NEWS

WATER RESOURCES RESEARCH INSTITUTE

OF THE UNIVERSITY OF NORTH CAROLINA

NORTH CAROLINA STATE UNIVERSITY AT RALEIGH   UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Number 65   June 1971

HOUSE HEARINGS ON WATER RESOURCES RESEARCH SCHEDULED

Chairman Harold T. Johnson (Calif.) of the Subcomittee on Irrigation and Reclamation, Committee on Interior and Insular Affairs, U. S. House of Representatives, has scheduled hearings on H. R. 1400 and related bills to amend the Water Resources Research Act of 1964 for June 29 in Washington, D. C. The amendments would increase Institute annual allotments from $100,000 to $250,000 and authorize programs for technology transfer. Similar legislation passed the Senate in the last Congress, but no action was taken by the House.

Professor David H. Howells, Institute Director, will testify in support of the legislation on behalf of the Universities Council on Water Resources. It was previously endorsed by Governor Scott in letters to Senator Jordan and Congressman Roy Taylor, members of the Senate and House Committees on Interior and Insular Affairs, respectively.

NEW EPA GRANTS FOR NCSU PROJECTS ANNOUNCED

During the past month the Environmental Protection Agency announced the approval of two major research projects at N. C. State University dealing with water pollution control. These are:

Design Criteria for Swine Waste Treatment Systems
Total project cost $152,183 -Project Director:
Dr. Frank J. Humenik, Department of Biological and Agricultural Engineering

Characterization and Treatment of Urban Land Runoff
Total project cost $119,688 - Project Director:
Dr. Newton V. Colston, Department of Civil Engineering

ENVIRONMENTALISTS WARNED AGAINST EXTREMISM

EPA Administrator William D. Ruckelshaus warned against an "eco-backlash" in a talk to the National Audubon Society last month. He cautioned that persons dedicated to environmental causes must be "ecologically literate" or run the risk of "informed rebuttal" which could undercut the public support so vital for constructive action.

ENVIRONMENTAL IMPACT STATEMENTS

The Council on Environmental Quality 102 Monitor May 1971 lists the following new environmental impact statements for North Carolina projects:

Atlantic Harbor of Refuge: Carteret County

Dredging of channels 7 ft. deep and 50-70 ft. wide.

Charlotte - Airport project. New runway and runway extension.

Drum Inlet Navigation Project

Dredging ocean-bar channel 150 ft. wide and 9 ft. deep. Purpose: To provide a safe passage through inlet.

Edenton - Relocation of highway to bypass Edenton. Length: 6.6 miles.

Falls Lake - See p. 6 of May News.

Goldsboro - Airport project. Expansion of parking apron, constr. of taxiways, etc. Date 4/16.

New Hope Lake Project

Earthdam, 14,300 acre lake. 22 miles of free-flowing stream inundated. Purpose: Flood protection, water supply, water quality control, and recreation. Copy available for review at Institute office.

Williamston - Martin County airport project. Runway extension, etc.

EXTENSION GRANTED FOR REFUSE ACT PERMITS

The Environmental Protection Agency has granted industry a 90-day extension from July 1 to October 1, 1971, to provide certain detailed laboratory test data which is required in Permit applications under the 1899 Refuse Act. Nevertheless, all industries must still file basic information regarding discharges by July 1, including data on rate of flow, temperature, and nutrients. "Critical" industries must also report by July 1 on the following pollution characteristics: total suspended, dissolved, and volatile solids; alkalinity; 5-day biochemical oxygen demand; chemical oxygen demand; ammonia and nitrate nitrogen; and phosphorus.

MEETINGS ON PROPOSED NEW VESSEL STANDARDS

Public meetings have been held in four cities during the month of June to review and discuss the recently proposed new regulations providing Federal performance standards for vessel sanitation devices.

The locations were: Miami, Florida, June 9; Chicago, Illinois, June 11; San Francisco, California, June 18; and New York, N. Y., June 22. The proposed regulations are required by the Water Quality Improvement Act of 1970, and were published in the Federal Register of May 12. Persons wishing to comment on them have 45 days in which to submit statements. The written views, comments, and recommendations may be sent to the Administrator, Environmental Protection Agency, 1626 K Street, N.W., Washington, D. C. 20460.

Under the regulations, marine devices would be required to provide a treatment approximately equivalent to the secondary treatment standard being imposed by EPA and the States on all municipal facilities. Secondary treatment normally includes the removal of 85 percent biochemical oxygen demand, 90 percent of suspended solids, and of substantially all bacteria. Initial standards and regulations will become effective for new vessels within two years after they are established and for existing vessels within five years.

FEDERAL CONSTRUCTION AGENCIES CRITICIZED FOR WATERWAYS PROJECTS

Nathaniel P. Reed, the new Assistant Secretary of Interior for Fish and Wildlife, told the House Conservation Subcommittee on June 3 that the Corps of Engineers and Soil Conservation Service are paying "nothing more than lip service" to environmental protection. "What is needed," he said, "is a complete rethink and redirection by the men who are designing and constructing the projects." Reed alleged that "stream channel alteration under the banner of channel 'improvement' for navigation, flood reduction, and agricultural drainage is undoubtedly one of the more, if not the most, destructive water development or management practices from the viewpoint of renewable natural resources." He urged a complete review of all stream channelization projects by federal environmental agencies and a new national policy on flood control.

Prior to his recent appointment as an Interior Department Assistant Secretary, Reed was chairman of Florida's Department of Air and Water Pollution.

CHANNEL IMPROVEMENT GUIDELINES

Through Watershed Memorandum 108, the Soil Conservation Service has provided guidelines for the review of approved watershed work plans that include stream channel improvement. This review is one of the steps to implement the SCS declaration that "we can do nothing less than to re-evaluate each of our programs and practices to make sure that its impact on the environment as a whole is a beneficial one." Its purpose is to determine what changes in work plans or engineering design are needed to further national policy and goals for the environment. Because of the interest in stream channelization, the guidelines are summarized below.

1. Channel improvement is to be planned and carried out with minimum losses to fish and wildlife habitat. Losses are to be minimized by (1) selecting measures that are least damaging to habitat, (2) incorporating design features to reduce the damaging effect of the measures, (3) locating measures to avoid areas of high habitat value, (4) using construction methods that minimize disturbance and destruction of habitat, (5) vegetating denuded areas as quickly as practical, and (6) operating and maintaining measures in a way that is least damaging to the habitat. Unavoidable losses are to be mitigated to the maximum practicable degree. Opportunities for mitigation should be fully explored.

2. Channel improvement is supplementary to floodwater retardation, not an alternative for achieving an adequate level of flood protection. Channel improvement should be considered only after it has been determined that land treatment and all feasible floodwater retarding structures will not provide an adequate level of flood protection. Except in watersheds where retardation is obviously impractical, this determination should be based on reservoir floodrouting studies, maximum use of all available storage opportunities in the watershed, and minimum practical release rates combined, where feasible, with two-stage inlets for the principal spillway.

3. Channel improvement is not to be used where its primary purpose is to bring new land into agricultural production. It is not to be used where floodwater retarding structures provide an adequate level of protection for land currently in agricultural production. Restoration of former productivity may constitute bringing new land into agricultural production if the land is not now used for cultivated crops or crops normally seeded for hay and pasture.

4. In agricultural flood plains, the level of flood protection should be only high enough to permit profitable use of such land within its capabilities for sustained agricultural production. If the protection by floodwater retarding structures provides an acceptable level of protection but falls short of achieving the optimum goal, the environmental impact of increasing the level of protection by channel improvement should be considered carefully before including channel improvement in the plan. Consideration should also be given to the fact that many crops can withstand some flooding without consequential damage.

5. In nonagricultural flood plains, the level of flood protection should be sufficient to protect the principal residential, commercial, or industrial areas from a 100-year flood. Except in unusual cases channel improvement should not be used if its primary purpose is to make land suitable for nonagricultural development. In areas of expected development, serious consideration should be given to zoning, flood proofing, early warning systems, or other nonstructual devices to alleviate damage.

6. Channels are to be planned and designed so that they will be stable and can be maintained at a reasonable cost. This means that channels must be stable immediately after construction as well as after aging.

7. Stability is one of the primary considerations in the location of channels. This usually means that improved channels should follow existing alignment approximately. But realignment or relocation should be considered if it will not endanger stability and if project or environmental needs can be better served.

8. Even though they may increase costs, the least destructive construction techniques are to be used, including such practices as seasonal construction, minimum clearing, sectional construction, limiting excavation to one bank, using temporary sediment basins and other devices to limit sedimentation and other pollution during construction, and prompt vegetation of spoil, channel banks, and other disturbed areas. Plant materials should be selected for their ability to control erosion, and provide food and cover for wildlife, and for beauty and ease of maintenance.

EPA SETS RULES ON TAX WRITE-OFF FOR ANTI-POLLUTION FACILITIES

The Environmental Protection Agency has announced the adoption of final regulations for certifying pollution-control facilities of businesses which qualify for rapid amortization under Section 169 of the Internal Revenue Code. Section 169 was added to the code by the Tax Reform Act of 1969.

Treasury Department regulations for the fast tax write-off of such facilities were published in the Federal Register on May 17, 1971. They provide in general that a taxpayer may amortize over a 60-month period the cost of any treatment facility that has been certified by appropriate State agencies and by EPA.

The new EPA regulations, published in the Federal Register on May 26, 1971, provide guidelines as to facilities that may be eligible for the certification. Forms for the certification will be made available through EPA Regional Offices, which will make the Agency's determination as to the eligibility of such facilities.

RIVER AERATION IN WATER QUALITY MANAGEMENT

A recent study at Rutgers University concludes that induced oxygenation of deep navigable rivers by aeration appears to be an entirely feasible and economical alternative to advanced waste treatment under appropriate conditions, costing approximately half as much as to achieve a given dissolved oxygen level. This was the experience on the Delaware River as reported by the Environmental Protection Agency in its report, "Oxygen Regeneration of Polluted Rivers: The Delaware River," Whipple, W. Jr., et al, Water Pollution Control Research Series 16080 DUP 12/70, Environmental Protection Agency - Water Quality Office, Washington, D. C. 20242.

INSTITUTE RESEARCH PROGRAM FOR FY 1972

The Institute's research program for the coming year is being reviewed in the News over a period of several months. This started with the April issue.

Additional projects are summarized below. Others will be covered in subsequent issues.

Water Resources Planning (continued)

• Precipitation Variability Over North Carolina

The objective of this project is to describe rainfall variance over the State of North Carolina in time and space. Precipitation data for the past 30 years or more will be analyzed to obtain detailed descriptions in a meteorological time-space frame and seasonal-geographic dependencies.

The information desired is broadly in measures of rainfall dependability, both serially in time at individual sites and in simultaneous comparisons between sites of different distances. In contrast to the mean state known from climatic norms and totals, this is a step toward increased understanding and prediction as well as toward assessing the complex physical relationships involved in rainfall-evaporation-runoff, rainfall and plant processes, and rainfall and water supply.

Work will progress from initial investigations of variances in monthly precipitation and of models for examining "wet-day" and "dry-day" sequences at individual sites, to the more complicated analysis of time-space rainfall regimes for the entire State.

PRINCIPAL INVESTIGATORS: Dr. Walter J. Saucier and Dr. Allen H. Weber, Department of Geosciences, North Carolina State University at Raleigh

STARTING DATE: May 1, 1971
COMPLETION DATE: June 30, 1972

• Non-Agricultural Drainage

To prepare Chapter 13 of the North Carolina State Water Plan dealing with non-agricultural drainage.

PRINCIPAL INVESTIGATOR: Dr. Carlos Bell, Department of Civil Engineering, University of North Carolina at Charlotte

STARTING DATE: July 1, 1971
COMPLETION DATE: June 30, 1972

Water Quality Management

• Public Participation in Water Pollution Control Policy and Decision Making

The framework for water pollution control in North Carolina and most other states is to classify streams as to best usage, monitor to determine compliance, and enforce through regulatory powers as necessary. Classification as to "best usage" establishes public goals for water quality and has many implications for resource allocation, public and private investment, and quality of the environment. Public participation is extremely important, yet serious questions exist as to public perception of the issues involved and the adequacy of administrative processes for eliciting a response from the public at large.

The N. C. Board of Water and Air Resources is initiating a review of stream classifications throughout the State during the present year. This will include regional public hearings on policy as well as assigned best-usage stream classifications. This occasion offers a rare opportunity to conduct a concurrent study of public perception of water pollution control issues, examine participation in administrative hearings, and develop recommendations for public education and strengthening opportunities for public participation in the development of water pollution control policy and decision making.

PRINCIPAL INVESTIGATOR: Dr. A. Clarke Davis, Department of Sociology and Anthropology, North Carolina State University at Raleigh

STARTING DATE: July 1, 1970
COMPLETION DATE: June 30, 1972

- Effect of Organic Pollutants on the Chelation Capacity of Natural Waters

The use of organic chelating agents in the home, on the farm, and in industry has increased drastically in recent years. Synthetic detergents are a prime example. Phosphate is presently used as a component to soften water by forming stable complexes of calcium, magnesium and trace metal ions. Because of public pressure, manufacturers are seeking replacements for phosphate and these will probably be organic chelating agents. Such materials are also widely used in the textile industry, in electroplating, as a food additive, and for other purposes. Chelates are important in trace metal transport and plant and animal metabolism. Their role in the ecology of natural waters is largely unknown, though there is mounting evidence that it is an important one. The objective of this project is to establish whether the chelation capacity of natural waters is being adversely affected by pollution and to determine the importance of chelation capacity as a measure of water quality.

PRINCIPAL INVESTIGATOR: Dr. Kenneth W. Hanck, Department of Chemistry, North Carolina State University at Raleigh

STARTING DATE: July 1, 1971
COMPLETION DATE: June 30, 1972

- An Investigation of Curricula Materials and Methodology for Training Operators of Wastewater Treatment Facilities

The shortage of qualified operators for wastewater treatment facilities in North Carolina is a serious matter. Future requirement for more complex advanced waste treatment will compound the problem. Present law requires operator certification by the State and recognizes the need for operator training. This investigation would provide the foundation for a more effective training program by determining the knowledge and skill requirements for the several grades of operators, developing a detailed training curricula to meet these needs, and determining the most appropriate combination of methodology and materials to be used in implementing the training objectives.

PRINCIPAL INVESTIGATOR: Professor James C. Brown, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

STARTING DATE: July 1, 1971
COMPLETION DATE: June 30, 1972

- An Assessment of the Quantitative and Qualitative Nature of Exotic Substances in Surface Waters of North Carolina and Their Implication as Water Supply Contaminants

Land runoff, municipal, and industrial wastes introduce many substances into surface waters which are complex in nature, not adequately assessed as to quality standards, and poorly understood as to their chronic long-term effects on human health where receiving waters are used as a source of public water supply. Since present water treatment processes in common use do not remove most of these materials, there is great need for a better understanding of their quantity, character, and effects.

This project will continue present monitoring of stations on the Haw and New Hope Rivers, expand sampling procedures to establish the presence of exotic and unknown materials in these streams together with some exploratory investigation of their presence in a related downstream treated water supply.

PRINCIPAL INVESTIGATOR: Dr. Charles M. Weiss, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

STARTING DATE: July 1, 1971
COMPLETION DATE: June 30, 1972

Water and Wastewater Management in Dairy Processing

Increasing population and economic growth will inevitable impose greater demands on the available water resource and capital investment in water pollution control facilities. This fact underscores the importance of encouraging the most economic solutions possible. Waste treatment is costly and should be the last resort. A continuing effort toward "in-plant" solutions to industrial waste problems should be sustained. This project deals with dairy processing plants. Through in-plant studies it will develop information and an educational program to encourage water conservation and waste reduction by the dairy processing industry.

PRINCIPAL INVESTIGATORS: Dr. V. A. Jones, Dr. A. P. Hansen, and Mr. R. E. Carrawan, Department of Food Science, North Carolina State University at Raleigh

STARTING DATE: July 1, 1971
COMPLETION DATE: June 30, 1972

ENGINEERS ADOPT POLICY STATEMENT ON ENVIRONMENTAL QUALITY

The American Society of Civil Engineers has adopted a policy statement on environmental quality to guide Society members in their professional work and roles as citizens in a democratic society. The Society recommends:

1. In relation to his work, the civil engineer must recognize the effect his efforts will have on the environment. He is, therefore, obligated to increase his knowledge and competence in incorporating ecological considerations in his design.

2. In relation to his client, the civil engineer must inform the latter of the environmental consequences of the services requested and the design selected, recommending only responsible courses of action. He must be prepared to relinquish his services in the event the client insists on a course of action which can be demonstrated to have undesirable consequences to the environment. The engineer must also seriously weigh social and national considerations and alternatives when appropriate, in addition to the apparent lowest-cost and technical aspects of a project.

3. In relation to ASCE, the civil engineer must fully utilize mechanisms within the Society which lend support to his own individual efforts to implement environmental considerations. Active support by the Society will enable him to deal more effectively with clients reluctant to accept such factors in their projects.

4. In his role as a citizen, the civil engineer must recognize the urgent need for adequate legislation and enforcement to protect the environment. He must, therefore, take the lead in modifying or supporting governmental programs to insure adequate environmental protection.

STATUS OF STREAMS AND GROUNDWATER IN NORTH CAROLINA

Streamflow throughout the State was at or above normal during May. Significant rises occurred in the western Piedmont on May 13 and 16. No major damage was reported.

Groundwater levels continued to rise during the month.

— U. S. Geological Survey

WATER RESOURCES LEGISLATION IN THE NORTH CAROLINA LEGISLATURE

Bills Ratified

S. B. 400 — Mining Act of 1971

S. B. 96 — Environmental Bill of Rights

Bills Introduced

S 641 — Bald Head development

" To encourage the development of Bald Head Island as a major resort area and to prohibit State condemnation of said island."

S 743 — Creating metro water districts

"Establishing metropolitan water districts." Creates Metropolitan Water Districts Act. Permits two or more political subdivisions in county to petition bd. of county comm'rs for creation of metropolitan water district by filing resolution of governing body of each subdivision requesting proposed district; and petition signed by not less than 15% of freeholders residing in any unincorporated area.

S 758
H 1217 — Clean Water bonds

" To authorize the issuance of one hundred fifty 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." Authorizes general obligation State bond issue for purposes indicated by title, subject to approval by voters of the State at Statewide election to be held not later than May 6, 1972. Creates a Clean Water Fund for: grants to units of gov't construction or improvement of wastewater treatment works, wastewater collection systems and water supply systems, with maximum 25% grant limit of total construction cost subject to possible additional 5% if necessary for project to qualify for federal aid, to meet extreme public necessity, or to provide funds to acquire realty where federal funds not available therefor.

S 774
H 1229

Animal Waste Pollution Control Act

" To control pollution from animal and poultry production units." Requires that animal or poultry production units shall be operated in such manner that: (1) no animal wastes are discharged in waters in violation of water quality standards applicable to stream; (2) foul or noxious odors caused by unit are minimized; and (3) insects, vermin or pests bred in or attracted to operations are suppressed.

S 775
H 1230

Interstate Environmental Compact

" Entering into the Interstate Environmental Compact and for related purposes." Enacts Interstate Environmental Compact and enters NC into Compact along with other state signatories for purposes of engaging in cooperative efforts in environmental problems.

H 995

Uniform water well contractor law

" To amend Article 6 of Chapter 87 of the General Statutes of North Carolina, relating to water well contractors."

S 802

Regional sewage disposal systems

"To encourage and promote regional sewage disposal systems, and to define the functions of the State Department of Water and Air Resources and the State Department of Administration in relation to planning of regional sewage disposal systems."

H 1275

(Joint Resolution) Sedimentation, pollution study

" To provide that the North Carolina Board of Water and Air Resources conduct a study of sedimentation problems and pollution."

WATER RESOURCES LEGISLATION IN THE CONGRESS

Bills Passed (House) :

H. R. 56	To amend the National Environmental Policy Act of 1969, to provide for a national environmental data system.
H. R. 6359	To amend the Water Resources Planning Act to authorize increased appropriations.

Bills Introduced:

S 1879	To provide for the establishment of National Recreational Water Course System, and for other purposes.
H. R. 8319 H. R. 8591	To amend the Federal Water Pollution Control Act to provide for its uniform application to all of the navigable waters of the U. S. and to provide financial assistance to States and Municipalities for water quality enhancement and pollution control, and for other purposes.
H. R. 8503	To amend the Water Resources Planning Act to include provision for a national land use policy by broadening the authority of the Water Resources Council and river basin commissions and by providing financial assistance for statewide land use planning.
H. R. 8544	To amend the Land and Water Conservation Act of 1965, as amended.

H. R. 8554	To amend the IRC to encourage the abatement of water and air pollution by permitting rapid amortization of the entire cost of all qualifed pollution abatement works.
H. R. 8665 H. R. 8914	To amend the Federal Water Pollution Control Act to establish health and welfare standards which must be met by all synthetic detergents and to ban from detergents all phosphates and those synthetics which fail to meet the standards by June 30, 1973.
H. R. 8736	To amend section 8 of the Federal Water Pollution Control Act, relating to grants for the construction of treatment works, in order to increase the Federal share of construction costs and to authorize the obligation of certain amounts for such grants, and to amend section 10 of the Act relating to water quality standards, and for other purposes.
H. R. 8959	To amend the Clean Air Act and the Federal Water Pollution Control Act in order to prevent false and deceptive advertising with respect to products and services to prevent and control air and water pollution.
H. R. 8960	To reduce pollution which is caused by litter composed of soft drink and beer containers, and to eliminate the threat to the Nation's health, safety, and welfare which is caused by such litter by banning such containers when they are sold in interstate commerce on a no-deposit, no-return basis.
H. R. 8935	To amend the Federal Water Pollution Control Act in order to authorize the Secretary of the Interior to incur obligations for construction grants under section 8 of such Act, and for other purposes.
H. R. 8921	To amend the Federal Water Project Recreation Act to provide that all project and operational costs for anadromous fish enhancement programs operated by non-federal agencies shall be borne by the Federal Government, and for other purposes.

NEW PUBLICATIONS RECEIVED BY THE INSTITUTE

(These may be borrowed from the Institute for a two-week period. Where individual copies are desired, readers are encouraged to request copies from the organization issuing the publication. The addresses are provided by the News for this purpose.)

Water Resources Planning

"An Annotated Bibliography on the Design of Water Resources Systems," by H. Asfur, et al, WRC, Univ. of Calif., Los Angeles, Calif. 90024, Mar. 1971.

"Economic-Ecologic Anaylsis in the Charleston Metropolitan Region: An Input-Output Study," by E. A. Laurent, et al, WRRI, Clemson Univ., Clemson, S. C. 29631.

"A Preliminary 'Least Cost' Study of Future Groundwater Development In Northeastern Illinois," by A. F. Moench, et al, Ill. State Water Survey, Urbana, Ill. 61801, 1971.

"The New Hope Project: A Reevaluation," (A student report), Dept. ESE, Sch. Pub. Health, UNC, Chapel Hill, N. C. 27514, May 1971.

"An Analysis of New Jersey's Water Pollution Control Program," by P. H. Burch,Jr., et al, Rutgers - The State Univ., New Brunswick, N. J. 08903, Nov. 1970.

"Optimal Policy For Operation of a Multipurpose Reservoir," by B. J. Prochaska, et al, WRRI, Clemson Univ., Clemson, S. C. 29631, Jan. 1971.

"Evaluating Urban Core Usage of Waterways and Shoreline," by I. L. Whitman, et al, (prin. Inv.) Battelle Memorial Inst., Columbus Lab., 505 King Ave., Columbus, Ohio, 43201, April 30, 1971.

"Water Law Developments," by Water Law Committee, WRRC, VPI & State Univ., Blacksburg, Va. 24061, 1970-1971.

"Water Resource Planning In The Urban-Metropolitan Context," by M. M. Hufschmidt, Dept. of City & Reg. Planning, UNC-CH, 27514, Jan. 1971.

"Stochastic Population Dynamics for Regional Water Supply and Waste Management Decision-Making," by P. Meier, WRR, Univ. of Mass., Amherst, Mass. 01002, Aug. 1970.

"Identification and Interrelationships of Secondary Benefits in Waterways Development," by R. K. Rainer, et al, WRRI, Auburn Univ., Auburn, Ala. 36830, April 1971.

Water Quality Management

"Optimum Mechanical Aeration Systems For Rivers And Ponds," by Wm. T. Hogan, USGPO, Wash., D. C. 20402, Price - $1.25, Nov. 1970.

"Effect of Environmental Factors On Benthal Oxygen Uptake," by A. J. McDonnell, et al, The Pa. State Univ., Univ. Park, Pa. 16802, Aug. 1969.

"Study and Interpretation of the Chemical Characteristics of Natural Water," (second edition) by J. D. Hem, USGPO, Wash., D. C. 20402, Price - $2.25, 1970.

"Reuse of Chemical Fiber Plant Wastewater and Cooling Water Blowdown," by EPA-WQO, USGPO, Wash., D. C. 20402, Price - $.70, Oct. 1970.

"Retention Basin Control of Combined Sewer Overflows," by Springfield Sanitary District, USGPO, Wash., D. C. 20402, Price - $1, Aug. 1970.

"Potential Environmental Modifications Produced By Large Evaporative Cooling Towers," by E G & G Inc., USGPO, Wash., D. C. 20402, Price - $.75, Jan. 1971

"Research On Dry - Type Cooling Towers For Thermal Electric Generation, Part I," by J. P. Rossie, et al, USGPO, Wash., D. C. 20402, Price - $2.50, Nov. 1970.

"Research On Dry - Type Cooling Towers For Thermal Electric Generation, Part II," by R. W. Beck & Asso., USGPO, Wash., D. C. 20402, Price - $1, Nov. 1970.

"The Effect of Detergents on Gas Absorption Processes," by J. A. Caskey, et al, WRRC, VPI and State Univ., Blacksburg, Va. 24060, April 1971.

"Eutrophication Program," by WRC, The Univ. of Wis., 1324 West Dayton St., Madison, Wis. 53706, Nov. 1970.

"Respiration of Aquatic Macrophytes in Eutrophic Ecosystems," by A. J. McDonnell, et al, The Pa. State Univ., Dept. of Civil Engr., Univ. Park, Pa. 16802.

"Aerated Lagoon Treatment Of Food Processing Wastes," by K. A. Dostal, USGPO, Wash., D. C. 20402, Price - $.55, March 1968.

"Guidelines: Biological Surveys At Proposed Heat Discharge Sites," by R. R. Garton, USGPO, Wash., D. C. 20402, Price - $1, April 1970.

"An Analytical And Experimental Investigation Of Surface Discharges Of Heated Water," by K. D. Stolzenbach, USGPO, Wash., D. C. 20402, Price - $1.75, Feb. 1971.

"Vortex Separation For Oil Spill Recovery Systems," by American Process Equip. Corp., USGPO, Wash., D. C. 20402, Price - $.60, Oct. 1970.

"Polymeric Materials for Treatment and Recovery of Petrochemical Wastes," by Gulf South Research Inst., USGPO, Wash., D. C. 20402, Price - $.70, Mar. 1971.

"Recovery, Separation, and Identification of Phenolic Compounds From Polluted Waters," by S. D. Faust, et al, WRRI, Rutgers - The State Univl, New Brunswick, N. J. 08903, Jan. 1971.

"Secondary Treatment of Potato Processing Wastes," by K. A. Dostal, USGPO, Wash., D. C. 20402, Price - $.65, July 1969.

"Aerobic Secondary Treatment of Potato Processing Wastes," by The R. T. French Co., USGPO, Wash., D. C. 20402, Price - $1.50, Dec. 1970.

"Reaeration Measurements in a Eutrophic Stream," by W. A. Blain, et al, Dept. of Civil Engr., The Pa. State Univ., Univ. Park, Pa. 16802.

"Pedologic Features Of Reservoir Sedimentation," by H. Kohnke, et al, Purdue Univ., WRRC, Lafayette, Ind. 47901, April 1971.

"Sedimentation," by H. Olaru, USDC, Nat'l. Tech. Inf. Ser., Springfield, Va. 22151, 1970.

"Control of Infiltration and Inflow into Sewer Systems," by American Public Works Assoc., USGPO, Wash., D. C. 20402, Price - $1.25, Dec. 1970.

"An Electromembrane Process for Regenerating Acid from Spent Pickle Liquor," EPA, USGPO, Wash., D. C. 20402, Price - $1, Mar. 1971.

"Mathematical Models For The Prediction Of Temperature Distributions Resulting From The Discharge Of Heated Water Into Large Bodies Of Water," by R. C. Y. Koh, USGPO, Wash., D. C. 20402, Price - $1.75, Oct. 1970.

"Mathematical Models For The Prediction Of Thermal Energy Changes In Impoundments," by Water Res. Engr., Inc., USGPO, Wash., D. C. 20402, Price - $1.50, Dec. 1969.

"A Predictive Model For Thermal Stratification and Water Quality in Reservoirs," by M. Markofsky, et al, USGPO, Wash., D. C. 20402, Price - $2, Jan. 1971.

"Toxic Substances," by Council on Env. Quality, USGPO, Wash., D. C. 20402, April 1971.

"Cost of Domestic Wells and Water Treatment in Illinois," by J. P. Gibb, Ill. State Water Survey, Urbana, Ill. 61801, 1971.

"Utilization of Waste Fluosilicic Acid" by H. E. Blake, Jr., et al, USDI, Bureau of Mines, 4800 Forbes Ave., Pittsburgh, Pa. 15213, April 1971.

"Beneficial Uses of Waste Heat-An Evaluation," by R. R. Garton, et al, Head Proj. Rpt. System, Of. of R&D, WQO, EPA, Wash., D. C. 20242, Sept. 18, 1970.

Water Quantity Management

"Dispersion In Heterogeneous Nonuniform Anisotropic Porous Media," by R. A. Greenkorn, USGPO, Wash., D. C. 20402, Price - $1, Sept. 1970.

"Flood Plain Information Mecklenburg County, N. C.," Mallard Creek, Toby Creek & Doby Creek, (Vol. III) by Corps of Engr., Charlotte-Mecklenburg Planning Commission, Charlotte, N. C. 28202, April 1971.

"Projected Groundwater Deficiencies In Northeastern Illinois, 1980-2020," by R. J. Schict, et al, Ill. State Water Survey, Urbana, Ill. 61801, 1971.

"Hydrodynamics And Discharge Measurements Of Storm Sewers," by E. L. Bourodimos, et al, WRRI, Rutgers - The State Univ., New Brunswick, N. J. 08903, Mar. 1971.

"Conference Proceedings Hydrologic Models in Water Resources Management," by Clemson Univ., WRRI, Clemson Univ., Clemson, S. C. 29631, Mar. 1970.

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