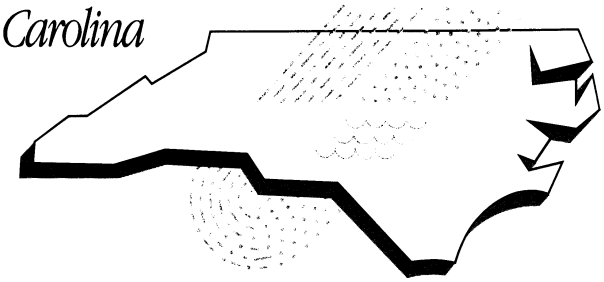
Water Resources Research Institute News
of The University of North Carolina



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Recommendations support approach of N.C. Wetlands Restoration Program

National Research Council report says goal of no net loss of wetlands function is not being met

In a report released in June, an expert panel convened by the National Research Council said that the Clean Water Act Section 404 program that allows developers to fill in wetlands in exchange for restoring or creating others is not meeting the goal of "no net loss" in function of wetlands, although the committee did conclude that the rate of loss has declined over the past decade.

The National Research Council is the principal operating arm of the National Academy of Sciences and National Academy of Engineering. It provides scientific and technical advice under a congressional charter. The committee convened to evaluate the Section 404 program included two NC State University professors, Dr. Robert O. Evans and Dr. J. Wendell Gilliam. The committee also examined North Carolina's Wetlands Restoration Program.

Evans said that in performing its evaluation, the committee conducted an extensive literature review, heard briefings from outside experts and organizations, and visited wetlands restoration and creation sites in Florida, Illinois, and Southern California. He said that during site visits the committee was looking for the potential for the site to evolve to a "functioning" wetland—one that could provide flood retention, pollutant filtering capability, wildlife habitat, or other services. However, he said that what the committee often saw instead was permanently flooded open-water wetlands.

"Hydrology has always been a major criterion for whether a wetland restoration is successful," said Evans. "A mitigation may need to be just over the "jurisdictional" line hydrologically, but to be on the safe side, permittees have made restored or created wetlands wetter than natural wetlands. These open-water wetlands may not be as effective for water quality because vegetation can't be

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Director's Forum

TMDLs: Identifying and improving impaired waters

Kenneth H. Reckhow, Director, Water Resources Research Institute

Probably the most controversial recommendation in the recent National Academy of Sciences report on the Total Maximum Daily Load program concerns the identification of impaired waters. On the one hand, it is widely acknowledged that the states have placed waterbodies on the 303d list of impaired waters for a range of reasons and with great variation in the strength of the scientific supporting evidence. On the other hand there is extreme resistance in some circles to adding scientific and statistical rigor to the listing process. What can be done?

In the long run, the answer is to improve the science by incorporating good monitoring design principles and statistical hypothesis testing into the listing decision, thus improving the chances for correct diagnosis of the truly impaired waters. This scientific advancement needs to be accompanied by critical review of water quality standards so that appropriate designated uses are met. To understand these recommended solutions, a review of ambient water quality standards in the United States and practices for assessing compliance, is instructive.

Water quality standards consist of two primary components: a *designated use* (e.g., trout waters) that specifies the desired use for the waterbody, and a *criterion* (e.g., chlorophyll a) that serves as a scientific measure of achievement of the designated use. Although science helps inform the decision, determining designated uses primarily involves making value judgments concerning water quality goals. While costs and benefits of compliance may be considered, selecting a criterion for determining achievement of the designated use is primarily a scientific assessment.

Assessing compliance with water quality standards is essentially a scientific task that is analogous to disease diagnosis in medicine and can be viewed from a statistical hypothesis-testing context. The doctor uses sample information from a medical examination, while the water quality scientist uses samples from a monitoring program. Fundamentally, the objective is to minimize the possibility of declaring a standard violation when the waterbody is truly in compliance or declaring compliance when the waterbody is truly in violation.

From a scientific perspective, the standards compliance diagnosis problem is best addressed using statistical hypothesis testing. To do this, samples are taken and a "null" hypothesis is established; for listing purposes the null hypothesis may be "the waterbody is in compliance," whereas for delisting the null hypothesis may be that "the waterbody is in violation." The actual hypothesis test may be based on a binomial distribution, with samples then simply expressed as dichotomous – compliance or noncompliance. Alterna-

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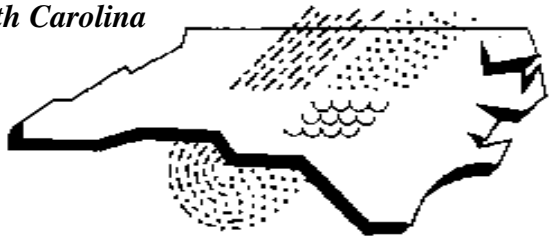

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tively, to allow the actual magnitude of the observations to matter, a probability distribution (e.g., lognormal) could be selected to represent the criterion. Due to practical limitations for many state agencies, the binomial test is likely to be the more common choice.

Contrast that rigorous analytical strategy to the approaches currently employed to assess standard violations and list impaired waters. Available water quality data and visual assessments have been combined for judgment calls by the states for most of the current 303d lists. Not knowing the implications of 303d listing decisions, states often placed waterbodies on the 303d list with little or no actual water quality data. For example, most of the evaluated waters in Mississippi are on the state's 303d list; they were placed there in many instances based on windshield surveys undertaken by the county soil and water conservation districts in the belief that this would increase the amount of federal funds allocated to Mississippi under the EPA 319 program. Mississippi now has over 2,000 TMDLs to develop in the next eight years, with apparently little water quality data to either confirm noncompliance or prioritize the needs.

So given this 303d listing dilemma, why is the improvement in scientific practice through statistical hypothesis testing being resisted? In all likelihood, the resistance reflects an understandable concern that, given the haphazard basis for the current 303d list, rigorous statistical testing would result in a number of waterbodies being removed from the current list. This may indeed happen, although additional water quality monitoring is also likely to lead to currently unlisted waterbodies being identified as impaired. Still, how should we respond to those who feel that the requirement for hypothesis testing will shrink the list of impaired waters?

The answer is clear. Improvements in science enhance the TMDL program. In this case, they help identify the truly impaired waterbodies, thus directing resources appropriately. If the result of

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Wetlands *continued*

maintained, and much of the biological activity to improve water quality occurs within vegetation."

Another problem that the committee observed on its site visits was inappropriate placement on the "landscape" of restoration and creation projects, Evans said.

"EPA has insisted on on-site, in-kind mitigation," Evans said. "By that I mean restoration or creation of the same kind of wetland being impacted on the same or nearby site. This policy has forced mitigation on unsuitable landscapes and ignores that sometimes the lost function may not be the most important one for a watershed."

The committee also found that record keeping by the Corps is not adequate to track what functions are lost when wetlands are filled or the status of the required compensation wetlands—that is whether compensatory mitigation project were actually undertaken and whether they met permit conditions. Therefore, it concluded, it is not possible to determine whether compensatory mitigation under Section 404 is contributing to the objective of restoring and maintaining the quality of the nation's waters.

Recommendations

The National Research Council committee made a number of recommendations to improve the Section 404 compensatory mitigation program. Among the most important are:

- The Corps of Engineers should track the wetland area and functions lost and regained in a national database. In cooperation with states, the Corps should encourage establishment of watershed organizations that would track monitor and manage wetlands in public ownership or under easement.
- Site selection for wetland conservation and mitigation should be conducted on a watershed scale in order to maintain wetland diversity, connectivity, and appropriate proportions of upland and wetland systems needed to enhance the long-term stability of the wetland and riparian systems.
- All mitigation wetlands should become self-sustaining. In order to accomplish this goal, proper placement in the landscape to establish hydrogeological equivalence should be assured. Hydrological variability should be incorporated into wetland mitigation design and evaluation.
- Destruction of wetlands that are difficult or impossible to restore—such as fens or bogs—should be avoided. Riparian wetlands should receive special attention and protection because their value for stream water quality and overall stream health cannot be duplicated in any other landscape position.
- Compensatory mitigation sites should receive long-term stewardship, that is on a time frame expected for other publicly valued assets like parks.

N.C. Wetlands Restoration Program

Evans said that the NRC recommendations support the approach taken by the N.C. Wetlands Restoration Program.

"North Carolina is doing a watershed by watershed assessment," said Evans. "They look at what should not be impacted, and where is it most beneficial to do mitigation, just as the committee suggests."

Ron Ferrell, head of the N.C. Wetlands Restoration Program, said that while it is gratifying to hear it acknowledged that the state's program is on track, he is still focusing on some improvements.

"We still need to solidify accountability," said Ferrell, "and widen our approach to include, for instance, wildlife habitat."

Ferrell said that while 63 projects are underway in the program, no site is more than one year old, so that the program is still focusing on individual site monitoring. But, he said, eventually watershed monitoring will need to be developed to determine the effect of mitigation on water quality.

September action of the North Carolina Environmental Management Commission

At its regular meeting on September 13, 2001, the N.C. Environmental Management Commission (EMC) took the following action:

■ Approved reclassifying Mills Creek in Moore County as High Quality Waters (HQW). The reclassification includes the condition that HQW stormwater controls will not apply to areas in which municipalities are using the "5/70"provision of the Water Supply Watershed rules (15A NCAC 2B .0215(3)(b)(I)(E).

■ Approved a Special Order by Consent containing provisions that will allow Pitt County Gin and Cotton Company to operate while a new rule establishing emission control requirements for cotton gins is being developed.

■ Adopted temporary amendments to rules establishing certification criteria for laboratory facilities performing tests, analyses, measurements, or monitoring required by State environmental laws and rules. In addition to updating techniques and methods references, the temporary rule increases fees charged for certification.

■ Approved holding a public hearing on the proposed reclassification of a segment of the Hiwassee River in Cherokee County from WS-IV protected area to WS-IV critical area. The N.C. Department of Transportation has proposed to build a bridge in the critical area of the Town of Murphy's water supply intake. The town and the Division of Environmental Health are concerned that the bridge will cause contamination of the water supply. Therefore, the town will relocate its water intake about 0.5 miles upstream of the existing intake, necessitating expansion of the existing critical area.

■ Approved the final White Oak River Basinwide Water Quality Plan. Commissioner Charles Peterson commended the basinwide planning staff for bringing about the interagency interaction needed to address closed shellfishing waters in the basin.

■ Adopted temporary rules establishing a permitting system for development in isolated wetlands and surface waters. The rules were developed and adopted in the wake of a U.S. Supreme Court decision that removed isolated wetlands from jurisdiction of the U.S. Army Corps of Engineers. Following that decision, the EMC confirmed the intent of its rules to regulate isolated wetlands and isolated waters. However, the EMC's wetland rules did not contain provisions for impacts to isolated wetlands, so rules had to be developed to establish a permitting program. Permanent rules are now in the making.

■ Adopted an Administrative Law Judge's (ALJ) recommendation to uphold a civil penalty of $50,700 and costs of $275 against J.C. Faw of Wilkes County for failure to comply with requirements of an NPDES Stormwater General Permit for a construction site.

■ Adopted an ALJ's recommendation to uphold a civil penalty assessed against Heater Utilities of Wake County for violations of its NPDES permit's monthly average and daily average effluent limits for fecal coliform at its Spring Creek subdivision wastewater treatment plant. Odes L. Stroupe, attorney for Heater, said that the company was challenging the fine because it actually wanted the EMC to review the Department of Environment and Natural Resources NPDES enforcement policy. In 1998, DENR adopted a new, more stringent wastewater discharge permit enforcement strategy that includes a set fine for violations of permit limits regardless of the size of the wastewater treatment plant. Stroupe said that the policy means a facility serving a few hundred people will be assessed the same fine as a city the size of Greensboro or High Point. He said Heater believes the policy is unfair to small discharging facilities, believes it is not consistent with EMC rules, and believes the change in enforcement policy amounts to a rule change without going through the appropriate Administrative Procedure Act requirements.

Commission Chairman David Moreau pointed out that "the fine policy is not a creation of the EMC." Moreau said, "The statute gives that authority to the Secretary [of DENR], so your argument is best made on the 14th floor of this building." (The Secretary of DENR has his offices on the 14th floor of the Archdale Building.) Moreau said that commissioners sitting on Civil Penalty Remissions Committees have confronted the results of the enforcement policy and have asked the Secretary to reconsider the policy. Moreau pointed out that the role of the EMC in the challenge brought by Heater was only to decide if the policy was applied correctly.

■ Adopted an ALJ's recommendation to uphold a civil penalty against S.H. Knight Oil Company of Stokes County for failure to permanently close two underground storage tanks.

■ Adopted an ALJ's recommendation to uphold a civil penalty against Mike Cooper of Jackson County for violation of the prohibition against open burning.

The EMC removed from its agenda adoption of temporary rules for the NPDES Phase II Stormwater Program. According to Vice Chairman Charles Peterson, there are unresolved legal issues regarding how the NPDES stormwater rules affect counties.

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

At its regular meeting on September 12, 2001, the Water Quality Committee of the N.C. Environmental Management Commission took the following action:

■ Approved Water Supply Watershed Protection ordinances for Wayne County and the Town of Gastonia.

■ Approved staff request to begin the process to reclassify (1) a section of the Little Tennessee River in Macon and Swain counties to Class B (for body contact recreation), (2) Swift Creek in Edgecombe, Franklin, Nash, Vance and Warren counties to Outstanding Resource Waters, (3) three sections of the New River in Onslow County as Shellfishing and High Quality Waters, (4) a section of Southwest Creek in Onslow County to SC.

■ Tabled a request from George Fortune of Cary for a major variance from the Neuse River Riparian Area Protection rules.

■ Approved a request from James Andrews of Durham for a major variance from the Neuse River Riparian Area Protection rules.

■ Deferred until October a staff request to consider establishing a General Major Variance from buffer rules for airport facilities. The request was prompted by filing in the N.C. General Assembly of Senate Bill 855 "An Act to Clarify the Definition of Airport Facilities for Certain Purposes," which essentially exempts airport facilities from all buffer rules, and which DENR opposes. Commissioner Robert Epting, a private pilot, was concerned about the definition of "airport facilities" and offered to work on language for the variance with the attorney for the N.C. Airports Association.

■ Approved the Coastal Habitat Protection Plans Annual Report for presentation to the General Assembly's Environmental Review Commission and Joint Legislative Commission on Seafood and Aquaculture.

■ Approved holding public meetings on the draft Watauga River Basinwide Water Quality Plan. The public meeting will be held October 23. For details check the Basinwide Planning website at http://h2o.enr.state.nc.us/basinwide/index.html.

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September action of the EMC Groundwater Committee

At its regular meeting on September 12, 2001, the Groundwater Committee of the N.C. Environmental Management Commission took the following action:

■ Agreed to ask the full EMC at its October meeting to approve publication of notice and text of permanent rule amendments for the Dry-Cleaning Solvent Cleanup Program (15A NCAC 2S). No public hearing is planned since no comments were received under the 60-day notice of rulemaking proceedings. Among other things, the rule amendments clarify that all dry cleaning facilities—not just those that want to be covered by the cleanup fund—are subject to minimum management requirements.

■ Approved publication of Notice of Rulemaking Proceedings for amending groundwater quality standards setting maximum concentration levels for eleven substances: butylbenzyl phthalate, total coliforms, diethylphthalate, total dioxins, epichlorohydrin, hexachlorobenzene, naphthalene, nickel and nickel soluble salts, phenol, selenium, and styrene.

The committee removed from its agenda consideration of a procedure for evaluating tax certification requests for animal waste management systems. State law provides for exemption from assessment or taxation of "real and personal property that is used . . . exclusively for air cleaning or waste disposal or to abate, reduce or prevent the pollution of air or water." To gain exemption under this law, a property owner must receive a certificate from the Environmental Management Commission confirming that the property has "as its primary rather than incidental purpose the reduction of water pollution resulting from the discharge of sewage and waste." The Department of Environment and Natural Resources received requests for certification from animal producers and referred the requests to the EMC. The EMC referred the issue to its Air Quality, Water Quality and Groundwater committees. The Groundwater Committee was scheduled to hear from DWQ staff and the Attorney General's office about legal issues. However, according to Groundwater Section Chief Arthur Mouberry, the Department of Revenue maintains that the lagoon-spray field system does not qualify for the tax exemption because the spray fields are also used for growing crops. Therefore, he said there are unresolved legal issues.

Commissioner Robert Epting said that he was sorry the item was removed from the agenda because he would like to send a message to DENR that lagoon-sprayfield systems are not pollution control facilities but sources of pollution.

Likewise, Groundwater Chairman Ryan Turner said that if the EMC certified the lagoon-sprayfield systems for tax exemption, the body would be certifying that the systems control pollution. "I'd like to weigh in on that issue," said Turner.

EMC Water Quality Committee *continued*

■ Approved presenting to the full EMC a request to hold public hearings on draft permanent rules amending the wastewater discharge rules (15A NCAC 2H .0103 and .0106) dealing with discharges from decontamination facilities in emergency situations. The EMC approved temporary rules in April in response to requests to prepare for possible outbreaks of Foot and Mouth Disease. The Water Quality Committee approved with several changes permanent rules that will also address emergency responses for other biological or chemical decontamination activities conducted by State or Federal Authorities.

■ Heard an update from Pat Davis of the Triangle J Council of Governments on development of a nutrient response model for Jordan Lake.

Water Quality Committee Chairman Charles Peterson removed from the committee's agenda an update on the status of the second phase of the TMDL for nitrogen in the Neuse Estuary. Commissioner Peterson said that in view of the "changing federal climate" for TMDLs he wants the committee to hear from modelers and other experts before they hear staff recommendations for the TMDL. A special presentation for the committee will be scheduled, and the issue will return to the Water Quality Committee in October.

Also removed from the Water Quality Committee agenda was consideration of a procedure for evaluating tax certification requests for animal waste management systems. The same item was removed from the Groundwater Committee's agenda. See the explanation on page 7.

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

At its regular meeting on September 12, the N.C. Environmental Management Commission's Water Allocation Committee heard several reports regarding interbasin transfers:

The third round of allocations of Jordan Lake Water Supply Storage. When the EMC approved opening the third round of water supply allocations from Jordan Lake, it instructed the N.C. Division of Water Resources (DWR) to complete a Cape Fear River Basin Water Supply Plan and to recommend third round allocations by September 2001. DWR staff reported that they have not been able to complete the plan or recommendations. The plan and third round allocation recommendations are to be presented in October, when staff will request to go to public hearing with the recommendations. Commissioner David Moreau raised a number of questions concerning information that the EMC will be given to help make the decision on third-round allocations. Moreau was particularly concerned about the accounting procedure for transferred water returned to the basin, saying that the current Corps of Engineers procedure results in users not receiving full credit in the water supply storage pool for water returned. Moreau stated that the DENR should discuss the accounting procedure with the Corps.

"The State of North Carolina bought storage for water supply," said Moreau. "Somebody's got to start applying political pressure." He said that resolution of this issue could make a difference in the EMC's willingness to allocate more Jordan Lake water supply storage. Staff of DWR were asked to investigate whether the Corps of Engineers has discretion to modify the return accounting procedure and report in October.

The issue of a drought management plan for Jordan Lake was also raised, with a representative of the City of Fayetteville saying he had understood a drought management plan would be developed before round-three allocations were started. The committee decided not to ask staff of DWR to develop a drought management plan on an accelerated schedule but to review the results of the hydrologic model before putting the plan on a schedule. Information on the Cape Fear River Basin Water Supply Plan can be found on the DWR website at: http://www.ncwater.org/Water_Supply_Planning/Cape_Fear_Basin_Water_Supply_Plan/ .

Interbasin Transfer request from the Charlotte-Mecklenburg Utilities (CMUD). CMUD's 16.1 million-gallons-per-day (MGD) transfer of water from the Catawba River Sub-basin to the Rocky River Sub-basin was grandfathered under the current interbasin transfer law. Now, CMUD is requesting to increase the interbasin transfer to 33 MGD. Staff of DWR stated that the increase is reasonable with conditions to address secondary impacts, and recommended proceeding to public hearing with the request. The committee agreed to send the request to the full EMC in October. A public hearing will be held in November or December. Information on the CMUD request can be found on the DWR website at : http://www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/Status/Cmud

Future Interbasin Transfers. Staff of DWR said that additional interbasin transfer requests are pending for Mecklenburg County and Union County, Concord/Kannapolis, and Salisbury. Staffer Tom Fransen also reported that staff is seeing issues arise with development of new electric generation turbines, which have high consumptive water use that can constitute an interbasin transfer.

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

In addition to environment-related legislation reported in the July/August 2001 WRRI News, the following environment-related bills were passed by the General Assembly as of September 21. This list is not comprehensive.

S 247 AN ACT TO REALLOCATE THE PROCEEDS OF THE CLEAN WATER BONDS AND TO DEFER THE ISSUANCE OF THE CLEAN WATER BONDS, NATURAL GAS BONDS, AND PUBLIC SCHOOL BUILDING BONDS UNTIL AFTER JANUARY 1, 2002.

S 432 AN ACT TO ALLOW NONPROFIT WATER CORPORATIONS AND THE STATE OF NORTH CAROLINA TO JOIN CERTAIN WATER AND SEWER AUTHORITIES AND CONCERNING THE RIGHT OF SUBSEQUENTLY JOINING MUNICIPALITIES TO HAVE VOTING MEMBERSHIP.

S 848 AN ACT TO INCLUDE PUBLIC LIVESTOCK MARKETS WITHIN THE DEFINITION OF ANIMAL OPERATIONS FOR THE PURPOSE OF REGULATING THE ANIMAL WASTE MANAGEMENT SYSTEMS THAT SERVE THESE MARKETS AND TO PROVIDE THAT AN ANIMAL WASTE MANAGEMENT SYSTEM THAT SERVES A PUBLIC LIVESTOCK MARKET MAY BE PERMITTED EITHER AS AN ANIMAL OPERATION OR UNDER THE STATE'S GENERAL WATER QUALITY STATUTES.

H 189 AN ACT TO AUTHORIZE THE COASTAL RESOURCES COMMISSION TO ADOPT TEMPORARY RULES TO ESTABLISH ADDITIONAL EXCEPTIONS TO THE 30-FOOT BUFFER REQUIREMENT ALONG PUBLIC TRUST AND ESTUARINE WATERS IN CERTAIN CIRCUMSTANCES AND TO ALLOW STRUCTURAL MODIFICATIONS TO PIERS TO PREVENT OR MINIMIZE STORM DAMAGE, AND TO EXTEND THE TIME THAT TEMPORARY RULES TO PROTECT WATER QUALITY AND RIPARIAN BUFFERS IN CERTAIN RIVER BASINS WILL REMAIN IN EFFECT SO AS TO ALLOW THE ENVIRONMENTAL MANAGEMENT COMMISSION ADDITIONAL TIME TO CONSULT WITH PERSONS WHO ARE INTERESTED IN OR MAY BE AFFECTED BY THE ADOPTION OF PERMANENT RULES TO REPLACE THOSE TEMPORARY RULES.

H 570 AN ACT TO PROVIDE FOR THE IMPLEMENTATION OF THE ADMINISTRATIVE RULE ENTITLED "TAR-PAMLICO RIVER BASIN-NUTRIENT SENSITIVE WATERS MANAGEMENT STRATEGY: AGRICULTURAL NUTRIENT CONTROL STRATEGY" WITH CERTAIN MODIFICATIONS, TO AUTHORIZE THE ENVIRONMENTAL MANAGEMENT COMMISSION TO INCORPORATE THESE MODIFICATIONS INTO A REVISED ADMINISTRATIVE RULE, AND TO DIRECT THE SOIL AND WATER CONSERVATION COMMISSION TO APPROVE BEST MANAGEMENT PRACTICES AND A NUTRIENT LOADING POINT SYSTEM FOR PASTURE-BASED PRODUCTION AND MANAGEMENT OF LIVESTOCK.

H 612 AN ACT TO SPECIFY THE EFFECTIVE DATE OF THE ADMINISTRATIVE RULE RECLASSIFICATION BY THE ENVIRONMENTAL MANAGEMENT COMMISSION OF CERTAIN WATERS IN THE NEUSE RIVER BASIN BELOW FALLS LAKE DAM THAT WOULD HAVE THE EFFECT OF ALLOWING THE TOWN OF WAKE FOREST TO WITHDRAW ADDITIONAL WATER FROM THE NEUSE RIVER AND TO PROVIDE THAT THE 2004 REGULAR SESSION OF THE 2003 GENERAL ASSEMBLY MAY DISAPPROVE THE RULE.

H 968 AN ACT TO CLARIFY THE AUTHORITY OF COUNTIES AND CITIES TO PROVIDE FOR THE DEFENSE OF AND TO PAY JUDGMENTS AGAINST SOIL AND WATER CONSERVATION SUPERVISORS AND EMPLOYEES.

H 1257 AN ACT TO ESTABLISH A SURFACE WATER IDENTIFICATION TRAINING AND CERTIFICATION PROGRAM AS A COMPONENT OF THE RIPARIAN BUFFER PROTECTION PROGRAM.

H 1272 AN ACT REQUIRING STATE AGENCIES TO USE LIFE-CYCLE COST ANALYSIS FOR THE DESIGN, CONSTRUCTION, OPERATION, MAINTENANCE, AND RENOVATION OF STATE FACILITIES AND FOR THE PURCHASE, OPERATION, AND MAINTENANCE OF EQUIPMENT FOR THESE FACILITIES AND IMPLEMENTING A PILOT PROGRAM TO REVIEW THE USE OF THE TRIANGLE J COUNCIL OF GOVERNMENTS' HIGH PERFORMANCE GUIDELINES IN THE RENOVATION OR CONSTRUCTION OF STATE FACILITIES.

H 1301 AN ACT TO CLARIFY THE CIRCUMSTANCES IN WHICH LAND-USE RESTRICTIONS AND RECORDATION OF THOSE RESTRICTIONS IN THE OFFICE OF THE REGISTER OF DEEDS ARE REQUIRED IN CONNECTION WITH THE CLEANUP OF A RELEASE FROM A PETROLEUM UNDERGROUND STORAGE TANK IN ORDER TO PROTECT THE ENVIRONMENT AND PUBLIC HEALTH, TO ENSURE ENFORCEABILITY OF RESTRICTIONS, AND TO PROVIDE NOTICE TO SUBSEQUENT OWNERS OF THE PROPERTY; AND TO MAKE CONFORMING CHANGES TO RELATED STATUTES.

Studies

"Studies" is a new department in the WRRI 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.

Study shows disinfection with hypochlorite adds bromate to drinking water

Bromate is a chemical compound (BrO_3) that is toxic in high doses and has been shown in animal studies to be mutagenic and carcinogenic in very low doses. Toxicological studies have put the lifetime cancer risk at 1 in 100,000 (10^{-4}) for 5 µg/L (parts per billion).

In 1998, the U.S. EPA promulgated the National Primary Drinking Water Regulations Stage 1 Disinfectants and Disinfection Byproducts rule setting a maximum contaminant level goal of zero for bromate in finishing drinking water (reflecting the agency's position that there is no "threshold" below which no health effects occur) and a maximum contaminant level of 10 µg/L based on a 10^{-4} cancer risk and the ability of current analytical methods to detect and quantify the compound. The rule takes effect for large public water supply systems in December 2001 and for small surface water and all groundwater systems in December 2003. Consideration has been given to regulating bromate in drinking water closer to the MCLG in the future—perhaps initially lowering the MCL to 5 µg/L.

The Stage 1 Disinfectants and Disinfection Byproducts rule focuses concern about bromate on water treatment processes using ozonation, since bromate in drinking water results principally from ozonation of raw water containing bromide. Monitoring requirements are applied to community water systems and nontransient noncommunity water systems using ozone for disinfection or oxidation. The rule specifies control of the ozone process as "best available technology" for reduction of bromate.

However, new work by Carrie A. Delcomyn, Howard S. Weinberg, and Philip C. Singer in the Department of Environmental Sciences and Engineering at UNC-Chapel Hill suggests that concern about bromate in drinking water should also include the 50 percent of all water treatment plants that use hypochlorite for disinfection.

In a recent article in the *Journal of Chromatography* A (920 [2001]213-219), the scientists describe work undertaken to develop more sensitive, less hazardous, and easier analytical techniques for detecting and quantifying bromate and chlorite (also a compound of health concern) in finished drinking water chlorinated using sodium hypochlorite. Their method uses ion chromatography in conjunction with a post-column reaction and achieves practical quantitation of bromate at 0.05 µg/L—a level corresponding to 10^{-6} cancer risk. Unlike other methods used for bromate quantitation, the UNC method does not require the use of toxic reagents and does not require multiple reaction steps.

The scientists demonstrated their method by applying it to a variety of waters from treatment plans using hypochlorination. They also evaluated commercially produced hypochlorite feedstocks for the presence of bromate.

Water treatment plants involved in the study provided the scientists samples of the hypochlorite solutions they use for disinfection. The researchers diluted the feedstock samples and evaluated the dilutions for bromate. As an example, they found concentrations of 20.6 mg/L (parts per million) of bromate in a 13.2% solution of feedstock from one facility, and 36 mg/L in a 15.4% solution of feedstock from another facility. (The dilutions are comparable to those used by water treatment plants.)

Evaluation of raw water and finished water showed increases in bromate concentration after disinfection with hypochlorite solution.

The authors conclude that their method has demonstrated the ability to detect bromate in chlorinated drinking water down to a 0.05 µg/L level and that it is user-friendly enough to be used on-site at drinking water facilities.

However, their work also raises additional concerns about bromate in drinking water and, in particular, the difficulties plants using ozone plus hypochlorite disinfection might face in meeting any future lowering of the bromate MCL.

The Journal of Chromatography A is a peer-reviewed journal published by Elsevier. Corresponding author on this study is Howard S. Weinberg (howard_weinberg@unc.edu).

UNC scientists develop strategy for "floating" dense contaminants out of aquifers

Much of what is called "groundwater contamination" is contamination of aquifer soils by dense compounds that are not soluble in water. These compounds, referred to as dense nonaqueous phase liquids or DNAPLs, are most often

highly toxic chlorinated solvents such as trichloroethylene (TCE), a solvent historically used for rocket engine flushing, metal cleaning and degreasing of equipment, electronics, and heavy machinery. TCE is a common contaminant at thousands of Department of Energy, Department of Defense, NASA and private industry facilities. Because TCE is denser than water and only slightly soluble in water, it tends to accumulate as pools below the water table and release contaminants to the surrounding groundwater for long periods. Using the traditional approach to groundwater cleanup, in which contaminants in groundwater are pumped to the surface and treated in above-ground treatment systems, for remediation of DNAPLs can take many years of effort and cost millions of dollars. Because DNAPLs are such a prevalent form of contamination and so difficult and costly to clean up, government and private industry are investing heavily in development of innovative technologies to remediate DNAPL sites.

Among the nation's leading scientists focusing on DNAPL remediation are those in the Center for Multiphase Research in the Department of Environmental Sciences and Engineering (DESE) at UNC-Chapel Hill. In an article published in *Environmental Science & Technology* (Vol 34, No 4, 2000), Cass T. Miller, Edward H. Hill, III, and M. Moutier of UNC-CH DESE describe a strategy for cleaning up subsurface pools of DNAPLs that involves floating pools by increasing the density of the underlying groundwater.

Most approaches to cleaning up DNAPLs in ground water rely on getting the compounds to go into solution in water or other solvent injected to flush out the aquifer soils. These approaches are not very efficient because DNAPLs are very insoluble. Trying to flush out DNAPLs is also risky because once the compounds are mobilized, they may move deeper into aquifer soils, contaminating previously uncontaminated areas. The investigators hypothesized that it should be possible to move a pool of DNAPLs in a controlled fashion to a place when it could be captured without dissolving the compound. They conducted bench-scale studies using one-dimensional columns and two-dimensional flow cells to determine how such a strategy could work. They packed columns and cells with medium and coarse sands, topped off by fine sand, then flushed out gases and saturated the sands with deionized water. They then injected TCE with red dye to create a DNAPL pool and left it to reach a quasi-static state.

In three different experiments, they explored two approaches to "density controlled mobilization." In the first two experiments, they injected a dense brine solution at the bottom of the column and a flow cell. The brine mobilized the pool, floating most of the TCE upward where it was removed with a syringe. After a downward flush with deionized water to wash out the brine, the residual TCE was distributed throughout the column, with no pools evident. This left the TCE in an ideal state for removal using conventional flushing approaches, such as cosolvents or surfactants.

In the third experiment, they explored the use of desaturation to enhance the mobilizing effect of the brine. As in the first two experiments, they injected brine at the bottom of the flow cell. They then used a syringe to desaturate the sand containing the DNAPL pool, in much the same way a well would pump water out of an aquifer. The syringe collected not only water but also DNAPL. When the syringe started withdrawing mostly air, they stopped pumping and flushed the cell downward with a water and surfactant solution to remove the brine. They estimated that more than 90% of the TCE was removed by this method.

The authors say these results clearly demonstrate that controlled-mobilization strategies promise a major advance for remediation of contamination containing DNAPL pools. Using dense solutions to mobilize the pools can remove large fractions of the DNAPLs rapidly. The investigators are continuing work on the methods, with the intention of developing refined flushing strategies and solutions, extending the processes to larger scales, and eventually conducting field scale trials.

Environmental Science & Technology is published by the American Chemical Society and includes various types of articles. Articles chosen for the current research section are peer-reviewed. Corresponding author for this study was Cass T. Miller, casey_miller@unc.edu.

Director's forum *continued*

statistical hypothesis testing incorrectly leads to removal from the 303d list of waterbodies that truly do not meet their designated use, then does this mean that the requirement for hypothesis testing was a bad decision? No! It means that the water quality standard is inadequate, most likely because the criterion does not adequately reflect the designated use, or the criterion level is not stringent enough, or the hypothesis test error rate needs adjustment. All of these corrective measures are appropriately addressed at improvement of the criterion to properly and accurately reflect the designated use.

It makes little sense to oppose the proposed scientific improvements in the listing process. Rejecting improved listing may keep current 303d lists intact, but flawed lists will likely result in state resources being directed toward developing TMDLs for some waterbodies which are actually in compliance. Further, without scientific and statistical improvements in the listing process, misdiagnosis will continue at a needlessly high rate. The potential for seeing acutally impaired streams dropped from 303d lists can and should be addressed by properly revising the standard to best represent the designated uses.

We should encourage improvements in the science, as we should encourage the accurate reflection of values in water quality standards; both of these are essential to the primary goal of attainment of the designated use.

WRRI report available

WRRI has recently published a peer-reviewed technical completion report on a research project 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.

Evaluation of Performance and Operational Costs for Three Biological Nutrient Removal Schemes at a Full-Scale Wastewater Treatment Plant
Report No. 334 June 2001

Karl G. Linden
Department of Civil and Environmental Engineering, Duke University
James M. Hawkins and
Mary P. Bonislawsky
Black & Veatch, Charlotte, NC

A two-year nutrient removal study was conducted at McDowell Creek Wastewater Treatment Plant in Charlotte, North Carolina. The overall objective of the research was to evaluate performance and operational costs for three biological nutrient removal (BNR) schemes implemented at the plant, including documenting and monitoring effluent nitrogen and phosphorus levels for each configuration, and tracking the operations, maintenance and chemical input costs for operation. The nutrient removal schemes evaluated included the University of Cape Town/Virginia Initiative Plant (UCT/VIP) process, the Charlotte North Carolina (CNC) process, the modified Orange Water and Sewer Authority (OWASA) process, and the chemical phosphorus removal process.

The three different BNR processes were studied over two years. The UCT/VIP process was on-line for approximately 18 months, the CNC process was on-line for approximately four months, and the modified OWASA process was on-line for approximately two months. The original objective was to operate each BNR process for the same amount of time. However, this was not possible due to operational issues, continuing upgrades, commitment to effluent quality and time constraints. The UCT/VIP process appeared to be the most stable of the three processes; therefore, plant operators preferred that this process remain on-line throughout most of the study.

Each BNR process was analyzed similarly by profiling nutrients throughout the treatment train and documenting chemical usage and power consumption. On a cost basis, there was not a significant difference among processes. The ability to meet effluent limits with the least operational difficulty became priority.

All processes were successful in removing phosphorus and nitrogen from the wastewater to meet permit limits of 1 mg/L and 10 mg/L for total phosphorus and nitrogen respectively. All processes required supplemental acetic acid feed to assist in anaerobic phosphorus release.

The study found that BNR is more sensitive than conventional treatment and must be monitored closely to achieve efficient operation. Low levels of alum addition for phosphorus precipitation were necessary to meet regulatory limits during periods of instability. Operation of WWTPs is site-specific, thus a significant period of trial must be completed before performance optimization can properly be assessed and assured over the long-term.

Regular maintenance inspections are necessary to ensure proper mechanical performance. If a pump or mixer breaks down, it usually leads to operational failure. Keeping backup pumps available (when reasonable) may help ensure quality mechanical performance. Optimization of chemical inputs, such as acetic acid and alum, is necessary after steady-state operation of the BNR process has been achieved. Belt press filtrate and any other return streams must be monitored and regulated as closely as possible to eliminate slug inputs of nutrients that may lead to upsets in the BNR balance.

Digest

New arsenic report. In September the National Research Council released a report saying that new studies "strengthen the evidence of a link between bladder and lung cancer and exposure to arsenic in drinking water. "Even very low concentrations of arsenic in drinking water appear to be associated with a higher incidence of cancer," said Robert Goyer, chair of the committee that wrote the report and professor emeritus of pathology, University of Western Ontario, now living in Chapel Hill, NC. "We estimated the risk of developing cancer at various arsenic concentrations, and now it is up to the federal government to determine an acceptable level to allow in drinking water supplies." The committee found that men and women who daily consume water containing 3 parts per billion (µg/L) of arsenic have about a 1 in 1,000 increased risk of developing bladder or lung cancer during their lifetime. At 5 parts per billion, the risk is about 1.5 in 1,000; at 10 parts per billion, it is greater than 3 in 1,000; and at 20 parts per billion, it is close to 7 in 1,000. The committee's risk estimates are greater than those on which EPA based its pending rule (10 µg/L) because the committee used some different estimation methods and assumptions. The data showing a relationship between chronic exposure to arsenic in drinking water and cancer are abundant. However, more research is needed to study the extent to which exposure also causes diseases other than cancer, the committee said.

For a news release on the report and a link to the full report, go to web address: http://www4.nationalacademies.org/news.nsf/isbn/0309076293?OpenDocument.

Water efficient plumbing savings. According to a report from the American Water Works Association (AWWA), American consumers stand to save $35 billion simply by using widely available water efficient plumbing products in their homes. According to AWWA's survey of 3,700 utilities nationwide, the use of more efficient plumbing fixtures will reduce the amount of water produced nationwide by 3.5 billion gallons per day. This reduction results in smaller operation and maintenance costs at water utilities, as well as downsized or deferred capital projects. When combined with the resulting energy savings from the downsizing, communities will save $127 per person by 2020—savings that translate into $35 billion for the nation. The savings from conservation are produced largely through the installation and regular use of water efficient plumbing fixtures such as aerated showerheads, energy-efficient clothes washers and 1.6 gallon-per-flush toilets. These fixtures have been installed in cities from New York to San Diego and have received high performance ratings by consumers in customer satisfaction surveys, regardless of locale. Likewise, a report issued by the American Water Works Research Foundation in 1999 determined that the performance of water-efficient toilets equals that of the older models while using only half the water. The report found that conservation would alleviate pressure on water supplies most significantly in densely populated areas of the country, such as New England, the Mid-Atlantic region and Pacific Northwest. The report can be downloaded in pdf format at http://www.awwa.org/plumbing.

Global cooling and agriculture. Researchers in Lawrence Livermore National Laboratory's Atmospheric Science Division have determined through climate model simulations that a previously recognized cooling trend between 1000 and 1900 AD can, in part, be attributed to land-use change. Forests look dark from the sky, but agricultural lands look lighter. Dark colors tend to absorb sunlight, and light colors tend to reflect sunlight back out to space. This reflection of solar energy to space tends to cool the Earth, especially in regions such as the eastern and mid-western United States, where huge tracts of land have been converted to crops. According to the researchers, the estimated temperature change in the continental United States as a result of change from forests to agriculture is up to a 2 degree Fahrenheit cooling. Greenhouse gas emissions in the 20th century likely overcame any cooling trends that took place up to that time. The LLNL news release on the research is available at http://www.llnl.gov/llnl/06news/NewsReleases/2001/NR-01-04-08.html

EPA Inspector General audit of wastewater discharge program. In August, the U.S. Environmental Protection Agency's Office of the Inspector General released an audit of the effectiveness of EPA and state enforcement of wastewater discharge permits, calling EPA's compliance system "incomplete, inaccurate, and obsolete." According to the audit report, the Inspector General focused on the Clean Water Act discharge program because of a lack of recent audit coverage in the area. Permit enforcement is particularly of concern, according to the audit, because of the backlog of expired discharge permits and the implementation of the Total Maximum Daily Load (TMDL) Program. In 2000, about 25 percent of all major discharger permits were expired, reflecting lost opportunities to update technology or water quality objectives and impairing enforcement effectiveness. As TMDLs are developed, new discharge limitations are likely to be needed and effective enforcement will play a big role in meeting water quality standards. To examine the effectiveness of the discharge permit program, auditors evaluated national data and three EPA regions, including region 4, and within region 4 evaluated North Carolina's program. The audit found that state programs lacked data for hundreds of thousands of small dischagers, that they did not report to EPA serious toxicity violations, that they have not developed strategies for identifying unpermitted stormwater dischargers, that they sometimes delay enforcement action for a year or longer, and that their penalties fail to recover economic benefit of noncompliance. The audit says that EPA and the states have traditionally focused enforcement efforts on major dischargers because they are relatively few in number but discharge large quantities of pollutants. However, this strategy does not take into account the relative risks presented by contaminated runoff, such as storm water and concentrated animal feeding operations; a rapidly growing number of smaller dischargers; and unique problems causing impairments in individual watersheds. The audit proposes a risk-based enforcement strategy. EPA should encourage states to develop mechanisms to evaluate tradeoffs in enforcement investments. Because states do not have the resources to monitor and fully enforce all permits, the audit recommends that states need more latitude to redirect resources. The full report is available at http://www.epa.gov/oigearth/audit/list901/finalenfor.pdf.

Combining aquaculture and hydroponics for mutual benefit

November 6-9, 2001
Bryson City, NC

Combining plant production with fish production promises a solution to nutrient enrichment of streams from fish farm effluent. For a course brochure, contact Aquaculture International, Inc, P.O. Box 606, Andrews, NC 28901. Phone or fax: (828) 479-6294. Email cwjohnson@graham.main.nc.us

In Memoriam: James M. Stewart

James M. Stewart, former associate director of the Water Resources Research Institute, died July 21, 2001, in Kinston.

Dr. Stewart received the BS and MS degrees from N.C. State University and worked with the Agricultural Extension Service for 10 years, serving as County Extension Chairman for Granville County for four years. He came to WRRI in 1970 as a research associate while he was completing work on an EdD. He was named assistant director for research application in 1972 and, the following year, was promoted to associate director with responsibility for information dissemination and application of research findings to water resource problems in North Carolina. He retired in 1989 and moved with his wife, Catherine, to Kinston where they restored an historic family home.

During his tenure at WRRI, Dr. Stewart played an important role in broadening the Institute program to encompass research application as well as research generation. He developed the Institute's technical completion report format, with emphasis on up-front presentation of research conclusions and recommendations; served as editor of the WRRI News; and organized numerous forums to examine emerging water resources problems and issues.

Dr. Stewart developed a strong and lasting education and training partnership between WRRI and the N.C. Sedimentation Control Commission (SCC) and Erosion and Sediment Control Program. He served for many years on the SCC's Education Committee and was instrumental in launching the *Sediments* newsletter. He also served on the N.C. Aquatic Weed Control Council and was active in promoting North Carolina's efforts to deal with nuisance aquatic species.

Recruiting for the 2002 Natural Resources Leadership Development Program

The Natural Resources Leadership Institute (NRLI) is a multi-faceted instructional and community service program provided by North Carolina Cooperative Extension at NC State University. The institute consists of two programs: Leadership Development and Environmental Decision Making. Our goal is to enhance sound natural resource management and environmental quality in North Carolina by advancing the application of collaboration and conflict resolution in policy decision-making.

The Leadership Development Program brings people together from government agencies, private industry, community and environmental organizations, and educational institutions to explore approaches controversial environmental issues and the learning of leadership competencies. The program consists of six three-day workshops, two one-day practicum review sessions, and a 12-month practicum project.

Participants receive training in dispute resolution and collaborative processes, negotiation, environmental policy, working with the media, and engage in various leadership development activities. Rather than focusing on building teams, we help individuals and organizations build bridges and partnerships.

Institute participants have had a measurable impact on natural resource and environmental policy in the state, and have expanded the capacity of collaborative decision-making. The Fellows have engaged other people and organizations in dozens of projects around the state dealing with such controversial issues as endangered species protection, water quality improvement, and sustainable forestry. Our Environmental Decision-Making Program is also expanding the capacity of collaborative decision-making by assisting groups and organizations engaged in these processes through facilitation and mediation.

NRLI is currently accepting applications to the 2002 Natural Resources Leadership Development Program until October 26, 2002. To receive an application, contact Mary Lou Addor at 919.515.9602 or Mary_Addor@ncsu.edu or access an online application at:http://www.ces.ncsu.edu/depts/agecon/PIE/nrli/Leader/applicat.htm

People

Harry LeGrand, Raleigh groundwater consultant, has been named to the National Ground Water Association's Group 2020.

D.G. Martin, former vice president for public affairs with the University of North Carolina system, has been named director for North and South Carolina of the Trust for Public Land.

Dan Oakley is now General Counsel for the N.C. Department of Environment and Natural Resources. **Jim Gullick** has replaced Oakley as head of the Attorney General's Environmental Division.

Jeanette Powell has left the Division of Water Quality's Stormwater and General Permits Unit to pursue part-time employment.

R. Wayne Skaggs, William Neal Reynolds Professor of Biological and Agricultural Engineering at NC State University, has been installed as president of the American Society of Agricultural Engineers.

Viney Pal Aneja, Research Professor in the NC State University Department of Marine, Earth, and Atmospheric Sciences, has received the Air & Waste Management Association's 2001 Lyman A. Ripperton Award in recognition of his ability to inspire students to excellence in professional and social endeavors.

Mike Strobel, currently Hydrologic Investigations Section Chief for the U.S. Geological Survey N.C. District, is leaving to become the Associate District Chief in Nevada.

Jody Eimers, currently a Hydrologist for the U.S. Geological Survey N.C. District, is leaving to become the Environmental and Hydrologic Investigations Section Chief in the Long Island Subdistrict of New York.

Websites

EPA's **Watershed Assessment, Tracking and Environmental Results (WATERS)** integration web site unites geographically specific water quality data from state web sites and various EPA sites, including its new National Water Quality Standards Database and its Total Maximum Daily Loads Database, with the U.S. Geological Survey's National Hydrographic Dataset. State and federal water quality managers, as well as interested citizens, can use WATERS to quickly identify the status of individual waterbodies of interest to them. It can also be used to generate summary reports on all waters of a state. **http://www.epa.gov/waters/**

The U.S. Geological Survey has launched its new online **National Water Information System (NWISWeb)**. Found at **http://water.usgs.gov/nwis**, the website allows users to access several hundred million pieces of archival and real-time data. The data come from a nationwide network of more than 1.5 million USGS water data collection stations.

The Tennessee Department of Environment and Conservation has a new web site aimed at keeping the public up-to-date on **current and emerging water supply issues in Tennessee**. Growing water needs in urban areas to the South of Tennessee, such as Atlanta, and effects of drought on groundwater in areas to the west of the state are raising concerns about interbasin transfers from the Tennessee River. The new website provides information about state policy initiatives, water supply legislation, and public notices for water supply proposals. **http://www.tdec.net/watersupply**

A new website developed by the Conservation Technology Information Center and the American Farm Bureau Federation provides **virtual tours of new manure management technologies. http://www.agtours.org**

Publications

The N.C. Wetlands Restoration Program has announced the availability of the **Watershed Restoration Plan for the French Broad River Basin** and **Guide to the North Carolina Wetlands Restoration Programs' Watershed Restoration Planning Strategy**. The documents are available as pdf files at http://h2o.enr.state.nc.us/wrp/index.htm or a hard copy can be obtained from Crystal Braswell at (919) 733-5208.

Three new fact sheets in pdf format that present a **summary of the economics of BMPs to control nitrogen in the Neuse River Basin** are available at http://www.ag-econ.ncsu.edu/extension.htm.

United Nations Publications has announced a number of new water-related publications dealing with Dispute Resolution, Eutrophication, Hydropolitics, Pollution, Water Crisis, Water & Development, and Water Management. Descriptions and ordering information can be found at web address: http://www.un.org/Pubs/update/envirupd.htm.

The U.S. Geological Survey North Carolina District has recently published the following reports which can be obtained from Kay Hedrick at (919) 571-4037 or khedrick@usgs.gov.

- Mountain Island Lake, North Carolina: Analysis of ambient conditions and simulation of hydrodynamics, constituent transport and water-quality characteristics, 1996-97
- Compilation of water-resources data and hydrogeologic setting for Brunswick County, North Carolina, 1933-2000
- Susceptibility index to surface contamination for the Little Cross Creek Watershed, Cumberland County, North Carolina
- Effects of land use on water quality and transport of selected constituents in streams in Mecklenburg County, North Carolina, 1994-98
- Low-flow characteristics and discharge profiles for selected streams in the Cape Fear River Basin, North Carolina, through 1998

The USGS National Water-Quality Assessment Program has published **Water Quality in the Upper Tennessee River Basin, Tennessee, North Carolina, Virginia, and Georgia, 1994-98**. This report is available in html and pdf format at web address: http://water.usgs.gov/pubs/circ/circ1205/

The American Water Works Association has published **Handbook of Water Use and Conservation by Amy Vickers**. The "most thorough reference ever published" it contains "hundreds of water-efficiency technologies and practices for all customer groups." To order go to web address: http://www.awwa.org/bookstore/timssnet/products/tnt_products.cfm

National Sea Grant has published **Aquatic Nuisance Species Report**, which includes a report on risk assessment, research, and activities to combat nuisance species in North Carolina. Contact Barbara Doll at N.C. Sea Grant (919) 515-5287 or barbara_doll@ncsu.edu.

The Estuarine Research Federation will hold its 16th Biennial Conference, "An Estuarine Odyssey," Nov 4 - 8, 2001, at the Tradewinds Conference Center, St. Pete Beach, Florida. Among the special sessions offered are Nutrient Enrichment and Harmful Estuarine and Coastal Marine Algal Blooms organized by NCSU's JoAnn Burkholder; Environmental Impacts of Hurricanes Dennis, Floyd and Irene on Coastal North Carolina: A Glimpse into the Effects of Climate Change? organized by UNC-Chapel Hill's Hans Paerl, and Anthropogenic Impacts on the Ecology of Tidal Creeks and Canals organized by UNC-Wilmington's Michael Mallin. For information go to web address: http://www.erf.org/erf2001/ERF2001.htm

Conferences and workshops

NC State University Soil Science Extension will present **Sediment and Erosion Control Workshop: Latest Information with Hands-On Demonstrations** Oct 12, 2001, at the Jane S. McKimmon Center and the Sediment & Erosion Control Research & Education Facility on the NCSU campus. For information visit website: http://www.soil.ncsu.edu/swetc/sediment/sediment.htm.

NC State University Soil Science Extension will present **On-Site Wastewater System Technology: Up-Front Solutions to Back Yard Problems** Nov 7-9, 2001, at the Jane S. McKimmon Center. For information visit website:http://www.soil.ncsu.edu/swetc/onsiteconf/upfront.htm.

The American Water Works Association will present **2001 Water Quality Technology Conference and Exhibition** Nov 11-15, 2001, at the Opryland Hotel and Convention Center in Nashville, TN. For information go to website: http://www.awwa.org/01wqtc/.

The N.C. Section of the **American Water Works Association & N.C. Water Environment Association** will hold their 81st Annual Conference November 11-14, 2001, at the Pinehurst Resort Hotel in Pinehurst, NC. For information call (919) 829-9694.

The Xeriscape Council of New Mexico is completing plans for the **8th Xeriscape Conference** to be held Feb 22-23, 2002 at the Albuquerque Convention Center. Sen Paul Simon will keynote and speak on his book "Tapped Out"! Conference details and registration info: http://www.xeriscapenm.com.

The Virginia Water Resources Research Center and Virginia Tech will present **Virginia Water Research Symposium 2001**, Nov 14-16, 2001, at the Doubletree Hotel in Charlottesville, VA. The event includes two special short courses: "Stream Corridor Assessment for Watershed Protection" and "Making the Most of a Media Interview." For registration information go to web address: http://www.conted.vt.edu/ssl/vwrs-reg.htm.

Batelle will present the **International Conference on Remediation of Contaminated Sediments** Oct 10-12, 2001, in Venice, Italy. For information go to web address http://www.battelle.org/environment/er/conferences/sedimentscon/default.htm.

The **North American Lake Management Society** will hold its 21st International Symposium Nov 7-9, 2001, at the Monoa Terrace Community and Convention Center in Madison, WI. For information go to website: http://www.nalms.org.

The University of Massachusetts Northeast Regional Environmental Public Health Center will present the **17th Annual International Conference on Contaminated Soils, Sediments and Water** Oct 22-25, 2001, at the University

North Carolina Precipitation/Water Resources

	July	August
Rainfall (+/- average)		
Asheville	5.50" (+0.98")	3.20" (-1.49")
Charlotte	2.24" (-1.68")	0.64" (-3.09")
Greensboro	4.06" (-0.45")	4.88" (+1.00")
Raleigh	4.13" (+0.12")	3.09" (-0.93")
Wilmington	7.26" (-0.87")	5.62" (-1.32")

Streamflow **Index Station** (County, Basin)	**July mean flow (CFS)** (% of long-term median)	**August mean flow (CFS)** (% of long-term median)
Valley River at Tomotla (Cherokee, Hiwassee)	121 (109%)	149 (120%)
Oconaluftee River at Birdtown (Swain, Tenn)	161 (48%)	416 (131%)
French Broad River at Asheville (Buncombe, FB)	977 (70%)	1,040 (76%)
South Fork New near Jefferson (Ashe, New)	312 (90%)	254 (84%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	59.9 (94%)	38.4 (65%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	81.4 (55%)	78.7 (70%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	121 (55%)	61.2 (31%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	269 (71%)	221 (57%)
Deep River near Moncure (Lee, Cape Fear)	360 (90%)	226 (34%)
Black River near Tomahawk (Sampson, Cape Fear)	169 (39%)	647 (138%)
Trent River near Trenton (Jones, Neuse)	19.7 (22%)	88.3 (120%)
Lumber River near Boardman (Robeson, Lumber)	660 (108%)	314 (45%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	22 (53%)	29.9 (68%)
Potecasi Creek near Union (Hertford, Chowan)	61.1 (160%)	22.9 (29%)

Groundwater **Index well (Province)**	**July depth below surface (ft)** (departure from average for month)	**August depth below surface (ft)** (departure from average for month)
Blantyre (Blue Ridge)	35.16 (-4.06)	37.37 (-5.27) (recrd mnth low)
Mocksville (Piedmont)	20.92 (-2.85) (recrd mnth low)	21.28 (-3.73) (recrd mnth low)
Simpson (Coastal Plain)	4.94 (+0.56)	4.32 (+0.97)

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

of Massachusetts Amherst. For information go to web address: http://www.UMassSoils.com/.

The **N.C. Section of the American Water Works Association-Water Environment Association** has workshops and seminars scheduled through November 2002. The calendar can be accessed at http://www2.ncsu.edu/ncsu/CIL/WRRI/NCAWWA-WEASchedule.htm.

The University of Wisconsin-Madison College of Engineering will present **Soil Bioengineering: Sensible Solutions for Our Built Environment** Oct 1-2, 2001, in Santa Clara-San Jose, CA, and **Soil Engineering for Non-Soils Engineers and Technicians** Oct 3-4, 2001 in Santa Clara-San Jose, CA, and Oct 22-23, 2001, in Madison, WI. For information go to web address: http://epdweb.engr.wisc.edu/.

Southern Appalachian Man and the Biosphere (SAMAB) will hold its 12th Annual Conference, "**From Issues to Action: Opportunities for Stewardship in the Southern Appalachians**," Nov 6-8, 2001, at the Holiday Inn SunSpree Resort in Gatlinburg, TN. For information visit web address: http://samab.org/.

The National Arbor Day Foundation will present **The Practice of Restoring Native Ecosystems National Conference** Nov 6 - 7, 2001, at the Arbor Day Farm Lied Conference Center in Nebraska City, NE. For information go to web address: http://www.arborday.org/programs/conferencereg28.html.

The American Society of Agricultural Engineers will present **Watershed Management to Meet Emerging TMDL Environmental Regulations Conference and Exhibition**, March 11-13, 2002, Radisson Plaza, Fort Worth, Texas. For information go to web address: http://www.asae.org/meetings/tmdl/index.html.

Call for Papers

The Water Environment Federation's Collection Systems Committee and the California Water Environment Association have issued a call for papers for a 2002 Specialty Conference that will examine approaches to wet weather and operations maintenance issues. "Planning for the Inevitable" will be held May 29 - June 1, 2002, in San Francisco, CA. Deadline for abstracts is November 2, 2001. For a copy of the call in pdf format go to web address: http://www.wef.org/pdffiles/CS02CFP.pdf.

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 WRRI website, and additions and changes will be posted there (http://www2.ncsu.edu/ncsu/CIL/WRRI/2002seminars.html). For information email Jeri_Gray @ncsu.edu.

September 24, 2001
Archdale GFHR
Dr. Kenneth H. Reckhow
WRRI and Duke University
Recommendations for the Total Maximum Daily Load Program

October 23, 2001
1132 Jordan
Dr. R. Wayne Skaggs
NC State University
Examination of the Wetland Hydrologic Criterion and Its Application in the Determination of Wetland Hydrologic Status

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/ to report violations.

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

NCWRA
North Carolina Water Resources Association

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 WRRI (919/515-2815)

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