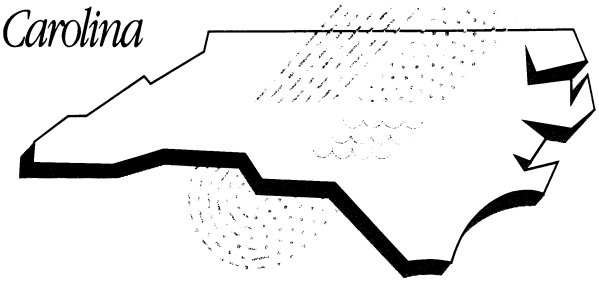
Water Resources Research Institute News
of The University of North Carolina



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Can we afford our sewers?

If you live in a town or city, beneath your streets and paralleling your urban streams is a underground network of pipes—some as large as ten feet in diameter—that carry wastewater from homes, institutions, and businesses to wastewater treatment plants. These networks of small service lines, larger collectors and trunk lines, and giant interceptors—called sanitary sewers or wastewater collection systems—are currently under intense scrutiny locally and nationally.

Sewers are overflowing

Across the country, our hundreds of thousands of miles of sewers are aging, vulnerable to infiltration and overloading during wet weather, and subject to backups into homes, overflows into public areas, and spills into streams. When sewer backups and overflows occur, they expose the public to pathogens that cause diseases from simple gastroenteritis to typhoid fever and threaten water quality and aquatic life.

Because there are no nationwide standards for operating or reporting on sanitary sewer systems, no one knows how often or how much sewage is spilled into public places and into streams. From small surveys, the U.S. Environmental Protection Agency has estimated that there are 40,000 sewage spills nationwide every year. A survey by the National Urban Institute found that sewage spills due to breaks in sewer lines occur most often in young, growing cities of the South and West, indicating that the problem is caused as much by inadequate construction standards and poor management as by aging pipes.

In 1998, a wet year, the N.C. Division of Water Quality received 3,479 reports of sewage spills accounting for 230 million gallons of sewage, 191 million of which reached surface waters. From January 1999 to August of 1999 (a period of serious drought in North Carolina) DWQ had 1,770 reports of spills accounting for more than 36 million gallons of sewage, 28 million gallons of which reached surface waters.

EPA and sewer operators are at loggerheads

EPA considers the threat to public health and the environment from sewer overflows to be serious. In May, President Clinton directed EPA to propose, by May 2000, a national regulation to prevent sewer overflows. EPA convened a Sanitary Sewer Overflow Federal Advisory Committee to help develop the regulation, but in July representatives of cities, counties, and sewer agencies walked away from the talks, saying the process was leading toward huge public

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Director's Forum

What can we learn from Hurricane Dennis?

Kenneth H. Reckhow, Director, Water Resources Research Institute

For approximately two weeks at the end of August and in early September, Hurricane Dennis alternately threatened and battered North Carolina. As the storm meandered off the coast, newscasters described Dennis as "unpredictable." Was that true? Are there lessons from hurricane forecasting and storm preparedness that can aid us as we confront other phenomena of nature?

Was Hurricane Dennis truly unpredictable? That is, were meteorologists unable to forecast the path of the storm? No, the storm's movement was not unpredictable; nor, on the other hand, was its trajectory forecast with certainty and without error. Even in the early days of the hurricane, most television meteorologists, consulting multiple computer forecasting models, projected at least the possibility that Dennis would move along the southeast coast to North Carolina. Once Dennis arrived off our coast, some models forecast the stall, the subsequent turnaround, and the ultimate landfall point. Even the "unpredicted" path over the Research Triangle was, in fact, roughly predicted by one forecasting model, according to Greg Fishel, meteorologist for WRAL in Raleigh.

What can we learn from this? First, natural processes are difficult to predict accurately. While some of the hurricane forecasts were right, some were wrong. In situations like that, many meteorologists routinely consult several computer models, which essentially provide them with several distinct scientific analyses on which to base forecasts.

Simultaneous use of several different forecasting models is a useful strategy when models can be wrong. For example, we have recognized this point in designing the WRRI Neuse Estuary modeling approach. As a consequence, a basic feature of the Neuse ModMon project in support of TMDL development will be the application of at least three independently developed forecasting models. Just like the meteorologist concerned with hurricane forecasting, we believe that the opportunity to consult several models will improve forecasting reliability for algal blooms and fishkills in the Neuse.

A second lesson from the experience with Hurricane Dennis comes from noting that the storm forecasts were constantly updated and improved with new information. No one would consider basing decisions on a one-week old weather prediction, because it is universally recognized that new information can be acquired, and then a revised, improved forecast can be made. This potential for improved forecasts (leading to improved decisions) leads us to recommend a similar "adaptive" strategy for science-based management of the

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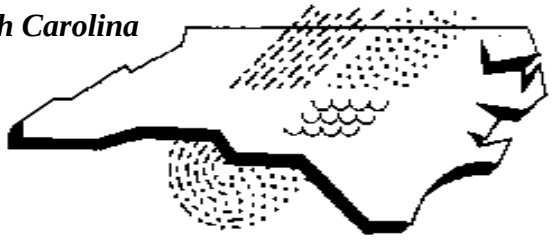

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Neuse. Here, as in the weather forecasting example, we recognize that initial model forecasts for the Neuse TMDL will be uncertain, but they can be improved with monitoring of the Estuary's response to the initial management decisions.

We must make decisions concerning such phenomena as major storms, droughts, algal blooms, and fishkills with the awareness that scientific predictions are virtually never certain. Addressing this scientific uncertainty in the short term, weather forecasters simply consult multiple scientific assessments (computer models) and continually update forecasts. This is a prudent strategy, not only because it provides the most up-to-date science, but also because decision makers and the public have learned through experience to expect this approach from weather forecasters and then to use the resultant forecasts effectively.

As aquatic scientists, we might consider a similar scheme for the presentation of scientific forecasts on, for example, water supplies and water quality. For these forecasts to be used sensibly, we need to help consumers of our forecasts deal with scientific uncertainty. This is not as easy as the meteorologist's task however, since most people have experience interpreting and using weather forecasts on a daily basis but rarely gain experience with decisions based on uncertain forecasts of droughts and algal blooms.

When the social, economic, and environmental consequences are severe, as they can be with hurricanes, droughts, algal blooms, and fishkills, we generally recognize the value of well-funded programs for research and forecast modeling. To add value to this research effort, we need equal diligence in working to make these forecasts matter by translating the forecasts in an informative and effective way for decision making.

Can we afford our sewers? *continued*

expenditures that would provide little public health gains.

Indeed, EPA's estimate of how much will have to be spent over the next 20 years to solve the sewer overflow problem nationally is staggering—$80-$90 billion. That is in addition to the more than $100 billion EPA estimates is needed to construct new sewer systems and to build and upgrade treatment plants to accommodate growth and meet discharge regulations.

Operators of sewage systems say that EPA estimates are low and that more than $330 billion will have to be spent on construction and rehabilitation of sewage systems called for by growth, current regulations, and draft sewer regulations. Municipalities and other sewer agencies have proposed to Congress their own legislation to address sewer overflows, which EPA opposes. Differences between EPA and sewer operators center on whether the goal should be to prevent all sewer overflows or to accept that some are unavoidable when wet weather causes infiltration into sewer lines and provide operators relief from liability for unavoidable overflows.

North Carolina gets ahead of national regulation

Hurricanes and hogs combined to focus attention on sewer overflows and treatment plant by-passes in North Carolina several years ago. After Hurricane Fran dumped 10 inches of rain on Piedmont and Coastal North Carolina in September 1996, the effects of wet weather on area sewer systems became obvious, and the threat to downstream residents and water quality drew strong concern. In addition, as the State began applying the regulatory ratchet to overflowing hog lagoons, pork producers responded by pointing out occurrences of sewer system overflows in growing communities in the headwaters of coastal rivers.

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Can we afford our sewers? *continued*

As a result, in July 1998 the N.C. Division of Water Quality (DWQ), after consulting with stakeholders, implemented new enforcement initiatives aimed at preventing sewer overflows. DWQ announced stringent penalties for nonreporting of spills, higher fines for spills, and possible requirements for publishing notice of spills in local newspapers. In addition, DWQ required municipalities and other operators to begin evaluating sewer systems and developing plans for correcting maintenance and operational deficiencies. DWQ also put together a stakeholder group to develop a whole-collection-system permit to encourage system operators to do systematic preventive maintenance rather than simply respond to problems.

However, as part of their major water quality legislation for 1999, North Carolina lawmakers applied even more stringent requirements to sewer operators. In the Clean Water Act of 1999 (HB 1160), the N.C. General Assembly mandated that municipalities and others that operate wastewater collection systems* issue press releases whenever their systems discharge 1,000 gallons or more of untreated wastewater and publish newspaper notices whenever they discharge 15,000 gallons or more.

In addition, operators of wastewater collection systems must issue annual reports on the performance of their systems to customers and to the Department of Environment and Natural Resources, reporting the extent to which the systems have violated federal or state water quality laws, regulations, or rules.

And, beginning July 1, 2000, the N.C. Environmental Management Commission must phase in a permit program for wastewater collection systems, starting with the largest systems and those that have received notices of violation for wastewater discharges. These systemwide permits will require sewer operators to adhere to design, construction, and performance standards; meet operation and maintenance requirements; and develop capital improvement plans.

** Spill notice requirements also apply to operators of animal waste management systems.*

Sewers proliferate

The regulatory spotlight turned on sewer systems illuminates a proliferating network that promises to consume larger and larger shares of local resources. There are an estimated 758,000** miles of public sewer lines in the United States—enough to circle the earth 30 times.

In North Carolina, the Rural Center has documented 7,500 miles of sewer pipe in 75 counties. The Rural Center's assessment did not include North Carolina's most populous counties, such as Mecklenburg, Wake, Guilford, Durham, and Cumberland. Considering that the Charlotte-Mecklenburg Utility District alone has 2,880 miles of sewer (enough to stretch from coast to coast) it seems likely that North Carolina has between 15,000 and 20,000 miles of sewer pipe. According to the Rural Center's assessment, a significant part of that infrastructure is deteriorating vitrified clay pipe installed 60-70 years ago.

EPA says that the nation's sprawling sewer systems are generally not being adequately maintained and that governments need to invest $81.9 billion over the next 20 years to replace or rehabilitate sewer lines and prevent wet weather infiltration. To gage the financial burden that this implies consider this: During 1995-1998, capital spending by local governments nationwide on wastewater infrastructure averaged about $10 billion. To reach the level of sewer rehabilitation EPA says is needed, local governments will have to increase that annual capital spending level by 40% or divert 40% of that annual capital spending level to sewer rehabilitation. This comes at a time when local governments in many parts of the country are struggling to meet the demands of growth.

*** This estimate was produced using these facts: According to EPA about 1,000 miles of sewer pipe are needed to serve 250,000 people, and about 189.7 million people in the United States are currently served by publicly owned treatment plants. This estimate does not include about 25 million people served by privately owned wastewater systems.*

In its 1996 Clean Water Needs Survey, EPA estimated that public sewer operators in North Carolina need to spend $217 million on sewer rehabilitation. Since then, the Agency has revised its national estimate of spending needed on sewer repairs upward by about 700%. If the same increase in needs applies in North Carolina, then local governments here could need to spend more than $1.5 billion on sewer repair alone.

With population growth running at 1.7% a year, local governments also face the need to build hundreds of miles of new sewers each year. The N.C. Rural Center projects that North Carolina needs to spend a total of $7.34 billion to expand, upgrade, and rehabilitate its sewer systems over a 20-year period.

Are our sewer systems sustainable?

In August, EPA sponsored a conference in Austin, TX, and invited experts from across the country to address the question of whether our current urban water and wastewater infrastructure is sustainable and, if not, what sustainable systems would look like. Speakers interpreted "sustainable" as a system that is affordable and maintains current goals and standards for protecting human health and water quality into the future.

Although some speakers addressing wastewater systems expressed ambivalence, most lined up on one side or the other of an emerging debate. The debate is between those who believe that technological advancements can make the current "end-of-pipe," highly centralized systems sustainable and those who think that sustainability in wastewater treatment and disposal requires a more decentralized approach that eliminates some of the sewer infrastructure. Proponents of decentralization point to evidence of major diseconomies of scale of sewer networks that can offset the economies of scale in other components

of the wastewater treatment process to greater or lesser extents, depending on development density.

Problems with the current system

Speakers listed the problems with today's highly centralized sewerage systems:

- **They are costly.** According to Bob Lee with EPA's Office of Wastewater Management, nearly 70% of the $23 billion being spent annually by local governments on wastewater infrastructure is for operations and maintenance and as sewer systems grow, so do operations and maintenance budgets.
- **They are subject to mishaps.** Bruce Beck of the University of Georgia pointed out that reliability of wastewater infrastructure is becoming a major issue because, with huge systems, mishaps are bigger, more apparent, and more destructive of the environment.
- **They distort the nitrogen cycle.** Beck pointed out wastewater treatment plants either discharge effluent high in nitrates or discharge N_2 into the atmosphere, when the need is to fix nitrogen.
- **Their operation causes environmental disturbance.** David Venhuizen, P.E. of Austin, TX, pointed out that installing gravity sewers typically requires excavations in sensitive streamside areas and that central treatment plants concentrate waste into huge point sources of pollution.
- **They treat a resource as a waste.** Several speakers said that the end products of wastewater treatment—reclaimed water and solids—should be considered resources to be used rather than wasted.

The technological fix

Several speakers contributed to a vision of future wastewater systems "honed to engineering perfection."

According to Gary Skipper of MGD Technologies Inc., better operation of wastewater collection systems depends on understanding what goes on within the systems, and that requires advanced flow monitoring and measuring capabilities. Advances in flow velocity measurement in the 1980s revealed a surprising piece of information—that many sewer systems do not operate under free flow conditions even under dry weather conditions. With additional similar advances, better system models could be developed to aid in sewer management.

Ray Sterling of Louisiana Tech said that a major problem with existing sewer systems is that they are underground and there is limited ability to track pipe deterioration and perform maintenance before breaks and overflows occur. But, he said, "smart pipes" that allow widespread monitoring and trenchless technology that provides for more economical installation with less environmental impact will make sewer systems of the future more reliable. In addition, renewal technologies—such as cured-in-place pipe liners that can also provide monitoring capabilities—can help with rehabilitation of existing systems.

The structural fix

Framing an alternative vision, David Venhuizen described the decentralized concept of wastewater management. This concept rejects the practice of piping huge volumes of wastewater long distances to discharge them at a single point. In this vision, smaller wastewater treatment plants serving clusters of homes and businesses reduce the number of sewer miles and size of pipes needed and make it possible to use reclaimed water where it is produced.

Ray Sterling described advanced technologies, including remote telemetry, that could make such smaller plants largely autonomous and schemes for covering plants to eliminate aesthetic and odor problems.

According to Venhuizen, the decentralized concept also incorporates the use of on-site and alternative natural-treatment systems where they are more appropriate but puts all wastewater systems under one regulatory and management authority. Said Venhuizen, "We have to get away from the attitude that if you're not on public sewer, you're on your own."

Neil Grigg of Colorado State University (a former N.C. WRRI director) had the last word on sustainability of urban water systems. Grigg said that the sustainability of all urban water systems, including wastewater systems, depends on society's willingness to pay for them, and that depends on society's knowledge and understanding of the role the systems play in health and environmental protection.

"Urban water infrastructure is not a term the average person identifies with," said Grigg.

Until governments devise more effective education and public involvement processes that help the public understand and take ownership of their wastewater systems, the country cannot move toward sustainability, he said.

Bob Lee of EPA left the group with an unsettling question: Will the rising cost of our sewers drive down our expectations for water quality?

The N.C. Division of Water Resources and others will present

Central Coastal Plain Water Conservation Workshop October 7, 1999 Kinston, NC

The N.C. Division of Water Resources has proposed measures to address problems with groundwater supplies in the 15-county Central Coastal Plain. Water conservation can make existing water supplies go further and play a significant part in solving the water supply problem. This workshop will show local officials, suppliers, and water customers how.

Download a brochure in pdf format at http://www.dwr.ehnr.state.nc.us/wsas/conserve/watercon.pdf or call Partrick Beggs with the N.C. Division of Water Resources at (919) 715-5444.

September action of the N.C. Environmental Management Commission

The North Carolina Environmental Management Commission (EMC) did not meet in August. On September 9, the EMC met in New Bern.

Bill Holman, newly appointed Secretary of Environment and Natural Resources, addressed the EMC, detailing several of Governor James B. Hunt, Jr.'s environmental priorities and initiatives and announcing that the U.S. Environmental Protection Agency has approved the total maximum daily load (TMDL) for total nitrogen for the Neuse River. *(The Neuse total nitrogen TMDL document may be downloaded in pdf format from the N.C. Division of Water Quality website: http://h2o.enr.state.nc.us/TMDL/Neuse_TMDL_june.PDF)* Water Quality Section Chief Coleen Sullins noted that the TMDL agreement will require some modification of wastewater treatment plant load allocations previously approved by the EMC.

Holman noted that—as a result of recent legislation—effective October 1, municipalities and other sewer operators and animal waste management system operators will have to publish newspaper notices of waste and wastewater spills of more than 15,000 gallons.

New EMC members attending their first meeting were sworn in by Jerry F. Waddell, Chief District Court Judge of District 3B. New members appointed by the N.C. House are Anne Barnes of Chapel Hill, a former N.C. legislator, and Don Abernethy of Hickory, a former president of the N.C. Association of Conservation Districts and member of the N.C. Soil and Water Conservation Commission. Robert G. Ray of Cullowhee was appointed to the EMC by the N.C. Senate. The Senate also reappointed Robert Epting of Chapel Hill.

The EMC took the following action:

- Approved publication in the *N.C. Register* of text of rules governing minimum management practices for dry-cleaning facilities (see related article on page 9).
- Approved temporary rules and approved proceeding with permanent rulemaking for preapproval of reimbursements from the State's Leaking Petroleum Underground Storage Tank Cleanup Funds.
- Approved holding a public hearing on amendments to air quality rules to exclude Title V facilities from the activities exempted from permit requirements, to redefine "insignificant activities," to remove the provision that allowed treating research and development operations as independent facilities for Title V permitting purposes, and to require insignificant activities to be placed in Title V permits.
- Approved holding a public hearing on changes to the air quality volatile organic compound emissions rules. *(For information on air quality rules under development visit website: http://daq.state.nc.us/Rules/Hearing/)*
- Adopted amendments to air quality rules to exempt from the state air toxics rules those wood furniture manufacturing operations complying with wood furniture manufacturing operations maximum achievable control technology.
- Approved the Neuse River Basin Model Stormwater Program for Nitrogen Control. This model program provides guidance for the 15 local governments in the Neuse River Basin that must develop programs to address nitrogen in runoff from developed areas. (See related discussion under Water Quality Committee report.)
- Rescinded a resolution to the General Assembly asking for funding for wetland restoration activities in the Tar-Pamlico River Basin. The Water Quality Committee had recommended that any request to the General Assembly for funds for wetland restoration activities should include all river basins and be based on basinwide wetlands restoration plans currently under development.
- Delegated to the Water Quality Committee the authority to make decisions on major variances to the Water Supply Watershed Protection rules.
- Upheld the validity of its "wetlands" rules (15A NCAC 2B .0231). The Division of Water Quality began regulating ditching and draining of wetlands using these rules in the wake of invalidation of the "Tulloch Rule" (see March/April 1999 *News*). The authority of the EMC to regulate wetland draining under these rules was challenged through a petition for a "Declaratory Ruling" by the N.C. Home Builders Association, N.C. Citizens for Business and Industry, N.C. Aggregates Association, N.C. Farm Bureau Federation and several individuals. In a letter to Chairman David Moreau, Governor Hunt had urged the Commission to uphold its rules, saying that the Statewide Wetland and Stream Management Strategy initiative (see announcement on page 13) is a more appropriate forum for discussing State regulation of wetlands than the petition for Declaratory Ruling.
- Approved publishing in the *N.C. Register* a notice of rulemaking to adopt new rules for Petitions for Declaratory Rulings and for Petitions for Rulemaking. This rulemaking was spurred by a petition from environmental groups to intervene in the petition for a Declaratory Ruling on the wetlands rules. The Commission currently has no procedures for considering interventions in petitions for Declaratory Ruling or Rulemaking.
- Rejected the recommendation of an Administrative Law Judge (ALJ) on a contested civil penalty. The case involved violation of the prohibition on open burning by a subcontractor for which the General Contractor (GC) had been assessed a civil penalty. The GC contested the assessment. The ALJ essentially dismissed the penalty

against the GC because the GC was not the landowner or in "operational control" of the burning activity. The GC had no representative present and there was some question as to whether notification of the hearing had been received. However, the case sparked a good bit of discussion among commissioners regarding the responsibilities of General Contractors for the actions of subcontractors. EMC counsel Frank Crawley said that while GCs can theoretically go to subcontractors to recover fines for their violations, in reality it is often impossible to find them. Commissioner Will Fowler asserted that General Contractors who really want to hold subcontractors responsible for violations of environmental rules can find ways to do so through "failsafe agreements." New Commissioner Anne Barnes said that to dismiss the penalty against the GC in this case would simply encourage situations in which General Contractors fail to control subcontractors and subcontractors "hit and run."

"There must be some way we can make subcontractors share the responsibility when they violate environmental rules," said Barnes. She suggested the issue might need to be presented to the General Assembly.

The Commission voted to reject the ALJ's recommendation and uphold the original penalty based on arguments in the brief that General Contractors in control of construction sites are equally responsible for violations of environmental rules.

September action of the EMC Water Quality Committee

The Water Quality Committee of the N.C. Environmental Management Commission met in New Bern on September 8. Among actions taken by the committee were the following:

■ **Exemptions to wetlands rules.** Discussed three versions of a temporary rule to exempt from the State's wetlands rules certain activities (farming, forestry, certain infrastructure maintenenace activities, temporary sedimentation basins, and others). Such activities had been exempt from Clean Water Act Section 404 permitting and 401 water quality certification requirements. However, when the "Tulloch Rule" was invalidated and the State began regulating the draining of wetlands under its own wetland rules, these exemptions were no longer valid. The Water Quality Committee had instructed staff of the Division of Water Quality to develop rules to grant the same exemptions that had existed under the 404 program. The three versions of an exemption rule differ in language describing exempted activities and in what they require of activities being exempted, including notification of activities impacting wetlands and proper use of BMPs in order to be deemed in compliance with wetlands rules. The Water Quality Committee decided not to recommend a single version of the rule to the full EMC but to give stakeholders an opportunity to talk to EMC members before a temporary rule is considered for implementation. A temporary rule will probably be presented to the EMC for adoption at its December meeting.

■ **Neuse stormwater model program.** Approved and sent to the EMC for action the following day the Neuse River Basin Model Stormwater Program for Nitrogen Control. The model program was developed by a working group of local government representatives and Division of Water Quality staff. The model program was supposed to have been approved by August 1, but the group working on the model did not reach consensus on a draft plan and in July requested additional time to work out differences. Mark Senior of the City of Raleigh presented the model stormwater program for the working group. He said that the revised program contains less prescriptive language than the draft, makes the program easier to read by moving much general information to appendices, provides more flexibility for addressing post-development peak flows, adjusts retrofit opportunity identification requirements, and adheres to the minimum criteria for public education called for in the rules, rather than endorsing a basinwide cooperative education program.

However, Senior also presented stakeholder concerns about the Neuse stormwater rules themselves, indicating that local governments in the basin may seek changes to the rules. He said that local governments have strong concerns about the requirement that peak runoff from new construction be held to predevelopment conditions for the 1-year, 24-hour storm. The requirement, he said, will necessitate many small on-site detention facilities which will burden local governments with maintenance and inspection responsibilities and create liability and public health concerns. He questioned the usefulness of the requirement in preventing streambank erosion, as it is intended to do, and called the requirement a "rider" to the Neuse rules, which are supposed to be aimed at reducing nitrogen.

Senior said local governments also object to the Neuse stormwater rules because they, along with the Neuse buffer rules, place severe limitations on the use of regional stormwater controls. In addition, he said the stormwater rules are not applied evenly across jurisdictions and do not target mitigation funds for the areas in which they are paid.

Water Quality Committee members were not particularly complimentary of the model plan. Commissioner Robert Epting said he was not convinced that the model program would achieve the 40% reduction in nitrogen loading from urban stormwater that the Neuse rules call for. He was particularly critical of elements that are aimed at reductions from existing development—public education and retrofit requirements.

"This model program emphasizes new development," said Epting. "What I'm

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EMC Water Quality Committee *continued*

critical of is that we don't tell the public that we are already the problem."

EMC Chairman David Moreau said that there is no basis for evaluating how well the model program will perform because no information has been provided on what reductions are possible. "We need some cases to look at to see where reductions can be achieved," said Moreau.

Water Quality Committee Chairman Charles Peterson expressed dissatisfaction with the accountability provisions for nitrogen reductions from urban stormwater.

Noting that local governments' concerns about the Neuse stormwater rules are a separate issue from the model program, Peterson suggested that those concerns be forwarded to the group developing stormwater requirements for local governments in the Tar-Pamlico Basin.

■ **Change to Water Supply Watershed model ordinance.** Staff of the Watershed Protection Program presented to the Water Quality Committee a proposal for allowing developers to develop more densely on one parcel of land in a water supply watershed by developing less densely or not at all on a "paired" parcel. Committee members expressed strong reservations about the proposal, noting that there was nothing in the proposal to prevent a developer from developing a parcel in the critical watershed area at 100% of the density allowed by averaging a pair of parcels and offsetting it with no development on a parcel at the outer edge of the watershed area. EMC Chairman David Moreau noted that studies show that concentrated areas of imperviousness create more pollution than smaller, scattered areas and that therefore it is not correct to assume that averaging will have no adverse effect on water quality. Peterson suggested that averaging might be allowed in the "protected" area of watersheds and not in the "critical" areas. The Committee tabled the proposal for further study.

■ **Coastal Habitat Protection Plan Program.** Mike Street of the N.C. Division of Marine Fisheries presented the first annual report on development of Coastal Habitat Protection Plans required by the Fisheries Reform Act of 1997. Street said that the Newport River has been selected as a pilot for development of habitat protection plans and that a draft for that river will be complete by the end of the year. The EMC, Coastal Resources Commission, and Marine Fisheries Commission must approve annual reports on habitat protection plans, and they must be presented to the General Assembly's Joint Legislative Commission on Seafood and Aquaculture and the Environmental Review Commission. The committee recommended approval of the first annual report to the EMC, which approved it the following day.

■ **N.C. Estuarine Shoreline Protection Stakeholder Group Recommendations.** Jeanette Powell of DWQ presented to the Committee a summary of recommendations to protect coastal water quality that resulted from a facilitated stakeholder process conducted by the N.C. Coastal Resources Commission (CRC) and the Division of Coastal Management. Powell said that the CRC will formally request that the EMC address recommendations by bringing a petition for rulemaking, perhaps in October. Among the issues the CRC will ask the EMC to address through rulemaking are:

❍ Adoption of water quality management goals for primary pollutants of concern in each of the eight river basins draining to the coast.

❍ Application of stormwater management strategies and riparian buffer strategies appropriate to each of the eight coastal river basins.

❍ Extension of stormwater control strategies for controlling pollutants of concern within all eight coastal river basins.

The full text of the stakeholder report, ***Protecting North Carolina's Coastal Resources: A Framework for Maintaining and Improving Water Quality***, is available in pdf format at website: http://dcm2.enr.state.nc.us/Current%20Issues/current_mainpage.htm

■ **Sustainable Coast Initiative.** Dr. James Merritt of the University of North Carolina at Wilmington asked the Water Quality Committee to recommend to the EMC a resolution of support for a new nonprofit organization, the Sustainable Coast Corporation. This organization, said Merritt, will lead in applying a new approach to assisting decision making along North Carolina's coast. It will create local stakeholder groups to assist local governments in developing long-term, comprehensive growth management strategies and will provide technical assistance and scientific research to assist stakeholders and local government officials as they address growth management issues. The organization will seek funding from foundations and the General Assembly, Merritt said. The Water Quality Committee recommended support of the concept to the EMC, which agreed to a resolution of support the following day.

September action of the EMC Groundwater Committee

At its meeting on September 8, the Groundwater Committee of the N.C. Environmental Management Commission approved initiating a number of changes to groundwater quality standards. These changes—to be presented to the full EMC in October—will establish concentration limits for a host of compounds in groundwater, including arsenic and methyl-tert butyl ether (MTBE). Staff also sought approval to initiate a tempo-

continued

Legislature declines to address problems with dry-cleaning solvent cleanup law

One piece of environmental legislation that failed to win approval in the 1999 session of the General Assembly was a bill aimed at correcting problems with the law establishing the State's Dry-Cleaning Solvent Cleanup Program. While it is widely acknowledged that the program cannot be implemented as currently constituted, some lawmakers were concerned about the impact of proposed fixes on the State's General Fund. Therefore, dry cleaners and staff of the N.C. Division of Waste Management (DWM) will go back to the General Assembly to try to work out acceptable changes to the program when lawmakers return in May 2000.

The program

In 1997at the urging of the dry-cleaning industry, the General Assembly passed legislation establishing a fund and mandating development of a program to clean up sites contaminated with dry-cleaning solvents. The Superfund Section of DWM was to develop the program, and the Environmental Management Commission (EMC) was to adopt rules to implement it by January 1, 1999. However, even before the legislation was passed, the Department of Environment and Natural Resources (DENR) was predicting that the taxes imposed to fund cleanups would not produce enough revenue to cover costs. Other problems with the legislation establishing the program became evident shortly after a stakeholder/DWM working group began meeting in September 1998.

The problems

The major problem with the legislation is that it essentially sets up circumstances under which all dry cleaning solvent cleanups would be funded by the State's Dry-Cleaning Solvent Cleanup Fund but provides revenue for the fund that is far short of what will be needed. The law requires that in order to be eligible for the fund, dry cleaners must demonstrate financial responsibility by (1) obtaining $1 million worth of liability insurance or posting a $1 million bond, or (2) obtaining a determination of uninsurability from the EMC. During early meetings of the stakeholder/DWM work group, it became evident that liability insurance for existing dry cleaning facilities is virtually unavailable and that most will not be able to post bonds of the amount required. That means that virtually all contaminated dry cleaner sites in the state would be declared uninsurable and thus eligible for cleanup money from the Dry-Cleaning Solvent Cleanup Fund.

The Dry-Cleaning Solvent Cleanup Fund has been receiving privilege and excise taxes of $5.85 per gallon on chlorine-based dry-cleaning solvents and $0.80 per gallon on hydrocarbon-based solvents sold and/or used in North Carolina since October 1997. As of June 30, 1998, fund receipts were 60% below what had been projected for that timeframe, and a balance of only $418,898 was available for site cleanup. Estimates of cleanup costs range from $167,000 per site (the dry-cleaning industry) to $4.5 million (the projected cost for the one dry-cleaning site in North Carolina listed to be cleaned up under Superfund). The industry estimates that as many as 1,500 current and former dry-cleaning sites in the state may have contamination. These facts make it obvious that taxes on solvents will not provide enough funding for the cleanups that need to be done.

Legislative changes proposed to the 1999 Session of the General Assembly by the dry-cleaning industry included repealing insurance requirements—thereby intentionally creating a cleanup program funded solely by the Cleanup Fund—and earmarking (through a phase-in) the sales tax on dry cleaning services for the fund. Because this solution would divert money from the General Fund, the proposed legislation failed.

Because the funding mechanism for the Dry-Cleaning Solvent Cleanup Program is not viable, DENR Secretary Bill Holman has asked the Division of Waste Management to suspend implementation of the program. Holman said program implementation will resume when the General Assembly has addressed the funding problem.

The only rules related to the Dry-Cleaning Solvent Cleanup Program that are currently making their way through the rulemaking process are those to establish minimum management practices for storage and handling of solvents. DENR is moving to implement these rules because they can help prevent future pollution from dry cleaning solvents.

September action of the EMC Groundwater Committee *continued*

rary rule to put limits on arsenic and MTBE into effect as soon as possible.

According to the N.C. Division of Public Health of the Department of Health and Human Services, the current N.C. groundwater standard for arsenic is 2,500 times what is recommended, and exposure at the current level poses a significant cancer risk as well as other health effects risks.

MTBE is a gasoline oxygenate that has been widely detected in groundwater supplies. It is an animal carcinogen, although its precise human health effects are under debate. The N.C. Occupational and Environmental Epidemiology Branch (formerly the Environmental Epidemiology Section) recommended in 1995 tightening the groundwater standard for MTBE.

EPA is required to change the national standard for arsenic in drinking water and is considering changes in drinking water standards for MTBE.

Action of the 1999 Session of the N.C. General Assembly

In addition to bills reported in the July/August *News*, the following environment-related legislation was passed by the 1999 Session of the General Assembly before its adjournment in August and signed into law by the Governor.

HB 222 An act to strengthen the littering law by increasing the minimum and maximum fines and by requiring community service if the litter is more than five hundred pounds, is a hazardous waste, or is discarded for commercial purposes (littering by a business for economic gain). Increases fine for littering under 15 pounds and not for commercial purposes to not less than $250 or more than $1,000 for first offense and not less than $500 or more than $2,000 if the litterer has a prior offense. Fine for littering more than 15 but less than 500 pounds and not for commercial purposes increases to not less than $500 or more than $2,000, and the violator is requires to perform 24 hours of community service. For any violation involving more than 500 pounds, littering for commercial purposes, or a hazardous waste, removing the litter, restoring property damaged or paying for restoration, and performing community service is mandatory.

HB 1098 An act to strengthen the Sedimentation Pollution Control Act of 1973 and to require that the examination for a general contractor's license include questions that test an applicant's knowledge of the requirements of the Sedimentation Pollution Control Act of 1973. Provides that approval of erosion control plans shall be conditioned on applicant's compliance with federal and State water quality laws, regulations and rules. Provides that plans shall be disapproved if implementation of the plan would result in a violation of riparian buffer protection rules. Provides that plans involving utilization of ditches for the purpose of de-watering or lowering the water table must be forwarded to the Division of Water Quality. Increases the maximum civil penalty for violation of SPCA law and rules from $500 to $5000 and provides that penalties may be assessed on the day of discovery and daily from the date of the violation if a deadline stated in the Notice of Violation is not met. Removes the cap on the percentage of administrative costs that may be recovered through plan review fees. Amends the General Statutes governing licensing of general contractors (Chapter 87) to provide that the State Licensing Board for General Contractors shall test applicants' knowledge of requirements of the SPCA and rules adopted pursuant to the act.

HB 1160 Clean Water Act of 1999.

- Extends moratoria on construction or expansion of swine farms to July 1, 2001.
- Extends to July 1, 2001, and expands to Brunswick County (was previously only Columbus County) a pilot program for inspection of animal waste management systems.
- Provides that the Department of Environment and Natural Resources shall develop an inventory of all inactive animal waste lagoons and rank each on the extent to which the lagoon constitutes a threat to public health, the environment, or the State's natural resources.
- Increases the maximum civil penalty for violations of water quality laws from $10,000 to $25,000. Effective Oct 1, 1999, and applying to violations that occur on or after Oct 1, 1999, provides that more than $10,000 may be assessed daily for continuous violations only if a civil penalty has been imposed against the violator within the prior two years. Also provides that more than $10,000 per day may be assessed for continuing reporting violations only if they are determined to be intentional. In ensuing years, the time period for considering previous violations in setting penalties is lengthened so that for violations occurring after Oct 1, 2002, violations during the previous five years may be taken into account.
- Authorizes the Department of Environment and Natural Resources to distribute funds from the Wetlands Restoration Fund or convey real property directly to a federal or State agency, a local government or a private, nonprofit conservation organization to acquire, manage, and maintain real property or an interest in real property for restoration purposes.
- Authorizes Soil and Water Conservation Districts to acquire easements under the Conservation Reserve Enhancement Program (CREP) and authorizes DENR to convey real property or an interest in real property acquired under the CREP to a federal or State agency, a local government, or a private, nonprofit conservation organization.
- Authorizes the N.C. Environmental Management Commission to adopt temporary rules to protect water quality standards and uses as required to implement basinwide water quality management plans for the Cape Fear, Catawba, and Tar-Pamlico River Basins. EMC must consult with interested parties, publish notice of intent to adopt a temporary rule in the *N.C. Register*, and hold a public hearing before adopting the temporary rules. The authorization is in effect until July 1, 2001.
- Requires owners or operators of municipal or domestic wastewater collection and treatment systems to:
  - provide customers an annual report summarizing performance of the system and the extent to which the system has violated its permit or federal or State water quality laws, regulations, or rules;
  - issue a press release to all print and electronic news media in the county when there is a discharge from the system of 1,000 gallons or more of untreated waste or wastewater to the surface waters of the state;
  - publish a notice in a general circulation newspaper in the county when there is a discharge of 15,000 gallons or more of untreated waste or wastewater to the surface waters of the state.
- Requires owners or operators of animal waste management systems to issue a press release when there is a discharge of 1,000 gallons or more of animal waste to the surface waters of the State and to publish a newspaper notice when there is a discharge of 15,000 gallons or more.
- Requires the Department of Environment and Natural Resources to develop and implement a one-county pilot program to inspect and provide technical assistance to municipal and domestic wastewater treatment works. The pilot program is to begin by Jan 1, 2000, and conclude by July 1, 2001. Interim reports are to be submitted and a final report is due July 15, 2001, to the Environmental Review Commission.
- Provides that the EMC may not issue a permit for a new or expanded treatment plant that would discharge to surface waters unless the applicant has prepared engineering and fiscal analyses on alternatives and has considered the alternatives and is in compliance with requirements of its collection system permit.
- Provides that the EMC shall develop engineering standards for municipal and domestic wastewater collection systems that will allow interconnection on a regional basis and report on progress toward establishing these standards on a quarterly basis.

- Provides that the EMC shall develop and implement a permit program for municipal and domestic wastewater collection systems on a systemwide basis. The permit program must establish performance standards, minimum design and construction requirements, a capital improvement plan, operation and maintenance requirements, and minimum reporting requirements. The EMC is to phase-in whole-collection-system permitting over a five year period beginning July 1, 2000, and give priority to those collection systems serving the largest populations, those under a moratorium, and those that have received notices of violation for discharge of untreated wastewater.
- Clarifies that DENR may limit to $2 million the maximum amount of Clean Water Grants to local governments with high bond ratings and changes public hearing and referendum requirements for local governments applying for Clean Water Bond Funds.
- Requires DENR to report to the ERC on progress of the State Wetlands Stream Management Advisory Committee, including an evaluation of current federal and state wetlands protection programs.
- Requires the EMC to study and report to the ERC on whether and under what circumstances privately owned wastewater systems should be required to connect to publicly owned systems.
- Requires the EMC to report to the ERC on progress in implementing the Governor's Lagoon Conversion Plan.

HB 1233 An act to amend the Structural Pest Control Act. Creates the Structural Pest Control Committee and a new Division of Structural Pest Control in the Department of Agriculture and Consumer Services to adopt, administer, and enforce rules governing use of chemicals for structural pest control and licensing of structural pest control applicators.

SB 829 An act to direct the Joint Legislative Transportation Oversight Committee to study issues related to prohibiting the erection of outdoor advertising on a portion of Interstate Highway 40 and to impose a moratorium pending the committee's report to the General Assembly. Applies to the portion of I-40 from the Orange-Alamance county line to the municipal limits of the City of Wilmington.

SB 247 An act to withdraw North Carolina from the Southeast Interstate Low-Level Radioactive Waste Management Compact, to limit the authority of the Low-Level Radioactive Waste Management Authority, and to direct the Radiation Protection Commission to study and formulate a plan for low-level radioactive waste management.

SB 953 An act to enact the Ambient Air Quality Improvement Act of 1999. Sets sulfur content standards for gasoline sold in North Carolina. Amends requirements for the Motor Vehicle Emissions Testing and Maintenance Program and establishes a schedule ending in 2006, for extending emissions inspections to specific additional counties. Establishes conditions under which the EMC, after July 1 2006, may designate other counties to implement emissions inspections. Requires coordination between DOT, transportation planning organizations, and DENR on determination of regions in regional travel demand models and provides that adjustment of regional boundaries shall reflect, among other things, effects of transportation patterns on air quality. More.

SB 1049 An act to amend and codify the law that provides for compensatory mitigation as an alternative to the maintenance of riparian buffers and that authorizes the Environmental Management Commission to delegate responsibility for the implementation and enforcement of the State's riparian buffer protection requirements to local governments, as recommended by the Neuse River Buffer Rules Stakeholder Advisory Committee and requested by the Environmental Management Commission. Provides that the EMC establish a program by which those who cannot avoid the destruction of riparian buffer area may pay into a Riparian Buffer Restoration Fund, donate real property or an interest in real property to DENR, restore or enhance an existing riparian buffer, or construct alternative measures that reduce nutrient loading. Establishes conditions for delegation by the EMC to local governments of the buffer protection requirements, provides DENR shall provide technical assistance on the buffer protection program to local governments and provide a stream identification training program for individuals who want to determine the existence of surface waters for purposes of the rules. Establishes the Riparian Buffer Restoration Fund.

HB 163 The Studies Act of 1999.

- Provides that the Legislative Research Commission may study the following:
  - Wastewater system construction permits and related issues.
  - Red imported fire ants, including impacts on health, environment, land use, and economy and feasibility of control/eradication.
  - Apple industry, including marketing production, effect of pesticide control, use of pesticides marketed in other countries, etc.
  - Environmental impacts and sources of pollution. This refers to a bill introduced during the 1999 session that would have established a commission to identify and prioritize significant sources of environmental pollution in the State as a whole and on a regional basis, identify technologies and methodologies to control or reduce pollution or degradation, report findings, and make recommendations. The LRC may decide the scope of this study.
  - Coastal beach movement, beach renourishment, and storm mitigation.
  - Development-rights transfer and the creation of development-rights banks.
  - The issue of home rule powers for cities and counties.

- Provides that the Environmental Review Commission shall study motor vehicle emission testing and maintenance requirements as they relate to individual counties.

- Provides that DENR shall study the following:
  - Issues related to evaluating and improving compliance with the Forest Practice Guidelines Related to Water Quality
  - Current procedures concerning permits issues for open burning in or near woodlands under the protection of DENR when burning is to occur on five or more acres. DENR shall determine whether more controls are needed.

August action of the N.C. Sedimentation Control Commission

At its regular meeting in August, the N.C. Sedimentation Control Commission (SCC) took the following action:

- Gave staff approval to initiate rulemaking to increase plan review fees to $40 per acre. Legislation passed during the 1999 Session of the General Assembly (House Bill 1098) removed the cap on the percentage of administrative costs for the erosion and sedimentation control program that may be recovered through plan review fees, so fees will be increased to help provide more resources for implementation of the program.

- Voted to request that Governor Hunt use his authority to put into effect at an earlier date rules that the SCC had adopted in February to (1) allow State and local erosion and sediment control programs to require a preconstruction conference when one is deemed necessary, (2) reduce the number of days allowed for establishment of ground cover after completion of construction, (3) require that persons initiating land-disturbing activity notify the agency that issued the plan approval of the date that the activity will begin. Unless the Governor uses his authority to put the rules into effect earlier, they cannot become effective until after the next session of the General Assembly and would be delayed until August 1, 2000.

NCSU research shows no benefits from bacterial septic tank additives

Are bacterial additives necessary to keep septic systems functioning normally? Do additives reduce sludge that accumulates in the bottom of the tank or the scum that floats on the top of water in the tank or the solids suspended in the scum and water? Not according to research conducted in the Department of Soil Science at N.C. State University.

Recent research conducted by graduate student Gregory H. Clark under the direction of Dr. Michael T. Hoover, found no substantial or long-term statistically significant benefits from adding bacterial additives to septic systems.

From January 1977 to December 1997, Clark monitored 48 septic tanks serving homes in two mobile home parks in Chatham and Orange counties. The 48 tanks were grouped into 12 blocks of four tanks based on maintenance level and initial sludge depth and scum thickness. Three liquid bacterial septic tanks additives and a control were randomly assigned within each block. While he was collecting data, the primary researcher did not know which tanks had additives and which did not.

Sludge depth was monitored once every four weeks at three locations in the tank. Scum thickness was monitored every four weeks at numerous locations through the inlet opening and averaged. BOD_5 and total suspended solids were also measured once every four weeks on a subset of 20 tanks.

A total organism count was done on all 48 tanks every 12 weeks beginning on the 12th week of the study.

When data collection was complete and Clark made statistical comparisons among the various treatments and the control, he concluded that:

- There was no difference in sludge depth between any of the treatments and the control. The additives did not reduce thickness of sludge depth or reduce the rate of sludge accumulation.
- While it appeared that some of the additives may have reduced scum levels, the evidence was inconclusive. Initial scum thickness appeared to be the main factor controlling average scum thickness over the monitoring period.
- There appears to be an inverse correlation between sludge depth and scum thickness, indicating that significant scum accumulations capture incoming solids and prevent them from settling to the bottom in tanks that receive less than ideal maintenance. The use of inlet tees in septic tanks might control this problem.
- The additives had no effect on total suspended solids.
- A very limited, transitory effect was noticed for BOD_5.
- All additives tested during the study contained live, viable bacteria. However, all 48 tanks, including the control tanks, maintained very high populations of organisms over the course of the study.

While Clark says that more research is needed under many different circumstance before definitive conclusions can be drawn, his study did not demonstrate any practical value in using bacterial septic tank additives.

The research was the basis for Clark's master's thesis, "The Effect of Bacterial Additives on Septic Tank Performance." For more information contact Dr. Mike Hoover at N.C. State University (919/515-2815) or mike_hoover@ncsu.edu.

The U.S. EPA has proposed revisions to the total maximum daily load (TMDL) program and associated NPDES water quality standards. Among the changes proposed to the NPDES program is a requirement that new and expanding dischargers into impaired water obtain offsets and a provision that EPA could object to, and ultimately reissue, expired and administratively-continued permits for discharges to impaired waterbodies in NPDES-authorized states. For more information go to website http://www.epa.gov/owow/tmdl/proprule.html

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.

Compliance with EPA's Information Collection Rule for North Carolina Surface Water Supplies: Bench-Scale Testing of the Efficacy of Carbon Adsorption and Membrane Separation
Report 322 June 1999

Francis A. DiGiano, Sabine Arweiler, Christoph Hartmann, and James A. Riddick

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Recent and pending regulations to control the concentrations of disinfection by-products (DBPs) in drinking water are creating a need for new treatment technologies. Because DBPs are formed by the reaction of chlorine and other disinfectants with natural organic matter (NOM), it may be possible to control DBPs concentrations by controlling NOM. Among the most promising technologies for reducing NOM are granular activated carbon (GAC) adsorption and nanofiltration (NF) membrane treatment. Under its Information Collection Rule (ICR), the U.S. Environmental Protection Agency is requiring large drinking water utilities with high levels of total organic carbon in their source water to conduct bench- or pilot-plant studies of one of these technologies to help evaluate them.

In this project the investigators performed bench-scale testing of GAC adsorption and NF membrane treatment for three N.C. drinking water utilities: the cities of Durham, Fayetteville and Raleigh. They compared the results from the three utilities with the hope that studies would produce results similar enough that any pilot testing required might serve more than one utility.

The rapid, small-scale column test (RSSCT) was used for GAC evaluation, and ways to modify it to give more complete information were examined. RSCCT was used to predict the breakthrough curves of NOM. GAC service times before 1 mg/L total organic carbon was reached ranged from 48 to 91 days if the empty-bed-contact time (EBCT) was 10 minutes and 107 to 246 days if the EBCT was 20 minutes. The logistic function provided a practical way to generalize breakthrough behavior among the utilities and to interpret seasonal trends.

Three different bench-scale tests were used for membrane evaluation: the rapid, bench-scale membrane test (RBSMT), the batch recycle membrane test (BaReMT), and the batch internal recycle membrane test (BaIReMT). BaReMT produced similar patterns of flux decline and NOM rejection to the EPA-recommended RBSMT. Over 80% removal of NOM was produced for all three water supplies. The BaIReMT was more convenient than either the RBSMT or the BaReMT. Particles and bacteria probably contributed to fouling in addition to NOM; atomic force microscopy and scanning electron microscopy images helped identify them. Flux decline was 20% in about 4 days of operation. No strong differences were noted in membrane performance among the three test waters. The cleaning procedure gave nearly complete flux recovery although foulants remained, and this is of concern for long-term operations. The extent of flux decline would detract from practical application.

Among other things, the investigators recommend that long-term bench-scale studies should be compared to pilot-scale studies to determine if a steady-state pattern of flux decline and recovery is achieved in either and if the patterns are similar.

Public Meeting Announcement

Statewide Wetland and Stream Management Strategy (SWSMS) Regional Public Meetings

All meetings begin at 7:00 pm

Sept 29, Asheville
Asheville-Buncombe Tech Community College

Oct 27, Greensboro
Guilford Tech Community College

Dec 1, Wilmington
Cape Fear Community College

Dec 2, New Bern
Craven Community College

The N.C. Department of Environment and Natural Resources (DENR) has set out to develop a Statewide Wetland and Stream Management Strategy (SWSMS) to make wetland and riparian programs work more efficiently and effectively in North Carolina. An Advisory Committee made up of representatives of business and industry, agriculture, forestry, conservation organizations, government and others has identified key issues they think the SWSMS should address. This fall the Advisory Committee will hold public meetings to obtain citizen input on wetland and stream protection issues. Citizens are encouraged to attend and share ideas and concerns with the Advisory Committee. Reports on progress toward a SWSMS, including recommendations for regulatory and nonregulatory programs, will be presented to the N.C. General Assembly.

For additional information, contact Shannon Stewart with the N.C. Division of Water Quality (919/733-9582) or visit website http://h2o.ehnr.state.nc.us/NDbranch/wetland/swsms.html

La Niña holding on

According to the National Oceanic and Atmospheric Administration (NOAA), the Pacific cold sea surface event called "La Niña" is persisting and is predicted to hold on into 2000. NOAA's September 10, ENSO Advisory reported strengthening cold conditions in August. The advisory also reported new model predictions that the current cold episode could last into May 2000.

The longer-term climate effects in North Carolina could be a continued deficit of normal rainfall into the spring of next year. Because La Niña increases hurricane activity in the Atlantic, the state could see increased storm activity in the fall and short-term relief from drought conditions. According to hydrologists, however, such intense, short-term precipitation events do not relieve long-term hydrological drought conditions.

According to the N.C. Drought Monitoring Council, as a result of long-term dry conditions that have persisted since May 1998, North Carolina has experienced moderate or worse drought conditions, with the Central Piedmont (including Charlotte, Greensboro, and Raleigh) experiencing severe to extreme drought. In early August, streamflows were no more than 40% of normal for most of the State. The extended dry period and heavy pumping had also resulted in lower than normal ground water levels in shallow wells, causing some wells to run dry. The Drought Monitoring Council on August 16 said it could take six months of normal precipitation to alleviate drought conditions.

Reduced streamflow took its toll on water quality in coastal rivers. Websites maintained by the Neuse Rapid Response Team (http://esb.ehnr.state. nc.us/nrrt.html) and the Tar-Pamlico Rapid Response Team (http://esb.ehnr.state.nc.us/prrt.html) display salinity, dissolved oxygen, and temperature profiles. A look at these profiles in for July and August shows salinity levels several parts per thousand higher than usual pushing their way upstream, causing stratification, and depressing dissolved oxygen.

According to Hans Paerl at the UNC Institute of Marine Sciences at Morehead City, a saltwater wedge managed to push its way up the Neuse River to Vanceboro, whereas it usually extends only to New Bern. He said the unusually salty conditions have also lured crabs further upstream above New Bern.

Saltier, warmer water has lower capacity to hold oxygen and can stress fish. However, Paerl said that increased streamflow from inland runoff as a result of storms—such as recent Hurricane Dennis—can be a mixed blessing. While it reduces salinity it also brings to the estuaries more nutrients and other pollutants that have been accumulating on streets and other surfaces during dry periods.

North Carolina Precipitation/Water Resources

	July	August
Rainfall (+/- average)		
Asheville	3.85" (-0.67")	3.37"(-1.32")
Charlotte	3.39" (-0.53")	1.42"(-2.31")
Greensboro	4.14" (-0.37")	5.00"(+1.12")
Raleigh	3.00" (-1.01")	3.18"(-0.84")
Wilmington	4.54" (-3.59")	8.35"(+1.41")

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)	284	(255%)	83 (67%)
Oconaluftee River at Birdtown (Swain, Tenn)	688	(207%)	234 (74%)
French Broad River at Asheville (Buncombe, FB)	1,380	(98%)	573 (42%)
South Fork New near Jefferson (Ashe, New)	302	(87%)	165 (54%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	58	(92%)	26 (44%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	104	(70%)	81 (72%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	119	(54%)	62.5 (31%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	158	(42%)	98.5 (25%)
Deep River near Moncure (Lee, Cape Fear)	214	(53%)	275 (41%)
Black River near Tomahawk (Sampson, Cape Fear)	205	(48%)	171 (36%)
Trent River near Trenton (Jones, Neuse)	104	(117%)	14.2 (19%)
Lumber River near Boardman (Robeson, Lumber)	452	(74%)	295 (42%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	12.9	(31%)	5.07 (12%)
Potecasi Creek near Union (Hertford, Chowan)	10.5	(28%)	4.19 (5%)

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)	31.36 (-0.31)	33.01 (-1.00)
Mocksville (Piedmont)	18.00 (-0.02)	18.65 (-1.31)
Simpson (Coastal Plain)	4.44 (+1.20)	6.63 (-1.27)

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

Conferences and workshops

The International Erosion Control Association has the following workshops scheduled:

- Practical Approaches for Effective Erosion and Sediment Control, Nov 16, 1999, in Denver and Dec 14, 1999, in Atlanta
- Reducing Erosion and Managing Sediment on Construction Sites, Nov 17, 1999, Denver
- How to Put the BEST Back into your Best Management Practices, Oct 27, 1999, in Seattle and Dec 15, 1999, in Atlanta.

For information call IECA at 800-455-4322 or register online at http://wwww.ieca.org.

The Conservation Technology Information Center and others will present a workshop on the establishment of TMDLs Dec 14 and the Conservation 2000 conference Dec 15-17, 1999, in New Orleans. For information call 765-494-9555, email ctic@ctic.purdue.edu, or visit website http://www.ctic.purdue.edu

Call for papers

The American Society of Engineers has issued a call for papers, posters, and session ideas for its ***2000 Joint Conference on Water Resources Engineering and Water Resources Planning & Management*** to be held July 30-Aug 2, 2000, at the Hyatt Regency Minneapolis. Technical symposia being integrated into the conference include: stream restoration, sedimentation engineering, paleofloods, well hydraulics and modern velocity and discharge measurement techniques and applications. For more information call ASCE at 703-295-6030 or visit website http://www.mpls2000.asce.org. The deadline for paper abstracts and posters is Oct 15, 1999.

Publications

The U.S. Geological Survey has recently published ***The Quality of Our Nation's Waters*** (USGS Circular 1225), a non-technical booklet presenting some major findings of the National Water-Quality Assessment (NAWQA) and an accompanying fact sheet (USGS Fact Sheet 116-99). This report, which presents insights on nutrients and pesticides in water and on pesticides in bed sediment and fish tissue, is the first in a series of publications based on the NAWQA studies. These publications are available through the NAWQA Program. Phone (703) 648-5718; email: nawqa_whq@usgs.gov; website: http://water.usgs.gov/lookup/get?nawqa.

The National Water Research Institute has published ***The Value of Water: Recognizing and Using the Full Potential of Your Water Supply.*** This 12-page booklet was produced to help policy makers develop a broad view of the value of water supplies. Contact WRRI for a copy or contact the National Water Research Institute at (714) 378-3278 or email: NWRI-1@worldnet.att.net.

The Trust for Public Land has recently published ***The Economic Benefits of Parks and Open Space: How Land Conservation Helps Communities Grow Smart and Protect the Bottom Line***. Contact 800-714-LAND or publications@tpl.org for a copy.

A publication that assists local governments in developing tree ordinances is now available on the Internet. The publication, ***Guidelines for Developing and Evaluating Tree Ordinances***, contains information that can assist local governments in assessing existing ordinances, determining community needs, drafting new ordinances, and evaluating new ordinance performance. It is available at http://phytosphere.com/treeord/Ordintro.htm

Recent N.C. Sea Grant publications. Write N.C. Sea Grant at Box 8605, NCSU, Raleigh, NC 27695-8605, or call (919) 515-2454.

- ***Coastal Water Quality Handbook***, which is based on questions concerned citizens have asked Sea Grant in letters and at public meetings. The 72-page booklet discusses river and estuarine pollution, how water quality affects estuarine habitats and fisheries; seafood safety; drinking water; the legal framework for protecting coastal water quality, and what actions citizens can take to improve water quality. The publication, UNC-SG-97-04, is available for $6.00

- ***Salt Marsh Restoration: Coastal Habitat Enhancement***. The report, written by Dr. B.J. Copeland of the NCSU Department of Zoology, is a summary of research conducted by numerous scientists over 30 years. It is intended to be of use to coastal interest groups, management entities and technical practitioners involved in setting goals for creation and restoration of valuable salt marsh habitats. The 32-page booklet is publication number UNC-SG-98-08.

- ***Flounder Aquaculture and Stock Enhancement in North Carolina: Issues, Opportunities and Recommendations***. This document, UNC-SG-99-02, is a summary of three workshops sponsored by the N.C. Board of Science and Technology and others.

- ***Coastwatch*** High Season 1999. This issue of the magazine includes a look at the effects of the N.C. Coastal Area Management Act (CAMA) on the 25th anniversary of its passage. Subscriptions to *Coastwatch* are currently offered for $15 for six issues.

1999-2000 Water Resources Research Seminar Series

Presentations take place in the Ground Floor Hearing Room of the Archdale Building in downtown Raleigh or in Room 1132 of Jordan Hall on the N.C. State University campus. Presentations begin at 3 pm unless otherwise noted. This schedule is also posted on the WRRI website, and any changes will be posted there. (http://www2.ncsu.edu/ncsu/CIL/WRRI/2000seminars.html) For additional information contact Associate Director Robert Holman at (919) 515-2815 or Robert_Holman @ncsu.edu.

Monday, Oct 11, 1999, Jordan
Network Analysis for Evaluating the Consequences of Nitrogen Loading
Professor Robert Christian, East Carolina University Dept Biology

Monday, Nov 22, 1999, Archdale
Examination of Long-Term Nutrient Data in the Neuse River Watershed
Professor Craig Stow, Duke Univ Nicholas School of the Environment

Tuesday, Jan 18, 2000, Jordan
Algal, Bacteria, and BOD Responses to Nutrient Gradients in Coastal Plain Watersheds
Research Associate Michael Mallin, UNC-Wilmington Center for Marine Science Research

Monday, Feb 21, 2000, Archdale
Predicting Long-term Wetland Hydrology Using Hydric Soil Field Indicators
Professor Michael Vepraskas, NC State Univ Dept Soil Science

Monday, Mar 27, 2000, Jordan
Soil Processes Impacting Groundwater Quality in the North Carolina Piedmont: Contamination by Organic Agrochemicals
Asst Professor Dharni Vasudevan, Duke Univ Nicholas School of the Environment

Monday, April 24, 2000, Archdale
Impact of Sediment Processes on Water Quality in the Neuse River Estuary
Asst Professor Marc Alperin, UNC-Chapel Hill Dept Marine Science

Monday, May 22, 2000, Jordan
Benefits of Quality Improvements in N.C.'s Water Resources
Asst Professor Dan Phaneuf, NC State Univ Dept Agricultural and Resource Economics

North Carolina Water Resources Association

NCWRA

North Carolina Section of the American Water Resources Association

Luncheon and Forum Schedule

Dec 6, 1999	Cape Fear Basin: Water Quantity Issues
Feb 14, 2000	Mitchell River Watershed: Case Study
April 10, 2000	Capacity Use
Sept 11, 2000	Land Use Planning

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

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