NEWS
WATER RESOURCES RESEARCH INSTITUTE
OF THE UNIVERSITY OF NORTH CAROLINA

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CONTENTS

NEW WATER BOND VOTE CONSIDERED

As current clean water bond fund nears exhaustion, a new bond referendum to assist in funding water and sewer facilities is being discussed. House Speaker Carl J. Stewart, Jr. is promoting a $230 million bond referendum to finance water and sewer facilities for municipalities in North Carolina. A co-sponsor of the measure is Rep. Robert Farmer of Wake County who is Chairman of the House Finance Committee. Governor James B. Hunt, Jr. and State Treasurer Harlan E. Boyles are also supporting the bond referendum.

Should the bond referendum measure be endorsed by the General Assembly, it could be submitted to the voters this fall for approval. Voter support would mean that enough money would be made available to supplement water and sewer facility costs for the next five years.

Currently, bond funds are used to assist communities with 12 1/2 percent of the cost of construction of sewer facilities and grants of up to 25 percent of the eligible project costs of water supply systems.

The December issue of the *News* contained a summary of how previous funds have been used and the status of 1971 clean water bond program. Those funds are essentially exhausted.

N.C.'S FARMERS HOME ADMINISTRATION LEADS NATION IN WATER AND WASTEWATER FINANCING

North Carolina's Farmers Home Administration lead the Nation last year in the amount of money loaned for water and waste disposal systems. It made 64 loans valued at $42,030,100 for water and waste disposal systems and 48 grants worth $24,437,300.

Since the FmHA program began it has financed 219 domestic water systems and 24 water and waste disposal systems in NC.

The Community Programs staff of FmHA also processed loans for fire and rescue departments, health care facilities, medical foundation facilities, schools, hospitals, retirement homes, doctors' clinics, and other facilities totaling $27,190,100. FmHA also made industrial development grants in the state worth $1,050,000.

For its efforts the Community Programs section of FmHA in North Crolina was presented the Distinguished Service Award by the Secretary of Agriculture for "dynamic team leadership and superior service to rural communities in North Carolina through an aggressive and positive loan program in water, waste, and other essential community facilities."

Families served by the FmHA program in this State totaled 896,720.

WHO WILL REGULATE SEPTIC TANKS?

Inadequate and poorly functioning septic tanks are a significant water pollution source in NC. A battle continues to see where the authority to regulate them will reside.

With less than two months remaining before new state septic tank regulations are to go into effect, a battle is underway to have the regulations rest with local officials rather than with the state.

After nearly two years of struggle between developmental interest and environmentalists, the State Health Service Commission, adopted a compromise package of state septic tank regulations on December 15. The compromise package of regulations is scheduled to go into effect July 1.

The new regulations prescribe where septic tanks for residential areas can be located in relation to drinking water sources, other septic tanks, and shellfish breeding grounds. The regulations for the home system would be the responsibility of the Health Services Commission. They are to be enforced by the local health authorities.

For systems of over 3,000 gallon capacity, the authority for regulation resides with the Environmental Management Commission.

On April 29, Senator E. Craig Lawing, D-Mecklenberg, introduced a bill that would have the effect of overturning the Commission's actions and place the authority to set rules and regulations for county or city health boards, county commissioners or other local authorities.

In its May 12 meeting the Environmental Management Commission voiced its opposition to the Lawing measure. The Lawing bill could place the responsibility for regulations with one of several agencies at the local level.

NEW INSTITUTE REPORTS

The Distribution of Toxic Metals in Marine Ecosystems as a Result of Sewage Disposal and Natural Processes, *by Patrick J. Whaling, Richard T. Barber, and Jacqueline C. Paul,* Duke University Marine Laboratory, Beaufort, NC.

The role of sewage disposal and natural food chain processes in the distribution of toxic metals in marine ecosystems was examined in several small eastern North Carolina estuaries receiving different inputs. On the basis of metal distribution, estuaries receiving treated sewage effluent were clearly distinguishable from those not receiving this discharge. The magnitude and spatial extent of the elevated toxic metal distributions was very limited in both sediments and organisms. While some organisms did have elevated metal concentrations, the economically important oysters did not, nor did the marsh grass, *Spartina alterniflora*. The large and consistent variation in the amount of mercury and other trace metals discharged to the surrounding estuaries by various eastern N.C. towns was traced to variations in the metal content of inflow to the plant and not to operational variations between the plants. It was not possible to account for the origin of the metal variations in wastewaters of these small towns which have no known commercial activities using these metals. Experiments with fish and shrimp fed natural foods containing wide variations in toxic metal strongly suggest that ingestion is the process responsible for the observed species specific variation in metal concentrations between organisms inhabiting the same environment.

Nitrogen Recycling in the Chowan River, *by Donald W. Stanley and John E. Hobbie*, Department of Zoology, School of Agriculture and Life Sciences, North Carolina State University at Raleigh.

Highlights of the Summary and Conclusions

This project studied the utilization and recycling of nitrogen in the lower Chowan River, N.C. The Chowan River Basin drains approximately 12,600 km^2 in southeastern Virginia and northeastern N.C. One objective was to determine how significant recycling of the nitrogen nutrients is for algal growth in the river. The second objective was to determine what factors limit algal growth in the Chowan at different times of the year. A final objective was to generate information that could be used in models that would simulate biological processes (e.g., algal growth) in the river.

At the four stations sampled, nitrogen levels were typical of estuarine systems in this region. Nitrate concentrations were high in winter and low during the summer. This seasonal pattern results from a combination of high rates of input from land runoff in the winter and high rates of removal by rapidly growing algae in the summer. Ammonia concentrations had less seasonal variation and were usually lower than the nitrate concentrations. Particulate nitrogen levels remained high throughout the year, but even in the summer when algal biomass was highest over 50% of the particulate nitrogen was detrital. Although the data on dissolved organic nitrogen (DON) are incomplete, they do show that DON is the most abundant form of nitrogen in the river and that the concentrations decrease downriver. It is likely that uptake and remineralization of DON occurs in the river.

Diatoms were the most abundant algae during the winter, whereas dinoflagellate, blue-green and green algae made up most of the biomass during the summer. Measurements every other week during 1975 showed that algal biomass was much higher in summer than winter. Even so, the peak summer biomass was no higher than in other lakes and estuaries of the region. However, in 1975 blooms were not encountered in the lower Chowan like those which had occurred in the summers of 1972-1974.

Similarly, algal photosynthesis and nitrogen uptake rates were higher in summer than in winter and were typical for the region. Annual algal production in the river was around 100 g $C \cdot m^{-2}$, over 90% of which occurred between May and October. In nearby estuaries where rates were measured, the annual algal production was about the same as it was in the Chowan River during 1975.

River flow exerts a very strong control on algal biomass in the Chowan River during the winter. This was illustrated vividly in July 1975 when algal biomass declined rapidly during a short-lived period of high river flow. Biomass subsequently rose again to normal summer levels as soon as the river flow returned to normal.

Temperature and light fluctuations also cause part of the high seasonal variability in algal growth in the river, and both of these factors appear to limit algal growth at all times of the year. Light limitation is especially severe in winter because of high turbidity. Based on experiments, we conclude that temperature alone, in the absence of other limitations, is responsible for a 6 to 10-fold seasonal change in the rates of algal growth and nitrogen assimilation. Both carbon and nitrogen uptake are also limited by low light intensities in the Chowan. Even on the brightest summer days, algal growth is only about 20% as rapid as it would be if light penetrated all the way to the bottom of the river.

Nitrogen concentration, on the other hand, limits algal growth in the Chowan only during the summer. We base this conclusion on evidence from nitrogen enrichment experiments which showed that as long as ammonia or nitrate levels in the river remain higher than 50 $\mu g\ N \cdot liter^{-1}$, nitrogen should not be limiting to algal growth. Summer was the only period when dissolved inorganic nitrogen levels fell below this concentration.

Nitrate and ammonia uptake data show that ammonia is used preferentially, especially when ammonia concentrations are high. As a result, nitrate becomes important as a nitrogen nutrient only during the summer when ammonia levels are low.

During the summer factors such as light, temperature, and flow are more favorable to algal growth than at any other time of the year. Therefore, because the summertime input of "new" nitrogen from the watershed is so low (e.g., 400 kg $N \cdot day^{-1}$) any additional input should significantly increase the algal biomass.

The complete research reports indicated above are available free to N.C. residents and may be purchase by others for $4.00 each from the Water Resources Research Institute.

1975-1976 Institute Annual Report. The new Annual Report of the Water Resources Research Institute is available upon request. The 60-page publication contains brief descriptions of each research project and the overall program of the Institute. Some 53 pictures depict research activities and water scenes in North Carolina.

LAND APPLICATION OF WASTES WORKSHOPS

The WRRI will be co-sponsoring a Workshop on the Land Application of Wastes to be held at the Jane S. McKimmon Center for Extension and Continuing Education, NCSU, Raleigh, N.C. Two sessions are scheduled; one on June 1-2, the second on June 15-16. Highly qualified researchers/speakers will each present a portion of the Workshop. The program for the two-day Workshop is:

WEDNESDAY, June 1/15

8:00 *REGISTRATION*

8:30 *Welcome* - Dr. James M. Stewart, Associate Director, Water Resources Research Institute

8:45 *Clayton County Success Story* - Dr. Wade Nutter, U. of Ga.

10:00 *BREAK*

10:25 *Regulatory Agency Viewpoint* - Mr. Robert Carter, N.C. Department Natural and Economic Resources

10:50 *Viral and Public Health Aspects of Land Application* - Dr. Mark Sobsey, University of N. C., Chapel Hill

11:15 *Strategy of Land Application* - Dr. Frank Humenik, N.C. State University

12:15 *LUNCH* - Mr. Bob Bastian, U.S. Environmental Protection Agency

1:15 *Municipal Case Studies:*
Small Municipal Effluent - Dr. Michael Overcash, N.C. State University

2:45 *BREAK*

3:00 *Municipal Sludge Management* - Dr. Bobby Carlile, N.C. State University

4:15 *Discussion*

5:00 *ADJOURNMENT*

5:30 - 6:30 *Social*

THURSDAY, June 2/16

8:30 *Case Study - Vegetable Processing Waste* - Dr. Joseph Phillips, N.C. State University

9:30 *Discussion*

10:00 *BREAK*

10:30 *System Monitoring* - Dr. Wendell Gilliam, N.C. State University

11:15 *Economics* - Mr. Douglas A. Griffes, Project Engineer, Metcalf & Eddy, Inc./Sheaffer & Roland, Inc.

12:00 *LUNCH* - Professor Emeritus, David H. Howells, N.C. State University

12:45 *Animal Processing Waste*

Animal Waste - Dr. James Barker, N.C. State University

Poultry Processing Waste - Dr. Michael Overcash, N.C. State University

2:45 *BREAK*

3:00 *Natural and Synthetic Fiber Waste* - Dr. Larry King and Dr. Dhiraj Pal, N.C. State University

4:30 *Management* - Dr. Joseph Phillips, N.C. State University

5:00 *ADJOURNMENT*

For registration information call or write North Carolina State University Division of Continuing Education, Post Office Box 5125, Raleigh, North Carolina 27607, Attention: Kelly R. Crump (919) 737-2261.

In addition to this Workshop the WRRI has recently completed its second publication in the technology transfer series. The publication *Some Important Considerations for the Land Application of Wastewater* is currently in print and will be available at the June Workshop.

WATER QUALITY DOWN IN 76 - SAYS WILDLIFE FEDERATION

The National Wildlife Federation's annual rating of environmental quality, "EQ Index," for 1977 says the trend in water quality is down again despite continued progress in cleaning up water pollution caused by communitites and industries. One principal reason for the downslide, according to a report in *National Wildlife* magazine for February-March, is that the enormous load of pollutants from non-point sources was hardly touched at all.

Other adverse factors that were cited included: (a) the Kepone affair in Virginia, which raised public awareness of the dangers posed by poisonous pesticides and other toxic substances in U.S. waters to new heights; (b) a worsening of water contamination by PCBs (polychlorinated biphenyls), which have been detected at potentially harmful levels in many areas; (c) a faltering of EPA's construction grants program for local sewage treatment facilities, particularly in the most populated and polluted areas, due in part to failure to allocate funding for needed local projects; (d) EPA's apparent "kid gloves" treatment of municipal polluters, only half of whom will reach 1977 goals of the 1972 Federal Water Pollution Control Act Amendments even as 90 percent of industrial dischargers are expected to do, and (e) what appears to be a concerted attempt to slow down or ease up on federal clean water deadlines, including the National Commission on Water Quality's recommendation that "mid-course corrections" in the federal requirements include rollbacks in clean water deadlines.

.... *Water News*

SCS UNDERTAKES NATIONAL EROSION INVENTORY

SCS Administrator R. M. "Mel" Davis has announced that an inventory will commence next month to determine the extent of soil erosion throughout the country. Data from each of the 72,500 sample sites will be evaluated to estimate the amount of sediment produced by erosion and to provide information on soil and water conservation needs, prime farmland, potential cropland, water quality, and land use.

The most common types of water and wind erosion affecting farmland will be studied this year. Gully, streambank, roadside, and construction site erosion will be inventoried during 1978. Iowa State University, which helped design the study, will cooperate with the Soil Conservation Service in compiling the data. Fieldwork for the first part of the inventory will be completed by November 1, and state-by-state data will be available May 1, 1978. Sediment yield estimates will be completed in mid-1979.

RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act of 1976 (RCRA) brings solid waste disposal under Federal supervision. Prior to the Act solid waste was basically controlled by local governments with assistance from the state. Under the Act state regulations of solid waste disposal must meet minimum federal standards. Key objectives of the Act are:

(a) Federal technical and financial assistance for solid waste management plans,

(b) training programs,

(c) prohibition of open dumps,

(d) regulation of hazardous waste disposal,

(e) provision of guidelines for solid waste systems,

(f) promotion of research, development and demonstration programs, and

(g) promotion of resource recovery from solid waste materials, including energy production.

Hazardous solid waste disposal is a major concern of RCRA. What types of solid wastes are to be considered "Hazardous" must be defined by April, 1978. Continuous records or "trip tickets" may be required to follow the movement of hazardous wastes from their point of origin to final disposal. Storage, processing, and disposal site operators must obtain permits, and standards are to be developed for handling and disposing of hazardous wastes.

Human health dangers and environmental degradation resulting from solid waste disposal must be reduced to acceptable levels or eliminated under RCRA. Contamination of ground water by substances leaching from disposal sites is a primary concern.

Resource conservation and resource recovery recycling is to be encouraged by demonstration projects and studies of economic, organizational, and technical difficulties.

A Federal inventory of all solid waste disposal sites considered to be open dumps is to be completed by 1978. Open dumping is prohibited; however, if a State elects to develop its own solid waste management plan to meet Federal requirements, a five-year period is provided to close down open dumps or convert them to acceptable disposal sites.

Financial aid for rural communities is to be made available to help them meet the new requirements. This is the only provision in RCRA for Federal aid to build disposal facilities (other than demonstration facilities).

Enforcement of RCRA relies on citizen action to bring suits against violators. However, federal enforcement can be undertaken with hazardous waste violators. Public participation in developing all aspects of the new requirements is required.

EPA is to develop and publish guidelines for solid waste management within one year, indicating the level of performance that can be achieved by various waste disposal practices; and within two years to describe acceptable disposal practices that will protect human health and safety, and water and air quality, including aesthetic considerations. Minimum standards for solid waste disposal are to be provided to the states within the two-year period.

For more information on the Resource Conservation and Recovery Act contact the U.S. Environmental Protection Agency, Solid Waste Branch, Region IV, 345 Courtland Street, N.E., Atlanta, Georgia 30308

Copies of this summary are available upon request.

KUENZLER REVIEWS CHANNELIZATION RESEARCH BEFORE COMMISSION

Dr. Edward Kuenzler, Department of Environmental Sciences and Engineering, presented a report on an Institute supported project, *Effects of Stream Channelization on Water Quality in Natural and Channelized Streams*, at the May 12 meeting of the Division of Environmental Management. The following is a brief summary of his remarks:

Landowners in the coastal region of North Carolina are often troubled by poor drainage of bottomlands which border local streams. In their natural condition these streams are shallow with gentle slopes, the higher flows during winter and spring result in flooding along the stream and the long-term development of floodplain swamp forest vegetation. Farmers have received some relief from flooding by construction of canals which straighten, widen, and deepen the stream and thereby result in less frequent and shorter periods of flooding. Such "channelization" by both public and private groups have destroyed hundreds of miles of natural streams in eastern North Carolina in the past 20 years.

A number of impacts have been reported or may be expected as a result of extensive channelization. Less extensive flooding probably causes changes in the kinds of trees which dominate the bordering swamps; cypress and tupelo gum are two valuable timber trees which seem particularly vulnerable. Bottomland furbearers, game, and waterfowl, such as woodducks, will be largely lost. There is evidence of marked reductions in abundance of sports fish, and habitat for spawning and growth of herring, alwives, and shad is destroyed. A doctoral study now being completed in the Department of Environmental Sciences and Engineering indicates that a variety of crustaceans, insects, and earthworms quickly colonizes the swamp floor each winter when it floods. These animals feed upon decaying leaves which fell during the fall and in turn are undoubtedly an important source of food for resident and transient fishes. Thus the capacity of bottomland swamps to provide their traditional harvests of timber, furs, game, and important fish species is reduced by channelization.

Recent studies of natural and channelized swamp streams supported by the Water Resources Research Institute indicate that the quality of the water itself is also changed. Channelized streams are more turbid than natural streams, particularly after heavy rains, because the higher water velocities in channels keep silts and clays in upland runoff from settling as they would in a swamp forest. Fertilizer elements are substantially more concentrated in channelized stream waters. Nitrate leached from nearby farms may be ten times higher in channelized streams on the average over the year, and nitrate and phosphate are relatively higher still in channelized streams during periods of rapid runoff. Transport of additional silt downstream to our estuaries adds to the present load tending to smother valuable oyster beds, and additional nutrients in the lower reaches of our coastal rivers hold the potential for noxious algal blooms such as have occurred in the Chowan River. Dissolved oxygen levels are lower during late summer in natural swamp streams and fish may show signs of oxygen stress; evidently, however, they are adapted to endure such stress and maintain their abundance in spite of occasional low oxygen. These studies have also shown that the water in channelized streams contains higher levels of dissolved salts, but less color, less organic carbon, less iron, and less manganese than natural streams; the ecological meaning of these differences is not yet clear. It is recommended that water quality changes be considered along with changes to the forests, the wildlife, and the fishes in assessing the economic and social impacts of further extensive channelization of our coastal streams.

FY 1978 INSTITUTE RESEARCH PROGRAM

The Office of Water Research and Technology, U.S. Department of the Interior, has approved $150,814 in matching grants to the Water Resources Research Institute for four new projects to commence on October 1, 1977. This will be matched by an equal amount of state funds. Several new Annual Allotment projects will also be initiated in FY 78. All Institute projects for the coming year are listed below (asterisk indicates new project to be initiated subject to availability of funds):

WATER RESOURCE PLANNING

State Water Resource Planning and Policy
- Dr. Maynard M. Hufschmidt, Dept. of City & Regional Planning, UNC-Chapel Hill

Use of Fluvial Processes to Minimize Adverse Effects of Stream Channelization
- Dr. N. R. Nunnally, Dept. of Geography and Earth Sciences, UNC-Charlotte

Effects of Stream Channelization on Water Quality of Flood Plain Swamps in Eastern North Carolina
- Dr. E. J. Kuenzler, Dept. of Env. Sciences & Engr., UNC-Chapel Hill

Effects of Stream Channelization on Bottomland and Swamp Forest Ecosystems
- Dr. T. E. Maki, School of Forest Resources, NCSU

* *Legal Aspects of Flood Plain Management*
- Prof. Milton S. Heath, Jr., and Prof. William A. Campbell, Institute of Government, UNC-Chapel Hill

* *Experimental Studies on Energetics and Nutrient Cycling in Floodplain Swamp Ecosystems*
- Dr. E. J. Kuenzler, Dept. of Env. Sciences and Engr., UNC-Chapel Hill

* *Evaluation of Public Participation in "208" Areawide Waste Treatment Programs*
- Dr. D. R. Godschalk, City & Regional Planning, UNC-CH

Water Resource Consequences of Second Home and Recreational Land Development
- Dr. Shirley Weiss, City and Regional Planning, UNC-CH

* *Economic and Technical Evaluations of Animal Waste Management Systems Which Comply with Water Pollution Regulations*
- Prof. J. C. Williamson, Jr., Economics and Business, NCSU
  Dr. M. R. Overcash, Dept. Bio. and Agr. Engr., NCSU
  Dr. Philip Westerman, Dept. Bio. and Agr. Engr., NCSU

Implementation of the SSARR and NCSSARR Streamflow Simulation System
- Dr. E. H. Wiser, Dept. of Bio. and Agr. Engr., NCSU

Water Management in Coastal North Carolina
- Dr. D. A. Okun, Dept. of Env. Sciences & Engr., UNC-CH
  Dr. Charles R. O'Melia, Dept. of Env. Sciences & Engr., UNC-CH
  Dr. J. K. Sherwani, Dept. of Env. Sciences & Engr., UNC-CH
  Dr. Larry King, Dept. Soil Science, NCSU
  Prof. W. J. Wicker, Institute of Government, UNC-CH
  Prof. Milton S. Heath, Jr., Institute of Government, UNC-CH

WATER QUALITY MANAGEMENT

Performance Objectives for Stormwater Management in Urban Areas
- Dr. H. R. Malcom, Dept. of Civil Engr., NCSU

Water Quality Ramifications of Converting Forest to Intensive Agriculture
(Coop. with Sea Grant Program and NCDNER)
- Dr. R. T. Barber and Dr. W. Kirby-Smith, Duke University Marine Laboratory

Development of Nutrient Models for the Pamlico River Estuary
- Dr. D. T. Lauria, Dr. C. R. O'Melia, and Dr. E. J. Kuenzler, Dept. of Env. Sciences & Engr., UNC-CH

Effects of Large-Scale Agricultural Land Development of Water Resources
- Dr. R. W. Skaggs, Dept. of Bio. and Agr. Engr., NCSU
  Dr. J. W. Gilliam, Dept. of Soil Science, NCSU
  Dr. T. J. Sheets, Dept. of Entomology, NCSU

Land Application of Industrial Wastes
- Dr. Michael Overcash and Dr. Philip Westerman, Dept. of Bio. and Agr. Engr., NCSU

Wastewater Spray Transport in Land Application
- Dr. Parker C. Reist, Dept. of Env. Sciences & Engr., UNC-CH

* *Alternative Methods of On-Site Disposal of Domestic Wastewater in the Piedmont*
- Dr. L. King and Dr. L. Stewart, Dept. of Soil Science, NCSU

* *Stream Monitoring for Heavy Metals by Analysis of Benthic Macroinvertebrates*
- Dr. C. M. Weiss, Dept. of Env. Sciences & Engr., NCSU
  Dr. R. P. Maas, Dept. of Chemistry, UNC-Asheville

* *Groundwater Quality Modeling for Water Resource Management*
- Dr. J. K. Sherwani, Dept. of Env. Sciences & Engr., UNC-CH

* *Nitrogen Cycling in Alluvial Swamp Forests*
- Dr. M. M. Brinson, Dept. of Biology, ECU

* *A Study of Red-Sore Disease and Aeromonas hydrophila in Selected Reservoirs and Estuaries in North Carolina*
- Dr. Gerald Esch, Dept. of Biology, Wake Forest U.

Survival and Fate of Enteric Viruses in Soil Wastewater Treatment Systems
- Dr. M. D. Sobsey, Dept. of Env. Sciences & Engr., UNC-CH

Pollution from Rural Land Runoff (EPA Project)
- Dr. F. J. Humenik, Dept. of Bio. & Agr. Engr. & Agr. Exp. Station, NCSU
  Dr. D. W. Hayne, Institute of Statistics, NCSU
  Dr. J. W. Gilliam, Dept. of Soil Science & Agr. Exp. Station, NCSU
  Dr. A. M. Witherspoon, Dept. of Botany & Agr. Exp. Station, NCSU
  Dr. W. S. Galler, Dept. of Civil Engr., NCSU

Effective Stormwater Runoff Control Strategies for the Protection of Dissolved Oxygen in Streams
- Dr. David H. Moreau, Dept. of City and Reg. Planning, UNC-CH

REGIONAL TECHNOLOGY TRANSFER

Demonstration of Selected Techniques for Technology Transfer in the South Atlantic Gulf Region
- Dr. James M. Stewart, Water Resources Research Institute, of the UNC

WATER RESOURCE DATA AND INFORMATION

* *Hydrologic Modeling System*
- Dr. E. H. Wiser, Dept. Bio. & Agr. Engr., NCSU

Hydrologic Information Storage and Retrieval System
- Dr. E. H. Wiser, Dept. of Bio. and Agr. Engr., and Exp. Station, NCSU

Southern Water Resources Scientific Information Center
- Mr. William C. Lowe, D. H. Hill Library, NCSU
  Dr. James M. Stewart, Water Resources Research Institute of the UNC

KEY ISSUES RAISED AT 208 WORKSHOP

On May 4, 1977, a workshop on North Carolina's 208 problems was held. The objective of the workshop was to identify 208 program requirements which present significant technical challenges to the State and to determine whether these requirements can be met within the limitations of current capabilities. The workshop format began with brief presentations by 208 program participants. Each participant discussed his group's accomplishments to date, projected accomplishments over the next two years with the present level of technology, and problem areas where assistance is needed.

Mr. Ken Bartel, Chief of Water Quality Planning for Pennsylvania, described their Comprehensive Water Quality Management Program (COWAMP). He also reacted to points raised by North Carolina speakers and brought the Pennsylvania perspective.

During the discussion period the following preliminary conclusions were expressed:

1. Successful completion of 208 studies seems to require the understanding of many complex cause and effect relationships. How can the plans be completed when it is clear these relationships will not be understood by November 1978?
2. How can Best Management Practices (BMP) be enforced until Point 1 above is resolved?
3. Since 208 is an interdisciplinary planning process, how can we develop a common language and the appropriate standards, especially to confront the requirement for a continuing planning process?
4. How can we arrive at acceptable definitions of the desired levels of water quality established by PL 92-500? What are "fishable and swimmable waters"?
5. What field data collection programs are called for by the 208 requirements?
6. How can 208 planning be related to other environmental management programs?
7. How can equity be maintained in the establishment of BMP's especially at the level of the individual or small enterprise?
8. A great deal of work is needed to improve approaches to the public participation process. How can we overcome the barriers to achieving this?

Detailed proceedings containing a list of other problem from the workshop will be disseminated when they are prepared. It is expected that follow-up workshops and seminars will be conducted to take advantage of the information gained at this initial problem assessment workshop.

WETLAND PROTECTION SYMPOSIUM

National leaders in wetlands protection law will discuss needed changes in policies at a National Wetland Protection Symposium scheduled for June 6-8, 1977 at the Sheraton Inn in Reston, Virginia. The Environmental Law Institute of Washington, D.C. will conduct the symposium in cooperation with the U.S. Fish and Wildlife Service.

POSITIONS AVAILABLE

Water Resources Management Specialist with the Water Resources Center, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln. This person will participate in all aspects of the Center's programs. Contact: Dr. Millard W. Hall, Director; Water Resources Center, 310 Agricultural Hall; University of Nebraska; Lincoln, Nebraska 68583. Telephone (402) 472-3305.

The Conservation Foundation is seeking an individual with a bachelor's degree to work in the field of hydrology for three months, beginning June 1, 1977. The salary is $150/week for a period of 12 weeks, less standard deductions. Work on an advance degree in hydrology is desirable. Contact: Dr. Jeffery Zinn, The Conservation Foundation, 1717 Massachusetts Avenue, N.W.; Washington, D.C. 20036. Telephone (202) 797-4300.

Assistant or Associate Professor and Extension Specialist Resource Management and Policy. Interested persons should send a brief professional resume to: Dr. Raymond D. Vlasin, Chairman; Department of Resource Development; Michigan State University; East Lansing, Michigan 48824. Telephone (517) 355-3421.

The Department of Environmental Systems Engineering at Clemson is now actively searching for a person to fill the position of Department Head. The Department has well-established graduate programs leading to the M.E., M.S., and Ph.D., as well as programs of active research and public service. For details contact: Linvil G. Rich, Chairman of the Search Committee; Clemson University; Clemson, South Carolina 29631. Telephone (803)656-3276.

The International Science and Education Council has endorsed recruiting among land-grant universities for two-year assignments to Saudi Arabia. Positions available include farm production economist, range management specialist, and data processing specialist. For details, call 919:737-3201, NCSU, Office of International Programs.

For the academic year beginning September 1977, an economist with the rank of at least associate professor (or equivalent) is being sought for the Scientific Advisor position in the Office of the Assistant Secretary of the Army (Civil Works). Interested applicants should submit a completed Standard Form 171 (Personal Qualifications Statement) to: Mr. Charles R. Ford, Acting Assistant Secretary of the Army (Civil Works); Room 2E570, The Pentagon, Washington, D.C. 20310.

WATER RESOURCE CONDITIONS IN NORTH CAROLINA

Rains on April 4th and 5th caused minor flooding along many streams in the Mountain and northwestern Piedmont regions. The flooding caused considerable property damages in several low-lying areas of Jackson, Buncombe, and Madison counties. The recurrence intervals for stream peaks during the flooding ranged from about 2 to 40 years.

Monthly-mean flows at USGS index gaging stations ranged from one-half of the long-term normal in the Neuse River near Clayton to over 1-1/2 times normal for the French Broad River at Asheville. By April 30, however, flows across the State had receded to below normal conditions, and mean-daily discharges on the 30th ranged from slightly below normal in the Mountains to only about 1/5 normal flow in some eastern streams.

Ground-water levels rose in the Mountains and Piedmont and declined in most of the Coastal Plain region. Levels were above long-term averages for April in the Piedmont and Mountains and near normal in the Coastal Plain region.

WATER RESOURCES LEGISLATION IN NORTH CAROLINA

<u>BILLS INTRODUCED</u>

<u>Senate</u>

S 577 County water, sewer districts, bonds

"To permit the creation of county water and sewer districts, the issuance of the bonds and notes of such districts, and the levy of taxes within such districts." Adds new Art. 6 to GS Ch. 162A (Water and sewer systems) with general effect indicated in title. Provisions include 1) board of county commissioners by resolution may create county water and sewer district upon receipt of petition from 51% of voters in district, after public hearing (preceded by three published and posted notices, with first publication at least 20 days before hearing) and upon finding of need, benefit to residents, and economic feasibility without excessive tax; 2) district may not include land within town limits unless town governing board agrees; 3) resolution creating district and a notice (form prescribed) to be published once weekly for two straight weeks in newspaper where hearing notice was published; 4) requires any action challenging creation of district within 30 days of first publication; 5) specifies that inhabitants of district constitute body corporate and politic with powers and characteristics thereof; 6) board of commissioners of county where district is located is governing body of district; and 7) district is authorized to issue bonds and levy taxes for sewer or water systems.

S 589 Sewage disposal rules jurisdiction

"To amend Article 13, Chapter 130, North Carolina General Statutes, relating to water and sewer sanitation." Rewrites GS 130-160 to transfer exclusive regulatory power over sanitary sewage disposal systems of 3,000 gallon or less design capacity not discharging effluent directly to surface waters from Comm'n for Health Services, Dep't of Human Resources to local boards of health. Directs Comm'n to provide boards with relevant technical information.

<u>House</u>

H 891 Environmental comm'n rules filing

"To provide that certain rules of the Environmental Management Commission shall be filed with the Attorney General as provided by Chapter 150A of the General Statutes." Amends GS 143-215.4 (b) (comm'n procedures generally) and 143-215.56 (b) floodway regulations to be filed with Attorney General (now Sec'y of State) in compliance with the Administrative procedure Act, GS Ch. 150A.

H 894 Dredge registration repeal (Iden. S 476)

"To repeal G.S. 146-6.2 requiring registration of earth-moving equipment in the coastal area." As title indicates.

H 895 Watershed debt term increase (Iden. S 475)

"To amend G.S. 239-28 to increase the possible term of years for watershed district debts." Amends cited section to permit watershed district debts to be contracted for 40 (now 20) year periods. Effective July 1, 1977.

H 897 Soil and water appointment dates (Iden. S 481)

"To amend G.S. 239-7 to change pertinent dates in the appointment of soil and water conservations districts' supervisors." Amends indicated section to provide that appointed members of district board of supervisors to be recommended by elected

members by Oct. 31 (now, Dec. 31), to be appointed by November meeting (now, January), and to take office in December (now, January). Reduces terms of present appointed members to conform to change. Effective July 1, 1977.

H 899 New River land purchase increase (iden. S 480)

"To increase the amount of land the Department of Natural and Economic Resources may acquire in fee simple along the New River." Amends GS 113A-35.1 to raise from 400 to 550 acres amount of land Dep't of Natural and Economic Resources can acquire along New River. Provides land received by donation not to count in 550 acre limit.

H 907 Industrial waste study commission

"To create a commission to study the disposal of industrial wastes in this state, to ascertain the problems associated with such wastes, and to make recommendations for necessary legislation to the 1979 session of the General Assembly." As title indicates; comm'n to consist of five representatives appointed Speaker and five senators appointed by Lt. Governor; study to include whether there should be publicly financed facilities for industrial waste disposal. Report to be made to presiding officers by Jan. 15, 1979; comm'n to terminate on filing.

H 980 Land Policy Act amendments (Iden. S 565)
H 1007

"To amend Article 9 of G.S. Chapter 113A so as to take account of actions by the State Land Policy Council pursuant to said Article and to carry out recommendations of that Council." Amends Art. 9, GS Gh. 113A as follows: (1) reorganizes Land Policy Council as Land Resources Comm'n (LRC) within Dept't of Natural and Economic Resources consisting of 32 members: eight dep't heads (Administration, Agriculture, Cultural Resources, Commerce, Natural and Economic Resources, Revenue, Human Resources, Transportation), six members each from four district committees. Three district committees consist of elected local officials residing in district and selected by Governor from lists recommended by League of Municipalities and Ass'n of County Comm'rs. Fourth district committee consists of six members of Coastal Resources Comm'n designated by it. (2) Creates Advisory Council on Land Resources to advise LRC consisting of 24 members appointed by Governor, including citizens with relevant occupational interests and elected local officials. (3) District committees of LRC to review and certify local land classification plans. (Plans already approved by Coastal Resources Comm'n automatically certified.) Full LRC to develop instructions concerning preparation of local land classification plans and systems for monitoring large-scale developments and new communities and for reviewing proposed key facilities; and to continue to perform state-level functions of former Land Policy Council, such as revising the state land classification system and state land policy. (4) By July 1, 1980, requires every county to develop land classification plan classifying all its lands into five classes (developed, transitional, community, rural, or conservation) set forth in 1977 State Land Policy Report approved by Governor. Cities may do same or allow counties to prepare plans for them. (5) By Nov. 1, 1977, requires each county to notify LRC if it intends to prepare plans. LRC, through district committees, authorized (but not required) to classify these lands if county fails or declines to do so. (7) Plans reviewed by LRC district committee and certified if internally consistent, compatible with plans of abutting counties, and in accord with LRC instructions. Certified plans must be taken into account by state agencies in locating state projects, in making construction loans or grants to local gov'ts, and state licensing of actions that involve large-scale developments or new communities. (8) LRC is to monitor large-scale developments and new communities; review proposed key facilities; and study policies on areas of environmental concern, and recommend legislation thereon to 1979 General Assembly.

H 1087 Animal Waste Study Comm'n created

"To create a commission to study the disposal of domestic animal waste in this state, to ascertain the problems associated with such waste, and to make recommendations for necessary legislation to the 1979 session of the General Assembly." Creates twelve-member Domestic Animal Waste Study Comm'n to (1) assess current domestic animal waste disposal practices; (2) study impact as pollutant of flowing streams and whether waste creates public nuisances; and (3) recommend legislation to prevent future pollution and public nuisances. Defines domestic animal as cattle, swine, horses, sheep, goats, turkeys, and chickens. Comm'n members to be selected as follows: three representatives appointed by Speaker, three senators appointed by Lt. Governor, one domestic animal producer appointed by Governor, one non-government environmentalist appointed by Governor, Sec'y of Natural and Economic Resources, Sec'y of Human Resources, Dean of School of Agriculture at NCSU, and Comm'r of Agriculture. Expenses of Comm'n to be paid from Contingency and Emergency Fund. Comm'n to report to General Assembly by Jan. 15, 1979.

H 1119 Dep't Natural Resources, Community Development

"To reorganize the Department of Natural and Economic Resources as the Department of Natural Resources and Community Development; to create a North Carolina Employment and Training Council in the Department of Natural Resources and Community Development; and to make necessary conforming changes."

H 1117 Coastal Management Act amended

"To amend Article 7 of G.S. Chapter 113A so as to restrict the Coastal Resource Commission's authority to designate areas of environmental concern, to provide for more effective permit coordination and to strengthen the role of local governments under the Coastal Area Management Act."

H 1179 Clean water bond act

"To authorize the issuance of two hundred thirty million dollars in bonds of the state to provide funds for environmental improvement through grants to units of government for construction and improvement of wastewater treatment works, wastewater collection systems and water supply systems."

WATER RESOURCES LEGISLATION IN THE CONGRESS

BILLS INTRODUCED

Senate

S 1187 *"To provide a comprehensive system of liability and compensation for oil spill damage and removal costs."*

S 1206 *"To provide temporary authority to the Administrator of the Small Business Administration to facilitate water conservation practices and emergency actions to mitigate the impacts of the 1976-77 drought."*

House

H.R. 6335 *"To provide that no contracts may be entered into by the Bureau of Reclamation for water supply for purposes of irrigation without prior public notice and opportunity for hearing."*

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.)

Abbreviations used throughout as follows:

ARS	- Agricultural Res. Service
ASCE	- American Society of Civil Engineers
CEQ	- Council on Environmental Quality
DEM	- Division of Environmental Management
EDS	- Environmental Data Service
EMC	- Environmental Management Comm.
EPA	- Environmental Protection Agency
ERC	- Engineering Research Center
ERS	- Economic Research Service
GAO	- General Accounting Office
IHD	- International Hydrological Decade
IWR	- Institute for Water Resources
NAS	- National Academy of Sciences
NCDNER	- N.C. Dept. of Natural & Economic Resources
NERC	- National Environmental Research Center
NOAA	- National Oceanic & Atmospheric Adm.
NPS	- National Park Service
NSF	- National Science Foundation
NTIS	- National Technical Information Service
NWC	- National Water Commission
OWP	- Office of Water Programs
OWRT	- Office of Water Research & Technology
RTI	- Research Triangle Institute
SCS	- Soil Conservation Service
TVA	- Tennessee Valley Authority
UCOWR	- Universities Council on Water Resources
UNC-SG	- University of N.C. Sea Grant
USDA	- U.S. Department of Agriculture
USDC	- U.S. Department of Commerce
USDI	- U.S. Department of the Interior
USGPO	- U.S. Government Printing Office
USGS	- U.S. Geological Survey
WPC	- Water Pollution Control
WQS	- Water Quality Standards
WRC	- Water Resources Council
WRI	- Water Resources Institute
WRRC	- Water Resources Research Center
WRRI	- Water Resources Research Institute
WRSIC	- Water Resources Scientific Information Center

Water Resources Planning

"The Commonwealth's Land Use - Proceedings of a Conference," (#727), 2/77, ed. by J. Paxton Marshall, *et al*, WRRC, VPI, Blacksburg, VA 24061.

"Connecticut River Water Resource Decision-Making," (#83), 7/76, by E. R. Kaynor, WRRC, U. of MA, Amherst, MA 01002.

"Economic Assessment of Waste Water Aquaculture Treatment Systems," (EPA-600/2-76-293), 12/76, by U.B. Henderson, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Environmental Impact Statements in Water Resources Planning and Decision-Making," (C-5222 #4213 2), 12/76, by M. D. Bradley, *et al*, U. of AZ, College of Earth Sciences, Dept. of Hydrology & Water Resources, Tucson, AZ 85717.

"An Investigation of the Nearshore Region of Lake Ontario IFYGL," (EPA-600/3-76-115), 12/76, by Great Lakes Lab., State U. College, Buffalo, NY, avail. from NTIS, Springfield, VA 22151.

"Irrigation Management Affecting Quality and Quantity of Return Flow," (EPA-600/2-76-226), 9/76, by L. S. Willardson, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Economic Incentives for Land Use Control," (EPA-600/5-77-001), 2/77, by F. H. Rueter, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Storm Water Management Model: Level I - Comparative Evaluation of Storage-Treatment and Other Management Practices," (EPA-600/2-77-083), 4/77, by J. P. Heaney, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Monroe Reservoir, Indiana - Parts I & II," (TR #87), 3/77, by K. M. Bradbury, *et al*, WRRC, Purdue U., West Lafayette, IN 47906.

"The Citizen's Guide to North Carolina's Shifting Inlets," (UNC-SG-77-08), 3/77, by S. Baker, UNC-SG, 1235 Burlington Lab., NCSU, Raleigh, NC 27607.

"Operating Policy Adaptations for a Reservoir System," (TR #79), 9/76, by G. H. Toebes, *et al*, WRRC, Purdue U., West Lafayette, IN 47907.

"Public Participation in Water Resource Development - A Bibliography," (OWRT/WRSIC 76-205), 8/76, by WRSIC, OWRT, USDI, Wash., DC 20240.

"Effects of Stream Channel Improvements on Downstream Floods," (#102), 1/77, by J. H. Huang, *et al*, WRRI, U. of KY, Lexington, KY 40506.

"Short Course Proceedings Applications of Stormwater Management Models - 1976," (EPA-600/2-77-065), 3/77, ed. by F. A. DiGiano, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Optimization Model for the Design of Urban Flood-Control Systems," (CRWR-141), 11/76, by D. L. Lott, Center for Res. in Water Resources, U. of TX, Austin, TX 78712.

"Systematic Development of Methodologies in Planning Urban Water Resources for Medium Size Communities - Application of Linear Systems Analysis to Ground Water Evaluation Studies," (TR #91), 2/77, by C. T. Bathala, *et al*, WRRC, Purdue U., West Lafayette, IN 47907.

Water Quality Management

"Fruit Cannery Waste Activated Sludge as a Cattle Feed Ingredient," (EPA-600/2-76-253), 9/76, by L. A. Esvelt, for EPA, avail. from NTIS, Springfield, VA 22151.

"Extraction of Chemical Pollutants From Industrial Wastewaters with Volatile Solvents," (EPA-600/2-76-200), 12/76, by J. P. Earhart, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Elimination of Pollution From Cottage Cheese Whey By Drying and Utilization," (EPA-600/2-76-254), 9/76, by S. Boxer, for EPA, avail. from NTIS, Springfield, VA 22151.

"Toxicity of DDT Food and Water Exposure to Fathead Minnows," (EPA-600/3-76-114), 12/76 by A. W. Jarvinen, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"The Swirl Concentrator for Erosion Runoff Treatment," (EPA-600/2-76-271), 12/76, by R. H. Sullivan, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Proceedings Seventh National Symposium on Food Processing Wastes," (EPA-600/2-76-304), for EPA, avail. from NTIS, Springfield, VA 22151.

"Proceedings of the Sixth National Symposium on Food Processing Wastes," (EPA-600/2-76-224), for EPA, avail. from NTIS, Springfield, VA 22151.

"On-Line Measurement of the Infrared Spectra of Gas Chromatographic Effluents," (EPA-600/4-76-061), 12/76, by P. R. Griffiths, for EPA, avail. from NTIS, Springfield, VA 22151.

"Hazardous Wastes: A Risk-Benefit Framework Applied to Cadmium and Asbestos," (EPA-600/5-77-002), 2/77, by A. P. Carlan, for EPA, avail. from NTIS, Springfield, VA 22151.

"Effects of Exposure to Heavy Metals on Selected Fresh Water Fish Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species," (EPA-600/3-76-105), 10/76, by S. Sauter, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Herbicide Report - Chemistry and Analysis Environmental Effects Agricultural and Other Applied Uses," (EPA-SAB-74-001), 5/74, by Hazardous Materials Advisory Committee, for EOA, avail. from NTIS, Springfield, VA 22151.

"Dialysis for Concentration and Removal of Industrial Wastes," (EPA-600/2-76-223), 10/76, by J. K. Smith, *et al*; for EPA, avail. from NTIS, Springfield, VA 22151.

"Design Parameters for the Land Application of Dairy Manure," (EPA-600/2-76-187), 10/76, by S. D. Klausner, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Land Application of Sewage Sludge Under Adverse Conditions," (#53), by Pollution Control Div. Public Works Dept., The Regional Municipality of Niagara, avail. from Training and Technology Transfer Div. (Water), Env. Protection Serv., Environment Canada, Ottawa, Ontario K1A OH3.

The following publications on Land Treatement of Municipal Wastewater Effluents are available from EPA, 345 Courtland St., NE, Atlanta, GA 30308:

"Land Treatment of Municipal Wastewater Effluents - Case Histories," 1/76.

"Land Treatment of Municipal Wastewater Effluents - Design Factors I," 1/76.

"Land Treatment of Municipal Wastewater Effluents - Design Factors II," 1/76.

"Chemical Dynamics of A Confined Limestone Aquifer," (84), 3/77, by V. LeFebre, WRRI, New Mexico St. U., Box 3167, Las Cruces, NM 88003.

"Effects of Log Handling and Storage on Water Quality," (EPA-600/2-76-262), 9/76, by G. S. Schuytema, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Manure Harvesting Practices: Effects on Waste Characteristics and Runoff," (EPA-600/2-76-292), 12/76, by R. W. Hansen, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Continuing Need for Improved Operation and Maintenance of Municipal Waste Treatment Plants, (Report to the Congress)," (CED-77-46), 4/77, by Comptroller General of US, Wash., DC 20548.

"Demonstration of Aeration Systems for Poultry Wastes," (EPA-600/2-76-186), 10/76, by J. H. Martin, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Frequency of Organic Compounds Identified in Water," (EPA-600/4-76-062), 12/76, by W. M. Shackleford, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Papermill Wastewater Treatment by Microstraining," (EPA-600/2-76-252), 9/76, by F. R. Bliss, for EPA, avail. from NTIS, Springfield, VA 22151.

"Water Reuse in a Paper Reprocessing Plant," (EPA-600/2-76-232), 10/76, by L. E. Streebin, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Water Pollution - Causes and Cures," 76, by S. D. Mortin, avail. from Mimir Publishers, Inc., Madison, Wisconsin 53705, Price - $9.95.

"University of California Saline Water Conversion Research," (#63), 7/76, by Sea Water Conversion Lab., U. of CA, Berkeley, CA 94704.

"Lethal Effects of Suspended Sediments on Estuarine Fish," (TP 76-20), 12/76, by J. M. O'Connor, *et al*, for U.S. Army Corps of Eng., avail. from NTIS, Springfield, VA 22151.

"Automated Treatment and Recycle of Swine Feedlot Wastewater," (EPA-600/2-76-240), 9/76, by E. P. Taiganides, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons," (Bul. #100), 3/77, by T. G. Ciravolo, *et al*, WRRC, VPI & St. U., Blacksburg, VA 24061.

"Trichlorofluoromethane in Groundwater - A Possible Indicator of Ground-Water Age," (TR #90), 1/77, by J. M. Hayes, *et al*, WRRC, Purdue U., West Lafayette, IN 47907.

"Evaluation and Upgrading of a Multi-Stage Trickling Filter Facility," (EPA-600/2-76-195), 12/76, by J. H. Koon, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Analytical Variability of Five Wastewater Parameters Petroleum Refining Industry," (EPA-600/2-76-234), 9/76, by L. H. Myers, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

"Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods," (EPA-600/2-76-231), 9/76, by J. T. White, *et al*, for EPA, avail. from NTIS, Springfield, VA 22151.

Water Quantity Management

"Overlay of Large, Placed Quarrystone and Boulders to Increase Riprap Stability," (TP 76-19), 12/76, by B. L. McCartney, *et al*, for U.S. Army Corps of Engr., avail. from NTIS, Springfield, VA 22151.

"Urban Water Runoff & Water Quality Control," 12/76, by J. T. Wildrick, *et al*, WRRC, VPI & St. U., 617, N. Main St., Blacksburg, VA 24061.

"Conventional Urbanization and Its Effect on Storm Runoff," 8/76, by M. L. Terstriep, *et al*, IL State Water Survey, Urbana, IL 61801.

"Characterization of Urban Runoff in the Maryland Suburbs of Washington, DC," (TR #38), 4/76, by R. M. Ragan, *et al*, WRRC, U. of Maryland, College Park, MD 20742.

Miscellaneous

"Proceedings of the International Water Resources Educational Workshop," (#1), 7/76, by WRRC, U. of HI, Honolulu, HI 96722.

"To Eel Or Not To Eel: An Economic Analysis of a Part-time Eel Fishing Enterprise," (UNC-SG-77-02), 2/77, by L. Abbas, UNC-SG, 1235 Burlington Lab, NCSU, Raleigh, NC 27607.

"Dissolved Oxygen, Temperature, Survival of Young at Fish Spawning Sites," (EPA-600/3-76-113), 12/76, by John J. Perterka, for EPA, avail. from NTIS, Springfield, VA 22151.

"ORD Publications Summary," (EPA-600/9-76-013d), 12/76, by Tech. Info. Operations Staff, EPA, avail. from NTIS, Springfield, VA 22151, Price - $3.00.

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