

WATER RESOURCES RESEARCH INSTITUTE

OF THE UNIVERSITY OF NORTH CAROLINA

Number 205

April 1983

CONTENTS

	<u>Page</u>
N.C. Mercury Levels Studied in Monitoring, Research	1
A Fishy Story: Aquaculture in North Carolina	2
State Outlines Strategies for Control of Phosphorus from Point Sources	2
Report Describes Variations in N.C. Precipitation	2
Lake Classification Scheme Developed in N.C. Clean Lakes Survey	3
States Will Feel Pinch of Federal Budget Cuts, Subcommittee Told	3
Meetings Reflect Public Concern Over Toxic and Hazardous Wastes	3
Oregon Restricts Landfilling of Recyclable Wastes	4
Trade Show-Erosion Control Seminar Held in Raleigh	4
Cane Creek Reservoir Project Moves Ahead	4
State Moves to Control Pollution From Toxic Wastes	5
EMC Grants Temperature Variance	5
EPA Looks at Wetlands Use in Wastewater Management	5
Wetlands Conservation Program Announced	6
Methods for Reducing Trihalomethane Levels Set by EPA	6
North Carolina Environmental Directory Under Development	6
Institute Reports:	
<i>Erosion of Banks Along Piedmont Urban Streams</i>	7
<i>Nutrient and Multi-Species Criteria Standard for the Chowan River, North Carolina</i>	7
Workshops, Conferences and Short Courses	7
Positions Available	8
Water Resources Conditions in North Carolina	8
Water Resources Legislation in North Carolina	8
New Publications Received by the Institute	9

N.C. MERCURY LEVELS STUDIED IN MONITORING, RESEARCH

Mercury, one of the more toxic metals, is widespread in the environment. Its uptake by organisms is fast and the rate of elimination is slow. It has no

known physiological function, so even trace amounts in an organism are detrimental.

Concern over mercury in the aquatic environment has prompted several efforts to learn more about its occurrence in the state.

These include monitoring by the state and Institute research studies. The N.C. Division of Environmental Management regularly monitors mercury concentrations in water at 330 locations. The monitoring program also includes sampling for mercury in sediment and fish tissues. The DEM mercury monitoring and the data it is producing are discussed in a recent publication, "An Assessment of Mercury in North Carolina." The document notes that sources of mercury are either natural or man influenced. Those from man's activities include the Chlor-alkali industry and the production of electric batteries, mercury vapor lamps, and electrical relays with liquid contacts. Mercury is also used in the manufacturing of vinyl chloride, urethane plastics, and acetaldehyde.

An additional source of mercury released into the environment is the burning of fossil fuels by industrial processes. And in North Carolina a possible source may be a residual left over from the operation of gold mines in the Piedmont and Mountains.

The assessment document also notes that many mercury compounds exist. Methyl mercury is the most toxic of these and the most likely to reach critical levels in aquatic life. In the aquatic environment, under normal conditions, inorganic mercury is readily converted to methyl mercury. Uptake of methyl mercury by fish is extremely rapid, and fish can bioconcentrate the mercury thousands of times above levels in the water. Consumption of the fish constitutes a direct mercury input to humans. For these reasons, fish tissue analysis is considered the ultimate test for mercury in the environment.

Two years of fish tissue collection and analysis by DEM in 1980 and 1981 revealed only one sample, taken in 1980, with mercury concentration exceeding the FDA action limit of 1.0 mg/kg. The assessment document states that the statewide monitoring "indicates no current problems of mercury concentrations in fish tissue."

An exception is the Abbotts Creek drainage area near Lexington, N.C., where an intensive DEM investigation is now underway. Preliminary investigations verified elevated levels of mercury in the water column, sediments, and fish tissue. A special monitoring program is being conducted, and warning signs have been posted for the public. Also, actions were begun by several state agencies to alleviate the discharge believed to be causing the problem.

A WRRRI research project begun last year should shed more light on the significance of mercury levels in North Carolina. Dr. M. M. Kimberly of the N.C. State University Department of Marine, Earth and Atmospheric Sciences is

conducting a study to differentiate between industrial and natural sources of mercury in the Rocky River drainage basin, located in the Piedmont region. The study will determine the importance of natural weathering as a source of mercury. Kimberly is testing the hypothesis that sulfide ore deposits are contributing detectable levels of mercury to the streams. Also being tested is the hypothesis that minnows are good indicators of local mercury abundances.

A continuing study by Dr. Mark Shuman of the UNC-Chapel Hill Department of Environmental Sciences and Engineering supported by WRRI seeks to provide a toxic metal budget for Jordan Lake. During the research, Shuman has developed an analytical procedure for mercury. This method uses mercury amalgamation on gold and allows analysis in water to as low as 10 ng/l (0.010 ppb) of mercury, allowing mercury measurements to be made with greater sensitivity and analysis than in any other lab in the state or Southeast.

A FISHY STORY: Aquaculture, a term derived from the phrase "aquatic cultivation," is the production of fish and shellfish in closely managed habitats. Aquaculture encompasses a variety of enterprises such as raising fish and shellfish for human consumption (trout, catfish, oysters, shrimp, crayfish); sportfish for fee-fishing (bass, bluegill); fish and shellfish for bait (minnows, shiners, crayfish); ornamental fish (goldfish); and fish for control of aquatic weeds (tilapia).

In North Carolina the aquaculture industry consists primarily of trout production in the mountains. Although in small numbers, catfish, sportfish, baitfish, crayfish, goldfish, and fish for aquatic weed control are commercially produced here. There are approximately 30 licensed trout producers in North Carolina and about 15 licensed producers of other fish--catfish, goldfish, and baitfish. There are probably more than 100 operations in North Carolina that buy and raise young fish with which to stock fee-fishing ponds.

The trout industry is well developed in North Carolina. In the United States, North Carolina is second only to Idaho in trout production. More than one million pounds of trout, with a market value in excess of \$2 million dollars, were produced here in 1981. It is estimated that 450 gallons/minute of cool, well-oxygenated water are needed to produce 10,000 pounds of trout a year; thus trout farming is limited by availability of suitable water. Water supplies are ample for the culture of the various other fish commercially raised here.

Presently, aquaculture in North Carolina is little more than an additional source of high-priced gourmet fish, but there is great potential for the aquaculture industry here. Around the world and across this country, aquaculture is expanding. As production costs for beef and other feed-lot animals increase, fish will become an increasingly attractive protein source. With the depletion of natural populations and the resulting higher costs of harvesting, cultured fish will become more important.

North Carolina compares favorably with other states in that it has relatively abundant water available at low cost and inexpensive land and labor.

The bright prospect for the future of aquaculture involves improved technology to increase growth rates

and decrease mortality, improved marketing to increase demand for the products, and improved hybrids and other species that perform well under culture.

Aquaculture is a young, rapidly developing science. Research is being conducted on nutrition and diseases of fish, and hybrids such as the striped bass/white bass have been very successful. Aquaculture is not a "get rich quick" business, but interest in it is increasing, and someday North Carolina may be known for aquaculture as well as agriculture.

STATE OUTLINES STRATEGIES FOR CONTROL OF PHOSPHORUS FROM MUNICIPAL POINT SOURCES A number of North Carolina's water bodies are overenriched with nutrients. They are termed "eutrophic." Notable is the lower Chowan River, where nuisance algal blooms and other water quality problems have been well publicized. A recent survey by the N.C. Division of Environmental Management identified 24 eutrophic water bodies in the state.

Efforts to stem increases in eutrophication have focused on reducing the amount of nutrients entering lakes and estuarine waters. Reductions in phosphorus inputs are considered especially important. DEM has investigated strategies for phosphorus control.

Discharges from municipal wastewater treatment plants are a source of phosphorus. Chemical treatment methods exist that are able to remove 80-90 percent of the phosphorus from this source. However, costs for outfitting and operating treatment plants for that level of phosphorus removal are quite high at a time when funds for making such changes are limited.

A ban of phosphate detergents, on the other hand, would offer at least a 30-40 percent reduction in phosphorus discharged from municipal wastewater treatment plants. It would involve no initial investment and no appreciable cost to consumers, and it could be rescinded at any time.

DEM has recommended a phosphate detergent ban for 66 of the state's Coastal Plain and Piedmont counties "as a first step in addressing the nutrient enrichment problems in these areas." Further phosphorus reductions may eventually become necessary in certain areas, requiring chemical removal of the nutrient at treatment plants. But at present, with eutrophication problems just emerging, such costly steps as chemical removal do not seem justified, according to a DEM report, "Strategies for Municipal Point Source Phosphorus Control." The report describes options for phosphorus removal, including the phosphate detergent ban.

There are four options available for implementing the ban: (1) legislative action, (2) joint legislative-Environmental Management Commission action, (3) the existing authority of the Environmental Management Commission, or (4) local government action.

REPORT DESCRIBES VARIATIONS IN N.C. PRECIPITATION A report just published by the State Climatologist's Office provides a guide to precipitation across North Carolina. "Variations in Monthly Precipitation Over North Carolina" is a simplified version of an earlier Institute technical report by Dr. Walter J. Saucier of the N.C. State University Department of Marine, Earth and Atmospheric Sciences. It is intended for use by technicians

and the general public in making precipitation-related climatic decisions.

North Carolina's precipitation patterns are quite complex. Spatial and temporal distribution of precipitation are partly controlled by the state's geographic position relative to the global atmospheric circulation system. Also, physiographic controls are imposed by the Appalachian Mountains in the western part of the state and the Atlantic Ocean to the East.

This report describes the causes of the state's precipitation, the factors governing its occurrence, and how they combine to influence the amount and timing of precipitation throughout the year.

A useful feature of the report is a set of maps showing the average yearly and monthly precipitation across North Carolina and the standard deviations. They illustrate the extent to which precipitation varies in the state. For example, Highlands, N.C., in the mountain area, averages over 82 inches of precipitation annually (the highest amount in the eastern U.S.). Asheville, only 50 miles away in a sheltered valley, averages less than 40 inches per year. Farther east, the Piedmont is generally the driest section of the state, with some areas receiving less than 43 inches annually. Then precipitation averages increase steadily as one approaches the coast.

Authors of the new report are B. K. Eder, J. M. Davis, and P. J. Robinson of the N.C. Climate Program Office, N.C. State University and UNC-Chapel Hill. Copies are available from the Institute.

LAKE CLASSIFICATION SCHEME DEVELOPED IN N.C. CLEAN LAKES SURVEY

The N.C. Division of Environmental Management, having completed work on its Clean Lakes Classification Survey, has released a report on the

program. The report describes a new trophic state index and lake classification scheme for North Carolina, developed during the Survey.

The Survey was part of the EPA Clean Lakes Program, a series of federally assisted grants to protect and/or restore publicly owned freshwater lakes. DEM received funding in 1981 to classify the state's publicly owned freshwater lakes according to their trophic state conditions and to determine lake priority for restoration efforts. The established goal of this work was to develop a feasible trophic classification scheme that could be used in future lake investigations. The ranking of lakes according to restoration priority was considered a secondary objective, due to uncertain funding of future clean lakes projects, according to the report.

Sixty-five lakes were examined during the Survey, including 39 suggested in responses to a statewide questionnaire and lakes with known eutrophication or other problems.

The report emphasizes trophic state index development, illustrates several data analysis techniques for trophic state assessment, and provides an in-depth critique of the more frequently used trophic state indices.

The report lists three major conclusions from the Survey.

1. The newly developed North Carolina trophic state index and lake classification scheme provided a statistically sound and verifiable

tool of assessing trophic state conditions in North Carolina lakes. This approach can be applied to future lake investigations and the water quality management program and for illustrating lake eutrophication problems to the public.

2. Lake trophic state in North Carolina was greatly affected by the presence of high concentrations of suspended sediments. High sediment loads were probably the major factor in the poor results of the standard single variable trophic state indices. Control of sediment loads in tributaries would greatly improve overall lake water quality.
3. A major factor in considering lake priority for restoration is the presence or absence of the aquatic weeds, such as *Hydrilla verticillata*. This macrophyte is a potential threat to all freshwater lakes if not controlled while still confined to a relatively small area of the state.

STATES WILL FEEL PINCH OF FEDERAL BUDGET CUTS, SUB-COMMITTEE TOLD

Many states, feeling the pinch of the recession and state tax cuts, will be hard pressed to absorb federal cuts in environmental grants.

Various state groups told a Senate subcommittee on February 16 that if the 26 percent cut in state environmental programs proposed by the Reagan Administration for fiscal 1984 is enacted, "states would have to reduce environmental permitting, monitoring, field inspection, compliance, and enforcement efforts, resulting in a corresponding reduction in environmental quality," according to an article in "Current Developments," a newsletter from the Bureau of National Affairs.

State officials at the hearing before the Senate Environment and Public Works Subcommittee on Toxic Substances and Environmental Oversight called fiscal conditions in all 50 states "extremely bleak." They noted that federal cuts would force states to weigh environmental program funding programs against human services and welfare programs, the article said.

It was also pointed out that programmatic and financial cooperation from EPA are especially needed now, in the face of new challenges in controlling toxic chemical pollution.

MEETINGS REFLECT PUBLIC CONCERN OVER TOXIC AND HAZARDOUS WASTES

The Governor's Waste Management Board, formed to deal with toxic and hazardous waste issues, has hosted a series of public meetings

across the state to review toxic and hazardous waste programs in North Carolina.

It is estimated that as many as 900 people attended the meetings. In all, 11 hours of public comment were given, including testimonies from individuals and representatives of environmental groups and industries. The majority of the comments received were well-prepared and well-articulated, according to Board Members, and reflect the intensity of the public's concern on the subject.

Items stressed by the public during these meetings include the following:

1. The state should be allowed to be more restrictive than federal laws on land-disposal regulations.

2. A state law or regulation that prohibits burial of certain categories of hazardous wastes in landfills.
3. A state law that applies a standard of strict liability to generators, transporters, treaters, storers, and disposers of hazardous wastes.
4. An appropriation from the General Assembly to match federal Superfund monies to clean up orphan waste dumps in North Carolina.
5. The state should be allowed to call for annual reports from generators, treaters, storers, and disposers of hazardous wastes.
6. Sufficient funds should be appropriated by the General Assembly for a reasonable regulatory program to protect the health, safety, and environment of the people of North Carolina.
7. Establish a waste-management coordinating committee under the Governor's Waste Management Board to enhance and strengthen the present coordination between state agencies and departments.
8. Strong support for the use of alternative technologies to land disposal of hazardous wastes.
9. The state should strongly pursue the Pollution Prevention Pays concept of waste management.

In addition to these top nine items, several other needs were cited during the public comments. They are:

- A two-year moratorium on hazardous waste landfills
- More local control on siting decisions
- Environmental Impact Statements by the state for treatment, storage, and disposal facilities
- More liberal tax credits for industry to encourage reduced waste generation
- That improperly disposing of hazardous wastes be a felony instead of a misdemeanor

OREGON RESTRICTS LANDFILLING OF RECYCLABLE WASTES The State of Oregon's Revised Statutes for hazardous wastes outline the Oregon Department of Environmental Quality's responsibility for determining which wastes may be landfilled.

The statutes provide that the Oregon Environmental Quality Commission shall provide for the highest and best practicable disposal of the hazardous wastes in a manner that will minimize:

- (a) The possibility of a dangerous uncontrolled reaction, the release of leachate, noxious gases or odors, fire, explosion or the discharge of the hazardous wastes; and
- (b) The amount of land used for burial of the hazardous wastes."

The statutes also state that "The department may limit, prohibit or otherwise restrict the disposal of certain hazardous wastes at a hazardous waste disposal site owned by the state if necessary to protect public health, welfare or safety or the environment or to prolong the useful life of the hazardous waste disposal site."

Also, "the department shall monitor the origin and volume of hazardous waste received at a hazardous waste disposal site and may curtail or reduce the volume of the wastes that may be accepted for disposal as necessary to prolong the useful life of the site."

In addition, the hazardous waste disposal site license that the Department issued to Chem-Security Systems, Inc., a company licensed by the state to operate a hazardous waste disposal site, contains provisions that no wastes must be accepted for disposal unless they have received prior approval from the Department. Under the prior approval procedure, Chem-Security must submit to the Department a written disposal request for all wastes proposed to be brought to the site. The disposal request must include detailed information on the waste provided by the generator and the treatment and/or disposal procedure proposed by Chem-Security. Depending on the type of waste and on whether the site can provide an acceptable disposal procedure, the Department may approve or disapprove a disposal request. It is the Department's policy not to permit the site to accept recyclable waste that is acceptable to a recycling facility and to prohibit the site from landfilling liquid wastes that can be acceptably handled in lined evaporation ponds.

TRADE SHOW-EROSION CONTROL SEMINAR HELD IN RALEIGH Education is an important tool in controlling sediment, North Carolina's greatest water pollution problem. Those involved in land-disturbing activities need to know the impact that soil erosion and sedimentation have on water and land resources, the laws governing erosion control, the best methods of erosion control, and the benefits of using them.

Educational efforts have addressed construction and development activities, one of the primary causes of erosion. Yet they have often failed to reach the small contractors, who do a great deal of construction work in the state.

To reach this important group, a new approach was tried recently. In a joint effort by the state and a group of concerned developers, a trade show was held March 9 in Raleigh, The Eastern North Carolina Equipment Show and Erosion Control Seminar brought together those involved in earth-moving activities and vendors of earth-moving equipment and other products such as seeds, synthetic erosion control products, and fertilizer.

The show was sponsored by the N.C. Sedimentation Control Commission's Education Committee (using civil penalty funds collected for erosion control violations), the N.C. Department of Natural Resources and Community Development, and a group called PROD (Progress for Raleigh-Wake County through Orderly Development). These sponsors viewed the trade show as "an ideal opportunity for promoting erosion and sedimentation control, while at the same time serving as an information exchange and promotion of new equipment, products, and supplies."

A barbeque lunch attended by 500 persons was provided compliments of PROD. The afternoon seminar addressed such topics as erosion control and the contractor, the Sedimentation Control Commission--purpose and goals, PROD--how and why it works for the development industry, and the N.C. erosion control program and how to make it work for you. Workshops were held on banking and erosion control techniques.

CANE CREEK RESERVOIR PROJECT MOVES AHEAD At its meeting on March 10, the Environmental Management Commission approved the recommended findings of hearing officer Virgil L. McBride and issued a certificate

authorizing the Orange Water and Sewer Authority (OWASA) to exercise the powers of eminent domain to acquire water, water rights, and lands needed to construct the Cane Creek public water supply reservoir. A primary factor in this decision was the EMC finding that the reservoir project is consistent with the maximum beneficial use of the water resources of the State. Intervenor associated with OWASA included the Town of Chapel Hill and the Board of Trustees of the University of North Carolina. Opposing the EMC action were the Cane Creek Conservation Authority (CCCA) and associated intervenors, which included the Lower Cape Fear Water and Sewer Authority and several individual land owners. This action came after five years of controversy and litigation. Attorneys for CCCA promised appeals of the EMC decision.

The Cane Creek dam and reservoir will impound runoff from 32 square miles and store 3 billion gallons. The safe yield is expected to be at least 10 million gallons per day for an anticipated service life of 100 years. The reservoir will extend approximately 3.5 miles upstream from the dam and flood 480 acres. About 760 acres of land must be acquired to provide the necessary perimeter protection and structural sites. Approximately 80 percent of the total land needed is forested, 14 percent is under cultivation, and 6 percent is in pasture. The earth fill dam will be 900 feet long at the top, with a maximum height of 75 feet above the creek bed. It will contain approximately 200,000 cubic yards of earth and rock fill.

Alternative sources of water supply considered by OWASA included the B. Everett Jordan Lake, direct pumping from a weir on the Haw River, and expansion of University Lake. The hearing officer held that the clear sense of the testimony was that the Cane Creek reservoir offered the safest and best alternative in terms of providing water of consistently high quality while minimizing the risks attendant to the other alternatives.

STATE MOVES TO CONTROL POLLUTION FROM TOXIC WASTES

Biological monitoring by the N.C. Division of Environmental Management uncovered a highly toxic discharge into a small tributary to the Henry River near Hickory

last month.

Division personnel told the N.C. Environmental Management Commission Thursday that wastewater discharged by Neuville Mobile Sox Inc. of Burke County was toxic to test organisms in concentrations of less than three percent.

The Division ordered the plant to stop discharging on February 7, and the staff initiated an investigation to identify the toxic agent.

The Company prepares socks for distribution by washing them in a mixture of chemicals, pressing them and packaging them for distribution.

The toxic agent was identified as a biocide used to treat the socks to prevent foot odor. Further tests on the biocide confirmed that it is highly toxic.

The highly toxic nature of the plant's discharge was confirmed by tests conducted by the division's mobile bioassay and biomonitoring laboratory. The computerized laboratory exposed fathead minnows to native water containing varying concentrations of the plant's wastewater.

The tests showed that concentrations as low as two percent were fatal to 100 percent of the minnows over a 96-hour period.

Further investigation of the unnamed tributary to the Henry Fork River indicated that the biological organisms that normally inhabit such a stream were not present in normal numbers, a further indication that a toxic agent was impacting the creek.

The plant has resumed operations without the biocide, and Environmental Management staff as well as company management are monitoring the effects of the operation carefully.

"Neuville Mobile Sox Inc. has been most cooperative in our investigation of this problem," said Robert F. Helms, director of the Division of Environmental Management. "They have done everything we asked them to do, and they demonstrated extreme concern for the impact their operation has had on the environment."

The mobile laboratory was sent to the plant after earlier chemical tests and acute toxicity static screening bioassay tests, plus citizen complaints, indicated there might be problems associated with the operation.

The plant treats its process water and domestic wastewater in a small treatment plant on its premises.

EMC GRANTS TEMPERATURE VARIANCE The N.C. Environmental Management Commission on March 10 granted Abbott Laboratories Inc. of Nash County permission to increase the temperature of an unnamed stream up to 10 degrees centigrade above its normal temperature.

The plant, which manufactures and assembles intravenous solutions and related medical equipment, had petitioned for a variance from the thermal standard to allow the company to raise the temperature 10 degrees centigrade. The state standard allows a change of 2.8 degrees centigrade.

The creek is an unnamed tributary of Beech Branch in the Tar-Pamlico River Basin.

K.D. Sturgis, an administrative hearing officer for the N.C. Department of Natural Resources and Community Development, held a hearing on the issue September 8, 1982, and determined that the variance would present no threat to human health or safety and would result in no appreciable harm to the creek.

In recommending that the EMC grant the variance, however, Sturgis stated that in no event should the stream temperature be allowed to exceed 32 degrees centigrade, which is also a state standard.

Sturgis failed to support the company's request to exceed the 10-degree allowance five percent of the time.

Under state and federal environmental laws, heat is a pollutant and is thus subject to regulation.

EPA LOOKS AT WETLANDS USE IN WASTEWATER MANAGEMENT Wetlands, which have natural abilities to purify water, are sometimes used in the wastewater treatment process. EPA has identified over 400 wastewater discharges to wetlands in its Region IV, which includes North Carolina and seven other southeastern states.

Aware that many issues attend the use of wetlands in wastewater management and that pressures for such use will probably increase in the future, EPA in 1981 initiated an Environmental Impact Statement (EIS) on the topic. The purpose of the two-phase study is to assess the use of freshwater wetlands for wastewater management in Region IV. It is intended to provide scientists, engineers, and planners responsible for wastewater planning with procedures and analytical tools to evaluate wastewater management in wetlands as an alternative to more conventional options.

Phase I of the EIS has identified key institutional, scientific, and engineering factors that must be considered in evaluating this option, according to an EPA bulletin. The first phase has included inventories of existing wetlands discharges, wetlands classification systems, permitting procedures and policies, wetlands values and functions, impacts of wastewater additions to wetlands, and engineering alternatives.

Phase II of the EIS, to be conducted in conjunction with representatives of each of the Region IV states, will involve the development and evaluation of assessment tools needed for the decision-making process in each state. A handbook will be produced to delineate methods of analysis as well as safeguards and guidelines for evaluating, selecting, permitting, and monitoring wetland systems acceptable for wastewater management.

Key scientific considerations identified in Phase I include wetland vegetation, geomorphology, water quality, wildlife values, and linkages to other systems. Engineering considerations include acceptable pollutant and hydrologic loading rates, appropriate distribution systems and detention times, appropriate disinfection systems, and site-specific discharge criteria. Institutional considerations identified include existing and future uses of the wetland, ownership and proprietary rights of private wetlands, and requirements of the NPDES permitting and water quality standards programs.

Additional information on this EIS is available from the EPA project officer: Mr. Ronald Mikulak, Environmental Protection Agency, NEPA Compliance Section, 345 courtland Street, Atlanta, GA, Telephone (404) 881-3776.

WETLANDS CONSERVATION PROGRAM ANNOUNCED The Nature Conservancy and the Richard King Mellon Foundation have launched a \$50 million program to conserve wetlands.

The new National Wetlands Conservation Project will identify critical wetland areas across the country. During the next five years, key areas will be acquired and managed with the help of government, business and private philanthropy. The first emphasis will be on acquiring 17,000 acres of wetlands along the Escambia River in Florida.

The Mellon Foundation contributed \$25 million to the project, the Conservancy said, which is the largest single grant made by a private philanthropy for conservation purposes.

The gift will be matched by the Conservancy with contributions from individuals, businesses, government agencies and other philanthropies.

...Wildlife Management Institute

METHODS FOR REDUCING TRIHALOMETHANE LEVELS SET BY EPA

EPA recently listed 10 methods, five generally available and five not generally available, that could be used by communities to reduce the levels of

trihalomethanes to achieve the maximum level specified under the Safe Drinking Water Act. A rule, which became effective March 30, 1983, and applies to all public water systems that serve more than 10,000 people, established criteria and procedures that EPA or a state with primary enforcement responsibility that issues variances must follow in determining if a community must install one of the generally available methods.

Generally Available Methods:

- Use of chloramines as an alternate or supplemental disinfectant or oxidant;
- Use of chlorine dioxide as an alternate or supplemental disinfectant or oxidant;
- Improved existing clarification for trihalomethane precursor reductions;
- Movement of the point of chlorination to reduce trihalomethane formation and, where necessary, substitution for the use of chlorine as a pre-oxidant chloramines, chlorine dioxide, or potassium permanganate; and,
- Use of powdered activated carbon for trihalomethane precursor or trihalomethane reduction seasonably or intermittently at dosages not to exceed 10 milligrams per liter on an average annual basis.

Additional Treatment Methods:

- Introduction of off-line water storage for trihalomethane precursor reduction;
- Aeration for trihalomethane reduction "where geographically or environmentally appropriate";
- Introduction of clarification where not currently practiced;
- Consideration of alternative sources of raw water; and,
- Use of ozone as an alternate or supplemental disinfectant or oxidant.

More details on the rule and the methods listed may be obtained from Joseph A. Cotruvo, Criteria and Standards Division, Office of Drinking Water (WH-550), EPA, 401 M St., S.W., Washington, D.C. 20460; telephone (202) 472-5016.

NORTH CAROLINA ENVIRONMENTAL DIRECTORY UNDER DEVELOPMENT The North Carolina Center for Public Policy Research, a private nonprofit, non-partisan research organization has received a grant from the Z. Smith Reynolds Foundation to produce a comprehensive guide to the environmental groups in North Carolina. The purpose of the directory will be to identify the private citizen groups (and perhaps government agencies), concerned with the environment in North Carolina, determine their objectives, and, to some extent, evaluate how successful these groups have been in addressing environmental issues before the state. Scheduled for release in the summer of 1983, the North Carolina Environmental Directory will include the following information on each group:

1. Name, address, phone number;
2. Officers, staff;
3. Membership;
4. Program objectives of each group;
5. Major issues the group currently addresses, including those issues
 - a. on which the group has developed policy papers, or

- b. has pursued legislative action;
- 6. Issues the group plans to pursue over the next few years.

Suggestions for information that would make the directory more useful to you or are interested in learning more about this directory, please call Ms. Blumenthal at the North Carolina Center for Public Policy Research (919-832-2839).

NEW INSTITUTE REPORTS *Erosion of Banks Along Piedmont Urban Streams* by Dr. Michael P. Wilson, Department of Geology, Texas A&M University, formerly of the Department of Geography and Earth Sciences at UNC-Charlotte.

The purpose of this study was to survey the areal distribution of streambank failures and eroded reaches in an urban setting and to identify those variables associated with each mode of bank failure and channel shape.

Identification and mapping of stream-bank sediments and failure modes were a major part of the research. Variables for measurement included channel width-depth ratio, three-dimensional distribution of cohesive and non-cohesive soils, bank curvature, roots, large voids, sediment size, plasticity, and strength. The study provides base-line data regarding the spatial distribution of bank failures and associated sediments.

Urbanized and non-urbanized tributary streams of the Piedmont are usually cut into post-European reddish sands and pre-European-settlement gray cohesive soils. These streams are eroding by scour and bank failure. Currently, berms (or inner-channel terraces) are a common product of bank failure; otherwise inner-channel deposition is common product of bank failure; otherwise inner-channel deposition is rare and consists of point bars formed as meanders begin to develop.

The cohesive sediments are more scour resistant than the sandy sediments. Bank failure is of the slab type, and is a normal part of the erosion process. Traditional design approaches have failed to create stable channels, primarily because (1) we do not understand erosive processes in cohesive sediment, and (2) urban environments require abnormally narrow channels.

Erosion in channels less than about twelve feet deep can be reduced significantly by consideration of natural fluvial processes, artificial berm development, and judicious use of rip-rap. Torvane strength, color, composition and particle size distribution readily characterize bank materials and their erodibility.

Nutrient and Multi-Species Criteria Standard for the Chowan River, N.C. by Dr. A. M. Witherspoon and Roger Pearce, N.C. State University Botany Department.

This research consisted of an investigation of changes in nutrient concentrations, phytoplankton biomass, and environmental parameters in the Chowan River Complex from October 1978 through December 1981.

The response of phytoplankton to a given concentration of a given nutrient was determined using a growth response ratio for each nutrient relative to chlorophyll-a and algal wet weight biomass.

Species of the three genera that periodically bloom in the river were isolated, and a minimum nutrient

requirement for each was determined. The results suggest that the River is in excess of necessary nutrients for moderate algal growth.

In addition, the following recommendations were made.

1. Reductions in both phosphorus and nitrogen should be done simultaneously.
 - (a) Neither nitrogen nor phosphorus should be reduced alone.
 - (1) Rationale: A reduction in phosphorus alone would reduce algal biomass. However, a reduction in total biomass would decrease competition for nutrients, thus nitrogen levels would increase. An increase in nitrogen levels would favor the growth of Microcystis. This would create a situation more damaging than currently exists.
 - (2) Rationale: A reduction in nitrogen alone would favor an increase in other algae, in particular, flagellates. It is not known if a specific organism may develop that would be detrimental to the system, say Peridinium (dianoflagellates). While nitrogen fixation is important, algal communities have not been shown to bloom with N₂-fixation as the only source of nitrogen.
2. The ratio between nitrogen and phosphorus must be made such that diverse species will compete for each. Thus, no species or groups of species would gain an advantage.
3. Reductions by percent of both nutrients, nitrogen and phosphorus, as indicated in the conclusions and text, is highly recommended.

(EDITOR'S NOTE: Either of the reports described here may be obtained free from the Water Resources Research Institute, North Carolina State University, 124 Riddick Building, Raleigh, NC 27650-5999, Telephone (919) 737-2815. A fee of \$8.00 prepaid is charged for out-of-state requests.)

WORKSHOPS, CONFERENCES, AND SHORT COURSES Formation and Control of Trihalomethanes in Drinking Water, Chapel Hill, NC; May 5, 1983; fee \$25. Contact Judith Carter, Office of Continuing Education, UNC-CH School of Public Health, Chapel Hill, NC 27514; telephone 919/966-4032.

Hierarchical-Multiobjective Approach in Water Resources Planning and Management. The 12th Annual One-Week Short Course presented by Center for Large Scale Systems and Policy Analysis, Case Institute of Technology of Case Western Reserve University, to be held May 9-13, 1983, Case Western Reserve University, Cleveland, Ohio.

For further details contact: M. A. Pelot, Center for Large-Scale Systems and Policy Analysis, Rm. 612C Crawford Bldg., Case Western Reserve University, Cleveland, Ohio 44106. Telephone (216) 368-4492 or 4493.

Water Quality Assessment of Toxic and Conventional Pollutants in Lakes, Streams and Estuaries. April 4-8, 1983, Atlanta Marriott, Atlanta, GA and May 2-6, 1983, Palmer House, Chicago, IL. This five-day workshop is intended for engineers, chemists, biologists, and others who are involved in evaluating pollutant loadings and their effect on water quality in streams, lakes (including

impoundments), and estuaries. This methodology utilizes a preliminary analysis procedure to identify potential problem areas that can then receive more intensive analysis. This workshop is sponsored by USEPA. For further information, contact Virginia Hathaway, JACA Corporation, 550 Pinetown Rd., Ft. Washington, PA 19034.

Groundwater Compliance: Designing, Installing and Operating Groundwater Wells. To be held April 18-19, 1983, Hilton Gateway Hotel, Newark, New Jersey. This timely conference will bring together the relatively few who have had experience in dealing with groundwater at hazardous waste disposal sites and those who need the benefit of this experience.

For further information, contact The Center for Energy and Environmental Management, Box 536, Fairfax, VA 22030, telephone - Conference Hotline 800-424-9068 or in Washington, DC 800-250-5900.

POSITIONS AVAILABLE Unusual opportunity for Ph.D. Hydrologist. Tarleton State University, part of the Texas A&M University System, has been authorized to offer a B.S. Degree in Hydrology beginning with the Fall 1983 semester. This will be the only such degree in the state of Texas and one of very few in the nation. The program will be administered by a Director in conjunction with an advisory board of outstanding professionals.

Applicants should send a resume and the names of three references to: Dr. Thomas C. Hinkson, Head, Department of physical Sciences, P.O. Box T-69, Tarleton State University, Stephenville, Texas 76402. The deadline for application is April 15, 1983.

WATER RESOURCES CONDITIONS IN NORTH CAROLINA

Near-record rainfall for the month of February caused high flows (upper 25 percent of record)

across the State and widespread moderate flooding. The most severe flooding occurred on the 2nd in the Mountains and foothills where many streams reached 2- to 4-year flood levels. Floods at stations on the Pigeon River at Canton and the Watauga River at Sugar Grove reached 50- and 10-year flood levels, respectively. Minor flood damage occurred in Alleghany, Buncombe, Mecklenburg, Union, and Watauga counties.

Mean monthly flows at index stations ranged from 50 percent above normal for the South Yadkin River at Mocksville, to 80 percent above normal for the Contentnea Creek at Hookerton.

Ground-water levels rose significantly across the State. Levels were 1½ to 4 feet above long-term averages for February and 1 to 6 feet higher than those a year ago.

...U. S. Geological Survey

WATER RESOURCES LEGISLATION IN NORTH CAROLINA

Bills Introduced

House

- H 220 CAMA massive land conversions
"To modify the exemptions under the Coastal Area Management Act so as to regulate massive conversions for corporate farming and peat mining." Amends GS 113A-103(5)(b)4 to exclude massive land conversions for corporate farming and peat mining from agricultural and forestry activities exempted from the definition of "development" for purposes of the Coastal Area Management Act.
- H 232 CAMA consultation on water permits
"To give CAMA input into the granting of permits outside the coastal area that affect water quality in the coastal area." Amends GS 113A-125(b) to require that all permits, special orders, or certificates for water pollution control issued under Art. 21 of GS 143 affecting coastal water quality be administered in coordination and consultation with Coastal Resources Comm'n (though not subject to veto of Comm'n).
- H 306 Sanitary district lawsuit power
"To allow a sanitary district to engage in litigation or join with others in litigation opposing the withdrawal of water from the Roanoke River basin." Adds new GS 130-128.1 granting sanitary districts power indicated in title.
- H 345 Water and sewer employee defense
"To allow water and sewer authorities to defend officers and employees and pay any or all of a claim made or civil judgement entered against any of them." Amends GS 160A-167 and 162A-6 to permit a water and sewer authority organized under GS 162A, Art.1 to (1) defend an officer or employee against civil or criminal actions brought against him in his individual or official capacity for an act or omission committed in course of his duties and (2) pay all or part of civil judgment entered on such a claim (now, cities, counties, county ABC boards, and certain volunteer fire dep'ts and rescue squads have such power).

...Daily Bulletin--The General Assembly of North Carolina Institute of Government, University of North Carolina at Chapel Hill

NEW PUBLICATIONS RECEIVED BY THE INSTITUTE

(Residents of North Carolina may borrow these from the Institute for a two-week period. Where individual copies are desired, readers are encouraged to request copies from the organization issuing the publication. The addresses are provided by the News for this purpose.)

Water Resources Planning

- "Hydropower Reconnaissance Report Falls Lake Neuse River Basin, N.C.," 5/81, by Hydrologic Engineering Section, U.S. Army Engineer District, PO Box 1890, Wilmington, NC 28401 (Neuse River Basin)
- "Planning for Urban Fishing and Waterfront Recreation," (FWS/OBS-80/35), 7/81, by D. L. Leedy, et al, avail. from Superintendent of Doc., USGPO, Washington, DC 20402 (06A)

Water Quality Management

- "North Carolina Clean Lakes Classification Survey," 1982, Water Quality Section, DEM, NRCD, PO Box 27687, Raleigh, NC 27611. (02H)
- "In Situ Survival of Enteric Bacteria in Estuarine Environments," (#140), 1/83, by M. W. Rhodes, et al, WRRRC, VPI&SU, 617 N. Main St., Blacksburg, VA 24060-3397. (05A)
- "A Case Study of Land Treatment in a Cold Climate - West Dover, Vermont," (CRREL Report 82-44), 12/82, by J. R. Bouzoun, et al, US Army Corps of Engineers, Cold Regions Research & Engineering Lab., Hanover, NH 03755. (05D)
- "Strategies for Municipal Point Source Phosphorus Control," 1/83, Water Quality Section, DEM, NRCD, PO Box 27687, Raleigh, NC 27611. (05B)
- "The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions," 9/82, by M. A. Foote, et al, Center for Coastal & Environmental Studies, Rutgers, Doolittle Hall--Busch Campus, New Brunswick, NJ 08903. (02L)
- "Proceedings of the Workshop on Agrichemicals and Estuarine Productivity, September 18-19, 1980," 12/82, by NOAA, Contact Duke Univ. Marine Lab, Beaufort, NC 28516. (05B)
- "Assessment of Saline Water Use in Coal Transport and Multipurpose Systems," (JPLD-425), 12/82, by D. P. Maynard, et al, avail. from USDI, Bu. of Reclamation, Denver, CO 80225. (Water & Energy)
- "Dredged Sediment for Agriculture: Lake Paradise," (#175), 1/83, by W. D. Lembke, et al, WRC, U. of IL at Urbana-Champaign, Urbana, IL 61801. (02J)

Water Quantity Management

- "Mean Monthly, Seasonal, and Annual Pan Evaporation for the United States," (NWS 34), 12/82, by R. K. Farnsworth, et al, avail. from NTIS, USDC, Sills Bldg., 5285 Port Royal Rd., Springfield, VA 22161. (02D)
- "Water Quality of Airport Storm Runoff," (#144), 7/82, by E. Christokos-Comack, et al, WRRRC, U. of HI at Manoa, Honolulu, HI 06822. (05A)

Miscellaneous

- "Southern Regional Environmental Assessment: Environmental Status Report," (EPA-600/8-83-001), 1/83, by Sci. & Public Policy Program, U. of OK, for EPA, Office of R&D, Washington, DC 20460. (EPA)
- "Handbook of Forecasting Techniques," (IWR Contract Rpt. 75), 12/75, by Center for the Study of Social Policy, IWR, avail. from NTIS, 5285 Port Royal Rd., Springfield, VA 22151. (06A)
- "Handbook of Forecasting Techniques, Part I--List of Techniques; Part II--Description of 31 Techniques," by Center for the Study of Social Policy, IWR, avail. from NTIS, 5285 Port Royal Rd., Springfield, VA 22151. (06A)
- "A National Program for Soil and Water Conservation, 1982 Final Program Report & Env. Impact Statement," 9/82, by USDA, SCS, PO Box 27307, Raleigh, NC 27611. (03F)

ITEMS OF INTEREST:

N.C. Mercury Levels Studied in Monitoring, Research, page 1
A Fishy Story: Aquaculture in North Carolina, page 2
Report Describes Variations in N.C. Precipitation, page 2
Meetings Reflect Public Concern Over Toxic and Hazardous
Wastes, page 3
Oregon Restricts Landfilling of Recyclable Wastes, page 4
EPA Looks at Wetlands Use in Wastewater Management, page 5
Methods for Reducing Trihalomethane Levels Set by EPA,
page 6

WATER RESOURCES RESEARCH INSTITUTE
OF THE UNIVERSITY OF NORTH CAROLINA
124 RIDDICK BUILDING
N. C. STATE UNIVERSITY
RALEIGH, NORTH CAROLINA 27650-5999

ADDRESS CORRECTION REQUESTED

PRINTED MATTER

NONPROFIT ORG.
U. S. POSTAGE
PAID
RALEIGH, N. C.
PERMIT NO. 549