

## 50 years of NC WRRI

By Rhett Register

In 1964, eight years before passage of the Clean Water Act, the federal government authorized a unique piece of legislation in response to concerns over water availability and quality. The Water Resources Research Act called for the creation of local centers of water research that would “enlist the intellectual power of universities and research institutes in a nationwide effort to conserve and utilize our water resources for the common benefit.”

The following year, North Carolina Governor Dan Moore and University of North Carolina President William C. Friday announced the establishment of a state water institute. Headquartered at NC State University, the Water Resources Research Institute of the University of North Carolina System, or WRRI, has been at the forefront of addressing the state’s water resource needs for 50 years.

### Research Funding: A Brief History

As one of the nation’s 54 state water institutes, WRRI administers and promotes federal-state partnerships in research and information transfer on water-related issues. The institute’s federal funding is provided by the U.S. Geological Survey and matches state funds. For every \$1 in state match received by WRRI, the institute leverages an additional \$2 of funding.

In the 1960s, WRRI provided research funding for pressing issues such as mosquito control, industrial waste and the effects of urbanization. Results helped create a new, less environmentally damaging method for controlling mosquitos, new principles for water conservation and waste minimization in North Carolina industries, and provided information for state and local governments on the effects that growth and urbanization would have on natural resources.

During the 1970s, WRRI funded research into the effects of channelization of streams



WRRI-funded researchers work in watersheds throughout the state.

for agricultural and residential purposes. Results helped usher in a new era of stream restoration and management. Additionally, studies the institute funded raised concerns about water quality in the proposed Jordan Lake Reservoir and began to tackle water quality issues arising from the increasing number of large confined animal production units.

The 1980s saw WRRI focus on urban stormwater, nutrient pollution and hydrilla — an invasive aquatic plant that was spreading at an alarming rate. WRRI funded studies on how the plant and other exotic species survive and reproduce in North Carolina waters. In 1985, WRRI helped create the N.C. Urban Water Consortium consisting of the state’s 12 largest drinking water/wastewater utilities. WRRI provides support for the group as well as a sub-group that focuses on stormwater issues. It also connects both entities with university expertise.

In the 1990s WRI focused on drinking water, funding studies that looked into disinfection by-products — compounds created during the interaction of chlorine and organic materials in raw water. At certain levels, these compounds can increase the risk of cancer. These and other toxics in wastewater were being limited by new regulations that, among other things, required a test that used aquatic organisms rather than

measurement of specific chemicals. WRI funded research and outreach that helped dischargers comply with the changes. The 1990s also saw the implementation of the Water Supply Watershed Protection Act, a state law that began to protect water resources at the watershed level. The act featured land-use restrictions that were controversial, and WRI funded research into what impacts the law would have on land availability and housing costs in watersheds.

For a more in-depth overview of WRI’s first 35 years of research funding and outreach, visit [go.ncsu.edu/WRIat50](http://go.ncsu.edu/WRIat50).

**WRI Since the Millennium**

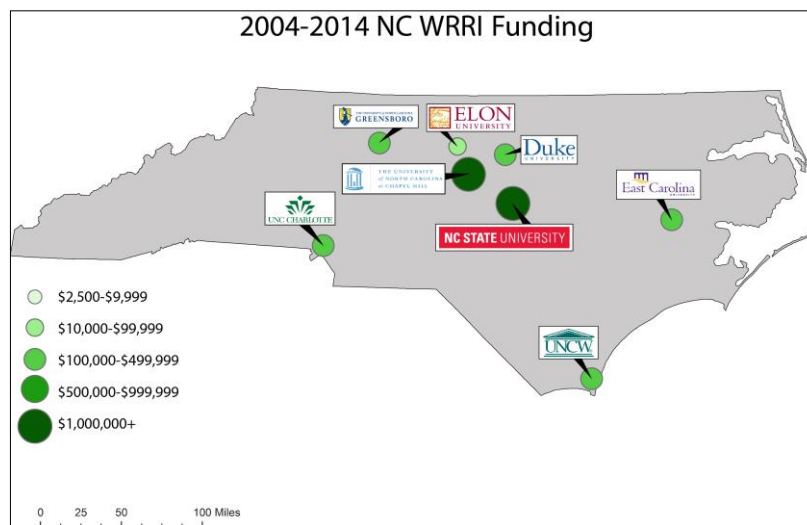
WRI continues to address priority statewide water-resource needs. Since 2000, the institute has funded more than 230 research projects. These projects reflect WRI’s strong and collaborative relationships with local governments, N.C. Department of Environment and Natural Resources, universities, non-governmental organizations, industry and private water resource professionals across the state.

The top five most-funded project areas include nutrient management, stormwater

management, potable water supply, toxic chemicals and wastewater treatment. What follows is a list highlighting some of the research funded by WRI from the last 15 years.

**Controlling Nutrients**

Nutrient management remains a pressing concern for the state. With funding from WRI, Hans Paerl, of the University of



North Carolina at Chapel Hill Institute of Marine Sciences, helped characterize the nitrogen cycle of the Neuse River. By cataloging the sources and sinks of the nutrient, Paerl’s findings have helped researchers and managers understand contributions to algae blooms and lowered water quality that have plagued the waterbody. Wayne Robarge, of NC State University, helped quantify the input of nitrogen to the Neuse River system from air deposition originating from intensive animal production operations.

Constructed stormwater wetlands and vegetated buffers can reduce excess nutrients in water. These systems remove nitrogen by transforming it into inert nitrogen gas. Research by Bongkeun Song of the University of North Carolina at Wilmington helped characterize the microbial processes that allow this transformation to occur. Song suggests

vegetation that can be used in stormwater wetland construction to maximize nitrogen removal. Deanna Osmond, of NC State University, studied the nitrogen reduction values of shrub buffers used in the Neuse River Basin. This effort helped increase the number of best management practices available to farmers and real estate developers in the region.

### **Managing Stormwater**

WRI funding for research in stormwater management has resulted in changes to the NCDENR Stormwater BMP Manual. Bill Hunt, of NC State University, has conducted research into mitigation strategies for reducing the flow of stormwater and stormwater pollutant inputs into receiving waterbodies. Results of Hunt's research have been incorporated into multiple NCDENR Stormwater BMP Manual revisions. Hunt's use of drainage modeling software originally created for agriculture has allowed researchers to better evaluate stormwater BMPs. Additionally, research by Richard McLaughlin, of NC State University, into the use of polyacrylamide to reduce erosion at construction sites has provided managers multiple options for controlling and reducing sediment pollution associated with stormwater runoff from disturbed sites.

### **Potable Water Supply**

Droughts in the first decade of 2000 prompted state legislation calling for an increase in the use of reclaimed water. Mark Sobsey, of the University of North Carolina at Chapel Hill, developed new methods to detect and quantify pathogens in reclaimed water. Sobsey is building upon these findings by looking at the microbial quality of reclaimed waters in North Carolina and providing assessments of health risks based upon various water-exposure scenarios.

Reuse of graywater, or water from bathing and washing facilities that are not toilets or food preparation areas, also has potential to reduce pressures on source water. Francis de los Reyes, of NC State University, used

advanced molecular techniques to quantify the pathogens found in graywater. De los Reyes then used the findings to quantify the risk of infection associated with a wide range of exposure scenarios.

Orlando Coronell, of NC State University, has described the fouling properties of local source water on nanofiltration and reverse osmosis installations in the state and provided corresponding cleaning strategies. This information provides water treatment plant operators with locally tailored information about optimum cleaning strategies for membranes.

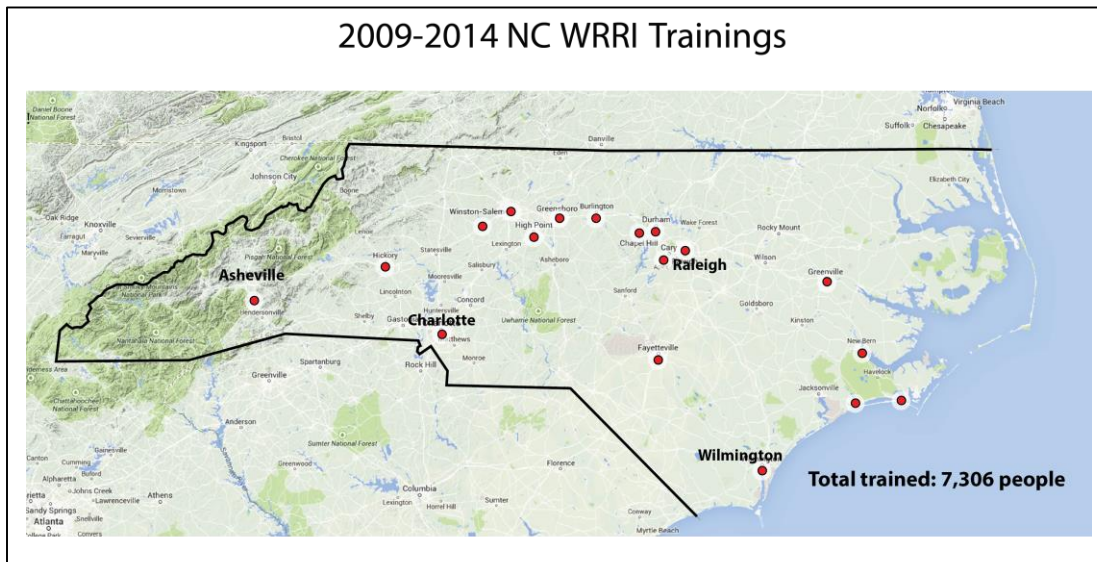
### **Toxics and Wastewater Treatment**

Increasingly, the public is concerned about chemicals in drinking water. Detlef Knappe, of NC State University, analyzed the removal effectiveness of drinking water treatment processes that are currently employed by members of the N.C. Urban Water Consortium. He determined, at a bench scale, what processes were most effective in removing some of the most common biochemically active compounds.

Knappe is closely examining the occurrence of, and treatment options for, 1,4-Dioxane in North Carolina drinking water sources. The chemical, which is an industrial and manufacturing byproduct of processes involving the chemical ethylene oxide, is a human health concern and probable carcinogen. It has been found in drinking water in multiple locations in the state. Working with wastewater treatment plants to create methods for identifying sources, Knappe is determining the factors that control concentrations.

### **More than Just a Funding Source**

Besides providing funding for research, WRI conducts education and outreach and provides expertise on numerous state, regional, and national commissions and committees.



**Education and Outreach**

Between 2010 and 2015, WRI has supported the degree activities of over 120 undergraduate and graduate students across six UNC campuses. WRI programs also engage 100 K-12 students per year in North Carolina public schools, and WRI education products and services reach over 3,000 individuals in universities, local governments, and private businesses across the state.

In 2010, WRI was made a Center of Excellence for Watershed Management by the U.S. Environmental Protection Agency. A new initiative cofounded by WRI in 2014 will assist watershed organizations within the state with watershed protection and restoration efforts. The North Carolina Watershed Stewardship Network, or WSN, fosters partnerships and shares the expertise of professional and volunteer stewards across North Carolina by providing online and in-person networking and skill-building opportunities. WRI and the UNC Institute for the Environment have provided funds for programming support. As a first step, the WSN has built the most comprehensive database of watershed organizations and programs in North Carolina. Development of an interactive web tool is underway that watershed organizations can use to easily share information and resources. To learn more, visit [www.ncwatershednetwork.org](http://www.ncwatershednetwork.org).

**Training and Expertise**

WRI provides technical and professional support to the NCDENR as required by the N.C. Sedimentation Pollution Control Act of 1973. The institute has trained over 10,000 erosion and sediment control professionals in 25 years. Between 2010 and 2015 alone, more than 5,840 individuals participated and received approximately 600 professional development units from WRI.

WRI also contributes expertise on numerous state, regional, and national commissions and committees, including as a governor appointee to the N.C. Sedimentation Control Commission.

**Looking Ahead**

For 50 years, WRI has worked to preserve, protect and enhance North Carolina’s water resources. By funding research and providing outreach and education, the institute links cutting-edge, locally applicable research with end-users. In 2015, WRI is developing a strategic plan to leverage its successes for maximum effectiveness moving forward into the future. The institute will continue to work with government agencies, universities, nonprofits, and industry to identify and address North Carolina’s water resource needs into the future.

