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## ENVIRONMENTAL MANAGEMENT COMMISSION APPROVES PUBLIC HEARINGS ON WATER SUPPLY WATERSHED PROTECTION REGULATIONS

In an effort to meet a statutory deadline for adopting water supply watershed classifications and regulations, the Environmental Management Commission (EMC) agreed in May to put before the public regulations drafted by the staff of the Division of Environmental Management (DEM) and the Water Supply Watershed Advisory Council. However, it was clear the Commission has serious reservations about the draft rules and expects substantial changes to result from the public hearing process.

In presenting the request to proceed to public hearings to the

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full commission, the EMC Water Quality Committee noted that the panel would have to depart from its regular procedures in order to meet the deadline for adoption imposed by House Bill 156. The

Water Quality Committee had received a report from the Water Supply Watershed Advisory Council and the draft regulations only a few days before.

House Bill 156, also called the Watershed Protection Act, passed by the General Assembly last June, requires the EMC to adopt water supply classifications and regulations by Jan 1, 1991, and to reclassify all water supply watersheds by Jan 1, 1992. The law requires local governments to submit their protection ordinances to the EMC for approval by July 1, 1992.

*CONTINUED*

The bill also created the Water Supply Watershed Protection Advisory Council and charged it with assisting in development of watershed protection rules. Beginning in February, the council, chaired by Raleigh Mayor Avery Upchurch, held five public meetings and one work session in an effort to devise a classification scheme and to craft rules to assure that all sources of public water supply are protected. On April 30, the Advisory Council voted to send a report on its deliberations to EMC but declined to adopt draft watershed protection regulations. Draft regulations that went to EMC were accompanied by a letter listing issues of concern that the council did not have time to sufficiently consider. The Council sent a separate report to the General Assembly's Environmental Review Committee suggesting several minor amendments to the Watershed Protection Act.

A summary of the main features of the draft watershed protection regulations appears on page 3. According to the draft, all water supply watersheds must be classified according to characteristics of the watershed. Except for class WS-I (formerly A-I) watersheds, where no development is allowed, local governments are required to design a plan that will protect public sources of drinking water either by limiting the density of development in watersheds or by placing less strict limitations on development and requiring the construction of devices to control runoff or a combination of the two methods. A number of other activities are either prohibited or controlled in watersheds and, to a greater degree, in critical areas of watersheds.

Depending on the size of the area requiring protection in large watersheds, the regulations

could affect from 25 percent to 50 percent of the state.

During the Advisory Council hearings and in discussions before the EMC Water Quality Committee and the full commission, a number of broad areas of concern and a greater number of more specific technical questions were raised.

Most of the broad questions that surfaced in discussions related to equity:

\* How can equity between upstream and downstream users be addressed? That is, what justification can be found for prohibiting communities upstream from another community's water supply intake from using the stream for waste disposal purposes or for requiring upstream communities to limit development to benefit downstream communities. Can compensation schemes be devised for such restrictions?

\* How can equity between property owners within watersheds (particularly critical areas) and property owners outside watersheds be addressed? That is, what justification is there for restricting use of personal property, and can incentives be offered to property owners for use of their property for water supply protection purposes?

\* Can an equitable and effective watershed protection program be designed around the statutory exemption for agriculture?

Many of the large number of technical questions that arose concerned ascertaining how regulations would affect water quality. Such questions included:

\* How far upstream of a water supply intake must protection measures be in place

to adequately protect the supply, particularly in very large watersheds like the Cape Fear River?

\* Does the requirement to control the one-inch storm provide the same level of water quality protection in densely developed areas that it does in less developed areas?

The Water Supply Watershed Protection Advisory Council has scheduled a meeting for May 30 to continue its examination of issues and concerns.

DEM has tentatively scheduled six public hearings and a series of educational meetings across the state.

The public hearings will probably occur in the third and fourth weeks of August and are proposed for Murphy, Asheville, Morganton, Greensboro, Hamlet and Raleigh.

Educational meetings will be conducted by the Division of Environmental Management Regional Offices.

For details on both the public hearings and educational meetings, contact Steve Zoufaly, Division of Environmental Management, P.O. Box 27687, Raleigh, NC 27611 (919/733-5083)

#### IRRIGATION DRAINAGE WATER REGULATION

*A committee of the National Research Council (research arm of the National Academies of Science and Engineering) says in its final report "Irrigation-Induced Water Quality Problems: What Can Be Learned from the San Joaquin Valley Experience" that federal and state water quality regulations should be expanded to include irrigation drainage water. The report suggests retiring land from agricultural production, raising water prices, and draining used farm water into oceans to prevent continued environmental deterioration in the West. The committee evaluated activities of an interagency group established to respond to the Kesterson National Wildlife Refuge selenium pollution problem.*

**SUMMARY OF PROPOSED WATER SUPPLY WATERSHED PROTECTION REGULATIONS**

<u>Proposed Classification</u>	<u>Dischargers</u>	<u>Land Use Description</u>	<u>Allowable Density</u>		<u>Regired Control with High Density Option</u>	<u>Non-residential Development</u>	<u>Land Application of Sludge</u>	<u>Hazardous Materials Controls</u>
			<u>Without Stormwater Controls, Low Density Option</u>	<u>With Stormwater Controls, High Density Option</u>				
WS-I	None allowed	Uninhabited un-developed	n/a	n/a	n/a	n/a	none	n/a
WS-II								
Critical Area	Only existing discharges qualifying for General Permit	Pre-dominantly Un-developed	1 du/2ac 6% built upon	Not Allowed	n/a	No new industrial	None	None allowed
Watershed			1 du/2ac 6% built upon	Allowed only as added protection, not to increase density		Limited to 10% of watershed	None	Must maintain inventory and have spill/failure containment
WS-III								
Critical area	No new	Low to moderately developed	1du/2ac 6% built upon	6-30% built upon area	Control the 1 <sup>st</sup> storm	No new industrial	None	None allowed
Watershed	Domestic & non-process only		1du/1ac 12% built upon	12-30% built upon area	Control the 1 <sup>st</sup> storm	Limited to 10% of the watershed	Allowed	Inventory, spill/failure containment
WS-IV								
Critical Area	Domestic, no new industrial	Moderate to highly developed	1du/1ac 12% built upon	12-30% built upon area	Control the 1 <sup>st</sup> storm	Allowed	None	Inventory, spill/failure containment
Watershed or protected area	Domestic & industrial		2du/1ac 24% built upon	24-70% built upon area	Control the 1 <sup>st</sup> storm	Allowed	Allowed	Inventory, spill/failure containment

## EMC ADDRESSES OUTSTANDING RESOURCE WATERS ISSUES

At the April Environmental Management Commission meeting, what one commissioner called a "precedent-setting decision" resulted from a compromise reached on a proposal to reclassify part of Alarka Creek in Swain County to Outstanding Resource Waters (ORW). ORW is a supplemental classification for waters of high quality with some special value or characteristic not protected by existing water quality standards.

Most of Swain County is national forest, and the county has had few development opportunities. The entire drainage area of Alarka Creek is privately owned by a group of individuals known as Alarka Laurel, Limited, and negotiations had begun between these owners and a potential developer when the Division of Environmental Management (DEM) received a request to designate the headwaters of the creek ORW. DEM and Wildlife Resources staff evaluated the area. They determined that Alarka Creek has excellent water quality and that a self-sustaining native brook trout population exists in the headwaters.

Commissioner Charles A. Brady, III noted at the April meeting that research indicates North Carolina brook trout may be a unique subspecies and that brook trout survive in the headwaters of Alarka Creek in significant numbers only because the community is isolated from more competitive species by a set of waterfalls.

A public hearing was held on the proposal to reclassify the upper reaches of the creek

*The Alarka Creek reclassification presented a unique case of natural resource management involving sole ownership of the entire drainage area, potential economic development, and the protection of valuable resources.*

ORW. More than 100 people attended, and the majority opposed the ORW designation. Following the hearing, however, numerous favorable written comments were received.

After reviewing hearing and written comments, DEM staff recommended that Alarka Creek receive—not ORW designation—but High Quality Waters (HQW) designation, with a prohibition on discharges in the headwaters above the falls. Designating the headwaters section of the creek ORW would have essentially the same effect, since ORW designation prohibits new or increased discharges, but, according to Water Quality Section Head Steve Tedder, the HQW designation does not draw the same public opposition that ORW designation does.

Commissioner Arthur W. Cooper noted that there seems to be a general public misconception that ORW designation prevents development.

Tedder said that under either ORW designation or HQW designation with the supplemental management restriction, development may occur in the Alarka Creek headwaters area but runoff must be strictly controlled and wastewater effluent must be piped below the falls for discharge to the creek.

The Commission voted to reclassify Alarka Creek HQW with a prohibition on discharges above Alarka Falls. One

commissioner stated that the decision establishes a precedent for consideration of economic factors in assigning special water quality and resource designations. Another called the designation an equitable compromise and said that the decision preserves the integrity of the ORW classification.

### Prohibition on Marinas to Be Reconsidered

Acting on another issue related to ORW designation, the Commission voted to reconsider rules prohibiting marina construction in certain coastal Outstanding Resource Waters but declined to set a date for public hearings on proposed rule modifications until further studies of the environmental effects of marinas can be completed. The request for rule modification was prompted by a DEM report revealing little pollution of nearby waters by upland marinas (*North Carolina Coastal Marinas: Water Quality Assessment*).

Commissioner Charles H. Peterson said that the Commission must show willingness to revisit regulations when new information is presented but also said he thought proposed rule modification is premature in the case of marinas because the DEM study does not address all the relevant issues, including effects of marinas on shellfish and metals and organics in sediments.

Steve Tedder told the commissioners the water quality study was only part of his section's overall investigation of upland marinas and that additional studies will be conducted.

The Commission directed division staff to determine when public hearings can be held based on projected study completion.

## WRRRI ADVISORY COMMITTEE URGES RESEARCH ON WATERSHED PROTECTION

Better information is needed to support water supply watershed protection programs in North Carolina. That is the opinion of the Advisory Committee of the Water Resources Research Institute of The University of North Carolina (WRRRI). The committee, made up of representatives of federal and state agencies, local governments, environmental organizations, and water and electric utilities, met recently to recommend 1991 research priorities for the state's water institute.

The committee suggested high priority be given to studies that would give a more accurate picture of which activities cause the most significant water quality problems in water supply watersheds and the most cost-effective way of controlling pollution from those activities.

Dr. David H. Moreau, Director of WRRRI, noted that the Water Supply Watershed Protection Advisory Council, in its report to the Environmental Management Commission cited issues it felt had not been adequately addressed. "The Council obviously feels a need for more and better information about technical aspects of watershed protection," he said.

"Moreover, local governments, managers of water treatment and wastewater treatment plants, and the staff of the Division of Environmental Management are trying to anticipate what these regulations are going to mean for their operations, and they keep

### HOLMAN, GRAY JOIN WRRRI STAFF

*Dr. Robert E. Holman, III joined the staff of WRRRI as associate director June 1. Holman was formerly director of the Albemarle-Pamlico Estuarine Study in the N.C. Department of Environment, Health, and Natural Resources.*

*Jeri Gray, formerly a part-time editor with the Institute, joined the staff full time as technology transfer specialist in February.*

*Holman earned the BA in biology from Bridgewater College, the MS in marine biology from Old Dominion University, and the PhD in botany from NCSU. He has served with the N.C. Division of Environmental Management since 1979 when he joined the division as coordinator of the Chowan River Project. From 1983 to 1985, he served as head of DEM's Biological Monitoring Group and from 1985 to 1988, he was coordinator of the Water Supply Protection Program.*

*Holman assumed responsibilities formerly carried out by Dr. James M. Stewart, including liaison with university research faculty and federal, state, and local agencies.*

*Gray earned a BA in English from Western Carolina University and a BA in philosophy from NCSU. She has worked with WRRRI on a part-time basis since 1986.*

*Gray has primary responsibility for newsletters, technical reports, and other publications.*

encountering gaps in the information base.

"Urbanization continues at a fast pace in watersheds that serve as drinking water supplies, like Raleigh's Falls of the Neuse Lake, Charlotte's Mountain Island Lake, and Greensboro's Lake Townsend.

"Ample evidence exists to show that development in general has an adverse effect on water quality, but there are very limited data to show how different types and densities of development are likely to affect water quality. Those data are needed to support regulatory policies such as those being considered by the EMC."

Moreau said that the WRRRI Advisory Committee believes WRRRI can perform a valuable service by coordinating a number of short-term projects aimed at answering very specific questions about watershed protection.

In addition to watershed protection studies, the WRRRI Advisory Committee recommended priority attention to the question of equitable allocation of water resources, including the issue of interbasin transfer; controlling toxic substances in municipal and industrial wastewater discharges; and the effects of toxics in river sediments.

#### MUTANT TURTLES

*A sampling of rivers which run through agricultural areas in southeast Kansas has turned up deformities in almost half of the turtles examined. A biologist with the Kansas Department of Wildlife and Parks, which is performing a nine-year study, pointed out that birth defects in amphibians are rare and that turtles trapped in grassland areas of the state had far fewer defects than those trapped in farm areas. The use of farm chemicals is being blamed for widespread disappearance of 24 species of amphibians and reptiles in Kansas. Kansas and other farming states are considering new regulations of pesticides and herbicides. U.S. Water News Mar 1990*

## DUPLIN COUNTY IS SITE OF MAJOR USDA INTERAGENCY WATER QUALITY INITIATIVE

As part of its 1990 water quality efforts, the U.S. Department of Agriculture has announced two water quality projects to be carried out in Duplin County. Educational and technical assistance programs aimed at water quality improvement will be jointly implemented by the USDA's Cooperative Extension Service (CES) and Soil Conservation Service (SCS). Additional assistance will be provided by an interagency work group that includes the N.C. Division of Environmental Management, the N.C. Division of Soil and Water Conservation, the Duplin Soil and Water Conservation District, and the local Agricultural Extension Service.

According to Roger Hansard, water quality specialist with SCS in Raleigh, one of the programs is a "hydrologic unit," or watershed-wide nonpoint source pollution (NPS) control project to be carried out in the Goshen Swamp Watershed located in northwestern Duplin County and a small part of Wayne and Sampson Counties. Duplin County is one of the biggest agricultural counties in the entire Southeast. Within the watershed are both significant animal operations and extensive row crop farming. The Extension Service will conduct the educational efforts, and SCS will provide technical assistance to farmers for the implementation of best land management practices (BMPs). The USDA Agricultural Stabilization and Conservation Service (ASCS) is providing special project funds for cost-sharing. The N.C. Agricultural

Cost Share Program, administered by the local Soil and Water Conservation District, will also be used to help farmers install BMPs.

The project's goal is to bring 70 percent of the 41,000 acres of cropland in the 133,000-acre watershed under BMPs, said Hansard.

The second water quality effort is within the same watershed. It will be a demonstration project in the 5,050-acre area called Herrings Marsh Run. Here the goal is to bring 100% of the cropland under BMPs and to encourage farmers to adopt other water quality enhancement measures, such as pesticide and fertilizer management programs.

There will be 37 "hydrologic units" across the county Hansard said. The USDA selected the sites because of current or impending water quality impairment as the result of agricultural activity. Also a consideration in the selection was the ability to improve the water quality problems with existing conservation measures and the ability to monitor the site to demonstrate the project's effectiveness.

According to Hansard, sampling in the Goshen Swamp Watershed has identified nutrient problems in surface water resulting mainly from animal operations but also from surface runoff. The "hydrologic unit" project is also aimed at protecting groundwater. "The BMPs will be designed with this in mind," Hansard said.

Success of the five-year project will be assessed in several ways, Hansard said. The Agricultural Research Service (ARS) and the U.S. Geological Survey (USGS) will be involved in water quality monitoring. The level of farmer participation will be assessed, and comparisons will be made between current

fertilizer and pesticide application practices and waste management practices and the practices in use when the project is complete.

## MOBIL OIL NPDES PERMIT COMMENT PERIOD EXTENDED

The EPA has again extended the post-hearing comment period on the draft National Pollutant Discharge Elimination System (NPDES) permit proposed for Mobil Oil Exploration and Production Southeast, Inc. for use of an offshore drillship vessel approximately 45 miles northeast of Cape Hatteras, NC.

A public hearing was held on January 31, 1990, in Manteo concerning the proposed draft permit. During the hearing numerous parties requested extension of the post-hearing comment period, and the comment period was extended to April 2. EPA has again extended the comment period to June 4, 1990, at the request of the State of North Carolina. The proposed NPDES permit contains limitations on the amounts of pollutants allowed to be discharged and was drafted in accordance with the provisions of the Clean Water Act. The pollutant limitations and other permit conditions are tentative and open to comment from the public.

Written comments may be submitted to the EPA, Region IV, 345 Courtland Street, NE, Atlanta, GA 30365, Attn: Diane Brown. Public Notice Number (90NC002) and NPDES number (NC0052523) should be included in the first page of comments.

## JUDGE SAYS N.C. SHOULD RETAIN AUTHORITY TO ENFORCE HAZARDOUS WASTE LAWS

According to the *Environment Reporter*, an EPA administrative law judge decided on April 12 that North Carolina's authority to enforce federal hazardous waste laws should not be revoked. The decision came in proceedings brought against the State by EPA, GSX and the Hazardous Waste Treatment Commission over a 1987 law which requires that each gallon of effluent from a commercial hazardous waste facility be diluted by 1,000 gallons of surface water.

Plaintiffs complained that the law discriminates against commercial facilities and is directed at preventing out-of-state waste from coming into North Carolina because it does not apply to industrial facilities. The judge found that the law was not designed to prohibit out-of-state waste and that it is not inconsistent with the federal program.

The decision is seen as upholding the right of states to enact environmental laws more stringent than the federal government's and as confirming that states may make distinctions between commercial hazardous waste treatment facilities and industrial facilities.

The final decision of whether to end the proceedings against North Carolina now rests with EPA Region IX administrator Daniel McGovern.

## USGS REPORTS DATA FROM GUILFORD COUNTY STUDY OF BEST MANAGEMENT PRACTICES

The U.S. Geological Survey has published the results of four years of data collection on the water quality effects of best land management practices (BMPs) such as grassed waterways, contour farming, and strip cropping in the Piedmont North Carolina. The interim data report *Hydrologic and Chemical-Quality Data from Four Rural Basins in Guilford County, North Carolina, 1985-88* presents hydrologic and chemical quality data collected from October 1984 through September 1988 for a USGS-Guilford Soil and Water Conservation District (GSWCD) cooperative study. The study is aimed at evaluating the effectiveness of BMPs in reducing the amount of nutrients,

chemicals, and sediment leaving agricultural sites with well-drained soils with a loamy surface layer and a clayey subsoil characteristic of the Piedmont. It is being conducted in an area in the headwaters of the Haw River.

Four small basins were selected for study. A forested basin was chosen to provide data on background hydrologic and chemical-quality conditions. A mixed-use basin was chosen to provide data on changes in water quality constituents brought about by the implementation of BMPs, which was begun in the fall of 1989. Paired agricultural basins, cultivated principally for tobacco, were chosen to study differences in levels of water quality constituents and volume of runoff on sites using BMPs and sites using standard management practices (SMPs). Practices used in the BMP basin are grassed waterways, field borders, contour farming, crop rotation, and strip cropping. The SMP basin is characterized by row orientation up and down the slope,

unmaintained grassed waterways, and continuous production of tobacco during the growing season without crop rotation.

While data collection is ongoing, a preliminary analysis based on the first year of data indicates that concentrations of organic constituents and sediment in surface runoff are reduced significantly by the use of BMPs. According to a paper by one of the principal USGS investigators, Catherine Hill, presented at the national American Water Resources Association symposium in 1989, concentrations of selected inorganic constituents of storm runoff were 50 to 75 percent less at the agricultural site using BMPs than at the tobacco field and mixed land use basin using standard management practices. Total nitrogen ranged from 3 to 48 mg/l at the SMP tobacco site and the mixed-use basin, while concentrations ranged from 1 to 12 mg/l at the control (forested) and BMP basins.

The preliminary analysis indicates that the use of BMPs reduced suspended sediment concentrations in runoff from the tobacco field by 60 to 70 percent. However, the sediment concentration at the BMP agricultural field still exceeded that from the mixed-use basin by 50 to 60 percent. Farm ponds in the mixed-use basin may act as sediment traps. Analysis of groundwater samples indicated similar levels of nutrients regardless of the type of land management practices used.

Data collection for the study is to be concluded by September 1990, and a full report will be published in 1991. The interim data report, Open File Report 89-578 may be borrowed from WRRI and is available from the U.S. Geological Survey, Books and Open-File Reports, Federal Center, Box 25425, Denver, CO 80225.

## DIGEST

**N.C. LRIS NAME CHANGE** As a result of the creation of the North Carolina Department of Environment, Health, and Natural Resources, the Land Resources Information Services (LRIS) has become the Center for Geographic Information and Analysis (CGI&A). It is part of the newly formed Division of Statistics and Information Services.

**NORTH CAROLINA FRESHWATER MOLLUSKS DECLINE** Surveys by the N.C. Wildlife Resources Commission and the Corps of Engineers indicate catastrophic declines among many native species of freshwater mollusks in river systems of the Coastal Plain and Piedmont. Financed by the U.S. Fish and Wildlife Service and N.C.'s Nongame and Endangered Wildlife Program (funded by taxpayer check-off), studies over the past several years have documented virtual replacement of native mollusks in some river systems by exotic Asiatic clam, massive population declines among most native mollusks, and almost no signs of reproduction among most mollusk species. The declines are likely consequences of pollution, sedimentation, spread of pollution-tolerant exotic species, and streamside development. *North Carolina Natural Heritage Program Newsletter* Year End 1989

**\$5 MILLION FOR NORTH CAROLINA FISH AND WILDLIFE RESTORATION** According to a press release from the office of Representative Walter B. Jones, North Carolina will receive nearly \$5 million from the U.S. Fish and Wildlife Service to support fish and wildlife restoration and

### SLUDGE MANAGEMENT GUIDEBOOK AVAILABLE FROM LAND-OF-SKY REGIONAL COUNCIL

A new document on sewage sludge management is available from the Land-of-Sky Regional Council. The "Sludge Management Decision-Making Guide" is intended for local officials and others who select sludge management options.

Last year, new N.C. rules prohibiting co-disposal of sewage sludge and solid waste in landfills resulted in a re-evaluation of management options for many municipalities. Land-of-Sky obtained state 205j funding and provided assistance to its member governments in review and selection of available options, including the publication of this guide.

Descriptions of and comparisons between available options, including land application, composting, alkaline stabilization, pelletization, incineration, and dedicated landfilling, are covered. Considerations in the decision-making process are presented to aid in evaluating options. Also included is a guide to the permitting process in North Carolina in chart form to help clarify requirements. Finally, a list of actions that can be taken immediately is included to assist local officials. The appendices contain helpful information, resources, contacts, pertinent state permitting regulations, and more.

The guide is available for \$15.00 (North Carolina residents add 5% sales tax) from: Land-of-Sky Regional Council, 25 Heritage Dr., Asheville, NC 28806.

hunter education programs during fiscal year 1990. Taxes paid by hunters and fishermen on sporting equipment and motorboat fuels and import duties on fishing tackle and pleasure boats totaled \$279 million to be apportioned among states based on land and water areas and the number of hunting/fishing license holders.

**WATER AND SEWER GRANTS TO WESTERN NORTH CAROLINA COUNTIES** North Carolina Governor James Martin has requested \$2.9 million from the Appalachian Regional Commission (ARC) to be combined with other federal, state, local and private source to fund water and sewer projects, solid waste recycling efforts, and specialized training programs for several western counties. The governor's annual project package submitted to the ARC includes \$2.1 million for water and sewer improvements in Caldwell, Avery, Haywood, Mitchell, Burke, and Ashe Counties. The governor also asked for \$300,000 to establish a network in the 29 ARC-eligible counties to identify markets for recyclables and aid local governments in supplying those markets. *County Lines*, publication of the N.C. Assoc. of County Commissioners, Mar 14, 1990

**NO LOCAL PESTICIDE REGULATION** According to a Wisconsin Supreme Court ruling, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) reserves the right to regulate pesticides to state and federal governments. In March the court affirmed an earlier order by a Washburn County, WI, trial court declaring invalid a pesticide ordinance issued by the town of Casey in an attempt to protect groundwater. *Groundwater Pollution News* Mar 29, 1990

**AQUIFER DECLINES IN CHARLESTON, SC, AREA** In the fall of 1989 the fountains on Calhoun Street and at the corner of Wentworth and Meeting Streets in historic Charleston, SC, stopped flowing. The USGS and the S.C. Water Resources Commission are investigating the possibility that loss of water to this and other wells in Charleston is due to declining artesian pressure in the Cretaceous aquifer. The well that supplied Charleston's historic fountains was drilled in 1876, and since that time the Cretaceous aquifers that underlie the S.C. Coastal Plain have been heavily developed to supply not only Charleston but the East Cooper area and Summerville as well. Declines in potentiometric surfaces of Cretaceous aquifers across a three-county area have been reported, and a project is underway to define the geologic framework, groundwater hydrology, and water quality of the Cretaceous aquifers. A groundwater flow model will be constructed which may be used to establish a Capacity Use Area designation for the three-county area. *Palmetto Waters* Jan/Feb/Mar 1990

**SEWAGE IN FLORIDA KEYS** In a recent study, the Florida Keys Land and Sea Trust found that pollution from improperly treated sewage is contaminating water in the Florida Keys and endangering coral reefs. The worst pollution is in canals surrounded by homes which are served by septic tanks that leak slightly treated wastewater into the groundwater which discharges into the canals. At Sand Key, which is located downstream from a sewage treatment plant, coral is dying from "black band disease," and algae is taking over the reefs. *U.S. Water News*, April 1990

## WRRRI REPORTS AVAILABLE

The Water Resources Research Institute has recently published reports on research projects for which it provided funding. Free single copies of the reports are available to federal water resources agencies, state water resources research institutes, and other water research institutions with which exchange agreements have been made.

Single copies of Institute reports are free to public agencies, institutions, industries, and private citizens of North Carolina as long as they are in print. Copies of out-of-print publications are available for a \$5 reproduction charge (\$10 if billed). Nonresidents of North Carolina will be charged a prepaid amount of \$8 per copy and \$10 if billed. Reports may be obtained from:

WRRRI, Box 7912  
North Carolina State University  
Raleigh, NC 27695-7912  
(919/737-2815)

### Report No. 250

#### **Managing Public Water Supplies During Droughts: Experiences in the United States in 1986 and 1988**

by David H. Moreau and Keith W. Little,  
Water Resources Research Institute of The  
University of North Carolina

This report reviews and analyzes results of two surveys of drought management in municipal water supply systems. One survey covered the drought of 1986 in the Southeast; the other, the nationwide drought of 1988. The study also explores the current state of drought management through detailed

case studies. It includes the development of a risk-based drought management model, and it examines the effectiveness of drought management plans with the use of models for daily water use.

Among the major findings of the surveys are

1. fifty percent of all urban water supplies in the country were adversely affected by the drought of 1988;
2. slightly less than 50 percent of all the utilities had drought contingency plans in place before 1988;
3. less than 30 percent of the respondents in the survey had any kind of quantitative method to support making of decisions during droughts;
4. the existence of a drought policy had a positive effect on the effectiveness of conservation programs; and
5. the existence of a decision-support system had a positive effect on the level of satisfaction with decisions.

The case studies revealed a wide range of practices in drought management, but for the most part, municipalities are still basing plans on historical droughts. The study also shows the kinds of errors that are commonly made in estimating the effectiveness of conservation programs in the absence of appropriate models for comparing water use with conservation to

what water use would have been without conservation.

#### Report No. 251

### Nutrient Processing and Water Quality in a Piedmont Bottomland Receiving Urban Wastewater

by Edward J. Kuenzler, Alice B. Carberry, and Shichin Tzeng, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

In this study, instream nutrient concentrations above and below a municipal wastewater outfall on a Piedmont stream were analyzed to assess the effectiveness of the stream's bottomland forest system in removing nutrients from the water. Contrary to results of a similar study conducted in Coastal Plain swamps by the investigator in 1985-6, only phosphate was shown to be significantly removed.

Only limited general conclusions about the effectiveness of Piedmont bottomlands in removing nutrients from wastewater can be derived from the study because the study coincided with a drought period. However, results do suggest that (1) at the specific study site, phosphate trapped in sediment is returned to the water when alum addition reduces phosphate in wastewater treatment plant effluent and, therefore, reduces instream phosphate concentration and (2) because of long-term discharge of wastewater to the study site, little further phosphorus removal and perhaps phosphorus regeneration at certain times can be expected from this system.

The study site was New Hope Creek in southwestern Durham County and northeastern Chatham County. The site includes three greentree subimpoundments constructed by the Corps of Engineers to be

flooded from November through February for wintering waterfowl. The southernmost subimpoundment receives municipal discharge from Durham's Farrington Road Wastewater Treatment Plan. Sampling to determine conductivity and chloride, nitrate and phosphate concentrations was conducted every four weeks at ten stations located above, at, and for 3.75 km below the wastewater outfall.

Low precipitation during the study period resulted in less-than-average stream flows and in only localized or short-term inundation of the floodplain. The wastewater treatment plant effluent exceeded 25% of total stream flow during 15 months and exceeded 50% during nine months of the two-year study.

Concentrations of nutrients in New Hope Creek decreased below the outfall because of simple dilution, but net removals of nutrients from the stream water were not detectable except for a small but significant rate of phosphate removal.

A parallel study was conducted of organic matter, phosphorus content, and sorption capacity of the floodplain soils. Soil phosphorus content and sorption capacity were shown to be increased by winter flooding of the greentree impoundment.

An important goal of the study was to estimate the ability of the stream-wetland system, including the winter subimpoundments, to reduce nutrient inputs to Jordan Lake and retard the rate of eutrophication of this important body of water. The study does not present evidence that the New Hope Creek bottomland system can be relied upon to provide significant enhancement of the quality of water flowing into Jordan Lake. According to the report, continuing efforts are needed to reduce the nitrogen and phosphorus loadings from the

Durham wastewater treatment plant.

### ADDITIONAL WATER-RELATED COURSES AVAILABLE

The following water-related courses in the Department of Plant Science and Technology (Division of Agricultural Engineering) at N.C. Agricultural and Technical State University in Greensboro were not included in the course listing in the last issue of the NEWS:

- AGEN 410 Hydrology
- AGEN 524 Water Resources Development & Distribution
- AGEN 600 Soil & Water Conservation Engineering I
- AGEN 701 Soil & Water Conservation Engineering II
- AGEN 714 Applied Hydrology (Hydrogeology)

For registration information contact Dr. Godfrey A. Gayle or Dr. Samuel J. Dunn, Department of Plant Science and Technology, N.C. A&T State University, Greensboro, NC 27411. Telephone (919) 334-7787 or (919) 334-7543.

### FREE WATER QUALITY CHECKLIST AVAILABLE

The American Ground Water Trust offers the Water Quality Self-Help Checklist free to homeowners who are concerned about their water quality and want to do something about it. The 15-page brochure will help homeowners analyze their own water supply and farming

operations as a means to voluntarily reduce or prevent pollution from agricultural activities. The brochure is divided into sections which help the user answer the question "Is your drinking water safe" by pulling together such information as

- \* Basic Info on Water Supply and Testing
- \* Your Farm's Potential to Pollute
- \* Off-site Problems
- \* Fertilizers
- \* Ag Chemicals - Storage and Handling
- \* Container Disposal
- \* Taking a Water Sample
- \* Recommended Individual Action

Free copies of the checklist can be obtained by sending a stamped, self-addressed business envelope to: Water Quality Brochure, The American Ground Water Trust, 6375 Riverside Dr., Dublin, OH 43017.

## POSITIONS AVAILABLE

The Department of Biological and Agricultural Engineering at North Carolina State University is seeking candidates for two positions:

Solid Waste Management Visiting Assistant Professor or Extension Specialist. Responsibility for developing a statewide Extension program on solid waste management. PhD required for visiting assistant professor. MS preferred, BS in engineering or environmental sciences required for extension specialist. Three-year appointment subject to satisfactory performance and availability of funds. Closing date: When a suitable candidate has been found.

Water Quality Extension Specialist. Responsibility for providing technical support for an intensive field project to achieve voluntary adoption of practices in rural areas to protect surface and groundwater. MS in engineering or environmental sciences or a BS degree and experience in water quality and waste management programming is required. One-year appointment with reappointment

subject to availability of funds. Closing date: When a suitable candidate is found.

Contact: Dr. Frank J. Humenik, Assoc. Head Dept. Biological and Agricultural Engineering, NCSU, Box 7625, Raleigh, NC 27695-7625.

The Department of Geography at Utah State University seeks candidates for the position of Assistant Professor in Watershed Science. This is a 50% teaching, 50% research tenure track position available September 1, 1990. Candidates must have a PhD in a closely related field and have training and expertise in multiple use of wildland resources. Closing date is April 15 or until a suitable candidate is found. For additional information contact: Dr. James P. Dobrowski, Chair, Watershed Science Search Committee; Geography Dept.; Utah State University; Logan, UT 84322-5240 (801) 750-2759.

Florida International University at Miami seeks candidates for two positions:

Tenure-track position for a person with research interests in environmental chemistry. The position is a joint, 12-month appointment between the department of chemistry and the Drinking Water Research Center. Teaching responsibilities at graduate and undergraduate levels, active research program expected. PhD required, postdoctoral experience desirable. Available either Aug 1990 or Jan 1991. Closing date: May 24, 1990. Contact: Dr. Leonard Keller, Chairperson; Dept. Chemistry; Florida International University, Miami, FL 33199.

Visiting Faculty Position in environmental engineering beginning August 15, 1990, for two semesters. Candidates should have a doctorate in the field and be competent to teach graduate and undergraduate courses in environmental engineering, including courses in physical/chemical treatment of wastewater, solid and hazardous wastes. Closing date: June 15, 1990. Contact: Oktay Ural, Professor and Chairman; Civil & Environmental Engineering Department; Florida International University, Miami, FL 33199. Phone (305) 348-3055.

### REDUCE SOLID WASTE

To eliminate unwanted catalogs and advertising circulars: Prevent your name from being placed on mailing lists by writing to DMMA, Mail Preference Service, 6 East 43rd Street, New York, NY 10017. When unsolicited mail comes to your address, clip your address label and return it to the mailer with a request to remove you from the mailing list.

## UPCOMING CONFERENCES AND WORKSHOPS

The American Water Resources Association has issued a call for papers for its February 1991 symposium on surface and groundwater quality in Cleveland, OH. The symposium will consist of three concurrent sessions under the subtopics pollution prevention, remediation, and the Great Lakes. Both invited and contributed papers will be presented in poster and oral technical sessions. Student papers are encouraged and will be presented in a separate session. Papers are called on the following or related topics:

- \* wetlands management
- \* water quality risk assessment
- \* groundwater regulation/legislation
- \* surface water/groundwater interaction
- \* agricultural impacts on water quality
- \* Great Lakes water quality
- \* water quality modeling
- \* data acquisition/management
- \* basin-wide water quality management
- \* institutional impacts on water quality
- \* behavior and mobility of water contaminants

Deadline for submission of abstracts is June 29, 1990. For additional details contact WRRRI or the Technical Program Chairman Aaron Jennings, Dept. of Civil Engineering, The University of Toledo, 2801 W. Bancroft St. Toledo, OH 43606, Telephone (419) 537-2476.

The Universities Council on Water Resources (UCOWR) will hold its 1990 Annual Meeting at the U.S. Hotel Thayer on the grounds of the U.S. Military Academy at West Point, NY, July 31 - Aug. 3. The theme is "Water Issues in an Environmental Era." The conference is designed to provide an overview and specific examples of how environmental issues will be addressed in the decade of the 90s and beyond. For information regarding registration and hotel reservations, call Margery Robinson (618) 536-7571, Mark Yeshnik (914) 938-3509, or Stan Siaw (914) 938-3528 or write UCOWR Executive Director's Office, 4543 Faner Hall, Southern Illinois University, Carbondale, IL 62901.

The Interstate Conference on Water Policy will hold its 1990 Annual Meeting August 26 - 30 in Atlantic City, NJ. Topics include Environmental Issues for the 90's, Environmental Liabilities, Infrastructure

Implementation, Respecting the Big Sinks (Ocean, Bays, Great Lakes), Financing of Federally Mandated and Authorized Programs and Projects, Innovative Financing Approaches, Improving State/Federal Relations. For additional information contact Dirk C. Hofman, Executive Director NJWTT, ICWP 1990 Annual Meeting, CN 029, Trenton, NJ 08625 (609) 292-1840.

The University of Texas at Austin College of Engineering offers two short courses in June. Water Quality Modeling will be presented June 11-13, 1990, and Water Quality Modeling with WASP4 will be presented June 13-15. For information, contact UT-A Continuing Engineering Studies at (512) 471-3506.

The American Society of Civil Engineers, the American Water Resources Association, the American Water Works Association, and the National Water Well Association are sponsoring CONSERV 90, the National Conference and Exposition Offering Water Supply Solutions for the 1990s August 12-16, 1990, in Phoenix, AZ. For information, contact CONSERV 90, 6375 Riverside Dr., Dublin, OH 43017 (614) 761-1711.

The Association of Ground Water Scientists and Engineers division of the National Water Well Association will present a field seminar titled The Geologic Modeling of Depositional Environments and Its Application to the Ground Water Professional June 5-8 and September 3-6, 1990, in Charleston, SC. Participants can receive 2.1 continuing education units for the course. Advance registration is necessary. For additional information contact: Depositional Environments, National Water Well Association, P.O. Box 182039, Dept. #017, Columbus, OH 43218 (614) 761-1711.

The Water Pollution Control Federation will hold its annual conference in Washington, DC, October 7-11, 1990. The conference theme is Water Quality Stewardship. For details contact WPCF Conference Department, 601 Wythe Street, Alexandria, VA 22314.

The Greater Greenville Chamber of Commerce and Clemson University are sponsoring the Eighth Carolina Regional Conference on Issues in Environmental Law and Technology June 19-21, 1990, at the Greenville, SC, Hilton and Towers. For program information contact Dr. Eric H. Snider at Clemson University (803) 656-5564. For registration information contact Mrs. Jan Keaton (803) 656-3308.

The Georgia Institute of Technology will present a three-day workshop titled Geostatistics: Theory, Practice, and Personal Computer Applications July 9-13, 1990, in Atlanta. Participants will be introduced to EPA's GEO-EAS and GEOPACK. For

information contact Education Extension-R, Georgia Institute of Technology; Atlanta, GA 30332-0385 (404)894-2400 or 1-800-325-5007.

The American Water Resources Association is sponsoring the International Symposium on Tropical Hydrology and Fourth Caribbean Islands Water Resources Congress at the Sands Hotel and Casino Beach Resort, San Juan, Puerto Rico, July 23-27, 1990. For information contact AWRA at (301) 493-8600.

## WATER RESOURCES CONDITIONS FOR MARCH AND APRIL

In March, storm systems spread abundant precipitation across the Great Plains into parts of the Mississippi Valley and the Southeast. These systems brought severe weather with tornadoes and local flooding from eastern Texas to the Carolina coast. During the middle of the month, torrential rains of over 10 inches caused severe flooding in Alabama and Georgia.

Unseasonably warm weather dominated the nation for the third month in a row until the latter part of March, when a blast of arctic air plunged over the central and southern Plains and across the East.

On Wednesday, March 14, Charleston, WV's record high of 89°F was the highest in the nation. By the following Monday winter had returned, and two inches of snow were on the ground.

In North Carolina, March rainfall at Asheville and Raleigh was 0.82 and 1.33 inches above normal, respectively. At Charlotte and Greensboro, rainfall was 1.26 and 1.24 inches below normal, respectively. The greatest amount of rainfall for the second time in four weeks was in the upper Little Tennessee River basin at Highlands, Macon County, with 7.98 inches. Rainfall at Sugar Loaf Mountain and Nantahala

was 7.20 and 6.46 inches, respectively, according to the National Weather Service.

Minor flooding, mud slides, and road closings were reported and a few evacuations were necessary in western counties on March 17 and 18 as a result of heavy rainfall. The recurrence interval of flooding in the Cartoogehaye and upper Little Tennessee Rivers approached the 10-year level.

Streamflow was generally excessive in the Blue Ridge and western Piedmont and normal in the Piedmont and Coastal Plain.

Groundwater levels in unconfined aquifers rose and were above average in index wells in the Blue Ridge (where a new high was set for the period of record) and Coastal Plain. The water level in the index well in the Piedmont declined but remained above average and was a record high for the month of March.

In April rainfall was below normal in Asheville, Charlotte, Greensboro and Raleigh. Streamflow decreased to the normal range across the state, except at Contentnea Creek, where flow returned to the excessive range, and at the Oconaluftee River at Birdtown and Watauga River near Sugar Grove, where flow fell to the deficient range.

Groundwater levels in unconfined aquifers declined in index wells in all three provinces; in April. However, in the Blue Ridge and Piedmont, levels remained in the above average range, setting record highs for the month of April.

— U.S. Geological Survey

### THAMES BUBBLER

A 600-ton vessel called the "Thames Bubbler" is being used on England's River Thames to oxygenate the river after a heavy rainfall. A plant aboard the vessel produces oxygen by separating it from nitrogen in the air. The oxygen is then injected into the water at high pressure.

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## NEW PUBLICATIONS RECEIVED BY THE INSTITUTE

Residents of North Carolina may borrow these publications from the institute for a period of two weeks. If you need copies to keep, please request them from the organizations issuing the publications. Addresses are provided for this purpose.

### WATER QUANTITY

Water Resources Issues and Agriculture. 1989. Lectures by Ernest T. Smerdon and J. Leonard Ledbetter. J.W. Fanning Lecture Series, Center for Continuing Education, University of Georgia, Athens, GA. 30601 (03-F)

### WATER QUALITY

Methods for Determination of Inorganic Substances in Water and Fluvial Sediments. Chapter A1 of Techniques of Water-Resources Investigations of the United States Geological Survey. 1989. Edited by Marvin J. Fishman and Linda C. Friedman. Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25415, Denver, CO 80225. (05-A)

Workstation Environment for Wastewater Treatment Design using AI and Mathematical Models. 1990. By Jehng-Jung Kao et al. Department of Civil Engineering, University of Illinois at Urbana-Champaign. Research Report 213. Available from Water Resources Center, University of Illinois, 205 N. Mathews Ave., Urbana, IL 61801.

Protecting Our Drinking Water: A User-Friendly Guide for North Carolina's Local Officials. 1989. By Bill Finger. The Conservation Foundation of North Carolina. 1024 Washington Street, Raleigh, NC 27605.

### MISCELLANEOUS

The Second Progress Report under the 1987 Chesapeake Bay Agreement. 1989. Chesapeake Executive Council. U.S. Government Printing Office:1990-720-080/0632. (02-L)

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The State of the Chesapeake Bay Third Biennial Monitoring Report - 1989. 1989. Chesapeake Bay Program Monitoring Subcommittee. (02-L)

Nesting of Two-Dimensional Models for Tidal Flow Computations. 1990. By Jan J. Leendertse, Ary Roos, and Johan C.M. Dijkzeul. The RAND Corporation, 1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138. (08-B)

The Causes of the 1981 Slide in San Luis Dam. 1989. By James Michael Duncan and Timothy D. Stark. Twenty-seventh Henry M. Shaw Lecture in Civil Engineering, Department of Civil Engineering, Box 7908, NCSU, Raleigh, NC 27695-7908. (08-A)

Soil Survey of Nash County, North Carolina. 1989. National Cooperative Soil Survey - USDA Soil Conservation Service, 4405 Bland Road, Suite 205, Raleigh, NC 27609. (08-D)

Soil Survey of Martin County, North Carolina. 1989. National Cooperative Soil Survey - USDA Soil Conservation Service, 4405 Bland Road, Suite 205, Raleigh, NC 27609. (08-D)

A Solid Waste Agenda for North Carolina Cities and Counties. 1989. By Philip J. Prete. The Conservation Foundation of North Carolina. 1024 Washington St., Raleigh, NC 27605.

1990 Directory of the Association of Environmental Engineering Professors. 1990. In care of AEEP President Thomas M. Keinath, Envir. Systems Engineering, Clemson University, Clemson, SC 29634-0919. (10-B)

California Water Resources Center Annual Report, July 1, 1988 - September 30, 1989. Rex J. Woods, Ed. Water Resources Center, University of California, Rubidoux Hall-094, Riverside, CA 92521-0436. (10-C)

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