits. While the local benefits of individual practices may be limited, implementing a broad range of site-specific strategies provides watershed-scale benefits, including improved water quality, increased groundwater recharge, avoided water demand and enhanced flood mitigation.

Focus Area 3: Land Conservation and Preservation

Undisturbed and preserved natural land inherently provides many of the same benefits that engineered systems, such as GSI and NBS, seek to reproduce. Therefore, strategically conserving natural areas and restoring open space in flood-prone or low-lying areas can provide many One Water benefits for infiltration, groundwater recharge, water quality and limited flood protection. Land conservation also preserves green space, which may be used for recreation, and agricultural land, which is a vital component of Wake County's economic and cultural fabric. Together, land conservation and preservation can

Focus Points

The largest amount of potential conserved land is in Middle Creek (5.17 mi^2 total) and the Other Tributaries to the Neuse River (7.76 mi^2).

sustain the unique history and character of Wake County's rural areas and protect developed land through strategic acquisition and easements.

Implementation Scenarios

Future scenario analyses within WaterFALL evaluated the potential benefits of land conservation on water quality and quantity through the following scenarios:

Conservation of natural lands in developing areas

Future scenarios prioritized conserving 50% of the natural land areas in PLANWake Community and Community Reserve areas that are projected to convert to development. This resulted in 20 mi^2 of conserved forest (19.1 mi^2 in upland areas and 0.9 mi^2 in riparian areas) and 1.52 mi^2 of grass/shrub land (1.5 mi^2 in upland areas and 0.02 mi^2 in riparian areas).

Conservation of agricultural land in developing areas

Future scenarios prioritized conserving 50% of agricultural land areas (both crop and pasture) in PLANWake Community and Community Reserve areas projected to convert to development; this equated to conserving 7.7 mi^2 of upland areas and 0.03 mi^2 of riparian areas.

Potential Benefits

Direct Environmental Benefits

The following metrics represent the potential benefits of land conservation and preservation due to land use change. These values are estimates based on the WaterFALL model and represent mean annual predictions.

- **Stormwater Runoff**
  - **35%** ↓ in maximum annual daily runoff and **29%** ↓ in annual mean total runoff volume (1,500 MGY).
- **Groundwater Recharge**
  - **26%** ↓ in the projected infiltration loss (1,100 MGY).
- **Flood Impacts**
  - ↓ **frequency of peak flow** in **7 of 12 subbasins**:
    - Black Creek
    - Crabtree Creek
    - Little River
    - Middle Creek
    - Walnut Creek
    - Other Tributaries to Neuse River
    - Tributaries to Harris Lake
- **Nutrient and Sediment Reductions**
  - Nitrogen: Additional **2%** ↓ (210,000 lbs/yr) in mean annual loads.
  - Phosphorus: Additional **5%** ↓ (39,000 lbs/yr) in mean annual loads.
  - Sediment: Additional **8%** ↓ (52 million lbs/yr) in mean annual loads.

Note: Predictions indicate mixed results by subbasin for annual average nutrient and sediment load changes, with an overall combined decrease. However, daily and annual maximum loads increase.

Focus Points

The greatest opportunity for improved groundwater recharge from land conservation is in Swift Creek, Tributaries to Jordan Lake and Other Tributaries to the Neuse River.

The most potential for water quality improvement is in Crabtree Creek and Other Tributaries to the Neuse River.

Triple Bottom Line Outcomes

A TBL evaluation of Focus Area 3, Land Conservation and Preservation, is expected to provide a **Neutral/Positive** Economic outcome, a **Positive** Social outcome and a **Positive/Very Positive** Environmental outcome, as shown in Figure 31.

Figure 31. TBL outcomes for Focus Area 3.

These outcomes include:

- **Economic:** Land conservation requires investing upfront for land acquisition and/or easements. Lost economic opportunity costs—the value of potential development that may otherwise have occurred—and annual maintenance costs for monitoring and general upkeep are additional costs to consider. In the long term, land conservation can increase property values of nearby parcels, support local food systems through crop cultivation, and enhance tourism through related projects supporting parks and recreation, greenways, heritage sites and eco- and agritourism.
- **Social:** Preserved land can provide educational opportunities, public access to natural areas, and gathering spaces for community events that strengthen a shared sense of community and identity.
- **Environmental:** Land conservation preserves critical habitat, protects healthy soils, enhances water quality benefits and helps mitigate flooding. It also provides ecosystem services, such as carbon sequestration.

Focus Area 4: Flood Resilience

Floods can pose a serious risk to life, property, and cultural and heritage sites. This Plan takes a two-pronged approach to flood resilience: improving infrastructure (making changes to the built environment) and implementing planning efforts (improving education, emergency response plans and community capacity).

Implementation Scenarios

Future scenario analyses within WaterFALL evaluated the potential benefits of implementing GSI in subbasins upstream of projected flood hotspots and how it would affect the flood frequency and duration in Wake County. This implementation included the following WaterFALL scenarios:

Installing bioretention, permeable pavement and green roofs on developed lands projected to increase in density and any newly developing land

GSI is installed to store 199 MG of stormwater within areas projected to experience an increased frequency of high flows. The modeled GSI practices are designed to treat the first 1.5 inches of rainfall.

Focus Points

The Walnut Creek and Crabtree Creek subbasins have the greatest opportunity for targeted GSI implementation providing daily maximum storage capacity of runoff volume of 82.2 MG and 61.8 MG, respectively.

Potential Benefits

Direct Environmental Benefits

The following metrics represent the potential benefits of GSI alone upstream of projected flood hotspots. These values are estimates based on the WaterFALL model and represent mean annual predictions.

- **Stormwater Runoff**
  - **19%** ↓ in maximum annual daily runoff and **25%** ↓ in mean annual total runoff volume (1,200 MGY).
  - **2,300 MGY** of stormwater runoff stored for reuse.
- **Groundwater Recharge**
  - **7%** ↓ in the projected infiltration loss (300 MGY).
- **Flood Impacts**
  - ↓ **frequency of peak flow** (highest 10% of flows) events in **7 of 12 subbasins**:
    - Black Creek
    - Crabtree Creek
    - Little River
    - Middle Creek

- Walnut Creek
- Other Tributaries to Neuse River
- Tributaries to Harris Lake

- **Nutrient and Sediment Reductions**
  - Nitrogen: Additional **4%** ↓ (460,000 lbs/yr) in mean annual loads.
  - Phosphorus: Additional **4%** ↓ (29,000 lbs/yr) in mean annual loads.
  - Sediment: Additional **6%** ↓ (36 million lbs/yr) in mean annual loads.

    Note: Predictions indicate mixed results by subbasin for annual average nutrient and sediment load changes, with an overall combined decrease. However, daily and annual maximum loads increase.

Triple Bottom Line Outcomes

A TBL evaluation of Focus Area 4, Flood Resilience, showed overall **Positive/Very Positive** outcomes, as shown in Figure 32.

Figure 32. TBL outcomes for Focus Area 4.

These outcomes include:

- **Economic:** While projects may have high capital costs, the primary economic benefits are the reduced and/or avoided costs from flood damage and potential savings through lower flood insurance premiums.
- **Social:** Flood resilience practices, including holding emergency preparedness exercises and developing educational resources, directly protect public health. Strategies such as property buyouts must be properly planned and coordinated to avoid the displacement of vulnerable communities.
- **Environmental:** Green and blue infrastructure solutions provide other One Water benefits by restoring natural floodplains and enhancing ecosystem services, including urban heat island mitigation, enhanced biodiversity and improved water quality.

Focus Areas' Resilience to Climate Conditions

Three different climate projection models were used when developing this Plan. The analyses showed that the potential climate conditions vary by the location affected and the frequency, duration and magnitude of weather events. The resulting impacts on water quantity and quality vary; some effects would be beneficial, such as when a lower frequency of storm events reduces the overall runoff, while other effects would be harmful, such as when the magnitude of precipitation events increases but the number of events decreases. When examined in conjunction with future land use change, the combined impacts on water quantity and quality are again mixed, with some positive and some negative impacts (Tetra Tech and RTI 2025).

The land use and GSI-based strategies were simulated under the combination of future land use change and climate conditions to examine the resilience of these potential strategies. For this analysis, the One Water Teams used the climate model that produced the most extreme water quantity impacts and the largest decreases in water quality to simulate the worst-case scenarios. In these combined scenarios, the water management strategies continued to provide benefits under future land use change alone, although that level did not always equate to reducing the same percentage of the quality or quantity lost.

For example, the GSI practices installed within Walnut Creek under Focus Area 4 captured more runoff in the land use change scenario than in the land use and climate scenario (Table 10). Because the projected climate introduces larger but less frequent storms, the drop in capture volume and percentage indicates that the GSI-based strategy can be adjusted to increase the capacity of the GSI to improve this strategy's resilience to potential weather extremes.

Similarly, the strategies relying on land use changes that function as management actions, such as the land conservation and preservation targets within Focus Area 3, showed similar benefits for water quantity. However, that quantity is a smaller percentage of the projected change when climate is also considered. Under the Focus Area 3 scenario, Swift Creek has land development in both natural and agricultural areas. Conserving and preserving portions of these lands resulted in an increased reduction in runoff volume (Table 10). The combined land use and future climate scenario indicates that these land management strategies are resilient to weather extremes. These strategies can likely be further targeted to key locations and land change types to expand the benefits for the volume and percent of the expected increases in runoff reduction.

Table 10. Results of WaterFALL land use and climate scenarios.

Waterbody	Focus Area	Runoff Capture Increase by Scenario	
		Land Use Change Only	Land Use and Climate
Walnut Creek	Focus Area 4	43% (570 MGY)	28% (530 MGY)
Swift Creek	Focus Area 3	38% (253 MGY)	19% (257 MGY)

Constructed wetland at Beech Bluff County Park, Willow Spring, N.C.

6. Conclusions

Wake County and its municipal partners are confronting growing challenges in managing shared water resources amid climate and rapid population growth. With this Plan, the County will adopt an integrated and collaborative approach to help meet increasing water demands, mitigate environmental pressures and support sustainable development.

Since August 2022, the County has conducted technical studies and engaged stakeholders to assess water resource conditions and community priorities. These efforts reflect the County's commitment to a One Water approach and provide important insights on the current and future challenges to surface water, groundwater, wastewater, stormwater and flood management.

Land use and changing climate analyses conducted through the WaterFALL model indicate that over the next 50 years, Wake County is likely to experience the following impacts:

- Increases in water demand, along with more frequent drought periods
- Increases in groundwater vulnerability
- Increases in stormwater runoff

Stakeholder Engagement Summary

2,871 responses to two public surveys

1,278 stakeholder contacts

57 professionals at the One Water Visioning Summit

60 stakeholders at virtual stakeholder meetings

121 subject matter experts at **5** technical workshops

249 participants at **10** sector-specific stakeholder meetings

- Increases in pollutant loading to surface water
- Decreases in forest, agriculture and open space
- Increases in localized flooding

The County designed the four interconnected focus areas to maximize benefits for local communities. These focus areas work together to strengthen existing tools and efforts to support water supply and address pollution, wastewater, nutrients, stormwater, flooding and climate challenges. Taken together, they deliver cumulative benefits greater than any single approach and will help guide the County toward a resilient and sustainable water future.

Focus Area 1. Optimized Water Supply. Wake County aims to secure reliable water for over 2 million future residents in the next 50 years. Today, 85% of residents rely on surface water, while 15% depend on groundwater through private wells or community wells.

To protect these sources, utilities are working to expand the supply capacity, upgrade treatment systems and prepare for contaminants like PFAS (Tetra Tech and Hazen 2023a). Strategies that protect groundwater and improve recharge will help mitigate impacts to future groundwater supplies. Stormwater and greywater reuse will help further diversify supplies and offset potable water demand.

During the outreach process, stakeholders expressed support for using greywater or rainwater to flush toilets, wash cars, and water non-food garden plants and lawns. Support for greywater reuse was higher among attendees of public meetings, indicating that education and awareness may increase acceptance and interest. Well users requested more information and tools about well testing results, current groundwater level observations and contamination (Tetra Tech 2025).

Focus Area 2. Site-Specific Strategies to Improve Water Quality and Hydrology. Urbanization increases impervious surfaces, which reduces infiltration and increases pollutant runoff. The WaterFALL modeling results show that management of stormwater will be an important strategy to improve water quality.

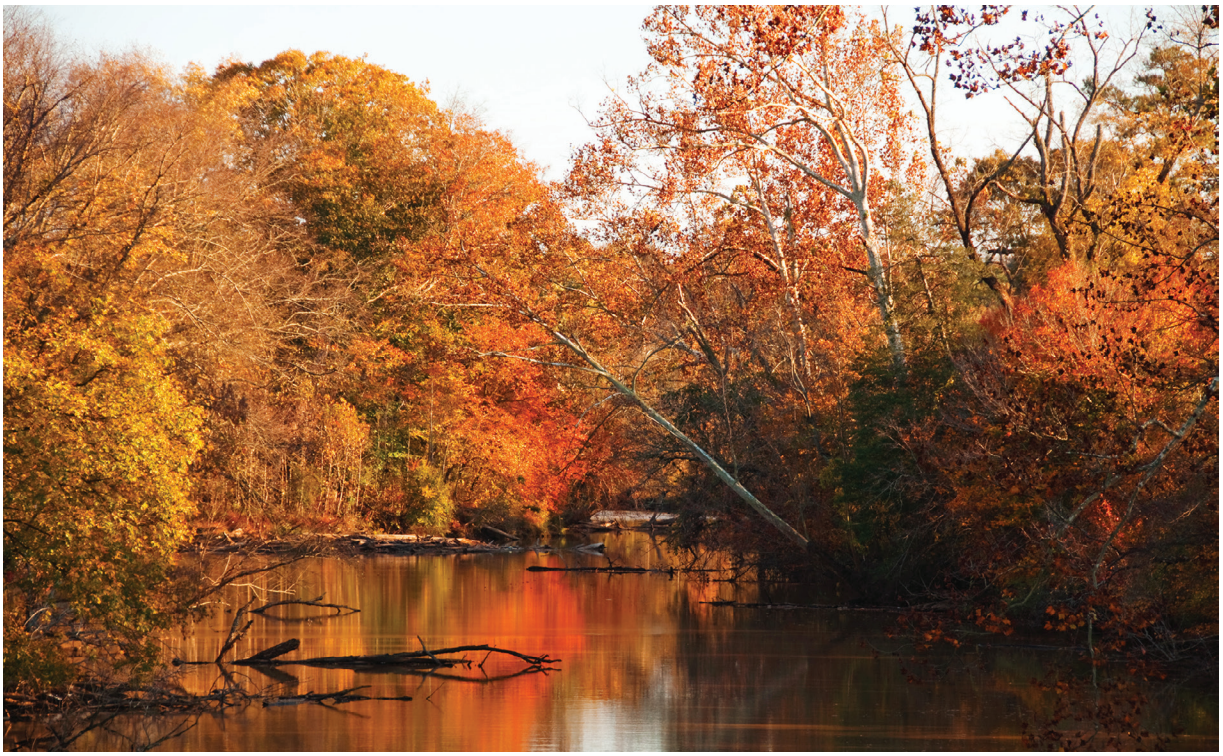
Implementing site-specific strategies like GSI and low-impact development helps slow and filter stormwater runoff. Expanding composting at both an individual and regional scale further reduces nutrient imports, reduces waste and promotes groundcover. In addition, regular maintenance and repair of septic systems provide water quality and public health benefits.

Stakeholder meeting attendees expressed concerns about stormwater runoff's impact on water quality, particularly from pollutants like fertilizers and pesticides. Engagement efforts

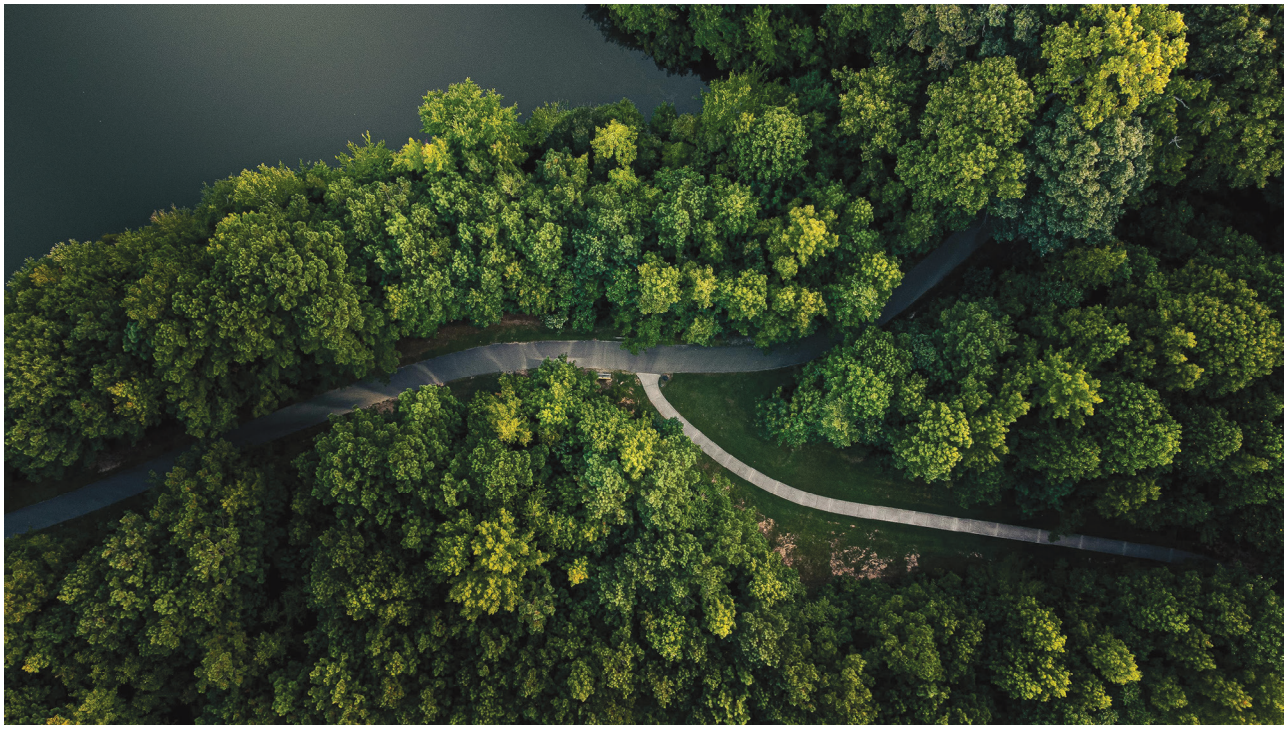
indicated strong support for GSI and green streets, especially tree plantings, alternative landscaping, rain barrels and conservation landscaping; however, developers and property owners raised concerns about the costs of implementing and maintaining GSI and the regulatory challenges associated with design and construction. Engagement efforts revealed that having the resources to raise awareness and knowledge among property owners, designers, developers and design reviewers is an important factor for GSI to become a competitive and desirable option in Wake County (Tetra Tech 2025).

92% of the respondents to the 2025 countywide survey expressed a willingness to support "green streets."

Focus Area 3. Land Conservation and Preservation. Growth projections show a 60%–70% decline in grasslands, crops and pasture over the next 50 years (Tetra Tech and RTI 2025). WaterFALL modeling results demonstrate that land conservation can contribute to mitigating loss of groundwater recharge, pollutant reduction and reducing projected future stormwater runoff. Forests, wetlands and farmlands recharge aquifers, filter pollutants and buffer floods and are therefore a focus area for conservation within the Wake One Water Plan.



Riparian vegetation along the Neuse River in Raleigh, N.C.



Trailside tree canopy in Apex, N.C.

The One Water Plan emphasizes protecting tree canopy and natural vegetated cover, maintaining healthy soils and retaining stormwater runoff onsite. By combining smart-growth planning with groundwater modeling, the County can steer development away from sensitive recharge zones and toward areas that support higher-density developments that integrate sustainable water use. Leveraging tools like the Wake County Land Cover Analysis and Tree Canopy Assessment to incentivize tree conservation and future tree plantings will help protect green space while enhancing communities and public health.

During the outreach process, stakeholders shared concerns about the threat to natural resources and agricultural lands. Farmers expressed concerns about the negative impacts of stormwater runoff and emphasized the need for better regulations to mitigate erosion and sediment control issues from development occurring adjacent to farms. Farmers also highlighted the importance of clear communication between developers, municipalities and community stakeholders (Tetra Tech 2025).

Focus Area 4. Flood Resilience. Flooding threatens homes, infrastructure and ecosystems. Climate models show more intense rainfall and longer dry spells. WaterFALL model results indicate that targeted GSI can help to reduce localized flooding threats and decrease the frequency of flooding.

A comprehensive approach to flood resilience will strengthen floodplain management, expand GSI and improve emergency preparedness. Participation in FEMA's Community Rating System helps reduce insurance costs and incentivize proactive flood protection. In addition to GSI, grey infrastructure strategies will be needed to ensure dams, pipes and culverts are sized correctly for future storms. Expanding the flood gauge network and conducting emergency preparedness outreach will increase public safety and the community's resilience to future flood impacts.

Attendees at the stakeholder meetings expressed concerns about increased flooding due to urban development in Wake County and emphasized the need for better stormwater management. Residents support implementing GSI (e.g., rain barrels, conservation landscaping) on their properties, which can help reduce localized flooding by intercepting and storing or infiltrating runoff (Tetra Tech 2025).

The One Water Plan aligns with PLANWake and supports Wake County's broader goals for community health and wellbeing, sustainable growth, preserving green spaces and ensuring access to clean water. To move forward, Wake County will need to take near-term steps across all four focus areas. Achieving the One Water vision and goals requires collaborating with developers, utilities, conservation groups, community partners and public advisory boards.

Adaptive Management

This Plan marks the beginning of a decades-long journey. As conditions evolve, so will this Plan. It is a "living document," and the County will use adaptive management to refine strategies and advance progress. Adaptive management continuously adjusts strategies to fit shifting conditions caused by climate, population growth, or new information and data. By learning from outcomes and refining actions, adaptive management helps optimize resource use, reduce costs and increase the effectiveness of water programs. It encourages ongoing coordination among stakeholders, including strengthening regional partnerships with upstream and downstream neighbors in adjacent counties. This helps ensure that decisions reflect diverse perspectives and emerging priorities.

Early implementation will focus on organizational strategies and building support for practices like stormwater and greywater reuse, GSI, composting and alternative landscaping. As climate and land use patterns shift, the County will revise its strategies and actions as needed.

Next Steps

Action is required to secure a resilient and sustainable water future. Wake County invites residents, businesses, developers and municipalities to unite in implementing the Wake One Water Plan. Together, the County and its municipalities can protect water resources, preserve landscapes and shape a future that reflects Wake County's vision and values.

How can Wake County residents and organizations help?

- Follow the County's social media accounts to learn about recent events and how to participate in upcoming events.
- Learn about County programs that promote rainwater harvesting systems, rain garden installations, tree planting and streamside cleanups. Install these practices and participate in stream cleanups.
  - Water Partnership GSI (https://wake.gov/gsi)
  - Wake County Big Sweep (https://www.wake.gov/bigsweep)
  - Well Maintenance and Testing (https://www.wake.gov/welltesting)
  - Septic Maintenance and Repairs (https://www.wake.gov/SepticMaintenance)
- Learn about and practice proper well maintenance, including regular water quality testing.
- Learn about and install water-saving appliances and plumbing fixtures, such as low-flow toilets and high-efficiency washing machines.
- Learn about and practice water-saving and conservation landscape practices around your home or business.
- Regularly inspect and maintain your septic system.
- Learn about ways to floodproof your property and purchase flood insurance if you are in a high-risk area.

The County encourages ongoing participation and collaboration by all stakeholders to address water challenges and shape a more sustainable future. More detailed information is available on the Wake County One Water Plan website: https://www.wake.gov/OneWater.

Appendix: Supplemental Project Documents

Wake County invested in significant stakeholder involvement and technical assessments that supported the development of the One Water Plan. A summary of project documents and resources is provided below. To obtain a copy, contact Wake County Planning and Development Services Department.

Vision Summit Summary – On December 7, 2022, Wake County hosted a One Water Vision Summit with 50 water professionals, including County and municipal officials, business executives and nongovernmental organization members. Summit attendees discussed water management needs (water supply, wastewater treatment, stormwater, flooding, and surface and groundwater quality) and key issues facing Wake County. They also reviewed other One Water initiatives underway across the nation to identify ideas and strategies that Wake County could build on.

Engagement Report from Visioning Phase – Summarizes findings from three virtual stakeholder meetings with environmental and community organizations, businesses and academic interests held in March 2023. It also includes the results of a public survey that received over 1,600 responses and ran from March 23 to May 8, 2023. Both engagement efforts gathered input and insights from Wake County stakeholders for the One Water Plan vision, goals and objectives.

Vision, Goals and Outcomes Guiding Our County's Water Future – Reflects input received from the Vision Summit, the stakeholder engagement process and public draft distribution of the Plan. The document outlines vision statements to guide the County and its partners in developing specific strategies that accomplish the collective vision, with an emphasis on the economic, social and environmental benefits for the Wake County community. It also includes goals to address all aspects of the vision statement. Each goal includes outcomes that present the envisioned result of effectively implementing that goal.

Technical Memorandums –

- **Stormwater Program Review Memorandum** – Summarizes the results of an evaluation of the County's and local municipalities' stormwater programs to identify gaps and barriers to developing the Plan, along with building blocks for the County's One Water initiative. It also discusses how the County and municipalities can adopt a watershed-scale approach to stormwater management.
- **Water Supply Plans and Data Gaps** – Discusses how the County currently meets its water supply needs and alternative sources of water to meet the County's future growth needs.

- **Groundwater Assessment in Wake County** – Outlines the assessment methodology, results and recommendations for sustainable groundwater management in Wake County.
- **Evaluation of Wastewater Treatment Capacity to Meet Future Demands** – Discusses three types of wastewater management systems serving Wake County residents and businesses and the probable change and growth in wastewater treatment demands the County will face in the next 50 years. It also explores management strategies the County can use to overcome challenges and to take advantage of opportunities to implement the One Water Plan goals to meet the County's growing and changing needs.
- **Drivers on Nutrient Loadings** – Assesses the impact of population growth, land use changes and climate on nutrient loads. Nutrients from decentralized/on-site wastewater systems and municipal wastewater sources are also presented and analyzed. The results were then used to inform the selection of mitigation measures included in the Wake County One Water Plan.
- **Greywater Reuse Impact Analysis** – Defines greywater and how it can be legally used for non-potable uses, such as flushing toilets, evaporative cooling tower makeup, fire suppression systems, clothes washers, outdoor irrigation and/or vehicle washing.

Strategies Prioritization Engagement Efforts Summary – Summarizes findings from four Subject Matter Expert Technical Strategy Workshops in 2024 and 2025, 10 sector-specific stakeholder meetings in 2025, and the strategies prioritization public survey that received over 1,200 responses and ran from April 2 to May 9, 2025.

Wake County One Water Scenario Analysis – Summarizes the potential water quality and hydrology benefits of a subset of strategies identified in the One Water Plan and modeled using WaterFALL.

Triple Bottom Line Evaluation – Provides details on how the One Water Team checked the balance between projected economic, social and environmental outcomes for the four proposed focus area primary action categories to ensure neutral to very positive ratings across this triple bottom line (i.e., checking that proposed strategies help to avoid unintended negative outcomes).

Stakeholder Engagement Summary Report – Summarizes all engagement efforts related to the development of the Wake County One Water Plan and provides a brief summary of public comments received on the draft plan.

Implementation Plan – In collaboration with the Wake County Water Partnership and subject matter experts, the County developed a suite of action strategies to implement the One Water Plan. The strategies are grouped into these four focus areas of One Water practices that align with the County's One Water and PLANWake goals: optimized water supply, site-specific strategies to improve water quality and hydrology, land conservation and preservation and flood resilience.

Glossary

Term	Definition
Alternative landscaping	Replacing managed turf lawns and gardens with native vegetation, meadow-style plantings or xeriscaping to reduce water demand, provide pollinator habitat and promote healthy soils and infiltration.
Anthropogenic	Describes something that is caused or created by humans as opposed to occurring naturally.
Assimilative capacity	The maximum amount of pollution that a water body can receive without experiencing significant or long-term damage.
Baseflow	The portion of streamflow originating from groundwater discharges. Baseflow provides waterways with a stable water supply, even during surface dry periods.
Blue infrastructure	A systematically planned network of natural and constructed waters, such as coastal areas, wetlands, rivers or ponds that foster environmental health while aiding in the management of water resources.
Centralized system	An off-site system, more commonly known as a wastewater treatment plant, that treats wastewater and discharges it to surface waters.
Closed nutrient cycle	A system in which nutrients are continuously transferred and reused in the environment, resulting in reduced amounts of nutrient pollution entering waterways.
Cloudburst storm	When higher temperatures cause increased atmospheric water retention, water is released as rain in high-intensity and short-duration events.
CommunityViz Model	This add-on for ESRI's ArcGIS Desktop software uses Scenario Planning to predict future outcomes under different conditions and compare the advantages and disadvantages of various scenarios or policy choices. To predict where future growth will occur, the model considers development trends and the factors that make locations more suitable for development. Wake County used the CommunityViz model to develop datasets to determine future potential groundwater reliance.
Decentralized system	An on-site system, more commonly known as a septic system, that treats wastewater and slowly disperses it into the ground where it is filtered by the soil.
Deep infiltration	The movement of water farther underground, often through percolation to a deeper water table recharging groundwater aquifers.
Deposition	The process through which water vapor becomes solid (e.g., snow, ice).
Ecosystem services	The benefits living organisms reap from the environment's systems of processes, such as water and air purification which occur naturally.
Evaporation	The process through which water changes from a liquid to a gas.
Evapotranspiration	The combined process of water surface evaporation, soil moisture evaporation and plant transpiration.
Floodplain management	Refers to the suite of policies and practices used to manage flood-prone areas around waterways.

Term	Definition
FUTURES®	Open source land change model that simulates the regional-scale environmental impacts of urban growth, capturing development spatial structure.
Green infrastructure	Practices such as rain gardens and bioswales, which harness the natural water and air filtration benefits provided by soils and vegetation (i.e., ecosystem services) to address stormwater, reduce flooding and support environmental health and resilience.
Grey infrastructure	Engineered structures, such as concrete pipes, storm drains, levees and dams, that collect and convey stormwater and wastewater.
Greywater reuse	The capture, treatment and reuse of discarded water from washing machines, bathtubs, showers and sinks.
Groundwater	Water that exists underground in saturated zones (water-filled spaces in sediment and rock) beneath the land surface.
Groundwater recharge	The process by which water seeps into the ground and replenishes underground water supply.
High-flow event	An instance when a stream or river experiences faster flows and higher water levels than are typical (often caused by heavy rains).
Hydraulic conductivity	A hydrogeological quantification that describes how easily water can flow through a saturated porous material or surface, such as soil.
Hydrologic	Relating to the distribution and properties of water on Earth.
Hydrologic cycle	The biogeochemical process by which water travels between the Earth's surface, atmosphere and subterranean level.
Impervious surface	Hard surfaces, such as concrete or asphalt, preventing water from infiltrating the soil.
Implementation tools	Strategies to complete on-the-ground projects or introduce progressive changes directly affecting water management.
Infiltration	The process by which water soaks into the soil and rock layers below the land surface. Water can be intercepted or redistributed by vegetation, wetlands or pervious surfaces.
Interception	The process of interrupting the water moving from the land surface to surface waters.
Land conservation	The preservation of land through acquisition or easements
Level of effort	The staff and financial resources needed to complete a task.
Low-flow period	A time when a stream or river experiences slower flows and lower water levels than are typical (such as during droughts or the dry season).
Mean annual flow	The average daily streamflow levels within a given year.
MODFLOW®	MODFLOW® is the USGS's three-dimensional (3D) finite-difference groundwater model for simulating and predicting groundwater conditions and groundwater/surface-water interactions. https://www.usgs.gov/tools/modflow.
Municipal water supply system	Publicly owned water supply systems that provide drinking water to County residents and businesses.

Term	Definition
Nature-based solutions	Refers to a suite of engineered systems intended to mimic the function of natural systems, including riparian buffers, tree plantings and stream restorations.
Net infiltration	The total amount of water seeping into the ground after accounting for water removed by runoff, evaporation or other mechanisms.
Nutrient loading	The introduction of nutrients (e.g., nitrogen, phosphorus) into aquatic environments.
OASIS®	Modeling software program used to simulate water system changes based on potential scenarios such as changes in water demand and supply management options, water quality or facility sequencing.
One Water	An emerging concept in the United States that values all forms of water as a resource, including stormwater and wastewater.
Passive conservation	Natural land that is protected through easements or conservation and allowed to remain in an undisturbed condition with limited management and restoration.
Permeable	Refers to the characteristic of a surface or material that allows liquids or gases to pass through it. Note that not all permeable surfaces are pervious.
Pervious surface	Surfaces, such as grassed lands, soil or gravel, that allow water to infiltrate the ground, thereby decreasing runoff. Note that all pervious surfaces are permeable.
Phase I	The Phase 1 NPDES stormwater rule, promulgated in 1990, uses permit coverage to address stormwater runoff from municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more, construction activities disturbing areas of five acres or more, and certain industrial activities.
Phase II	The Phase 2 NPDES stormwater rule, promulgated in 1999, uses permit coverage to address stormwater runoff from MS4s serving populations of 50,000 or more and construction activities disturbing areas between one and five acres.
PLANWake	The Wake County comprehensive plan, adopted in 2021, designed to intentionally guide growth over a 10-year period.
Plant uptake	The process by which plants absorb water and nutrients from the soil through their roots and transport it internally for photosynthesis and other functions.
Precipitation	Any form of water, liquid or solid, that falls from the atmosphere and reaches the Earth's surface, including rain, snow, sleet and hail.
Private drinking water wells	Privately owned wells that provide drinking water to fewer than 25 people or 15 connections.
Privately owned community water system	Privately owned water supply systems that provide drinking water to at least 25 people or 15 connections.
Radionuclide contamination	As it relates to Wake County, radionuclides, such as uranium, found in bedrock that can pollute groundwater resources, and may lead to human health impacts.
Shallow infiltration	The absorption of water near the surface, often the initial step of water entering soil.
Single-family dwelling units	Single-family dwelling units (SFDU). The Plan used this data to determine the population distribution potentially reliant on groundwater wells.

Term	Definition
Soil saturation	Occurs when all the pore spaces between soil particles are filled with water, achieving maximum soil water content. Water flow in saturated soil is mainly controlled by gravity. Soil saturation contributes to flooding and runoff.
Soil-Water-Balance®	USGS's modified Thornthwaite-Mather model developed to generate estimations of potential groundwater recharge.
Stormwater	Water from precipitation that reaches the ground.
Stormwater capture	A management technique that collects, stores and infiltrates water that would otherwise run off during storm events.
Stormwater reuse	The capture and use of stormwater.
Stormwater runoff	Water from precipitation that flows across surfaces and does not infiltrate into the ground.
Subbasin	A defined drainage area, that drains to a specific point on a stream or river.
Surface storage	Water that collects above ground in wetlands, rivers, lakes and other water bodies.
Surface water	Open water bodies, including lakes, creeks, streams and rivers, as well as wetlands and manmade water bodies like wet ponds.
Technical tools	The actions and resources used to build more organizational capacity, garner public support, and develop plans for implementing One Water practices.
Timeframe	The time at which the action category begins and its general duration.
Total runoff	The flow from a watershed that becomes surface water, including water falling directly on streams as precipitation, flowing over land surfaces and via channels, infiltrating soils and moving laterally to streams, and flowing from groundwater sources.
Transpiration	The process of water moving through a plant and evaporating from its leaves, stems and flowers. Transpiration is a passive process that occurs through a plant's stomata and is largely controlled by atmospheric humidity and soil moisture content.
Triangle Water Partnership	Partnership of water systems in the Triangle region with a focus on strengthening water supply planning work and collaboration.
Wake County Water Partnership	Wake County Board of Commissioner Advisory Committee that includes local stakeholders and jurisdictional entities in Wake County working to provide guidance on water-related issues while fostering collaboration.
Wastewater	Water that has been used, such as in homes for washing, flushing toilets, bathing and food preparation or in businesses for processing, heating and cooling.
WaterFALL®	Hydrologic modeling tool and decision-support platform that can simulate daily streamflow, water quality and water availability at multiple geographic scales, allowing for the evaluation of management efforts under current and future scenarios.
Watershed	An area of land where all surface water (rainfall, snowmelt, etc.) drains to a common outlet, such as a river, lake or ocean.
Well interference	Condition in which multiple pumping wells withdrawing groundwater affect the availability of groundwater due to overlapping drawdowns (cone-like depressions in the groundwater table formed by pumping the groundwater).

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Photo Credits and Sources

Page ii: Wake County Water Partnership (Wake County)

Page ix: Constructed wetland at Beech Bluff County Park in Willow Spring, N.C. (Wake County)

Page 1: Northern Cricket Frog (*Acris crepitans*) (Wake County Facebook/Sam Ray) https://www.facebook.com/wakegov/posts/pfbid05jFZcSm9DWUuvLnaoEiksytr8eYXqUKmGsHMEMbE1yd-4jxh55bRyYY77L95AsHZcl

Page 1: Falls Lake (Upper Neuse River Basin Association)

Page 25: View of the Neuse River (Wake County/Vail Stewart Rumley)

Page 30: Attendees at the Wake County One Water Vision Summit (Wake County)

Page 31: Kayakers (Wake County) https://www.wake.gov/departments-government/parks-recreation-open-space/all-parks-trails/harris-lake-county-park/harris-lake-visitor-information

Page 35: Tree-lined street in downtown Wake Forest, N.C. (Wikimedia/Rysnap 1024) https://upload.wikimedia.org/wikipedia/commons/6/6e/Wake_forest_nc_downtown.jpg

Page 39: Lake Crabtree boathouse in Morrisville, N.C. (Wake County Facebook) https://www.facebook.com/wakegov/posts/pfbid032nfUAfhx5Re8CjXAcrxhMQ9ALHPr4txsrCAf9Hc4Q77X-auAimBQa36D24V5rD26Ll

Page 45: Cistern at Beech Bluff County Park in Willow Spring, N.C. (Wake County)

Page 46: Top to bottom

Greywater from a washing machine outlet is being collected to irrigate a Los Angeles, CA home's ornamental garden (Flickr/Craig Dietrich) https://www.flickr.com/photos/craigdietrich/8061515006/

Rain barrel capturing stormwater in Wake County (Wake County)

USGS Rocky Branch groundwater observation well in Wake County (Wake County)

Fishing at Falls Lake (Upper Neuse River Basin Association)

Page 50: Top to bottom

Bioretention at the Wake Technical Community College in Raleigh, N.C. (Wake County Facebook) https://www.facebook.com/photo/?fbid=1124424806379951&set=a.224519839703790

Crops in Wake County (Wake County Soil and Water Conservation District)

Wildflower garden in Wake County's Historic Oak View County Park (Wake County Facebook) https://www.facebook.com/photo/?fbid=4096774978546 89&set=a.224519839703790

Wake County employee performing a septic system inspection (Wake County Facebook) https://www.facebook.com/wakegov/posts/pfbid0uWtsoxBQJkCWmMzzFn5RFwoqYBttigysCa1QYR1i2nUL-dRqA5vgPYUvzF5ndP6Yql

Page 53: Autumn roadside market in Wake County provides local foods. (Wake County)

Page 54: Turnipseed Nature Preserve sign. (Wake County)

Page 55: Top to bottom

Bioswale and curb bump outs in Pennsylvania (Flickr/Philadelphia Water Department)
https://www.flickr.com/photos/philadelphiawater/9087961484/in/photostream/

Farmland in Wake County permanently protected under the County's Farmland Preservation Program, which helps secure impervious lands and protects water resources (Wake County Facebook)
https://www.facebook.com/wakegov/posts/pfbid027r19rFpm7NPbSvk7Q1hQjRJjf1NES19QoLi7jBJPmTqB-yA5hef2cJpsTi2BrTNf9l

Urban trees in a Raleigh, N.C., greenspace line Hargett Street (Flickr/James Willamor)
https://www.flickr.com/photos/bz3rk/30523305030

Crops in Wake County. (Wake County Soil and Water Conservation District)

Page 58: Top to bottom

Lassiter Mill Dam on Crabtree Creek in Raleigh, N.C. (Flickr/James Willamor)
https://www.flickr.com/photos/bz3rk/12709172783/

Water released from Falls Lake dam in Wake Forest, N.C. (Flickr/Mark Peterson)
https://www.flickr.com/photos/markpeterson1/13913341589/

Constructed wetlands at Sandy Pines Preserve in Wendell, N.C. (Wake County)

Flooding in Wake County (Wake County)
https://www.wake.gov/departments-government/water-quality-division/watershed-management-erosion-sedimentation-control-floodplain-and-stormwater-management/floodplain-management

Page 60: Aerial view of Walnut Creek and its surrounding floodplain in Wake County (Wake County Facebook)
https://www.facebook.com/photo/?fbid=604802345008869&set=a.224519839703790

Page 61: Vegetated swale at Beech Bluff County Park in Willow Spring, N.C. (Wake County)

Page 75: Constructed wetland at Beech Bluff County Park, Willow Spring, N.C. (Wake County)

Page 77: Riparian vegetation along the Neuse River in Raleigh, N.C. (Flickr/James Willamor)
https://www.flickr.com/photos/bz3rk/10692085046/in/photostream/

Page 78: Trailside tree canopy in Apex, N.C. (Pexels/Daniel Shapiro)
https://www.pexels.com/photo/trees-around-alley-in-forest-16653753/