

WATER RESOURCES RESEARCH INSTITUTE

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NOTICE OF WATER RESOURCES RESEARCH GRANTS

Applications from faculty members of senior colleges and universities in North Carolina for grants under the Institute's Fiscal Year 1976-77 Annual Allotment Program will be accepted until February 2, 1976. No exceptions will be made to this cutoff date.

The purpose of the Annual Allotment Program is to encourage new research related to the water resource problems of North Carolina and the South Atlantic Gulf Region. The Institute's "Summary of Water Resource Problems and Research Needs of North Carolina," discusses and highlights areas in which the Institute is attempting to develop research. A copy of this report is available upon request from the Institute. First consideration will be given to proposals which attempt to respond to these recognized State and regional needs.

Priority will be given to short-term proposals which launch important new work and have the potential for continued support. Grants for proposals involving more than one year's support will be approved on an annual basis. Projects will be considered for renewal on the basis of individual merit.

The federal fiscal year is being changed from July 1 - June 30 to October 1 - September 30 effective 1976. While a project or two will be funded effective July 1, the majority will be funded October 1, and investigators should plan accordingly.

Copies of instructions for preparation of proposals can be obtained from the Institute by calling the Office of the Director, 124 Riddick Building, North Carolina State University, Raleigh, North Carolina 27607, Telephone Code 919, 737-2815.

NEW INSTITUTE REPORTS

Report No. 107

Strategies for Water Quality Monitoring

by

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This study provides general guidelines for the preliminary design of a water quality monitoring system. The design is defined as the specification of the parameters to be determined, the number and location of sampling stations, and the frequency of sampling. The role of several objectives in the determination of monitoring strategy is considered. The objectives examined are the characterization of stream water quality, enforcement of stream standards and the detection of long-term trends. Principal component analysis is used to identify important water quality parameters and to find the appropriate size of a monitoring network. Information content defined as the reciprocal of the variance of the estimate of the mean concentration is suggested as a valid criterion for the design of a monitoring network for the characterization of water quality. Impact index based on the probability, severity and frequency of violation, number of direct users of the stream water, predominant use and the size of stream is proposed for determining the priority of location in an enforcement network. A protocol for the sampling of non-point sources is presented. The Research Triangle area in North Carolina is used as a case study. A possible framework for the strategy of water quality monitoring is described. This consists of an initial one-time baseline data collection program and eventually three types of networks: (a) an extensive network at relatively large number of key points, (b) an intensive network in selected drainage sub-basins, and (c) a regulation network.

Report No. 90

Capacity of Water-Based Recreation Systems Part III: Methodology and Findings

by

Harold K. Cordell, Gordon A. Hammon, John Graham,
William L. Hafley, and M. Roger Warren

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Statistics and Biomathematics, and Forestry
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This is the third of a series of publications reporting on research to develop methods, models, and guidelines for planning and managing water-based recreation systems. The previous reports are: *Capacity of Water-Based Recreation Systems: Part I, The State of the Art* - Gordon A. Hammon, Harold K. Cordell, *et al.*, (April 1974) and *Capacity of Water-Based Recreation Systems: Part II, A Systems Approach to Capacity Analysis* - Gordon A. Hammon, Harold K. Cordell, *et al.*, (July 1974).

In this report, methods conceptualized and tested for collecting and processing data describing recreational boating behavior are presented. The test site was Lake Burlington in the Piedmont of North Carolina. Means for data collection included questionnaires, interviewing, shoreline-based observation, and aerial photography.

Based on an analysis of the interview and on-site observation data, a major finding is that capacity, measured as number of boats which should use a lake system at the same time, probably should not be fixed by the managing authority. Boaters at the study site appeared to have acclimatized themselves to the frequently heavy use conditions which sometimes exceeded 1 boat per 6 acres of water surface. Thus, managers and planners' continual search for the magic number called capacity, which if found and used is believed to be the solution to many management problems, appears to be an unnecessary pursuit.

LAND APPLICATION OF ANIMAL WASTES

The *Research Status Effects of Land Application of Animal Wastes* by Powers, Wallingford and Murphy of Kansas State University, has been published by EPA as Report EPA-660/2-75-C10 May 1975.

Animal wastes were found to be extremely variable in their chemical composition. This necessitates the analyses of wastes before application so that rates can be based on nitrogen or salt content of the waste. Variability of the chemical composition and the necessity for chemical analyses before application precludes the use of specific application rates that can be used nationally.

Numerous literature is available on the short-term effects of applying animal waste to land, but there appears to be little information available on the long-term effects of animal waste on the physical, chemical, and biological properties of the soil. Even fewer publications are available on guidelines which provide methods of calculating animal waste application rates. Because of the lack of data on long-term effects on the fate of nutrients and soluble salts added to the soil, it appears that the best and safest application rate is one which supplies just enough nitrogen to maintain optimal plant growth so that the maximum amount of this nutrient can be recycled. Few states have published guidelines on the application of animal waste to land. In areas where guidelines are not available, many agricultural scientists use rule-of-thumb figures for application rates of animal wastes. In order to avoid errors inherent in rule-of-thumb figures, more experimental data are needed so that guidelines can have a wider applicability.

One of the basic objectives of this report was to recommend needed research. This includes:

1. The denitrification process as affected by soil temperature, climate, and waste composition. While it is recognized that this process can cause large losses of soil nitrogen into the atmosphere, little is known on how animal waste applications affect this process. In some cases denitrification may account for large errors in underestimating the application rate for a given agronomic system. For this reason, additional research is needed on the denitrification process in soils that have received animal wastes.

2. The fate of soluble salts in manure upon addition to land. In many parts of the United States there is sufficient precipitation to move the soluble salts in manures below the root zone. The ultimate fate and pathways of these salts should be known. Often salts may leach into groundwater by percolation and into surface streams through underground recharge. Insoluble salts may lower the quality of groundwater and surface streams. For this reason, additional research should be done on the fate of inorganic salts upon addition and incorporation to the soil.
3. The long-term effect of manure application on crops. There are numerous publications on the effects of animal waste on crop growth. In particular, there was a great deal of research done on fertilization of crops with animal manure during the early part of this century. Additional information on build-up of toxic chemicals in plants such as copper, arsenic, and the accumulation of nitrates in plant material and their effect on foraging livestock is needed. For this reason, some long-term studies on the effect of animal waste application to land on crop growth and crop quality should be made.
4. Methods of standardizing animal waste analyses and research reporting. In order to compare research results and establish application rates there must be a standardization of data. Analyses should be expressed on a dry-weight basis except possibly for liquids of low solids content (approximately 1 percent or lower). Data on the location of research by climate and soil characteristics should also be made. Depth of impervious layers, water tables, and other pertinent information should be reported. It is only with these standardizations that meaningful comparisons can be made and guidelines established. Therefore, it is suggested that a standardization of data be established.
5. Nitrogen mineralization and decay rates of manure under different climatic and soil conditions. Because much of the nitrogen contained in animal waste is in an organic form, the decay rate, or the rate at which nitrogen is mineralized in the soil, becomes an important factor in the availability of the nitrogen for plant uptake and for leaching into groundwater. For this reason, more information is needed on mineralization or decay rates in various parts of the country.

There are several areas in which it is felt that additional research is not needed. One of these is additional characterization of beef, dairy, swine, and poultry wastes. The numerous publications on the characterization of these wastes all show extreme variability and, as mentioned in this report, they are difficult to classify by climate. There has been little research done, however, on the characterization of sheep, horse, and fish hatchery wastes. Knowledge of the composition of these wastes must also be known before disposal.

CONFERENCE PROCEEDINGS ON "NON-POINT SOURCES OF WATER POLLUTION" AVAILABLE

The conference on non-point sources of pollution from agriculture, forestry-related mining, and construction activities is available from the Virginia Water

Resources Research Center. State-of-the-art presentations on the four principal dimensions of non-point sources are included. Some 21 significant papers were presented at the conference and are contained in this volume. A copy may be borrowed from the Institute or purchased for \$8 from: Virginia Water Resources Research Center, 225 Norris Hall, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

ARMY ENGINEERS EXTEND COMMENT PERIOD ON PERMIT REGULATION

The 90-day comment period on the Corps of Engineers expanded authority to regulate the discharge of dredged or fill material in "the waters of the United States including the territorial seas" has been extended to December 5, 1975.

Significant comments continue to be received on the interim final regulation which was published in the *Federal Register* last July 25. The Corps of Engineers has conducted four major regional public hearings in September and many local public information meetings since then on the regulation.

On September 5, the administrator of the Environmental Protection Agency published guidelines for evaluating permit applications for disposal of dredged or fill material. The 90-day comment period on the EPA guidelines also ends on December 5.

The Corps of Engineers extended the comment period on its regulation because many comments on the EPA guidelines also relate to the Corps' regulation and additional direct comments on the latter are expected as information meetings continue through November.

All comments received by December 5, 1975, will be reviewed and evaluated by the Corps of Engineers in future revisions of its interim final regulation.

All comments, suggestions or objections to the regulation should be submitted in writing to the Chief of Engineers, Forrestal Building, Washington, D. C. 20314, ATTN: DAEN-CWO-N.

WATER RESOURCES PLANNING ACT SIGNED BY FORD

Legislation extending the Water Resources Planning Act was signed by President Ford this month. In terms of appropriations, the Act extends authorization for state planning grants for fiscal years 1977 and 1978 at the same level as in past years. Funds from this are used for state water resource planning by the Division of Resource Planning and Evaluation, Department of Natural and Economic Resources.

WAYS TO IMPROVE IMPACT STATEMENTS SUGGESTED

A recently completed study of Environmental Impact Statements (EIS) by the Institute of Ecology suggested that there is an overemphasis on the statements themselves rather than attaining the goals of the National Environmental Policy Act (NEPA).

According to the study, the focus should be on the goals of NEPA and improving the role of the statements in the decision-making process.

Recommendations on improving statements include reducing their length and having precise statements on the goals and objectives of proposed actions, statements of purpose for each EIS section, and citations to all references and studies used in EIS preparation.

The study says that Environmental Impact Statements should be improved "to permit the reader to identify the major purpose and anticipated benefits of the proposed action, the major controversies involved, the major potential environmental impacts and the major planned mitigation efforts."

Other recommendations include accurate identification and collection of data with better use of the data for description, evaluation, and prediction of potential impacts.

A more complete statement of findings can be found in *The Environmental Impact Assessment Project: A Critical Appraisal* available for \$2.50 from the Institute of Ecology, 955 L'Enfant Plaza, S.W., Suite 2600, Washington, D. C. 20024.

NEW U.S.G.S. PUBLICATION

Topographic Maps - Standard quadrangle maps - scale 1:24,000 - 75¢/copy

Maxton 1974

Cary 1973 (resurvey)

These may be ordered from: Branch of Distribution
U. S. Geological Survey
1200 South Eads Street
Arlington, VA 22202

or purchased from map dealers in various cities of the State.

POLLUTION HELP LINE BUSY

From January through October better than 300 calls were placed to North Carolina's Pollution Help Line 1-800-662-7308. Citizens calling this number have their questions answered or are referred to specific divisions and sections of the Department of Natural and Economic Resources for a response. Queries on water led the list with 142 phone calls followed by air with 123.

Citizens from any place in North Carolina can call 1-800-662-7308 to request information or report pollution problems. Local citizens may call 829-4740, Extension 251 or 316.

SHORT COURSE ON URBAN STORMWATER MANAGEMENT

A three-day course with lectures and exercises is to be conducted especially for design professionals and municipal officials involved in the design and management of urban drainage systems.

Objectives of the course are to familiarize designers with the application of fundamental hydraulic and hydrologic design techniques in responding to emerging stormwater management requirements in urban areas. *Urban Stormwater Management* is a broad term which is used to identify those activities undertaken to prevent damage associated with urban storm flows.

Lecture and participative design exercises will be conducted covering the topics of Stormwater Collection, Stormwater Channels, Stormwater Impoundments, and Sediment Basin Design.

Instructor for the course is Dr. H. Rooney Malcom, Assistant Professor of Civil Engineering, North Carolina State University. Dr. Malcom is a Professional Engineer in North Carolina and is a recipient of one of the Outstanding Extension Service Awards for 1975, presented for outstanding contributions to Extension and Continuing Education at North Carolina State University. He is currently the principal investigator for the Institute research project, *Performance Objectives for Stormwater Management in Urban Areas*.

The course will be taught December 15-17, 1975, at the Sheraton Motor Inn, Greensboro, and on March 8-10, 1976, at the Howard Johnson Motor Lodge, Crabtree Valley, Raleigh. For information, contact John Gordon (919) 737-2261, North Carolina State University, Division of Continuing Education, P. O. Box 5125, Raleigh, North Carolina 27607.

CONFERENCE ON MARINE RESOURCES OF THE COASTAL PLAINS STATES

The Coastal Plains Marine Center, in cooperation with Virginia, North Carolina, South Carolina, Georgia, and Florida, is sponsoring a Conference on Marine Resources of the Coastal Plains States at The DeSoto Hilton, Savannah, Georgia, on December 11 and 12. The conference is designed to provide a means through which federal, State, and local government administrators, scientific researchers, and representatives of private industry, as well as private citizens, can communicate recent findings and ideas regarding some of the major coastal and marine issues facing the Coastal Plains States. For additional information contact Coastal Plains Center for Marine Development Services, 1518 Harbour Drive, Wilmington, North Carolina 28401.

STEWART HEADS INFORMATION TRANSFER COMMITTEE

Dr. James Stewart, Associate Director of the Institute, has been named chairman of the Universities Council on Water Resources Committee on Education and Research on Technology Transfer. The Committee, composed of university representatives from eighteen states, is concerned with implementation of new findings and knowledge gained from water research and educational functions of the universities.

POSITIONS AVAILABLE

The North Carolina State University Department of Zoology is seeking an Assistant or Associate Professor in Aquatic Ecology. Interests may span the range from fresh water to marine ecosystems. Contact Dr. B. J. Copeland, Department of Zoology, North Carolina State University, Raleigh, N. C. 27607.

The Geological Survey is recruiting to fill the vacancy for an Assistant Chief Hydrologist for Operations. Contact the Water Resources Division, Office of Assistant Chief Hydrologist for Operations, Reston, Virginia.

Announcement of a vacancy has been received for Project Manager in Guinea with experience in all the fields of applied hydrology and in the organization and administration of a Hydrological Service on a national scale. Contact The Secretary-General, World Meteorological Organization, Case Postale No. 5, CH-1211 GENEVA 20, Switzerland.

The Department of Environmental Sciences at the University of Virginia has an opening for a hydrologist and/or hydrogeologist at the Assistant Professor level. Contact Mr. R. Dolan, Department of Environmental Sciences, University of Virginia, Charlottesville, Virginia 22903.

The joint position of Director of the Utah Water Research Laboratory (UWRL) and Director of the Utah Center for Water Resources Research (UCWRR) is available. For further information contact Dr. Doran Baker, Chairman of the Screening Committee, College of Engineering, Utah State University, Logan, Utah 84322, prior to December 31, 1975.

WATER RESOURCES CONDITIONS IN NORTH CAROLINA FOR OCTOBER

Runoff from heavy rains on the 17th-18th caused significant flooding on many streams in the western Piedmont. The most severe flooding occurred in Wilkes, Burke, Yadkin, Rutherford, and Cleveland counties where the recurrence intervals of many flood peaks ranged from 5 to 50 years. Flood peaks, having recurrence intervals of 50 years, were recorded at USGS gaging stations located on the First Broad River near Casar and Roaring River near Roaring River. The flood waters caused minor damage

to several bridges and highways in Wilkes County. Rains from the same storm also caused sharp rises on most streams in the Mountains but no significant flooding was reported.

Monthly mean flows at index gaging stations ranged from normal at Neuse River near Clayton to over two times normal flow in the French Broad River at Asheville. Flows at the end of the month were considerably below normal in the Coastal Plain region, near normal in the Piedmont, and about 1 1/2 times above normal October flow in the Mountains.

Groundwater levels declined. Water levels remained slightly above the long-term averages in the Piedmont and Mountains and below average in the Coastal Plain.

WATER RESOURCES LEGISLATION IN THE CONGRESS

New Public Laws

House

H.R. 5952 To extend authority for financial assistance to the States for water resources planning. Signed October 15, 1975.

Bills Passed

Senate

S. 506 Water resources planning, amended.

House

H.R. 6669 Water resource development feasibility investigations, amended.

Bills Introduced

House

H.R. 10247 To establish the Boundary Waters National Recreation Area, to designate the Boundary Waters Wilderness.

H.R. 10280 To authorize a study for the purpose of determining the feasibility and desirability of designating the Daniel Boone Trail as a national scenic trail.
H.R. 10338

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

Water Resources Planning

- "State Guidelines for Local Planning in the Coastal Area Under the Coastal Area Management Act of 1974," 10/75, Coastal Resources Comm., PO Box 650, Morehead City, NC 28557.
- "Coastal Development and Areas of Environmental Concern, Proceedings of a Symposium," (UNC-SG-75-18), 9/75, Ed. by S. Baker, UNC Sea Grant Prog., 1235 Burlington Lab., NCSU, Raleigh, NC 27607.
- "Economics of Water Supply Planning and Management," (#90), 6/75, by J. C. Frey, et al, Inst. for Res. on Land and Water Resources, PA St. U., U. Pk., PA 16802.
- "Clarks Creek Flood Plain Study, Catawba County, North Carolina, 10/75, by USDA, SCS, PO Box 27307, Raleigh, NC 27611.
- "An Information Retrieval System for the Macroinvertebrate Fauna of Indiana Rivers and Lakes," (#70), 9/75, by W. P. McCafferty, WRRRC, Purdue U., W. Lafayette, IN 47907.
- "A Land Capability Model for the Lower Lake Monroe Watershed," (#66), 7/75, by J. R. Chiesa, et al, WRRRC, Purdue U., W. Lafayette, IN 47907.
- "Water Quality Management Plan, Neuse River Basin," (DRAFT COPY), (Sub-basin 03), 10/75, EMC, NCDNER, Raleigh, NC 27611.
- "Water Quality Management Plan, Yadkin River Basin," (DRAFT COPY), (Sub-basins 01,17,05,10), 10/75, EMC, NCDNER, Raleigh, NC 27611.
- "Ecologic Modeling of Puget Sound and Adjacent Water," (WRE 11930), 9/75, for EPA, avail. from Water Resources Engineers, Inc., Walnut Creek, CA 94596.
- "North Carolina Water Plan - Technical Report - Neuse-White Oak River Basin - Volume I," (DRAFT), 3/75, Div. of Res. Plan. & Evaluation, NCDNER, Raleigh, NC 27611.
- "Implementation of a NPDES Data Management System," (#69), 9/75, by A. B. Whinston, WRRRC, Purdue U., W. Lafayette, IN 47907.
- "An Appraisal of North Carolina's Potential for Outdoor Recreation," 9/75, USDA, SCS, PO Box 27307, Raleigh, NC 27611.
- "Systematic Development of Methodologies in Planning Urban Water Resources for Medium Size Communities," (#65), 9/75, by D. M. Naber, et al, WRRRC, Purdue U., W. Lafayette, IN 47907.
- "Economic Impact of Fiscal Constraints of Water Project Construction," 10/75, for OWRT, by Harza Eng. Co., 150 South Wacker Dr., Chicago, IL 60606.
- "The Williamette River Greenway: Cultural and Environmental Interplay," (WRRRI-35), 9/75, by W. D. Honey, Jr., WRRRI, OR St. U., Corvallis. OR 97331.

Water Quality Management

- "Chemical Coagulation/Mixed-Media Filtration of Aerated Lagoon Effluent," (EPA-660/2-75-025), 6/75, by J. F. Grutsch, et al, American Oil Co., for EPA, avail. from USGPO, Wash., DC 20402.
- "Scientific and Technical Assessment Report on Cadmium," (EPA-600/6-75-003), 3/75, for EPA, by NERC, Res. Triangle Pk., NC, avail. from USGPO, Wash., DC 20402.
- "Pollution Abatement from Cattle Feedlots in Northeastern Colorado and Nebraska," (EPA-660/2-75-015), 6/75, by L. K. Porter, et al, ARS, for EPA, avail. from NTIS, USDC, Springfield, Va 22151.
- "A Quantitative Method for Effluent Compliance Monitoring Resource Allocation," (EPA-600/5-75-015), 9/75, by A. I. Cohen, et al, Systems Control, Inc., for EPA, avail. from NTIS, USDC, Springfield, VA 22151.
- "Relative Throughfall Enrichment by Biologic and by Aerosol-Derived Materials in Loblolly Pines," 8/75, by K. J. Banaszak, et al, WRRRI, MS St. U., MS St., MS 39762.

*Agency name changed to NC Division of Environmental Management (NCDNER).

**Agency name changed to Office of Water Research & Technology (OWRT) as of July 29, 1974.

- "Study of Silver Lake Eutrophication - Current Problems and Possible Solutions," (#19), 7/75, by S. K. Bhagat, et al, WRC, WA St. U., Pullman, WA 99163.
- "Predicting the Performance of Feedlot Control Facilities at Specific Oregon Locations," (WRRRI-34), 8/75, by R. B. Wensink, et al, WRRRI, OR St. U., Corvallis, OR 97331.
- "Water Quality in a Central Oklahoma Stream as Influenced by Fish Hatchery Effluent," (ARS-S-66), 9/75, by A. Olness, et al, USDA, ARS, PO Box 53326, New Orleans, LA 70153.
- "Geochemical and Sedimentological Analysis of Tygart Lake, West Virginia," (#7), 9/75, by M. I. Collin, WRI, WV U., Morgantown, WV 20506.
- "Improving the Statistical Reliability of Stream Heat Assimilation Prediction," (EPA-660/3-75-037), 6/75, by R. W. McLay, et al, for EPA, avail. from USGPO, Wash., DC 20402.
- "Environmental Applications of Advanced Instrumental Analysis: Assistance Projects, FY 74," (EPA-660/4-75-004), 6/75, by A. L. Alford, EPA, avail. from NTIS, USDC, Springfield, VA 22151.
- "Lake Classification - A Trophic Characterization of Wisconsin Lakes," (EPA-660/3-75-033), 6/75, by P. D. Uttormark, et al, U. of WI, for EPA, avail. from USGPO, Wash., DC 20402.
- "The National Stream Quality Accounting Network (NASQAN) - Some Questions and Answers," (Circular 719), by J. F. Ficke, et al, USGS, National Center, Reston, VA 22092.
- "Non-Point Sources of Water Pollution," (Proceedings), 9/75, Ed. by P. M. Ashton, et al, WRRRC, 225 Norris Hall, VPI & St. U., Blacksburg, VA 24061.
- "Kinetic Model for Orthophosphate Reactions in Mineral Soils," (EPA-660/2-75-022), 6/75, by C. G. Enfield, et al, NERC, for EPA, avail. from USGPO, Wash., DC 20402.
- "Organic Compounds in Pulp Mill Lagoon Discharges," (EPA-660/2-75-028), 6/75, by B. F. Hrutfiord, et al, U. of WA, for EPA, avail. from NTIS, USDC, Springfield, VA 22151.
- "Tentative Reference Method for the Measurement of Gross Alpha and Gross Beta Radioactivities in Environmental Waters," (EPA-680/4-75-005), 6/75, by Quality Assurance Br., for EPA, avail. from NTIS, USDC, Springfield, VA 22151.
- "Research Reports Supported by Office of Water Research & Technology," (7/74-6/75), USDI, OWRT, WRSIC, Wash., DC 20402.
- "Laboratory Modeling of Thermal Structure in Stagnant Water." (#62), 6/75, by R. Viskanta, et al, WRRRC, Purdue U., W. Lafayette, IN 27907.
- The following publications were prepared for US Army, Corps of Engineers, avail. from NTIS, USDC, 5285 Port Royal Rd., Springfield, VA 22151.
- "Evaluation of Potential Use of Vegetation for Erosion Abatement Along the Great Lakes Shoreline," (MP 7-75), 6/75, by V. L. Hall, et al.
- "Stability of Gobi Block Revetment to Wave Attack," (TM-55), 10/75, by B. L. McCartney, et al.
- "Geomorphology, Shallow Structure, and Sediments of the Florida Inner Continental Shelf, Cape Canaveral to Georgia," (TM-54), 7/75, by E. P. Meisburger, et al.
- "Use of the Radioisotopic Sand Tracer (RIST) System," (TM-53), 6/75, by C. W. Judge.
- "Salt Marsh Establishment and Development," (TM-52), 6/75, by E. W. Garbisch, Jr., et al.
- "Guidelines for the Application of Wastewater Sludge to Agricultural Land in Wisconsin," (#88), 1975, by D. R. Keeney, et al, Dept. of Natural Res., Box 450, Madison, WI 53701.
- "Water Quality Control Through Single Crop Agriculture No. 4," (EPA-660/2-75-026), 6/75, by D. R. Lundberg, et al, Bemidji St. College, for EPA, avail. from NTIS, USDC, Springfield, VA 22151.
- "Water Quality Management and Information Systems," (#68), 9/75, by A. B. Whinton, WRRRC, Purdue U., W. Lafayette, IN 47907.

Water Quantity Management

- "Three Dimensional Simulation of Thermally-Influenced Hydrodynamics Flows," (#190), 1/75, by L. D. Spraggs, et al, Dept. of Civil Engineering, Stanford U., Stanford, CA 94305.
- "The Stochastic and Chronologic Structure of Rainfall Sequences - Application to Indiana," (#57), 8/75, by M. L. Kavvas, et al, WRRRC, Purdue U., W. Lafayette, IN 47907.
- "Models of the Stochastic and Chronologic Structure, Prediction and Simulation of Runoff Sequences - Application to the Lower Ohio Basin," (#60), 8/75, by P. C. Tao, et al, WRRRC, Purdue U., W. Lafayette, IN 47907.
- "Response of Saturated Sands to Cyclic Shear at Earthquake Amplitudes," (#87), 10/75, by V. P. Drnevich, et al, WRRRI, U. of KY, Lexington, KY 40506.

Miscellaneous

- "Geological Bibliography of North Carolina's Coastal Plain, Coastal Zone, and Continental Shelf," (UNC-SC-75-13), 6/75, by S. R. Riggs, et al, UNC Sea Grant Prog., 1235 Burlington Lab., NCSU, Raleigh, NC 27607.
- "North Carolina Forestry Council Report - Long Range Program," 10/75, Off. of Forest Resources, PO Box 27687, NCDNER, Raleigh, NC 27611.
- "Information About Hazardous Waste Management Facilities," (EPA-530/SW-145), 7/75, by D. Farb, et al, avail. from Solid Waste Information, EPA, Cincinnati, OH 45268.
- "Landfill Disposal of Hazardous Wastes: A Review of Literature and Known Approaches," (EPA-530/SW-165), 9/75, by T. Fields, Jr., et al, avail. from Solid Waste Information, EPA, Cincinnati, OH 45268.

Water Resources Research Institute
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