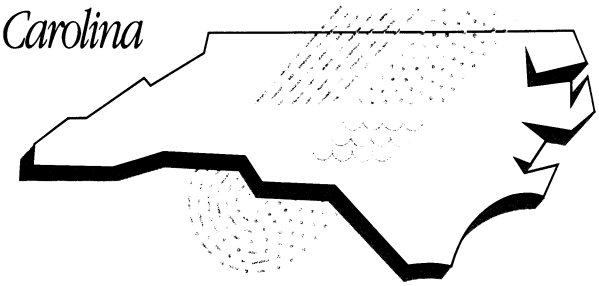
Water Resources Research Institute News
of The University of North Carolina



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# Straight talk from experts highlights 2000 WRRI annual conference

Keynote speakers and other experts at WRRI's 2000 annual conference didn't mince words about the aftermath of Hurricane Floyd, the effects of development and other drainage system modifications on flooding, and the smart way to address flooding in urban areas. In sum, their message was that the leaders and people of North Carolina need to "get real" about what it will take to recover from Hurricane Floyd and mitigate flooding that the predicted increase in tropical storms and hurricanes in North Carolina could bring—not just in the eastern part of the state but across the heavily urbanized Piedmont as well.

Keynote speaker Billy Ray Hall, who served as director of the Hurricane Floyd Redevelopment Center, said that North Carolina will be recovering from Hurricane Floyd for eight to ten years at a minimum. The disaster is estimated to have caused $5.5 billion in damages, including 63,000 houses flooded with 7,300 destroyed and a quarter of a million people displaced. Hall said that, at that time, federal and state funds committed to hurricane response under the Stafford Act amounted to about $1.5 billion. He said the N.C. General Assembly in special session committed $836 million to the recovery effort, "$504 million out of the hide of government."

"North Carolina is $416 million in the hole going into this session of the General Assembly," said Hall. "and along with all the other unmet needs for hurricane recovery, the lawmakers will have to face the need for $20 million in floodplain mapping to help local governments prepare for future events.

"What happens if this year we have a 200-year storm? North Carolina is in no position fiscally to respond to anything for the next four years unless someone's willing to run for governor and propose a tax increase to get us back on track."

## It won't take a hurricane

According to Dr. Stan Riggs of East Carolina University, it wouldn't take

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## Director's Forum

# It's time to revisit the turbidity standard

*Kenneth H. Reckhow, Director, Water Resources Research Institute*

An apparent loophole in the North Carolina water quality standard for turbidity in surface waters allows exceedances of the numeric standard under certain conditions. Given that sediment is regarded by some to be the major surface water pollutant in North Carolina, perhaps it is time to reconsider the way the standard is written.

The North Carolina water quality standard for turbidity for all fresh surface waters (Class C waters) states:

> *Turbidity in the receiving water will not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity will not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level cannot be increased. Compliance with this turbidity standard can be met when land management activities employ Best Management Practices (BMPs) recommended by the Designated Nonpoint Source Agency. BMPs must be in full compliance with all specifications governing the proper design, installation, operation and maintenance of such BMPs.*

Thus there are circumstances when the numeric limit (50/25/10 NTU) is exceeded but the standard, as written, is not violated. These circumstances allowing exceedances include waterbodies with turbidity from natural sources and turbidity from nonpoint sources for which approved practices (BMPs) have been properly implemented. It certainly seems possible that these exceptions could be common and constitute a large fraction of the observed exceedances.

Turbidity in surface waters is caused by fine suspended and colloidal material; turbidity prevents light penetration and gives water a cloudy appearance. Turbidity may be due to microorganisms or other organic matter in the water, but in areas of North Carolina with erodible soils, it is often caused by fine soil particles such as silt and clay. Land surface disturbance activities, such as construction and agriculture, create an environment for erosion of fine soil material that causes turbidity.

There are of course well-established erosion and sedimentation control practices that constitute approved BMPs referred to in the turbidity standard. When these practices are properly designed, installed, and maintained, they can be quite effective in the prevention of sediment movement to natural waters. However under certain conditions, it is recognized that these practices fail to prevent the fine soil particles causing turbidity from reaching surface waters. That results in the loophole in the standard.

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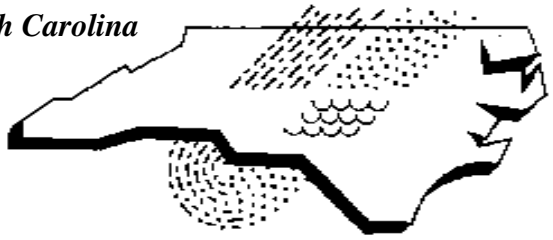

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*WRRI offices are located at 1131 Jordan Hall*
*on the North Carolina State University campus*
*Mailing address: Box 7912, NCSU, Raleigh, NC 27695-7912*
*Telephone: (919) 515-2815 General Email: water_resources@ncsu.edu*

***WRRI Staff***

*Director/Kenneth H. Reckhow (Ken_Reckhow@ncsu.edu)*
*Associate Director/ Robert E. Holman (Robert_Holman@ncsu.edu)*
*Newsletter Editor and Tech Transfer Spec/ Jeri Gray (Jeri_Gray@ncsu.edu)*
*Business and Administrative Officer/ Mary Sanford (Mary_Sanford@ncsu.edu)*
*Secretary/ Julie Mason (Julie_Mason@ncsu.edu)*

What should be done? Standard setting involves a balancing of costs and benefits. If the levels of turbidity in the standard are often violated downstream of land disturbance activities that are served by approved but ineffective BMPs, then the implication is that the additional erosion control costs to meet the numeric NTU levels are not justified by the expected benefits. Yet, in other situations, such as NTU violations due to non-construction urban runoff, the implication of the standard is that the turbidity control costs are justified.

This apparent inconsistency needs to be re-examined. Certainly, the total cost and distribution of costs of pollutant control can vary by source type and result in regulations that accommodate these variations. However, the acknowledged shortcomings of approved practices to adequately reduce turbidity strongly suggest that the Sedimentation Control Commission and the Environmental Management Commission should revisit the way this standard is written.

**Upper Cape Fear Workshop: Planning and Managing Urbanization to Protect Water Quality**

**June 7-8, 2000**
**Guilford County Agricultural Center**
**Greensboro, NC**

With population growth anticipated for the Piedmont-Triad region, it is more important than ever to take measures to guide future growth and development in a way that will ensure protection of water resources and quality of life over the long term. Join experts assembled by the N.C. Cooperative Extension Service and others for a unique opportunity to learn about technical and policy tools available for planning and managing growth to protect water quality.

This workshop is approved for 9 Professional Development Hours (PDHs) for Professional Engineers and has been submitted to the N.C. Board of Landscape Architects and the N.C. Chapter of the American Institute of Certified Planners for Continuing Education Credit.

For agenda and registration information, contact Joni Tanner at (919) 513-1678 or joni_tanner@ncsu.edu.

## *WRRI conference continued*

another 500-year storm to cause devastating flooding such as that seen following Hurricanes Dennis and Floyd.

"The cumulative impact of a series of slow-moving tropical depressions could produce a similar flooding event," said Riggs in his presentation.

Riggs said that the period from the 1960s to the early 1990s was a time of high growth and development in the state with few hurricanes, which encouraged severe modification of drainage systems and subsequent land-use changes and encroachment into the floodplain. Streams were channelized, Riggs said, and dikes were built along stream channels severely modifying the floodplain. Marginal wetlands were ditched and drained, destroying secondary floodplains and changing the hydrodynamics of drainage systems. These modifications significantly increased the water flow off the land and down the tributaries.

"We then compounded the problem by building more and more roads with small culverts and bridges across the streams and rivers, while filling the adjacent floodplains to form partial dams across the diminished floodplains," he said. "People and their infrastructure encroached into these altered wetlands and floodplains, and urban sprawl further increased the extent of impervious surface, diminishing infiltration and increasing runoff."

Given the severe modification of the earth's "plumbing system," when two back-to-back storms dumped extraordinary amounts of rain on Eastern North Carolina, disaster was inevitable.

"Ahoskie, which is high above any river, flooded because ditching and draining moved more water off the land faster, which was then held back by road dams," said Riggs.

According to N.C. DOT, 1,200 "road dams" blew out as a result of flash flooding from Floyd.

Riggs pointed out that one-third of the Tar River Basin drains to a constriction point in the Tar River just above Princeville (site of the worst flooding).

"Then the new Highway 64 road dam immediately downstream held that water back, " he said.

He said that because of Princeville's location in the meander in the floodplain, when the next storms come, "they'll get flooded again. It's their destiny."

Riggs said that society needs to "learn to live by the rules of a river" and realize that major alternation of runoff patterns and subsequent encroachment will always lead to disastrous human and economic consequences.

"However, the economic and political pressures are so severe that we are already moving back into the floodplain. Have we learned anything from these storms? We MUST deal with the cumulative impacts of development," he said.

### Dealing with cumulative impacts of development

Dealing with the cumulative impacts of development upstream is exactly what Charlotte-Mecklenburg is doing, according to Dave Canaan, Director of Storm Water Services for Mecklenburg County. Charlotte-Mecklenburg's aggressive approach is based on knowing how to deal effectively with the impacts from development upstream based on future, built-out conditions in the watershed. This requires up-to-date local data and careful data analysis, Canaan said.

According to Canaan, 100-year-magnitude storms in 1995 and again in 1997 proved that Mecklenburg County has serious flooding problems that could get worse as development in the fast-growing county continues. The county's floodplain maps, provided by the Federal Emergency Management Agency (FEMA), had been prepared in 1970 and were obviously inaccurate. Recognizing accurate floodplain mapping as a public safety issue, the Mecklenburg County Commissioners in June 1999 took the initiative and authorized funds for new floodplain mapping. The project will cost about $1.4 million with the county paying for 60% of it.

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## WRRI conference continued

By funding its own floodplain mapping project, Mecklenburg County will get updated maps more quickly and will also overcome one of the most serious shortcomings of FEMA maps. FEMA will not draw floodplain maps based on future landuse conditions. In places like Mecklenburg County, this is a significant concern because as little as six months after FEMA floodplain maps are made available, the maps are outdated due to development upstream. By using a built-out scenario to calculate its future floodplains, the county will have the tools necessary to establish floodway encroachment limits and minimum finished floor elevations for new structures to prevent future development from flooding.

Canaan said that the "knee-jerk" reaction to catastrophic flooding is to prohibit building in the floodplain. But, he said, "It's not building in the floodplain that causes flooding; it's upstream development. With intense development going on, we don't know where the floodplain is.

"With increased computing power and better rainfall and flood data [possible through USGS-local cooperative stream gaging] it is now easier to get good data with which to do the hydrologic/hydraulic analyses to produce useful floodplain maps," said Canaan.

Mecklenburg's pilot floodplain analysis led the county to begin revising its floodplain ordinance. Maps for all the county's watersheds are expected to be complete this summer.

Canaan said that floodplain ordinances derived from data-based analyses are more likely to solve local flooding problems than a "no development in the floodplain" policy.

"Local governments, FEMA and the state need to start treating floodplain mapping as a safety issue like fire and police protection," he said.

*Details about Mecklenburg County's floodplain remapping project are on the county's website at http://www.co.mecklenburg.nc.us/coeng/storm/floodinfo/floodinfo.htm.*

# N.C. Public Water Supply Section begins evaluation of water supplies

Over the next three years, the N.C. Public Water Supply Section (Division of Environmental Health, Department of Environment and Natural Resources) will investigate every source of public drinking water in the state and issue reports telling consumers how susceptible their water supply is to pollution. (The investigations will not include water sampling.) The studies and reports are required by the Safe Drinking Water Act Amendments of 1996.

Under the Source Water Assessment provisions of the 1996 amendments, states were required to develop and submit to EPA plans for conducting water supply evaluations. The N.C. Public Water Supply Section (PWSS) convened a Technical and Citizens Advisory Committee in September 1998 to provide advice on how the evaluations should be done. Additional TAC Advisory meetings were held in November and December 1998. The U.S. Geological Survey's N.C. District conducted pilot studies to test and further refine some of the methods that will be used in the evaluations. North Carolina submitted its Source Water Assessment Plan in February 1999, and the plan was approved in November 1999. The PWSS is now implementing its Source Water Assessment Plan.

Public drinking water watersheds and well areas will be evaluated in two phases.

The Phase I evaluation will rate public water supplies as to their risk for pollution. In Phase I, the boundaries of all surface water supply watersheds and the contributing areas of all public water supply wells will be delineated. (Because North Carolina has a Water Supply Watershed Protection Program, surface water supplies have already been delineated.) Then, each watershed or well area will be rated for its vulnerability to contamination, using geological and other physical criteria and methodologies specified in the plan (For an explanation of the rating methodology, see the U.S. Geological Survey report noted at the end of this article). Next, an inventory of potential contamination sources within the watershed or well area will be compiled from existing databases and databases currently being updated or created, and a contaminant rating will be established. Finally, the vulnerability rating and the contaminant rating will be combined to produce a susceptibility rating (or risk rating) of "higher," "moderate," or "lower" for each public water supply source.

Draft reports on the Phase I susceptibility ratings will be provided to public water supply systems for correction and verification. They will then be finalized and made available to the public. The reports and/or maps are expected to be available on the Internet. Public water supply systems must include in their annual Consumer Confidence Reports a notice that the source water evaluations are available, a summary of the results, and information about how customers

**Public Water Supply Systems in North Carolina**

| Type of System | Number of Surface Water Systems | Number of Groundwater Systems |
|---|---|---|
| Community | 140 | 1,940 |
| Non-transient non-community | 6 | 629 |
| Transient non-community | 5 | 5,359 |
| Total | 151 | 7,928 |

Community systems serve 15 or more connections or 25 or more people year round (cities, subdivisions, etc). Non-transient non-community systems serve the same 25 or more people for six months or more (schools, workplaces, etc.). A transient non-community system serves a population that changes frequently (restaurants, churches, etc. )

can get copies. Phase I assessments are expected to be finalized and ready for public release in June 2002.

Phase II evaluations will investigate in more detail the potential contaminant sources in watersheds and well areas, including examinations of permit information and other required records of individual facilities. Phase II evaluations will be completed for public water supply sources that are rated "higher" for susceptibility to contamination, to the extent that budget and time constraints permit. The Source Water Assessment Plan establishes criteria for deciding which source waters with "higher" ratings should receive Phase II evaluations first. Phase II assessments are expected to be issued in May 2003.

According to Jessica Miles, Chief of the N.C. Public Water Supply Section, source water assessments are meant to be informational tools that consumers can use to protect their drinking water sources. Miles said that the state will develop a Source Water Protection Program through which public water supply systems and their customers can receive financial or technical assistance to develop voluntary source water protection programs.

Those interested in the technical details of how source water evaluations in North Carolina will be done can access *North Carolina's Source Water Assessment Program Plan* at the N.C. Public Water Supply Section's website at http://www.deh.enr.state.nc.us/pws/index.htm or by contacting Elizabeth Morey of the Public Water Supply Section at (919) 715-0674 or Elizabeth.Morey@ncmail.net. The U.S. Geological Survey has also published a report on its pilot study of methods for rating the vulnerability of watersheds and wells to pollution. The report, *Methods of Rating Unsaturated Zone and Watershed Characteristics of Public Water Supplies in North Carolina* by J.L. Eimers, J.C. Weaver, Silvia Terziotti and R.W. Midgette is available at http://water.usgs.gov/pubs/wri/wri994283. A copy can be obtained from the N.C. District Office at (919) 571-4000.

# Governor names Sedimentation Control Commission members

Governor James B. Hunt, Jr. has named four individuals to the N.C. Sedimentation Control Commission (SCC) to replace commissioners whose terms expired.

Kenneth H. Reckhow has been named chairman of the SCC. Reckhow is a professor in the Duke University Nicholas School of the Environment and director of The UNC Water Resources Research Institute (WRRI). The Sedimentation Pollution Control Act mandates that the director of WRRI serve on the SCC, but the governor chooses the chairman.

Phillip Gibson of Cullowhee has been named to fill one of two seats on the commission reserved for a "nongovernmental conservationist." Gibson is natural resources program manager for Western North Carolina Tomorrow, a nonprofit organization headquartered at Western Carolina University.

Ralph Stout of Greensboro has been named to the commission as representative of the Carolinas Associated General Contractors (AGC). Stout is president of Southern Seeding Service, Inc.

Kyle Sonnenberg has been named to the commission as a representative of local government. Sonnenberg is town manager of Southern Pines.

At press time, several appointments or reappointments to the SCC remained to be made.

Following is the list of current commissioners with contact information:

Dr. Kenneth H. Reckhow, Chairman
(Director WRRI)
Box 7912, NCSU
Raleigh, NC 27695-7912
(919) 515-2815

Daniel V. Besse
(Rep. N.C. Environmental Management Commission)
P.O. Box 15306
Winston-Salem, NC 27113
(336) 722-1674

Donnie W. Brewer, P.E.
(Rep. Professional Engineers of N.C.)
Rivers & Associates, Inc.
P.O. Box 929
Greenville, NC 27835
(252) 752-4135

John R. Bratton
(Rep. N.C. Mining Commission)
Wake Stone Corp
P.O. Box 190
Knightdale, NC 27545
(919) 2660-1100

James Ferguson
(Rep. Soil and Water Conservation Commission)
11571 Betsy Gap Road
Clyde, NC 28721
(828) 627-6458 (H)

Phillip Ray Gibson
(Nongovernmental conservationist)
Western North Carolina Tomorrow
P.O. Box 222
Cullowhee, NC 28723
(828) 227-7492

Dr. Wendell Gilliam
(Member, NCSU Soil Science faculty)
Box 7619, N.C. State University
Raleigh, NC 27695-7619
(919) 515-2040

Ray B. Killough
(Rep. N.C. public utility)
Piedmont Natural Gas
P.O. Box 33068
Charlotte, NC 28233
(704) 364-3120 Ext 273 (O)

Kyle Sonnenberg
(Rep. Local Government)
Town Manager
125 Southeast Broad St.
Southern Pines, NC 28387-9524
(910) 692-7021

Ralph Stout, Jr.
(Rep. Carolinas AGC)
Southern Seeding Service, Inc.
P.O. Box 22092
Greensboro, NC 27420
(910) 292-2917

Fred Roger Watson
(Rep. Home Builders Assoc.)
MSD-Buncombe County
2000 Riverside Dr. Business Park
Asheville, NC 28054

# April/May action of the N.C. Environmental Management Commission

At its April 2000 meeting the N.C. Environmental Management Commission took the following action:

■ Approved temporary rules and rulemaking for permanent rules to establish a compliance schedule for technical requirements for underground storage tanks (USTs) located near water supply wells and certain surface waters. Inspections and surveys had revealed that about 80% of USTs within 500 feet of water supply wells serving convenience stores have not been upgraded with secondary containment as required. The rules will establish dates by which tank owners must meet specific secondary containment requirements and will also require installation of leak detection devices, tightness testing, and sampling of water supply wells.

■ Approved alternatives to be presented at public hearings for controlling nitrogen oxides (NOx) from utilities. For public hearing dates and locations, check the events calendar on the N.C. Division of Air Quality website at http://daq.state.nc.us/.

■ Approved a report prepared by staff of the Division of Water Quality examining "whether and under what circumstances a privately owned wastewater collection system or treatment works may be required to connect to a publicly owned treatment works in order to protect public health or the environment." The report, to be made to the legislative Environmental Review Commission, was required by House Bill 1160, the Clean Water Act of 1999. The report found that publicly owned wastewater facilities are assessed fines for violations of pollution rules more frequently than privately owned facilities (see table on right). It concluded that, given the violation records, "it may not be appropriate to single out privately owned facilities for connection to publicly owned facilities." The section of the report titled "Departmental Perspective," warns that requiring private facilities to connect to public facilities can have a negative impact on the public facilities and that there are other ways to bring private facilities into compliance. The staff report found that public school systems are frequent violators of NPDES permits, with 42.3% of all permitted school facilities having been fined. Commissioner Robert Epting pointed out that fines for environmental noncompliance are not retained by the state but are returned to the county where the violation takes place, and that counties, therefore, have no incentive to bring their schools into compliance. "A school board writes a check for the fine and gets it back next week," said Epting. Commissioners directed staff to explicitly inform the legislature of the problems with school systems and convey suggestions from the Commission on possible ways to help bring schools into compliance.

■ Approved a major variance to the Tar-Pamlico riparian buffer rule for residential construction on existing lots on barrier islands, principally Ocracoke.

In May, the EMC took the following action:

■ Approved initiating permanent rulemaking to delineate and establish the Central Coastal Plain Capacity Use Area and establish a rule to regulate water use through permitting in this capacity use area. A public hearing is expected to be held in September, and the rule is expected to be presented to the EMC for approval in October. A staff request to adopt a temporary rule for this capacity use area was withdrawn at the last minute, but commissioners noted that the EMC could still consider adopting a temporary rule after receiving input at the public hearing. For information contact Nat Wilson with the N.C. Division of Water Resources at (919) 715-5445.

■ Postponed consideration of adoption of permanent rules for control of nutrient inputs from agriculture, stormwater and nutrient management in the Tar-Pamlico River Basin. Management of grazed pasture remains an issue and needs to be addressed in stakeholder meetings, according to Commissioner Charles Peterson.

■ Approved the final French Broad River Basinwide Water Quality Plan.

■ Delegated to the Water Quality Committee authority to grant individual variances from riparian buffer rules in the Tar-Pamlico Basin and any subsequently adopted riparian buffer rules.

**Types of permitted wastewater facilities and records of fines assessed for permit violations (7/1/98 through 3/15/00)**

| Type of facility | Number of facilities | Number Assessed | Percent Assessed | Number Assessed 3-4 times | Number Assessed 5-10 times | Number Assessed >10 times |
|---|---|---|---|---|---|---|
| Major Municipal | 147 | 39 | 26.5% | 10 (25.6%) | 2 (5%) | 0 |
| Major Private | 102 | 11 | 10.7% | 3 (27.3%) | 0 | 0 |
| Minor Municipal | 165 | 70 | 42.4% | 25 (35.7%) | 4 (5.7%) | 2 (2.9%) |
| Minor Private | 1013 | 206 | 20.3% | 34 (16.5%) | 23 (11.2%) | 3 (1.5%) |
| School | 182 | 77 | 42.3% | 11 (14.2%) | 5 (6.4%) | 2 (2.6%) |

Figures taken from the report "Regionalization of Privately Owned Wastewater Treatment Facilities," March 31, 2000. Prepared by the Division of Water Quality of the N.C. Department of Environment and Natural Resources in response to House Bill 1160.

# April/May action of the EMC Water Quality Committee

At its April 2000 meeting the Water Quality Committee of the N.C. Environmental Management Commission (EMC) took the following action:

■ Heard a staff report on issues relating to animal waste lagoons. Dennis Ramsey of the Division of Water Quality told commissioners that a database of inactive lagoons is being compiled and that there are currently about 1,000 lagoons in the database. Ramsey said that each lagoon is being evaluated on site to determine the risk it poses and to begin prioritizing lagoons for possible closure. Ramsey said that a notice of rulemaking on new performance and technical standards for animal waste management technologies was published in the March 15, 2000, *N.C. Register* and that comments are being taken on the proposal.

■ Heard a report from Assistant DENR Secretary Robin Smith on the department's development of recommendations for new floodplain legislation/regulations. Smith said the department is working on amendments to the state statute related to flood ways that would allow the EMC to develop regulations to address floodplain management. She said the current law allows local governments to regulate development for purposes of floodplain management and that a possible amendment might allow the EMC to establish minimum standards and allow the State to step in where local governments fail to implement minimum standards. (The legislative Environmental Review Commission is considering this legislation and may introduce it in the current Short Session.)

■ Heard an update on the development of Coastal Habitat Protection Plans. As part of the Fisheries Reform Act of 1997, the N.C. General Assembly required the Coastal Resources Commission, the Marine Fisheries Commission and the EMC to approve plans to help protect and restore resources critical to North Carolina's commercial and recreational fisheries. The Department of Environment and Natural Resources (DENR) is developing the plans, which must protect habitats including wetlands; spawning areas; threatened and endangered species habitat; primary and secondary nursery areas; shellfish beds; submerged aquatic vegetation; and Outstanding Resource Waters. Public meetings have been held to receive input for development of habitat protection plans in the Coastal Oceans Management Unit—which includes the barrier islands, ocean waters, submerged habitats, and seashores—and for the Chowan Management Unit. Draft plans for these units are expected to be ready for review by the Intercommission Review Committee in October. The next public meetings are scheduled for February 2001. All plans must be complete by 2003. For more information on the Coastal Habitat Protection Plans visit the N.C. Division of Marine Fisheries website at http://www.ncfisheries.net/habitat/chpp1.htm.

In May, the Water Quality Committee took the following action:

■ Approved Water Supply Watershed Protection Ordinances for Jackson and Northampton counties and the Towns of Beech Mountain, Star, and Stoneville.

■ Approved criteria and a model ordinance amendment for density averaging involving noncontiguous parcels of land in water supply watersheds. Density averaging is allowed by the Water Supply Watershed Protection rules. The adopted criteria give local governments guidance on modifying ordinances to implement density averaging in a way that will comply with minimum standards.

# Third round of allocations from Jordan Reservoir to begin

An ad hoc committee of the N.C. Environmental Management Commission voted May 10 to ask the full commission to begin a new round of allocations of water supply from Jordan Reservoir. The action came in response to a request by the City of Durham that the commission reconsider its round-two allocations, which denied Durham a share of the water supply. Durham's new long-range water and sewer plan projects its raw water demands will exceed the safe yield of its existing reservoirs in 2006. Rather than reopening the round-two allocation process as requested, the EMC committee voted to initiate a third round of allocations and instructed the staff of the Division of Water Resources to develop an accelerated schedule for the process. Commissioners want a schedule that will bring third-round allocation recommendations to the full EMC within a year. The ad hoc committee, chaired by Commissioner Leo Green, will hold a phone meeting in June to consider the third-round allocation schedule. For more information contact Tom Fransen with the N.C. Division of Water Resources at (919) 715-0381.

# Digest

**"New" state aquarium.** After two years of expansion construction, the N.C. Department of Environment and Natural Resources opened its "new" North Carolina Aquarium on Roanoke Island, near Manteo on May 19. At approximately 68,000 square feet, the "new" aquarium on Roanoke Island is twice its former size and features hundreds of animals found in North Carolina's diverse aquatic environments. The Roanoke Island Aquarium is home to the state's largest ocean tank. For more details about the Roanoke Island aquarium visit website http://www.aquariums.state.nc.us/files/watersobx.htm, or visit the aquarium on Airport Road, three miles north of Manteo, off US 64, adjacent to the Dare County Regional Airport.

**N.C. facts from the 1997 Natural Resources Inventory.** According to the USDA Natural Resources Conservation Service, during the period 1992 to 1997 North Carolina ranked fifth in the nation in number of acres of nonfederal land converted for development. During that time, about 156,300 acres of land previously used for cropland, pasture, and forest were converted for urban and transportation uses. During 1982-1992, North Carolina had ranked third in acres developed, with 93,580 acres being converted. In 1982, 8.6% of all nonfederal land in the state was in urban and transportation uses. By 1997, that figure had risen to 14.7%. Nationwide, the rate of development more than doubled between 1992 and 1997 to 3 million acres per year.

**Capturing carbon by no-till**. According to the Conservation Technology Information Center, no-till agricultural systems can sequester 400 pounds to 800 pounds of carbon per acre (or 1.4 tons of carbon dioxide/acre/year) in the top two inches of the soil and can increase organic matter approximately 0.1 percent per year. On the other hand, every tillage trip mixes oxygen into the soil, oxidizing organic matter and releasing carbon dioxide into the atmosphere. Capturing carbon is thought to be important because excess carbon dioxide in the atmosphere increases radiation of heat back to earth and traps heat at the earth's surface, perhaps contributing to global warming. In 1998, North Carolina led the south in increase in the use of conservation tillage on cropland, with no-till being the most popular system used. According to the Natural Resources Conservation Service, over 25% of 4,832,522 acres of cropland in North Carolina were planted in no-till for 1998.

**Bottled water labeling**. The Safe Drinking Water Act Amendments of 1996 require all public water supply systems to provide consumers annual reports on the quality of their drinking water. These reports must tell customers where their water comes from, what contaminants have been detected in the water and how the levels detected compare to the limits set by EPA, what health effects detected contaminants could have, and whether the system is complying with all National Primary Drinking Water Regulations. The reports provide customers of public water supply systems information on which to base an assessment of the safety of their drinking water. People who drink bottled water do not have the same information. Bottled water is regulated by the U.S. Food and Drug Administration (FDA), and only nutritional information is currently required on bottled water labels. However, the Safe Drinking Water Act Amendments also require that FDA study the feasibility of methods of informing customers about contents of bottled water, and public water suppliers are lining up against the bottled water industry in an effort to influence what information consumers get. In February, FDA published in the *Federal Register* (Feb 22, 2000, Vol. 65, No. 35) its draft study report, with comments due by April 24. The International Bottled Water Association (IBWA) issued comments on the report, saying that "new federal regulations calling for additional labeling or other requirements are unnecessary." IBWA maintains that its Model Code "establishes tougher requirements for bottled water than federal and state authorities," and that "quality control and labeling practices for bottled water are already, by federal and state law, among the most stringent for any food product." On the other hand, public water supply systems, as represented by the American Water Works Association, have issued statements saying that consumers of bottled water ought to be provided the same information that public water supply customers get, including information on what kind of treatment the water has received. FDA says it will consider comments on the draft and publish a final report identifying appropriate methods of providing information on bottled water, if it determines there are any. FDA does not say when it expects to publish the final report. Several studies have raised questions about the quality of bottled water. A study at Case Western Reserve School of Dentistry in Cleveland recently compared the quality of Cleveland tap water and 57 samples of bottled water from local stores. The investigators found that only three samples of bottled water tested had the recommended amount of fluoride, while all tap water samples did. It also found bacterial levels in bottled water ranging from 0.01 colony-forming units per milliliter to 49000 CFUs/mL. It found bacterial counts in samples of tap water ranged from 0.2 to 2.7 CFUs/mL. In its *Federal Register* notice, FDA said that because bottled water is often recommended for immune-compromised individuals, information on how the water has been treated—particularly for inactivation of Cryptosporidium—may be appropriate to put on a bottled water label.

**Conservation plumbing vote in House.** On April 12, the House Subcommittee on Energy and Power voted by a one-person margin not to send forward Representative Joe Knollenberg's bill that would amend the Energy Policy and Conservation Act of 1992 to eliminate the federal

standard for low-flow plumbing products. Among the bill's co-sponsors were N.C. representatives Richard Burr, Walter B. Jones, Jr., Sue Myrick, and Cass Ballenger. The American Water Works Association (AWWA), drinking water organizations, plumbing equipment manufacturers, and environmental organizations had lobbied to defeat the bill. AWWA says that it is possible the provisions of the bill will be added to other bills in this Congress and that Rep. Knollenberg has said he will reintroduce the bill in the next Congress. According to AWWA, "the new and efficient plumbing products are a cornerstone for local water conservation programs that avoid the added cost to consumers of new infrastructure. The regulatory stability provided by current Federal law is important to the U.S. plumbing industry."

**Defending the sludge regulations.** On March 22, the U.S. House Science Committee held a hearing to investigate whether EPA, in its development and enforcement of the Part 503 Sludge Rule, failed to foster sound science with an open exchange of ideas and information between scientists, EPA officials, and private citizens. The 503 Sludge Rule allows land application (spreading) of sewage sludge to fertilize or condition the soil. Although the 503 Sludge Rule establishes minimum quality standards for sludge to be land applied, some scientists, including scientists at EPA, question the adequacy of these standards. Some have proposed more stringent standards, additional source separation and greater pretreatment of contaminants. The hearing also explored allegations that EPA scientists who disagree with EPA's science associated with the sludge rule were ignored or, worse, subjected to harassment as well as reports of intimidation directed at private citizens who express concerns about EPA sludge policies and the science behind those policies. The hearing testimony is available at website http://www.house.gov/science/106_hearing.htm#Full_Committee

# Efforts to eliminate MTBE promise major political debate

At a March 20 press conference, U.S. EPA Administrator Carol Browner announced that the agency had taken the first step toward eliminating use of the fuel additive MTBE (methyl tertiary butyl ether) by publishing notice that rulemaking will be initiated under the Toxic Substances Control Act to eliminate over three years the use of MTBE in gasoline. Browner characterized the rulemaking as a "backstop" and said that the Clinton Administration will also send Congress a legislative package that would ban MTBE but mandate content levels in gasoline for ethanol and other "biofuels." The administration's proposal is supported by groups such as the Renewable Fuels Association and the Governors' Ethanol Coalition.

MTBE, a compound first used as an octane enhancer and then as an oxygenate, has contaminated an estimated 21% of ambient groundwater and 5% to 10% of community water wells in areas where it has been widely used. Moreover, according to an article in the May 1, 2000, issue of *Environmental Science & Technology*, "significant numbers of MTBE releases may . . . continue to reveal themselves as problematic sources of contamination for the nation until at least 2010." While the health effects of MTBE are uncertain, contamination at low levels can render water supplies useless by altering taste and odor. (See *WRRI News* March/April 2000). While there is widespread—although not universal—agreement that the use of MTBE must be eliminated, opinions vary about what—if anything—should take its place as an oxygenate in motor fuels for areas experiencing ozone or smog problems.

Last year the National Research Council (NRC) released results of a study of the differences between the additives ethanol and MTBE. According to the report, gasoline made with ethanol is less effective in reducing ozone pollution but "the overall impact of either oxygen additive on reducing ozone . . . is very small." NRC said that reductions in ozone-forming emissions, which EPA has attributed to oxygenated fuels, is "largely because of better emissions control equipment and components of reformulated gasolines—other than oxygen additives—that improve air quality."

In Congress, Senator Bob Smith (R-NH), chairman of the Senate Environment and Public Works Committee, has voiced opposition to mandating the use of ethanol or other "renewable fuels" in reformulated gasoline, saying that he sees no basis for replacing one mandate with another.

In February, the Northeast States for Coordinated Air Use Management, the American Lung Association and the American Petroleum Institute announced their support for eliminating the oxygenate standard. The Oxygenated Fuels Association immediately issued a statement saying that eliminating the standard would result in "a national fuel disaster"

At press time no bills had been introduced that would either mandate the use of renewable fuels or repeal the oxygenate standard. However, at last count, 14 bills had been introduced in Congress to deal with one or more aspects of the MTBE problem. Some bills would simply ban the use of MTBE. Some would allow states to waive the oxygenate content requirement for reformulated gasoline if they could show they can maintain national ambient air quality standards without it. Some would ban MTBE and facilitate, but not mandate, the use of ethanol by requiring Clean Air Act rule changes.

Bills have also been introduced that would provide funding for research on ways to remove MTBE from drinking water and for other purposes, provide grants to states where governors have declared drinking water emergencies due

*continued page 10*

## MTBE continued

to MTBE contamination, direct priority funding from the federal leaking underground storage tank trust fund to areas where drinking water has been contaminated by MTBE, and require state source water assessment programs to prioritize groundwater areas and aquifers contaminated by or vulnerable to contamination by MTBE.

Several bills and one Congressional Resolution would express the sense of Congress that the United States should promote renewable ethanol to replace MTBE.

Because of the many powerful stakeholder groups involved, observers and some in Congress are predicting that the issue of how to modify the reformulated gasoline requirements in the Clean Air Act will be one of the major political debates of the current session.

# Carolina Onsite Water Recycling Association formed

A group of individuals representing agencies, organizations, and companies with interests in on-site wastewater treatment and disposal have formed the Carolina Onsite Water Recycling Association (COWRA). Willem van Eck of Cary is president of the new organization. The purpose of COWRA is to promote management of "all onsite aspects of the hydrologic cycle." It will provide information and education to encourage the proper maintenance of wells as well as "water recycling systems," or septic systems.

According to van Eck, "COWRA looks ahead to a day when onsite wells and water recycling systems are expertly designed, built, planned, and installed as well as accurately mapped and recorded as a reference basis for perpetual servicing and maintenance by private contractors within public water utility districts."

For more information, contact van Eck at wvaneck@mindpsring.com or (919) 380-1202.

# WRRI reports available

*WRRI has recently published peer-reviewed technical completion reports on research projects for which it provided funding. Single copies of WRRI reports are available free to federal/state water resource agencies, state water resources research institutes, and other water research institutions with which exchange agreements have been made. Single copies of publications are available to North Carolina residents at a cost of $4 per copy prepaid ($6 per copy if billed) and to nonresidents at a cost of $8 per copy prepaid ($10 per copy if billed). Send requests to WRRI, Box 7912, North Carolina State University, Raleigh, NC 27695-7912 or call (919) 515-2815 or email: water_resources@ncsu.edu.*

***Bacterial Regrowth in Drinking Water Distribution Systems: A Comparison of Durham and Raleigh***
**Report 326 January 2000**

*Francis A. DiGiano, Donald E. Francisco, Weidong Zhang, and Laura Todd*
Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

Studies have shown that "adequate" residual disinfectant concentration leaving the water treatment plant does not guarantee control of bacterial regrowth. From a regulatory point of view utilities are concerned with the presence of bacteria in the bulk water of their distribution systems. However, these bacteria very likely originate from attached growth on the pipe walls. The relationship between attached and unattached (bulk-water) bacteria is complex and not well understood.

This research was directed toward investigating the factors influencing both attached and unattached bacteria in two distribution systems that use different disinfectant strategies. The City of Durham uses chlorine while the City of Raleigh uses chloramines by addition of ammonia to chlorine. This comparison is especially important in North Carolina because many water utilities are interested in switching from chlorine to chloramines in order to meet new U.S. Environmental Protection Agency (EPA) regulations related to reduction of chlorine disinfection byproducts.

Regrowth was measured by heterotrophic plate count (HPC) using R2A agar. An experimental apparatus and analytical procedures were developed to measure the attachment of bacteria. A comparison was made of attachment to cast iron, ductile iron, and glass during exposure to low and high concentrations of chlorine and chloramine. Monthly sampling of bulk water over 17 months at 10 stations provided about 160 measurements of each chemical and microbial parameter considered important in assessing the bacterial regrowth problem. The average assimilable organic carbon (AOC) was found to be high enough to support bacterial regrowth if the disinfectant residual concentration was low but not necessarily as low as the detection limit of about 0.2 mg/L.

Maintenance of sufficient disinfectant residual depends on control of oxidant demand, but this could strongly depend on minimizing corrosion within the system. Chloramine seems to offer greater promise in controlling this growth because it persists at higher concentrations for a longer time in the distribution system. Notwithstanding its stability, given enough time and the presence of oxidant demand, chloramine will decrease as was evident at one of the 10 stations included in Raleigh. In addition, excess ammonia led to nitrification which further decreased chloramine residual.

The effectiveness of controlling regrowth by either flushing (Durham), or switching from chloramine to chlorine for one month (Raleigh) is doubtful. This research showed that the HPC returned in

a short time to values found before either control measure.

Measurement of attached growth showed that high concentrations existed on the surface of cast iron and ductile iron pipe material in the absence of disinfectant residual. More important, attached growth existed even when the bulk-water disinfectant concentration was high; this was true for both chloramine and chlorine residuals.

A simple regression model revealed that the most important factor affecting HPC was disinfectant residual although to a much lesser extent, temperature, AOC, and pH were shown to be important. However, a more powerful statistical approach combined with more frequent data collection at more sampling sites would be needed to yield better results from regression modeling but at considerable expense. The alternative is a mechanistic model of the regrowth process or better yet, a mechanistic model that accounts for uncertainty in parameter estimation.

### *Geochemical Tracers of Groundwater Movement between the Castle Hayne and Associated Coastal Plain Aquifers*
**Report 328 February 2000**

*Terri L. Woods, E. Glynn Beck, Delynda L. Tolen-Hehlhop, Rae Troiano and J. Kevin Whitley*
Department of Geology, East Carolina University

Cretaceous aquifers are important sources of water supply in the North Carolina Coastal Plain. Significant water level declines in the Cretaceous aquifers will drive increased exploitation of the Castle Hayne and other Cenozoic aquifers. Adequate chemical and hydrologic data are necessary for prudent management of this resource. This investigation focused on the Castle Hayne Aquifer. The Castle Hayne is the most productive aquifer in the area. It is already extensively developed for industrial uses and is fast becoming an important source for public water supply.

A preliminary study had provided basic chemical and strontium isotopic signatures for waters from the Castle Hayne, a marine limestone of Eocene-Oligocene age. Concentrations of $SO_4$, Cl, Sr, Ca, and Mg, alkalinities, and strontium isotopic ratios could not be completely explained by dissolution of aquifer materials along flow paths. Leakage into the Castle Hayne from underlying and overlying units appeared to have a significant impact on water chemistry; therefore, a major objective of this research was to identify and characterize the various waters entering the Castle Hayne. The chemical and strontium isotopic signature of groundwater from the Pliocene Yorktown and Upper Cretaceous Peedee were studied. Previously collected data were evaluated along with samples collected for this study.

This study confirms previous results that indicate mixing within the Castle Hayne of freshwater and water with a dissolved salt composition similar to that of seawater. The major geochemical processes determining Upper Castle Hayne Aquifer groundwater compositions are: (1) dissolution of aquifer minerals, (2) leakage of water from overlying aquifers and surface waters, (3) mixing along the salt water/fresh water interface, (4) intermixing of saltier groundwater from underlying aquifers, (5) exchange with aquifer minerals, (6) dissolution of salts from soils.

Among the study's conclusions are:

- Eastern waters, high in total dissolved solids, alkali and chlorine, are heavily influenced by mixing with saline formation waters, especially near heavily pumped wells supplying municipalities.

- Along the coast, old river channels such as that of the paleo-White Oak River under Bogue Banks appear to allow seawater to move inland more readily than other deposits.

Among the study recommendations are:

- Locations of paleo-river channels in coastal regions should be determined because these old river channels (as well as old tidal inlets) appear to allow seawater to move inland more readily than other depositions along the coast.

- The possibility that recharge of acidic, organic-rich waters from swamps, lakes and water-logged soils into deeper aquifers is occurring in some places should be investigated, as this process can significantly affect water quality.

- High-iron content is one of the most expensive water quality issues to deal with. Therefore, the processes causing rapid changes in the iron content of aquifers in their recharge areas should be investigated.

**Corrections**

There were two errors in the March/April 2000 issue of the *WRRI News*:

- North Carolina's current groundwater standard for arsenic is 0.05 milligrams per liter mg/L (50 micrograms per liter), the same as the current EPA standard, not 0.5 milligrams per liter (500 micrograms per liter) as stated on page 9. As stated correctly on page 6, rulemaking is underway to change the N.C. standard from 0.05 mg/L to 0.00002 mg/L.
- A multimedia radon mitigation program would not necessarily be strictly voluntary, as stated on page 11. Building codes could be changed to require radon barriers in new homes, and real estate laws could be modified to require testing and mitigation at time of resale.

# Fate of proposed TMDL rule uncertain

Spurred by continuing lawsuits seeking to force implementation of Section 303 (d) of the Clean Water Act and uncertainty among states about how to implement the program, the U.S. EPA in August 1999 proposed changes to total maximum daily load (TMDL) rules. These rules specify how states are to identify waters that are not in compliance with water quality standards, establish priorities, and implement improvements. Proposal of rule changes followed more than two years of study by a TMDL Federal Advisory Committee.

Under the proposed rules, some currently unregulated sources (animal operations, aquacultural operations, and some forestry operations) causing water quality problems could be required to have NPDES permits. In addition, large new and significantly expanding dischargers to impaired waters would be allowed only when they commit to reducing pollution from other sources by 1.5 pounds for every pound they add.

Significant opposition to the proposed TMDL rules emerged among agricultural and forestry interests, and states expressed concern over the workload and costs of the proposed TMDL program. The comment period was extended and closed on Jan 20, 2000. EPA has said that it plans to issue the final rule this summer.

Meanwhile, on March 30, 2000, a Federal district court in San Francisco affirmed EPA's and states' authority to identify waters impaired by nonpoint sources and develop TMDLs for such waters under section 303(d) of the Clean Water Act. The decision came in a suit filed by the American Farm Bureau Federation and other agricultural and timber groups to prevent development of a sediment TMDL for the Garcia River.

After being called to Congress several times to answer questions about the TMDL program, EPA sent a letter on April 5 to Congressional leaders highlighting the expected elements of the final TMDL regulation. In the letter from Assistant Administrator for Water Chuck Fox, EPA says the final rule will drop the requirement for offsets of new pollution and revise the forestry requirements to clarify that NPDES permits will not be required for runoff from forestry operations under any circumstances.

Nevertheless, on April 13, Senator Bob Smith (R-NH), chairman of the Senate Environment and Public Works Committee, and Senator Michael Crapo (R-ID), chairman of the Subcommittee on Fisheries, Wildlife and Water, introduced a bill that would block for 18 months implementation of the TMDL program. The senators say they are concerned that the proposed rule "could dramatically change the relationship between states and the federal government in regulating certain sources of water pollution," that "the draft rules are not sufficiently supported by sound science," and that the rules "represent a dramatic departure from current regulations."

# National Wildlife Federation says North Carolina one of few implementing TMDL's

In a recent report titled *Pollution Paralysis II: Code Red for Watersheds*, the National Wildlife Federation rated states' efforts to clean up nonpoint source pollution through the Clean Water Act Total Maximum Daily Load (TMDL) requirements. The current report is a follow-up to one prepared in 1997 which found that "with few exceptions, the states were doing a poor job in implementing this critical tool." The current report concludes that states are still not properly using TMDLs. The report grades states' efforts. There were no A's. North Carolina was one of six states that got a B for "improved." There were six C's for "mediocre." All the other grades were D's and F's. The report is available in pdf format at website http://www.nwf.org/nwf/watersheds/paralysis/index.html.

# TMDL rules promise gains in water quality but present implementation challenges, paper says

In a discussion paper made available in March, James Boyd of Resources for the Future says that EPA's proposed total maximum daily load (TMDL) rules promise to expand the gains in water quality accomplished over the first 25 years of the Clean Water Act by taking "an inevitable step toward a mature phase of regulation in which all sources of water quality degradation are addressed."

However, Boyd says the new TMDL rules present a host of implementation challenges that call for tempered optimism:

- Creating scientifically based, legally meaningful causal links between dispersed nonpoint sources, controls, and changes in pollutant loads is difficult, and developing technical underpinnings of TMDLs will be costly.
- Resistance from unregulated nonpoint source interests together with limited federal authority to compel their compliance will act as a brake on efforts.
- The proposed TMDL rules' emphasis on trading will simply serve as a distraction in the near term because monitoring and enforcement mechanisms to compel corrective actions by nonpoint sources are not in place.

The discussion paper, "The New Face of the Clean Water Act: A Critical Review of the EPA's Proposed TMDL Rules" (Discussion Paper 00-12) is available in pdf format at web address: http://www.rff.org/disc_papers/PDF_files/0012/pdf.

# Western North Carolina Tomorrow offers guide to home building or buying in the mountains

Breath-taking views and peace and quiet lure many people into buying property in Western North Carolina. However, if property buyers don't take the time to examine the environmental considerations when buying or building a home on rugged mountain terrain, they may end up spending thousands of dollars and suffer many hardships.

Due to the complexities and variations within the mountain region, there are certain limitations that may arise when purchasing mountain property. Some of these include steep slopes, shallow, rocky soils and flood plains, problems with septic systems and the availability of high-quality drinking water.

To help potential buyers with some of the complications that may arise when buying mountain property, Western North Carolina Tomorrow, a nonprofit citizen leadership organization that addresses regional issues, has published a booklet, entitled "A Mountain Home Guide: Buying Mountain Property, Building a Mountain Home, Nine Factors to Consider."

Copies of the booklet are available at Western North Carolina Tomorrow's website, http://www.wnct.org.

The booklet is also available by contacting WNCT at P.O. Box 222, Cullowhee, NC, 28723, or by calling Phillip Gibson or Betty Dishman at 828-227-7492 or 1-800-621-0008. A donation of $2.00 is suggested to cover the cost of the booklet.

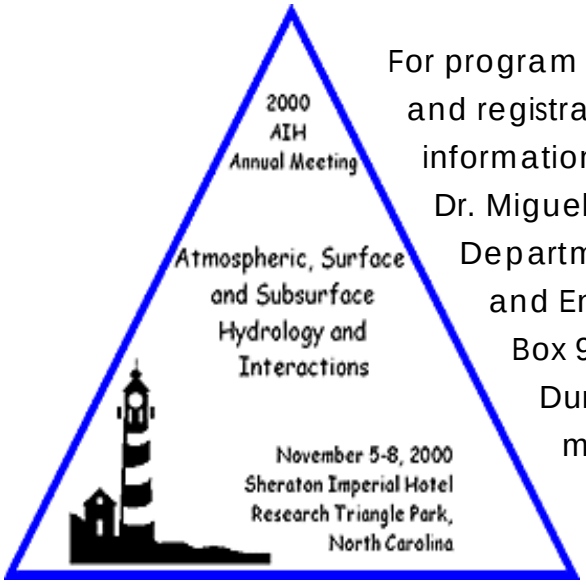
## Ecology and Health Conference 2000
## June 28-29, 2000
## Sheraton Capital Center Hotel
## Raleigh, North Carolina

Over the last 200 years man has significantly altered the earth's environment. We have modified the physical planet and the processes that provide a stable environment, often with little knowledge of the real effects of these modifications. We have just begun to understand how changes in one of the earth's environments can have cascading effects on the nature and quality of life in many other environments. For example, mineral nutrients discharged into surface waters can lead to algal blooms hundreds of miles downstream, causing fish to die from oxygen depletion, shellfish to be contaminated with algal toxins, drinking water treatment costs to increase, and commercial and sport fisheries to suffer economically. Recently, the serious effects of environmental change on human health have become clearer, as environmental disruptions have been linked to the emergence of certain infectious and chronic diseases. Further environmental change appears inevitable, yet society has formulated few comprehensive plans for dealing with its effects, especially those that impact human health.

This two-day conference will explore the basic principles and processes by which the environment affects human health. Nationally known speakers will describe basic ecological principles and interconnections, and the effects of global scale changes, human behavior, pollution and environmental changes on human health. Roundtable panels of national and local experts will discuss environmental changes in North Carolina and their effects on the health and well being of the people of the state.

The registration fee of $75.00 includes daily breaks, lunch on each day, an evening reception on Day 1, a continental breakfast on Day 2, and all program materials

For program and registration information visit website: http://www.sph.unc.edu/oce/courses/ecoimpact.htm or call the UNC-Chapel Hill School of Public Health's Office of Continuing Education at 919-966-4032.




For program and registration information contact
Dr. Miguel A. Medina, Jr.
Department of Civil and Environmental Engineering
Box 90287, Duke University
Durham, N.C. 27708-0287
miguel.medina@duke.edu
or visit website:
http://www.aihydro.org

# More drought looming if rains do not return, USGS warns

Last summer's drought may move westward this summer as streamflows in many parts of the United States continue below normal. At a March press conference, USGS Director Charles G. Groat warned that continued below-normal streamflow and low ground-water levels may signal a return of last summer's drought.

Based on data from the USGS network of more than 7,000 stream gages nationwide, there are some areas of the country — particularly east of the Mississippi River — where streamflows are at record-low flows for this time of year.

"This is the time of year where streamflow conditions should be about normal, but in the eastern half of the country, we're anywhere but that." Groat said. "We should be seeing ground-water recharge taking place now and we're not seeing that either."

There is a slightly different phenomenon occurring from last year's drought. Now, the drought is moving west, clearly into the Appalachians and the southeast, he said. These are areas that did not receive recharge from the last year's busy hurricane season like the eastern seaboard did. USGS scientists are also seeing near record-low streamflows in the Ohio Valley, the center of the Midwest, the Lower Mississippi River Basin and into the southeast.

"This is the time of year we are supposed to be recharging our groundwater and reservoirs," said Groat. "That hasn't happened this winter and so we don't have the buffer we need when we start making withdrawals in the summer. We anticipate additional drought problems in the months ahead based on the low volume of surface and ground water we're seeing now."

# USGS will stop printing *Water Resources Conditions in North Carolina*

The U.S. Geological Survey North Carolina District announced in March that it will discontinue printing its monthly *Water Resources Conditions in North Carolina* bulletin. The monthly conditions report will continue to be available on the district's website at http://nc.water.usgsl.gov/.

The announcement said that the change is being made to increase efficiency at reduced costs in keeping with eliminating government waste.

At this time, WRRI intends to continue printing a bi-monthly summary of N.C. water resources conditions gleaned from the USGS website.

## North Carolina Precipitation/Water Resources

| | March | April |
|---|---|---|
| **Rainfall (+/- average)** | | |
| Asheville | 3.82" (-0.81") | 5.11"(+1.75") |
| Charlotte | 3.59" (-0.84") | 5.48"(+2.80") |
| Greensboro | 2.95" (-1.48") | 4.47"(+1.63") |
| Raleigh | 1.76" (-2.01") | 4.66"(+2.07") |
| Wilmington | 2.61" (-1.27") | 4.64"(+1.77") |

| **Streamflow Index Station** (County, Basin) | **March mean flow (CFS)** (% of long-term median) | | **April mean flow (CFS)** (% of long-term median) |
|---|---|---|---|
| Valley River at Tomotla (Cherokee, Hiwassee) | 223 | (52%) | 401 (119%) |
| Oconaluftee River at Birdtown (Swain, Tenn) | 500 | (62%) | 792 (108%) |
| French Broad River at Asheville (Buncombe, FB) | 2,240 | (77%) | 2,509 (98%) |
| South Fork New near Jefferson (Ashe, New) | 398 | (70%) | 576 (95%) |
| Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee) | 93 | (80%) | 89.8 (83%) |
| Fisher River near Copeland (Surry, Yadkin/Pee-Dee) | 170 | (74%) | 177 (83%) |
| South Yadkin River near Mocksville (Rowan, Yadkin/PD) | 285 | (57%) | 408 (102%) |
| Rocky River near Norwood (Stanly, Yadkin/Pee-Dee) | 1,120 | (38%) | 919 (65%) |
| Deep River near Moncure (Lee, Cape Fear) | 1,330 | (45%) | 1,744 (98%) |
| Black River near Tomahawk (Sampson, Cape Fear) | 1,340 | (95%) | 990 (98%) |
| Trent River near Trenton (Jones, Neuse) | 264 | (92%) | 224 (132%) |
| Lumber River near Boardman (Robeson, Lumber) | 1,710 | (66%) | 1,417 (78%) |
| Little Fishing Creek near White Oak (Halifax, Pamlico) | 129 | (43%) | 200 (115%) |
| Potecasi Creek near Union (Hertford, Chowan) | 146 | (32%) | 392 (164%) |

| **Groundwater Index well (Province)** | **March depth below surface (ft)** (departure from average for month) | **April depth below surface (ft)** (departure from average for month) |
|---|---|---|
| Blantyre (Blue Ridge) | 32.57 (-1.93) | 31.54 (-1.70) |
| Mocksville (Piedmont) | 17.62 (-2.29) | 17.36 (-1.88) |
| Simpson (Coastal Plain) | 3.26 (-0.11) | 2.80 (+1.15) |

Source: U.S. Geological Survey's *Water Resources Conditions in North Carolina*

# Websites

**The Center on Urban & Metropolitan Policy of the Brookings Institution** has established a website making available cutting edge research and policy ideas on cities and metropolitan areas: http://www.brookings.edu/urban.

**The Council on Environmental Literacy** has established a website to help students and teachers study environmental issues by guiding them to the best resources available on the Internet: http://www.enviroliteracy.org.

The **Federal Highway Administration maintains an Environmental Guidebook Website** providing access to information on environmental laws, executive orders, regulations and procedures related to the National Environmental Policy Act (NEPA) and the Transportation Decision-making Process: http://www.fhwa.dot.gov/environment/guidebook/contents.htm

# People

**Terry Rolan**, Director of Environmental Resources for the City of Durham, NC, has been awarded Honorary Membership in the American Water Works Association. The AWWA Board of Directors cited Rolan for his "numerous contributions to the Association and to the AWWA Research Foundation which improved programs and services provided to the membership of AWWA and to the general public." Rolan has also been appointed to serve a three-year term on the AWWA Board of Directors beginning in June 2000. Among his many services to the water research community, Rolan is a member of the Advisory Committee of The UNC Water Resources Research Institute.

**Ruth Swanek**, who formerly oversaw water quality modeling and TMDL development for the N.C. Division of Water Quality, has joined CH2M Hill in the company's Raleigh office.

# Publications

**Who Will Pay for Environmental Improvements in the 21st Century?** Agriculture in the United States has historically produced a food supply that is relatively inexpensive. However, agriculture can have negative impacts on the natural environment. Many people are working toward the goal of protecting the environment while maintaining the agricultural producer's ability to operate an enterprise that provides an adequate standard of living, contributes to the community, and produces high quality, affordable food. This guide provides literature citations and links to Internet sites that offer various perspectives on the economic aspects of agricultural operations and environmental quality. Assembled by the National Agricultural Library for distribution at the symposium "Who Will Pay for On-Farm Environmental Improvements in the 21st Century?" it is available at http://www.nal.usda.gov/wqic/ResourceGuide.html.

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## WRRI NEWS SUBSCRIPTION UPDATE

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Water Resources Research Institute
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Box 7912, N.C. State University
Raleigh, NC 27695-7912

# 1999-2000 Water Resources Research Seminar Series

Presentations take place in the Ground Floor Hearing Room of the Archdale Building in downtown Raleigh or in Room 1132 of Jordan Hall on the N.C. State University campus. This schedule is also posted on the WRRI website, and any changes will be posted there. (http://www2.ncsu.edu/ncsu/CIL/WRRI/2000seminars.html) For additional information contact Associate Director Robert Holman at (919) 515-2815 or Robert_Holman @ncsu.edu.

**Monday, May 22, 2000, Jordan**
Soil Processes Impacting Groundwater Quality in the North Carolina Piedmont: Contamination by Organic Agrochemicals
*Assistant Professor Dharni Vasudevan*
*Duke University*
*Nicholas School of the Environment*

**Tuesday, June 27, 2000 Jordan**
Algal, Bacteria, and BOD Responses to Nutrient Gradients in Coastal Plain Watersheds
*Research Associate Professor*
*Michael A. Mallin*
*Center for Marine Science Research*
*University of North Carolina at Wilmington*

Presentations begin at 3 pm.

NCWRA
North Carolina Water Resources Association

**2000 - 2001 Luncheon and Forum Schedule**

| | |
|---|---|
| September 18, 2000 | Land Use Planning |
| December 4, 2000 | Endocrine Disrupters in the Environment |
| February 5, 2001 | Water Reuse |
| April 9, 2001 | Dam Removals in North Carolina |
| September 17, 2001 | On-Site Wastewater Issues |
| December 3, 2001 | Flood Plain Management |

All luncheon/forums take place at 11:30 am at the Jane S. McKimmon Center on the N.C. State University campus. For additional information call Robert Holman at WRRI (919/515-2815).

*Luncheon cost for nonmembers will increase to $20 January 1, 2001. Join NCWRA and save!. Contact WRRI.*

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**OF THE UNIVERSITY OF NORTH CAROLINA**
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NORTH CAROLINA STATE UNIVERSITY
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