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of The University of North Carolina

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Neuse River nutrient management rules adopted

On December 11, the N.C. Environmental Management Commission adopted what Chairman David Moreau called "a landmark piece of basinwide water quality planning" when it approved the Neuse River Basin Nutrient Sensitive Waters (NSW) Management Strategy. Nearly two years in the making, the Neuse NSW rules were the subject of intense public scrutiny and debate up to the very moment of their adoption, with "hearing officers" (commissioners who conducted public hearings and worked with staff to craft the rules) disagreeing on the day of the vote about what constitutes "equity" with regard to allocation of nitrogen loading among wastewater treatment plants in the lower basin.

Before voting on the entire rule package, commissioners debated the method to be used to allocate the nitrogen loading "pie" available to large wastewater dischargers below Falls Lake. The discussion centered on whether individual nitrogen load allocations should be based on each discharger's 1995 "permitted" flow rather than on its "actual" flow, as had been recommended by the majority of the Neuse Hearing Officers.

Municipalities that have planned for growth and constructed wastewater treatment plants that can easily be equipped to treat additional volumes of wastewater have received permits from the state to discharge additional volumes in the future. Thus, many dischargers have larger "permitted" than "actual" flows and will receive a larger share of the nitrogen loading pie when calculations are based on permitted flows.

While they emphasized that there was no disagreement among hearing officers on the total nitrogen load to be allocated to wastewater dischargers, Commissioners Jeffrey Morse and Leo Green presented the "minority" view that basing individual loads on actual flows would deny municipalities that have planned for growth the opportunity to use the wastewater treatment capacity in which they have invested heavily.

Arguing for the hearing officers' "majority" view, EMC Chairman Moreau said that basing allocations on permitted flows will excuse dischargers with high ratios of permitted to current flows from taking any action to reduce nitrogen concentrations for many years and will force others to make drastic reductions right away. Moreau argued that the plan should put all dischargers at the same starting line and require those who want to grow to pay (by reducing nitrogen loading) to do so.

Commissioner Robert Epting argued that planning to increase wastewater discharges to the Neuse when the river has no additional assimilative capacity was wrong and that such

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Director's Forum

Kenneth H. Reckhow, Director, Water Resources Research Institute

Decision variables, standards, and water quality models: Improving the usefulness of predictive science

Are water quality predictions of nutrient concentrations or dissolved oxygen levels directly useful for decision making? The answer is clearly yes, if water quality standards exist for nutrients or dissolved oxygen. However, the answer is less clear when these variables are not regulated by standards.

To see this, consider why standards are important in characterizing the usefulness of response variables. Standard setting requires value judgments on the acceptable tradeoff among relevant variables. For example, in setting a standard for chlorophyll *a*, decision makers must choose the chlorophyll level for the standard based in part on a tradeoff between what is desirable for water quality and what is feasible from an economic perspective. This requires input from scientists, but ultimately standard setting is a task for decision makers, not for scientists (unless those scientists are also elected or appointed public officials).

By setting the chlorophyll standard, decision makers established public values for chlorophyll, and this makes predictions of expected chlorophyll *a* levels meaningful for decision making. Of course, if benefits and costs were not considered in the standard setting process, then decision recommendations based on the standard and the regulated variable may be misleading.

Now think about variables not governed directly by standards. For example, how are decision makers to evaluate a plan based on a prediction of only nitrogen concentration, without further interpretation (by scientists) of what that nitrogen concentration means?

To fix ideas further, consider the following two water quality predictions:

- *A 30% reduction in nitrogen loading will reduce the spatial extent and duration of anoxia and hypoxia in the estuary by one-third.*
- *A 30% reduction in nitrogen loading will reduce the number of major fishkills in the estuary by one-third.*

With or without water quality standards, many aquatic scientists would find the first predictive statement more informative and useful. This conclusion reflects the fact that scientists can infer a great deal about an aquatic ecosystem from the statement concerning the extent of anoxia and hypoxia. They infer this, of course, from their scientific knowledge.

However, decision makers lack the depth and breadth of scientific

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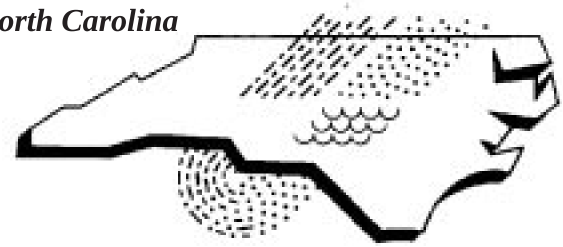

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knowledge acquired by the trained aquatic scientist. Despite limited knowledge, decision makers will still think about the anoxia/hypoxia predictions in terms of publicly meaningful responses, such as fishing, shellfishing, and aesthetics, specific to the site of interest. They do this because anoxia and hypoxia have no meaning or importance beyond serving as precursors or indicators of impacts on other resources or activities. At best, anoxia and hypoxia are surrogate decision variables that are useful to the nonscientist only if interpreted.

Thus, in the absence of water quality standards or additional scientific interpretation, decision makers are ill-equipped to directly use the first predictive statement. The second predictive statement, while limited in scope, is more useful because it *directly* addresses one of their concerns.

Why is this issue important? For aquatic scientists, this discussion should serve to emphasize that we must extend our predictive models to cover publicly meaningful variables, *regardless of the scientific uncertainties*. Why? If we do not, that is, if we simply predict the spatial and temporal extent of anoxia and hypoxia, we relinquish to the decision makers the scientific task to extend the prediction to variables or attributes that are important to their constituents. Leaving this extrapolation in the hands of decision makers increases prediction uncertainty and increases the risk in decisions.

Even when undertaken by scientists, predictions of these publicly meaningful variables are likely to be quite uncertain. High uncertainty does *not* mean that these predictions are to be avoided by scientists; these variables must be assessed since they are a basis for decision. Predictions can take the form of direct extensions of the mathematical model and/or they can be verbal descriptions of system response. Whatever form they take, however, they should be provided by scientists, and not left for speculation by decision makers.

Neuse NSW rules *continued*

planning should not be rewarded. “It is time to say we erred and to respect the river’s capacity,” said Epting.

Commissioner Douglas Boykin took advantage of the debate to return to a favorite theme, pointing out that “point” sources have already been “ratcheted down” tightly and that in the future, pollution reduction will have to be made on the “nonpoint” side. Boykin said he was encouraged by the nonpoint source strategy contained in the Neuse NSW rules.

After a lengthy discussion, the commission voted narrowly to base dischargers’ nitrogen loading allocations on permitted flow, then approved the entire rule package unanimously.

In presenting the package of rules, EMC Vice Chairman Charles Peterson reminded the public that while the rules were crafted to implement a legislatively mandated 30% reduction in nitrogen loadings to the Neuse River at New Bern, they should be considered a first step in adaptive management and that further nutrient reductions could be necessary in the future.

Barring action by the Governor, the Rules Review Commission, or the General Assembly, most of the Neuse NSW rule package will take effect in August of 1998. Two temporary rules will take effect in mid January.

Temporary rules

The first temporary rule approved by the Commission in December is an amended version of the temporary riparian area rule which was put into place in June 1997. This temporary rule provides a definition for “forest vegetation” that includes small woody and herbaceous plants, saplings, and dense, mature trees. Another clarification prohibits installation of utilities in riparian “zone one,” or within 30 feet of the streambank. The version of the riparian area rule that will be filed as a permanent rule will include these clarifications.

At the same time the EMC made these clarifications to the riparian area rule, they approved proceeding with an additional riparian area rule that will protect all riparian areas, regardless of existing vegetation. This rule will require public notice and separate rulemaking.

The second temporary rule adopted by the EMC in connection with the Neuse NSW package was a requirement that wastewater dischargers in the Neuse Basin notify the Division of Water Quality by March 1, 1998, if they intend to become part of a dischargers’ association. Setting this notification deadline was necessary so that basinwide NPDES permitting can proceed on schedule.

What the Neuse NSW rules require

1. Riparian buffer requirements. Areas adjacent to a body of water in the basin that contain existing forest vegetation (defined to include undisturbed mature stands, cutover forest stands, and stands of shrubs, saplings and herbaceous plants) must be preserved and maintained to accomplish sheet flow and maximum pollutant removal. At least 30 feet of streamside buffer containing forest vegetation (zone one) must be preserved, and an additional 20 feet of upland area (zone 2) must be maintained in dense ground cover. The rules specify what activities are allowable in each zone and provide that local governments that have been issued a Municipal Separate Stormwater Sewer System permit or delegated a local stormwater program must assure protection of riparian areas by recording them on new or modified plats.

2. Wastewater discharge requirements. (This summary includes only the nitrogen requirements).

In five years, the collective total nitrogen load for all individually permitted wastewater dischargers in the basin can be no more than 2.8 million pounds per year (this represents a 30% reduction of 1995 nitrogen loadings).

Dischargers in the basin who had a permitted discharge of less than 0.5 million gallons per day (MGD) in 1995 are allocated a collective total of 280,000 pounds of total nitrogen per year.

Dischargers above Falls Lake with permitted flows equal to or greater than 0.5 MGD are allocated a total of 444,000 pounds of total nitrogen per year, to be

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allocated among them based on ratio of individual 1995 permitted flow to the group's total 1995 permitted flow. It is to be assumed that 15% of the total 444,000 pounds of nitrogen discharged by large wastewater dischargers above Falls Lake will be discharged to the lower Neuse (this amounts to 66,600 pounds annually).

All wastewater dischargers below Falls Lake with permitted flows equal to or greater than 0.5 million gallons per day must either

(a) within five years, meet an annual mass loading limit for total nitrogen based on the ratio of their 1995 permitted flow to the total 1995 permitted flow from all dischargers of more than 0.5 MGD below the lake times 2.45 million pounds per year, or

(b) join an Association of dischargers which may pool their load allocations and meet nitrogen limits as a group. If such an association is formed, it must be formed by March 1, 1998, and must accept any discharger who applies before that date. An agreement that sets annual loading targets must be developed between the association and the Division of Water Quality and approved by the EMC.

The association must document reductions in nitrogen loads by dischargers in Craven, Jones, Pamlico and Carteret counties because they are closer to the estuary, and more of their nutrients reach the trouble spots.

The discharger association may meet nitrogen limits by "purchasing nitrogen offsets." To purchase offsets, the association would make payments to the N.C. Wetlands Restoration Fund, and the monies would be targeted to restoration of wetlands and riparian areas within the Neuse River Basin. If the association does not meet its collective load reduction requirements, it will be required to purchase nitrogen offsets.

Any person who wishes to get a permit for a new wastewater discharge in the Neuse Basin must obtain a nitrogen load allocation from an existing discharger or purchase offsets by payments to the Wetlands Restoration Fund. New dischargers must meet an annual nitrogen mass load limit based on 3.5 milligrams per liter and their permitted flow.

3. Stormwater control requirements. Ten municipalities and five counties (based on population and other factors) in the Neuse Basin are required to develop, adopt, and implement stormwater management programs approved by the EMC.

In cooperation with the affected localities, the Division of Water Quality is to develop a model stormwater management program designed to (1) hold nitrogen loading from new development at 70% of that contributed by 1995 land uses in the nonurban areas of the Neuse River basin, using an export standard of 3.6 pounds/acre/year, and (2) hold the increase in peak flow leaving the site during the 1-year, 24-hour storm to what it was under predevelopment conditions.

The model program must also include review of new development plans for compliance with riparian buffer requirements, a public education program, identification and removal of illegal discharges, and identification of suitable locations for potential stormwater retrofits.

The named local governments are required to develop and submit for approval stormwater management plans that equal or exceed the model plan. If a locality fails to submit an acceptable plan within the time allotted (two and a half years from effective date of rules, which would be about February 2001), then the requirements will be enforced under the federal NPDES municipal stormwater permitting program.

4. Agricultural nitrogen loading reduction. Within five years, all persons engaged in agricultural operations in the Neuse Basin—including animal operations of any size—are required to collectively reduce total nitrogen loading 30% from 1991-1995 average loadings. To accomplish reductions, agricultural operators may complete a specified sign-up process and participate in a collective local strategy or individually implement best management practices specified in the rules, including forested riparian buffers, water control structures, and nutrient management plans. Failure to do one of the two could result in civil or criminal penalties or legal action.

Local strategies based on site-specific BMPs are to be developed and implemented by Local Advisory Committees. A Local Advisory Committee for each county or watershed (as determined by the Basin Oversight Committee, see below) is to be formed by the Directors of the Division of Water Quality and the Division of Soil and Water Conservation based on nominations by federal, state and local agencies and local farmers. Membership of the Local Advisory Committees will be composed primarily of employees of natural resource agencies and local farmers and will be approved by the EMC and the Soil and Water Conservation Commission. Soil and Water Conservation Districts may be designated as lead agency on these committees. These committees will also be responsible for tracking BMP implementation locally and making annual reports to the Basin Oversight Committee.

A Basin Oversight Committee (BOC) for the agricultural strategy is to be established by the Secretary of the Department of Environment and Natural Resources, with nominations from agencies and groups specified in the rules. This commission is to calculate nitrogen loadings from agricultural operations (including atmospheric emissions) above New Bern and below New Bern and develop an accountability methodology (including a way to track BMP implementation and ways to quantify nitrogen reductions by BMPs) to demonstrate that the target nitrogen reductions can be met by BMPs approved by the Soil and Water Conservation Commission. The BOC must submit a draft accountability methodology to the EMC within six months after the rules become effective and a final version within one year. The BOC is also to review local nitrogen reduction strategies and present them to the EMC for approval within two years of the rules' effective date.

The Neuse NSW rules specifically state that as information on atmospheric nitrogen loadings from animal operations becomes available, other best management practices for animal operations may be required to achieve a net total nitrogen loading reduction from animal operations based on 1991-1995 conditions.

continued next page

Expert panel makes recommendations for scientific response to *Pfiesteria piscicida*

Recently, Governor James B. Hunt, Jr. asked the Water Resources Research Institute to convene a panel of experts to help the State frame a science-based response to concerns about the toxic alga *Pfiesteria piscicida*. In December the panel met in the Research Triangle Park for a two-day workshop aimed at identifying specific research questions that must be answered in order to find ways to control blooms of the organism. Composed of experts from the fields of ecology, fisheries, and public health, the panel was chaired by Dr. Jeffrey Wright, the Canadian scientist who led that nation's response to an outbreak of domoic acid shellfish poisoning in the late 1980s. After reviewing the most recent publications relating to *Pfiesteria piscicida*, the panel composed a report on the state of knowledge about the organism and what needs to be learned in order to develop a management strategy. The panel called their report ***The Raleigh Report 1998***. Following is a review of the highlights of their report.

The state of knowledge about *Pfiesteria piscicida*

The more scientists learn about *Pfiesteria piscicida* the greater mystery it becomes. *P. piscicida* is a dinoflagellate— that is a microscopic, single-celled alga that has both plant and animal characteristics. The creature is known to assume as many as 23 forms, and it finds nourishment in several ways. It feeds on other algae species. One of its forms has been observed devouring fish tissue and blood. It has also been observed to steal chloroplasts—photosynthesizing elements—from other algae, presumably so it can make its own food when prey is not available. It has also been discovered that the toxic zoospore form of *P. piscicida* harbors endosymbiotic bacteria which apparently play some role in the organism's life cycle. It is well established that *P. piscicida* produces a toxin, which in laboratory settings has been observed to kill fish in a matter of a few hours. *P. piscicida* has been definitely identified in high densities in waters where fishkills have occurred in a number of estuarine locations in the Southeast. It is also well established that the *P. piscicida* toxin has caused physical and neurological illness in scientists directly exposed to it, and it has been shown to cause neurological damage in rats in the laboratory.

What we need to know about *Pfiesteria piscicida*

Human health effects: The most important thing to know about *P. piscicida* right away is how to prevent it from affecting human health. To know how dangerous *P. piscicida* toxin is to humans exposed in the natural environment, the chemical composition of the toxin (or toxins) must be discovered. While there is no evidence that toxin(s) produced by *P. piscicida* and similar species reach consumers in fish and shellfish, the possibility cannot be completely ruled out, and it must be learned whether it may accumulate in shellfish or fish. To do that, a way to detect the toxin in fish and shellfish must be developed. Until the nature of the toxin, how it may reach people, and the way it works are known, there is no reliable way to measure the human health effects of exposure or determine when people have been exposed.

The Raleigh Report panel recommends that research agencies place high priority on characterizing and identifying the toxin(s), conducting animal studies, conducting pharmacological studies to determine the mode of action, and developing a consistent disease description and objective diagnostic tests for *P. piscicida* poisoning. In addition, say the panel, studies should be conducted to determine how finfish and shellfish are affected by the toxin and the extent to which they store and concentrate *P. piscicida* toxin, as well as toxins produced by other forms of algae.

Until scientists learn more about the organism and its toxin(s), the best way to protect human health is to educate people to avoid areas where the toxic form may be active (areas of fish with lesions and fishkills), and to establish an observation and communication network among fishermen and others in frequent contact with estuarine waters and health care professionals to report fishkills and human health events and to follow up reports of illness with testing.

To accomplish this, the Raleigh Report panel recommends that public health agencies produce educational materials and distribute them to the appropriate groups.

Effects on fisheries: To determine whether *P. piscicida* is having a devastating effect on important fish populations,

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Neuse NSW rules *continued*

5. Nutrient management requirements. People who in a calendar year apply fertilizer to cropland and other production areas that total 50 acres; golf courses, recreational land, right-of-ways or other turfgrass areas that total 50 acres; or lawns and gardens that total 50 acres must either undergo training and obtain a certificate or be able to produce documentation within 24 hours that their application practices comply with nutrient management standards adopted by federal and state agencies. Failure to do one or the other can result in civil or criminal penalties or legal action. Homeowners and others who apply fertilizer to less than 50 acres per year are encouraged to seek information on correct fertilizer application rates and follow the recommendations.

This is only a brief summary of the Neuse NSW rules and should not be relied on for compliance purposes. The rules can be obtained from Marsha Byrd with the N.C. Division of Water Quality at (919) 733-5083, Ext 558.

we need to know how it affects different species of fish and if it affects growth and reproduction of fish that are not obviously harmed. Menhaden is the fish species most affected by *P. piscicida*. Is that because menhaden are more susceptible to the toxin than other fish species, because menhaden exude something that strongly stimulates the production of the toxin, or because menhaden, being filter feeders, are simply attracted to the same areas as *P. piscicida* by the availability of algal food?

To answer those and other questions that will allow resource managers to assess the effect of *P. piscicida* on fisheries, the Raleigh Report panel recommends studies of fishkill events, studies in the laboratory and in aquaculture systems to determine the relative vulnerability of fish species and stages, surveys of fish abundance in conjunction with measurement of environmental conditions, and studies using biochemical indicators of stress in areas affected by and areas not affected by *P. piscicida*.

Ecosystem effects and controls. To help resource managers formulate a control strategy for *P. piscicida*, scientists must learn what stimulates it to change form—particularly what causes blooms of its toxic form. What environmental factors that we might control—such as nutrient loading—influence formation of its toxic life stage? Does starvation play a role—that is, when its algal prey disappear or decrease, does it change forms so it can feed itself another way? While small laboratory experiments may point to some answers, learning about *P. piscicida*'s life cycle in the wild requires studies under more realistic field conditions.

The Raleigh Report panel recommends conducting a coordinated set of laboratory studies (in which environmental factors can be tightly controlled), mesocosm studies (simulated field conditions in which some factors can be controlled) and full scale field studies (where little can be controlled but conditions are more realistic) to help identify environmental factors that affect *P. piscicida*. They recommend that this set of studies be followed by modeling to extrapolate the results to ecosystems and predict the probability of *P. piscicida* blooms and their ecosystem effects.

However, in order for scientists to do laboratory experiments and observations to learn more about the life cycle and characteristics of *Pfiesteria piscicida*, they must first have the creature to work with. Because *P. piscicida* is so difficult to identify and changes life forms so often, the only way a scientist can be sure he/she has the right creature is to get a culture of "clones" from someone who has definitely identified the creature and has kept the culture pure. Keeping *P. piscicida* –as well as other forms of toxic algae—alive in the laboratory is both difficult and expensive, and very few good cultures exist. The Raleigh Report panel recommends that North Carolina join with federal agencies to help establish and maintain *P. piscicida* isolates at the Bigelow Laboratory of Ocean Sciences, which houses, maintains, and distributes marine phytoplankton cultures.

While we know that *Pfiesteria piscicida* can kill fish, until there is a quick, sure way to differentiate among the many *Pfiesteria*-like organisms that have been discovered, scientists will not make much progress in determining if the fishkills are due only to *P. piscicida* or if other species may also produce toxins and kill fish. Therefore, it is crucial to learn right away how to identify *P. piscicida*—definitely, consistently, and quickly. Because it is microscopic and because many other species resemble it and may live in the same waters, other species can be mistaken for it in analyses of waters where fishkills have taken place. Complicating the fact that *P. piscicida* and other species look alike under the standard light microscope is the fact the *P. piscicida* takes on many different forms. The only way to identify *P. piscicida* definitely is to meticulously count the plates in a suspect organism's "armor" under a scanning electron microscope. This procedure takes great expertise, specialized equipment, and a long time.

The Raleigh Report panel recommends that resources be devoted to developing molecular probes that will allow scientists to identify the various species that resemble *P. piscicida* and to developing nucleic acid probes that can identify organisms at the race or clone (descendants of an individual) level.

Immediate management measures: Because *Pfiesteria piscicida* and its close relatives are still such mysteries, scientists cannot link their presence or the emergence of toxic forms to any particular source of nutrients. However, both the Raleigh panel and other groups of distinguished scientists say that there is overwhelming evidence that nutrient enrichment arising from human activities in watersheds is causing coastal eutrophication, which leads to events of oxygen depletion in bottom waters, outbreaks of toxic microorganisms, and fishkills.

There can be little question, they say, that reducing the loading of nitrogen and phosphorous (both organic and inorganic forms) to estuarine waters will reduce eutrophication and lower the risk of toxic outbreaks of *Pfiesteria*-like dinoflagellates, as well as hypoxic events and fishkills. They say that, given current levels of understanding, all sources of nutrients should be targeted for management, including deforestation, human wastes, artificial fertilizers, animal waste, urbanization, and atmospheric deposition.

December action of the N.C. Environmental Management Commission

In addition to adopting the Neuse River NSW Management Strategy, the N.C. Environmental Management Commission (EMC) took the following actions at its December 11 meeting:

- Approved recommendations from its hearing officer and the N.C. Division of Water Quality on water supply allocations from the Jordan Lake reservoir in the Cape Fear Basin. The only community to receive an allocation was Holly Springs in Wake County, which is to receive a 2.0 million-gallon-per-day allocation. Requests from Durham, Fayetteville, and Greensboro were denied. Requests from Harnett County and Chatham County were delayed. Requests from a group of communities in western Wake County (Cary, Apex, Morrisville, and Wake County/Research Triangle Park) are being considered on a schedule dictated by the need to perform analyses required for issuing a certificate for interbasin transfer of water. In addition to taking action on allocation requests, the EMC approved modifying existing water supply contracts to base contracts on use of storage allocated rather than on a maximum rate of withdrawal and to require development of drought and water shortage response plans.

■ Adopted air quality rules setting emission standards and specifying monitoring provisions, reporting and recordkeeping requirements, and compliance schedules for municipal solid waste landfills.

■ Adopted air quality rule amendments making Division of Air Quality name corrections, clarifying reporting and recordkeeping rules and operational standards, clarifying incinerator rules, adding perchloroethylene to the list of compounds that must be reported, and amending three exclusionary rules.

■ Approved granting the Forsyth County local air quality program jurisdiction over the Guilford County section of the Piedmont Landfill.

■ At the request of Cumberland County, which has repealed its open burning rules, rescinded certification of the county's local air pollution program.

■ Approved the list of priority projects for loans and Intended Use Plan for the state's wastewater treatment State Revolving Fund based on the assumption that North Carolina will receive about $24 million from EPA for 1998.

■ Confirmed appointment or reappointment to the Water Pollution Control System Operators Certification Commission of C.L. Gobble of the Town of Louisburg, Wayne Bryant of Greenville Utilities Commission, Dr. Donald Francisco of UNC-Chapel Hill, and C.D. Malone of Hydro Management Services.

■ Approved holding public hearings on proposed revision of water supply watershed boundaries for Morganton (Catawba River), Wilkesboro (Yadkin River) and Winston-Salem (Yadkin River). For information about these revisions and public hearings contact Steve Zoufaly with the N.C. Division of Water Quality at (919) 733-5083 Ext 566.

■ Approved reclassification of Toms Creek in McDowell County and of Mill Creek from its source to Swannanoa Creek to Class C High Quality Waters. (A proposed reclassification of Swannanoa Creek was withdrawn because a soybean oil spill resulting from a train derailment degraded the stream's bioclassification rating.)

■ Approved reclassifying Clear Creek in Henderson County to Class B for primary recreation.

■ Approved reclassifying Cascade and Indian Creeks in Stokes County (both are entirely within the Hanging Rock State Park and support rare invertebrates) to Outstanding Resource Waters.

■ Approved revising water supply watershed boundaries for 24 run-of-the-river water supplies and extending comment period on four additional proposed boundary revisions. For information contact Steve Zoufaly with the N.C. Division of Water Quality at (919) 733-5083 Ext 566.

■ Adopted permanent rules for the Wetlands Restoration Fund and approved holding public hearings on proposed rules for the Wetlands Restoration Program. **Public hearings are scheduled for February 5, 1998, at Catawba Valley Community College in Hickory and February 10, 1998, at Lenoir Community College in Kinston.** For a copy of the proposed rules and more information on the public hearings, call the Wetlands Restoration Program at (919) 733-5083 Ext 530.

December action of EMC Water Quality Committee

At its regular meeting on December 10, the N.C. Environmental Management Commission's Water Quality Committee took the following action:

■ Approved holding public meetings to provide information and receive public input on the draft Yadkin-Pee Dee River Basinwide Water Quality Plan. Four public meetings are planned in the basin in February. For information on the plan and public meetings, contact Darlene Kucken with the N.C. Division of Water Quality at (919) 733-5083 Ext 354.

■ Approved Water Supply Watershed Protection ordinances for the towns of Carthage and Louisburg, the City of Greensboro, and Cherokee, Clay, Lee Mitchell, Person, Randolph, Robeson, Stokes, Transylvania, Vance and Wilkes counties.

EMC Groundwater Committee hears more bad news for state's leaking underground storage tank (LUST) cleanup fund

At its December 10 meeting the N.C. Environmental Management Commission's Groundwater Committee had an agenda heavy with technical information requested by Chairman Ryan Turner and Groundwater Section Chief Arthur Mouberry. Most of what the committee heard had negative implications for the state's overburdened trust fund for cleaning up leaking underground storage tanks.

The committee heard a report from State Toxicologist Ken Rudo on widespread contamination of wells by the gasoline additive Methyl tertiary (tert)-Butyl Ether (MtBE) and pending EPA changes to drinking water standards for the compound.

Rudo said that MtBE was introduced in 1979 as an octane booster in gasoline. In 1992, the percentage of MtBE per volume was increased as part of the winter oxygenated fuel program in several North Carolina cities.

According to Turner, MtBE is more soluble in water than other constituents of gasoline, doesn't sorb to soil particles, and is resistant to biodegradation. Therefore, when underground storage tanks leak gasoline, MtBE travels in groundwater faster and reaches wells more quickly than other contaminants. Over the last few years, MtBE contamination has been confirmed in some 2000 wells in North Carolina and thousands more across the nation, as well as in some surface water supplies.

According to Rudo, EPA allowed the use of MtBE without knowing its health effects and refused to classify it as a carcinogen in spite of the discovery of what Rudo called "hidden" cancer studies implicating it as a probable animal carcinogen. Rudo said that in 1993-94, North Carolina made a determination that MtBE is a probable animal carcinogen—the first state to do so—and recommended a 200 part-per-billion (2 mg/l) groundwater standard.

Only recently, Rudo said, EPA has classified MtBE as a B2 carcinogen (meaning that it is a proven animal carcinogen but that no data on human effects is available). He told the committee that EPA was expected to propose a new drinking water standard of 20 ppb to 40 ppb but that he has recommended to the groundwater staff that the EMC change the MtBE standard to 70 ppb, a recommendation which will be presented to the Groundwater Committee this spring. There will be a problem of settling on a standard because agencies are basing their recommendations on different "tumors," according to Rudo.

(On December 12, EPA released a drinking water advisory on MtBE recommending water suppliers ensure the MtBE levels not exceed 20 to 40 ppb. The advisory says this level will avoid problems with taste and odor. The advisory is available at http://www.epa.gov/OST/Tools.)

Mouberry said that once the standard is changed, LUST sites closed out with MtBE contamination above 70 ppb may have to be reopened and cleaned up further if people in the area are using groundwater for water supply. According to Groundwater Committee Chairman Turner, the most effective way to remove MtBE from groundwater is pump and treat, which is also one of the most expensive treatment methods. That was part of the bad news for the state's LUST trust fund.

The Groundwater Committee got more bad news about demands on the trust fund when staff briefed it on a delay in developing analytical methodology crucial to the new risk-based process for cleaning up groundwater contamination.

According to Ruth Strauss of the Groundwater Section staff, under the current program, when UST leaks are discovered, soil and water must be analyzed for certain groups of contaminants, including "total petroleum hydrocarbons" and, because there is no analytical method that can be relied on to distinguish and measure individual petroleum hydrocarbons, the cleanup standard must be set using the most toxic and mobile fraction of the group.

If risk assessors and remediators knew what specific petroleum constituents were present at a contaminated site, then risk could be more accurately assessed, cleanup could be better targeted, and cleanup money could be more wisely spent.

When North Carolina's risk-based cleanup rules were developed, it was anticipated that a method to analyze for individual petroleum hydrocarbons would be available by the time the rules became effective. However, development of analytical methods by the State of Massachusetts has progressed more slowly than anticipated and the methodology is still in draft. Until the methodology is finalized, remediators will have to use the total petroleum hydrocarbon analysis and continue to base cleanup on the most toxic fraction.

Officials had been relying on full implementation of the risk-based rules to hold down demand on the state's cleanup fund as a large number of new leaks are expected to be discovered when tanks have to be upgraded to meet new rules. Mouberry said he could not predict how much this setback would cost the fund, only that it definitely will.

Clean Water Management Trust Fund trustees award $30 million to 40 projects

During the initial grant cycle, which ended July 2, 1997, trustees of the North Carolina Clean Water Management Trust Fund (CWMTF) selected for funding 40 projects that offer great promise to help restore, improve or protect water quality in North Carolina. From a total of 141 applications submitted in the first funding cycle, 40 were approved, 19 were deferred, and 82 were rejected as not demonstrating sufficient water quality benefits.

Grants to the 40 projects selected total about $30 million, leaving approximately $58 million in the Fund. The 19 projects that were deferred in the first funding cycle will be given further consideration at the trustees meeting in Raleigh on January 25-26.

There are two funding cycles for the CWMTF each year. Applications submitted during the second cycle, which ended December 1, 1997, are now under evaluation, with anticipated action by May 1998.

Listed below are the 40 projects approved for funding:

IMPROVED WASTEWATER MANAGEMENT

- $80,000 to Bryson City in the Little Tennessee watershed to implement the town's Surface Water Preservation Program including the removal of sewer lines from creek beds.
- $1,200,767 to the Tuckaseigee Sewer and Water Authority for a program to eliminate the straight pipe discharges of sewage to the waters of Scott's Creek in the watershed.
- $570,000 to Tabor City for the repair of their waste treatment facility.
- $1 million to the Town of Fairmont towards the regionalization and repair of failing wastewater management systems.
- $1,037,000 to the Town of Seaboard for the repair of their failing land application wastewater management treatment system in the Chowan watershed.

■ $1 million to the City of Gastonia to assist in their project to remove the wastewater discharge from degraded Catawba Creek and to reroute that effluent through the "state of the art" treatment facility at Long Creek;
■ $1 million to Pamlico County to assist in their demonstration project which will remove two wastewater discharges from the Neuse River and move to a land application system utilizing corporate forest lands;
■ $160,000 to Craven County to establish a revolving low-interest, loan fund to assist low income families and individuals in the repair and replacement of failing septic systems;
■ Up to $800,000 to City of Goldsboro for a demonstration wastewater reuse project, which will use one million gallons of wastewater effluent per day for irrigation;
■ Up to $1.6 million to City of Goldsboro towards a demonstration project for the utilization of created wetlands in the polishing of wastewater effluent to result in lower discharges of nitrogen to the Neuse River Basin.

ACQUISITIONS OF RIPARIAN BUFFERS
■ $2.25 million to the Wildlife Resources Commission towards the acquisition of the Suggs Millpond property and the headwaters of two tributaries of the Cape Fear River;
■ Up to $502,500 to the City of Fayetteville to buffer tributaries to their water supply watershed;
■ Up to $254,000 to the town of Hillsborough to acquire buffer areas linking a series of conservation properties along the Eno River in the Neuse Watershed;
■ Up to $378,200 to the North Carolina Coastal Land Trust for the purchase of Turkey Quarter Island and mainland riparian buffers in the Neuse River watershed (the project includes a restoration plan for the entire sub-basin;
■ Up to $2,520,000 to the North Carolina Coastal Federation for the purchase of critical buffers to the shellfishing resources of Hoop Hole Creek and Bogue Sound;
■ $4,200,000 to the Wildlife Resources Commission towards the purchase of the South Mountains Rollins tract, a tract of more than 17,000 acres that includes virtually all of the headwaters of the Broad River;
■ Up to $1,056,000 to the Wildlife Resources Commission to purchase riparian buffers along the Roanoke River;
■ Up to $280,000 to the University of North Carolina at Pembroke for the acquisition and restoration of riparian properties adjacent to Mill Branch Creek in the Lumber River Basin;
■ Up to $750,000 to Durham County for the preservation of flood plain properties in the New Hope Creek drainage of the Cape Fear River watershed;
■ $400,000 to North Carolina Division of Parks towards the purchase of riparian properties along the Lumber River;
■ Up to $880,000 to the Piedmont Land Conservancy to purchase property, acquire conservation easements and develop a restoration and protection strategy for the Mitchell River in the Yadkin River watershed.

URBAN GREENWAYS
■ Up to $200,000 to the City of Rocky Mount for the acquisition of 1.7 miles of riparian properties which will stimulate development of a City greenway along the Tar River;
■ Up to $195,000 to Swain County Economic Development Commission to restore degraded lands into a functional greenway;
■ Up to $550,000 to City of Morganton for the acquisition and restoration of riparian properties in the Catawba River Basin;
■ Up to $56,000 to the Town of Claremont for the acquisition of riparian properties in the Catawba River Basin;
■ Up to $50,000 to the Town of Lenoir for the acquisition of riparian properties in the Catawba River Basin.

CONSERVATION EASEMENTS
■ Up to $334,000 to the Sandhills Area Land Trust to acquire a conservation easement on a 400 acre forested buffer of Drowning Creek (an ORW in the Lumber Basin);
■ Up to $285,450 to the NC Division of Soil and Water Conservation to create a riparian buffer program to guide in the acquisition of easements on agricultural lands in select sub-basins of the Tar-Pamlico and Neuse watersheds.

STREAMBANK RESTORATION AND STORMWATER CONTROL
■ $250,000 to the North Carolina Division of Water Resources to develop a series of pilot stream restoration projects in the Neuse River and other watersheds;
■ $394,103 to the NC Cooperative Extension Service to finance the repair of streambanks and restoration of wetlands in the Watauga watershed;
■ Up to $3.885 million to Macon County for an extensive streambank stabilization and wetland program on the Little Tennessee;
■ Up to $1 million to the City of Greensboro to restore and preserve the natural function of South Buffalo Creek and adjacent wetlands;
■ $30,000 to the Town of Lake Waccamaw to divert urban stormwater (that is currently polluting the lake) into adjacent wetlands which can act as a natural filter.

PLANNING PROJECTS
■ Up to $250,000 to the North Carolina Center for Geographic Information Analysis for the development and management of a Geographic Information System;
■ $90,000 to the NC Coastal Federation and the NC Coastal Land Trust to work in concert with the NC Division of Marine Fisheries towards the development of a Shoreline Incentives Program;
■ $59,000 to the Triangle J Regional Council of Governments for the development of a systematic strategy of the restoration and preservation of riparian lands in the 770 square mile Upper Neuse River Basin;
■ $110,000 to the Land of Sky Regional Council of Governments and RiverLink to assist in the development of the French Broad River Corridor Protection Initiative;
■ $50,000 to the NC Global TransPark Development Commission to plan for the strategic acquisition of riparian lands in a 13 county region of the central Neuse River watershed;
■ $118,866 to the Buncombe Soil and Water Conservation District for a pilot project which targets Newfound Creek in the French Broad River Basin (Newfound Creek has been significantly degraded by nonpoint source pollution from agricultural operations, and the proposed project is a comprehensive strategy of planning, education, and implementation);
■ $50,000 to the Catawba Lands Conservancy for a two-year planning initiative to identify and prioritize opportunities for the acquisition of conservation easements on riparian properties in the South Fork Creek watershed of the Catawba River Basin.

According to the U.S. EPA publication *The Water Monitor*, reports of amphibian deformities have become increasingly widespread and common in recent years, with confirmed reports from at least 23 states and three Canadian provinces. A national reporting system for the public and researchers has been developed by EPA and the USGS on the Internet. The site is the North American Reporting Center for Amphibian Malformations (NARCAM) at http://www.npwrc.org/narcam. The site includes a report from Gates County, NC, where a green frog (*Rana clamitans*) with extra fore limbs was found in June 1997.

Annual North Carolina Water Resources Research Conference

WATER RESOURCE PROTECTION: Understanding and Management

April 1, 1998

NCSU McKimmon Center Raleigh, North Carolina

The Water Resources Research Institute of The University of North Carolina is sponsoring an annual conference to encourage scientists in North Carolina to share their water-related research findings with colleagues and with elected and appointed officials of local, state, and federal agencies with water-related responsibilities as well as industrial, professional, and environmental organizations and other interested groups.

Co-Sponsors: North Carolina Department of Environment and Natural Resources, North Carolina Cooperative Extension Service, North Carolina Water Resources Association, United States Geological Survey

Preliminary Agenda

8:00- 9:00 am **Registration**

9:00- 9:15 **Welcome/Conference Overview**
Kenneth Reckhow - WRRI

9:15-10:00 Plenary Session: **Waterborne Pathogens**
* Pathogens, Fecal Indicators, and Animal Waste - Mark Sobsey - UNC-CH
* Pfiesteria and Pfiesteria-Like Organisms - JoAnn Burkholder - NCSU

10:00-10:15 **Break**

10:15-12:00 Concurrent Session I

A. Wetlands
1. Needs for Reference Wetlands in North Carolina - Mark Brinson - ECU
2. Wetlands for Highway Runoff - Curtis Richardson - Duke
3. Wastewater Treatment by Constructed Wetlands - Halford House - NCSU
4. Tulula Bog Restoration Project - Kevin Moorhead - UNC-A

B. Water and Wastewater
1. Dual Water Supply Systems - Dan Okun - UNC-CH
2. Trace Element Analysis - Howard Weinberg - UNC-CH
3. Comparison of Bacteria Regrowth in Two Distribution Systems - Francis DiGiano - UNC-CH
4. Strategies for Algae Removal in Drinking Water Treatment - Detlef Knappe - NCSU

12:00- 1:00 pm **Luncheon Address: *Interaction Between State Government and University Community***
Secretary Wayne McDevitt, N.C. Department of Environment and Natural Resources

1:00- 3:00 Concurrent Session II

A. Atmospheric Impacts
1. Ammonia Emissions & Fate in Eastern North Carolina - Viney Aneja - NCSU
2. Atmospheric Deposition on Aquatic Systems - Hans Paerl - UNC-CH
3. Atmospheric Transport & Fate and Links to Water Resources - Robin Dennis - EPA/RTP
4. To Be Announced

B. Erosion & Sediment Control and Storm Water
1. Effect of Hydrodynamics on Pollutant Removal in Water Quality Ponds - Robert Borden - NCSU
2. Detention Pond Efficiencies - Robert Hunt - NCSU
3. Sediment Impact on Aquatic Communities - Seth Reice - UNC-CH
4. Piedmont Detention Basins as Sediment Traps - Randall Forsythe - UNC-C

3:00- 3:15 **Break**

3:15- 5:00 Concurrent Session III

A. Water Quality
1. Modeling of the Neuse River Estuary - Robert Christian - ECU
2. Lumped Parameter Water Quality Modeling - Wayne Skaggs - NCSU
3. Water Quality Modeling of the Catawba Chain - Jerad Bales - USGS
4. Turbidity, Suspended Solids, and Water Quality in Coastal Waters - Lawrence Cahoon - UNC-W

B. Groundwater
1. Impact of Pre-1993 Swine Waste Lagoons - Ronald Huffman - NCSU
2. Albemarle-Pamlico Ground Water Studies - Tim Spruill - USGS
3. Pesticide Detection in Ground Water Wells - Richard McLaughlin - NCSU
4. Ground-Water Recharge in the Neuse River Basin - Ted Mew - DWQ

Poster Session:

Apart from the presentations, there is space for up to 30 posters of individual research projects. Time has been extended until February 6, 1998 to provide an abstract of these projects. Posters should be related to the concurrent sessions of wetlands, water & wastewater, atmospheric impacts, erosion & sediment control and storm water, water quality, and ground water. A limited amount of space is available and selection of posters will be based on the number of abstract received on each topic. Abstracts need to be provided as a disk copy or e-mailed to: water_resources@ncsu.edu. Content of abstract should include working title, author(s), affiliation(s), address, telephone, fax, e-mail, purpose and objective, findings and conclusions, and importance to North Carolina.

Registration:

A registration fee of $30 covers the proceedings, two breaks, and lunch. There is a late fee of $10 if registration is not received by March 17, 1998. Student registration fee is $15 and $5 late fee after the March deadline. Please use the registration form on this page and photocopy if required. Make check payable to "UNC Water Resources Research Institute-1998 Annual Conference." Registrations will be taken on a first-come, first-served basis until seating capacity is reached.

Check for $30 must be received no later than March 17, 1998 ($40 after March 17). Student check for $15 must be received no later than March 17, 1998 ($20 after March 17).

Return registration form with check to: Water Resources Research Institute, 1998 Annual Conference, Box 7912, North Carolina State University, Raleigh, NC 27695-7912.

If you have questions, call Linda Lambert or Eva Walters at WRRI (919) 515-2815 or e-mail WRRI at: water_resources@ncsu.edu.

REGISTRATION FORM

Water Resource Protection: Understanding & Management Conference

Name: ____________________

Affiliation: ____________________

Mailing Address: ____________________

City: __________ State: __________ Zip __________

Telephone #: ____________________

Rules proposed for Drinking Water State Revolving Loan Fund

The Safe Drinking Water Act Amendments of 1996 established a new Drinking Water State Revolving Loan Fund (DWSRF) to help public water supply systems address risk to public health and comply with Safe Drinking Water Act rules. About $46 million from the federal fund and state match will be available to N.C. systems in 1998.

For some months, the N.C. Public Water Supply Section and stakeholders have been developing rules for administering North Carolina's fund. Those rules, including the criteria to be used for rating loan applications, are now available for public review. They can be downloaded in Adobe PDF from web site: http://www.deh.ehnr. state.nc.us/ pws/dave2.htm (click on "H. DWSRF DRAFT Rules/Criteria"), or are available from Jerry Perkins, Head of the Enforcement & Administration Branch, at (919) 715-3236.

It is expected that a public hearing will be held in April to take comment on North Carolina's draft rules before they are presented for adoption to the N.C. Commission for Health Services. For information on the public hearing check the WRRI web site or the Public Water Supply Section's web site (address above) or call Jerry Perkins at the number above.

Bill Holman named Assistant Secretary for Environmental Protection

Governor James B. Hunt, Jr. announced on Jan 7 that he has appointed former N.C. Sierra Club lobbyist Bill Holman as Assistant Secretary of Environmental Protection in the Department of Environment and Natural Resources (DENR). Holman replaces Linda Rimer, who is taking a position with the U.S. Environmental Protection Agency.

Linton succeeds Memory as Head of Research Division of UNC General Administration

In December UNC President Molly Corbett Broad announced that Dr. Richard Linton, associate vice president for research of the 16-campus University of North Carolina, has been selected to head the Research Division of UNC General Administration. Linton, who holds the dual title of associate vice president for research and director of sponsored programs, assumed responsibilities previously held by Dr. Jasper Memory, who retired December 31 following 12 years as UNC's vice president for research.

The fundamental mission of the Research Division is to advance sponsored programs and research across the University and to help sustain the major growth in externally funded projects achieved over the past decade. Other division initiatives will include expanding the application of information technologies for enhancing scholarly research, promoting interinstitutional collaboration and the internationalization of research programs, and improving communication and accountability at both state and federal levels to underscore the critical role of academic research and graduate education.

A native of Pennsylvania, Linton earned a PhD in chemistry from the University of Illinois in 1977 and joined the UNC-Chapel Hill faculty that year. He joined UNC General Administration in 1987 as assistant vice president for research and was named associate vice president four years later.

His expanded responsibilities will include the administration of UNC sponsored programs, oversight of UNC centers and institutes (including the UNC Water Resources Research Institute), facilitation of interinstitutional cooperation in research and international programs, and the development of Internet resources to facilitate sponsored research.

Notice of Public Hearing

February 3, 1998, 11:00 a.m.
Ground Floor Hearing Room,
Archdale Building, Raleigh

A public hearing will be conducted by the N. C. Department of Environment and Natural Resources to take comment on amendments governing **priority criteria for funding wastewater and water supply projects through the state's Clean Water Revolving Loan and Grant Program**. House Bill 515 requires that DENR include the existence of a comprehensive land-use plan when prioritizing construction projects for funding. Proposed amendments set up a range of bonus points to be added to the existing criteria which will reward land-use planning and the degree to which it is implemented. For additional information, contact Bobby Blowe, P.E., Chief, Construction Grants & Loans Section, Division of Water Quality at (919) 733-6900.

CLEAN WATER ACT SECTION 319 GRANT PROPOSALS BEING ACCEPTED

THE DIVISION OF WATER QUALITY OF THE N.C. DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES IS NOW ACCEPTING PROPOSALS FOR THE FISCAL YEAR 1999 SECTION 319 FUNDING CYCLE UNTIL FEBRUARY 27, 1998.

SECTION 319 OF THE CLEAN WATER ACT GRANTS ARE GIVEN FOR NONPOINT SOURCE WATER QUALITY RELATED PROJECTS INCLUDING WATERSHED IMPROVEMENT, EDUCATION, AND BEST MANAGEMENT PRACTICE DEMONSTRATION.

IF YOU WOULD LIKE MORE INFORMATION OR AN APPLICATION PACKET, PLEASE CONTACT LINDA HARGROVE AT (919) 733-5083, EXT 352 (LINDA@DEM.EHNR.STATE.NC.US).

WRRI reports available

Researchers say state and local officials need to give more attention to stormwater pond design, siting, and performance

New research sponsored by the UNC Water Resources Research Institute (WRRI) and the N.C. Urban Water Consortium suggests that for regional stormwater detention ponds to be as effective as advertised in protecting water quality, more data-based approaches to designing, siting, and managing these structures and modeling their performance are needed.

Independent research projects conducted in urban areas of Piedmont North Carolina show that wet detention ponds are dynamic, ecologically complex systems whose effectiveness cannot always be assured by following simple design recommendations. The research also calls into question some of the theoretical assumptions upon which state design guidelines and performance predictions are based.

In one research project, Drs Robert C. Borden and Sarah K. Liehr of the NCSU Department of Civil Engineering compared the performance of two regional stormwater ponds in the City of High Point's City Lake watershed. Both ponds generally conform to State design standards for wet detention ponds.

One of the ponds the researchers studied receives highly polluted runoff from a largely agricultural drainage area. While this pond is effective at removing suspended solids and associated pollutants, it experiences excessive algae growth because of the nutrients it receives. Some of the algae escapes the pond and travels downstream. A portion of the algae settles to the bottom of the pond where it is trapped during summer stratification. When cool weather causes the pond to "turn over," nutrients trapped in the cool anaerobic waters at the bottom of the pond may be released to downstream waters.

Borden says that the tendency of stormwater ponds to stratify and turn over means that they may not be as efficient in permanently trapping suspended solids and reducing nutrients as the State's evaluation criteria assume.

The second pond in the Borden/Liehr study receives runoff from an industrial site where a smaller stormwater basin is located. This pretreated runoff carries only fine-grained soil particles and does not contain as high a concentration of pollutants. Only small percentages of the remaining solids and pollutants are removed by this second stormwater pond.

Borden says these results show that the pollutant removal ability of similar ponds in the same general area can vary greatly, depending upon the quality of the runoff that flows into them and on internal pond dynamics. He suggests that to get the most water quality benefit for the dollar, local governments need to conduct site-specific field monitoring so that they can put their regional stormwater ponds in watersheds with the highest pollutant loads.

A separate study of ponds in the Charlotte area underscores the importance of understanding stormwater pond dynamics and knowing environmental conditions in a pond's drainage area. In one phase of this project Drs Craig Allen, Randall Forsythe and John Diemer of the UNC-Charlotte Department of Geography and Earth Sciences studied 20 ponds installed primarily for flood control. Most of the ponds are now 32 to 45 years old and have become shallow because of sediment accumulation. Sediment accumulations of 2.6 tons/acre/year are typical in this region of the Piedmont and suggest that the useful life of a wet detention basin without dredging is conservatively 50 years. Much of the accumulated sediment is very fine-grained and would not settle out in sediment fore bays proposed for engineered wet detention basins. Water in many of the older ponds is continually turbid, indicating a failure to settle suspended solids. This points to the potential for future engineered wet detention ponds to become sources of pollution if not maintained or closed on an appropriate time frame.

In another phase of the Charlotte study, researchers monitored the performance of a single newer pond for a full year with detailed analyses of several storms. As in the High Point study, the Charlotte researchers found stratification and exchange of dissolved material between the bottom sediments and the water. They found that, although the pond removed 98 percent of suspended solids, when storm inflow displaced resident pond water, the displaced water had higher concentrations of dissolved pollutants than the incoming stormwater. Overall, 60 percent removal efficiencies were found for BOD, Cr, Pb, and ammonium. However, some chemical constituents, such as TKN and Ortho P, showed less than a 20 percent reduction.

Both Borden and the UNC-C team emphasize that wet detention ponds can remove large amounts of heavier sediments and adsorbed pollutants where structural controls are needed for water quality protection. However, they also suggest that, to get optimum benefit from stormwater controls, the State may need to rethink some of its design guidelines, and local governments will need to site ponds carefully. They also say that state regulators need to rethink the way they evaluate the performance of regional stormwater ponds to take into account the variability in pond performance.

continued

In addition, the UNC-C team says that in watershed- and basin-scale water quality modeling, the State should give attention to the potential for aging flood management structures and private ponds across the state to become chronic sources of pollution. They also say that a remediation program for older structures could be an effective means of maintaining and improving water quality in North Carolina as an alternative to or in addition to building new BMPs.

The two research projects are the subject of peer-reviewed reports now available from the Water Resources Research Institute.

Report No. 309 ***Piedmont N.C. Wet Retention Basins: Performance Factors, Sedimentation Dynamics, and Seepage Losses*** by Craig Allan, Randall Forsythe, and John Diemer, Department of Geography and Earth Sciences, University of North Carolina at Charlotte, July 1997. (Contact Randall Forsythe (704) 547-4248 or rdforsyt@email.uncc.edu)

Report No. 311 ***Evaluation of Wet Ponds for Protection of Public Water Supplies*** by Robert C. Borden, Jason L. Dorn, Jeffery B. Stillman, and Sarah K. Liehr, Department of Civil Engineering, North Carolina State University, September 1997. (Contact Robert C. Borden (919) 515-7665 or RCBORDEN@EOS.NCSU.EDU).

continued

Water Resources Research 1997-98 Seminar Series

Tuesday, January 20, 1998, Room 1132, Jordan Hall, NCSU Campus. “History of Water Quality in North Carolina Estuarine Waters as Documented in the Stratigraphic Record.” *Assistant Professor Sherri Cooper, Nicholas School of the Environment, Duke University.*

Tuesday, February 24, 1998, Ground Floor Hearing Room, Archdale Building, downtown Raleigh. “Biologically Mediated Nitrogen Dynamics in Eutrophying Estuaries.” *Professor Hans Paerl, Institute of Marine Sciences, University of North Carolina at Chapel Hill.*

Tuesday, March 30, 1998, Room 1132, Jordan Hall, NCSU Campus. “Development of Methods of Estimating the Cost of Watershed Management Policies.” *Professor David Moreau, Department of City and Regional Planning, University of North Carolina at Chapel Hill.*

Monday, April 20, 1998, Ground Floor Hearing Room, Archdale Building, downtown Raleigh. “Effectiveness of Four ‘Best Management Practices’ for Reducing Nonpoint Source Pollution from Piedmont Tobacco Fields.” *Professor Carlyle Franklin, Department of Forestry, North Carolina State University.*

Tuesday, May 19, 1998, Room 1132, Jordan Hall, NCSU Campus. “Development of the Technical Basis and a Management Strategy for Reopening a Closed Shellfishing Area.” *Associate Professor William Kirby-Smith, Nicholas School of the Environment, Duke University.*

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, NCSU, Raleigh, NC 27695-7912 or call (919) 515-2815, or Email water_resources@ncsu.edu.

Workshops & Conferences

The **International Erosion Control Association** will present its 29th **Annual Conference and Trade Exposition** Feb 16-20, 1998, in Reno, Nevada. For complete conference information check web site http://www.ieca.org; call toll free 800-871-6022 and receive information by fax; email ecinfo@ieca.org; or phone 800-455-4322.

The **N.C. Cooperative Extension Service in cooperation with N.C. Sea Grant** will host two workshops in the **Neuse River Basin** to educate municipal and county leaders on **urban stormwater best management practices**. The workshops will target city/county planners and engineers, as well as private developers, planners, architects and engineers. One workshop will be held in New Bern on June 3-4, 1998, while the second will be in Raleigh during June 16-17, 1998. Cost of each workshop will be $190, and continuing education credits will be offered for professional engineers, landscape architects and planners. Tom Schueler of the Center for Watershed Protection will be featured speaker. For additional information contact Bill Hunt at wfhunt@eos.ncsu.edu or (919) 515-6751.

The Subcommittee on Hydrology of the Interagency Advisory Committee on Water Data and others will present the **First Federal Interagency Hydrologic Modeling Conference**: **Bridging the Gap between Technology and Implementation of Surface Water Quantity and Quality Models in the Next Century** April 19-23, 1998, at the Tropicana Hotel in Las Vegas, NV. The conference will provide an opportunity for professionals from federal, state and local agencies, universities, and the private sector to discuss development and implementation of surface-water quantity and quality models. About 160 papers and 30 demonstrations from the U.S. and 8 foreign countries will be presented. For information contact conference chair Ming Tseng, USACE, at (202) 761-8505 or ming.tseng@inet.hq.usace.army.mil or visit web site http://water.usgs.gov/public/wicp/

First Announcement and Call for Abstracts

An International Conference

THE SCIENCE OF MANAGING FORESTS TO SUSTAIN WATER RESOURCES

November 1998

Worcester, Massachusetts

Sponsored by UFRO Working Party 1.05.06 Multiple-use Silviculture, Society of American Foresters, National Association of State Foresters, Massachusetts Metropolitan District Commission, USDA Forest Service

An international conference is proposed to discuss contemporary issues in research on and the practice of forest management in forested watersheds for the sustained yield of quality water resources. Presentations are invited to address issues at a range of geographic scales, from the landscape and watershed to the stand. Broadly, the conference will address the regulation of the composition and structure of the forest component of managed watershed for the sustained yield of the broadest suite of water resources.

Abstracts are due February 15, 1998. Abstracts for both papers and posters will include the title, author(s) name(s) and affiliation(s), postal and email addresses, phone and TAX numbers of the corresponding author, identification of the submission as either a paper or poster, if a paper submission, the author(s) desire for publication in a peer-reviewed journal or a proceedings, and an abstract of no more than 200 words.

Submissions should be emailed in ASCII (DOS) text format to: rbrooks@forwild.umass.edu. If the abstract is being sent via surface mail, send both a hard copy and digital version on floppy disk in both (ASCII [DOS] text and WordPerfect or MS Word) to:

Robert T. Brooks, USDA Forest Service
201 Holdworth NRC
University of Massachusetts
Amherst, MA 01003-4230 USE
Tel: 413/545-1845 - Fax: 413/545-1860.

Registration: Registration will be limited to about 300 registrants. A registration fee will be charged. Individuals who want to receive registration materials but who are not intending to present a paper or poster should contact:

Jim Taylor
Metropolitan District Commission
Division of Watershed Management
20 Somerset Street
Boston, MA 02108 (USA)
Tel: 617/727-5274 Ext 281 - Fax: 617/727-8301
email: jim.taylor@state.ma.us

Calls for Abstracts

The **International Water Resources Association** will present the **Xth World Water Congress**, March 11-17, 2000, at the Melbourne Convention Centre in Melbourne, VIC, Australia. The Congress will provide a forum for high quality papers and presentations that revolve around the Congress themes: sharing the waters of the earth sustainable water management in a new millennium. All papers and presentations will be reviewed for suitability and content and will be subject to rigorous quality checks. Intending authors are required to prepare a 500-word abstract, which must be submitted before March 8, 1999. All papers will be published in the Congress proceedings. For more information on the Xth World Water Congress please write, call, or fax: Congress Secretariat: ICMS Pty Ltd, 84 Queensbridge Street, Southbank Victoria, Australia 3006. Phone: +61 3 9682 0244. Fax: +61 3 9682 0288.

A call for abstracts has been issued for **Composting in the Southeast Confer-**

North Carolina Precipitation/Water Resources

Rainfall (+/- average)

	November	December
Asheville	1.60” (-1.99”)	2.98” (-0.54”)
Charlotte	3.70” (+0.47”)	4.08” (+0.60”)
Greensboro	2.65” (-0.32”)	2.17” (-1.19”)
Raleigh	4.05” (+1.07”)	2.75” (-0.49”)
Wilmington	5.25” (+2.14”)	4.83” (+1.20”)

Streamflow

Index Station (County, Basin)	**Nov mean flow (CFS)** (% of long-term median)	**Dec mean flow (CFS)** (% of long-term median)
Valley River at Tomotla (Cherokee, Hiwassee)	144 (108%)	196 (86%)
Oconaluftee River at Birdtown (Swain, Tenn)	333 (89%)	487 (93%)
French Broad River at Asheville (Buncombe, FB)	1,300 (79%)	1,480 (72%)
South Fork New near Jefferson (Ashe, New)	213 (60%)	230 (49%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	33 (53%)	39 (44%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	88 (63%)	86 (52%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	183 (78%)	254 (78%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	1,388 (272%)	2,540 (224%)
Deep River near Moncure (Lee, Cape Fear)	859 (237%)	1,423 (130%)
Black River near Tomahawk (Sampson, Cape Fear)	1,236 (364%)	1,004 (141%)
Trent River near Trenton (Jones, Neuse)	73 (130%)	274 (189%)
Lumber River near Boardman (Robeson, Lumber)	1,179 (152%)	1,763 (146%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	90 (147%)	123 (83%)
Potecasi Creek near Union (Hertford, Chowan)	36 (96%)	105 (72%)

Groundwater

Index well (Province)	**Nov depth below surface (ft)** (departure from average for month)	**Dec depth below surface (ft)** (departure from average for month)
Blantyre (Blue Ridge)	32.93 (+0.63)	32.86 (+0.53)
Mocksville (Piedmont)	16.20 (+1.37)	15.54 (+1.53)
Simpson (Coastal Plain)	5.04 (-0.10)	3.18 (+0.79)

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

ence and Expo to be held Sept 9-11, 1998, in Athens. GA. Abstracts of 500 words or less must be emailed, post-marked, or faxed by Friday, Jan 16, 1998. For additional information on submitting abstracts, call Beth Graves with N.C. DPPEA at (919) 715-6506. or email Beth_Graves@owr.ehnr.state.nc.us. For conference information, visit web site http://www.bae.uga.edu/outreach/bioconversion/compost.html.

A call for papers is forthcoming for **Connections '98: Transportation, Wetlands, and the Natural Environment** to be held Sept 16-18, 1998, at the Shearton Grand in New Bern, NC. For information call Pam Cloer at the Center for Transportation and the Environment at (919) 515-7990 or email pcloer@unity.ncsu.edu.

Publications

The U.S. EPA Office of Water has recently published ***Water on Tap: A Consumer's Guide to the Nation's Drinking Water*** (EPA 815-K-97-002). The booklet provides answers to frequently asked questions about drinking water and describes changes in the Safe Drinking Water Act (SDWA) that will make new information available to consumers in the near future. It directs consumers to more detailed sources of information to help them become active participants in ensuring the quality of their drinking water. The booklet can be ordered through the Safe Drinking Water Hotline at (800) 426-4791 or downloaded in Adobe PDF format from web site: http://www.epa.gov/OGWDW/wot/wot.html.

(continued page 16)

A National Conference

Retrofit Opportunities for Water Resource Protection in Urban Environments

February 9-12, 1998
The Westin Hotel
Chicago, Illinois

Cosponsored by: U.S. EPA, Northeastern Illinois Planning Commission, Illinois Environmental Protection Agency

Overview:

Water resource managers have been successful at developing approaches for reducing nonpoint source pollution in newly developing urban areas. The issues become increasingly complex, however, when managers are faced with the challenge of reducing nonpoint source impacts within already developed urban environments. A diverse assortment of resource management tools—retrofits—are being developed, but their implementation has been hampered by a lack of technology transfer opportunities. This national conference is designed to facilitate the educational process, and to transfer this much needed information to state and local water resource practitioners.

The conference program brings together a wide array of progressive scientists and researchers, along with managers of successful local projects from across the country. Featured session topics include retrofit opportunity identification, modeling, and monitoring approaches for retrofit applications, conservation design strategies, innovative financing approaches, evaluating results and measuring success, newly emerging technologies, urban revitalization issues, riparian reforestation, and public education/involvement programs.

On Monday, February 9, a special pre-conference workshop, Practical Watershed Planning for Growing Watersheds, will explore practical and rapid techniques for preparing local watershed plans to protect urban water resources. The workshop is structured around a proven 12-step process for developing effective urban watershed plans. Your workshop instructors are nationally renowned Thomas R. Schueler and staff from the Center for Watershed Protection.

The Conference registration fee is $165 and includes 3 luncheons, 3 breakfasts, breaks, a reception and written materials and conference proceedings. There is an additional $55 registration fee for the pre-conference workshop. A $20 late fee will be charged for payments not received by January 28.

For additional information and registration form contact Bob Kirschner at the Northeastern Illinois Planning Commission's Natural Resources Department at (312) 454-0400.

Conference on Riparian Management in Forests of the Continental Eastern U.S.
March 23-25, 1998 - Columbus, Ohio

Sponsored by the USDA Forest Service and others

This conference will offer state-of-the-art information on managing forested riparian systems. Presentations will be made by 18 invited experts in riparian ecosystem management and research. Presented materials will be published in a desk reference and will be provided to participants following the conference. Conference topics include * Defining and Classifying Riparian Ecosystems * Hydrologic Function * Organic Contributions * Enhancing Biodiversity * Riparian Ecosystem Values and Benefits * Terrestrial and Aquatic Linkages.

For more information and an electronic mailback form, check the conference website: http://www.ncfes.umn.edu/riparian/ or contact Nancy Walters with the USDA Forest Service. Email: nwalters/nc@fs.fed.us or FAX: 612-649-5256.

The Fall 1997 issue of ***WaterWise***, a newsletter published by the N.C. Sea Grant College Program, examines the topic of harmful algae blooms. To subscribe to this newsletter contact Barbara Doll, Sea Grant's water quality specialist at (919) 515-5287 or email barbara_doll @ncsu.edu.

The December 1997 issue of ***Neuse Letter***, published by the N.C. Cooperative Extension Service focuses on the use of no-till agricultural technology to eliminate problems of soil erosion from fields. To be added to the mailing list for this newsletter, write Wake County Extension Center, Attn: Mitch Woodward, 4001 (e) Carya Drive, Raleigh, NC 27610 or email mwoodwrd@ wake.ces.state.nc.us.

The National Association of Water Companies offers for sale ***Sourcebook for Regulatory Techniques for Water Utilities***. This sourcebook was produced to provide water industry and regulatory professionals with a comprehensive and current compilation of regulatory policies and practices and to promote dialog on alternative regulatory techniques. For information contact NAWC, 1725 K St., NW, Suite 1212, Washington, DC 20006 (phone: 202/833-8383)

The Rocky Mountain Institute offers for sale a book ***Green Development: Integrating Ecology and Real Estate*** and a companion DC-ROM, ***Green Developments***. Green Development (D97-11) is 515 pages, hardback, with 150 photos and an extensive appendix of resources. It describes a "new field where environmental considerations are viewed as opportunities to create fundamentally better buildings and communities—more efficient, more comfortable, more appealing and ultimately more profitable." The book is available from RMI for $54.95 plus shipping & handling. The companion CD (D97-12) features more than 400 images and 30 minutes of audio and video clips and is free to purchasers of the book or can be bought separately for $7.00 plus shipping & handling. To order call (970) 927-3851; email: emalia @rmi.org or visit web site: http://www.rmi.org.

The U.S. Geological Survey has recently published ***Water-quality trends for streams and reservoirs in the Research Triangle area of North Carolina, 1983-95*** (USGS Water-Resources Investigations Report 97-4061), a product of a cooperative program between the USGS and the Triangle Area Water Supply Monitoring Project Steering Committee. For information contact USGS at (919) 571-4000.

North Carolina Water Resources Association

NCWRA

North Carolina Section of the American Water Resources Association

Luncheon and Forum Schedule

Feb 9, 1998	Safe Drinking Water Act in N.C. Information
Apr 13, 1998	Stream Restoration
Sept 14, 1998	Water Quantity Issues in N.C.
Nov 9, 1998	Nutrient Management

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

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