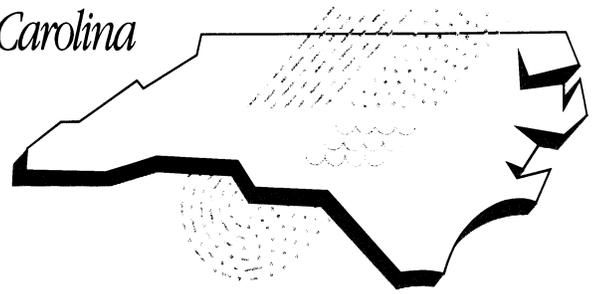


# Water Resources Research Institute News

of The University of North Carolina



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## Schwartz named Associate Director of WRRI

Stuart S. Schwartz, a PhD engineer with expertise in water supply planning and operation and watershed management, will join the Water Resources Research Institute of The University of North Carolina (WRRI) as Associate Director on January 2, 2002.

A graduate of the University of Rochester with BS and MS degrees in geology and biology, Schwartz received the PhD in water resources systems analysis from The Johns Hopkins University in 1988. From 1982 to 1995, he worked with the Interstate Commission on the Potomac River Basin, where he developed a program of externally funded applied research supporting the interstate restoration of Chesapeake Bay, and, as Director of Cooperative Water Supply Operations, coordinated the metropolitan D.C. area's use of the Potomac River for municipal water supply. Most recently, he served as Associate Hydrologic Engineer with the Hydrologic Research Center and as a Consulting Hydrologist in San Diego, CA. His current research focuses on drought planning, drought management, and the use of hydroclimatic forecast information in the operation and management of water resource systems.

In 2000, Schwartz served on the EPA Peer Review Panel on Assessing Consequences of Human Activities and a Changing Climate. He currently serves on the National Research Council's Committee on USGS Water Resources Research. He has served on a number of committees, including the American

Water Works Association's Source Water Protection Committee. He has organized symposia for the American Water Resources Association and the American Geophysical Union and serves as peer reviewer for a number of journals, including *Water Resources Research*.

As Associate Director of WRRI, Schwartz will work with the Institute's

Board and Advisory Committee to set research priorities, oversee administration of research activities, coordinate activities of the N.C. Urban Water Consortium, and develop initiatives to leverage State and Federal funding to build the Institute's research capacity.

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## Director's Forum

# Operational Water Quality Standards

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

Effective water quality management is built on a foundation of water quality standards. Recognizing this, most states have focused on making standards defensible from a scientific and social perspective. However, standards must also be protective, and for that we must consider the operational enforcement of the standard.

Standards become scientifically and socially defensible through careful determination of the designated use, an appropriate criterion, and an antidegradation policy. This basically means that the designated use should properly reflect regulatory requirements, societal preferences, and scientific assessments, while the criterion should reflect the science relating water quality indicators to use designation.

Standards become operationally enforceable when they are expressed in a manner that makes compliance assessment clear and unambiguous. Most surface water quality standards are based on a single, point-valued chemical criterion (e.g., 50 µg/l arsenic for Class C Waters in North Carolina). Standards are associated with two primary compliance activities; they are compared to measurements to determine if a waterbody is currently in compliance, and they are compared to model forecasts to determine if proposed management actions will achieve compliance. As examples, consider the following scenarios:

1. The turbidity standard for Class C Waters is 50 NTU (Nephelometric Turbidity Units). Given natural variability in precipitation and water runoff, changes in human activities in developed watersheds, and measurement error, a set of turbidity measurements over time at a single sampling station is going to vary.
2. The chlorophyll *a* standard is 40 µg/l for Class C Waters. Given the uncertainty in predictive model forecasts, it is highly likely that the upper tail of the

probability distribution characterizing chlorophyll *a* model forecast error will exceed 40 µg/l for any feasible management strategy for the Neuse Estuary.

Based on the wording in the North Carolina standards, compliance assessment should reflect a comparison of the precise fixed criterion with a distribution of measurements or forecasts. From a practical standpoint, how does this comparison proceed? In other words, is

compliance with the standard to be achieved only if there are no observations/predictions that exceed the numeric criterion (e.g., zero violations)? That strategy may be feasible when comparing a set of measurements with a fixed criterion. However, that approach is generally not compatible with water quality model forecast error distributions, which are apt to be highly dispersed and thus will likely have a nonzero forecast

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*WRI 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](mailto:water_resources@ncsu.edu)*

#### **WRI Staff**

*Director/Kenneth H. Reckhow ([Ken\\_Reckhow@ncsu.edu](mailto:Ken_Reckhow@ncsu.edu))  
Newsletter Editor and Tech Transfer Spec/ Jeri Gray ([Jeri\\_Gray@ncsu.edu](mailto:Jeri_Gray@ncsu.edu))  
Business and Administrative Officer/ Lynne Bridger ([Lynne\\_Bridger@ncsu.edu](mailto:Lynne_Bridger@ncsu.edu))  
Program Coordinator/ Julie Mason ([Julie\\_Mason@ncsu.edu](mailto:Julie_Mason@ncsu.edu))  
Accounting Technician/Gerry Cheney ([Gerry\\_Cheney@ncsu.edu](mailto:Gerry_Cheney@ncsu.edu))  
Office Assistant/Diane Fudge ([Diane\\_Fudge@ncsu.edu](mailto:Diane_Fudge@ncsu.edu))*

probability of exceeding a standard in most applications.

For TMDLs, the EPA recognized this dilemma and now allows 10% exceedances of the numeric criterion in assessing compliance based on measurements of current conditions. However, it is still unclear how model forecast distributions will be treated, as EPA and state agencies are unfamiliar with the magnitude of model error distributions, so they have little basis for selection of the allowable percent exceedances. Further, while EPA removed the ambiguity so that compliance assessment could proceed for TMDLs, 10% was an arbitrary choice.

Allowing a selected percentage of exceedances of a numeric criterion actually makes sense. In principle, unless there is an infinite penalty associated with exceedance of a criterion, an analysis of benefits and costs would lead to probabilistically based standards with a chance of exceedance of the criterion. In practice, determining cost/benefit-based standards is a difficult task; hence, the arbitrary choice of 10% exceedances was a pragmatic action by EPA.

Still, we should be able to do better. First, research could help guide the choice of allowable percent exceedances so that it bears some relation to the consequences of compliance and noncompliance. Second, research is needed on estimation of model forecast errors so that application of the standard in forecast scenarios incorporates a reasonable choice for percent exceedances. Finally, the language in the water quality standards needs to be expressed so that the standards are operationally enforceable.

The growing importance of the TMDL program and the 303(d) listing process have increased the need for operational water quality standards. By explicitly acknowledging variability and uncertainty through standards that allow for percent exceedances, the standards become less ambiguous and more enforceable.

## Revision of nutrient management standard for phosphorous will have impact in North Carolina

A pending change in Natural Resources Conservation Service standards for designing nutrient management plans for animal waste operations could force some animal producers in North Carolina to look for additional land on which to apply wastes.

Application rates for animal wastes have previously been based on plant needs for nitrogen. However, the unfavorable nitrogen-to-phosphorous ratio in manures has often resulted in an overapplication of phosphorous. When more phosphorous than plants can use is applied to land—in the form of animal wastes or fertilizer—phosphorous builds up in the soil. Some of the excess phosphorous may dissolve in soil water and seep out into streams or leach down into groundwater. Some excess phosphorous may bind itself to soil particles and be carried to waterbodies when soil is washed from fields. Over the last decade research has produced significant evidence that phosphorous can be delivered from some agricultural fields and animal waste application sites to waterbodies in quantities sufficient to cause eutrophication in freshwaters.

In response to the potential water quality impacts of phosphorous, the USDA Natural Resources Conservation Service in 1999 revised its policy on nutrient management to require that plans for animal waste management include consideration of potential phosphorous loss. NRCS in each state was required to revise its nutrient management (590) standard in the Field Office Technical Guide to incorporate measures to address phosphorous loss. The change means that phosphorous will be the rate-determining nutrient on sites with a high or very high potential for phosphorous loss.

According to Dr. Steve Hodges with the NCSU Department of Soil Science, there is no evidence of phosphorous problems in North Carolina's streams at this point. But, he says, the potential is there.

“Phosphorous is slow to move through the system. With the amount that is currently being applied to land, we think there could be a problem in the future. The new NRCS standard is a proactive approach to prevent future problems.”

In most states compliance with NRCS standards is voluntary, and in most states the new NRCS policy on phosphorous went into effect in May, 2001. However, the policy has not yet gone into effect in North Carolina because NRCS here chose to develop a method to assess phosphorous loss potential that takes site-specific conditions into account. Hodges has led development of the phosphorous loss assessment method. He says that a scientifically defensible method of assessing phosphorous loss potential across a range of soils and site conditions is important in North Carolina because the State's “Nondischarge” rules (15A NCAC 2H .0200) specify that animal waste management plans must meet standards in the NRCS Technical Field Guide and because application of animal wastes may be prohibited or restricted on land with high or very high potential for phosphorous loss.

### Identifying sites with high potential for phosphorous loss

NRCS policy lets states assess potential phosphorous loss by using a soil test or using a more sophisticated method to take site conditions into account. Simply using a soil test to assess the potential for phosphorous loss is problematic because the amount of phosphorous that may be delivered from an agricultural field to surface or groundwater depends not only on the concentration of phosphorous in the soil but also on the type of phosphorous applied, method of application, soil type, extent of soil erosion and sediment delivery, runoff

*continued on page 7*

## October action of the North Carolina Environmental Management Commission

At its regular meeting on Oct 11, 2001, the N.C. Environmental Management Commission (EMC) took the following action:

- Approved publishing a "Notice of Text" for new permanent rules and amendments to existing rules for the Dry-Cleaning Solvent Cleanup Fund. Temporary rules to provide for certifying contaminated dry-cleaning sites into the DSCA Program and governing assessment and remediation at sites went into effect Jun 1, 2001. The new permanent rules are essentially the same as the temporary rules, and no public hearing is planned.
- Approved holding a public hearing on the Interbasin Transfer Certification for the Charlotte-Mecklenburg Utilities' (CMUD) request to increase from 16.1 million gallons per day (MGD) to 33 MGD its transfer of water from the Catawba River subbasin to the Rocky River subbasin. The transfer will take place by consumptive use in eastern Mecklenburg County and wastewater discharges to the Rocky River subbasin. The EMC directed staff to take comment on three options: grant the certificate for the 33.0 MGD request; deny the certificate; or grant the certificate with conditions to address secondary impacts. Conditions are (1) require an annual report on Charlotte-Mecklenburg's implementation of its Surface Water Improvement and Management Program, (2) require Charlotte and Mecklenburg County to continue a stakeholder process aimed at controlling runoff from single-family development; (3) removal of the Goose Creek subbasin from the area to be served and placement of a moratorium on installation of new IBT water lines in the subbasin until impacts on the Carolina heelsplitter (endangered mussel) are fully evaluated and (4)

require CMUD to develop a compliance and monitoring plan for reporting maximum daily transfer amounts, compliance with certificate conditions, progress on mitigation measures, and drought management activities. (The public hearing was scheduled for Dec 11 and the comment period was to close Dec 14.) For more information go to the N.C. Division of Water Resources' website at: [http://www.dwr.ehnr.state.nc.us/Permits\\_and\\_Registration/Interbasin\\_Transfer/Status/Cmud/](http://www.dwr.ehnr.state.nc.us/Permits_and_Registration/Interbasin_Transfer/Status/Cmud/)

- Approved holding a public hearing on an Air Quality rule to control particulate emissions from cotton ginning operations. For information go to the N.C. Division of Air Quality website at: <http://daq.state.nc.us/>
- Approved changes to the Nitrogen Oxides Emission Standards rules to satisfy objections of the Rules Review Commission.
- Returned to the Codifier of Rules unchanged a temporary rule providing for development in isolated wetlands. The EMC had approved the temporary rule in September but, according to Commissioner Dan Besse, the Codifier of Rules refused to file it because he found that the record was not sufficient to support the need for a temporary rule. Besse said that the Codifier of Rules heard arguments from opponents of the temporary rule that the EMC had not met the standard for temporary rules and refused to accept the rule. Water Quality Chief Coleen Sullins told the EMC that this is the first time she is aware of that this process has been used by the Office of Administrative Hearings. After a lengthy discussion of the rule, much of which was a repeat of discussion in September, and the standard for temporary rules, the Commission voted to send the rule back

to the Codifier. The Commission adopted a motion by Besse to provide additional information about development projects being held up by the lack of a rule allowing impacts to isolated wetlands and tell the Codifier of Rules that additional information would not be forthcoming. Under the Administrative Procedure Act, once the EMC sends back a temporary rule unchanged, if the Codifier of Rules does not file the rule, it becomes effective 6 days after resubmission. New state rules allowing impacts to isolated wetlands became necessary following a U.S. Supreme Court decision that removed isolated wetlands from jurisdiction of the U.S. Army Corps of Engineers and essentially negated the federal program which would have allowed the impacts.

- Adopted a rule requiring all model year 2005 and 2006 heavy-duty diesel engines sold, leased, or registered in North Carolina to be of the type certified by the California Air Resources Board as meeting supplemental test procedures to ensure compliance with limits on non-methane hydrocarbon and nitrogen oxides emissions. The rule was adopted to prevent excess NOx emissions (which contribute to ozone) during a two-year gap between the time a Consent Decree requiring supplemental testing expires and the time a new federal rule on test procedures becomes effective.
- Approved holding public hearings on the following reclassifications: Little Tennessee River in Macon and Swain counties from Class C to Class B; Swift Creek in Edgecombe, Franklin, Nash, Vance, and Warren counties in the Tar-Pamlico River Basin to Outstanding Resource Waters; New River in Onslow County in the White Oak River Basin from Saltwater C to Shellfish and High Quality Waters; and Southwest Creek in Onslow County in the White Oak River Basin from Class C to Class Saltwater C. For information on the public hearings contact Elizabeth Kountis at

*continued*

(919) 733-5803, Ext. 369 or  
elizabeth.kountis@ncmail.net.

■ Approved holding a public hearing on a permanent rule to allow wastewater from emergency responses for biological or chemical decontamination activities conducted by State or Federal authorities to be deemed permitted provided that water quality standards are not contravened. The EMC had approved a temporary rule in April that deemed permitted wastewater discharges from decontamination facilities operated under declaration of emergency to contain outbreaks of foot-and-mouth disease. The permanent rule presented to the EMC, however, had been broadened. The broad nature of the rule concerned some commissioners, and Water Quality Chairman Charles Peterson directed that the matter be brought to the attention of the Water Quality Committee following the public hearings and before the permanent rule is presented to the EMC for adoption.

■ Delegated to Orange County authority to implement the Neuse River Riparian Area Protection Rule.

## October action of the N.C. EMC's Water Allocation Committee

At its meeting on Oct 10, 2001, the EMC's Water Allocation Committee agreed to send to the full EMC a recommendation to hold a public hearing on the third round of water supply storage allocations from Jordan Lake. The Division of Water Resources' recommendations for third-round allocations are based on projected needs of applicants through 2030 and are compatible with projected needs of all water supply systems in the Cape Fear River Basin through 2050. The recommendations are:

○ Chatham County - no change in existing 6.0 million gallons per day (MGD) allocation

- City of Durham - allocation of 10.0 MGD
- City of Fayetteville - no allocation
- City of Sanford - no allocation
- Harnett County - no allocation
- Town of Holly Springs - decrease the current 2.0 MGD allocation to 0.0 MGD
- Orange Water and Sewer Authority - decrease current 10.0 MGD allocation to 5.0 MGD
- Orange County - no change in existing 1.0 MGD allocation
- Towns of Cary and Apex - Allocate an additional 11.0 MGD for a total of 32.0 MGD
- Town of Morrisville - allocate an additional 1.0 MGD for a total of 3.5 MGD
- Wake County/Research Triangle Park - allocate an additional 2.0 MGD for a total of 3.5 MGD

The Division of Water Resources says that their recommendations leave 39 percent of Jordan Lake's water supply pool unallocated and available to meet future water needs. (One-third of Jordan's conservation pool is to be used for water supply and two-thirds for downstream flow augmentation.) Of the 50 percent of Jordan's water supply storage that may be allocated for use outside the Lake's watershed, at least 10 percent will remain unallocated and available for future water needs.

The EMC will be asked in December to approve holding a public hearing on the allocation recommendations. If the EMC approves, a public hearing will likely be held in February 2002; recommendations will come back to the Water Allocation Committee in March 2002; and the EMC will be asked to adopt the recommendations in April 2002.

**Recent issues of the *North Carolina Register* are now online at the Office of Administrative Hearings website:  
<http://www.oah.state.nc.us/rules/register/>**

## October action of the N.C. EMC's Water Quality Committee

At its meeting on Oct 10, 2001, the EMC's Water Quality Committee took the following action:

■ Approved a request for a major variance form Water Supply Watershed Protection rules for a single family residence in the Cane Creek WS-II watershed in Yancey County. The applicant agreed to stormwater treatment and inclusion of a large conservation easement, including a prohibition on logging in perpetuity.

■ Approved publication in the *N.C. Register* of Notice of Rulemaking Proceedings to begin the Triennial Review of Surface Water Quality Standards and Classifications. EPA has asked that North Carolina review its standards for mercury, arsenic, ammonia, and bacteria (use of E coli or enterococci instead of fecal coliform as an indicator of fecal contamination). Staff and the public have requested reviews of total residual chlorine, MTBE, cyanide and methylene blue active substances. Information on the Triennial Review can be downloaded in pdf format from the N.C. Division of Water Quality website at <http://h2o.enr.state.nc.us/csu/TRIENNIAL.pdf>. For information about the Triennial Review, contact Dianne Reid at (919) 733-5083 Ext 568 or [Dianne.Reid@ncmail.net](mailto:Dianne.Reid@ncmail.net).

■ Approved taking the draft Savannah, Hiwassee and Little Tennessee River Basinwide Water Quality Plans to public meetings. For information on the public meetings go to the Basinwide Planning Section website at <http://h2o.enr.state.nc.us/basinwide/index.html>

■ Approved sending to the full EMC in December a temporary rule making

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## EMC Water Quality Committee *continued*

changes to the Tar-Pamlico Agricultural Rule required by Session Law 2001-355 in response to objections raised in the General Assembly by the pasture industry.

■ Heard from the Stormwater and General Permits Unit of the Division of Water Quality that the proposal of rules to implement the NPDES Phase II Stormwater requirements is still on hold because of questions raised by the N.C. Association of County Commissioners regarding the inclusion of counties in North Carolina's proposed program and whether the EMC has authority to compel local governments to enact stormwater management programs. Bradley Bennett, head of the unit, said that the rules may be brought to the Water Quality Committee at its December 12 meeting with a request to waive the "30-day rule" and allow the rules to be considered by the full EMC the following day.

■ Approved publishing in the *N.C. Register* Notice of Rulemaking to increase the fees that may be paid into the Wetlands Restoration Fund in place of performing wetlands mitigation. Ron Ferrell, head of the Wetlands Restoration Program, told the committee that when the fee structure was set, the program had little experience on which to base the fees and that restoration has proven to be more costly than previously thought. He said the Department of Environment and Natural Resources will ask for both a temporary rule and a permanent rule to increase fees. He said that without a temporary rule, the Wetlands Restoration Program will be undertaking mitigation projects "at a loss."

## Environment-related legislation passed by the N.C. General Assembly

*In addition to environment-related legislation reported in the July/August and September/October 2001 WRR I News, the following environment-related bills were passed by the General Assembly as of November 9. This list is not comprehensive.*

S 312 AN ACT TO: (1) AMEND CERTAIN LAWS RELATING TO THE CERTIFICATION OF WELL CONTRACTORS AND TO INCREASE THE MAXIMUM CIVIL PENALTY THAT MAY BE ASSESSED FOR VIOLATIONS OF THE WELL CONTRACTORS CERTIFICATION ACT OR THE WELL CONSTRUCTION ACT; (2) CLARIFY THAT THE REQUIREMENTS OF G.S. 106-660 APPLY ONLY TO INSTALLATIONS THAT HANDLE, STORE, DISTRIBUTE, OR APPLY ANHYDROUS AMMONIA FOR FERTILIZER USE; (3) REQUIRE THAT SOLID WASTE THAT IS TO BE INCINERATED IN CERTAIN INCINERATORS BE VISUALLY INSPECTED IN ORDER TO PREVENT THE INCINERATION OF WASTE THAT MAY NOT BE LAWFULLY INCINERATED; AND (4) AMEND THE EXEMPTION OF CERTAIN ESTABLISHMENTS THAT PREPARE OR SERVE FOOD OR DRINK FROM REGULATION AS FOOD AND LODGING FACILITIES

H 1006 AN ACT TO CONSOLIDATE VARIOUS ENVIRONMENTAL REPORTING REQUIREMENTS.

H 1063 AN ACT TO PROVIDE FOR PERFORMANCE-BASED CLEANUPS OF DISCHARGES OR RELEASES OF PETROLEUM FROM UNDERGROUND STORAGE TANKS AND TO AUTHORIZE THE STATE BUILDING COMMISSION TO ADOPT RULES TO AUTHORIZE OPEN-END DESIGN AGREEMENTS FOR WETLANDS MITIGATION AND SIMILAR PROJECTS.

H 1299 N ACT TO APPROPRIATE FUNDS FROM THE NONCOMMERCIAL LEAKING PETROLEUM UNDERGROUND STORAGE TANK CLEANUP FUND TO SUPPORT THE ADMINISTRATION OF THE PETROLEUM UNDERGROUND STORAGE TANK PROGRAM.

## Environmental Management Commission works short-handed

State budget problems and redistricting have apparently kept the N.C. General Assembly and Governor Mike Easley intensely focused. As of Nov 12, no appointments had been made to the N.C. Environmental Management Commission to fill terms that expired on June 30 or July 1, 2001. Some commissioners with expired terms took matters into their own hands, causing the EMC to work short handed in October. Commissioner Robert E. Cook resigned and Commissioners Franklin S. Clark and Edwin S. "Jim" Melvin (all gubernatorial appointees) did not return following expiration of their terms.

In addition to Cook, Clark and Melvin, commissioners whose terms

expired in July are gubernatorial appointees Charles H. Peterson, Moses Carey, Jr. and Ryan D. Turner; House appointees Don Abernethy and Anne Barnes; and Senate appointees Robert Epting and Robert G. Ray. If all commissioners with expired terms are replaced, more than half the EMC members could be new to the rulemaking process.

On Nov 8, the Senate passed and sent to the House S 571 which would reappoint Robert G. Ray of Jackson County and appoint Maurice Anthony Lasher of Buncombe County to the EMC. The bill would also take two of the governor's appointments and give one additional appointment each to the House and Senate.

## NRCS phosphorous management standard *continued*

and leaching potential, proximity to the water body, and other factors.

Rather than setting a threshold level for soil test phosphorous above which animal waste application will be restricted or prohibited, the NRCS in North Carolina chose to develop a phosphorous loss index that takes into account all the variations. For nearly two years Hodges has led an interagency committee of university and agency scientists and engineers working on the Phosphorous Loss Assessment Tool, or PLAT.

The PLAT is an index that accounts separately for loss of sediment-bound phosphorous, loss of phosphorous released from soil to runoff, loss of phosphorous from leaching, and loss of phosphorous from applied sources to runoff then sums these losses for a total

loss assessment. The PLAT requires site-specific information including the dominant soil mapping unit, the cropping system, the hydrologic condition (including drainage depth and configuration), and the location of the nearest weather station. It requires information about waste application, including rate, total phosphorous content, solubility, dry-matter content, and density. The PLAT takes management practices into account by considering the existence and width of buffers and the use of water control structures, ponds, and sediment basins in calculating delivery ratios. The ultimate output of the PLAT is an assessment of low, medium, high, or very high risk for phosphorous loss to surface and groundwater.

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## Coastal Resources Commission adopts revised guidelines for land-use planning

Following a three-year effort to improve coastal land-use planning, the N.C. Coastal Resources Commission (CRC) adopted changes to Coastal Area Management Act (CAMA) land-use planning guidelines in October.

CAMA requires the 20 coastal counties to prepare land-use plans; however planning is optional for municipalities in those counties. The new guidelines offer three levels of plans that give local governments in the CAMA counties flexibility to meet local needs. A "core" plan will be the standard land-use plan; it will address all the required CAMA plan elements. Counties and municipalities that choose to exceed the core plan will complete an "advanced core" plan. This plan can also be used to help meet requirements of other programs, such as the NPDES Phase II Stormwater program, that also address goals of the CAMA program. Small non-oceanfront municipalities that are not experiencing high growth but contain "Areas of Environmental Concern" can choose to do a "workbook" plan, a simplified plan addressing CAMA planning elements that can be completed

using a workbook template provided by the N.C. Division of Coastal Management.

The new guidelines seek to improve protection of coastal water quality by implementing policies to prevent or control stormwater discharges as well as policies and land-use categories that protect open shellfish waters and restore closed or conditionally closed shellfish waters.

To aid local governments in developing high-quality land-use plans, the Division of Coastal Management will create a technical manual and a model land-suitability analysis and will provide training opportunities.

The CRC has also asked Secretary of Environment and Natural Resources Bill Ross to revise guidelines for state funding of CAMA land-use plans to provide incentives for plan implementation.

For additional information on changes to CAMA land-use planning, visit the N.C. Division of Coastal Resources website at: <http://dcm2.enr.state.nc.us/>

According to Hodges, sites that are assessed as medium or low risk for phosphorous loss will still have application rates based on plant needs for nitrogen. If a site has a "high" potential for phosphorous loss, application rates will be limited to phosphorous removed in the harvested crop. If a site has a "very high" risk, then no additional applications of phosphorous in any form can be made. Prohibition or restriction of phosphorous application would have a negative economic impact on animal growers whose land application sites are determined to have a high or very high risk for phosphorous loss. They would either have to purchase more land, which is often not available in areas of high animal concentration, or reduce the number of animals in their operations.

Two separate field evaluations of PLAT have been initiated, and one has been completed. Results from the first evaluation indicate that the largest potential phosphorous losses from animal waste application sites are from sites receiving poultry litter. According to Hodges, poultry growers who have been applying litter to the same sites for many years could need at least 8 times as much land as they now use to comply with the NRCS nutrient standard for phosphorous. Swine growers with high or very high risk sites could need at least 4 times as much land to manage the same amount of waste.

The team working on the PLAT expects to have a draft ready for public review in December. Several months will be allowed for public comment before the tool is finalized. The new NRCS nutrient management standard for phosphorous is currently scheduled to take effect in April 2002. However, animal producers will not automatically be required to obtain new nutrient management plans. The new standard will be implemented for (1) new operations, (2) when current animal waste management permits are reissued (Permits are not required for poultry litter application.), (3) if a change takes place in a waste management plan, or (4) if a producer receives new cost-share funding under the State's Ag Cost-Share Program.

Questions about the new NRCS nutrient management standard for phosphorous should be directed to Lane Price, Assistant State Conservationist, at (919) 873-2105 or [lane.price@nc.usda.gov](mailto:lane.price@nc.usda.gov).

## Studies

"Studies" is a new department in the WRR I News to publish summaries of water research articles and reports sent to us by investigators. Entries in this department will be straightforward summaries, not reviews or critiques. For each article or report, we will indicate the source and level of review provided the original. We aim to provide summaries from many different researchers, and if it becomes necessary, we will limit the number of articles or reports by any one individual that we will accept. We will accept articles and reports from agencies and private entities, but we intend to focus on academic research and will always devote at least half the space in any one issue to university investigators. To submit an article or report for this department, send it to Jeri Gray at the address or email address on page 2.

## What causes skin ulcers in fish?

Simply because they are concerned about sick or dying animals, people dislike seeing fish with "sores." In fact, there are many good reasons to be concerned about skin ulcers on fish. Disease can reduce fish populations and the abundance of seafood; aesthetically displeasing "sores" can affect important fishing and tourist industries; sick fish may be indicative of an ecosystem out of normal balance; and in some cases fish diseases are indicative of exposure to toxins that can harm people. When large numbers of fish with skin ulcers continue to turn up in our estuaries, what is the rational response?

Writing in the Nov/Dec 2000 issue of *Toxicologic Pathology*, Dr. Edward Noga of NC State University says that, given the state of knowledge about how fish develop skin ulcers, it is very difficult to make good decisions about what course of action should be taken to correct perceived problems.

Noga explains that unlike humans, fish do not have a layer of dead, tough cells on their skin to help protect them.

In almost all fish species, the epidermis consists entirely of living cells covered by a layer of mucus, and because it is living tissue, fish skin is a common target for many pathogens. Although the living skin and mucus have many antimicrobial factors, if a wound is opened in the skin, the many opportunistic pathogens that are ubiquitous in water can quickly colonize the wound.

The susceptibility of fish skin to damage depends upon age, sex, endocrine status, environmental conditions and species. Bottom dwelling species, such as flounder, have more layers of living cells (thicker skin) than do fish that inhabit the water column and never come in contact with solid objects. Atlantic menhaden, which inhabit the water column, have extremely thin skin and are highly susceptible to skin damage.

Scientists have studied skin ulcers in fish from Atlantic estuaries of the United States (Chesapeake Bay, Albemarle-Pamlico Sounds, St. Johns River and Indian River) and have identified a number of organisms infecting the wounds. The most common disease affecting fish in the Pamlico and Neuse River estuaries is ulcerative mycosis, in which an oomycete ("water mold") incites severe inflammation, usually producing aggressive, deep and penetrating lesions. Various kinds of water molds have been isolated from ulcerative mycosis lesions as have bacteria and protozoa. However, none are strong enough pathogens to open the wounds that must be present for infection to occur.

The key to answering the question "What causes skin lesions in fish" is answering the question "What opens wounds in fish skin." Around this issue, Noga says, some misperceptions have arisen.

A growing number of epidemiological studies have associated skin damage in fish with various chemical stressors, including petroleum, municipal sewage, pulp mill effluent, organochlorine pesticides, polynuclear aromatic hydrocarbons, polychlorinated biphenyls,

heavy metals, detergents, ammonia, and pH extremes. A small amount of anecdotal evidence links skin ulceration in fish to environmental hypoxia, an increasing phenomenon in eutrophying estuaries. Acute temperature changes may also cause epidermal thinning or a decrease in mucus cell density. It is also possible that some types of stressors (even toxins) might lead to skin ulcers by causing a change in hormonal balance rather than directly damaging the skin. In addition, trauma caused by catch and release of fish can cause serious skin damage and is considered a significant cause of skin lesions in some feral fish populations.

However, the discovery that the toxic dinoflagellate *Pfiesteria* can damage skin and cause ulcers in experimentally exposed fish has led many to assume that the appearance of skin lesions is evidence of the presence of *Pfiesteria* and its toxins. Because exposure to *Pfiesteria* is suspected to cause human illness, the presence of ulcerated fish in estuaries has heightened concerns about contact with the waters or fish taken from the waters.

According to Noga, however, demonstrating a link between *Pfiesteria* or any other stressor that could possibly cause wounds in fish, is exceedingly difficult. It is not possible to diagnose the initiating cause of an ulcer on a fish on the basis of pathology, he says. By the time ulcers are apparent on fish, the lesions are at least several days old, have been invaded by a host of infectious agents, and it is impossible to determine the initial insult that led to their development. Even if scientists could learn to recognize the earliest stages of ulcer development, they could not unequivocally diagnose *Pfiesteria* exposure because the skin damage caused by *Pfiesteria* is not unique. Only with the development of highly specific biomarkers of exposure will this be possible.

Similarly, although scientists know various stressors that can cause skin damage, by the time ulcers are apparent,

*continued*

environmental conditions have changed, and the smoking gun has disappeared. In addition, fish are highly mobile and often move great distances in a short period of time, so that initial skin damage may have occurred miles from where ulcerative fish are found.

"In summary," says Noga, "any suggestions of a correlation between the presence of ulcer-causing risk factors (e.g., *Pfiesteria* blooms) and the presence of fish with UM [ulcerative mycosis] at a given time and place are not scientifically valid."

Noga suggests several lines of inquiry that could help identify the ultimate cause of skin ulcers in fish. Studies are needed to demonstrate that *Pfiesteria* can experimentally induce ulcers in Atlantic menhaden, the species most commonly affected by ulcers. Assuming that such studies produced evidence that *Pfiesteria* can affect menhaden, he says, linking *Pfiesteria* exposure to specific fish disease epidemics in the field will require more laboratory research and better tools to detect *Pfiesteria* and its toxins. Because most risk factors have been linked only epidemiologically to skin ulcer development, controlled experimental studies and nontraditional approaches to assessing risk related to non-toxic stressors are needed.

Such studies are critical, Noga suggests, because until it is possible to distinguish among the stressors that could cause fish ulcers it is not possible to assess the importance of each possible cause and respond with rational management decisions.

*Toxicologic Pathology is a peer-reviewed journal published by the Society of Toxicologic Pathologists.*

## Cooling stormwater pond effluent

Shallow ponds used as stormwater management best management practices (BMPs) can cause increases in receiving stream temperature. With increasing urbanization and more ponds, stream temperatures can be expected to rise, and

higher temperatures may adversely affect stream biology.

In Maryland, where stream temperatures are regulated depending on use classification\*, the Maryland Department of Environment and others initiated a project to test a new concept—the groundwater siphon—for cooling stormwater pond effluent. The project was described in a paper presented at the American Society of Civil Engineers' Watershed '96 conference in Houston, TX, by Daniel J. O'Leary, P.E.

The intent of the groundwater siphon is to draw stormwater pond discharge from a surface water/groundwater mixing zone rather than from the pond surface water. An existing stormwater pond at a maintenance facility owned by the Maryland Department of Transportation in Baltimore was retrofitted with a siphon release structure. The structure consisted of a three-foot deep, stone-lined trench in the bottom of the pond which housed a perforated underdrain pipe. The trench was capped by coarse sand. A second pond at the site served as a control.

The investigators monitored temperatures of both ponds' surface water and water in the trench in the experimental pond over an approximate 2-month period in the late summer of 1995 and monitored the temperature of the ponds' outflow during two storm events significant enough to engage the siphon. They found temperatures of surface water in the ponds was within 2 degrees F of each other and that highest temperatures occurred at about 4 pm. They found that the average temperature of water in the trench of the experimental pond was more than 12 degrees lower than the average surface water temperature. They found that the temperature of the outflow from the experimental pond was 3 degrees F less than the surface water in the pond and the outflow temperature of the control pond.

The author notes that the trench used in the experimental pond was fairly shallow and that groundwater conditions at the site (not free-flowing) were less than favorable. He says that more favorable groundwater conditions should

produce better results at other sites. He also notes that the observation of temperatures in the trench being higher than the average pond surface temperatures at 7 am indicates that the groundwater siphon may have a slight warming effect on discharge from early morning storms.

*Papers presented at professional conferences are not generally peer-reviewed. The author of the paper may be contacted at Parsons Brinckerhoff, Baltimore, MD (410) 385-4178 or [oleary@pbworld.com](mailto:oleary@pbworld.com).*

*\* North Carolina also has standards for stream temperature. Temperature is not to exceed 84.2 degrees F for mountain and upper Piedmont waters and 89.6 degrees F for lower Piedmont and Coastal Plain Waters. The temperature for trout waters is not to exceed 68 degrees F. The N.C. Environmental Management Commission may establish other standards for temperature for specific waters.*

## Scientists measure lagoon ammonia emissions with infrared rays

Researchers at EPA's National Risk Management Research Laboratory (NRMRL) have expanded on the Cat Scan tomography principle to develop an infrared optical system that uses multiple paths to capture the emissions plume of a subject pollutant both vertically and horizontally. The result is a multi-dimensional system designed to continuously compute the total hazardous air emissions from area sources by mapping the plume dimensions and measuring pollution concentrations. The method is particularly effective in capturing fugitive area (nonpoint source) emissions—such as motor vehicle or landfills emissions—that previously could not be well-characterized. It is now being used at a concentrated animal feedlot operation to measure ammonia emissions from barn and lagoon sources. *NRMRL news release*

## WRRR report available

WRRR has recently published a peer-reviewed technical completion report on a research project for which it provided funding. Single copies of WRRR 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 WRRR, Box 7912, North Carolina State University, Raleigh, NC 27695-7912 or call (919) 515-2815 or email: [water\\_resources@ncsu.edu](mailto:water_resources@ncsu.edu).

### **Performance Evaluation of Regional Wet Detention Ponds and a Wetland for Urban Nonpoint Source Control Report 335 July 2001**

Robert C. Borden  
Department of Civil Engineering  
NC State University

In this project, the investigator monitored the pollutant removal efficiency of two regional wet detention ponds and a regional pond-wetland system in the watersheds of the City of High Point's two water supply reservoirs over a 12-month period to identify watershed and/or design characteristics that may influence BMP performance.

Mall Ponds A and B are large regional wet detention ponds that generally comply with the design standards of the N.C. Department of Environment and Natural Resources (N.C. DENR) for wet detention ponds. Pond A has three major tributaries that receive runoff from a mixture of medium and high-density residential, commercial, and institutional land uses originally

developed in the 1960s and 1970s. Mall Pond B receives runoff from a large recently completed shopping mall, and an older area containing a mixture of commercial, institutional, and residential land uses.

The Regency Pond-Wetland System treats runoff from a very large watershed containing a mixture of forest, open space, single-family residential land uses, and the Piedmont Triad International Airport. Because of restrictions on alteration of natural wetlands at the site, the pond-wetland system is significantly undersized in comparison to NCDENR design standards.

### Findings

The investigator found significant variation in pollutant concentrations and loading rates between different watersheds with similar land use classifications. He concluded that while some highly developed watersheds do generate high pollutant loads (e.g., older residential and commercial areas), other areas with high levels of impervious surfaces (e.g., new shopping mall) generate runoff with substantially lower pollutant concentrations and associated loads. Similarly, there can be large variations in pollutant concentrations and loads between different "undeveloped" areas.

In all the regional water quality ponds examined, chemical and biological processes had a major impact on pollutant removal efficiency. All of the ponds examined thermally stratified during the summer season with associated anaerobic conditions in the pond hypolimnion. Most of the ponds were eutrophic to hypereutrophic with significant algal production and associated removal of dissolved nutrients in the epilimnion. Common design criteria recommend that the average depth of water quality ponds be between 3 and 6 feet to prevent thermal stratification and development of anaerobic conditions in the pond bottom. The investigator concluded that it is not clear that thermal stratification is necessarily bad since the highest pollutant removal efficiencies are often

observed during stratified periods. But, he notes that thermal stratification does have a pronounced impact on biological and chemical processes in water quality ponds and should be considered when designing them.

The investigator found that pollutant removal efficiency was most closely correlated with the pollutant concentration in the pond influent—high influent pollutant concentrations correlated with high percentage removal efficiencies and low pollutant concentrations correlated with low removal efficiencies. He notes that this may be related to the concept of a "minimum irreducible pollutant concentration," a point below which it might not be reasonably possible to reduce effluent concentrations using conventional BMPs because of internal cycling of nutrient and turbidity by microbes, plants, and algae within a pond or wetland. He says that this concept may have important implications for planning and design of BMPs in highly urbanized areas. Some highly impervious watersheds generate high annual pollutant loads because of the large amount of runoff. However, pollutant concentrations discharging from these watersheds are close to the reported irreducible pollutant concentrations, so ponds and other BMPs would not be effective in removing pollutants.

A cost-effectiveness analysis showed that while the percent pollutant removal efficiency of the Regency Pond was relatively low, the total mass of pollutant removed per dollar of capital cost was much higher than for the other BMPs. This suggests that, in some cases, it may be desirable to construct BMPs in large watersheds, even if they cannot be sized to meet common design standards. However, this approach should be used with great caution since monitoring results from the Regency wetland showed that undersized wetlands might actually be net generators of pollutants.

### Recommendations

The investigator recommends that N.C. DENR and other agencies reconsider the

*continued next page*

current practice of designing ponds and other BMPs for specific total suspended solids (TSS) removal efficiency because, while none of the ponds examined in this study achieved the 85% TSS removal specified in the N.C. DENR design criteria, they were all reasonably effective in removing nutrients and other pollutants. He notes that if the objective is to achieve a certain level of nutrient removal, then it may be desirable to include this as a specific objective in the design standards since modifications that may increase suspended solids removal may or may not enhance nutrient removal.

The investigator also recommends that agencies rethink the design of devices that prevent debris from clogging pond outlet structures. He says that skirts around outlet structures often cause the pond effluent to be withdrawn from one to two feet below the surface of the water. This reduces the depth, surface area, and volume of the pond that provides effective pollutant removal and causes release of "dirtier" water. Alternative designs should be developed that withdraw water from closer to the free water surface.

## Digest

### **Arsenic in drinking water standard.**

U.S. Environmental Protection Agency Administrator Christie Whitman announced on Oct 31, 2002, that the arsenic standard in drinking water will be 10 parts per billion (ppb)—the same standard adopted by EPA under the Clinton Administration. Whitman halted implementation of the standard when she was appointed by President George Bush. According to EPA, when the Administrator initiated review of the standard for arsenic, there were indications that additional information was available that had not been considered previously. She asked for time to look at the new science and data that have come to light since the original (1999) study by the National Academy of Sciences on this matter. Whitman also asked that

three expert panels review all the new and existing materials. The National Academy of Sciences looked at risk, the National Drinking Water Advisory Council examined costs to water systems throughout the nation, and EPA's Science Advisory Board assessed benefits. Whitman reiterated that the additional study and consultation have not delayed the compliance date for implementing a new standard for arsenic in 2006. Nearly 97 percent of the water systems affected by this rule are small systems that serve less than 10,000 people each. EPA plans to provide \$20 million over the next two years for the research and development of more cost-effective technologies. The Agency also will provide technical assistance and training to operators of small systems, which will reduce their compliance costs, Whitman said. EPA will work with small communities to maximize grants and loans under current State Revolving Fund and Rural Utilities Service programs of the Department of Agriculture. — EPA news release

**TMDL rule delay.** In the Oct 18, 2001, *Federal Register*, EPA published a final rule establishing April 30, 2003, as the effective date of the revisions to EPA's Total Maximum Daily Load (TMDL) and National Pollutant Discharge Elimination System Program (NPDES) regulations published in the *Federal Register* on July 13, 2000. This delays by 18 months TMDL regulations proposed by the Clinton Administration. The action also revises the date on which States are required to submit the next list of impaired waters from April 1, 2002 to Oct 1, 2002. According to the *Federal Register* notice, "Based on concerns expressed by many interested organizations and in light of a recent report from the National Research Council (NRC), entitled "Assessing the TMDL Approach to Water Quality Management," which recommends changes to the TMDL program, EPA believes that it is important at this time to reconsider some of the choices made in the July 2000 rule, while continuing to operate the program under the 1985 TMDL regulations, as amended

in 1992. A delay of the effective date would allow the Agency to solicit and carefully consider suggestions on how to structure the TMDL program to be effective and flexible and to ensure that it leads to workable solutions that will meet the Clean Water Act goals of restoring impaired waters." The notice published by EPA also notes that current court orders and consent decrees require EPA to establish (if the States do not) approximately 2000 TMDLs in the next 18 to 24 months, and that these requirements are in place independently of any separate requirements in the July 2000 rule. However, EPA acknowledges that without the requirement to include an implementation plan as part of a TMDL—which would be required by the July 2000 rule—States may not develop implementation plans for all TMDLs.

**Cost of water.** Water Tech Online reported in August that a worldwide survey shows the average cost of water increased by 3.8 percent in 2000. The publication cites a survey by NUS Consulting Group, which found that the world price for water averaged 76.4 cents per cubic meter (264 gallons) and that water pricing increased in all 14 countries surveyed except for the Netherlands. Water is most expensive in Germany (\$1.52 per cubic meter) and cheapest in South Africa (\$0.34 per cubic meter). The average cost in the United States was found to be \$0.52 per cubic meter.

**Cleaning up after dogs.** In their article "Understanding Watershed Behavior," Tom Schueler and Chris Swann report that in the Chesapeake Bay area, 63% of people surveyed agree that pet wastes contribute to water quality problems. However, 41% of dog walkers never or rarely clean up after their dogs. Of these, 44% say they would not clean up even with fines, complaints from neighbors or availability of collection or disposal methods. Among the reasons given for not picking up dog waste: "because it eventually goes away," "just because," "too much work," and "no reason."

## Digest *continued*

**Terrorism and water resources.** The threat of terrorist attacks on the nation's water infrastructure and environment was the focus of the Water Resources and Environment Subcommittee of the U.S. House Committee on Transportation and Infrastructure in October. Several types of attacks were of concern at the hearing, including attacks threatening physical destruction of water infrastructure components, biological and chemical attacks that would attempt to infect or contaminate water systems at various points, and cyber attacks that would attempt to sabotage electronically controlled water systems. The director of the FBI's National Infrastructure Protection Center told the subcommittee, "With regard to contamination by biological agents, the nation's water supply may seem to be a logical target for a terrorist attack. In reality, targeting the water supply may prove difficult." Witnesses told the subcommittee that contamination of large-volume water supplies such as reservoirs is considered difficult because contaminants would be highly diluted. They suggested that the most vulnerable point in the water infrastructure may be at water distribution subsystems, after water has been treated. The Association of Metropolitan Water Agencies called on Congress to provide \$100 million to water supply systems to conduct vulnerability assessments and \$55 million more to enhance emergency response plans for water systems. On Oct 18, EPA Administrator Christie Whitman addressed fears for the security of the nation's water systems, saying the EPA believes the possibility of successful contamination of a water system is small. "It would take large amounts of contaminants to threaten the safety of a city water system," she said. "Because of increased security at water reservoirs and other facilities around the country and because people are being extra vigilant as well, we believe it would be very difficult for anyone to introduce the quantities needed to contaminate an entire system." She said EPA has worked with organizations like the Association of Metropolitan

Water Authorities to make sure water utilities receive information on steps they can take to protect their sources of supply and their infrastructure. In addition, Sandia National Laboratories is working with EPA to develop training materials for water companies so they can conduct thorough assessment of their vulnerable points, and EPA has worked with the FBI to advise every local law enforcement agency in the country of steps they can take to help watch for possible threats to water systems.

### Monitoring in Neuse continues

In response to a report in the WRR I 2001-2002 Annual Program ("With submission of nitrogen TMDL, Neuse ModMon Project winds down"), Dr. Hans Paerl of the UNC-CH Institute of Marine Sciences wrote to ask that we clarify the status of monitoring in the Neuse River Estuary.

Writes Dr. Paerl: "While DENR funds administered via WRR I have expired, we are continuing the critical monitoring activities of ModMon on other funds. Furthermore, Weyerhaeuser, DENR's Rapid Response Team and the USGS are continuing the "team concept" of collaborative monitoring the Neuse with us. At present, we (UNC-IMS) are monitoring 19 stations in the Neuse twice monthly, DENR-DWQ and Weyerhaeuser are monitoring once a month and USGS maintains in stream continuous monitoring capabilities. The hydrographic data continue to be put on the web within 24 hr and are shared by all of us."

### The future of water infrastructure.

"The day of cheap water is fast leaving us behind and the day of paying the true cost of water is about to dawn on this country. And what will bring about these changes in the pricing structure of water? It will be the collapse of American's aging water infrastructure, pure and simple." So reads an editorial in *U.S. Water News* written to publicize the views of the Water Infrastructure Network (WIN), a coalition of 29 organizations representing local government officials, municipal professionals, engineers, environmentalists, and labor

unions. WIN says that it will require \$23 billion annually to finance capital needs to renew the nation's drinking water and wastewater infrastructure—and that is on top of the \$60 billion already being spent each year by customers of local water and wastewater systems. WIN has asked Congress for \$57 billion in infrastructure spending between 2003 and 2007. Now spending for water and wastewater infrastructure improvements is being promoted in Congress as a component of an economic stimulus plan. On Oct 11 members of the Senate Environment and Public Works Committee wrote to the Senate leadership supporting inclusion of funding for water infrastructure assistance in any economic stimulus legislation. "Although Americans take clean, safe water for granted, our drinking and wastewater infrastructure is in disrepair throughout the nation, with literally billions of dollars in documented critical needs," said the letter. "We recommend funding between \$1 and \$5 billion in Federal matching grants to states and municipalities for the purpose of upgrading this critical, but aging and failing infrastructure." It is estimated that \$1 billion in infrastructure spending could create 42,000 jobs. However, in October, the director of the National Association of Water Companies told a Senate subcommittee that his organization and other private companies in the "H<sub>2</sub>O Coalition" oppose efforts by WIN and others to obtain massive federal funding for water infrastructure. "History has shown that these sorts of [direct grants] programs breed inefficiency, encourage dependency, stifle innovation, and do nothing to solve the fundamental problems," he said. The H<sub>2</sub>O Coalition believes that funding challenges can be met through enlarged and improved State Revolving Loan Funds and creative use of the private sector. While WIN wants a "long-term sustainable and reliable source of federal funding for clean and safe water," the H<sub>2</sub>O Coalition says utilities should be self-sustaining, not subsidized enterprises and should be financially supported through the rates they charge customers.

## First announcement and call for abstracts

# Water Resources Research Institute of The University of North Carolina 2002 Annual Conference “Setting the Agenda for Water Resources Research”

Tuesday, April 9, 2002  
Jane S. McKimmon Center, Raleigh, NC

The Water Resources Research Institute of The University of North Carolina (WRRI) requests abstracts for presentations and posters at its 2002 Annual Conference, “Setting the Agenda for Water Resources Research.”

The conference plenary session will be devoted to examination of a number of national studies and initiatives that will help determine the direction of water resources research over the coming decade and beyond. Speakers have been invited from the Water Science and Technology Board of the National Research Council (NRC), the U.S. Geological Survey’s Water Resources Division, and the NRC Committee to Assess the Scientific Basis of the Total Maximum Daily Load Approach to Water Pollution Reduction.

Technical sessions are being organized around the following topics: ■ Drinking Water and Wastewater ■ Erosion, Sediment Control, Sediment Processes, and Turbidity ■ Groundwater ■ Airborne Water Pollutants ■ Watershed Assessment, Planning, and Management ■ Wetlands and ■ Economics and Policy Analysis. Abstracts for presentations in these focus areas are particularly solicited; however, abstracts related to any and all water research and management topics will be considered, and additional sessions may be added depending upon abstracts received. Abstracts not accepted for oral presentation may be presented as posters. Abstracts are also solicited for posters.

For the required abstract format, please go to web address: <http://www2.ncsu.edu/ncsu/CIL/WRRI/2002abstractformat.pdf>. Please submit abstracts of 400 words or less in Microsoft Word or WordPerfect for PC by email to [Jeri\\_Gray@ncsu.edu](mailto:Jeri_Gray@ncsu.edu). \*\* All abstracts will be collected in a booklet and provided to all conference participants.

The deadline for abstract submission is December 10. Decisions on oral presentations will be made by January 7 and all authors will be notified by email of the status of their submissions.

A final conference agenda and registration form will be mailed to those on the WRRI-News mailing list in mid-late January. The final agenda and registration form will also be available on the WRRI website at : <http://www2.ncsu.edu/ncsu/CIL/WRRI/2002conference.html>

*\*\*Abstracts may also be submitted on PC disk to Jeri Gray, WRRI, Box 7912, NCSU, Raleigh, NC 27695-7912.*

## Drought in N.C. worst since 1986

At a meeting of the N.C. Drought Monitoring Council on Nov 8, representatives of various agencies painted a bleak picture for water resources in the state. Ryan Boyles, Assistant State Climatologist, said that many of North Carolina's major cities are experiencing "top ten" dry conditions, with rainfall deficits exceeded only by the drought of 1986. Charlotte is having its 2nd driest year since 1949. Precipitation across the state has been from 6-15 inches below normal over the last 12 months and from 10-25 inches below normal for the last 24 months. The mountain area is in the third year of drought although the area has recovered a bit recently. The Coastal Plain has experienced two years of rainfall deficits with the worst occurring recently.

Groundwater levels in USGS and Division of Water Resources monitoring wells have trended downward for several months, with DWR recording record lows in wells in Rowan, Randolph, Jefferson, and Transylvania counties.

New record low streamflows have been recorded at several USGS gages in the western Piedmont. On Oct 31, a record low streamflow of 57 cfs was recorded in the South Yadkin River near Mocksville. The previous low was 87 cfs.

The U.S. Army Corps of Engineers Wilmington District reported near record low inflows to Falls and Jordan reservoirs. Predictions are that if current conditions persist, the elevations in both reservoirs will be significantly below the "guide curve" by January. Without rain and with the requirement to meet minimum flows at Lillington, the water quality storage in Jordan could be exhausted early next year. While the reservoirs' water quality pools are threatened, the water supply pools are "doing well."

According to the National Weather Service, the long-term forecast can only be based on climate records, which would not hold out much hope of significant rainfall over the winter.

## Websites

The Southern Appalachian Man and the Biosphere's Watershed Initiative has built an interactive website to identify watershed organizations of each basin in the Southern Appalachians. The site is located at <http://samab.org/saris/> watershedorgs and is an initial building block of the Southern Appalachian Regional Information System (SARIS). As a component of SARIS, the site is one of many layers of information that help

people see the relationships among human activities and settlement patterns, water quality, geology, and vegetation. Basins are identified by their name and delineated by the U.S. Geological Survey 8-digit hydrologic unit codes.

## Publications

The U.S. Environmental Protection Agency is making available "Gravel Roads: Maintenance and Design Manual." The manual was developed

### North Carolina Precipitation/Water Resources

	September	October
<b>Rainfall (+/- average)</b>		
Asheville	4.37" (+0.50")	0.60" (-2.99")
Charlotte	4.31" (+0.81")	0.78" (-2.58")
Greensboro	2.06" (-1.46")	0.41" (-3.09")
Raleigh	0.86" (-2.33")	1.86" (-1.00")
Wilmington	5.62" (+0.58")	0.45" (-2.24")
<b>Streamflow</b>		
<b>Index Station</b> (County, Basin)	<b>September mean flow (CFS)</b> (% of long-term median)	<b>October mean flow (CFS)</b> (% of long-term median)
Valley River at Tomotla (Cherokee, Hiwassee)	129 (150%)	71.4 (87%)
Oconaluftee River at Birdtown (Swain, Tenn)	315 (133%)	187 (78%)
French Broad River at Asheville (Buncombe, FB)	1,045 (96%)	892 (63%)
South Fork New near Jefferson (Ashe, New)	187 (74%)	162 (45%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	31.5 (69%)	28.1 (46%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	56.2 (55%)	44.7 (37%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	59.4 (34%)	40.9 (23%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	253 (87%)	144 (66%)
Deep River near Moncure (Lee, Cape Fear)	133 (36%)	103 (42%)
Black River near Tomahawk (Sampson, Cape Fear)	371 (106%)	165 (72%)
Trent River near Trenton (Jones, Neuse)	43.1 (103%)	5.30 (13%)
Lumber River near Boardman (Robeson, Lumber)	302 (45%)	281 (56%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	15.5 (42%)	11.2 (34%)
Potecasi Creek near Union (Hertford, Chowan)	19.6 (127%)	3.28 (22%)
<b>Groundwater</b>		
<b>Index well</b> (Province)	<b>September depth below surface (ft)</b> (departure from average for month)	<b>October depth below surface (ft)</b> (departure from average for month)
Blantyre (Blue Ridge)	36.77 (-4.95)	37.47 (-4.00)
Mocksville (Piedmont)	21.64 (-3.87) (recrd mnth low)	22.05 (-4.12)
Simpson (Coastal Plain)	6.43 (-1.03)	7.77 (-2.34)

Source: U.S. Geological Survey's *Water Resources Conditions in North Carolina* <http://nc.water.usgs.gov/monthly/>

with a major emphasis on the maintenance of gravel roads, including some basic design elements. The manual is designed for the benefit of elected officials, managers, and grader operators who are responsible for designing and maintaining gravel roads. It is available in pdf for mat at: <http://www.epa.gov/owow/nps/gravelman.pdf>

The latest issue of *WaterWise*, published by the N.C. Sea Grant College Program, examines the use of permeable parking lots for control of stormwater runoff. *WaterWise*, edited by Barbara Doll, is a free newsletter devoted to water quality issues. To subscribe call (919) 515-2454.

The N.C. Wetlands Restoration Program has announced the availability of the **Watershed Restoration Plan for the Cape Fear River Basin** and its companion document **Guide to the North Carolina Wetlands Restoration Program's Watershed Restoration Planning Strategy**. The documents can be downloaded in pdf format from website: <http://h2o.enr.state.nc.us/wrp/index.htm> or a hard copy can be obtained

by calling Crystal Braswell at (919) 733-5208.

The Center for Marine Science at UNC-Wilmington has issued **Environmental Assessment of the Lower Cape Fear River System 2000-2001**. This period marks the fifth full year of sampling for the Lower Cape Fear River Program and investigators have begun analysis aimed at identifying trends in water quality in the Lower Cape Fear. For information contact Dr. Michael A. Mallin at (910) 256-3721 or [mallinm@uncwil.edu](mailto:mallinm@uncwil.edu).

## Conferences and workshops

The International Erosion Control Association will present its 33rd Annual Conference and Expo Feb 25- Mar 1, 2002, in Orlando, FL. The event begins with two days of training courses on Monday and Tuesday. On Wednesday, the world's largest exposition of erosion control products and technologies opens, and the conference, featuring more than 50 technical presentations, begins. Certified Professional Erosion and Sediment Control (CPESC) training and

examinations will also be available. For more information and to register go to website:<http://www.ieca.org/public/articles/details.cfm?id=3>

The American Institute of Hydrology will hold its 2002 Annual Meeting and Conference Oct 13-17, 2002, at the Sheraton Portland Hotel in Portland, OR. For details visit website: <http://www.bae.umn.edu/aihydro/>

## People

**Steve Wall** has replaced **Nat Mund** as Director of Governmental Relations for the Conservation Council of North Carolina. Nat has moved to Washington, D.C. Steve, who received his law degree from UNC-Chapel Hill, recently returned to N.C. from Washington.

**Tom Jones**, formerly Neuse Riverkeeper, has taken a position with the Clean Water Management Trust Fund.

**Jeanette Powell**, formerly with the N.C. Division of Water Quality, has taken a part-time position with AMEC (formerly Ogden Environmental).

## 2001-2002 Water Resources Research Seminar Series

Following are the currently scheduled research seminars for 2001-2002. Titles of some presentations may change. Presentations take place at 3 pm 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 WRRRI website, and additions and changes will be posted there (<http://www2.ncsu.edu/ncsu/CIL/WRRRI/2002seminars.html>). For information email [Jeri\\_Gray@ncsu.edu](mailto:Jeri_Gray@ncsu.edu).

### November 26, 2001 Archdale GFHR

*Res. Asst. Joseph MacDonald, UNC-CH*  
*Res. Asst. Michael Holmes, NCSU*  
Southern Village: A Case Study in the Water Quality Benefits of Compact Development

### January 22, 2002 1132 Jordan

*Dr. James D. Gregory*  
*NC State University*  
Development of Stream Identification Methodology, Greensboro, NC

### February 26, 2002 Archdale GFHR

*Dr. Robert C. Borden*  
*NC State University*  
Performance Evaluation of Regional Wet Detention Ponds and a Wetland for Urban Nonpoint Source Control

### March 26, 2002 1132 Jordan

*Mr. William F. Hunt*  
*and Dr. Grada A. Wossink*  
*NC State University*  
Cost Effectiveness Analysis of Structural Storm Water Best Management Practices in North Carolina

### April 23, 2002 Archdale GFHR

*Dr. Lawrence E. Band and*  
*Dr. Aaron Moody, UNC-Chapel Hill*  
Tracking Drought Impact on Managed and Unmanaged Ecosystems of NC

### May 28, 2002 1132 Jordan

*Dr. P.V. Sundareshwar, Nicholas School of the Environment, Duke University*  
Role of Sediment Processes in Regulating Water Quality of the Cape Fear River

## ***Swat-A-Litterbug!***

Motorists and pedestrians may report incidents of litter law violations to the N.C. DOT's Office of Beautification Programs by mailing or e-mailing Swat-A-Litterbug report cards. Owners of vehicles observed littering receive formal notes of warning signed by the Colonel of the Department of Motor Vehicles and the Colonel of the State Highway Patrol reminding them that littering violations may involve a penalty of \$1,000. In 1999, more than 8,000 litterbugs were reported.

To receive Swat-A-Litterbug report cards, call 1-800-331-5864 or visit website:[http://www.doh.dot.state.nc.us/operations/dp\\_chief\\_eng/roadside/Beautification/Litterbug/](http://www.doh.dot.state.nc.us/operations/dp_chief_eng/roadside/Beautification/Litterbug/) to report violations.

A toll-free hotline has been established state-wide for concerned citizens to report possible violations of the North Carolina Sedimentation Pollution Control Act. To report problems call 1-866-STOPMUD (786-7683).



### **Tentative 2001 - 2002 Luncheon and Forum Schedule**

December 3, 2001	Flood Plain Management	September 16, 2002	Drought
February 4, 2002	Interbasin Transfer	December 2, 2002	Air Borne Water Pollutants
April 8, 2002	Total Maximum Daily Loads (TMDLs)		

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

**WATER RESOURCES RESEARCH INSTITUTE  
OF THE UNIVERSITY OF NORTH CAROLINA**  
BOX 7912  
NORTH CAROLINA STATE UNIVERSITY  
RALEIGH NC 27695-7912

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