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Water Current

Gary L. Lewis, Acting Director
Volume 12, Number 2

Karen E. Stork, Editor
March/April, 1980

GUEST EDITORIAL

"NEBRASKA'S WATER: TWENTY-FIVE YEARS OF CHANGE"

By

Deon D. Axthelm*
Extension Water Resources Specialist

The groundwater reservoir of Nebraska, including the giant Sandhills aquifer, has given us envied status among more water-deficient states. This extensive underground system with its abundant supply of high quality water has made it possible to drill thousands of wells to serve domestic, irrigation and industrial uses.

Yet, reflecting back over my 25 years of service with the Cooperative Extension Service, University of Nebraska, I see the roots of profound changes beginning to reshape our basic concepts of future development, conservation and use of water resources.

Beginning with pioneer surface irrigation projects, the state's irrigation development was accelerated by well drilling to push Nebraska into third place ranking as an irrigation state. Wells were and are being drilled in all types of soils and terrain.

With many users operating under the illusion of an inexhaustible groundwater supply, water gushed from wells. Crops grew lush and fuel was cheap. Only a few far-sighted individuals and professionals, in agencies and industry, cared enough about the groundwater supply to record changes in groundwater levels.

* Editor's note: Deon Axthelm will retire later this year from many productive years on staff with the University of Nebraska Water Resources extension team, and we wanted our readers to share our appreciation for him and his ideas through this invited editorial. To respectfully modify an addage, old water extension staff never retire, they just put on their fishing boots and wade away. We'll miss Deon, and we know many of our readers will, too.

Soon, however, attitudes began to shift as yearly statistics pointed to consistently dropping water levels. New words crept into the vocabulary. Thoughtful and conscientious irrigators and water users began to preach and practice management and conservation. Still, because of the large number of users, more water was being removed than was recharged to the aquifer. Water levels in heavily pumped areas continued to decline.

Unfortunately, for some areas, "the horse was already out of the barn." Some wells delivered less water. Some stream flows were reduced. A surface reservoir shrank.

Now, more new -- and more discomfoting -- words are becoming commonplace in water resources dialogue: In-stream flows, transbasin diversion, surface and groundwater relationships, conjunctive water use, and more recently, sustained or perennial yield.

All of these words, symbolizing or defining major concepts, are common in relating to retaining water supplies or getting water to certain locations to serve specific uses. All are controversial because they affect various people or entities in different ways. They involve not only economic considerations but also value systems in the multiple -- and hopefully equitable -- uses of water.

The sustained yield concept is a particularly crucial issue because it is misunderstood by some people, leading to faulty conclusions on which to base decisionmaking. In its strictest sense, it does not take into account natural forces regulating the dynamics of the water cycle. In fact, general public awareness and understanding of the so-called sustained yield concept is at the same rudimentary state of understanding as the need for water level measurements was a quarter of a century ago.

In general, advocates of the sustained yield concept hold (incorrectly) that the same amount could be removed by pumping from an aquifer that is recharged to that aquifer in a given year. Thus, it is reasoned that there is no net loss and groundwater levels remain relatively constant.

Under natural, undistributed conditions, this would be true because average discharge is balanced by average natural recharge. Groundwater moves toward and contributes to stream flow, to evapotranspiration in shallow water table areas, and to some wetlands. However, this natural equilibrium, this equation, is upset by any removal of groundwater by pumping. Groundwater slowly moves to compensate for water leaving at a discharge point. The groundwater levels decline and eventually the groundwater discharge points and uses are shorted.

A "safe-yield" is safe only if we are content to "short" some discharge outlet or water use. At first, the water table declines a small amount and all discharges would be relatively the same. But as tables drop further, natural discharges also would be affected. Under "safe yield" pumping conditions, the ultimate depletion of underground water reservoirs -- or "mining" of water -- is masked for a longer time than under "full stream" pumping.

Groundwater management concepts must be based on the realities of hydrology as we move into a new era in water resources management in the 80's. The importance of water planning and enlightened decision making has the attention of most citizens -- an important first step. But time is moving on.

Pressures to maintain a viable agriculture to feed the nation and world, assure economic survival for farmer-irrigators, and preserve some natural, water-development areas to serve people's quest for quality of life will weigh heavy on users, governmental bodies, educators and special interest groups.

A willingness to do some demanding "homework" in attempting to understand complex water issues, open-mindedness and tolerance for other viewpoints and a spirit of give-and-take will be required if a "middle of the road" approach to water resource management is to be achieved. Such an approach might fall short of meeting the perceived needs of groups on the opposite ends of the spectrum -- "drill a well anywhere, everywhere developers" or "status quo environmentalists" -- but holds promise of serving the most needs of the greatest number of citizens into the foreseeable future.

ON THE HOMEFRONT

RESEARCH OVERVIEW

The Nebraska Water Resources Center is planning another one-day RESEARCH OVERVIEW for Monday, April 21, 1980 at the Nebraska Center for Continuing Education. The purpose of this year's Overview is to hold state-of-the-project presentations of those projects sponsored by the Office of Water Research and Technology (OWRT). Mr. Don Edward Donaldson, the new OWRT Regional Monitor for the Missouri River Basin region, will be in attendance to learn about Nebraska's OWRT program.

The program's agenda is as follows:

8:15 - INTRODUCTION

Gary L. Lewis, Acting Director
Nebraska Water Resources Center

8:20 - PREMIER VIEWING OF WATER CENTER'S NEW SLIDE SHOW

Karen Stork, Administrative Assistant
Nebraska Water Resources Center

WATER QUANTITY MANAGEMENT

8:45 - "Model Quantification of Stream-flow
Groundwater Interaction for Complex
Aquifer Geometry"

Marvin V. Damn, Research
Associate, Nebraska Water
Resources Center

9:05 - "Measurement of Actual Transpiration
of Native Grass Stands as a Compon-
ent of Nebraska Sandhills Ground-
water Hydrology"

A. Tyrone Harrison,
Associate Professor,
School of Life Sciences

WATER USE EFFICIENCY

9:25 - "Variability in Crop Physiological
and Morphological Characteristics
Controlling Water Use Efficiency
and Grain Yield"

Jerry D. Eastin, Professor
Department of Agronomy

9:45 - "Water and Energy Conservation
Using Center Pivot Irrigation
and Reduced Tillage Systems"

James R. Gilley, Associate
Professor, Department of
Agricultural Engineering

10:05 - Coffee Break

10:30 - "Improvement of Irrigation Sched-
uling Techniques for Corn Maturity
Range, Plant Population and Water
Supply Availability
and
"Water Conservation Through Limited
Irrigation on Corn and Grain Sorghum
in the Great Plains"

Darrell G. Watts, Associate
Professor, Department of
Agricultural Engineering

WATER QUALITY

11:00 "Ferrate Ion" Potential Uses in
Advanced Wastewater Treatment"

James D. Carr, Associate Pr
Depart. of Chemistry

- 11:20 - Distribution of Mineral Nitrogen Under Native Range and Cultivated Fields in the Nebraska Sandhills" Gary W. Hergert, Assistant Professor, Department of Agronomy, North Platte Station
- 11:40 - "Herbicide Loss from Treated Fields in Water and Sediment Runoff as Affected by Center Pivot Irrigation System and Tillage Treatment" Robert C. Leavitt, Assistant Professor, Department of Agronomy
- 12:00 - Lunch
- 1:30 - "The Biological Regulation of Bloom-Causing Blue-Grass Algae" Eugene L. Martin, Associate Professor, School of Life Sciences
- 1:50 - Reduction in Development of Bloom-Forming Blue-Green Algae by Nutrient Enrichment to Maintain Desirable Pre-Bloom Dominants" James R. Rosowski, Associate Professor, School of Life Sciences

NATURAL DISASTER PREDICTION AND RESPONSE

- 2:10 - "Remotely Sensed Crop Temperature for Water Resources Management" Blaine L. Blad, Associate Professor, Center for Agricultural Meteorology and Climatology
- 2:30 - "Automation of a Sprinkler Irrigation System by the Utilization of Real Time Weather Information" Albert Weiss, Ass't Professor and Agricultural Meteorologist, Panhandle Station, Scottsbluff
- 2:50 - Coffee Break

LEGAL, INSTITUTIONAL, SOCIAL AND ECONOMIC ASPECTS

- 3:15 - "Public Attitudes of Nebraskans Toward Water Policy" Susan Welch, Professor Department of Political Science
- 3:35 - "Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains" Raymond J. Supalla, Associate Professor, Department of Agricultural Economics
- 3:55 - "Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska" J. David Aiken, Water Law Specialist Department of Agricultural Economics
- 4:15 - "Evaluation of Legal and Institutional Arrangements Associated with Groundwater Allocation in the Missouri River Basin States" J. David Aiken and Raymond J. Supalla, Department of Agricultural Economics
- 4:35 - Concluding Remarks
- 4:45 - Adjourn

There is no fee for the program, and the public is invited.

PROPOSALS SUBMITTED TO OWRT

The following four matching grant proposals have been submitted to the Office of Water Research and Technology (OWRT) for consideration for funding in fiscal year 1981:

- (1) "Conservation of Soil, Water and Energy Through Reduced Tillage Systems," by Elbert C. Dickey;
- (2) "Tillage Practice Effects on Water Conservation and the Efficiency and Management of Surface Irrigation Systems," by Dean E. Eisenhauer;
- (3) "Multiple Objective Analysis Techniques for Water Resources Planning," by Jerald P. Dauer; and
- (4) "A Legal and Institutional Framework for the Integrated Management of Ground and Surface Waters," by Norman Thorson.

The Water Resources Center has also received seven proposals which are currently being reviewed by our Executive Committee for possible inclusion in our FY 1981 Annual Cooperative Program (formerly annual allotment) to OWRT.

WATER CENTER'S FIVE-YEAR RESEARCH PLANNING PROGRAM

Karen Stork recently represented the Nebraska Water Center at the annual meeting of the National Association of Water Institute Directors (NAWID) in Williamsburg, Virginia. Discussion at the meeting included the institutes' roles in the five-year research planning effort being conducted by the Office of Water Research and Technology. This activity was mandated by P.L. 95-467, the Water Research and Development Act of 1978 which states: "The designated state institutes shall cooperate with the Secretary in the development of five-year water resources research and development goals and objectives."

At the meeting it was decided that each state will prepare its own report with the following chapters: (1) summary; (2) state water resources; (3) use of the resource and introduction to water resource problems; (4) water and related land planning and development activities; (5) problem categorization and ranking; (6) institute priorities and justification for selection of those priorities; and (7) five-year research and development program. These reports will be integrated into regional and national reports later this year.

State reports are to be finished by October 1980. The Water Center will be working throughout the summer on this effort, and will probably schedule workshops for state and federal agency personnel and University faculty to discuss Nebraska's water problems and research needs. Center staff will be coordinating this exercise, and the Executive and Advisory committees will be asked to participate in the process and to review the final report.

NEW STAFF MEMBERS

The Water Resources Center is pleased to announce two new additions to its staff. Mr. Donn Rodekohr joined the Center on February 1, 1980 as a Water Resources Technologist. Donn will be assisting in a number of activities, including the state water planning and review effort. He earned a Bachelor's degree from the UNL College of Agriculture, Department of Poultry Science in 1973. After Graduation Donn worked for five years as a District Fisheries Biologist for the State Game and Parks Commission, and his most recent appointment was with the University Energy Conservation Office.

The other new staff member who joined the Center on March 10, 1980 as a Water Scientist is Mr. Daniel Sobashinski. Dan will be working as one of the major researchers on the Dee Creek project-- a water quality study of runoff from agricultural lands. Dan recently received his Master's degree in Forest Hydrology at the Pennsylvania State University where he also received his B.S. degree in 1977.

RECENT STAFF ACTIVITIES

Dr. M.-L. Quinn recently presented an invited paper at the weekly seminar of the Geography Department at the University of Nebraska-Omaha. Some 25 faculty members and graduate students heard some of the results from her work on the Upper Delaware River Basin.

Acting Director Gary Lewis presented the keynote paper on "Peak Flow Methods for Urban Watersheds" at a workshop on Urban Hydrology sponsored by the Nebraska section of the American Society of Civil Engineers and the Water Resources Center on April 2, 1980. Over 30 representatives of consulting firms and state and federal agencies attended the one-day workshop.

Mr. Donn Rodekohr recently attended a multi-sponsored Water Law Short Course at Fort Collins, Colorado. A number of aspects of water law pertaining to state planning activities were discussed. Among the speakers was Dr. Berton Lamb, a specialist with the Cooperative Instream Flow Service Group of the U.S. Fish and Wildlife Service.

WATER RESOURCES IN NEBRASKA

208 PROGRAM SHIFTED TO DEC

Governor Charles Thone recently shifted control of the state's "208" water quality program from the Natural Resources Commission to the Department of Environmental Control (DEC). The implementation of the state's "208" plan (which is named after the section of the Federal Water Pollution Control Act that requires control of non-point pollution sources) will now be coordinated by DEC.

Four years ago, then-Governor J. J. Exon assigned authority for "208" planning to the Natural Resources Commission, the state's main water planning agency. They developed the state's "208" plan which is now awaiting approval from the U.S. Environmental Protection Agency. Indications are that EPA will approve the plan.

DEC has scheduled a meeting for April 18, 1980 at 9:00 a.m. at the State Office Building to solicit public comments on "208" programs scheduled for the next fiscal year.

GEOHERMAL RESEARCH

The Conservation and Survey Division (Nebraska Geological Survey) is coordinating a two-year agreement with the U.S. Department of Energy to investigate the geothermal resource potential of Nebraska. Principal investigators for the project are William D. Gosnold, Jr., of the Department of Geography-Geology at University of Nebraska-Omaha and Duanne A. Eversoll of the Conservation and Survey Division, Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln. This research is a cooperative state-federal effort to inventory and document any potential low-level or high-level geothermal energy which might have application in Nebraska.

SUPPORT FOR WATER RESEARCH

Valmont Industries of Valley has pledged \$200,000 to spearhead an effort by the Nebraska irrigation industry to raise a million dollars in the 1980's to accelerate research on water problems.

Early commitments have also come from these other leaders in the industry: Lindsay Manufacturing Co., Lindsay, \$10,000 a year; Lockwood Corp., Gering, \$5,000 a year; and Roy Pearson of Holdrege, a major supplier of propane for irrigation, a gift of \$25,000.

The drive is being conducted within the industry as part of the Nebraska Campaign of the University of Nebraska Foundation. Included are manufacturers and suppliers of sprinkler, gravity and pump irrigation equipment and engines, suppliers of pipe, fuel and electricity, well drillers and land contractors.

Research areas the drive will support include more efficient utilization of water, attacks on the nitrate buildup in the Platte Valley and Sandhills, groundwater recharge, and alternate sources of energy for irrigation.

ANIMAL ESCAPE RAMPS FOR CONCRETE-LINED CANALS

Concrete-lined irrigation canals present a serious hazard to animals such as deer. A combination of steep slopes and slippery surfaces makes it almost impossible for an animal to get out of such a canal without assistance.

The alternatives for reducing animal losses in a concrete-lined canal appear to be, (1) providing animal-proof fences to prevent entry to the canals, or (2) providing assistance for animals to get out of the canals. The latter alternative is presently being investigated by the U.S. Water and Power Resources Service in relationship to the North Loup Division.

The North Loup Division will require approximately 13 miles of concrete-lined canal. To obtain more specific data concerning design and effectiveness of escape ramps, the Water and Power Resources Service, in cooperation with the Ainsworth Irrigation District, Nebraska Game and Parks Commission, and U.S. Fish and Wildlife Service, have initiated a testing program in the concrete-lined portion of the existing Ainsworth Canal. One escape ramp was constructed in the spring of 1979 and four additional ramps are presently under construction. The additional ramps will be completed prior to 1980 water deliveries for irrigation. A section of the existing concrete canal (side slope of 2:1) is removed and replaced with a concrete ramp with a slope of 4:1. The five experimental escape ramps will be located to test their effectiveness in curved and straight sections of the canal and in sections with varying water velocities.

The effectiveness of escape ramps will be monitored during the summer of 1980. Data obtained will be utilized to design animal escape ramps in concrete-lined canals of the North Loup Division. The five test ramps should also serve to reduce deer losses in the Ainsworth Canal.

FEDERAL HIGHLIGHTS

DOMENICI/MOYNIHAN COMPROMISE INTRODUCED

Senators Pete Domenici and Patrick Moynihan recently introduced as an amendment to S. 703 (Omnibus Water Resources Act) the National Water Resources Policy and Development Demonstration Act. This is basically the same proposal the Senators introduced last November in lieu of their S. 1241 water resources cost sharing proposal.

The new legislation would establish a five-year, \$1 billion per year water resources project demonstration program with the states essentially determining water project priorities. The \$1 billion is in addition to the current water resources program, and would be allocated to the states under a formula equally based on state land area and state population. Each states' allocation, if not used during the year received, would be retained by the state for use any other year during the demonstration program. The \$1 billion provided in the Domenici/Moynihan compromise would be available for any water resources project of the Corps of Engineers, the Soil Conservation Service and the Water and Power Resources Service.

The bill also includes a provision for the establishment of an independent U.S. Water Resources Council (WRC) composed of nine members: four Federal agency members, a Chairman and four other members appointed by the President. The independent WRC would re-view the demonstration program at the end of the five-year period.

Although the compromise demonstration program does not include any cost sharing provisions, Senators Domenici and Moynihan have suggested that the Administration's 5% up-front cost sharing provision might be included in those projects that go forward under the demonstration program. It is anticipated that the Administration will not consider the compromise proposal acceptable, since it provides for \$1 billion in addition to the current water resources program.

EPA GROUNDWATER STRATEGY

Early this year the U. S. Environmental Protection Agency (EPA) initiated a nine-month effort to develop a groundwater strategy "aimed at the protection of groundwater as a natural resource." The national groundwater strategy is an attempt to provide a "framework for policy development, a short and long-term federal and state action plan, and clear federal, state, local and private roles."

A draft issues paper has been developed by EPA and should be distributed shortly. At least one workshop is scheduled for June to gather further public comment on groundwater issues before the strategy is drafted. The draft strategy is scheduled for publication in the Federal Register in October for public review, and at least one workshop will be held. A State Advisory Committee, with one state agency representative from each EPA region, has met once as part of this effort, and another State Advisory Committee meeting will be held in May in Washington, D. C.

The EPA groundwater strategy effort will deal with a number of critical issues including "rational planning and priority setting; better coordinated regulatory requirements; effective monitoring; responsible delegation to states; and broadened or new authorities." The process will involve three phases: (1) the first phase will be identification of critical issues during which a policy committee and working groups will meet to develop draft papers; (2) the second phase will be development of the draft strategy; and (3) the third phase will be publication and approval of the final strategy.

WRC BUDGET CUTS

It appears that recent 1980 and 1981 budget cuts proposed by the Administration will include a significant reduction in the U. S. Water Resources Council's (WRC) Title III state water management grants program; however, WRC Title I activities and Title II river basin commission funds will not be reduced. President Carter has sent a rescission order to Congress which would reduce the 1980 Title III program from \$21 million to \$10 million. In addition, the Administration's 1981 budget request for Title III apparently will be reduced from \$30 million to \$21 million, and a budget

outlay limitation may be imposed restricting total Title III disbursements in 1981 to \$11 million of the \$21 million appropriation.

These proposed budget cuts are not yet official. The 1980 Title III program rescission order must be approved by both the U.S. House and Senate within 45 calendar days of continuous session. If Congress takes no action on the rescission during the 45-day period, they have, in effect, vetoed the rescission. However, it is also possible that the Title III program might be reduced during congressional efforts to reduce the budget.

U.S. WATER SCIENTIST TAKES UNESCO POST

Dr. John S. Gladwell, Director of the Idaho Water Resources Research Institute located at the University of Idaho, has accepted a two-year renewable appointment with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as Senior Advisor in the Division of Water Sciences, beginning in late April in Paris, France.

Dr. Gladwell has conducted many water-related research projects for the Office of Water Research and Technology (OWRT), Department of the Interior. He is the author of more than 75 scientific articles, reports, and presentations on water planning, research and management, pollution control, and small (low-head) hydro technology.

Well known for his work on small dam hydroelectric power, Dr. Gladwell has said that the United States trails far behind other technically developed countries in making use of small hydro potential. It is his thesis that small hydro power, when developed as part of a total energy package, can effectively reduce dependence on fossil fuels and help to hold down energy costs.

CONFERENCES

SHORT COURSE ON URBAN STORMWATER MANAGEMENT IN COASTAL AREAS

An ASCE National Symposium on "Urban Stormwater Management in Coastal Areas" will be held June 19 and 20, 1980, at Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Thirteen technical sessions with fifty-one papers have been scheduled. The symposium deals with the subjects of joint probability of tide and rainfall events, design of canal and detention basin, mathematical storm runoff quantity and quality model, planning model and management scheme, coastal flooding due to storm surge, and case studies. The symposium proceedings will be available at the conference.

For details on the program of the symposium and tour information for the Blue Ridge Skyline Drive and the Shenandoah National Park, please contact Dr. Chin Y. Kuo, Department of Civil Engineering, Virginia Polytechnic Institute and State University, Blacksburg, Va 24061, (703) 961-7153.

SHORT COURSE ON UNSTEADY FLOW IN CHANNELS

The Research Institute of Colorado in cooperation with Colorado State University will sponsor a short course, "Unsteady Flow in Open Channels," June 16-20, 1980. The objective of this course is to provide participants with an up-to-date treatment of practical problems of unsteady flow in open channels.

The registration fee is \$500. Registration forms may be obtained by contacting Dr. V. M. Ponce, Engineering Research Center, Colorado State University, Fort Collins, Colorado 80523. Telephone (303) 491-8231.

SHORT COURSE ON ADVANCED GROUNDWATER HYDRAULICS

A short course on Groundwater Hydraulics will be presented at the University of Michigan, June 9-13, 1980. The course is intended to provide an understanding of both water quantity and quality aspects involved in the management of groundwater resources. Emphasis is placed on combining models of water and solute movement into descriptions of regional groundwater problems.

Topics will include groundwater motion, groundwater pollution, unsaturated flow, artificial recharge, and models for management decision making.

For further information, contact Dr. Steven J. Wright, Department of Civil Engineering, University of Michigan, Ann Arbor, Michigan 48109.

GOVERNORS TO FOCUS ENERGY, AGRICULTURE

The fifth annual Missouri River Basin Governors' Conference will be held July 10-11, 1980 at the Kirkwood Motor Inn, Bismarck, North Dakota. Energy development, agricultural issues and energy resource development on Indian lands will be the main conference issues.

In announcing conference plans, North Dakota Governor Arthur Link noted that "these topics are especially timely in view of water issues surrounding the basin's long-standing role in agricultural production and predicted role in coal and synfuel development for the nation."

Three speakers scheduled to address the conference topics are Bob Bergland, Secretary of Agriculture; Ruth Daves, Department of Energy Assistant Secretary for Resource Application; and Peter McDonald, Chairman of the Council of Energy Resource Tribes.

Detailed information about the Governors' Conference may be obtained from the Missouri River Basin Commission, Suite 403, 10050 Regency Circle, Omaha, Nebraska 68114.

STATISTICAL COMPUTER TECHNIQUES IN HYDROLOGY AND WATER RESOURCES

A short course on the use of computers and statistics in hydrology and water resources will be held July 20-August 1, 1980, at Colorado State University, Fort Collins, Colorado. The major objective of the course is to provide participants with statistical techniques and a tape of computer programs designed for the analysis and synthesis of hydrologic data and to demonstrate the application of such techniques in water resources decisions. The course is intended for hydrologists, hydraulic engineers, water resources specialists, engineers and scientists interested in using computer and statistical techniques in hydrology and water resources.

Lecturers are Vujica Yevjevich, Jack W. Delleur, William L. Lane, Jose D. Salas, Jose M. Mergia, Jamie Millan, Daniel P. Sheer and Duane C. Boes.

For more information, contact the course director: Dr. Jose D. Salas, Engineering Research Center, Colorado State University, Fort Collins, Colorado 80523. Telephone (303) 491-8460 or (303) 491-8450.

INLAND WATERS '80

The American Society of Civil Engineers (ASCE) Water Resources Planning and Management Division is sponsoring a Division Specialty Conference on "Inland Waters '80" to be held July 29-August 1, 1980, at Green Bay, Wisconsin.

Topics to be discussed at the conference include the following:

- (1) Great Lakes Regional Policy and Management--New Initiatives;
- (2) The Great Lakes in 2000;
- (3) Great Lakes Levels and Flows--Management and Issues;
- (4) Water Quality Issues in Boundary and Transboundary Waters;
- (5) The Future of Coastal Zone Management in the Great Lakes;
- (6) U.S. Water Policy

A number of concurrent sessions will also be held on such subjects as water conservation, water quality modeling, water resources planning, impact analysis, water law and the civil engineer, and optimality in urban water systems design and operation.

Complete program and registration material can be obtained by writing to: Mr. Harry Tuvel, ASCE, 345 East 47th Street, New York, New York 10017.

POSITIONS AVAILABLE

WATER CENTER DIRECTOR

The University of Arkansas is seeking a Director for its Water Resources Research Center. The Director reports to the Vice President for Research and Graduate Studies and has day-to-day responsibility for the operation of a state-wide research and service program.

The Director will be responsible for encouraging, coordinating, and developing water resources research of importance to Arkansas and the Southwest, and for working with federal, state, municipal, educational and other public and private groups and interests concerned with water resources.

A Ph.D. with experience in water resources work is preferred. Applicants should have strong oral and written communication abilities; a willingness and interest in working with citizen groups, local government, and state government. The beginning salary will be \$30,000-\$35,000 for 12 months, commensurate with qualifications.

Interested applicants should submit their resume, and three letters of reference by April 15, 1980, to: Dr. Charles A. Leone, Vice President for Research and Graduate Studies, Administration Building #407, University of Arkansas, Fayetteville, Arkansas, 72701.

The University of Arkansas is An Equal Opportunity, Affirmative Action Employer.

RESEARCH OPENING

The University of Maine has an opening for a Ph.D. in a natural science who has a record of research support and publication on the effects of atmospheric deposition on ecosystems.

Applicants should have a broad knowledge of the ecology and biogeochemistry of terrestrial and fresh-water ecosystems. Applicants capable emphasizing this relationship will be given preference. Additional requirements of the successful applicant include ability to identify new research problems, stimulate and provide leadership in the development of new research programs, and integrate his or her activities into the ongoing programs in this field. The position may involve teaching one specialty course per year, guiding graduate student research, and will include partial administration of on-going programs in this field.

This is a two or three-year appointment on an academic year (nine month) basis. Closing date for applications is April 21, 1980, and the position will be filled by July 1, 1980. The salary is negotiable and the successful candidate may raise additional salary (2½ months/yr).

Applicants should forward a curriculum vita, three letters of reference, transcripts (if the Ph.D. was received in the last five years), and one copy of publications related to the goals of this position, to: Professor Stephen A. Norton, Department of Geological Sciences, University of Maine, Orono, Maine 04469.

ASSISTANT PROFESSOR POSITION AVAILABLE

The University of Texas at Al Paso is now accepting applications for an assistant professor with a Ph.D. (or near completion) in geomorphology with an interest in water resources and arid lands. The successful candidate will help develop a new B.S. program in physical geography and natural resources as a complement to existing undergraduate and graduate programs in geology.

The position is a two-year temporary appointment for September 1980 with a possibility of conversion to tenure track.

Interested applicants should send a letter of application, vita and three letters of recommendation to: Robert H. Schmidt, Professor of Geography, Department of Geological Sciences, University of Texas at El Paso, El Paso, Texas 79968.

The University of Texas at El Paso is an Equal Opportunity, Affirmative Action Employer.

ASSISTANT PROFESSOR CIVIL ENGINEERING

The Department of Civil Engineering at the University of Michigan has a faculty position open in the hydraulics-hydrology area. This is a tenure-track position in hydrology, and offers the potential for an individual to become a leader in teaching and research in this area at Michigan.

Applicants should have a Ph.D. with a concentration in hydrology. Duties will include teaching undergraduate and graduate courses in hydrology, as well as courses in one or more of the following areas: open channel flow, groundwater hydrology, coastal hydraulics and hydraulic structures. Ability and desire to participate in hydrology research and to develop sponsored research is essential. Starting date is on or before September 1, 1981.

Interested applicants should send resume and names of three professional references to: Professor Robert Hanson, Chairman, Department of Civil Engineering, University of Michigan, Ann Arbor, Michigan 48109.

The University of Michigan is a non-discriminating Affirmative Action Employer.

RESEARCH ASSISTANT PROFESSOR AND RESEARCH ENGINEER

The Utah Water Research Laboratory, Utah State University, is accepting applications for two full time positions--Research Assistant Professor and Research Engineer. Salary range is \$21,500 to \$28,000 based on qualifications and experience. Starting date is July 1, 1980.

Responsibilities include developing proposals, securing funding and conducting research, with the help of technical support personnel and graduate students, on hydrologic modeling by digital computer with particular emphasis on salinity transport; the evaluation of structural and nonstructural salinity management methods (particularly as related to irrigation in arid climates), both stochastic and deterministic techniques; and short courses to transfer modeling technology. The position of Assistant Professor will also involve teaching courses in the above areas.

The following qualifications are required: Ph.D. (Assistant Professor) or at least M.S. (Engineer) in Civil or Environmental Engineering; experience in the mathematical modeling of hydrologic systems; familiarity with the hardware and software normally used in hydrologic modeling; and familiarity with the problems related to salinity management and surface and ground-water quality deterioration as associated with arid climates. Relevant consulting experience is also desirable.

Qualified and interested applicants should send a resume of training and experience, a list of publications, and three letters of reference relative to qualifications to: L. Douglas James, Director, Utah Water Research Laboratory, Utah State University, Logan, Utah 84322. The deadline for applications is May 31, 1980.

Utah State University is an Equal Opportunity Affirmative Action Employer.

NEWSLETTER ITEMS SOLICITED

The WATER CURRENT newsletter will publish, without charge, announcements, programs for upcoming conferences, employment opportunities or other newsworthy items on hydrology, water resources or related topics.

QUESTIONS AND INQUIRIES

Newsletter items and inquiries should be sent to: Editor, Nebraska Water Resources Center, 310 Agricultural Hall, University of Nebraska, Lincoln, Nebraska 68583; or telephone (402) 472-3305.

RESEARCH REVIEW

PROJECT TITLE: Suitability of Region-Wide Irrigation Scheduling by Local Evapotranspiration Measurement

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Irrigation scheduling has been demonstrated to be effective in saving significant amounts of both the water and energy required for irrigation. To achieve these savings with irrigation scheduling, a method of determining how much water the crops require is needed. One of the best methods for determining this crop water use demand is the Penman equation which predicts evapotranspiration (ET) with weather parameters of temperature, humidity, solar radiation and wind. However, the data required at each site is extensive, including maximum daily temperature, minimum daily temperature, average daily dew point temperature, total sky solar radiation and daily wind run. Operating a weather station that is sophisticated enough to supply the above data at every field to be scheduled is not practical due to the cost involved and the technical expertise required.

The objective of this study was to determine if ET information gathered at one location was usable over a wide region. If the variability between a number of stations was too great, a closer spacing of weather stations would be required. On the other hand, if little variability was seen, a very small number of weather stations could adequately serve a large area by providing ET data that was relevant without a great deal of expense.

Three sites were chosen as weather stations to gather information needed for the Modified Penman equation--the University of Nebraska Panhandle Station at Scottsbluff, the High Plains Ag Lab in Sidney, and the Northwest Ag Lab in Alliance. These three sites form a triangle approximately 95 km on a side and represent three distinct different climates.

The results of three years of ET data collected between June and August showed no observed differences in ET that could be attributed to climatological difference in the measurement sites. The differences due to elevation and local surroundings were sufficiently small to be masked by the expected instrument errors. Instrument calibration, including hygrothermographs and silocon cell pyranometers, proved difficult and illustrated that the fewest number of measurement sites was optimum. Poor calibration can account for far greater differences than climatological differences within a 100-km radius given no great orographic, elevation or micrometeorological differences in location. This leads to the conclusion that within a 100-km radius of a weather station, the ET data will be representative of the crop water use in that area within the limitations of the equation.