NEWS
WATER RESOURCES RESEARCH INSTITUTE
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CONTENTS

WATER CONSERVATION

James E. Harrington, Secretary, Department of Natural & Economic Resources, opened the North Carolina Conference on Water Conservation at the Royal Villa in Raleigh on September 3 & 4 with a series of remarks that will be of genuine interest to North Carolinians.

"This conference," he said, "is about Conservation. Water conservation, to be sure, as the title says, but more than that. For our goal has to include saving energy, saving construction capital, saving operating costs, saving land, and to a very real extent, saving the future of our towns and cities, and our state's economy.

"Here in Raleigh, where the local officials have been running all out just to stay ahead of the curve, we have a good example. Raleigh's sewage treatment system now costs the city some $42,000 a month for total operations. Raleigh's badly needed new sewage plant will begin operation within the next few months--and just in time. But the cost of operating that new system--for <u>power</u> costs alone, will be $50,000 a month. Just the power bill will be greater than the total cost of the old system. Think what that means in terms of electric power, of water rates.

"And now let's take a look at some other headlines.

"'Reservoir Drying, Pond Tapped' - 'Industries Close to Save Water' - 'Drought May Close University' -'Army Will Haul Water to Drought-stricken Troy' - 'North Carolina Cities are Bone Dry'.

"Those are not headlines of the future. They are headlines from newspapers published within the last 10 years when dry weather hit our state.

"During the rainy season, or when you drive across the multitude of rivers and streams with which our state is blessed, it may be difficult to believe that North Carolina communities can run out of water. But, the fact is they can, they nearly have and they will continue to do so if we proceed on our present course.

"Recently our water planning people worked with various levels of government to obtain information about projected growth in North Carolina communities and about their existing water supplies. That information was put into the computer to determine just when communities in this state would run out of water if they had to depend upon their existing water supply.

"The results of the computer survey are interesting.

"Some 100 communities--or one out of four communities in North Carolina--could be in a critical water supply situation by the year 2000. Eight are in a critical supply situation now and 29 more face problems within the next 10 years.

"Before we hit any panic buttons, let me qualify these studies. We know that many of our cities are looking and planning ahead for water supplies. Many of the towns and cities on our preliminary list are already responding to the problems. Some have good ground water supplies they can tap with wells on a reasonably short notice.

"This study so far is very preliminary. There is more work to be done, and our water planning people will be contacting all these communities to tie in needed local information and verification.

"But, the study has value for this conference--it emphasizes that we can have water supply problems, and points out the need for a broader appreciation of water conservation measures.

"Conservation or reduction of demand can greatly stretch out existing water supplies.

"And right here I want to make it clear that conservation is a positive--not a negative concept. It means the optimum use of a fixed resource over time. Conservation is a means of recognizing the difference between what we use and what we waste out of just bad habits. Conservation faces the reality that we have limited resources and sets about using them efficiently.

"How can we use what we have more efficiently? There are a variety of ways. Many of them will be discussed today and tomorrow. The responsibility for conservation lies with the individual, industry and government--that just about covers everyone.

"The best use of our water resources requires not only the skill of the technician, but the understanding and interest of the ordinary citizen--because on him rests the ultimate responsibility for action.

"The Washington Suburban Sanitary Commission in Maryland has already developed an intensive educational program dealing with water conservation, which we will hear about later in the program. Across the country, the East Bay Municipal Utility District in Oakland, California has also been working on this problem. Their approach is to actively involve the consumer--to encourage him to change his water way of life.

"The people in Oakland have built their public awareness program to increase the appreciation of water as a resource; to clearly establish the concept of water conservation; and to give the customer specific means of conserving water in his own home or business.

"Our towns and cities in North Carolina need to look seriously at basic education programs for their water customers. This doesn't have to be an expensive effort. Citizen groups, engineering clubs, civic organizations and others could take on this type of education program as a project. The local governments could serve as the force behind the program and provide technical assistance when it's needed.

"Another means of conserving water is to start with the basic physical system. Is it well maintained or are there unrepaired leaks and other unaccounted for water losses? In a national study of municipal water management by large cities, it was found that losses from municipal water systems ranged from 1 to 54 percent, with an average of about 15 percent. Imagine your town with more than half its water unaccounted for. This reflects a loss of treated potable water before it even reaches the consumer. We will hear more about the control of system losses today from municipal officials in North Carolina.

"The construction industry can also play a major part in conserving water. For example, the average flush toilet takes about five gallons of clean potable water for each cycle. For a family of five, that means about 200 gallons of treated water down the drain every day. That is twice the amount used by European sanitation fixtures. Major U.S. suppliers now market more efficient units--they are available to builders right here in Raleigh, but are not yet used to any appreciable degree.

"The same principle applies to home appliances. Builders should consider the water and energy demand of clothes washers and dishwashers placed in a new home. They should because it means dollars of potential savings to homeowners through water and energy conservation, which is another selling point for the home. A recent *Consumer's Report* shows a range in water use between machines of comparable performance from 35 to 60 gallons. Hot water use differences ranged from 9 to 25 gallons per load. No need for more detail. That is enough to demonstrate the problem and opportunities we are missing to reduce water and energy costs.

"Industry has a lot to contribute, and to gain, by better management of industrial process water.

"What are your industry's opportunities for "closing the loop" on water use and wastewater production?

"If those of you in industry haven't asked yourself those questions, you should. Tomorrow afternoon we will hear reports on successful efforts to conserve water and wastes in the food processing, pulp and paper and textile industries.

"Of course, the importance of water conservation isn't just to save water. Supplying water costs the taxpayers large amounts of money. Water supply facilities cost a great deal, consume energy and have land use impacts.

"To illustrate some of these impacts of supplying water, let's look a moment at Raleigh. Raleigh deserves some recognition, because the planners and officials of this city have shown considerable foresight in working for the construction of these facilities I'm discussing.

"Many of you have probably read of the Falls of the Neuse flood control and water supply project for Raleigh and surrounding communities. That project will raise the water use capability for the city to nearly 100 million gallons per day or about five times the present average summer use. Construction costs will be approximately $70 million. Much of the project costs are other than those directly associated to water supply. But, needless to say, many millions of the cost can be attributed to water supply. And at costs like that, it doesn't pay to waste one drop of water.

"The water supply portion of the project will eventually cover 10,500 acres. As North Carolina continues to grow, we're going to be faced with making tremendous sacrifices of other land use needs to protect sites suitable for water supply.

"Again, it's imperative that with potential costs, potential energy uses, potential land impacts staring us in the face, that we get the most we can out of our water resources.

"Two final aspects of this conservation question are worth mentioning.

"First, dual systems. I've already mentioned various examples of the tremendous wastes of potable water for non-potable purposes. I know that a dual system is costly, but I don't think it's an idea we should totally dismiss. I would particularly ask those of you in the research end of this question to take a closer look at the pros and cons of a dual system.

"Second, probably the major influence on water use by householders, commerce and industry is price. A long history of cheap water and the wide use of promotional rate pricing has been a major contributor to the attitude that the supply of water is unlimited.

"We will hear more about pricing today from an economist and an official of a Virginia water authority, which has recently adopted a conservation pricing scheme.

"Questions city and industrial officials might ask on this subject are:

"Is the water rate structure and level properly designed so that beneficiaries equitably pay the full cost of their use of the water system? Does it encourage efficient or wasteful use? Can peak demands be moderated through peak load or seasonal pricing?

"I don't have the answers to those questions. For all of our sakes, I think they are questions for which we should seek answers.

"Today we are going to hear from people who have first-hand experience in water conservation. They will be speaking to us on the basis of actual experience.

"The purpose of this conference is to explore ways of making better use of existing water supplies and reducing the cost of waste-management through conservation and more efficient practices.

"But the purpose of this conference will not be served unless all of us view conservation as a new way of thinking and approach to solving water and wastewater problems. The purpose will not materialize unless city officials, businessmen, and the public adopt the conservation ethic--unless conservation is indelibly inscribed as the first step in meeting present and future water problems. It must become a way of thinking. It's definitely an idea whose time has come. Let's begin now."

MORE RATIONAL WATER RATES

Two papers at the North Carolina Conference on Water Conservation dealt with the question of water rates--their effects on efficient water use and other aspects of water management.

Dr. John J. Boland of the Johns Hopkins University told the Conference that current structures in use by water utilities in most states serve neither the utilities nor the public. In particular, the use of a declining-block water rate design and the existence of rate differences among user classes which are not cost-justified frustrate the efficient use of financial and natural resources, they discriminate inappropriately among groups of consumers, they fail to produce the required revenue under conditions of increasing costs, and they obscure the information necessary for efficient consumption decisions by individual users.

Those responsible for setting water rates, said Boland, should begin overhauling rate structures which were first designed in the days when water utilities were anxious to bring in more capacity. Strictly cost-based rate structures which eliminate archaic declining-block rate features should be adopted. Cost-based rates should reflect (insofar as cost data and customer acceptance permit) summer/winter and spatial cost differentials. Customer-related costs that do not vary with usage should be recovered by fixed charges unrelated to usage. In every case, the appropriate measure of cost is marginal cost, not average cost, in order to identify the true cost for which each customer should be held accountable. Marginal cost is defined as the added cost of producing the last 1000 gallons of water.

Only by squarely facing these issues associated with rate structure design, Dr. Boland told Conference participants, can the demand side of the demand-supply equation be effectively managed. The adoption of these rate structure recommendations will appropriately balance demand and supply, eliminate involuntary cross-subsidies between consumers, relieve the financial pressure on the utilities, and increase the net contribution of the water supply industry to the overall well-being of society.

The Fairfax County Water Authority has worked with Dr. Boland and his colleagues at Johns Hopkins and its consulting engineer in the implementation of a system of seasonal pricing that represents a sizable step toward more rational water rates. This was explained to the Conference by Assistant Engineer - Director Fred P. Griffith, Jr. The Authority provides wholesale and retail water service to approximately 554,000 residents of the northern Virginia suburbs of Washington, D. C.

In examining its water rates, Griffith said, the Authority could find no economic justification for continuation of its minimum charge and descending block rate (rate per 1000 gallons decreases with increasing use) for retail customers. After much study the Authority adopted a uniform rate for all water used--thus removing the prior incentive for inefficient water use associated with the declining block rates--with an added "excess use charge" for peak use in the summer. It is logical, said Griffith, that those customers who create peak demand should pay for the added plant capacity required to meet that demand. If peak demands are decreased as a result of this rate-making approach, future plant additions and water supply impoundments can be reduced in scope with resulting savings in capital and operating costs. Environmental impact of such projects will also be lessened.

RESERVOIR RECREATION CRITERIA

The Division of Resource Planning and Evaluation of the N.C. Department of Natural and Economic Resources has released a report of a special study of criteria for the evaluation of reservoirs for potential for meeting outdoor recreation needs.

No statewide recreation need evaluation has yet been made of the large number of reservoir proposals now being studied. Approximately 190 reservoir projects are currently under consideration--24 of which would have a surface area of over 500 acres. Copies should be requested from John E. Layden, Jr., Recreation Consultant at NCDNER.

NEW INSTITUTE RESEARCH PROJECTS APPROVED FOR FUNDING FY 1976

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

Assessment of Organic Contaminants in Water - Drs. R. F. Christman and F. K. Pfaender, Dept. of Env. Sc. & Engr., UNC-CH

Organic Carbon Budget and Deoxygenation in the Pamlico River Estuary in North Carolina - Drs. Graham J. Davis and Mark M. Brinson, Dept. of Biology, ECU

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

Use of Fluvial Processes to Minimize Adverse Effects of Stream Channelization - Dr. E. A. Keller, Dept. of Geography and Earth Sciences, UNC-Charlotte

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

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

Treatability Analysis of Sewage Sludge Digestor Supernatant - Dr. P. C. Singer, Dept. of Env. Sc. & Engr., UNC-CH

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

Phytoplankton Response to Water Quality in the Chowan River Estuary - Dr. A. M. Witherspoon, Dept. of Botany & Ag. Exp. Station, NCSU

HIGH POINT LAND SPREADING SLUDGE

Sewage sludge from the City of High Point is being effectively applied to farm lands. Currently the city has the capability of spreading up to 50,000 gallons per day of primary digester sludge. Applications of sludge are now being spread and disked in for corn and other farm crops. The city is operating three spreaders and has plans for a large tanker truck to haul sludge to the spreading sites. According to High Point officials, landowner requests for sludge are exceeding the supply. Nutrient costs, especially nitrogen, have risen dramatically and farmers are looking at sludge and wastewater as a nutrient source.

Experimental Plots

Lee Hadorowski, technology transfer specialist with High Point, working with Drs. Larry King and Bob Carlile, members of the Soil Science Department and Agricultural Experiment Station at North Carolina State University, are conducting a study to show the response of pasture grasses to various rates of sewage sludge. Some 24 large replicated plots using different rates and times of application are being compared on fescue pasture. Water Quality in streams in the area is being monitored by representatives of the Division of Environmental Management.

A similar experiment is planned for handling wastes from the City of Fayetteville. Details on these experiments may be obtained from either Dr. King or Dr. Carlile.

COSTS OF LAND APPLICATION OF WASTEWATER

A new EPA publication provides cost information for two stages of planning for alternative land application systems: (1) preliminary cost screening and (2) detailed cost estimates. Cost categories include land, preapplication treatment, transmission, storage, land application, and recovery of renovated water.

For preliminary screening costs, curves are presented relating capital, amortized, and operation and maintenance costs to average flow rates ranging from 0.1 to 100 mgd. Cost calculation procedures and an illustrative example are included.

For detailed planning costs, curves, tables, and data are presented for 33 individual cost components related to either flow rate or field area. For capital items, total construction costs are shown, and operation and maintenance costs are divided into labor, materials, and power where applicable.

The report is titled *Cost of Wastewater Treatment by Land Application*, (EPA-430/9-75-003), 6/75, by Charles E. Pound, *et al*, and was prepared by the Environmental Protection Agency, Office of Water Program Operations, Washington, D.C. 20460. A limited number of copies of this publication and a related one titled *Evaluation of Land Application Systems*, (EPA-430/9-75-001), 3/75, are available from the Institute upon request.

EFFECTIVE SYSTEM FOR HANDLING SWINE WASTES

Many swine officials believe that the number one swine problem facing producers is handling animal waste.

An excellent example of how swine waste can be handled with limited land and in close proximity to an urban area was demonstrated recently at a waste management workshop near Lexington. George Wetherill, Manager of Lexington Swine Breeders, Inc., working closely with North Carolina State University Biological and Agricultural Engineering Specialists, Frank Humenik, Michael Overcash, James Barker, L. Bynum Driggers, and Ronald Sneed, have designed a system which can handle the waste from a 300 sow (2100 100-lb hog equivalent) operation on seven acres of land without contamination of the water and air environment.

The system includes the use of an aerated lagoon, overland flow, unaerated lagoon, and spray irrigation on fescue. Making full use of a limited land area, the system effectively handles the nitrogen and hydraulic loading without runoff. A series of wells is used to monitor groundwater quality.

Complete details on the operation are available from Dr. Frank Humenik, In Charge of Extension, Biological and Agricultural Engineering, 200 Weaver Building, North Carolina State University, Raleigh, N.C. 27607.

ADDITIONAL TIME GRANTED FOR COASTAL ACT

The 1975 Session of the North Carolina General Assembly approved time extension amendments to the Coastal Area Management Act. Noting the extensive public participation and the comprehensive data-gathering process of the Act, the legislature moved to allow additional time for the key activities of the program. The amendments were sponsored by Representative Ronald Earl Mason of Beaufort.

The major change is the postponement of the deadline for submitting locally approved land use plans from November 23, 1975, until May 21, 1976. This will allow additional time for public comment on these county and municipal documents.

It will also allow time for a new local responsibility to be undertaken. Acting on a request from the Advisory Council, the Coastal Resources Commission agreed to delay the designation of Interim Areas of Environmental Concern (IAEC) until the local governments have had an opportunity to submit specific site recommendations on locally prepared maps.

To accommodate this local responsibility, the Commission has invited local governments to delineate their own selections and submit them to the Commission along with proposed land use plans by November 23, 1975, the original deadline. Completed plans will be due May 21, 1976.

Source - *The Coast Line*

PHOSPHATE SLIME POND PROPOSED

Texasgulf, Inc., has made application for a Department of the Army permit to construct an addition to an existing slimes settling pond adjacent to South Creek off the Pamlico River, near Aurora, Beaufort County, North Carolina.

Plans submitted with the application show the proposed diking of an area encompassing some 167 acres. This area is to be constructed adjacent to an existing slimes settling pond. The slime pond dike will be some 34 feet high and will have a width of 20 feet at the top. The construction material for the dike will be excavated from a high land source adjacent to the proposed structure. The purpose of the project is the disposal of phosphate slimes.

CORPS PERMITS FOR AUGUST

The Wilmington District, during the month of August, issued 75 Department of the Army permits and permit modifications for filling, dredging, bulkheads, piers, and other structures or works in navigable waters of the United States.

Prior to issuance of the permits, evaluation was made of the probable impact of the existing and proposed activity on the public interest. All factors relevant to the proposal were considered, including but not limited to conservation, economics, esthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use classification, navigation, recreation, water supply, water quality and, in general, the needs and welfare of the people.

MAINTENANCE DREDGING

The Wilmington District of the Corps of Engineers has announced plans to perform the following maintenance dredging:

Cape Fear River near Wilmington
- 24 locations between Navassa and mile 111.

Lockwoods Folly Inlet
- between ocean bar and mile 0.

SCS CONDUCTING COASTLINE SOIL SURVEY

For the first time, a detailed soil survey of the entire North Carolina coastline will be made, covering the area from the South Carolina border to Virginia, it has been announced by State Conservationist Jesse L. Hicks of Raleigh, who heads the Soil Conservation Service in North Carolina.

The survey--popularly called the "Outer Banks Soil Survey"--will cover coastlines of eight North Carolina counties--Brunswick, New Hanover, Onslow, Pender, Carteret, Hyde, Dare and Currituck--and will include all of Brown Island, Harker's Island and Roanoke Island.

According to Hicks this survey will have a unique function, since it will provide up-to-date scientific data that has not previously been available.

The survey will be carried out by the Soil Conservation Service in cooperation with the North Carolina Department of Natural and Economic Resources, the Soil Science Department at North Carolina State University, and the National Park Service, U.S. Department of the Interior. A main beneficiary of the survey, along with all citizens interested in coastal data, will be the North Carolina Coastal Resources Commission.

Most mapping will be done by soil scientists of the Soil Conservation Service, with some assistance from the Agricultural Extension Service. The Soil Conservation Service expects to complete field mapping within one year.

The survey will provide details on marshes and other coastal land types, and will include many areas of environmental concern.

An interdisciplinary approach will be used in the survey. Soil scientists will work with planners, botanists, and many other specialists interested in current research data.

NO CHANGE IN PUBLIC PARTICIPATION

No change in the nature of public participation has resulted from provisions of the Federal Water Pollution Control Act which were designed to encourage participation. report by James Ragan, Associate of Pacific Palisade California, for the National Commission on Water Quality, concludes that participation in policy making activities remains unchanged.

There is continued heavy reliance on public hearings for public participation. According to the report, most agencies may be simply going through the formalities of public participation. The report also cites as problems lack of timely information, low agency priority for public participation and not effectively dealing with citizen comments.

The report suggests changes of Section 101(e) of the Federal Water Pollution Control Act to include the development of a program for public participation, definite goals and objectives, and assignment of responsibilities for public participation. The report also suggests allocation of funds, evaluation of program effectiveness, and providing financial resources for citizen groups.

CITY ORDINANCE RESTRICTING GROWTH UPHELD BY COURT

The City of Petaluma, California recently enacted an ordinance which limits new housing to 500 dwelling units per year. That ordinance was upheld by the U.S. Court of Appeals for the Ninth Circuit.

Faced with rapid population expansion and the possibility of exceeding its sewage treatment facilities, the City of Petaluma enacted the ordinance as a means of controlling its growth rate.

Petaluma has developed a plan which establishes a 200-foot greenbelt area around the city as a boundary to urban development. The plan is also designed to preserve its "small town" character, provide necessary open space and maintain a low population density.

NATIONAL COMMISSION ON WATER QUALITY

The National Commission on Water Quality is proceeding rapidly with its report on the federal water pollution control program authorized by P.L. 92-500. Recent announcements include:

<u>Point Sources of Wastes</u> represent a major barrier to achievement of the 1983 water quality goals in many areas.

<u>Domestic Council Task Force</u> has been established by Chairman Nelson A. Rockefeller to review contractor studies and provide input from the executive branch. The task force will operate under the Domestic Council and is to be chaired by Asst. Sec. of Commerce Joseph E. Kasputys.

<u>Shortage of money</u> and <u>industry reluctance</u> are also viewed as major obstacles to meeting requirements of federal legislation. Money is seen as the principal problem by a cross-section of local government officials, industry representatives, consulting engineers, and environmentalists. EPA, however, sees money as a secondary reason for non-compliance and industry reluctance as the major problem.

GUIDELINES FOR "208" AREAWIDE WASTE MANAGEMENT PLANS

EPA has issued guidelines for areawide waste management plans under Section 208 of the Federal Water Pollution Control Act. The guidelines describe overall factors that should be taken into account and focus on an integrated approach to solving water pollution problems. They emphasize such nonstructural approaches as fiscal policy, land management, and nonpoint source preventative measures. Copies will be available in 4-6 weeks from EPA regional offices and EPA's Water Planning Division, 401 M Street, SW, Wash., DC 20460.

EPA PROPOSES REVISIONS TO WASTEWATER DISINFECTION

Problems of using a minimum level of disinfection, primarily chlorine, for all sanitary wastewater discharges is of questionable benefit especially where possible body contact is remote, according to a report by an EPA Task Force on secondary treatment. The report acknowledges that while considerable benefits are gained by the disinfection of wastewater, it recognized that certain potential environmental problems can result from the uncontrolled use of chlorine.

The proposed EPA revised statement reads that evidence exists that residual chlorine and certain chlorine-based compounds formed as a result of the chlorination of domestic wastewater can be toxic to aquatic life in relatively low concentrations. The report also says *it has been recently documented that chlorination may form carcinogenic compounds in secondary effluent.*

Excessive and unnecessary use of disinfectants is viewed as wasteful in both financial resources and energy according to the report which recommends that effluent limitations for fecal coliform bacteria be deleted from the definition of secondary treatment. The proposal calls for disinfection requirements for publicly owned treatment works and other domestic wastewater treatment plans to be established in accordance with water quality standards contained in Sections 301, 302, and 303 of the Water Pollution Control Act.

A complete text of the proposed revisions is found in 40 FR 34522, August 15, 1975.

PRACTICAL COURSE IN ENVIRONMENTAL LAW

Government Institutes Inc. is sponsoring a course specifically designed for: businessmen, engineers, scientists, consultants, and government officials who desire a foundation in environmental law. Although geared to environmental managers, many lawyers will find this course beneficial as an initial exposure or review of these fundamentals of environmental law.

In the environmental law field most of the law is relatively new and this complex area has developed rapidly. Regulations implementing these new laws are still being promulgated in a continuing stream. Court decisions interpreting these laws and regulations are frequent. The problem is how to obtain a proper perspective of this dynamic and broad area without severe loss of time. So a concentrated course has been created with the objective to provide a comprehensive working knowledge of the numerous considerations for complying with this new body of law. This is a practical course oriented to providing the fundamentals of environmental law comprehensively for those who wish to grow professionally through continuing education.

The course is scheduled for November 13-14 in Washington, D.C. For additional information contact: Mrs. N. C. McNerney, Government Institutes, Inc., 4733 Bethesda Ave., NW, Washington, DC 20014; or phone, (301) 657-2922.

URBAN STORMWATER MANAGEMENT

A three-day course for design professionals and public officials involved in the design and management of urban drainage systems will be offered in Greensboro, December 15-17, and in Raleigh, March 8-10. The course will concentrate on the application of fundamental hydraulic and hydrologic techniques for response to emerging stormwater management requirements in urban areas. For further information contact: Mr. John Gordon, Division of Continuing Education, NCSU, PO Box 5125, Raleigh, NC 27607; telephone (919) 737-2261.

SCS LEAFLETS DESCRIBE USE OF SOIL SURVEY

Soil survey data, if used, can be a very useful tool for builders, contractors, and planners. The USDA Soil Conservation Service has recently published a series of leaflets to describe how the use of soil surveys can help land use planners, developers and builders, recreation area planners, construction engineers, farmers and ranchers, and home buyers. One of the leaflets also provides information on the use of soil surveys for waste disposal. Another leaflet for land use planners tells how soil surveys can help planners determine suitability of soil for housing, commercial building, septic tanks, roads and highways, recreation, and other uses.

A copy of the leaflet relating to your specific use for soil survey information is available from local SCS offices or write USDA - SCS, Federal Building, New Bern Avenue, Raleigh, NC 27611.

POSITION AVAILABLE

The Illinois Department of Conservation is seeking a Natural Resources Researcher to join an interdisciplinary research team. The researcher will participate in the development of a planning-related program of applied environmental research, often involving an outdoor recreation component. Send resume to: Dr. Edward L. Hoffman, Supervisor, Research Section, Division of Long Range Planning, Illinois Department of Conservation, Springfield, Illinois 62706.

WATER RESOURCES CONDITIONS IN NORTH CAROLINA FOR AUGUST

Rainfall during August was below normal. High carryover flows from July, augmented by thunderstorm runoff during August, held flows near or above normal in the Mountain and Piedmont regions of the State. Monthly mean flows in the Coastal Plain region were considerably below normal. No significant flooding occurred during the month. At the end of the month, flows were receding and ranged from slightly below the long-term normal for August in the western Piedmont to only 20% of normal for many streams in the eastern Coastal Plain.

Groundwater levels fell during the month. Water levels were generally slightly above the long-term averages in the Mountains and Piedmont and below in the Coastal Plain region. On August 26 levels in the USGS observation well NC-44, located at Cove City, dropped to a record low of 83.97 feet below land surface. Levels in the well, which is located about 16 miles west of New Bern and in the Black Creek formation, are affected by nearby municipal withdrawals.

Source: *U. S. Geological Survey*

ENVIRONMENTAL LEGISLATION - HIGHLIGHTS

Editor's Note: Professor Milton S. Heath, Jr., Associate Director of the Institute of Government, University of North Carolina at Chapel Hill, has summarized the environmental legislation considered this year by the North Carolina Legislature. His introduction and highlights are included in this issue. The next issue of the News will carry a more detailed analysis of the water and air pollution control legislation.

This was a year of consolidation and moderate but broad-based progress for environmental protection and resource management law. The legislative goals of environmental agencies this year were modest, and the track record on achieving these goals was very good. The failure of the mountain area management bill was one notable shortfall but, balancing this disappointment, there were virtually no unpleasant surprises for environmental managers this legislative year.

Highlights of the session were:

- Enactment of legislation that should finally qualify North Carolina to administer a single water pollution permit system.
- Enactment of amendments strengthening pollution control enforcement powers and encouraging further delegation of responsibility to local authorities.
- Designation of stretches of the New and Linville Rivers as scenic rivers and legislation to control billboards near the Blue Ridge Parkway.
- Enactment of a permanent oil refinery permit law and a program to establish oil spill cleanup centers.
- Enactment of general increases in fish and game license fees and defeat of a bill to enlarge the Wildlife Resources Commission by four members appointed (two each) by the Speaker and Lieutenant Governor.

- Enactment of a package of bills to strengthen enforcement of forest fire laws, coordinate burning and air pollution permits, and designate enforcement officers for the laws to keep streams free of debris.
- Enactment of updating revisions to the pesticide and structural pest control laws, with emphasis on certification of private applicators, and acceptance of membership in the Interstate Pest Control Compact.
- Re-enactment of the industrial development revenue bond proposal for another try at the polls.

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	- Agric. Res. Service	OWP	- Office of Water Programs
ASCE	- American Society of Civil Engrs.	**OWRR	- Office of Water Res. Research
EPA	- Env. Protection Agency	SCS	- Soil Conservation Service
ERC	- Engr. Res. Center	TVA	- Tennessee Valley Authority
GAO	- General Accounting Office	USDA	- U.S. Dept. of Agriculture
IWR	- Inst. for Water Resources	USDC	- U.S. Dept. of Commerce
NAS	- Nat'l. Academy of Sciences	USDI	- U.S. Dept. of the Interior
NCDNER	- N.C. Dept. of Natural & Econ. Res.	USGPO	- U.S. Gov. Printing Office
NERC	- Nat'l. Env. Res. Center	USGS	- U.S. Geological Survey
NOAA	- Nat'l. Oceanic & Atmospheric Adm.	WPC	- Water Pollution Control
NPS	- Nat'l. Park Service	WQS	- Water Quality Standards
NTIS	- Nat'l. Technical Information Serv.	WRC	- Water Resources Council
NWC	- Nat'l. Water Commission	WRRI	- Water Resources Res. Institute
*OWAR	- N.C. Off. of Water & Air Resources	WRSIC	- Water Res. Sci. Information Center

Water Resources Planning

"Alternative Growth Patterns," by Sch. of Design, avail. from Randy Hester, 205 Brooks Hall, NCSU, Raleigh, NC 27606.
"Technical Report Three: Goals for Aurora"
"Technical Report Four: Comparison of Locational Alternatives"

"Conference on Water Conservation and Sewage Flow Reduction with Water-Saving Devices," (Proceedings), (#74), 7/75, Ed. by W. E. Sharpe, *et al*, Inst. for Res. on Land & Water Res., PA St. U., U. Pk., PA 16802.

"An Economic Analysis of the Patterns and Trends of Water Consumption Within the Service Areas of the Honolulu Board of Water Supply," (#84), 12/75, by H. S. Oh, *et al*, WRRC, U. of HI, Honolulu, HI 96822.

"Environmental Evaluation Report on Various Completed Channel Improvement Projects in Eastern Arkansas," (#30), 8/74, by E. E. Dale, Jr., WRRC, U. of AR, Fayetteville, AR 72701.

"Environmental Impact Evaluation in Freshwater Impoundments by Vegetation Analysis of the Terrestrial Ecosystem," (#49), 4/75, by P. W. Fairbairn, *et al*, WRRC, U. of MA, Amherst, MA 01002.

"A Case Study of Some Economic Aspects of the National Flood Insurance Program," 7/75, by L. R. Cheatham, WRRI, MS St. U., MS St., MS 37962.

"The Economics of Flood Insurance: An Analysis of the National Flood Insurance Program," (#46), 7/74, by G. A. Vaut, WRRC, U. of MA, Amherst, MA 01002.

"Flood Plain Land-Use Management: An Application of Operations Research Methodology," (#45), 1/75, by J. F. Smiarowski, *et al*, WRRC, U. of MA, Amherst, MA 01002.

"An Overview of the Impact Study of the McClellan-Kerr Multiple Purpose Arkansas River System," (#75-R3), 7/75, by L. G. Antle, IWR, avail. from NTIS, USDC, Springfield, VA 22151.

"Wildlife and Land Use Planning with Particular Reference to Coastal Counties," 4/75, by F. B. Barick, *et al*, NC Wildlife Res. Comm., Raleigh, NC 27611.

"Water Quality Management Plan, Yadkin River Basin," (Sub-Basins 50,54, & 57), (DRAFT), 8/75, Div. of Env. Mgt., NCDNER, PO Box 27687, Raleigh, NC 27611.

"Minnesota's Water Resources: A Primer," (#2), 5/75, by W. C. Walton, WRRC, U. of MN, St. Paul, MN 55114.

"A Three-Dimensional Model for Estuaries and Coastal Seas: Volume II, Aspects of Computation," (R-1764-OWRT), 6/75, by J. J. Leendertse, *et al*, Rand, Santa Monica, CA 90406.

*Agency name changed to N.C. Division of Environmental Management (NCDNER).
**Agency name changed to Office of Water Research & Technology (OWRT) as of July 29, 1974.

"A Study of Mosquito Prevention and Control Problems Associated with Stream Modification Projects," 7/74, by CO Inst. of Rural Env. Hlth., for WRC, 2120 L St., NW, Wash., DC 20037.

"Methods to Facilitate Managerial Effectiveness in Municipal Water Systems," 7/75, by K. W. Hollman, *et al*, WRRI, MS St. U., MS St., MS 39762.

"The Economic Impact of a Small Recreation-Oriented Reservoir," 7/75, by D. L. Daniel, *et al*, WRRI, MS St. U., MS St., MS 29762.

"Residential Canals Along the Gulf Coast," 7/75, by O. L. Paulson, Jr., *et al*, WRRI, MS St. U., MS St.. MS 39762.

"Rogue River Study - Report 2, The Concepts of Carrying Capacity: Its Application for Management of Oregon's Scenic Waterway System,' (#32), 6/75, by R. E. Pfister, *et al*, WRRI, OR St. U., Corvallis, OR 97331.

"Rookery Bay: Ecological Constraints on Coastal Development," 12/74, by J. Clark, avail. from Pub. Dept., The Conservation Foundation, 1717 Mass. Ave., NW, Wash., DC 20036, Price $4.

Rookery Bay Land Use Studies, Environmental Planning Strategies for the Development of a Mangrove Shoreline," avail. from Pub. Dept., The Conservation Foundation, 1717 Mass. Ave., NW, Wash., DC 22036.

Study No.

1 - The Demographic, Political, and Administrative Setting, 9/73, by C. Feiss, *et al*, Price $1.
2 - The Resource Buffer Plan: A Conceptual Land Use Study, 10/73, by A. R. Veri, *et al*, Price $1.
3 - Estuarine Water Quality, 6/75, by B. J. Yokel.
4 - Hydrography and Beach Dynamics, 10/73, by T. N. Lee, *et al*, Price $1.
5 - Estuarine Biology, 6/75, by B. J. Yokel.
6 - Applicability of the Interceptor Waterway Concept in the Rookery Bay Area, 11/73, by E. J. Heald, *et al*, $1.
7 - Policy and Regulatory Dimensions, 6/75, by T. M. Alexander, *et al*.
8 - Environmental Considerations for Water Management District 6 of Collier County, 1/74, by E. T. LaRoe, Price $1.50.
9 - Principles of Ecosystem Management, 6/75, by J. Clark, *et al*.
10 - Growth and Land Use, 6/75, by R. A. Lemire.
11 - Economic Implications of Land Development Alternatives, 6/75, by R. K.Davis, *et al*.
12 - A Simulation Modeling Approach to the Study of Development Alternatives, 6/75, by J. C. Zieman, *et al*.

"Environmental Assessment Special Use Permit Buxton to Avon Waterline Cape Hatteras National Seashore, Dare County, North Carolina," refer to (L7617-SER-PE), 8/75, SE Reg. Off., 3401 Shipple Ave., Atlanta, GA 03344 & Hdqtrs. Cape Hatteras Nat'l. Seashore, PO Box 457, Manteo, NC 27954.

"Values, Costs and Pricing Alternatives for Irrigation Water: Cañete, Peru," (Eco. Study #6), 7/75, by Unidad De Analysis Economico & J. A. Seagraves, Dept. of Eco., NCSU, Raleigh, NC 27607.

Water Quality Management

"Pathogenic Free-Living Amoebae In Arkansas Recreational Waters," 6/75, by L. W. Bone, *et al*, WRRC, U. of AR, Fayetteville, AR 72701.

"Survival of Pathogens in Animal Manure Disposal," (EPA-660/2-75-012), 6/75, by S. L. Diesch, *et al*, U. of MN, for EPA, avail from USGPO, Wash., DC 20402.

"Field-Level Planning for Areawide Waste Treatment Management, A Model for Planning under Section 208 of the Federal Water Pollution Control Act," 4/75, by D. H. Moreau, City & Reg. Plan. Dept., U. of NC, Chapel Hill, NC 27815.

"Some Effects of Cadmium on Coniferous Soil/Litter Microcosms," (EPA-660/3-75-036), 6/75, by H. Bond, *et al*, NERC, for EPA, avail. from USGPO, Wash., DC 20402.

"Chemical/Biological Relationships Relevant to Ecological Effects of Acid Rainfall," (EPA-660/3-75-032), 6/75, by J. O. Reuss, NERC, for EPA, avail. from USGPO, Wash., DC 20402.

"Radiation Treatment of High Strength Chlorinated Hydrocarbon Wastes," (EPA-660/2-75-017), 6/75, by T. F. Craft, *et al*, GA Inst. of Tech., for EPA, avail. from USGPO, Wash., DC 20402.

"Organic Color in Groundwater of Mississippi," 7/75, by M. T. Bond, *et al*, WRRI, MS St. U., MS St., MS 39762.

"Preliminary Investigation into Copper Cycling in Indian Lake, Massachusetts: A Lake Treated Annually with Copper Sulfate," (#47), 4/75, by K. H. Symmes, WRRC, U. of MA, Amherst, MA 01002.

"Corrosion by Domestic Waters," (Bul. 59), 1975, by T. E. Larson, IL St. Water Survey, Urbana, IL 61801.

"Survival and Growth Rates of Channel Catfish as a Function of Dissolved-Oxygen Concentration," (#33), 6/75, by R. W. Raible, WRRC, U. of AR, Fayetteville, AR 72701.

"Infrared Dry Caustic Vs. Wet Caustic Peeling (Food Processing) of White Potatoes," (EPA-660/2-74-088), 6/75, by O. Sproul, *et al*, Western Potato Serv., Inc., for EPA, avail. from USGPO, Wash., DC 20402.

"Hydro-Geochemistry in a Carbonate Basin - Geomorphic and Environmental Implication," (#44), 4/75, by A. L. Reesman, *et al*, WRRC, U. of TN, Knoxville, TN 37916.

"Lethal and Sublethal Effects of Herbicides on Zooplankton Species," (#43), 4/75, by D. L. Bunting, *et al*, WRRC, U. of TN, Knoxville, TN 37916.

"Wastewater Treatment and Reuse by Land Application - Volume II," (EPA-660/2-73-006b), 8/73, by C. E. Pound, *et al*, Metcalf & Eddy, Inc., for EPA, avail. from USGPO, Wash., DC 20402, Price $2.40.

"A Primer on Limnology," (#1), 3/75, by J. B. Lundquist, WRRC, U. of MN, St. Paul, MN 55114.

"Scientific and Technical Assessment Report on Manganese," (EPA-600/6-75-002), (STAR Series), 4/75, by NERC at RTI, EPA, Off. of R&D, Off. of Prog. Integration, Wash., DC 20460.

"Removal of Soluble Mercury from Waste Water by Complexing Techniques," (#74), 5/75, by D. L. Michelsen, *et al*, WRRC; VPI & St. U., Blacksburg, VA 24061.

"Correspondence Conference on Removal of Nitrogen From Municipal Wastewater," (#48), 3/74, by B. B. Berger, WRRC, U. of MA, Amherst, MA 01002.

"Biochrome Analysis as a Method for Assessing Phytoplankton Dynamics Phase II," (#32), 6/75, by R. L. Meyer, WRRC, U. of AR, Fayetteville, AR 72701.

"Bark As Trickling-Filter Dewatering Medium for Pulp and Paper Mill Sludge," (ERC-0975), 7/75, by G. R. Lightsey, ERC, GA Inst. of Tech., Atlanta, GA 30332.

"Taxonomy of *Klebsiella Pneumoniae* Isolated from Pulp/Paper Mill Wastewater," (EPA-660/2-75-024), 6/75, by M. K. Knittel, NERC, avail. from USGPO, Wash., DC 20402.

"Refinery Effluent Water Treatment Plant Using Activated Carbon," (EPA-660/2-75-020), 6/75, by G. C. Loop, Atlantic Richfield Co., for EPA, avail. from USGPO, Wash., DC 20402.

"Renovation of Secondary Effluent for Reuse as a Water Resource," (EPA-660/2-74-016), 2/74, by L. T. Kardos, *et al*, PA St. U., for EPA, avail. from USGPO, Wash., DC 20402.

"Present and Prospective Technology for Predicting Sediment Yields and Sources," (ARS-S-40), 6/75, Proceedings of Sediment-Yield Workshop, USDA, ARS, PO Box 53326, New Orleans, LA 70153.

"Automatic Organic Monitoring System for Storm and Combined Sewers," (EPA-670/2-75-067), 6/75, by A. Tulumello, Raytheon Co., avail. from NERC, Off. of R&D, EPA, Cincinnati, OH 45268.

"Recycle of Synthetic Warp Sizes from Textile Desizing Wastewater," (EPA-660/2-75-014), 6/75, by C. E. Bryan, NCSU, for EPA, avail. from USGPO, Wash., DC 20402.

"Adaptation of Copepod Population to Thermal Stress," (#34), 6/75, by B. P. Bradley, WRRC, U. of MD, College Pk., MD 20742.

"Trace Element Composition of Stream Sediments - An Integrating Factor for Water Quality," (#31), 6/75, by K. F. Steele, *et al*, WRRC, U. of AR, Fayetteville, AR 72701.

"Wilderness Water Quality: Bishop Creek Baseline Study, 1974," (#150), 6/75, by Env. Sci. & Eng. WRC, U. of CA, Davis, CA 95616.

"Zooplankton Production in Lake Ontario As Influenced by Environmental Perturbations," (EPA-660/3-75-021), 6/75, by D. C. McNaught, *et al*, St. U. of NY at Albany, for EPA, avail. from USGPO, Wash., DC 20402.

Water Quantity Management

"Improved Application of Geophysics to Groundwater Resource Inventories in Glaciated Terrains," (#59), 7/75, by J. M. Adams, *et al*, WRRC, Purdue U., W. Lafeyette, IN 47907.

"Annotated Bibliography on Trickling Irrigation," (#16), 6/75, by S. W. Smith, *et al*, ERC, CO St. U., Ft. Collins, CO 80521.

"Moisture and Energy Conditions in a Draining Soil Mass," (ERC-0875), 6/75, by W. L. Nutter, ERC, GA Inst. of Tech., Atlanta, GA 30332.

"Analysis of Colorado Precipitation," (#63), 6/75, by M. Kuo, *et al*, ERC, CO. St. U., Ft. Collins, CO 80521.

"Comparative Analysis of Estimation Methods in Nonlinear Functional Models of the Rainfall-Runoff Process," (#56), 12/74, by A. R. Rao, *et al*, WRRC, Purdue U., W. Lafayette, IN 47907.

"Flood Runoff From Urban Areas," (#33), 6/75, by R. H. McCuen, WRRC, U. of MD, College Pk., MD 20742.

"Final Report on Airborne Passive Microwave Measurements of NOAA Hydrology Sites," (Rpt. #1752FR-1), 6/73, by G. Poe, *et al*, Aerojet Electrosystems Co., for NOAA, USDI, Nat'l. Env. Satellite Serv., Hillcrest Heights, MD 20031.

Miscellaneous

"The following publications are prepared by US Army Corps of Eng., avail. from NTIS, ATTN: Operations Div., 5285 Port Royal Rd., Springfield, VA 22151.

- "A Study to Assess Goals for Uses and Management of Shoreline and Implications for Corps of Engineers Programs," (Rpt. 75-4), 7/75, by Coastal Zone Res. Comm., 5/75 by G. Pararas-Carayannis.
- "Verification Study of a Bathystrophic Storm Surge Model," (TM-50).
- "Features of Various Offshore Structures," (MP 3-75), 4/75, by J. Peraino, *et al*.
- "Concepts Analysis: Offshore Breakwater-Oil Storage Systems," (MP 4-75), 4/75, by J. Peranio, *et al*.
- "A Selected Bibliography of the Nearshore Environment: Florida West Coast," (MP 5-75), 4/75, by C. H. Saloman.
- "Establishment of Vegetation for Shoreline Stabilization in Galveston Bay," (MP 6-75), 4/75, by J. D. Dodd, *et al*.
- "Large Wave Tank Tests of Riprap Stability," (TM-51), 5/75, by J. P. Ahrens.

"Directory of Water Resources Expertise," 8/75, WRC, U. of CA, Davis, CA 95616.

"MERES and the Evaluation of Energy Alternatives," 5/75, Com. on Env. Qualtiy, avail. from USGPO, Wash., DC 20402, Price 65¢.

"Energy Alternatives: A Comparative Analysis," 5/75, The Sc. & Public Policy Prog., U. of OK, avail. from USGPO, Wash., DC 20402, Price $7.45.

"Quasi Realtime Oceanographic Experiment Using NOAA Satellite Data and Ship Data," 2/75, by F. M. Vukovich, for NOAA, avail. from Res. Triangle Inst., Res. Triangle Pk., NC 27709.

"Of Pests and People, A Research View," (A report on the Pesticide Research Center, Michigan State University), Pesticide Research Center, MI St. U., E Lansing, MI 48823.

"Small-Craft Harbors: Design, Construction, and Operation," (SR-2), 12/74, by J. W. Dunham, *et al*, US Army Corps of Eng., Coastal Eng. Res. Center, Kingman Bldg., Ft. Belvoir, VA 22060.

"An Evaluation of Title III Water Resources Planning Grants to States," Prepared for US WRC, by the Inst. of Gov. Res., U. of AZ, 10/73, avail. from WRC, Wash., DC 20037.

"Yellowtail Dam and Powerplant," (Technical Record of Design and Construction), 5/75, USDI Bu. of Reclamation, Denver, CO 80202, Price 33¢.

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