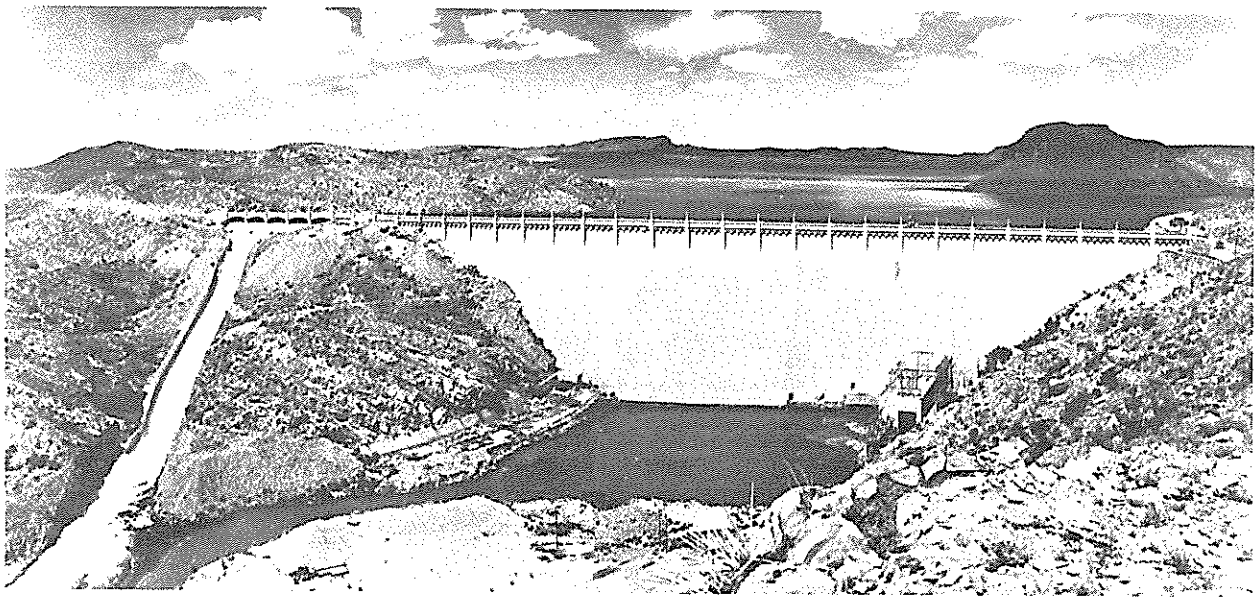
HISTORY

OF

NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

1962 - 1978



WATER IS KING IN ARID REGIONS

or in Spanish

EL AQUA ES REY EN LAS REGIONES ARIDAS

This picture was presented to Dr. Fabian Garcia, Director, New Mexico Agricultural Experiment Station by the Personnel of the Soil Conservation Service stationed in Las Cruces, New Mexico in 1942. Water going over the spillway, Elephant Butte Dam, for the first time, May 1942, and the only time up to 1978. Dr. Garcia, who recognized the great importance of water in New Mexico and the arid west, had this picture on his office wall until his retirement in 1945.

CORRECTIONS TO BE MADE WHEN REPORT #099 IS REPRINTED

Agua is misspelled, cover page

Appendix numbers incorrect

Page i and ii reversed

p 13 needs comma

pl 18 wrong date (74) 71

p 22 spelling of zoology

p 27a picture of Bromilow with Lyendecker name

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p 39 word by needed

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p 38 spelling capital, not capitol

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A HISTORY OF THE NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE
NEW MEXICO STATE UNIVERSITY
1963-1978

by

H. R. Stucky*

*Director of the New Mexico Water Resources Research Institute from its beginning in 1963 to 1971.

Foreword

This historical sketch of the development and operation of the New Mexico Water Resources Research Institute has been drawn from the legislative history of the Water Resources Research Act of 1964 as presented in Senate Calendar No. 95, Report No. 117 of the 88th Congress, First Session, dated April 8, 1963 and from Chronology of Significant Events Leading to the Evaluation of the Water Resources Research Act of 1964, Public Law 88-379, approved July 17, 1964 and the 1966 amendements thereto, from the Act, and from the Rules and Regulations on the Act published in the Congressional Record December 3, 1964. Other information came from the files of the Institute and from letters and other correspondence material which passed between Senator Clinton P. Anderson, Dr. William E. Morgan, President of Colorado State University at the time, and former President Roger B. Corbett, of New Mexico State University.

Thanks go to Gail Stockton, Assistant to the Director; Darlene Reeves, Administrative Assistant, in assembling the financial report and the list of projects and publications; Yolanda Arteaga and Susan Vaughn, who typed the manuscript and to Winston Comer for his editorial assistance. Special thanks to Lorena Newman, former Assistant to the Director, for assembling much of the early records up to 1971.

The responsibility for the interpretation and the final presentation of the material rests solely with the author.

Milestones in the Development of the Water Resources Research Institute at New Mexico State University 1956-1978

1956 - First Annual New Mexico State Water Conference held November 1-2.

1959 - Select Committee on National Water Resources. Was appointed with Senator Clinton P. Anderson of New Mexico and a member, with Senator Robert S. Kerr, Oklahoma as Chairman.

1962 - Water Resources Research Bill S.2 first introduced in the United States Senate, July 27, by Senator Clinton P. Anderson.

1963 - House Bill HR-2683 (identical to S.2) first introduced in House of Representatives, January 24, by New Mexico Congressman Thomas G. Morris.

1963 - New Mexico Water Resources Research Institute was established by the New Mexico State University Board of Regents in February, 1963.

1963 - President R. B. Corbett established a faculty committee to assist in the development of the newly established Institute. Dr. H. R. Stucky named temporary chairman, February 18, 1963.

1963 - Dr. H. R. Stucky was named as first Director of the New Mexico Water Resources Research Institute, September 18, - serving part time, becoming full time March 15, 1964.

1964 - Water Resources Research Act was signed July 17, by President Lyndon B. Johnson.

1964 - Governor Jack M. Campbell named New Mexico State University as the state institution to participate under the Water Research Act and as the one qualified to receive appropriations provided there in, letter dated September 3.

1965 - New Mexico State University Water Research Institute approved to be one of the 50 Universities to receive funding under S.2, February.

1965 - Water Resources Research Institute Office opened March 15, in the Agricultural Building on New Mexico State University Campus.

1965 - Senator Anderson in his letter to his Constituents, dated August 10, included the following quotes, "Just 11 months ago Congress created the Water Research program. As a result, a state water research center has been established in each of the 50 states and Puerto Rico - the first at New Mexico State University."

1966 - First WRRI Report published was the form of a map entitled, "Location of Irrigated Lands, Sources of Water, and Areas of Similar Consumptive Use Factors."

1966 - Inter-university memorandum dated July 8, 1966 signed by Presidents of the New Mexico Institute of Mining and Technology, University of New Mexico and New Mexico State University and the Institute Director on the conduct of Water Research work through the Water Research Institute.

1969 - Bids opened June 17, for the construction fo building to house the WRRI on New Mexico State University Campus.

1970 - Legislature made first direct appropriation of $104,000 of state funds to support Water Research through the Institute.

1970 - Research Building occupied March 15, 1970.

1971 - Professor John W. Clark named Director on July 1, replacing the retiring Director, Dr. H. R. Stucky. Clark served to June 30, 1976.

1976 - Professor J. W. Clark replaced by Dr. Garrey Carruthers who served as Acting Director from July 1976 to February 28, 1978.

1978 - Dr. Thomas Bahr named Director as of March 1, 1978 replacing Dr. Garrey Carruthers.

A History of the New Mexico Water Resources Research Institute

New Mexico State University

> "... to assist in assuring the Nation at all times a supply of water of sufficient quantity and quality to meet the requirements of its expanded population..." Water Resources Act 1964.

The story of the New Mexico Water Resources Research Institute is a story of people, many people. It is a story that began with the Native people and the unfolding problems occurring with the settlement and development of the area. It is a story which results from the basic scarcity of water and the attempts of people to cope with that scarcity.

Passage of the Water Resources Research Act of 1964 created the water resources research institutes or centers located in each of the 50 States and Puerto Rico. The central purpose of the Act was to initiate research, and to train personnel in order to solve some of the existing problems with respect to quantity and quality of water, and to at least prevent them from deteriorating further. The expectation was to find means for improvement.

In New Mexico, a "land of little rain," water has always been a problem, from ancient times to the present. Thus it is difficult to decide just where to begin tracing the history of the New Mexico Water Resources Research Institute. The name of the Institute is modern, but the concern for water resources reaches back to antiquity.

Water is the Life Blood of New Mexico
or in Spanish
"Agua es La Vida - sangre de Nuevo Mexico"

Water is required by all life. It influences all factors of the environment. It is the life-blood of New Mexico and has been since the early records of man in this area.

In the Chaco Canyon in Northwestern New Mexico, at Pueblo Bonito, which dates from about 920 A.D., archaeologists have found stone diversion dams that show considerable knowledge of irrigation on the part of the Indians of that time. The journal of Capitan Juan Jaramillo, who traveled with Coronado on his expedition along the Rio Grande Valley in 1540-1542, refers to irrigation among the Pueblo Indians, noting that "There is an irrigation stream, and the country is warm. They have corn, beans, and melons for food." Other evidence that irrigation was practiced by the early-day Indians have been found near Santa Rosa and Pecos, and among the Navajos.

New Mexico's distinctive tri-cultural history is apparent in its water laws. Indian, Spanish, and Mexican farmers of preterritorial New Mexico practiced the principle of prior appropriation, which was based on early Spanish and Mexican law. This principle, public ownership of surface water with rights assigned by prior appropriation and beneficial use, was perpetuated in early treaties, land grants, the New Mexico Territorial constitution and the 1912 State Constitution and has been applied to ground-water since 1931.

The Nature of Water

What is water and what are some of the characteristics that make it so important? It took 12 columns of fine print in the unabridged Webster's Third Dictionary to define water and the items having water as a part of their name, such as watershed, water meter, water tower, and waterway. This indicates how greatly water enters into our lives.

As stated by an unknown author, "Water is a 'must' for all forms of life on earth -- for drinking, growing food, keeping clean. Water is needed for work -- for cooling, carrying, lifting and building. And water is needed for play -- for swimming, boating, fishing and camping."

Environment and Ecology

In the early 60's the major water problem was perceived to be "conservation." Five years later it was "pollution," and in the early 70's quality of "environment" and "ecology" had been added. This indicates the broadening concept of the problem. Individuals, groups, institutions, and agencies expressed their concern for water quality and quantity throughout the nation.

Environment refers to the aggregate of climate, soil and biotic factors, and the social, cultural, economic, and political factors that influence the life and survival of the individual and the community.

Ecology is the study of the interrelationships of organisms with their environment. Factors that compose the environment are vastly complex and interrelated. Therefore, any change made in the environment is certain to have many unforeseeable effects.

Any action taken to solve the water problems of New Mexico must be carefully evaluated as to the total long-term effects which they are likely to have on the human population. Water supplies and consumption must be handled as part of an overall effort to manage the environment for the greatest long-term benefits to the total population.

Water does not respect boundaries, whether private, county, state or even international. It is being used and reused as it moves along. Therefore, all segments of our society -- government units, industry, and individual citizens in all walks of life -- must share in the proper use of water and the control of pollution.

The Reclamation Act of 1902 brought changes in the local control system of water use, although the acequia continues to exist in New Mexico. The Reclamation Act authorized a system of dams and reservoirs to impound water and thereby control floods, generate electrical power, and provide for a regulated supply of irrigation water as needed throughout the Nation, and it provided for Water-Users' Associations which were to administer the local use of water. The first project affecting New Mexico under this Act was the Rio Grande Project, approved in 1905, after which the Elephant Butte and Carlsbad water-use associations were formed. The Leasburg Diversion Dam was completed in 1908 and the first water flowing through the project works was delivered to three of the old acequias. The Elephant Butte Dam was constructed during 1912-1916. It was proclaimed by Bureau of Reclamation officials as impounding the largest artificial lake in the country. Caballo Dam, completed in 1938, was first planned as a flood control measure but its capacity was enlarged to permit year-round power generation at Elephant Butte.

Evolution of New Mexico State University

In the meantime a small college was growing up in the lower Rio Grande Valley -- a college that was to become New Mexico State University and the home of the New Mexico Water Resources Research Institute. Settlers of the Mesilla Valley founded the region's first institution of higher learning, Las Cruces College, in 1888, years before New Mexico became the forty-seventh state in 1912. In 1889 the Territorial Legislature passed an act naming the school the New Mexico College of Agriculture and Mechanic Arts and designating it as the land-grant institution for the state:

Growth was slow during the early years but more recently, especially since 1950, there has been remarkable progress. The dusty campus of the little "cow college" is no longer recognizable. The physical plant has grown from a single two-story brick building in 1890 to some 90 permanent buildings valued at well over $100

million in 1978. The institution has grown proportionately in academic stature and is now divided into five colleges and the graduate school. A wide range of academic degrees in a number of fields are offered at the undergraduate, master's and doctoral degrees levels.

In 1960 the University's name was officially changed to New Mexico State University. Its central purpose remains, as always, to promote the liberal and practical education of its students, but the research function has not been overlooked. The Agricultural Experiment Station was established in 1889 as part of the land-grant institution and its research publications, including many in the field of water problems, are among the earliest ones in the nation. The Engineering Experiment Station, established in 1931, has likewise been a leader in this field. In 1965 the Clinton P. Anderson Physical Science Laboratory building was constructed. It houses the University's contracting agency for applied research and development in the many Scientific and Engineering fields. The work was started at the University in 1946.

The most recent additions are the New Mexico Solar Institute, established in 1977 and the Dona Ana County Occupational Education Branch, which is a cooperative program between the Gadsen, Las Cruces and Hatch School Districts and New Mexico State University.

Water problems were in the forefront of the Agricultural Experiment Station, as shown in the publication "Bulletins of the Agricultural Experiment Station of New Mexico State University." The first bulletin on water was number 12 entitled "The Value of Water Purposes of Irrigation" by Arthur Goss, 1893, among a total of 695 bulletins published to date. The station issued many other publications on water problems from 1893 to the time WRRI was organized in 1963, and many others since then in cooperation with WRRI, and many others as a part of the Station's regular program. Also, many technical papers and journal articles on Water Resources have been published by the Agricultural and Engineering

faculties at New Mexico State University.

Background of the Water Resources Research Institute

The subject of water resources has served as the theme for numerous meetings, converences, and academic programs through the years. The Civil Engineering Department in the College of Engineering has been a leader in several special water resource areas.

A summer Conference on Water Resources for College Teachers was inaugurated by the Civil Engineering Department with the help of funds from the National Science Foundation. These conferences drew national and international attention and participation. The University has been the setting for a School of Water and Sewage Works Personnel jointly sponsored by the Civil Engineering Department, the New Mexico Department of Public Health, and the New Mexico Water and Sewage Association. Much of this work in the Civil Engineering Department was preformed under the leadership of Professor John W. Clark.

A water resources curriculum was developed by the Department of Agricultural Economics with courses designed to permit effective concentration on the agricultural, engineering and economic problems associated with the best use of water resources.

As the 1950's ended, the question of water resources began to transcend local interest on the part of states most affected by shortages, and assumed national importance. Up to this time there was a relatively small organized research effort to discover the available water resources of the nation and to guide the development and best use of these resources. As water shortages and pollution problems, combined with a mushrooming population, became increasingly obvious, the United States Senate in 1960 established a Select Committee on National Water Resources to study these problems. Senator Clinton P. Anderson of New Mexico was a member of the committee with Senator Robert S. Kerr of Oklahoma serving as chairman. In less than two years the committee issued 32 committee prints detailing the nation's water problems and showing local and geogrpahic differences in dealing with them. It con-

cluded its work with a strong recommendation that the federal government undertake a coordinated program of scientific research on water.

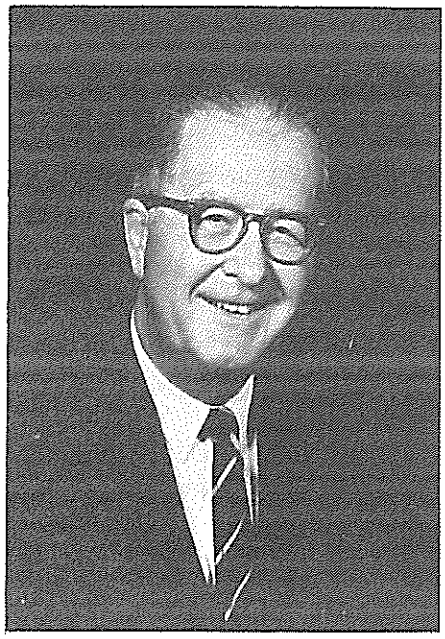
The Select Committee's report aroused considerable concern about the looming scarcity of water and the requirement for maintenance of water quality. A water Resources Planning Act was proposed by President John F. Kennedy, and the Senate's Interior and Insular Affairs Committee, with Senator Anderson as a member, earnestly began to collect information on the extent of the various state's water research activities from the appropriate agencies, universities, and other institutions. Their study showed much sentiment for combining education and research, and it uncovered a shortage of qualified personnel for water resources planning, research, and administration.

The American Association of Land Grant College and State Universities, through its Water Resources Committee, was instrumental in development of the Water Resources Research Act of 1964 (S.2) and in working with Senator Anderson and others toward its passage.

Federal Legislation to Establish Institutes

A bill to establish water resources research institutes at land-grant colleges and universities -- numbered S.3579, to be known as the Water Resources Research Act - S.2 was introduced in the United States Senate on July 27, 1962, during the Eighty-seventh Congress, by Senator Anderson. A similar bill was introduced in the House of Representatives by Congressman Thomas G. Morris of New Mexico on January 24, 1963.

Senator Clinton P. Anderson was the author of Senate Bill S.2 - "An Act to Establish Water Resources Research Institutes at Land-Grant Colleges and State Universities." It was originally introduced in the Senate as S-3519 on July 27, 1962, (Congressional Record. Vol. 108, part II, 87th Congress Second Section - page 14942). It was reintroduced as S.2 in the 88th Session by Senator Anderson for himself and 32 other Senators on January 14, 1963.



Clinton P. Anderson
U.S. Senator from New Mexico
1949 to 1972
U.S. Secretary of Agriculture
1945 to 1948

Senator Anderson's interest in water was not limited to authoring the Water Resources Research Act. In opening his talk entitled "Congressional Interest in Water Resources" before the Third Annual New Mexico Water Conference, November 6, 1958, he stated, "this is a rare privilege. When I received President Corbett's invitation to speak on this topic it was almost like suggesting that I sit down and tell my life story."

With this quote as background it is not surprising that Senator Anderson co-authored the Anderson - Aspinal Bill which established the National Saline Water Test Plants. This Bill became Public Law 85-833, signed into law September 2, 1968. The same Third Annual Conference, at which Senator Anderson spoke, passed one of only four resolutions passed by the Conference in its 23 year history, requesting that one of the test plants be located in New Mexico. Rogers Aston, representing the Conference, presented that resolution to Senator Anderson in Washington.

In his introduction of the Water Research Bill in the Senate, Senator Anderson said, "Title I of the Water Research Bill is in a very large measure drawn from the Hatch Act of 1887, which established Agricultural Experiment Stations at each of the land-grant institutions." The water research bill specified that the Secretary of the Interior was to administer the Act. It authorized an initial appropriations of $75,000, increasing to $100,000 in the third year, for each of the

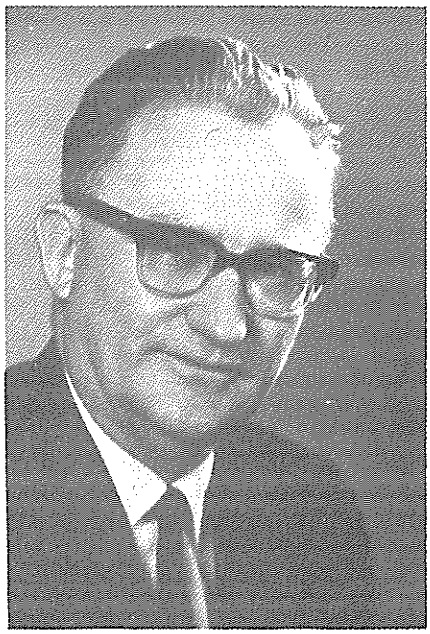
states and Puerto Rico, to help establish a statewide Water Resources Research Institute at its land-grant school or schools. It further provided additional funds for matching state, local, or donated funds for specific water research projects at these institutes, and it provided for publication of research results in the form of bulletins, reports, periodicals, reprints, and the like.

The mission of the Water Resources Research Institute, in New Mexico as in the other states, is spelled out in the Act as follows:

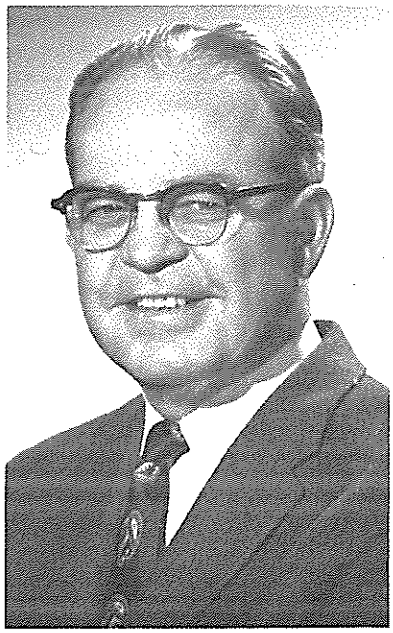
"It shall be the duty of each such water resources research institute or center to plan and conduct and/or arrange for a component or components of its college or university to conduct a research program of a basic or practical nature, or both, in relation to water resources, including but not limited to aspects of the hydrological cycle, supply and demand for water, conservation and best use of available supplies, methods of increasing such supplies, economic legal, social engineering, recreation, biological, geographic, ecological, and other aspects of water problems, as may in each case be deemed advisable by the institute or center." The Act further provides for the publication of results, and ... to encourage the training of scientists in fields related to water..."

The Water Resources Research Institute thus has dual responsibilities; the first, as its name implies, to conduct research, either basic or practical, interdisciplinary in scope, in water resource problems of local or regional emphasis, and it is to publish the results of this research, and second, it is to teach and train water resource scientists who will broaden and perpetuate the effectiveness of the newly gained knowledge.

Dr. William E. Morgan, as President of Colorado State University and Chairman of the Land-Grant College Associations Water Resources Committees, together with Roger B. Corbett, President of New Mexico State University and a member of the Land-Grant College's committee, worked with Senator Anderson as he drafted the Water Resources Research Act.



Dr. Roger B. Corbett
former President of
New Mexico State University



Dr. William E. Morgan
former President of
Colorado State University

Dr. Morgan was especially effective in recruiting the support of Senator Alcott and Representative Aspinal, both of Colorado, in supporting the legislation in Congress and in testifying for the research institute before the congressional committees.

Thomas G. Morris
Congressman for New Mexico

Congressman Thomas G. Morris, New Mexico Representative in Congress was the first to introduce H. R. 2638 into the House; on January 24, 1963. This bill was identical to S.2 introduced in the Senate by Senator Anderson on January 14, 1963. His interest in water is the same as most New Mexicans but was heightened by his close association with the Reclamation project at Tucumcari, New Mexico, Congressman Morris' home community.

Because the Eighty-seventh Congress was preparing for adjournment, the Senate referred the bill to the Senate Committee on Interior and Insular Affairs for further study. At the next Congress the bill was reported out of committee after receiving several suggestions and almost unanimous support from the various officials and agencies that had studied it in the interim.

In reading the report, Senator Anderson said, "The nation must 'lift itself by the bootstraps' and train the scientists it needs to do necessary water resources research work while research is being done. S.2 proposes to undertake such a two-pronged effort by repeating in the water resources field ... what has been so outstandingly successful in agriculture ... the establishment of water research agencies in the land-grant colleges and state universities of the nation, or some other institution of higher education within a state, as the state elects."

In the hearings that followed, the Water Resources Committee of the American Association of Land Grant Colleges and Universities was one of the groups called upon for comment and suggestions. Dr. William E. Morgan, President of Colorado State Univeristy, Fort Collins, Colorado served as Committee Chairman, and Dr. Roger B. Corbett, President of New Mexico State University; Dr. Daniel G. Aldrich, Chancellor, University of California; and Dr. Roy E. Huffman, Dean of Agriculture, Montana State University, were active members. Their leadership and the support of the other members of the committee, together with the efforts of Senator Anderson and Congressman Morris and others in government, were all important in marshalling the nationwide support for water research that led to the passage of the Water Resources Research Act of 1964.

The bill, as amended and finally passed by unanimous vote of both houses of Congress, was signed into law (Public Law 88-379, 88th Congress S.2) by President Lyndon B. Johnson on July 17, 1964, (Appendix A). By coincidence, it was on the same day 77 years earlier -- July 17, 1887 -- that its model, the Agricultural Experiment Station Act, was signed by President Grover Cleveland.

The Rules and Regulations Pursuant to the Water Resources Research Act of 1964 (PL 88-379) were issued by the Department of Interior. A copy of these Rules and Regulations as published in the Federal Register, Document 64-12380; filed December 2, 1964 is included as Appendix B.

Water Resources Research Institutes now exist in all of the fifty states and in Puerto Rico, Guam, the Virgin Islands, and the District of Columbia. Public Law 88-379 which activated them has been amended once, by Public Law 89-404, approved in April, 1966, as S.22 which details the method of reporting to the President and Congress.

A history of the Implementation and Recommendations - "Chronology of the Significant Events Leading up to the Enactment of the Water Resources Research Act of 1964," Public Law 88-379-(S.2) approved July 17, 1964 with the 1966 Amendments thereto (S.22) is included in its entirety in Appendix C.

Approval of Various State Institutes

The Congress provided for the funding of fourteen (14) institutes at $75,000 each to get the program under way with institutes in the remaining states to be funded at a later date as their applications were completed and approved by the Office of Water Resources Research. The New Mexico Water Resources Research Institute was among the first 14, with the agreement effective as of February 1, 1965. The final agreement was signed by Roland R. Renne, Director of the Office of Water Research for the United States on March 9, 1965 and by H. R. Stucky, Director of the Water Resources Research Institute, for New Mexico State University on March 12, 1965. (Appendix D).

New Mexico Water Resources Research Institute

Antedating the federal program by more than a year, the New Mexico Water Resources Research Institute was actually established by action of the Board of Regents for New Mexico State University in February, 1963. It was designated as a separate operating organization within

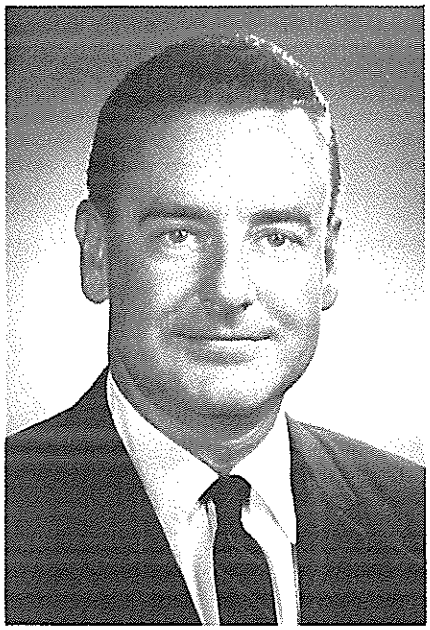
the University for the training of water scientists and engineers through research and investigation of water problems, to cooperate with the experiment stations of the Colleges of Agriculture and Engineering. In addition, faculty members of any department of the University's other colleges were eligible to propose appropriate projects for Institute sponsorship.

The Institute's first printed statement, issued in March, 1963, defined its function as follows: "The Institute will bring research and teaching programs related to water together into an operating unit to serve the state more effectively." It gave the name of H. R. Stucky, head of the Department of Agricultural Economics and Agricultural Business, as chairman, with Warren Viessman, Jr., Civil Engineering, as vice chairman and James I. Culbert, Earth Science, as secretary.

Members of the policy committee and their respective offices or departments were: Marvin L. Wilson, Associate Director, Agricultural Experiment Station; Frank Bromilow, Dean of Engineering and Director, Research Center; James F. Cole, Assistant to the University President; J. G. Watts, Botany and Entomology; Edward F. Thode, Chemical Engineering; Rex D. Peiper, Range Science; Harold Dregne, Agronomy; G. L. Guthrie, Business Administration and Economics; John J. Monagle, Jr. Chemistry; Eldon Hanson, Agricultural Engineering.

In September, 1964, after the Water Resources Research Act had become Public Law 88-379, S.2, the preceding July, New Mexico State University formally applied to the Office of Water Resources Research, Department of the Interior, for federal recognition as the Water Resources Research Institute for the State of New Mexico.

Governor Jack M. Campbell wrote a letter to the Secretary of Interior, The Honorable Stewart L. Udall, dated September 3, 1964, recommending New Mexico State University as the Institute Center for New Mexico. He stated "New Mexico State University has had nine Water Conferences in the past and has conducted many studies in connection with its outstanding agricultural and scientific program." (Appendix E).



Governor Jack Campbell

New Mexico Water Resources Research Institute the First in the Nation To Receive Approval Under S.2

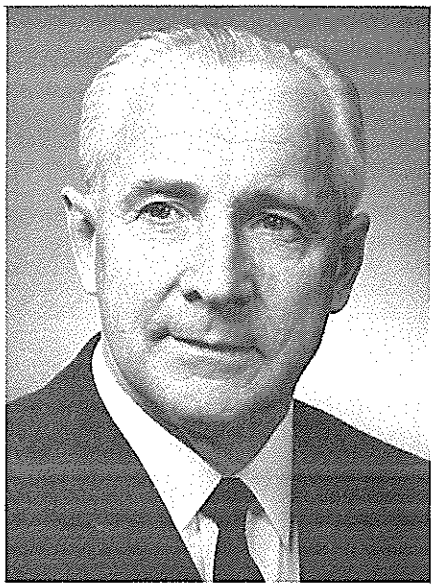
In February, 1965, the application was approved and New Mexico State University, as the state's land-grant institution, was designated, by Governor Jack Campbell, to recieve the federal funds for New Mexico under the new law.

It was a gratifying climax for Senator Anderson of New Mexico and the others who had worked for passage of the Act for nearly five years. In his newsletter to constituents, August 10, 1965, Senator Anderson included this item: "Just 12 months ago Congress created the water resources research program. As a result, a state water resources research center has been established in each of the 50 states and Puerto Rico -- the first at New Mexico State University." (Appendix F)

Office of Water Resources Research

The Office of Water Resources Research was established in the United States Department of Interior to administer the water research program under the Water Research Act of 1964. The name since 1975 is Office of Water Research and Technology.

The Office received the original applications from the several states and designated which University would be the official location in each state, where there was some competition for location. The Governor or the State Legislature generally recommended a University in the state to the Office of Water Research, and those recommendations were accepted where there was a single nomination.



Dr. Roland R. Renne

Eugene Eaton

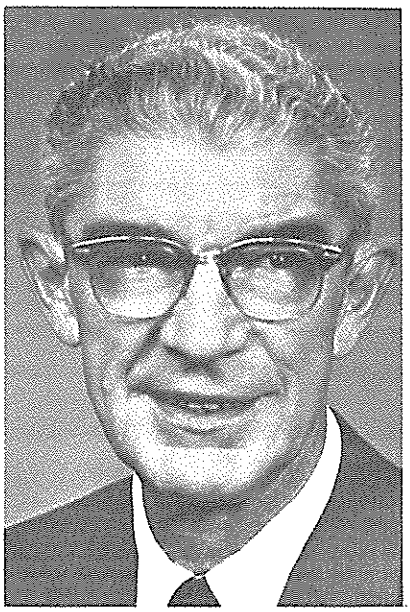
Dr. R. R. Renne, former President of Montana State University, was named as the first Director of the National Office on November 1, 1964. Dr. Renne worked on many of the West's water problems both from the research and administrative viewpoints as he moved from Assistant Professor of Agricultural Economics to Department Head and on to President of the University over a 20 year period.

The Assistant Director was Eugene Eaton, a long time employee of the Department of Interior in Washington, D.C., who was well acquainted with the workings of the federal government and the relationships in the Departments and between the administration and the Congress. He was also familiar with New Mexico, having spent over a year as one of the technical

staff of the Civilian Conservation Corps Company which was located in Mesilla Park in the early 30's. Dr. Renne and Mr. Eaton worked well as a team in the establishment and administration.

Dr. Garland Hershey, former State Hydrologist for the State of Iowa, replaced Dr. Renne and became the second Director of this important office on May 1, 1969.

The Office of Water Resources Research in cooperation with the State Water Research Institutes and Centers and several interested Federal Agencies developed a list of water research areas needing consideration (Appendix G). This was not an all inclusive list but did serve to direct the thinking of research professors who might, for the first time, consider making a research proposal to one of the State Institutes. This list could be greatly refined after 12 years of work by the Institutes, but it shows the wide range of water problems across the nation recognized as important for detailed study at that time.



Dr. Garland Hershey

Objectives of the New Mexico Water Resources Research Institute

The Water Resources Research Act as passed by Congress established two main goals; (1) research, and (2) training of students. Expanding on these goals, the New Mexico Water Resources Research Institute had begun to outline its basic objectives and operating statement -- a process that was to continue over several years.

The Institute's objectives in the beginning were as follows:

1. To promote scientific endeavor in the area of water resources research.

2. To encourage and facilitate the entry of qualified scientists into water resources research through their particular disciplines.
3. To coordinate, integrate, and facilitate the efforts of scientists and organizations conducting water resources research at New Mexico State University.
4. To interest, encourage, and train young scientists through research, experiments, and investigations.
5. To disseminate the results of New Mexico State University's water resources research work in both broad and specific areas to the public and to organizations interested in such research.
6. To provide the means of contact between the scientists doing this research and organizations supporting such research.

At the time the Institute was officially established on the campus in 1963, some thirty water research projects were under way at New Mexico State University, the University of New Mexico, and New Mexico Institute of Mining and Technology. Most were being conducted through the Engineering and Agricultural Experiment Stations. Others were supported by research grants or by regular appropriations. Areas covered included: economics of water resources, erosion and sedimentation, evaporation suppression, hydrology, multiple use of water resources, saline water conversion, water quality, weather and climate, and irrigation, drainage, and watershed management.

Researchers included staff members from the departments of agricultural engineering, agronomy, animal and range science, biology, botany and entomology, civil engineering, geoscience statistics, and agricultural economics. Also involved were personnel of several branch experiment stations and U.S. Department of Agriculture and Soil Conservation Service workers.

Institute has Statewide Responsibility

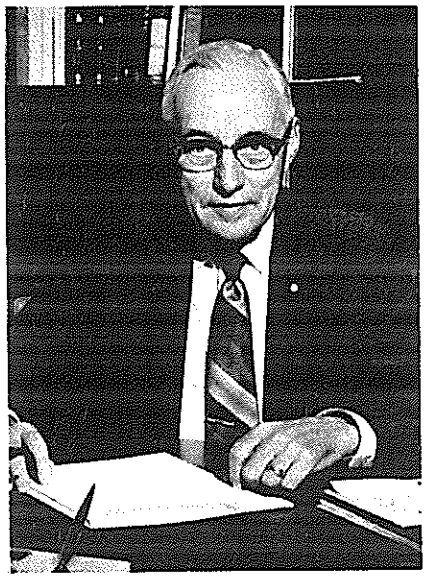
The Institute, although located at New Mexico State University, has statewide responsibility to encourage and conduct water resources research at New Mexico State University and other institutions of higher learning in New Mexico. It also can, and does, cooperate with private, county, state, and federal organizations interested in water research.

Directors of New Mexico Institute

The Institute has had four directors appointed since it was established by action of the Board of Regents in February, 1963. A brief biographical sketch of each points out the varied background of each person. There are two points in common: an intense interest in water and people, and a strong research background.

Dr. H. Ralph Stucky

Dr. H. Ralph Stucky was appointed as the first Director of the New Mexico Water Resources Research Institute by President Corbett, effective September 1, 1964 on a part-time basis. The appointment was for the purpose of completing the organization of the Institute and preparing the New Mexico State University applications to the Office of Water Resources Research, U.S. Department of Interior, for New Mexico. New Mexico State University was designated in accordance with the provisions of the National Legislation under Senate Bill S.2 signed into Law on July 17, 1964.



Dr. H. R. Stucky
First Director
Sept. 1, 1964 to June 30, 1971

Dr. Stucky was born and raised on an irrigated farm in the Gallatin Valley near Bozeman, Montana. He received a Bachelor's Degree in Animal Science from the University of Idaho, a Master's Degree in Agricultural Economics and a Doctoral Degree in Economics and Political Science from the University of Minnesota. His doctor's dissertation was entitled, "Settlement and Repayment Policies on Irrigation Projects." He came to New Mexico State University in 1954 as head of the Department of Agricultural Economics from the position as Extension Economist with Montana State University.

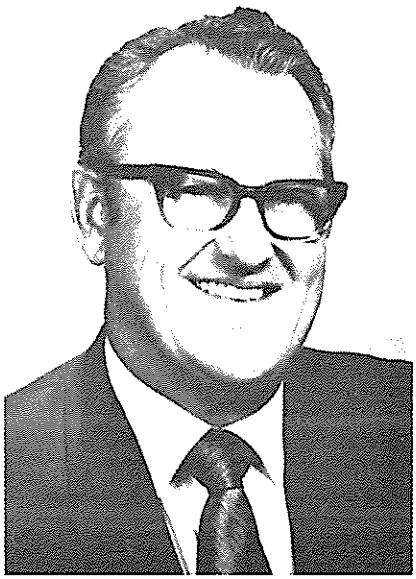
Stucky developed a four part curriculum in the Department of Agricultural Economics during his first year as head of that department.

One of those was a major in Water Resources Economics. Also, during that first year, he organized a department seminar on water resources which was the forerunner for the First Annual New Mexico State Water Conference held on the New Mexico State University Campus, October 31 and November 1 and 2, 1956. The Twenty-third Annual Water Conference was held in April, 1978.

Among his other work he served as Chairman of the Annual Water Conference 1956 through 1971, organized and directed the New Mexico Water Resources Research Institute during its formative years, authored more than 70 publications in the water resources field, served as Director of the National Universities Council on Water Research, and received a presidential commendation for outstanding National Contributions on Water Resources. The New Mexico State University Board of Regents named the Water Resources Research Institute Building "Stucky Hall."

John W. Clark

John W. Clark served as Director of the New Mexico Water Resources Research Institute from July 1, 1971 to June 30, 1976. He was Professor of Civil Engineering at New Mexico State University at the time he accepted the directorship of the Water Institute.



John W. Clark
Director
July 1, 1971 to June 30, 1976

Clark, a native of Illinois received his Bachelor's Degree and Master's Degree in Civil Engineering from the University of Missouri. He joined the New Mexico State University faculty in 1953 in the Civil Engineering Department.

Professor Clark was the principal investigator on several hundred thousand dollars worth of grants and awards from such organizations as the Natural Science Foundation,

National Institutes of Health, U.S. Department of Interior, and other State and private groups prior to becoming Institute Director.

Clark organized the first New Mexico Water Sewage Short School in 1955 and directed the first National Science Foundation Summer conference on Water Resources held June 10 to July 3, 1963 on the New Mexico State University Campus. He, long active in Water Control Organizations, was President of the Water Pollution Control Federation - Rocky Mountain Section in 1965, Chairman of the Governor's Advisory Committee on Water Pollution Control from 1956 to 1966, and served as a representative of engineering appointed by the Surgeon General to the Regional Health Advisory Board.

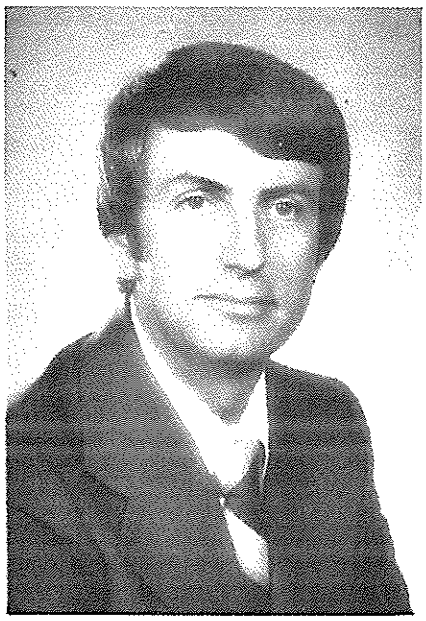
Professor Clark is the author of over 40 publications in technical magazines and journals in the field of water resources and in the health and sanitary engineering fields, including a textbook co-authored by Dr. Warren Viessman and Mark Hammer entitled, Water Supply and Pollution Control (3rd Edition, January 1977) which is used in over 200 colleges and universities.

During Clark's Directorship, the Institute's research program increased rapidly through grants obtained from local, private, and public agencies and through increased research contracts.

Dr. Garrey Carruthers

Dr. Garrey Carruthers was appointed Acting Director of the New Mexico Water Resources Research Institute effective July 1, 1976.

Carruthers, a native of Aztec, New Mexico, received a B.S. Degree in Agriculture in 1964, an M.S. Degree in Agricultural Economics in 1965 from New Mexico State University, and a Ph.D. in Economics from Iowa State University in 1968. He served as Assistant Professor in the Department of Agricultural Economics and Agricultural Business from 1968 to 1972 and Associate Professor from 1972 to 1974. On September 1, 1974, he accepted a White House Fellowship and was an Assistant to the Secretary of Agriculture, U.S. Department of Agriculture in Washington, D.C. where he continued until August 31, 1975. He was again



Dr. Garrey Carruthers
Acting Director
July 1, 1976 to February 28, 1978

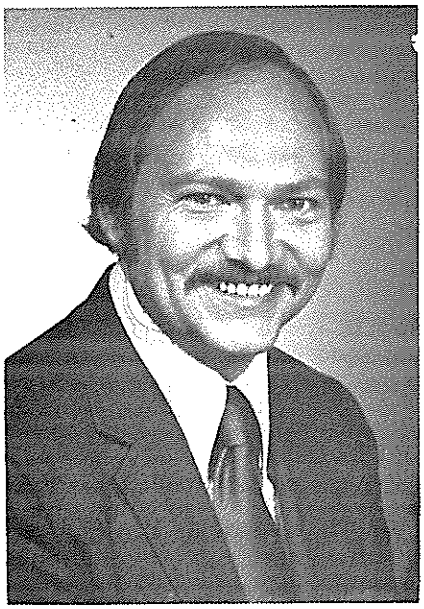
Associate Professor in Agricultural Economics at New Mexico State University from September 1, 1975 until he became Acting Director of the Water Resources Research Institute where he served until February 28, 1977. He then resumed full-time his responsibilities as Associate Professor in the Agricultural Economics Department.

During Carruthers' term as Acting Director, with the cooperation of the Advisory Committee, he coordinated the 22nd Annual Water Conference on "208 Water Quality Planning," which was one of the best attended conferences in recent years. Also, he renewed interest in developing New Mexico's large saline water reserves, an as yet untapped natural resource. Through his efforts a substantial Eisenhower Consortium grant was acquired in cooperation with Texas Tech. He also was instrumental in gaining further federal, state, and private funds for the Institute's research program.

Dr. Thomas G. Bahr

Dr. Thomas G. Bahr, a native of LaCrosse, Wisconsin, became Director of the New Mexico Water Resources Research Institute March 1, 1978. Bahr came to New Mexico State University after directing the Institute of Water Research at Michigan State for about five years. He first joined that staff in 1970 as Assistant Director.

He is a 1963 graduate of the University of Idaho with specialization in Fisheries Management and Water Quality. Bahr attended Michigan State University from 1963 to 1968, receiving a M.S. Degree in limnology and



Dr. Thomas G. Bahr
Director
March 1, 1978 to present

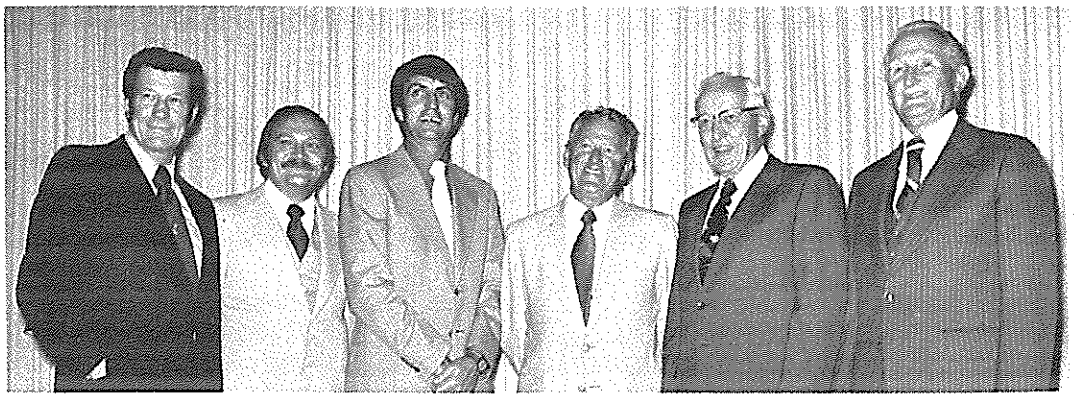
biochemistry and a Ph.D. in limnology. He later accepted a faculty position in the Department of Zoology at Colorado State University. Bahr's research interests have focused on the general area of water quality management including studies on the effects of pesticides and toxic agents on fish, the dynamics of heavy metals in aquatic systems, and nutrient effects and control of eutrophication in surface waters.

More recently, his studies have been focused on evaluating and developing alternative management schemes for the treatment of municipal wastewaters.

Historic Event

At the time Dr. Bahr was getting started as Director for the Institute, Dr. Thomas had a dinner for former President Corbett and all four of the Institute Directors and wives. A tape recording was made for historic purpose, of the impressions which each of the Directors and the two Presidents had regarding New Mexico Water Resources Research Institute.

The recorded discussions covered several questions regarding: the development of the Federal Legislation setting up the National program, the early development of the New Mexico Institute, and the impressions of each director on the importance of water in New Mexico, and the contributions the Institute has and will make to the understanding and direction the people of New Mexico will follow in the uses of this very scarce and vital resource. A copy of the tape is on file in the archives in the University Library.



President Thomas, Bahr, Carruthers, Clark, Stucky and Former President Corbett

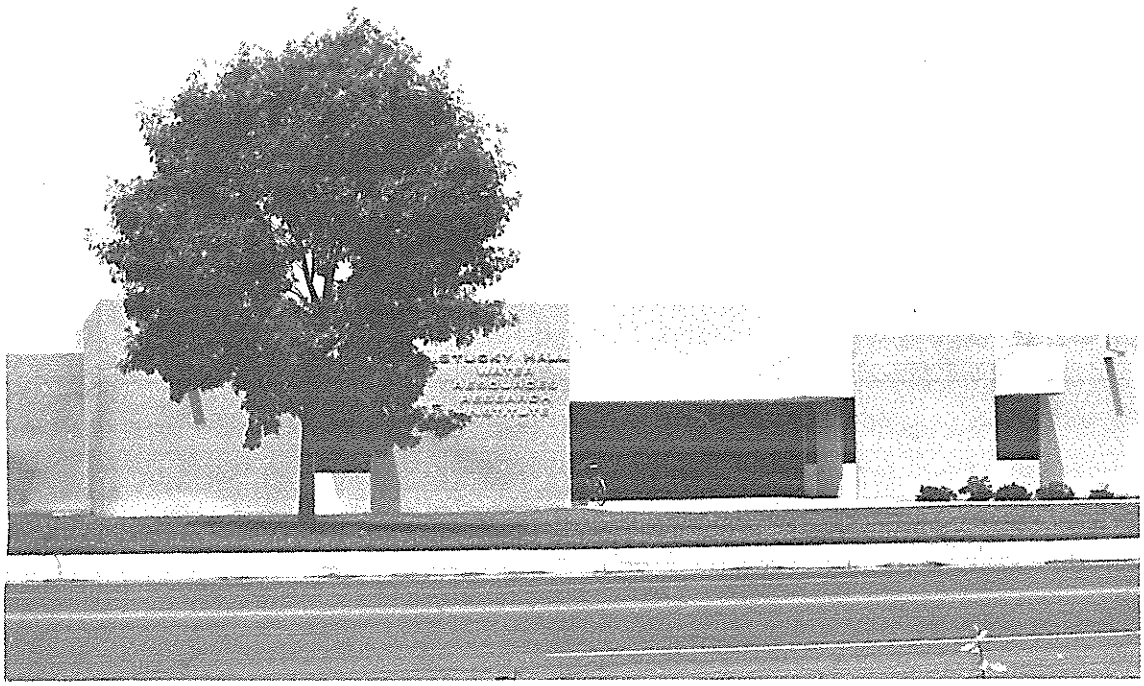
The Offices

The Institute opened for business in its own quarters for the first time on March 15, 1965. These first offices consisted of two rooms on the ground floor of the Agricultural Building, Rooms 115 a and b. At this time Dr. Stucky resigned as head of the Department of Agricultural Economics in order to give full time to the work as Director of the Institute. The role of the Director from September 18, 1964 to March 15, 1965, had been carried on a part-time basis by Dr. Stucky.

In 1967, it became apparent that the Institute's expanded program required more space than was provided by its two room office. A three story addition to the West side of the Agricultural Building was completed in 1968. Dr. Philip Leyendecker, Dean of Agriculture, offered to loan the use of a part of the third floor, Room W-300, to the Institute for its offices, starting in February 1968, for a period of about two years until other offices could be provided.

The Administration of New Mexico State University, the University Board of Regents, and the State Board of Educational Finance were keenly aware of the importance to New Mexico of the water research work of the Institute and the need for a permanent home for

its use. A building was approved for planning in 1967, with the hopes that it might be completed by 1969. Loren Maston Architecural firm completed the plans and $150,000 were allocated from the State Bond issues for construction.



The Wooten Construction Company received the contract and completed the building so that the Institute was able to move into its new home on March 15, 1970. In May 1970, the Board of Regents voted to name the new Water Resources Research Institute building "Stucky Hall."

Water Conferences

One of the earliest programs for organized and broadened study of water problems was the Annual New Mexico Water Conference, now in its third decade on the New Mexico State University Campus. Organized by H. R. Stucky, then head of the Department of Agricultural Economics, the first conference took place in Milton Hall on November

1-2, 1956, with Stucky as Chairman.

The conference grew out of popular interest in a water seminar held during the preceding spring as part of the course work in agricultural economics. Most of the same speakers were called back for the fall event and they included representatives of the Agricultural Experiment Station, Elephant Butte Irrigation District, State Engineer Office, U.S. Geological Survey, U.S. Army Engineers, and Agricultural Research Service, as well as New Mexico State University staff members.

About 150 persons attended and before the conference ended the participants voted to make it an annual affair. It has been held continuously since then. The conference provides a valuable service to the public by bringing together annually some 150 to 300 leaders to discuss water research, irrigation, and such other topics as education, law, legislation, health, and recreation, and their relationship to water. The speakers have come from within the state and from all parts of the nation, representing industry, academic institutions, state and federal government, private foundations, and women's organizations.

A review of the early conference reports list such speakers and topics as:

1st - 1956

Sources and Disappearance of Water in New Mexico
H. R. Stucky, Head Department of Agricultural Economics

Legal Status of Water in New Mexico
Charles Harris, Assistant New Mexico Attorney General

Effect of Interstate Compacts on New Mexico Water Supply
S. E. Reynolds, State Engineer

Water and It's Economic and Social Influence in New Mexico
R. B. Corbett, President of New Mexico State University

Ditch Linings and Control Methods
C. W. Lauritgen, Project Supervisor
Canal Living Testing in the Southwest, Logan, Utah

2nd - 1957

Public Recognition of the Nation's Water Problems
Charles C. Buner, Director of Land and Water Use Section
American Farm Bureau Federation, Washington, D.C.

Public Recognition of New Mexico Water Problems
Edwin L. Mechem - Governor of New Mexico

Viewpoint of Private Foundations on Water Problems
Rogers Aston, South Spring Foundation, Roswell, New Mexico

3rd - 1958

Orientation of Water Resources Research
Robert H. Black, Dean and Director of Agriculture,
New Mexico State University

Congressional Interest in Water Resources
Honorable Clinton P. Anderson, U.S. Senator from New Mexico

A Look at New Mexico Water Problems
A. S. Fiedler, U.S. Geological Survey, Washington, D.C.

Consumptive Use of Ground Water by Phreatophytes and Hydrophytes
Harry F. Blaney, Irrigation Engineer ARS, Los Angeles, California

Research Contribution to Water Resources Planning
Owen Brough, Chairman Committee on Water Resources
Development, Western Agricultural Economics Research Council
Pullman, Washington

Resolution from Water Conference to Senator Clinton P. Anderson
and to Fred A. Seaton, Secretary of Interior, requesting the
location of one of the five Saline Water Test Plants in New
Mexico

4th - 1959

National Water Legislation
Honorable Thomas S. Morris, Representative in Congress from New
Mexico

Water Laws as they Affect New Mexico
Mr. Ross Malone, President of American Bar Association
Roswell, New Mexico

Dr. Phillip Leyendecker
Dean of the College of Agriculture
and Home Economics, 1960 to 1976
New Mexico State University

Mr. E. O. Moore
Farmer and PCA
Roswell, New Mexico

Mrs. L. L. Lyon
League of Women Voters
Los Alamos, New Mexico

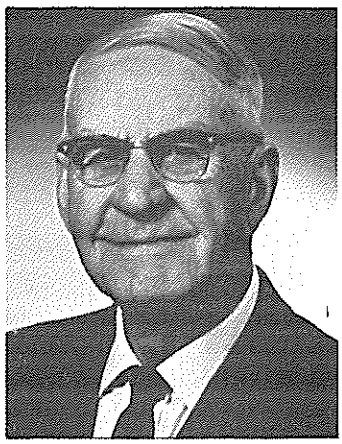
Mr. Fred Thompson
State Department of Game and Fish
Santa Fe, New Mexico

These New Mexicans (on pages 27A and 27B) and many others assisted in the development of the New Mexico Water Resources Research Institute. With leaders such as these and the many others who have contributed in so many ways, along with those who helped shape the National Legislation establishing a Water Research Institute in each of the states there was no way that these efforts could fail.

Mr. Lloyd Calhoun
New Mexico Electric Company
Hobbs, New Mexico

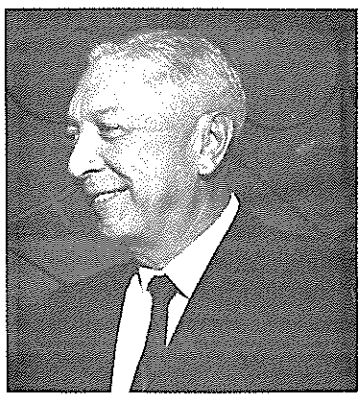
Mr. Jesse Gilmer
Rio Grande Compact Commissioner
El Paso, Texas

Dr. Frank Bromilow
Dean of the College of Engineering
1961 to 1974
New Mexico State University



Mr. W. H. Gary
Farmer and Member,
Interstate Stream Commission
Hatch, New Mexico

Dr. Marvin Wilson
Associate Director of
the Agricultural Experiment
Station, 1963 to 1977
New Mexico State University



Mr. Rowland Fife
Bureau of Reclamation
Albuquerque, New Mexico

Concept of Beneficial Use in Water Law in New Mexico
Mr. Justice Irwin Moise, Justice of New Mexico Supreme Court

5th - 1960

Report on Governor's Water Resources Committee
Jack Campbell, Chairman of Governor Resource Committee

Watershed Management Research
George Ellis, Cattlemen's Watershed Committee, Bell Ranch, New Mexico

Some Research Findings on the Alamogordo Creek Experimental Watershed
Robert V. Keppel, Watershed Studies, ARS, USDA Research Station, Tucson, Arizona

Water Needs of Tomorrow
A. L. Miller, MD, Director, Office of Saline Water
U.S. Department of Interior, Washington, D.C.

6th - 1961

Ground Water and Ground Water Law in New Mexico
Governor Edwin L. Mechem

Availability of Ground Water in New Mexico
William E. Hale, Ground Water Research Water Resources Division, USGS, Albuquerque, New Mexico

The Annual New Mexico Water Conference might be considered a forerunner of the Water Resources Research Institute. Starting as a seminar program in the Department of Agricultural Economics in 1956 with a report of the proceedings of that seminar published as Special Report No. 1, September 1956. The Annual Conferences which followed were more or less sponsored by the Department in cooperation with the Statewide Water Conference Advisory Committee. Eight conferences were held before the Water Institute was established. The conference then became a part of the Institute activities. Continuity of the conferences was maintained because it had much the same leadership from 1956 to 1971. Each succeeding Director has

continued sponsorship of the conference through the Institute.

An Advisory Committee from over the state was established and has continued each year to this time. This committee works along with a New Mexico State University Committee in establishing the theme for each conference and suggesting speakers who might make substantial contributions to each conference program. It will be noted from the names of speakers and titles of their papers in each of the conference programs, that not only the physical problems of water were considered, but the legal, social and political aspects were included. These conferences may have helped to focus the interests of Senator Clinton P. Anderson from New Mexico and Congressman Thomas G. Morris on the urgency of water problems and the need for National legislation.

It is believed that these conferences have had much effect on the success of the Water Resources Research Institute because they brought the leaders in the several agencies in the state, together with representatives of the water users in industry, recreation, and agriculture and with representation of the major universities of the states to discuss the water problems of New Mexico. Also, U.S. Senators and Representatives, State Senators and Representatives, Judges, outstanding attorneys and heads of numerous Federal Agencies participated in these conferences.

Altogether, this exchange of information and opinions helped every person attending the conferences to see the inter-relationship of the various communities in the state with the work of state and federal agencies and the Research Institute. The Water Conference Reports are widely used as reference material and are often quoted as sources of authentic information. The wide range of topics covered in the conferences points out the broad range of New Mexico water problems. A complete list of Water Conference Reports is presented as a separate section (Appendix H).

First WRRI Research Report

The first WRRI Research Report was published in 1966 in the

form of a color map, the first of its kind ever prepared for New Mexico.

This map gives an accurate location of the irrigated lands of the state. It also shows areas with differing consumptive-use requirements for water. Data for the map were assembled by Agricultural Economists and the State Engineer's Office with cooperation of U.S. Soil Conservation Service, Agricultural Research Service, and Agronomists and Agricultural Engineers of the Agricultural Experiment Station. The locations of the irrigated land by source of water supply, surface, ground, or combination of both, was drafted on the map by the State Engineers Office.

Flow Sheet

On September 26, 1966, the Institute inaugurated the first of a series of information letters which were to be issued from time to time to provide facts and discuss developments concerning the Institute's program. Called "Flow Sheet," the letter gave details of the founding of the Institute at New Mexico State University, explained its purpose and plan of operation, and discussed its research program. In soliciting new project proposals, the letter outlined the procedure for proposing and reviewing Institute-sponsored research projects. The title of the Institute newsletter was changed to The Divining Rod in 1977.

Statewide Advisory Committee

A statewide research advisory committee was established and held its first meeting, June 14, 1966, on the New Mexico State University campus. Members of this committee were: Steve Reynolds, State Engineer; Roland Fife, Bureau of Reclamation; Rogers Aston, President, South Spring Foundation; William D. Hurst, Regional Forester, U.S. Forest Service; William Hale, District Chief, Water Resources Division, U.S. Geological Survey; John W. Wright, State Department of Public Health; Lloyd A. Calhoun, Vice President,

New Mexico Electric Service; W. Robert Summit, Research Economist, U.S. Department of Agriculture, Economic Research Service; Fred Thompson, State Game and Fish Department; Einar Roger, State Conservationist, U.S. Soil Conservation Service. The purpose of this committee was to exchange information, and research needs, between the various agencies in New Mexico, including the New Mexico Water Resources Research Institute.

Research Advisory Board - 1965

A Research Advisory Board was established by the Institute Director to help establish the direction the research work should take. Also, the board was to review the projects being proposed by the various investigators who wished to conduct water research funded by the Institute. Since the water is of interest to research workers in many academic disciplines, this board represented several areas. The first members were all from the New Mexico State University faculty. The members, left to right in the picture were: Harold E. Dregne, Agronomist; William A. Dick Peddie, Biology, Warren Viessman, Jr., Civil Engineering, John W. Clark, Civil Engineering, and H. Ralph Stucky, Agricultural Economist and Institute Director.

Inter-University Agreement

Another development was the signing of an inter-university memorandum of agreement by the presidents of New Mexico Institute of Mining and Technology, University of New Mexico, and New Mexico State Univer-

sity on July 8, 1966 (Appendix I). The agreement formed a definite basis for accounting for the federal and matching funds on projects at the institutions operating through the Water Resources Research Institute. In the same year efforts were begun to obtain state funding for the Institute in order that it might better achieve its goals and render greater service to the state.

Brainstorming Session on Research Needs of Pecos Basin

To discuss the possibilities of a Pecos Basin project, the Water Resources Research Institute sponsored a "brainstorming session" one Friday evening at New Mexico State University. It was expected that possibly 40 interested persons might wish to attend. There were 71 participants from the three university units, together with private individuals and state and federal agency personnel. There was a brisk, sincere discussion which resulted in a project proposal entitled "A Comprehensive Water Resources Analysis of a Typical Overdrawn Basin in an Irrigated Semi-arid Area: Pecos River Basin, New Mexico." The investigators represented seven departments from the three universities as follows: Willis Ellis, Law, and Ralph d'Arge and Nathaniel Wollman, economics, University of New Mexico; C. E. Jacob, hydrology, and W. K. Summers, geology, New Mexico Institute of Mining and Technology; and from New Mexico State University, John W. Hernandez, civil engineering; Harold Dregne, agronomy; Robert Lansford, agricultural economics, H. R. Stucky, Institute Director and coordinator of the entire project.

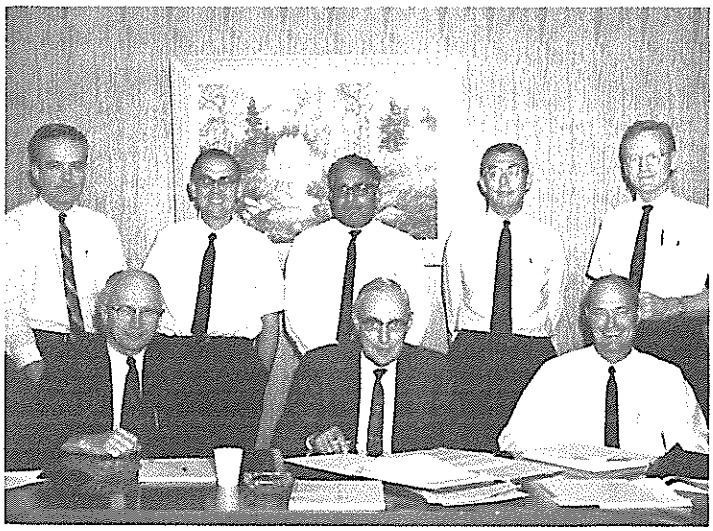
The result of this "brainstorming" session, was the organization of the first interdisciplinary-interuniversity project, Project 3109-102, a comprehensive study of the entire Pecos River Basin in New Mexico.

The need for research to assist the Basin in adjusting to a limited water supply became apparent in discussions held by the "Pecos Valley Aqualantee," an organization of 75 to 100 Valley

businessmen and farmers. Information assembled by the State Engineer, U.S. Geological Survey, U.S. Office of Saline Water, U.S. Bureau of Reclamation, New Mexico Agricultural Experiment Station, and others was considered by the Aqualantees in monthly meetings over a period of about two years.

Program Development and Review Board - 1967

With the signing of the Interuniversity Memorandum, dated July 8, 1977, there became a definite working relationship and certain responsibilities on the part of the University of New Mexico, Albuquerque, New Mexico Institute of Mining and Technology, Socorro and New Mexico State University. The Interuniversity Memorandum provided that representatives would be named to the Program Development and the Review Board by the presidents of each of the three institutes of higher education.



The members as named by the presidents were: (back row, left to right) William Ellis, Law, University of New Mexico; James Zimmerman, Biology, New Mexico State University; Narendra Gunaji, Civil Engineering, New Mexico State University; Nathaniel Wollman, Economist, University of New Mexico; Harold E. Dregne, Agronomist, New Mexico State University; (front row, left to right) C. E. Jacobs, Hydrologist, New Mexico Institute of Mining and Technology; H. Ralph Stucky, Agricultural Economist, Ex-officio member and chairman, New Mexico State University; and Frank Titus, Hydrologist, New Mexico Institute of Mining and Technology.

This board's function was to advise on the Water Research Program to be conducted through the Institute and to select the projects which

were to be recommended for funding by the Water Resources Research Institute. This board has continued to function as originally established, except with changes in membership from each university unit as appointed by the presidents.

Characteristics of the Water Resources Research Institutes or Centers

Each of the 50 states and Puerto Rico, Guam, the Virgin Islands, and the District of Columbia has an institute or center based on the Water Resources Research Act of 1964 - Public Law 88-379, 88th Congress, S.2 approved July 17, 1964 (Appendix A), and the Rules and Regulations pursuant to the Water Resources Research Act of 1964, published in the federal register, December 3, 1964 (Appendix B).

Although all of the institutes or centers are based on the 1964 legislation, there are similarities as well as differences between the way they are organized in each of the states. All are similar in that they are:

1. Generally located at the land-grant college or university in the state. In two cases they are at a State University, not land-grant institutions.
2. All received the same amount of funds from the Title I Annual Allotment Section, $110,000 each in Fy 1977-78, up from $75,000 in Fy 64-65. These are referred to as Annual Allotment projects.
3. All are eligible to present projects to the Office of Water Research and Technology, U.S. Department of Interior for consideration for matching funds on a 50-50 basis under Title I, section 101 of the act. These are referred to as Matching Grant Projects. The amount of research funded varies from year to year for each state based on the quality of the projects proposed and the expected contribution to the knowledge in the water resources field, and it's application to the solution of a local, state, or national water problem.
4. Each institute or center was authorized either be the Governor

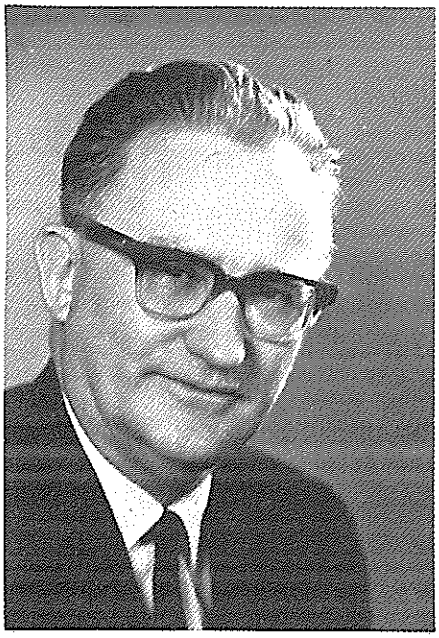
of the state, or by action of the state legislature to be a state wide water research agency for the state.

5. Each institute or center is authorized to enter into cooperative arrangements with individuals, corporations, local, state and federal agencies for funding water research projects and in the conduct of that research.
6. Most states have a Director whose responsibility is to conduct the work of the institute or center on a full time basis, generally working as a separate entity of the University. However, some states have Directors who operate on a less than full time basis, possibly working as a part of the Agricultural Experiment Station, or are associated with the College of Engineering.
7. Several states have separate quarters to house the Director and administrative staff, while others are quartered in less destinctly identifiable quarters.
8. Most, if not all institutes work in cooperation with the academic departments in one or more universities in the state and generally draw highly qualified faculty members from their departments to conduct specific research on a project to project basis.

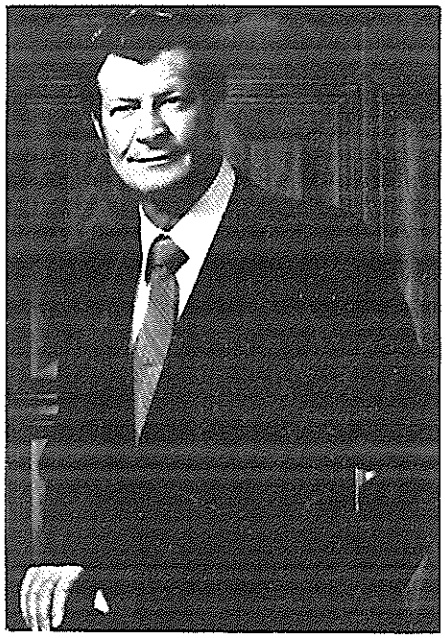
New Mexico Institute Characteristics

New Mexico State Water Resources Research Institute in many ways may reflect the importance that Roger B. Corbett, President of New Mexico State University, 1955 through 1970, and Dr. Gerald Thomas, President since 1970, together with the administrator in the President's office, and the administrators in the colleges and in many departments, have placed on the water problems facing the State of New Mexico and its people.

President Corbett and President Thomas strongly supported the New Mexico Water Resources Research Institute. Dr. Corbett, as a member of the Land-Grant College Association's Water Resources Committee working with Senator Anderson, Dr. William E. Morgan,



Roger B. Corbett
Former President NMSU
1955-1970



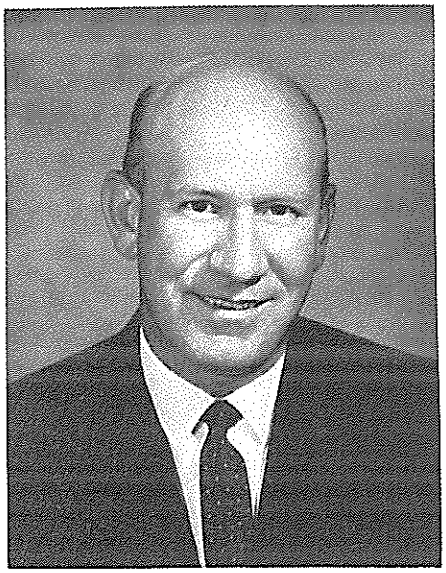
Gerald W. Thomas
President, NMSU
1970-19

President of Colorado State University and Chairman of the Land-Grant Water Committee, and with Congressman Thomas G. Morris of New Mexico, in developing the legislation.

Dr. Corbett, as mentioned before, had a major role in the early development of WRRI. He also strongly supported the development of the New Mexico State University Policy Statement and Basic Objectives and Operating Statement and the construction of the WRRI building which opened during his last year as President.

President Thomas came to New Mexico State with a strong interest in water research, having been chairman of the West Texas Water Conference and Dean of the College of Agriculture at Texas Tech University. He worked with the New Mexico State finance committees in getting an appropriation to the Institute of $100,000 for the first year and up to $161,000 for Fy 77-78 for the support of water research.

James F. Cole, affectionately referred to by everyone as "Jim", supported the idea of a water institute both from the view point of an active farmer and from his professional positions as an Agricultural Economist and as Assistant to President Corbett from September 1961



James F. Cole

to July 1965, and Administrative Vice President from then to his untimely death on May 11, 1966.

The support of these three men permitted the Water Research Institute to take it's place in the state as a major factor in the water research field, and to contribute much information through the research effort on the New Mexico and regional water problems.

Specific Characteristics

The New Mexico Institute has the following characteristics:

1. There has been a full time Director of the Institute continously since March 15, 1964.
2. The Institute operates as a unit administered directly from the President's office.
3. The Institute has been housed since 1970 in a separate building, built specifically for the exclusive use of the Water Resources Research Institute located on the University Campus. It is readily available for contacts with the University departments, the library, and it is easily identifiable by the faculty, students and the general public. The conference room and the reading room are often used by individuals and groups related to the work of the Institute.
4. The Institute has signed agreements setting out its working relationships as follows:
   a. Memorandum of Agreement between the United States of America - Office of Water Resources Research, New Mexico State University and the New Mexico Water Resources Re-

search Institutes, signed March 12, 1965 (Appendix D).

b. Annual allotment project agreement, signed March 12, 1965 (Appendix J).

c. Policy statement issued January 6, 1967 by New Mexico State University President, Roger B. Corbett (Appendix K).

d. Basic objectives and Operating Statement, issued January 6, 1967 by Richard Duncan, Vice-President for Research (Appendix L).

e. Memorandum of Agreement between University of New Mexico, New Mexico Institute of Mining and New Mexico State University, signed July 7, 1968 (Appendix I).

f. Supplement to the July 6, 1966 agreement between University of New Mexico, New Mexico Institute of Mining and Technology and New Mexico State University, signed June 23, 1970. (Appendix M).

5. Because of the New Mexico Water Resources Research Institute's unique relationships established by legislation and by the above agreements, the institute does not have a research staff of its own, but draws on the faculties and research assistants from the appropriate departments in one or more universities by soliciting either single faculty member proposals or by organizing multidisciplinary projects and again soliciting faculty member participation in the various phases of larger projects. This avoids building a staff which quickly gets "cast in concrete." When a project is completed the Institute is not obligated to support an "in-house" staff with a few research disciplines to conduct future project proposals.

6. Some projects are single discipline one man efforts, while others are multidisciplinary, multiuniversity projects with joint participation in the funding, the gathering of data and the research procedures and analysis. Participation by private, state or federal agencies may become available for support of either type of project, depending on the subject being studied.

Statewide Cooperation

The Water Resources Research Institute has produced over 140 publications to date, through 137 research projects. These publications are listed by year the publication was issued and by author and title in Appendix N. Many of the 137 projects are currently in progress.

The passage of the Water Resources Research Act of 1964 and the establishment of New Mexico Water Resources Research Institute provided means by which interdisciplinary - interuniversity research could be conducted. This was followed by the agreements between University of New Mexico, New Mexico Institute of Mining and Technology and New Mexico State University for cooperation between these three university units.

The appropriations from the New Mexico State Legislature further implemented this cooperation and provided additional means for this type of research. The State appropriations directly for work of the Institute were:

FY 70-71	$104,000	FY 74-75	$126,000
FY 71-72	108,000	FY 75-76	142,000
FY 72-73	113,000	FY 76-77	154,000
FY 73-74	118,000	FY 77-78	161,000

These appropriations were in addition to the $150,000 made available to New Mexico State University from the state capital outlay bond issue for the construction of the WRRI building.

A Policy Statement was signed by President Corbett in 1967 and a Basic Objectives and Operating Statement was signed by Vice President for Research Richard Duncan on the same date. These documents defined the working relationships between the departments on the New Mexico State University, and the relationships between the three universities, University of New Mexico, New Mexico Institute of Mining and Technology and New Mexico State University, and the New Mexico Water Resources Research Institute.

Without the agreements providing that the Water Resources Research Institute could solicit scientists from appropriate departments

in each of the three universities on a project to project basis and on a one or more year term, it would not have been possible to develop interdisciplinary-interuniversity research to the extent it has been developed in New Mexico.

First Institute Project - 1965

The first research project administered and funded through the newly established Water Resources Research Institute was Project 3109-20, "Synthetic Hydrology," with Warren Viessman, Jr., as principal investigator. On June 30, 1965, at the close of the fiscal year, and just four months after officially receiving federal funding, the Institute had 10 projects under way providing partial support for 12 principal investigators, 10 graduate students, two technical consultants, and one undergraduate student. A listing of all projects conducted through the New Mexico Water Resources Research Institute is presented in Appendix O.

Multidisciplinary Interuniversity Research

Multidisciplinary interuniversity research has been made possible through the various agreements entered into by the Institute with federal agencies and with the University of New Mexico, the New Mexico Institute of Mining and Technology and New Mexico State University. This type of research project is extremely useful for two major reasons. The first is that almost any mix of highly qualified research personnel can be drawn to the project from these three New Mexico institutions of higher learning, and second, several aspects of a large and complex problem can be studied at one time with exchange of information and coordination of effort between the various investigators.

Examples of these projects are given here to indicate the range of subjects and the variety of disciplines involved. Five projects are cited from among at least 30 such projects which have been completed or are now in progress.

The principal investigators and the detailed objectives are found in Appendix M. The detailed citation to year and page in Appendix M will be given at the end of each of these six project statements.

A. Projects 5700-306 - Title - Water Requisite for Crop Production in the Roswell Underground Water Basin started July 1, 1966 and
Project B-006 - Title - Resource Analysis of a Typical Overdrawn Basin in an Irrigated Semiarid Area - Pecos River Basin started July 1, 1966.

These two projects were started as a result of a brainstorming session held at New Mexico State University to more carefully outline the general problems of the Roswell Basin and to select specific research problems.

The Pecos Valley Conservancy District appealed to the Institute for the Water Requisite Research project to assist the farmers in arriving at the most economical and practical way of using the available water. The court decree issued January 10, 1966 set an annual duty of water of three acre-feet per acre with the total in any conservative five-year period not to exceed 15 acre-feet.

These projects were interdisciplinary-interuniversity studies on the entire length of the Pecos River Basin in New Mexico, while the above project covered only the irrigated lands near Roswell and Artesia, New Mexico and was carried on as an interdisciplinary study by a single university. There were 6 publications reporting various phases of the study. Refer to Appendix M.

B. Project No. B-015 - funded July 1, 1969 - Title - Soil Associations and Land Classification for Irrigation.

This project was organized and originally funded by the New Mexico Water Resources Research Institute with the Agronomy Department at New Mexico State University cooperating with the U.S. Bureau of Reclamation to do an Irrigatibility Classification for each county.

In doing the irrigability classification in Curry and San Juan counties, it was predetermined that a soil classification was necessary to do a good irrigatibility classification. Therefore, the Water Institute continued to fund the irrigability phase, but solicited and received funds and/or assistance of personnel from the U.S. Bureau of Reclamation, U.S. Indian Affairs, U.S. Bureau of Land Management, U.S. Soil Conservation Service, State Engineer's Office and the State Land Departments, so that both the irrigability classification and the soil classification were completed.

The results of this work were published by the Agricultural Experiment Station in cooperation with the Institute for thirty-one New Mexico counties plus the State summary.

County	Bulletin No.	County	Bulletin No.
Catron	229	Otero	238
Chaves	192	Quay	202
Colfax	239	Rio Arriba	254
Curry	162	Roosevelt	163
De Baca	206	Sandolval & Los Alamos	188
Dona Ana	183	San Juan	257
Eddy	170	San Miguel	221
Grant	200	Santa Fe	185
Guadalupe	246	Sierra	233
Harding	165	Socorro	234
Hildalgo	177	Taos	268
Lea	178	Torrance	187
Lincoln	212	Union	250
Luna	176	Valencia	267
McKinley	262		
Mora	205	State Summary	276

There were a total of 30 publications issued, 30 county reports and the state report. One publication included two counties. Refer to Appendix N.

C. Project No. B-061 - funded July 1, 1969

D. Project No. B-019 - funded July 1, 1970

E. Project No. B-026 - funded July 1, 1971

Title - An Analytical Interdisciplinary Evaluation of the Water Resources of the Rio Grande in New Mexico.

Plans for the project included a study of the water resources problems of geology, hydrology, engineering, soils, economics, law, and sociology, covering the entire drainage area of the Rio Grande in New Mexico - an area approximately 400 miles long and 75 to 125 miles wide. Six representatives of state and federal agencies were asked to serve as an advisory committee to meet with the research staff on various technical and policy questions.

There were 5 publications issued reporting the results of various phases of this project. Refer to Appendix M.

F. EPA Grant No. 13030 (GLM-308) - Funded July 1, 1971
Title - Influence of Trickle and Surface Irrigation on Return Flow Quality
P.I. - Dr. P.J. Wierenga, Department of Agronomy, New Mexico State University

The Environmental Protection Agency in cooperation with the New Mexico Water Resources Research Institute and the Agronomy Department of the New Mexico Agricultural Experiment Station conducted a field study to determine the effects of controlled surface irrigation and trickle irrigation on the quality and quantity of irrigation return flow.

G. EPA Grant No. 5803565-02-0 (e109-315) - Funded February 17, 1975, Title - Demonstration of Irrigation Return Flow Salinity Control

The general objectives of this project were to determine the feasibility of alternate management practices on the quality of drainage return flow and soil salinity in the Mesilla Valley and the Upper Rio Grande Basin in New Mexico. This project was an interdisciplinary interuniversity study involving several research departments. It was supported by the United States Environmental Protection Agency. Appendix O.

H. Rio Grande Regional Environmental Project (RGREP)

The Rio Grande Regional Environmental Project is a series of

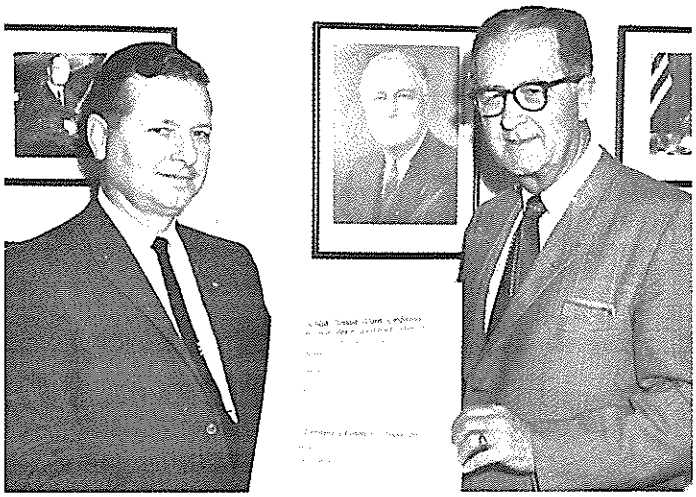
studies of the land and water resources along the Rio Grande from Elephant Butte Reservoir in New Mexico to Fort Quitman, Texas. The Bureau of Reclamation coordinated the studies which include a full water resource, economic, social, environmental and cultural assessment of the area through the cooperation of Federal, State, and local agencies. WRRI's contribution was to provide the USGS with facilities and services and to administer five RGREP related research projects.

Saline Water an Important Natural Resource in New Mexico

Saline Water is an important undeveloped resource in New Mexico. It has great potential for development for municipal and industrial uses in many New Mexico communities. The quality of the saline water varies, not only from community to community, but within the local areas. These variations are due to the volume and direction of entrance of fresh water recharge to the basin. It also varies with the depth of the wells and the amount of pumping withdrawals.

The potential value of saline water has been recognized for sometime, but the limited amount of technology available and the cost of desalting equipment has delayed development.

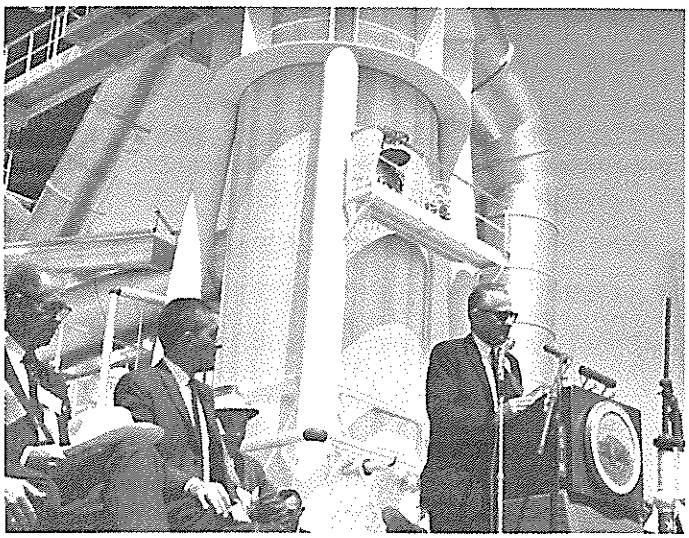
Senator Clinton P. Anderson exercised great leadership not only in the establishment of Water Resources Research Institutes but in the establishment of six National Saline Water Conversion Desalination Test Plants, one of which was eventually located at Roswell, New Mexico.



Rogers Aston, of Roswell, a long time effective member of the New Mexico State Water Conference Committee, is shown presenting a resolution from the Third Annual Water Conference (1968) to Senator Anderson in support of locating one of the Saline

Water Desalination Test Plants in New Mexico. This was one of only 5 resolutions ever passed during the Water Conferences in over 20 years.

The second picture shows New Mexico State University President Roger Corbett speaking at the dedication of the Roswell Saline Water Desalination Test Plant in July 1963, with Senator Anderson and Secretary of Interior Stewart Udall on the platform. This is the only Water Conference held off the New Mexico State University Campus during the entire span of the conference's history.



The New Mexico State Engineer and the U.S. Geological Survey had conducted limited studies prior to 1960 which defined the major areas where saline water was available in quantities. Also, many of the wells producing crude oil in New Mexico also produced saline water with the oil. The State Engineer's Office, U.S. Geological Survey, and the Office of Saline Water published the Office of Saline Water Report 561, 128 pages on the Saline Water Resources of the Tularosa Basin, New Mexico, with J.S. McLean, USGS as principal investigator. There were also a companion study to the above report, Office of Saline Water, Research and Development Program Report No. 776, H.R. Stucky and William C. Arnwine, New Mexico Water Resources Research Institute, entitled, Potentials of Desalting in the Tularosa Basin, New Mexico, A Case Study, August 1971, 83 pages. Another study entitled, A Preliminary Economic Feasibility Study for the Establishment of an Energy-Water Complex in the Tularosa Basin, New Mexico, with Robert R. Lansford as the major author, found that it was not economically feasible to desalt water in that area for irrigation. This publication, WRRI Report No. 068, 231 pages, was published in 1976.

Further research and investigations will be required on the methods of conversion of saline water to potable water for municipal use and to produce water for limited industrial uses. Also, research will be required on the social and economic impacts, and on the sizes of plants which might be used to produce social and economic benefits.

The Safe Drinking Water Act, PL 93-523, passed in 1974 with revisions in 1977, is focusing public attention on the fact that many communities do not have public water supplies which meet health standards. In many communities in New Mexico and in much of the West, the water supplies are too high in salinity.

It is known that saline water can be put to beneficial and healthful use by municipalities, as demonstrated by Dell City, Texas, Buckeye, Arizona, and several other communities in the West.

The shortage of water in some areas and the poor quality of water in these and other areas will push the reconsideration of the state's saline water resources and how these waters may be put to beneficial use.

The Water Resources Research Institute had a proposal before the 1978 New Mexico Legislature to fund extensive saline water research at the Saline Water Conversion Plant at Roswell, New Mexico. However, the Bill did not pass during that legislative session.

Funding of the Water Resources Research Institute FY-1964-65 through FY-1977-78

The funding for the Water Resources Research Institute's ongoing program is derived from a number of sources. The basic positions come from the Title I Annual Allotment and Matching Grants authorized by the Water Resources Research Act of 1964, and from appropriations made by the State Legislature for the direct use by the Institute. The breakdown of the income resources is given in Appendix P.

The above sources are supplemented by grants from other federal agencies, from other State sources, and from private funds.

These funds are very important to the work of the Institute since they provide flexibility to take up special research problems which may need to start at other than on a fiscal year basis and to take up special state projects which might not receive funding through the more or less national and regional matching grant programs.

Wide Cooperation and Participation

There have been 31 academic disciplines in six institutions of higher learning; The University of New Mexico, New Mexico Institute of Mining and Technology, Eastern New Mexico University, New Mexico Highlands University, Texas A & M University and New Mexico State University participating in research work supported by the Institute since 1964. These various disciplines were:

Agricultural Economics	Farm Management
Agricultural Engineering	Geography
Agronomy	Geology
Animal and Range Science	Geophysics
Anthropology	History
Architecture	Horticulture
Biology	Humanities
Botany and Entomology	Hydrology
Chemistry	Industrial Engineering
City and Regional Planning	Law
Chemical Engineering	Mechanical Engineering
Civil Engineering	Physics
Earth Science	Political Science
Economics	Sanitary Science
Education	Soils
	Wildlife Science

Funds were made available directly to the Institute through agreements with the Office of Water Resources Research, U.S. Department of Interior through the Water Resources Research Act of 1964; for the

annual allotment and matching grants. Also, direct appropriations were made to the Institute by the New Mexico State Legislature and direct funding for professional personnel were made available to collect data, or direct funding has been provided to the Institute by the following agencies:

State Engineer's Office
Interstate Stream Commission
Elephant Butte Irrigation District
Pecos Valley Conservancy District
U.S. Bureau of Reclamation
U.S. Bureau of Indian Services
State Land Office
U.S. Geological Survey
U.S. Office of Saline Water
U.S. Bureau of Land Management
Educational Title I Higher Education Act
U.S. Environmental Protection Agency
State Board of Educational Finance
Public Service Company of New Mexico
U.S. Forest Service
Eisenhower Consortium

This listing of universities and the academic disciplines involved together with the support of the Institute's research work from numerous sources as listed above, helps to show the depth of involvement and interest in the Institute program.

Two agencies located in Santa Fe have been especially cooperative with the Water Resources Research Institute and each has contributed to the effectiveness of the Institute in many ways.

State Engineer Office

The cooperation of Steve Reynolds, New Mexico State Engineer and his staff has been most helpful to the Water Research Institute since its inception, and to the New Mexico Water Conference. Mr.

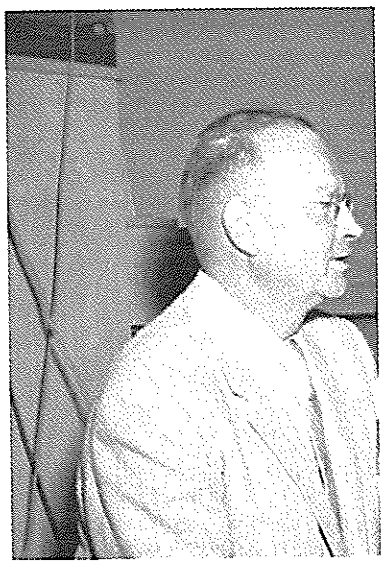
Steve Reynolds
State Engineer
1952 to the present

Reynolds has served on the advisory committee of the Water Conference for many years and has through his office supplied detailed information, staff support, and reviews on many research project outlines and manuscripts.

His office has, as defined by statute, "general supervision of the waters of New Mexico and the measurement, appropriation and distribution thereof," this office is also concerned with the way water is used in New Mexico, and the effect of these uses on both the quantity and quality available for use by various areas.

United States Geological Survey

The Geological Survey, Water Resources Division, U.S. Department of Interior, under the leadership of William E. Hale, has cooperated with the Institute Directors and the principal investigators on many projects. That office has a background of hydrologic information which has been made available. The study of the Saline Groundwater Resources of the Tularosa Basin was conducted in direct cooperation with the Institute's project on desalting.



William E. Hale

The State Engineer and the Geological Survey are presently cooperating on studies in various areas, especially on the Roswell Water Basin and the Rio Grande. Clyde Wilson and Robert White,

USGS, are presently housed in the Water Resources Office while conducting hydrological studies in the lower Rio Grande Valley area of New Mexico and at White Sands Missile Range.

Governors' Support

The Governors of New Mexico have all supported the Water Conference and the development and operations of the New Mexico Water Resources Research Institute. The Governors over this time were: Edwin L. Mechem, 1957-58, 1961-62, and he had previously served from 1951-54; John Burroughs, 1959-1960; Tom Bolack, one month, December 1962; Jack M. Campbell, 1963-66; David F. Cargo, 1967-70; Bruce King, 1971-74; and Jerry Apodaca, 1975-78.

Governor Campbell wrote a letter to Secretary of Interior Stewart Udall recommending the establishment of this Institute at New Mexico State University, while he and the others participated in the Annual New Mexico Water Conference programs, and since 1968 have supported state appropriations to the Institute. Each Governor has recognized the importance of water to New Mexico and how vital research was in the establishment of a sound water use and development program in the State of New Mexico.

Student Training

The Act of 1964 - S.2, listed two major purposes of the Water Resources Research Institutes. They were to (1) initiate research and (2) train personnel.

The scope of the research program and the abundant results could not have been accomplished without the strong basic scientific background of 135 different research scientists who served as principal investigators on the 137 research projects conducted or in progress. Several men and women participated in more than one project and as co-investigators.

Many students were employed and paid from funds through the Water Institute to assist the University professors, who were the principal investigators. These students not only made possible the volume and the quality of research, but they gained valuable training and experience from this employment.

The students were from a wide range of disciplines at five institutions of higher education in New Mexico and, on one project, from Texas A & M University. The number of students by years were:

65-66	38	71-72	123	77-78	106
66-67	34	72-73	64		
67-68	31	73-74	86		
68-69	52	75-76	104		
69-70	75	76-77	103	Total	816

It is, of course, not possible to record the impact of the experience and training on this group of students as a result of this employment. It is known that a very high percentage of these students took additional courses in the resources area as a result of this experience. Also, many undergraduate students changed their majors so they could get more courses and most of the M.S. and Ph.D. candidates gained valuable information which assisted them in the pursuit of these degrees. Many are now employed in the water resources field or the knowledge they received has strengthened their contributions to the understanding of the water resources areas; in history, sociology, law and economics as well as those more directly related fields of engineering, agriculture, geology, hydrology, and geophysics.

As each succeeding group of students who are employed to assist on WRRI projects adds to those who have already had this experience, the total impact is not just added to, but multiplied. This multiplication is due to the ever increasing number, the maturing of these students, and as they become participants in research, education, government, business and industry.

What of the Future for the Water Resources Research Institute?

The New Mexico Water Resources Research Institute has a strong base on which to build it's future research program and from which to produce significantly greater research results for use in the state of New Mexico and the region. Though the same is true of most, if not all, of the other 53 water research institutes, it is especially significant in New Mexico.

The U.S. Senate Select Committee reported the Upper Rio Grande and Pecos Basins to be the shortest of water in relation to prospective demand in 1980 of any basins in the Continental United States (U.S. Senate Print 1961). The Rio Grande and Pecos River drainage areas comprise about 75,000 square miles in New Mexico, about 62% of the state's area.

These statements indicate the importance of water in New Mexico. Water shortages were recognized as problems as far back as the Indian and early Spanish Culture. With the increasing population, and up to as late as 1970, an increase in the acreage of land being irrigated in New Mexico, the water problems have been intensified and complicated. According to the U.S. Census, New Mexico's population grew from 1,017,055 to 1,143,827 from 1970 to 1975, an increase of 12.5%, which is among the 10 highest states rates in the Nation for that period. The state's population has been growing at an even faster rate from 1975 through the first months of 1978, according to unofficial estimates.

Pollution, from industrial and municipal wastes and from uses of water for irrigation and the support of the livestock industry has been and is being, added to the problem of the growing shortage of water.

The intensification of water use in New Mexico is bringing problems to the front. These problems must be solved. Some answers to these problems are known by the research groups and the more

efficient business managers in industry agriculture and government. These answers in some cases are expensive to adopt or may create the need for painful social and financial adjustments. Research into possible alternative actions may be beneficial. In any case, the water research needs are much greater now than in the past and are increasing year by year.

For example, the increasing population is creating more pollution problems since all sources of water are used more intensively. Also, the water levels in many water basins in New Mexico are being drawn down because water is being pumped out faster than it is being recharged. This overdraft in some areas is tending to increase the salinity of the water pumped. Some irrigated land has already been dropped out of the farm operation because the cost of pumping is increasing while at the same time the yields of water from the wells are decreasing. This is particularly true in Curry and Roosevelt counties. New Mexico State Engineer Steve Reynolds states, "It is a certainty that wells will go dry, I mean economically dry, where it's no longer practical for farming."

The historically dry areas which New Mexico represents plus an increasing population and with pollution increasing due to the population growth, plus the over-pumping in many areas, there are increasingly serious economic and social problems which must be faced. Other problems are engineering, agricultural, biological, governmental, educational, and political associated with the changes in water quality and quantity in the State and region.

The work of the New Mexico Water Resources Research Institute is becoming increasingly more important. The challenge to meet this need faces not only the Director of the Institute and the Program Development Review Board, but political and governmental leaders to move ahead rapidly enough with water research to assist in the solution to the state's water-social-economic problems. These can not be separated one from the other, but as Mr. Fabion Garcia, an early Director of New Mexico Agricultural Experiment

Station, is quoted as saying, "Water is King in the Arid Southwest." This statement surely is true because the availability or the lack of water, and how that water will be used, will determine the shape of the economic and social life of New Mexico. The Water Resources Research Institute must, of necessity, play a major role in these determinations.

Dr. Thomas Writes - - -

Dr. Gerald Thomas, President of New Mexico State University had this to say, "Water -- most valuable and most limited resource. As the world's population continues to grow, the threat of large scale famine becomes more ominous. Consequently, the pressure on the world's basic resources will increase -- particularly the pressure on land, water and energy. Of these three basic resources, energy is now receiving the most attention due to the high cost and limited availability. But, it is my hope that, by the year 2000 -- perhaps sooner -- we will have developed 'alternative' sources of cheap energy. At least we know that there is an abundance of energy in the universe if we can convert it to man's use.

On the other hand, water becomes more and more critical with time. Water is a renewable resource, the supplies are limited. Over the long term, water will likely be the most limiting factor in world food and fiber production, exceeding both energy and land in importance and value."

Need for Information Dissemination

The research done by the Institute is valuable only if it gets out to the public and is used effectively in the future developments in New Mexico and the region. The same is true in each state and region across the nation.

When the agricultural experiment stations were organized and started functioning in 1887, there was a gradual buildup of valuable

research information which did not move out so the people could put it to beneficial use.

The Smith-Lever Act of 1914 established an Agricultural Extension Service, to be located at the Land-grant Colleges, to assist in moving the information gained by the Agricultural Experiment Station out into the communities and onto the farms to be put to beneficial uses.

It has been observed by many that the results of the Water Resources Research Institute projects may not be moving out from the colleges as rapidly as desirable, and that an extension arm could speed up the application of these water research projects results. In diseminating research results, Institute personnel and researchers have made themselves available as consultants, speakers at meetings, and participants in seminars and discussions as time permitted. They have published their fingings in the form of news releases, scientific papers, printed research reports, and bulletins, but this is not sufficient to meet the needs of the people.

Information and Education; the Number-one Need

The Institute conducted a series of "Citizens' Water Conferences" in eight areas of New Mexico in April and May 1971. These area meetings were followed by a state meeting to summarize the area reports. The need for more specific information and for additional educational programs was number one among the items listed by those attending the State "Citizens' Water Conferences" for solution of their problems. To the question, "Would you say there is a need for additional water resources information to meet the needs of local citizens?" Those attending these conferences: 89.6% yes, 3.3% no and 6.6% not sure. And to the question, "Do you feel there is an adequate public information programs on most phases of water resources in your area?" The answers: 10.9% yes, 81.0% no, and 8.1% not sure.

Dissemination of Water Research Project Results

The Water Resources Research Act of 1964 provided for research and training. It did not provide for information dissemination.

There is a great need for a carefully organized program to make water research results available to the general public. There is also a need for a general educational program regarding water problems. This would promote more complete understanding of how water problems are interrelated, and how each individual can participate in sound water planning and management programs.

These needs should be analyzed by the Directors of the state and territorial Institutes and Centers and by the Office of Water Research and Technology to determine how they can best be met. They should also be considered by the major state and federal agencies dealing with water, and by the state and national legislative bodies.

WATER RESOURCES RESEARCH ACT OF 1964

Public Law 88-379
88th Congress, S. 2
July 17, 1964

As amended by:

Public Law 89-404
89th Congress, S. 22
April 19, 1966

An Act

78 STAT. 329

To establish water resources research centers, to promote a more adequate national program of water research, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) this Act may be cited as the "Water Resources Research Act of 1964." Water Resources Research Act of 1964.

(b) In order to assist in assuring the Nation at all times of a supply of water sufficient in quantity and quality to meet the requirements of its expanding population, it is the purpose of the Congress, by this Act, to stimulate, sponsor, provide for, and supplement present programs for the conduct of research, investigations, experiments, and the training of scientists in the fields of water and of resources which affect water.

TITLE I—STATE WATER RESOURCES RESEARCH INSTITUTES

SEC. 100. (a) There are authorized to be appropriated to the Secretary of the Interior for the fiscal year 1965 and each subsequent year thereafter sums adequate to provide $75,000 to each of the several States in the first year, $87,500 in each of the second and third years, and $100,000 each year thereafter to assist each participating State in establishing and carrying on the work of a competent and qualified water resources research institute, center, or equivalent agency (hereinafter referred to as "institute") at one college or university in that State, which college or university shall be a college or university established in accordance with the Act approved July 2, 1862 (12 Stat. 503), entitled "An Act donating public lands to the several States and territories which may provide colleges for the benefit of agriculture and the mechanic arts" or some other institution designated by Act of the legislature of the State concerned: *Provided*, That (1) if there is more than one such college or university in a State, established in accordance with said Act of July 2, 1862, funds under this Act shall, in the absence of a designation to the contrary by act of the legislature of the State, be paid to the one such college or university designated by the Governor of the State to receive the same subject to the Secretary's determination that such college or university has, or may reasonably be expected to have, the capability of doing effective work under this Act; (2) two or more States may cooperate in the designation of a single interstate or regional institute, in which event the sums assignable to all of the cooperating States shall be paid to such institute; and (3) a designated college or university may, as authorized by appropriate State authority, arrange with other colleges and universities within the State to participate in the work of the institute. Appropriation. 7 USC 301-308.

(b) It shall be the duty of each such institute to plan and conduct and/or arrange for a component or components of the college or university with which it is affiliated to conduct competent research, investigations, and experiments of either a basic or practical nature, or both, in relation to water resources and to provide for the training of scientists through such research, investigations, and experiments. Such research, investigations, experiments, and training may include, without being limited to, aspects of the hydrologic cycle; supply and demand for water; conservation and best use of available supplies of water; methods of increasing such supplies; and economic, legal, social, engineering, recreational, biological, geographic, ecological, and other aspects of water problems, having due regard to the varying conditions

and needs of the respective States, to water research projects being conducted by agencies of the Federal and State Governments, the agricultural experiment stations, and others, and to avoidance of any undue displacement of scientists and engineers elsewhere engaged in water resources research.

Matching funds.

SEC. 101. (a) There is further authorized to be appropriated to the Secretary of the Interior for the fiscal year 1965 and each subsequent year thereafter sums not in excess of the following: 1965, $1,000,000; 1966, $2,000,000; 1967, $3,000,000; 1968, $4,000,000; and 1969 and each of the succeeding years, $5,000,000. Such moneys when appropriated, shall be available to match, on a dollar-for-dollar basis, funds made available to institutes by States or other non-Federal sources to meet the necessary expenses of specific water resources research projects which could not otherwise be undertaken, including the expenses of planning and coordinating regional water resources research projects by two or more institutes.

Applications for grants.

(b) Each application for a grant pursuant to subsection (a) of this section shall, among other things, state the nature of the project to be undertaken, the period during which it will be pursued, the qualifications of the personnel who will direct and conduct it, the importance of the project to the water economy of the Nation, the region, and the State concerned, its relation to other known research projects theretofore pursued or currently being pursued, and the extent to which it will provide opportunity for the training of water resources scientists. No grant shall be made under said subsection (a) except for a project approved by the Secretary, and all grants shall be made upon the basis of the merit of the project, the need for the knowledge which it is expected to produce when completed, and the opportunity it provides for the training of water resources scientists.

Payments.

SEC. 102. Sums available to the States under the terms of sections 100 and 101 of this Act shall be paid to their designated institutes at such times and in such amounts during each fiscal year as determined by the Secretary, and upon vouchers approved by him. Each institute shall have an officer appointed by its governing authority who shall receive and account for all funds paid under the provisions of this Act and shall make an annual report to the Secretary on or before the 1st day of September of each year, on work accomplished and the status of projects underway, together with a detailed statement of the amounts received under any of the provisions of this Act during the preceding fiscal year, and of its disbursement, on schedules prescribed by the Secretary. If any of the moneys received by the authorized receiving officer of any institute under the provisions of this Act shall by any action or contingency be found by the Secretary to have been improperly diminished, lost, or misapplied, it shall be replaced by the State concerned and until so replaced no subsequent appropriation shall be allotted or paid to any institute of such State.

Funds for printing, etc.

SEC. 103. Moneys appropriated pursuant to this Act, in addition to being available for expenses for research, investigations, experiments, and training conducted under authority of this Act, shall also be available for printing and publishing the results thereof and for administrative planning and direction. The institutes are hereby authorized and encouraged to plan and conduct programs financed under this Act in cooperation with each other and with such other agencies and individuals as may contribute to the solution of the water problems involved, and moneys appropriated pursuant to this Act shall be available for paying the necessary expenses of planning, coordinating, and conducting such cooperative research.

SEC. 104. The Secretary of the Interior is hereby charged with the responsibility for the proper administration of this Act and, after full consultation with other interested Federal agencies, shall prescribe such rules and regulations as may be necessary to carry out its provisions. He shall require a showing that institutes designated to receive funds have, or may reasonably be expected to have, the capability of doing effective work. He shall furnish such advice and assistance as will best promote the purposes of this Act, participate in coordinating research initiated under this Act by the institutes, indicate to them such lines of inquiry as to him seem most important, and encourage and assist in the establishment and maintenance of cooperation by and between the institutes and between them and other research organizations, the United States Department of the Interior, and other Federal establishments. Secretary of the Interior, responsibility.

On or before the 1st day of July in each year after the passage of this Act, the Secretary shall ascertain whether the requirements of section 102 have been met as to each State, whether it is entitled to receive its share of the annual appropriations for water resources research under section 100 of this Act, and the amount which it is entitled to receive.

SEC. 105. Nothing in this Act shall be construed to impair or modify the legal relation existing between any of the colleges or universities under whose direction an institute is established and the government of the State in which it is located, and nothing in this Act shall in any way be construed to authorize Federal control or direction of education at any college or university.

TITLE II—ADDITIONAL WATER RESOURCES RESEARCH PROGRAMS

"SEC. 200. (a) There are authorized to be appropriated to the Secretary of the Interior $5,000,000 for the fiscal year 1967, $6,000,000 for the fiscal year 1968, $7,000,000 for the fiscal year 1969, $8,000,000 for the fiscal year 1970, $9,000,000 for the fiscal year 1971, and $10,000,000 for each of the fiscal years 1972–1976, inclusive, from which appropriations the Secretary may make grants to and finance contracts and matching or other arrangements with educational institutions, private foundations or other institutions, with private firms and individuals whose training, experience, and qualifications are, in his judgment, adequate for the conduct of water research projects, and with local, State, and Federal Government agencies, to undertake research into any aspects of water problems related to the mission of the Department of the Interior which he may deem desirable and which are not otherwise being studied. Appropriations. 80 STAT. 129 80 STAT. 130

"(b) No grant shall be made, no contract shall be executed, and no matching or other arrangement shall be entered into under subsection (a) of this section prior to sixty calendar days from the date the same is submitted to the President of the Senate and the Speaker of the House of Representatives and said sixty calendar days shall not include days on which either the Senate or the House of Representatives is not in session because of an adjournment of more than three calendar days to a day certain or an adjournment sine die." Transmittal to Congress.

TITLE III—MISCELLANEOUS PROVISIONS

Cooperation of Government agencies.

SEC. 300. The Secretary of the Interior shall obtain the continuing advice and cooperation of all agencies of the Federal Government concerned with water problems, of State and local governments, and of private institutions and individuals, to assure that the programs authorized in this Act will supplement and not duplicate established water research programs, to stimulate research in otherwise neglected areas, and to contribute to a comprehensive, nationwide program of water and related resources research. He shall make generally available information and reports on projects completed, in progress, or planned under the provisions of this Act, in addition to any direct publication of information by the institutes themselves.

Availability of information.

SEC. 301. Nothing in this Act is intended to give or shall be construed as giving the Secretary of the Interior any authority or surveillance over water resources research conducted by any other agency of the Federal Government, or as repealing, superseding, or diminishing existing authorities or responsibilities of any agency of the Federal Government to plan and conduct, contract for, or assist in research in its areas of responsibility and concern with water resources.

SEC. 302. Contracts or other arrangements for water resources work authorized under this Act with an institute, educational institution, or non-profit organization may be undertaken without regard to the provisions of section 3684 of the Revised Statutes (31 U.S.C. 529) when, in the judgment of the Secretary of the Interior, advance payments of initial expense are necessary to facilitate such work.

SEC. 303. No part of any appropriated funds may be expended pursuant to authorization given by this Act for any scientific or technological research or development activity unless such expenditure is conditioned upon provisions determined by the Secretary of the Interior, with the approval of the Attorney General, to be effective to insure that all information, uses, products, processes, patents, and other developments resulting from that activity will (with such exceptions and limitations as the Secretary may determine, after consultation with the Secretary of Defense, to be necessary in the interest of the national defense) be made freely and fully available to the general public. Nothing contained in this section shall deprive the owner of any background patent relating to any such activity of any rights which that owner may have under that patent.

Cataloging center.

SEC. 304. There shall be established, in such agency and location as the President determines to be desirable, a center for cataloging current and projected scientific research in all fields of water resources. Each Federal agency doing water resources research shall cooperate by providing the cataloging center with information on work underway or scheduled by it. The cataloging center shall classify and maintain for general use a catalog of water resources research and investigation projects in progress or scheduled by all Federal agencies and by such non-Federal agencies of government, colleges, universities, private institutions, firms, and individuals as voluntarily may make such information available.

Agency responsibilities. Presidential action.

SEC. 305. The President shall, by such means as he deems appropriate, clarify agency responsibilities for Federal water resources research and provide for interagency coordination of such research, including the research authorized by this Act. Such coordination shall include (a) continuing review of the adequacy of the Government-wide program in water resources research, (b) identification and

elimination of duplication and overlaps between two or more agency programs, (c) identification of technical needs in various water resources research categories, (d) recommendations with respect to allocation of technical effort among the Federal agencies, (e) review of technical manpower needs and findings concerning the technical manpower base of the program, (f) recommendations concerning management policies to improve the quality of the Government-wide research effort, and (g) actions to facilitate interagency communication at management levels.

SEC. 306. As used in this Act, the term "State" includes the Commonwealth of Puerto Rico. "State."

"SEC. 307. The Secretary shall make a report to the President and Congress on or before March 1 of each year showing the disposition during the preceding calendar year of moneys appropriated to carry out this Act, the results expected to be accomplished through projects financed during that year under sections 101 and 200 of this Act, and the conclusions reached in or other results achieved by those projects which were completed during that year. The report shall also include an account of the work of all institutes financed under section 100 of this Act and indicate whether any portion of an allotment to any State was withheld and, if so, the reasons therefor." Report to President and Congress.

P.L. 88-379 approved July 17, 1964.
P.L. 89-404 approved April 19, 1966.

LEGISLATIVE HISTORY: -- P.L. 88-379, S.2

HOUSE REPORTS: No. 1136 (Comm. on Interior & Insular Affairs) and
No. 1526 (Comm. of Conference).
SENATE REPORT No. 117 (Comm. on Interior and Insular Affairs).
CONGRESSIONAL RECORD:
Vol. 109 (1963): Apr. 22, considered in Senate.
Apr. 23, considered and passed Senate.
Vol. 110 (1964): June 2, considered and passed House, amended.
July 2, House and Senate agreed to conference report.

LEGISLATIVE HISTORY: -- P.L. 89-404, S.22

HOUSE REPORT No. 1350 accompanying H.R. 3606 (Comm. on Interior & Insular Affairs).
SENATE REPORT No. 127 (Comm. on Interior & Insular Affairs).
CONGRESSIONAL RECORD:
Vol. 111 (1965): Mar. 25, considered and passed Senate.
Vol. 112 (1966): Mar. 30, considered and passed House, amended, in lieu of H.R. 3606.
Apr. 5, Senate concurred in House amendment.

RULES AND REGULATIONS
PURSUANT TO THE
WATER RESOURCES RESEARCH ACT OF 1964
(P.L. 88-379)

As Published in the:

Federal Register
Title 18-Conservation of Power and Water Resources
Chapter IV-Office of Water Resources Research
December 3,1964

UNITED STATES DEPARTMENT OF THE INTERIOR
OFFICE OF WATER RESOURCES RESEARCH
Washington,D.C. 20240

RULES AND REGULATIONS
pursuant to the
WATER RESOURCES RESEARCH
ACT OF 1964

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PART 501—GENERAL

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AUTHORITY: The provisions of this Part 501 issued under sec. 104, 78 Stat. 331.

§ 501.1 Purpose.

The regulations in this chapter are issued pursuant to the Water Resources Research Act of 1964 (Public Law 88-379), which authorizes appropriations to, and confers authority upon, the Secretary of the Interior in order to promote a more adequate national program of water research.

§ 501.2 Office of Water Resources Research.

(a) The Office of Water Resources Research has been established as a component of the Department of the Interior. It reports to the Secretary of the Interior and is administered by a Director.

(b) The Secretary has delegated to the Director authority to take the actions and make the determinations that, under the Act, are the responsibility of the Secretary, except for determinations under section 303 of the Act, the issuance of regulations, reporting to the President, and reporting to the Congress. The Director has redelegated to the Associate Director the authority of the Director, to be exercised under his general administrative direction.

§ 501.3 Definition of terms.

As used in this chapter, the term—

(a) "Act" means the Water Resources Research Act of 1964 (Public Law 88-379),

(b) "Allotment" means the funds made available to an institute in a particular fiscal year pursuant to section 100 of the Act and the regulations in this chapter,

(c) "Director" means the Director, Office of Water Resources Research,

(d) "Fiscal year" means a twelve-month period ending on June 30,

(e) "Institute" means a water resources research institute, center, or equivalent agency established in accordance with provisions of Title I of the Act,

(f) "Scientists" includes individuals in any professional discipline including individuals in the life, physical, or social sciences, and engineers,

(g) "Secretary" means the Secretary of the Interior or his authorized representative, and

(h) "State" includes each of the fifty States, and Puerto Rico.

§ 501.4 Allotments to institutes.

(a) Subject to the availability of appropriated funds, an allotment of $75,000 in the first fiscal year, $87,500 in each of the second and third fiscal years, and $100,000 in each fiscal year thereafter will be available to each State to assist in establishing and carrying on the work of an institute.

(b) An institute must be identified with a college or university in a State, unless two or more States cooperate in the designation of a single interstate or regional institute, in which event the sums assignable to all of the cooperating States shall be paid to such institute.

(c) An institute, as authorized by appropriate State authority, may, and is encouraged to, arrange with other colleges and universities within the State to participate in the institute's work. Such participation will not make the other colleges and universities ineligible for assistance under section 200 of the Act.

(d) Prior to receiving an allotment, each institute must meet certain qualifications prescribed in the Act and the regulations in this chapter.

§ 501.5 Programs of institutes.

(a) It shall be the duty of each institute to plan and conduct or arrange for a component or components of the college or university with which it is identified to conduct—

(1) Competent research, investigations, and experiments of either a basic or practical nature, or both, in relation to water resources, and

(2) Training of scientists through such research, investigations, and experiments.

(b) Such research, investigations, experiments, and training may include, without being limited to:

(1) Aspects of the hydrologic cycle,

(2) Supply and demand for water,

(3) Conservation and best use of available supplies of water,

(4) Methods of increasing such supplies, and

(5) Economic, legal, social, engineering, recreational, biological, geographic, ecological, and other aspects of water problems.

(c) Institutes shall give due regard to:

(1) The varying conditions and needs of the respective States,

(2) Water research projects being conducted (or supported) by agencies of the Federal and State governments, the agricultural experiment stations, and others,

(3) Advice and assistance as provided by the Director pursuant to section 104 of the Act,

(4) Coordination of their programs with programs of other institutes and agencies, and

(5) Avoidance of any undue displacement of scientists elsewhere engaged in water resources research.

(d) An institute may also plan for research, investigations, and experiments to be conducted as part of the institute's program at colleges and universities other than the college or university with which the institute is identified. For purposes of financial management, reporting, and other research program management and administration activities, the institute shall be responsible for performance of the activities of other participating colleges and universities. The activities of participating colleges and universities must meet all of the requirements (such as scope of work, qualifications, coordination with other research) that are applicable to other portions of an institute's program.

§ 501.6 Grants to institutes of matching funds for specific projects.

(a) Section 101 of the Act provides for grants to institutes with the condition that such grants be matched on not less than a dollar-for-dollar basis with funds from States or other non-Federal sources. Appropriations are authorized in the following amounts:

Fiscal year:	*Amount*
1965	$1,000,000
1966	2,000,000
1967	3,000,000
1968	4,000,000
1969 and each following year	5,000,000

(b) Subject to the availability of appropriations, such matching grants may be made to provide funds to meet the necessary expenses of specific water resources research projects, including the expenses of planning and coordinating regional water resources research projects by two or more institutes, if the projects for which such grants are sought—

(1) Could not otherwise be undertaken were it not for the Federal grant, and

(2) Are approved by the Director on the basis of—

(i) Merit of the project,

(ii) Need for the knowledge it is expected to produce when completed, and

(iii) The opportunity it provides for the training of scientists.

§ 501.7 Grants to, and contracts, matching or other arrangements with entities other than institutes.

(a) Grants, contracts, matching or other arrangements may be made, pursuant to section 200 of the Act, for research into any aspects of water problems related to the mission of the Department of the Interior that are not otherwise being studied, when such research is deemed desirable by the Director.

(b) Subject to the availability of appropriated funds, such grants may be made to, or contracts, matching or other arrangements made with, any of the following:

(1) Educational institutions (other than those establishing institutes under Title I of the Act),
(2) Private foundations,
(3) Other institutions,
(4) Private firms,
(5) Individuals,
(6) Local government agencies,
(7) State government agencies, or
(8) Federal Government agencies.

PART 502—REQUESTS FOR ALLOTMENTS TO INSTITUTES

Sec.
502.1 Initial allotment.
502.2 Allotments after first fiscal year.

AUTHORITY: The provisions of this Part 502 issued under sec. 104, 78 Stat. 331.

§ 502.1 Initial allotment.

In order to obtain an initial allotment, an institute should submit to the Director, Office of Water Resources Research, Department of the Interior, Washington, D.C., 20240, a request (in six copies) containing the following information:

(a) Evidence that the institute conforms to the requirements of subsection 100(a) of the Act in that—

(1) The institute has been established at the college or university in the State that was established in accordance with the Act of July 2, 1862 (12 Stat. 503) or, if established at some other institution, the institute is at a college or university that has been designated by act of the legislature of the State for the purposes of section 100 of the Act, or

(2) If there is in the State more than one college or university established in accordance with the Act of July 2, 1862 and no designation has been made by act of the legislature of the State for the purposes of section 100 of the Act, the institute has been established at the one such college or university designated by the Governor of the State to receive the allotment, or

(3) The institute has been designated as an interstate or regional institute by two or more States in cooperation as provided by section 100 of the Act.

(b) Evidence of the appointment by the governing authority of the institute of an officer to receive and account for all funds paid under the provisions of the Act and to make annual reports to the Director on work accomplished and the status of projects under way, together with a detailed statement of the amounts received under any provision of the Act during the preceding fiscal year, and of its disbursement, on schedules prescribed by the Secretary.

(c) Evidence that the institute has plans for, and will conduct or arrange for a component or components of the college or university with which it is identified to conduct

(1) Competent research, investigations, and experiments of either a basic or practical nature, or both, in relation to water resources, and

(2) The training of scientists through such research, investigations, and experiments.

(d) Names of other colleges or universities, if any, within the State with which arrangements have been made for their participation in the work of the institute, with indication of the nature and extent of such participation and an explanation of the arrangements by which such participation becomes a part of the work of the institute, and an acknowledgment of the institute's responsibility for planning, work performance, and reporting for the entire program of the institute.

(e) Evidence that the institute has, or may reasonably be expected to have, the capability of doing effective work in one or more of the various water resources research activities contemplated by the Act, which evidence shall include:

(1) The proposed general plan of operation of the institute showing its organization and a summary of the institute program activities, by project or other appropriate headings, which includes information concerning the substantive character and the anticipated magnitude, in man-years, of proposed activities,

(2) Description of facilities to be utilized,

(3) A list of staff personnel with specific details as to academic and professional training, research experience, and other pertinent qualifications, and the time they will devote to research, training, or other activities of the institute,

(4) The money, facilities, services, property, and other contributions, from sources other than the annual allotment of Federal funds, that will be available to the institute in the initial fiscal year.

(f) Evidence that the institute is giving due regard to

(1) Water research projects being conducted (or supported) by agencies of the Federal and State governments, the agricultural experiment stations, and others,

(2) Avoidance of any undue displacement of scientists elsewhere engaged in water resources research,

(3) Water resources conditions and needs of the State (or States, in the case of a regional institute) as ascertained by consultation with appropriate State officials and by other means,

(4) Advice and assistance as provided by the Director pursuant to Section 104 of the Act and section 501.2 of this chapter, and

(5) Coordination of its program with programs of other institutes and agencies.

(g) A statement that the institute is willing to enter into an agreement, in a form approved by the Secretary and the Attorney General, that all information, uses, products, processes, patents, and other developments resulting from any scientific or technological research or development activity financed with funds supplied pursuant to the Act will (with such exceptions and limitations as the Secretary may determine, after consultation with the Secretary of Defense, to be necessary in the interest of the national defense) be made freely and fully available to the general public.

(h) A financial plan relating expenditures to scheduled activity and rate of effort to be expended, and indicating the times at which there will be need for specified amounts of allotted Federal funds.

(i) An appropriate "Notice of Research Project," and supplementary documentation as may be requested by the Director, for each separately identifiable research project the institute proposes to undertake during the year, for submission, when the allotment is approved, to the Science Information Exchange for publication in a catalog of water resources research.

§ 502.2 Allotments after first fiscal year.

After the first fiscal year, in order to obtain an allotment, an institute should submit to the Director a request (in six copies) containing the following information:

(a) All amendments, deletions, and additions to previously submitted information that are necessary to make it currently applicable,

(b) Evidence that all reports due under Part 506 of this chapter have been submitted,

(c) Evidence that any moneys received by the institute under the Act that have been found by the Director to have been improperly diminished, lost, or misapplied have been replaced, and safeguards have been established by the institute that will assure proper handling of funds received under the Act in the future,

(d) An outline explaining any changes in its program the institute plans to make during the forthcoming fiscal year,

(e) A financial plan relating expenditures to scheduled activity and rate of effort to be expended, and indicating the times at which there will be need for specified amounts of allotted Federal funds,

(f) Evidence that the institute's program is effective and is giving due regard to:

(1) Water research projects being conducted (or supported) by agencies of the Federal and State governments, the agricultural experiment stations, and others,

(2) Avoidance of any undue displacement of scientists elsewhere engaged in water resources research,

(3) Water resources conditions and needs of the State (or States, in the case of a regional institute) as ascertained by consultation with appropriate State officials and by other means,

(4) Advice and assistance as provided by the Director pursuant to Section 104 of the Act and Section 501.2 of this chapter, and

(5) Coordination of its program with programs of other institutes and agencies.

PART 503—APPLICATIONS FOR GRANTS, CONTRACTS, MATCHING OR OTHER ARRANGEMENTS

Sec.
503.1 Applications by institutes for grants of matching funds for specific projects.
503.2 Applications for research grants, contracts, matching or other arrangements by entities other than institutes.

AUTHORITY: The provisions of this Part 503 issued under sec. 104, 78 Stat. 331.

§ 503.1 Applications by institutes for grants of matching funds for specific projects.

(a) *Manner of submission.* An application for a matching grant under section 101 of the Act for a specific water resources research project should be submitted by an institute in 15 copies to the Director, Office of Water Resources Research, Department of the Interior, Washington, D.C., 20240.

(b) *Definition of funds eligible for matching.* Non-Federal funds which may be used to match a grant of Federal funds, on not less than a dollar-for-dollar basis, are those that have been or will be made available to an institute by State or other non-Federal sources during the duration of the project for which the grant is sought to meet the necessary expenses of a specific water resources research project, including the expenses of planning and coordinating regional water resources projects by two or more institutes. The fair value of services, facilities, property, or other contributions supplied from non-Federal sources, but excluding the cost of permanent buildings, may also be included. Title requirements for property purchased with non-Federal funds and used to match grants under the Act are set forth in section 505.5 of this chapter.

(c) *Information required with application.* Applications for matching grants shall be in the form of proposals to undertake specific water resources research projects. Such proposals shall set forth for each project—

(1) The nature and scope of the project to be undertaken,

(2) The period during which it will be pursued,

(3) The name and qualifications of the person who will direct the project,

(4) The number and general qualifications of the personnel who will work on the project, with the name, education, experience, and accomplishments of the principal scientist who will be assigned to it,

(5) The location or locations at which the project will be pursued,

(6) The importance of the project to the water economy of the Nation, the region, and the State concerned,

(7) The relation of the project to the over-all program of the institute,

(8) The relation of the project to other known research projects theretofore pursued or currently being pursued by the institute and by others (including but not limited to projects listed by the Science Information Exchange),

(9) The extent to which the project will provide opportunity for the training of scientists,

(10) A financial plan setting forth cash requirements, subdivided between grant and non-Federal funds—

(i) For each quarter of the first fiscal year, and

(ii) For each subsequent fiscal year during the proposed life of the project,

(11) The facilities that will be devoted to the project,

(12) The salient points of the plan that will be followed in pursuing the project, including a financial plan in which expenditures are related to activity and rate of effort to be expended,

(13) The intended method of publishing the results of the project on a timely basis,

(14) The basis for a determination that the project could not be undertaken without the grant for which application is made,

(15) Evidence that all reports due under Part 506 of this chapter have been submitted,

(16) The names of other colleges or universities, if any, within the State with which arrangements have been made for their participation in the project, with indication of the nature and extent of such participation, an explanation of the arrangements by which such participation becomes a part of the work of the institute, and an acknowledgment of the institute's responsibility for the planning, work performance, and reporting for the entire project,

(17) Assurance that, if the grant is made, the required matching funds from non-Federal sources will be forthcoming, and

(18) Information as to whether the project has been or will be submitted to organizations other than the Office of Water Resources Research for the purpose of obtaining a contract or grant, with the names of any such organizations. Similar information, with the part (or parts) of the project appropriately identified, shall be provided when only a part (or parts) of the project has been or will be submitted to another organization.

(d) *Additional requirement.* There must be attached to the application an appropriate "Notice of Research Project", and supplementary documentation information as may be requested by the Director, for submission, if the project is approved, to the Science Information Exchange for publication in a catalog of water resources research.

§ 503.2 Applications for research grants, contracts, matching or other arrangements by entities other than institutes.

(a) *Eligible applicants.* As provided in paragraph (b) of § 501.7 of this chapter, individuals and organizations other than an institute established under Title I of the Act and the educational institution with which the institute is identified are eligible to apply for Federal funds under section 200 of the Act to assist them in undertaking research into any aspects of water problems related to the mission of the Department of the Interior that are not otherwise being studied.

(b) *Manner of submission.* An application should be submitted in 15 copies to the Director, Office of Water Resources Research, Department of the Interior, Washington, D.C., 20240. A separate application must be submitted for each project. If an application is signed by an authorized representative of an applicant, evidence of the authority of the representative must be attached.

(c) *Information required with application.* (1) If the applicant is an individual the application should include a statement in reasonable detail of his education, experience, accomplishments, and special qualifications for conducting the project for which application is being made.

(2) If the applicant is an organization, the application should include a statement as to its nature, officers, principal business, experience, and special qualifications for conducting the project for which application is being made.

(3) Each application shall also set forth the information specified in paragraphs (c) and (d) of § 503.1 to the extent applicable. (There is no requirement that matching funds be supplied from non-Federal sources in order to receive assistance under section 200 of the Act.)

PART 504—APPROVAL OF ALLOTMENTS AND APPLICATIONS

Sec.

504.1 Return of defective submissions.
504.2 Approval of initial allotments to institutes.
504.3 Approval of allotments to institutes after the first year.
504.4 Approval of grants to institutes of matching funds for specific projects.
504.5 Approval of grants to, and contracts, matching or other arrangements with, entities other than institutes established pursuant to the Act

AUTHORITY: The provisions of this Part 504 issued under sec. 104, 78 Stat. 331.

§ 504.1 Return of defective submissions.

(a) Upon receipt of a request for approval of an allotment or upon receipt of an application for a grant, contract, matching or other arrangement pursuant to the Act, the Director shall determine whether the submission conforms to the requirements of Part 502 or Part 503 of this chapter as appropriate. Non-conforming submissions will be returned with statements of the reasons for their return.

§ 504.2 Approval of initial allotments to institutes.

(a) The Director will approve the initial allotment to an institute when he has determined that the institute—

(1) Has been organized in conformity with subsection 100(a) of the Act,

(2) Has, or may reasonably be expected to have, the capability of doing effective work under the Act.

(3) Is committed to a program of work and a plan of operation that conform with the provisions of the Act and provide for activities that will not duplicate established water research programs, and

(4) Has a financial plan in which proposed expenditures have a reasonable relationship to the probable value of the results of the institute's activities.

(b) When the Director has determined that the initial allotment should be made to an institute, he will draft and sign a proposed continuing agreement setting forth the general terms and conditions of allotments, and forward five copies of it to the institute. The institute shall sign and return to the Director three copies of the continuing agreement. Such continuing agreement will also apply to grants to institutes of matching

funds for specific projects, pursuant to section 101 of the Act, if such grants are approved by the Director.

(c) The Director will also draft, sign, and forward to the institute five copies of an annual allotment agreement covering the initial annual allotment. The institute shall sign and return to the Director three copies of the annual allotment agreement.

§ 504.3 Approval of allotments to institutes after the first year.

(a) Each fiscal year after the first, the Director will approve an allotment to an institute when he has determined that the institute—

(1) Has, since receiving its preceding allotment, undergone no changes in its form of organization, finances, and plan of operation that disqualify it for an allotment pursuant to section 100 of the Act,

(2) Has submitted, in satisfactory form, all reports required in Part 506 of this chapter,

(3) Is committed to a program of work and a plan of operation that conform to the provisions of section 100 of the Act and provide for activities that will not duplicate established water research programs,

(4) Is engaged in, and is committed to, a program of research, investigations, and experiments and the training of scientists through such activities that represent competent and effective work of the types and in the manner provided for in the Act,

(5) Has properly accounted for all funds received pursuant to the Act and, if the Director has determined that any portion of such funds were improperly diminished, lost, or misapplied, has replaced them and supplied evidence that it has instituted safeguards that will assure proper handling of funds received under the Act in the future, and

(6) Has a financial plan in which proposed expenditures have a reasonable relationship to the probable value of the results of the institute's activities.

(b) In evaluating the plans of an institute, the Director will give due regard to the varying conditions and needs of the respective States.

(c) The Director will draft, sign, and forward to the institute five copies of an annual allotment agreement. The institute shall sign and return to the Director three copies of the annual allotment agreement.

§ 504.4 Approval of grants to institutes of matching funds for specific projects.

(a) The Director will approve an institute's application for a matching-fund grant under section 101 of the Act to assist in financing a specific project after determining that—

(1) The applicant is a qualified institute,

(2) Satisfactory assurance has been furnished that funds from non-Federal sources that will be devoted to the project will equal or exceed the amount of the proposed matching grant, and

(3) The proposed project is deserving of approval on the basis of its over-all merits, including consideration of—

(i) The need for the knowledge it is expected to produce when completed,

(ii) The opportunity it provides for the training of scientists,

(iii) The probability that it will be pursued with competence and completed within a reasonable time,

(iv) The relationship between the amount of the grant and the probable results to be achieved,

(v) Freedom from unnecessary duplication of work being performed by others, and

(vi) Evidence that the proposed project could not be undertaken without the aid of the requested grant.

(b) When the Director has determined that a matching grant should be made to an institute for a matching fund project, and if the institute has not previously executed the proposed continuing agreement required by paragraph (b) of § 504.2, he will forward such proposed continuing agreement to the institute for execution. The Director will also draft and sign a proposed matching grant agreement and forward five copies of it to the institute. The institute shall sign and return three copies of the proposed matching grant agreement, and, if one is submitted, three copies of the continuing agreement.

(c) If the proposed matching grant agreement, together with the continuing agreement if not previously executed, is not formally signed by the institute and returned to the Director within 30 days, the proposed matching grant agreement may be withdrawn by the Director.

§ 504.5 Approval of grants to, and contracts, matching or other arrangements with, entities other than institutes established pursuant to the Act.

The Director may approve proposals submitted under section 200 of the Act and § 503.2 of this chapter after determining that—

(a) The applicant for such grant, contract, matching or other arrangement is, as provided in paragraph (b) of § 501.7 of this chapter, a bona fide individual or organization, other than an institute established pursuant to the Act or the educational institution identified with such an institute, that has qualifications to perform work contemplated by section 200 of the Act,

(b) The proposal was properly signed by the applicant or its duly authorized agent,

(c) The work to be undertaken represents research into aspects of water problems related to the mission of the Department of the Interior,

(d) Such research is desirable and covers aspects of water problems not otherwise being studied,

(e) A reasonable relationship exists between the cost to the Government and the probable results to be achieved, and

(f) The applicant has expressed a willingness to enter into a research project agreement acceptable to the Director.

PART 505—FISCAL AND ACCOUNTING

Sec.
505.1 Procedure for obtaining payments.
505.2 Cost computation principles.
505.3 Capital and related expenditures.
505.4 Credits against cost and repayments to the Government.
505.5 Title to property.
505.6 Accounting records.

AUTHORITY: The provisions of this Part 505 issued under sec. 104, 78 Stat. 331.

§ 505.1 Procedure for obtaining payments.

(a) *Allotments.* (1) After the Director has determined that an institute's qualifications and plans are acceptable, and after the applicable agreements required by paragraphs (b) and (c) of § 504.2 of this chapter and paragraph (c) of § 504.3 of this chapter have been executed, he will provide the institute with public vouchers that it may sign and return for certification by the Director and payment. Each voucher will be in five copies. Two copies may be retained by the institute; three must be returned to the Director.

(2) The amounts and dates of such vouchers will be those that the Director decides, on the basis of the financial plan and reports the institute has submitted, will provide funds as they are needed by the institute to liquidate the liabilities it expects to incur.

(b) *Grants.* (1) After the grant agreement has been formally signed, payments of grant funds to the grantee will be made on public vouchers prepared, signed, and submitted by the grantee in three copies to the Director. Such vouchers will provide for amounts to be paid to the grantee as funds are required for the liquidation of liabilities the grantee expects to incur pursuant to the terms of the grant.

(2) In support of each such voucher the grantee will relate it to the approved financial plan.

(3) In the case of matching grants, the grantee will also submit evidence that a proper relationship is being maintained between expenditures of grant and non-Federal funds.

(c) *Contracts and other arrangements.* Individuals and organizations that conduct research under contracts or other arrangements pursuant to section 200 of the Act will submit to the Director, not more frequently than monthly, public vouchers in three copies, claiming payment or reimbursement as called for by the terms of the contract or other arrangement. Such vouchers shall detail deliveries, performance, expenditure or such other criteria for payment as are required by or are appropriate under the contract or other arrangement. Educational institutions and non-profit organizations may obtain advance payments of initial expenses upon submission of a voucher in three copies when, in the opinion of the Director, such payment is necessary to facilitate the work being done under contracts or other arrangements pursuant to the Act.

§ 505.2 Cost computation principles.

(a) *Applicability to allotments and grants.* The cost-computation principles prescribed in this section shall be utilized in the cost accounting required with respect to allotments and grants under the Act to provide evidence that the recipient has discharged the obli-

gation it assumed, when accepting these funds, to expend them solely for costs necessary for the accomplishment of the work for which they were received. These principles will also be applied in accounting for funds from other sources to the extent that such funds are applied to meet the requirement that grants be matched with non-Federal funds.

(b) *Applicability to contracts.* Computation of costs in accordance with the principles prescribed in this section is a prerequisite of payments from funds provided under the Act to a contractor under cost-reimbursement-type contracts. Such cost computation is also necessary for fixed-price contracts if they are terminated prior to completion or contain price-redetermination, renegotiation, or similar clauses.

(c) *Basic cost formulas.* Costs will be computed:

(1) By institutes and educational institutions, in accordance with Bureau of the Budget Circular A-21, as revised, except as provided in section 505.3.

(2) By all entities other than educational institutions and institutes, in accordance with the Federal Procurement Regulations (second edition) (Title 41, Code of Federal Regulations, Subpart 1-15.2) (29 F.R. 10288), except as provided in § 505.3.

§ 505.3 Capital and related expenditures.

(a) In no instance shall the Director approve payments pursuant to the Act which include any amounts representing, either directly or indirectly, the cost of permanent buildings. In no instance shall recipients of funds pursuant to the Act use such funds either directly or indirectly to pay the cost of permanent buildings.

(b) Payments received pursuant to the Act may be applied to capital expenditures, other than for permanent buildings, to the extent that such expenditures are provided for in plans for projects and other activities that have been approved by the Director.

§ 505.4 Credits against cost and repayments to the Government.

(a) Incidental income resulting from operations: (1) Income resulting from the work financed by allotments, grants, contracts, and other arrangements under the Act may be added to the funds in the hands of the allottee, grantee, or contractor and used for expenses of water resources research activities. Examples of such income are: Proceeds from the sale of scrap, water and other material produced as a by-product of, or remaining after use in, research activities; sale of, or royalties on, publications; etc. It is a responsibility of those receiving Federal funds under the Act to realize such incidental income to the maximum extent possible consistent with the purposes of the Act.

(2) In instances in which such incidental income results from joint expenditures of funds provided by the Act and of funds from other sources, such income shall be credited to their various sources in the ratio in which each contributed to the generation of the incidental income.

(b) Any interest earned on any funds received as allotments or grants under the Act shall accrue to the benefit of the United States and each institute or grantee shall submit as a part of its annual report a statement showing the amount of such interest earned during the period covered by the report.

(c) In the event an institute is dissolved or a research project conducted under a grant is completed or terminated prior to completion, all funds provided under the Act that remain in the hands of the allottee or grantee after liquidation of the costs chargeable to the allotment or grant will be returned to the Director.

(d) Similarly, any supplies and equipment or other assets that were purchased with funds provided under the Act as allotments may be disposed of by the Director at his discretion upon dissolution of an institute or, if purchased with grant funds, upon completion or termination of the project for which the funds were furnished.

§ 505.5 Title to property.

(a) Title to property purchased with Federal funds allotted to institutes pursuant to section 100 of the Act shall be in the name of the institute and not that of the State or the college or university with which the institute is identified. However, in instances in which a formal document evidencing title is prepared, and State law precludes its issuance in the name of the institute, titles such as the following will be satisfactory:

---------- University [or ---------- State] for the use and benefit of the ---------- Water Resources Research Institute.

(b) Title to property purchased with funds from non-Federal sources used to match grants under section 101 of the Act, shall, similarly, be vested in, or held for the use and benefit of, the institute. In the case of property purchased with non-Federal funds that is applied to meet matching requirements for grants under section 200 of the Act, title shall be vested in the grantee.

(c) In the case of reimbursement-type contracts, the title of property shall pass to and vest in the Government.

(1) Upon its delivery to the contractor if its purchase is paid for with funds supplied under the Act or the cost is reimbursable to the contractor from such funds, or

(2) Upon issuance of such property for use in the performance of the contract, or commencement of processing or use of such property in the performance of the contract, or reimbursement of the cost thereof by the Government, whichever first occurs.

(d) Title to property purchased with grant funds made available either under section 101 or under section 200 of the Act shall vest in the Government when acquired by the grantee, unless the grantee is a non-profit institution of higher education or a non-profit organization whose primary purpose is the conduct of scientific research and the Director determines that vesting title in such grantee would further the objectives of the Act.

§ 505.6 Accounting records.

(a) The officers of institutes appointed in compliance with section 102 of the Act, and appropriate officials of entities other than institutes, that receive funds under the Act, shall be responsible for maintaining books of account that clearly, accurately, and currently reflect the financial transactions involving allotments, grants, contracts, and other arrangements financed under the Act and also transactions financed with matching funds from sources other than the Federal Government. In addition, they shall maintain files of all papers necessary to explain and prove the validity of the transactions recorded.

(b) Such records, with all supporting and related documents shall, at all reasonable times, be made available, upon request, for inspection and audit by representatives of the Director and of the Comptroller General of the United States.

(c) Records relating to each allotment and each grant shall be retained and made available until the expiration of three years after the allottee's or grantee's last disbursement of such funds. Records with respect to contracts shall be retained and made available until the expiration of three years after the last payment thereunder was received by the contractor.

(d) The books and records maintained shall include a record of all property

(1) Received from the Federal Government,

(2) Charged as a cost of activities financed with funds provided by the Act,

(3) Included in costs paid with non-Federal funds to match grant funds, and

(4) Included in reimbursable costs under cost-reimbursement-type contracts.

(e) An accountability record shall be maintained for all items of such property that are nonexpendable and have an acquisition cost of $100 or more.

(f) Institutes, grantees, and contractors shall include the following provision in any contract or subcontract for services, equipment, or supplies they make that requires payments exceeding $2,500 from funds furnished under the Act or non-Federal funds used to match such Federal funds:

Representatives of the Director of the Office of Water Resources Research or of the Comptroller General of the United States shall, until the expiration of three years after final payment under this contract, have access to and the right to examine any directly pertinent books, documents, papers, and records relating to this contract.

For the purposes of this requirement, contracts or subcontracts for public utility services at rates established for uniform applicability to the general public are excluded.

PART 506—PROGRESS AND ACCOMPLISHMENT REPORTS

Sec.

506.1 Project completion or termination reports.
506.2 Annual reports by institutes.

Sec.
506.3 Annual reports by entities other than institutes.
506.4 Special reports.
506.5 Annual reports to the Congress.
506.6 Acknowledgment of Federal Government participation.

AUTHORITY: The provisions of this Part 506 issued under sec. 104, 78 Stat. 331.

§ 506.1 Project completion or termination reports.

(a) Recipients of funds under the provisions of sections 100, 101, and 200 of the Act are encouraged to publish, as technical literature, the findings, results, and conclusions relating to separately identifiable research projects undertaken pursuant to the Act. Fifty copies of such documents shall be furnished to the Director, together with supplementary information suitable for project documentation purposes.

(b) If a publication such as is described in paragraph (a) of this section has not been prepared with respect to a specific research project, recipients of funds under the provisions of sections 100, 101, and 200 of the Act shall, in conjunction with the completion or termination of the project, prepare a report which sets forth the findings, results, and conclusions relating to such project. Fifty copies of the report shall be furnished to the Director, together with supplementary information suitable for project documentation purposes.

§ 506.2 Annual reports by institutes.

(a) On or before September 1 of each year, each institute shall make an annual report relating to its program and activities conducted pursuant to sections 100 and 101 of the Act, for the year ending June 30, to the Director, in fifteen copies, which provides information as indicated in paragraphs (b), (c), and (d) of this section.

(b) Relating to the institute's program conducted pursuant to an allotment of funds and section 100 of the Act, the report shall provide—

(1) For each separately identified research project that was included as a part of the institute's annual program—

(i) A description of research performed and any findings, results, or conclusions relating thereto,

(ii) Supplementary information suitable for project documentation purposes,

(iii) A listing of any project-related publications or reports issued and papers prepared (with copies of such publications, reports, or papers being attached to each copy of the annual report),

(iv) In lieu of the information requested in subdivisions (i), (ii), and (iii) of this subparagraph (1), an appropriate reference to a project completion or termination report which contains similar information and which was submitted to the Director in accordance with the provisions of § 506.1, and

(v) Statements of project work remaining to be accomplished,

(2) A description of any other activities or work accomplished or remaining to be accomplished by the institute, including reports or publications issued and presented but not previously covered in subparagraph (1) of this paragraph (b),

(3) A record of training of scientists, and

(4) The nature and extent of activities conducted in cooperation with other institutes and research organizations.

(c) Relating to projects carried on pursuant to matching-fund grants and section 101 of the Act, the report shall provide, separately, for each project—

(1) Information similar to that prescribed in paragraph (b) of this section, and

(2) Other information relating to the project, as deemed appropriate by the institute.

(d) Relating to funds, the report shall provide detailed statements of the amounts received under the Act, and the disbursements thereof, on schedules prescribed by the Director—

(1) For the institute's annual program carried on pursuant to an allotment of funds under section 100 of the Act, and

(2) For each project carried on pursuant to a matching-fund grant under section 101 of the Act.

(e) In addition to information provided in their annual reports as prescribed above, institutes are encouraged to add a report section which provides general accounts of other significant or interesting water resources research developments and prospects, and analyses of local, State, regional or national water needs in relation to the program of the institute.

§ 506.3 Annual reports by entities other than institutes.

(a) On or before September 1 of each year each entity that has received funds under section 200 of the Act shall make a report relating to its activity for the year ending June 30 and submit such report to the Director, in fifteen copies. If there was more than one grant, contract, matching, or other arrangement in effect with the entity during the year covering more than one specific research project, the annual report shall be made up of separate sections, one for each such project, which provide—

(1) A description of research accomplished and the findings, results, and conclusions relating thereto,

(2) Supplementary information suitable for project documentation purposes,

(3) A listing of project-related publications or reports issued and papers presented (with copies of such publications being attached to each copy of the annual report),

(4) Statements of project work remaining to be accomplished,

(5) The nature and extent of activities conducted in cooperation with institutes or other research organizations, and

(6) A detailed statement of the amounts received during the year under grant, contract, matching, or other arrangement, and disbursements thereof, on schedules prescribed by the Director.

(b) If the entity has submitted to the Director a project completion or termination report in accordance with the provisions of section 506.1 of this chapter, the entity may make, in lieu of providing the information requested in subparagraphs (1), (2), and (3) of paragraph (a) of this section, an appropriate reference to such project completion or termination report.

§ 506.4 Special reports.

All organizations and individuals receiving funds under grants, contracts, or other arrangements pursuant to the Act shall submit such reasonable special or interim reports as may from time to time be specifically requested by the Director.

§ 506.5 Annual reports to the Congress.

Each year the Director shall prepare a recommended report suitable for transmission by the Secretary to the Congress, which report shall—

(a) Summarize the receipts and expenditures and work of the institutes in all States and of others that have received funds under the provisions of the Act,

(b) Indicate whether any portion of an appropriation available for allotment to any State has been withheld and, if so, the reasons therefor, and

(c) Summarize the advice and comments relative to needs and problems of the program authorized by the Act as such advice and comments may have been expressed by institutes and in the consultations described in Part 507 of this chapter, together with advice relative to the overall program secured by the Director from a special panel constituted by the Director for that purpose, which panel shall be composed of outstanding scientists, engineers, and laymen experienced in public affairs related to water resources.

§ 506.6 Acknowledgment of Federal Government participation.

Appropriate acknowledgment shall be given by institutes, grantees, and contractors to the Department of the Interior's participation in financing research carried out under provisions of the Act. Such acknowledgment shall be included in publications, news releases, and other information media developed by institutes and others to publicize, describe or report upon research activities and accomplishments carried out in whole or in part with funds received under provisions of the Act.

PART 507—CONSULTATION AND COORDINATION

Sec.
507.1 Cooperation.
507.2 Advice, assistance, and coordination.
507.3 Consultations.
507.4 Cooperation with cataloging center.

AUTHORITY: The provisions of this Part 507 issued under sec. 104, 78 Stat. 331.

§ 507.1 Cooperation.

The Director shall encourage and assist in the establishment and maintenance of cooperation by and between the institutes and between them and other research organizations, the United States Department of the Interior, and other Federal establishments.

§ 507.2 Advice, assistance, and coordination.

The Director shall furnish such advice and assistance as will best promote the purposes of the Act, participation in co-

ordinating research initiated under the Act by the institutes, and indicate to them such lines of inquiry as to him seem most important.

§ 507.3 Consultations.

The Director shall consult with and obtain the continuing advice and cooperation of all agencies of the Federal Government concerned with water problems, of State and local governments, and of private institutions and individuals, to—

(a) Assure that the programs authorized by the Act will not duplicate established water research programs,

(b) Stimulate research in otherwise neglected areas,

(c) Contribute to a comprehensive, nationwide program of water and related resources research, and

(d) Obtain assistance in evaluating programs of the institutes, proposals for grants, contracts or other arrangements, reports of work, and the activities carried on pursuant to the Act.

§ 507.4 Cooperation with cataloging center.

The Director will cooperate with the cataloging center (established in such agency and location as the President determines to be desirable) by providing information to the center on work underway or scheduled pursuant to provisions of the Act, and otherwise as appropriate for the purpose of improving communication of information on water resources research. Such information will be used for cataloging current and projected scientific research in all fields of water resources.

PART 508—AUDITS AND INSPECTIONS

Sec.
508.1 Introduction.
508.2 Audits.
508.3 Inspections.

AUTHORITY: The provisions of this Part 508 issued under sec. 104, 78 Stat. 331.

§ 508.1 Introduction.

Representatives of the Director and of the Comptroller General of the United States may conduct on-site audits and inspections of institutes and other entities which have received Federal funds pursuant to the Act.

§ 508.2 Audits.

Audits conducted at the direction or on behalf of the Director will extend to a determination and appropriate finding of fact concerning compliance with the provisions of the Act, the regularity and accuracy of financial transactions and recording, adequacy of property accountability and internal control, and reliability of financial reporting. As a part of such audits, examinations will be made on a selective basis to determine that matching funds (as defined in section 503.1 of this chapter) have been received and properly expended by recipients of matching-fund grants under the Act and that grantees maintain a proper relationship between costs paid with funds from non-Federal sources and with matching grant funds provided under the Act. Professional audit techniques will be applied and accepted principles of business administration will be the governing criteria.

§ 508.3 Inspections.

In relation to the substantive scientific research operations of allottees, grantees, contractors and others, the Director may, with such personnel as he considers qualified and with such procedures as he determines to be suitable, perform inspections of activities authorized and financed pursuant to the Act. Such inspections will cover acceptability of progress, consistency with approved plans, and other factors the Director deems important to enable him to discharge his responsibilities for achievements consistent with purposes of the Act.

[F.R. Doc. 64-12380; Filed, Dec. 2, 1964; 8:50 a.m.]

APPENDIX C

History of the Implementation and Recommendations - Chronology of the Significant Events leading up to the Enactment of the Water Resources Research Act of 1964, Public Law 88-379, (S.2) approved July 17, 1964, and the 1966 Amendments thereto (S.22).

October 29, 1959

In the Detroit hearings of the Senate Select Committee on National Water Resources, Prof. Raleigh Barlowe, head of the Department of Resource Development, Michigan State University, draws an analogy between the needs for water research and the situation existing when the Hatch Act in 1887 created the State agricultural experiment stations. He urges regional research laboratories to deal with water resources.

January 30, 1961

Report of the Select Committee on National Water Resources pursuant to Senate Resolution 48, 86th Congress, together with supplemental and individual views. Senate Report 29, 87th Congress, first session. Report recommends that the Federal Government undertake a coordinated scientific research program on water.

February 23, 1961

Natural resources message from the President of the United States to Congress. House Document 94, 87th Congress, first session. In this message, President Kennedy stated his intentions to ask the National Academy of Sciences to undertake a thorough and broadly based study and evaluation of the present state of research underlying the conservation, development, and use of natural resources, and his science adviser and the Federal Council for Science and Technology to review ongoing Federal research activities in the field of natural resources and to determine ways to strengthen total Government research efforts relating to natural resources.

January 18, 1962

Budget message from the President of the United States, John F. Kennedy, for fiscal year 1963. In the appendix to the budget, under the appropriation titled "Surveys, Investigations, and Research," for the Geological Survey in the Department of the Interior, the President proposed establishment of an Institute of Water Research in the U.S. Geological Survey.

March 16, 1962

Report of the House Committee on Appropriations on Department of the Interior and related agencies appropriations bill, 1963. House Report 1446, 87th Congress, second session. The House Appropriations Committee rejected the President's proposal.

Source

U.S. Congress, S. Rept. 29, 87th Cong., first sess., Jan. 30, 1961. Report of the Select Committee on National Water Resources pursuant to

S. Res. 48, 86th Cong., together with supplemental and individual views. Government Printing Office, Washington, 1961.

May 10, 1962

Report of Senate Appropriations Committee on Interior Department and related agencies appropriation bills, 1963. Senate Report 1490, 87th Congress, second session. The committee disallowed the request for funds for the establishment of an Institute for Water Research.

May 22, 1962

Letters sent out from chairman of Senate Interior and Insular Affairs Committee, Senator Clinton P. Anderson, to Federal agencies and departments inquiring about their water research activities.

July 27, 1962

S.3579, a bill to establish water resources research institutes at land-grant colleges and State universities and to promote a more adequate national program of water research, introduced by Senator Anderson. Congressional Record, volume 108, part 11, 87th Congress, second session, page 14942.

September 2, 1962

Committee print, "Water Resources Research", memorandum of the chairman to the Committee on Interior and Insular Affairs, U.S. Senate, transmitting reports of Federal departments, land-grant colleges, and State universities, other public, educational, and private institutions, and individuals, on water research activities, 87th Congress, second session, 431 pages.

November 26, 1962

Report of the National Academy of Sciences to the President on the research needs and opportunities related to U.S. natural resources requirements. One volume summary report from the Committee on Natural Resources of the National Academy of Sciences (Publication 1000, NAS-NRC), and seven supporting studies covering renewable resources, water, minerals, energy, marine, environment, and social and economic problems. NAS-NRC Publications 1000-1000G. The volume on "Water Resources," NAS-NRC Publication No. 1000B, written by Dr. Abel Wolman.

January 14, 1963

S.2, a bill to establish water resources research centers at land-grant colleges and State universities, to stimulate water research at other colleges, universities, and centers of competence, and to promote a more adequate national program of water research, introduced by Senator Anderson for himself and Senators Jackson, Kuchel, Metcalf, McGovern, Hart, Humphrey, Church, Lausche, Douglas, Gruening, Burdick, McGee, Williams (New Jersey), Randolph, Clark, Proxmire, Neuberger, Morse, Engle, Moss, Carlson, Mansfield, yarborough, Long (Missouri), Bayh, Hruska, Bartlett, McIntyre, Fong, Brewster, and Bible. Congress-

ional Record, volume 109, part 1, pages 190, 202-211, 467, 787; volume 109, part 2, page 2785; volume 109, part 3, page 3141. 88th Congress, first session. Referred to Senate Interior and Insular Affairs Committee.

January 24, 1963

H.R. 2689 (identical to S.2) introduced by Congressman Teague of Texas. Congressional Record, volume 109, part I, 88th Congress, first session, page 1043. Referred to House Interior and Insular Affairs Committee.

February 18, 1963

"Federal Water Resources Research Activities," report by task group of Federal Council for Science and Technology, transmitted to Congress by the President.

February 19 and 20, 1963

H.R. 4048 (identical to S.2) introduced by Congressman Matthews of Florida. Congressional Record, volume 109, part 2, 88th Congress, first session, page 2764. Referred to House Interior and Insular Affairs Committee.

March 25, 1963

"Federal Water Resources Research Activities." Committee print. Issued as memorandum of the chairman to the Committee on Interior and Insular Affairs, U.S. Senate, transmitting the report to the President on Water Resources Research prepared by the Federal Council for science and Technology. 88th Congress, first session. 213 pages.

April 8, 1963

S.2 reported by Senate Interior and Insular Affairs Committee. Senate Report No. 117 or Congressional Record, volume 109, part 5, 88th Congress, first session, p. 5869.

April 11, 22, and 23, 1963

S.2 debated in Senate. Congressional Record, volume 109, part 5. 88th Congress, first session, pages 6469, 6689, 6697, 6705, 6765, 6768, and 6772.

April 23, 1963

S.2 passed Senate with amendments. Congressional Record, volume 109, part 5, 88th Congress, first session, page 6785.

April 24, 1963

S.2, as passed and amended by Senate, referred to House Interior and Insular Affairs Committee. Congressional Record, volume 109, part 5, 88th Congress, first session, page 6927.

June 25, 1963

H.R. 7234 (identical to S.2 as passed by the Senate) introduced by Congressman Edmonson of Oklahoma. Congressional Record, volume 109, part 9, 88th Congress, first session, page 11529. Referred to House Interior and Insular Affairs Committee.

June 25, 1963

H.R. 7239 (identical to S.2 as passed by the Senate) introduced by Congressman Johnson of California, Congressional Record, volume 109, part 9, 88th Congress, first session, page 11529. Referred to House Interior and Insular Affairs Committee.

June 25, 1963

H.R. 7258 (identical to S.2 as passed by the Senate) introudced by Congressman Gray of Illinois. Congressional Record, volume 109, part 9, 88th Congress, first session, page 11529. Referred to House Interior and Insular Affairs Committee.

June 24 and 25, 1963
July 22 and 23, 1963

Hearing before the Subcommittee on Irrigation and Reclamation of the House Interior and Insular Affairs Committee, 88th Congress, first session, on S.2, H.R. 2683. H.R. 2689, H.R. 4048, H.R. 7234, H.R. 6239, and H.R. 7258, "Water Resources Research Centers." Serial No. 9 -- part I, Government Witnesses, 155 pages.

September 30 and October 1, 1963

Hearing before the subcommittee on Irrigation and Reclamation of the House Interior and Insular Affairs Committee, 88th Congress, first session, on S.2 H.R. 2683, H.R. 2689, H.R. 4048, H.R. 7234, H.R. 7239, and H.R. 7258. "Water Resources Research Centers." Serial No. 9 -- Part II, Public Witnesses, 155 pages.

February 10, 1964

S.2 reported with amendment by House. House Report 1136 or Congressional Record, volume 110, part 2, 88th Congress, second session, page 2932.

June 2, 1964

S.2 as reported with amendment made special order of House. House Resolution 711, Congressional Record, volume 110, part 9, 88th Congress, second session, pages 12451-12452.

June 2, 1964

S.2 as reported, debated, amended, and passed House, with title amended. Congressional Record, volume 110, part 9, 88th Congress, second session, pages 12452-12469.

June 8, 1964

Senate disagrees with House amendment of S.2 and asks for conference, Congressional Record, volume 110, part 10, 88th Congress, second session, page 12929.

June 8, 1964

Senate conferees appointed. Congressional Record, volume 110, part 10, 88th Congress, second session, page 12930.

June 15, 1964

House insists on its amendments and agrees to conference. Congressional Record, volume 110, part 10, 88th Congress, second session, page 13728.

June 15, 1964

House conferees appointed. Congressional Record, volume 110, part 10, 88th Congress, second session, page 13729.

June 29, 1964

Senate conferees changed (Senator Allcott replaced by Senator Jordan). Congressional Record, volume 110, part 12, 88th Congress, second session, page 15325.

July 2, 1964

Conference report on S.2 submitted in House and agreed to. House Report 1526. Congressional Record, volume 110, part 12, 88th Congress, second session, pages 15904-15909.

July 3, 1964

S.2 examined and signed in House. Congressional Record, volume 110, part 12, 88th Congress, second session, page 16249.

July 6, 1964

S.2 presented to President Johnson. Congressional Record, volume 110, part 12, 88th Congress, second session, page 15998.

July 17, 1964

S.2 approved by President. Public Law 88-379; 78 Stat. 329. Congressional Record, volume 110, part 13, 88th Congress, second session, page 16655.

July 28, 1964

S.3039 introduced by Senators Jackson and Anderson. "A bill to amend the Water Resources Research Act of 1964 in order to eliminate a provision making certain assistance under such act conditional upon

approval thereof by committees of the Congress." Congressional Record, volume 110 part 13, 88th Congress, second session, page 17203. Referred to Senate Interior and Insular Affairs Committee.

October 1, 1964

H.R. 12755 introduced by Congressman Bray of Indiana. (Bill identical to S.3039). Congressional Record, volume 110, part 18, 88th Congress, second session, page 23455. Referred to House Interior and Insular Affairs Committee.

December 3, 1964

Proclamation by Secretary of the Interior to set up Office of Water Resources Research in the Department of the Interior. Federal Register, volume 29, No. 234, page 16188.

January 5, 1965

S.22 introduced by Senator Anderson for himself and Senators Allcott, Bartlett, Bayh, Bible, Burdick, Carlson, Gruening, Hart, Jackson, Jordan, Kuchel, Long of MVssouri, Mansfield, McGee, McGovern, Metcalf, Morse, Moss, Tower, and Yarborough. "A Bill to promote a more adequate national program of water research." Congressional Record, volume 111, part 1, 89th Congress, first session, pages 167, 204-205, 537, and 5156. Referred to Senate Interior and Insular Affairs Committee.

January 26, 1965

H.R. 3606 introduced by Congressman O'Brien of New York, a companion bill to S.22. Congressional Record, volume 111, part 5, 89th Congress, first session, page 1215. Referred to House Interior and Insular Affairs Committee.

March 8, 1965

H.R. 5930, introduced by Congressman Hanley of New York. Congressional Record, volume 111, part 4, 89th Congress, first session, page 5065. Referred to House Interior and Insular Affairs Committee.

March 15, 1965

H.R. 6282 introduced by Congressman Pickle of Texas. Congressional Record, volume 111, part 4, 89th Congress, first session, page 5065. Referred to House Interior and Insular Affairs Committee.

March 22, 1965

Senate Report 127 with an amendment, from the Senate Interior and Insular Affairs Committee, reporting back the bill S.22. Congressional Record, volume 111, part 4, 89th eongress, first session, page 5473.

March 25, 1965

S.22, amended, passed the Senate. Congressional Record, volume 111, part 5, 89th Congress, first session, pages 5868-5869.

March 26, 1965

S.22 as passed by the Senate referred to House Interior and Insular Affairs Committee. Congressional Record, volume 111, part 5, 89th Congress, first session, page 6173.

June 9, 1965

H.R. 8916 introduced by Congressman Ashley of Ohio. (Bill identical to S.22 as passed by Senate). Congressional Record, volume 111, part 10, 89th Congress, first session, page 12962.

February 14, 51, and 18, 1966

Hearings on H.R. 3606 and related bills. House Interior and Insular Affairs Committee, Serial No. 25, 89th Congress, second session.

March 26, 1966

House Report 1350, "Promoting a More Adequate National Program of Water Research." 89th Congress, second session, 14 pages.

March 30, 1966

H.R. 3606 passed House. Subsequently, provisions of H.R. 3606 substituted for text of S.22. Congressional Record, volume 112, part 6, 89th Congress, second session, pages 7239-7241, and 7249.

April 5, 1966

Senate accepted House amendment of S.22. Congressional Record, volume 112, part 6, 89th Congress, second session, page 7620.

April 19, 1966

S.22 approved by the President. Public Law 89-404; 80 Stat. 129.

MEMORANDUM OF AGREEMENT

Whereas, in order to assure the Nation at all times of a supply of water sufficient in quantity and quality the Water Resources Research Act of 1964 authorizes the Secretary of the Interior to sponsor, provide for, and supplement present programs for the conduct of research, investigations, experiments, and the training of scientists in the fields of water and of resources which affect water; and

Whereas, the Director of the Office of Water Resources Research of the Department of the Interior, hereinafter called the Director, is duly authorized under the Act and is acting on behalf of the United States of America; and

Whereas, the Director of the Water Resources Research Institute is duly authorized and acting on behalf of the New Mexico State University and its Water Resources Research Institute, herein called the Institute; and

Whereas, the Institute is eligible in accordance with the Act to receive funds authorized by the Act,

Therefore, The Director and the Institute mutually agree as follows:

1. As used in this agreement and material incorporated herein, and in any annual allotment and matching grant agreements, the term --

(a) "regulations" means the rules and regulations (18 CFR, Ch. IV) issued by the Secretary of the Interior pursuant to the Water Resources Research Act of 1964, 78 Stat. 329;

(b) "request" means a request prepared by the Institute in accordance with regulations issued by the Secretary of the Interior and submitted to the Director for the purpose of obtaining an allotment of funds pursuant to section 100 of the Water Resources Research Act of 1964, including information submitted by the Institute to supplement or amend the initial request submittal and received by the Office of Water Resources Research prior to the date the Director approves an annual allotment agreement pursuant to the request; and

(c) "application" means an application prepared in accordance with regulations issued by the Secretary of the Interior and submitted to the Director by the Institute for the purpose of obtaining a grant of funds pursuant to section 101 of the Water Resources Research Act of 1964, including information submitted by the Institute to supplement or amend the initial application submittal and received by the Office of Water Resources Research prior to the date the Director approves a matching grant agreement pursuant to the application.

Other terms defined in part 501 of the regulations and used in this agreement and any incorporated material, and in any supplements to this agreement, shall have the meaning set forth for such terms in the regulations.

2. The Director agrees to furnish to the Institute matching grants subject to the approval of the Director, or allotments, or both, as long as it maintains its eligibility for such funds pursuant to the Act, Regulations and this agreement, and to the extent that appropriations are available for such allotments, matching grants, or both. The amounts of such funds shall be indicated in annual allotment and matching grant agreements.

3. The Institute recognizes that its program activities are subject to the coordination, advisory, and other responsibilities assigned to the Director pursuant to section 104 of the Act and part 507 of the Regulations.

4. The Institute agrees that it is primarily responsible, pursuant to regulations issued by the Secretary, for (1) receipt, disbursement, and accounting and reporting for any Federal funds received pursuant to this agreement, (2) conformance to financial plans as submitted to and approved by the Director; however, in order to permit flexibility in the Institute's administration of its program the Institute may make changes in its approved financial plans provided such changes do not exceed, for any one year, the dollar limitation on such changes stipulated in the annual allotment or matching grant agreements, (3) substantial performance of the plans of research, investigation, experiment and training submitted to and approved by the Director, and (4) compliance in all other respects with regulations issued pursuant to the Act.

5. The Institute agrees that if any Federal funds granted pursuant to this agreement are on a matching grant basis, it will assure the availability of the required non-Federal matching funds.

6. The Institute agrees not to contract out any part of the research and training activities financed, in whole or part, by allotment, matching grant, or both. However, arrangements for co-operative participation by other entities in the Institute's programs, made in accordance with regulations issued by the Secretary, are not restricted by this agreement.

7. The Institute agrees that the following listed general provisions, appended hereto, are applicable as a matter of public policy and law to activities undertaken in whole or part with Federal funds:

A. Equal Opportunity

B. Convict Labor

C. Covenant Against Contingent Fees

D. Officials Not to Benefit

E. Notice and Assistance Regarding Patent and Copyright Infringement

F. Authorization and Consent

Insofar as applicable, the above provisions are incorporated in, and made a part of, this agreement.

8. The Institute hereby agrees to accept and comply with such provisions as may be determined by the Secretary pursuant to Section 303 of the Water Resources Research Act of 1964 (P.L. 88-379).

FOR THE UNITED STATES OF AMERICA:

March 9, 1965
Date

Roland R. Renne
Director, Office of Water Resources Research

FOR THE INSTITUTE:

March 12, 1965
Date

H. R. Stucky
Director, Water Resources Research Institute

The New Mexico State University Water Resources Research Institute accepts the terms of article 8 of this agreement.

FOR New Mexico State University

March 12, 1965
Date

R. B. Corbett
President

STATE OF NEW MEXICO

OFFICE OF THE GOVERNOR
SANTA FE

JACK M. CAMPBELL
GOVERNOR

September 3, 1964

The Honorable Stewart L. Udall
Secretary of the Interior
U. S. Department of the Interior
Washington, D. C.

Dear Mr. Secretary:

As you know, New Mexico has a historic and vital interest in the purposes of the recently approved Water Resources Research Act. We have many agencies and institutions that have participated in many projects along this line, including New Mexico State University at Las Cruces. NMSU has had nine water conferences in past years and has conducted many studies in connection with its outstanding agricultural and scientific programs.

I would like to recommend that NMSU be named one of the early participants in the water resources research project as an institute center. I believe this fine school meets the requirements of the act and would qualify for the appropriations provided therein.

I would urge that serious consideration be given to NMSU's application, its significance to this program and to the development of water research in the Southwest.

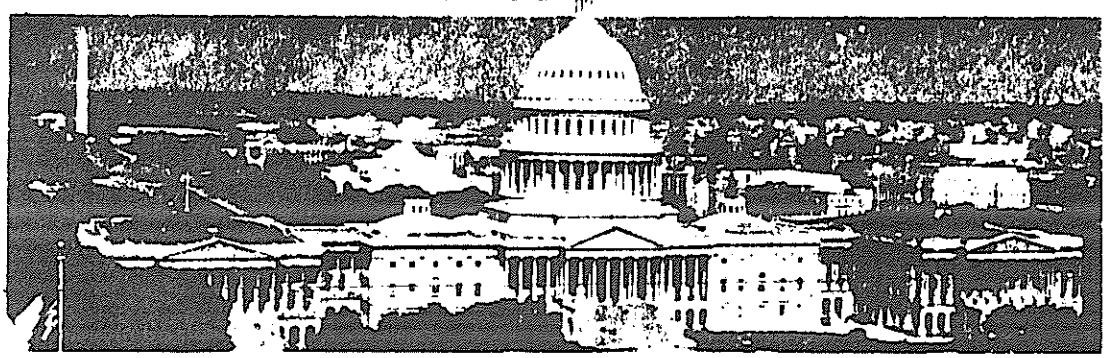
My personal regards and best wishes to you.

Sincerely,

Jack M Campbell

JACK M. CAMPBELL
GOVERNOR

NEWS FROM THE CAPITOL



By SENATOR CLINTON P. ANDERSON • DEMOCRAT • NEW MEXICO

Chairman, Senate Aeronautical and Space Sciences Committee; Member, Senate Committee on Public Land and Insular Affairs; Joint Committee and Joint Committee on Atomic Energy

WASHINGTON, August 10, 1965

DESALINATION PLANTS were the subject of intense interest last week from the Gulf Coast to the banks of the Hudson River. On Wednesday, ambassadors from 30 nations toured the desalting plant at Freeport, Texas, to learn how such facilities could benefit their countries. At President Johnson's request, I was to have accompanied the group. But the reapportionn ent fight in the Senate required me to stay here. Meanwhile, in New York City discussions were going forward on the possibility of building a multimillion-gallon desalination plant in tandem with a nuclear power reactor. At the White House on Thursday, the President told me he wanted to hasten the day when such giant plants will be in operation in water-short areas. Later in the day, Congress gave him tools to do so when we completed action on a five-year extension of the Anderson-Aspinall Act and provided an increased authorization of $200 million for the Office of Saline Water program. In the Senate recently, I commented on how the water programs many of us in the West had brought into being would prove of great value to the Northeast, where the worst drought in the history of a 12-state area has persisted for 45 months.

WHILE I DO NOT BELIEVE there are any insurmountable technical barriers to solving the water problems of our metropolitan areas, a better understanding is needed of the interrelationships among the factors that condition water supplies. Just 12 months ago, Congress created the water resources research program. As a result, a state water resources research center has been established in each of the 50 states and Puerto Rico- the first at New Mexico State University.) Each center has developed a program of research related to the important water problems of its state and region. During the past 12 months, Congress has appropriated more than $8,500,000 for support of these state centers and some 400 new research projects. As the West has provided experiences which may prove valuable to the drought-ridden Northeast, the action taken in that region over the next few critical months will be instructive to other sections of the Nation. No region is immune from water difficulties. We should view the crisis in the Northeast as an opportunity to develop the political and physical structures for avoiding similar situations in the Great Lakes region, the Midwest and elsewhere.

Research Areas

It is of interest to review the general research areas which were considered important for funding both at the federal and by the states and universities.

The Office of Water Resources Research, U.S. Department of Interior established a list for 1966. One or more of the following federal departments assigned the priorities:

Agriculture

Health Education and Welfare

Defense

Interior

The priority areas are:

Waste Water Reclamation and Reuse

Causes and Effects of Water Pollution from Rural Lands

Urban Storm Drain Design

River Forecasting for Water Resource Management

Water Conservation and Water Yield Improvement

Water Resource Economics

Soil Mechanics and Engineering Geology

Effects of Pesticides on Aquatic Environment

Groundwater-Surface Water Relationships

Chemical Relations Within Groundwater Bodies

All are Important Areas of Research for New Mexico

The newly appointed Directors of the several active state water research institutes meeting with the Offices of Water Resources Research (OWRR) and representatives of several federal agencies, developed a more specific list to suggest research areas, from which specific research projects might be developed. This, however, was not considered an all inclusive list. Many projects specific to a particular region of the nation, or a state, or a local problem were not to be exculded by any administrative adherence to this list:

Research Needs and Water Investigations Arranged Under Nine General Areas

1. Nature of Water

   Desalinization - interactive forces between water molecules and other molecules

Organics of water and chemical qualities of each
Nature of natural and polluted organic substances
Chemistry of minor elements

2. Water Cycle
   Precipitation, snow, ice and permafrost
   Evaporation and transpiration
   Streams and lakes
   Groundwater and hydrogeology
   Orceanic influences
   Forecasting

3. Water and Land Management
   Water movement in soils
   Water and plants
   Watershed protection
   Water-yield improvement
   Erosion and sedimentation
   Upstream flood abatement
   Irrigation
   Drainage

4. Development and Control
   Water supply
   Flood control (downstream)
   Hydropower
   Navigation
   Urban and industrial water-use problems
   Recreation
   Fish and wildlife
   Estuarine Oceanography

5. Qualitative Aspects
   Characterization of wastes
   Effects of pollution on water uses
   Interactions of wastes
   Disposal of waste effluents
   Surface interactions
   Effects of development on quality
   Quality characteristics
   Aqueous solutions

6. Reuse and Separation
   - Saline-water conversion
   - Advanced waste treatment
   - Improved treatment of wastes
   - Treatment of water
   - Use of water of impaired quality

7. Economic and Institutional Aspects
   - Role of water in growth
   - Economics of development and management
   - Economic analysis of institutions
   - Area appraisals

8. Engineering Works
   - Design
   - Materials
   - Construction and operation
   - Maintenance

9. Manpower and Research Facilities
   - Education and Training
   - Research facilities

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Urban Storm Drain Design
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Water Resource Economics
Soil Mechanics and Engineering Geology
Effects of Pesticides on Aquatic Environment
Ground Water-Surface Water Relationships
Chemical Relations Within Ground-Water Bodies

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1. Nature of Water

Desalanization - interactive forces between water molecules and molecules

Organics of water and chemical qualities of each
Nature of natural and polluted organic substances
Chemistry of minor elements

2. Water Cycle
   - Precipitation, snow, ice, and permafrost
   - Evaporation and transpiration
   - Streams and lakes
   - Groundwater and hydrogeology
   - Oceanic influences
   - Forecasting

3. Water and Land Management
   - Water movement in soils
   - Water and plants
   - Watershed protection
   - Water-yield improvement
   - Erosion and sedimentation
   - Upstream flood abatement
   - Irrigation
   - Drainage

4. Development and Control
   - Water supply
   - Flood control (downstream)
   - Hydropower
   - Navigation
   - Urban and industrial water-use problems
   - Recreation
   - Fish and wildlife
   - Estuarine Oceanography

5. Qualitative Aspects
   - Characterization of wastes
   - Effects of pollution on water uses
   - Interactions of wastes
   - Disposal of waste effluents
   - Surface interactions
   - Effects of development quality
   - Quality characteristics
   - Aqueous solutions

6. Reuse and Separation
   - Saline-water conversion
   - Advanced waste treatment
   - Improved treatment of wastes
   - Treatment of water
   - Use of water of impaired quality

7. Economic and Institutional Aspects
   - Role of water in growth
   - Economics of development and management
   - Economic analysis of institutions
   - Area appraisals

8. Engineering Works
   - Design
   - Materials
   - Construction and operation
   - Maintenance

9. Manpower and Research Facilities
   - Education and training
   - Research facilities

APPENDIX H

NEW MEXICO WATER CONFERENCES PROCEEDINGS - 1956-1977
And The General Theme Of Each Conference

Special Report No. 1 - Water Resources and Their Economic Importance in New Mexico, September 1956, 145 pp.

First Annual Water Conference - October 31, November 1, 2, 1956 - General Survey of Agency Water Activities, 112 p.

Second Annual Water Conference - November 7, 8, 1957, Theme -- "Water For New Mexico - Your Problem and Mine," 109 pp.

Third Annual Water Conference - November 6, 7, 1958, Theme -- "New Mexico Water - Present Use and New Sources," 146 pp.

Fourth Annual New Mexico Water Conference - November 5, 6, 1959, Theme -- "Water and Water Law," 144 pp.

Fifth Annual New Mexico Water Conference - November 1, 2, 1960, Theme -- "Watershed Management," 97 pp.

Sixth Annual New Mexico Water Conference - November 1, 2, 1970, Theme -- "Ground Water," 104 pp.

Seventh Annual New Mexico Water Conference - October 31, November 1, 1962, Theme -- "Water in 50 Years of Statehood with a Look to the Future," 116 pp.

Eighth Annual New Mexico Water Conference - July 1, 2, 1963, Theme -- "Saline Water Conversion," 81 pp.

Ninth Annual New Mexico Water Conference - March 19, 20, 1964, Theme -- "Research - The Key to the Future in Water Management," 81 pp.

Tenth Annual New Mexico Water Conference - April 1, 2, 1965, Theme - "People and Water in River Basin Development," 126 pp.

Eleventh Annual New Mexico Water Conference - March 31, April 1, 1966, Theme -- "Water Economics with Limited Supplies and Increasing Population," 157 pp.

Twelfth Annual New Mexico Water Conference - March 31, 1967, Theme -- "Water Quality - How Does it Affect You?" 116 pp.

Thirteenth Annual New Mexico Water Conference - March 28, 29, 1968, Theme -- Water for New Mexico to the Year 2000 and 2060, 167 pp.

Fourteenth Annual New Mexico Water Conference - March 27, 28, 1969, Theme -- Water Research and Development, 111 pp.

Fifteenth Annual Water Conference - March 12, 13, 1970, Theme -- "Water - There is No Substitute," 113 pp.

Sixteenth Annual Water Conference - March 25-27, 1971, Theme -- "Water - A Key to a Quality Environment," 197 pp.

Seventeenth Annual Water Conference - April 6, 7, 1972. Theme -- "Water in Land Use Planning," 141 pp.

Eighteenth Annual Water Conference - April 5, 6, 1973, Theme - "State Water Plan," 83 pp.

* A Set of papers supporting the Theme of the Proposed Nineteenth Annual New Mexico Water Conference, Theme -- "Water in Food and Fiber Production," 155 pp.

Twentieth Annual Water Conference - April 3, 4, 1975, Theme -- "Water for Energy," 146 pp.

Twenty-first Annual Water Conference - April 1, 1976, Theme -- "The National Safe Drinking Water Act," 125 pp.

Twenty-second Annual Water Conference - April 28, 29, 1977, Theme -- "Water in the Future - 208 and You," 105 pp.

Twenty-third Annual Water Conference - April 27, 28, 1978, Theme -- "New Mexico Water Resources, Considering The Possible,"

*This arrangement was made for the Nineteenth Conference because of the gasoline shortage in April 1974. Those who had been asked to present papers, were asked to send them in for duplicating. A report, similar to the proceedings of the Water Conferences was prepared and is included in this series.

The decisions at these Conferences covered local, state and National programs, legislation either posed or being considered, and the results of research projects and the operations being carried out by the various agencies. Special emphasis was given to Water Law in the Fourth Annual Conference in 1959.

Appendix I

NEW MEXICO STATE UNIVERSITY

WATER RESOURCES RESEARCH INSTITUTE

AGRICULTURE BUILDING ROOM 158
OFFICE OF THE DIRECTOR

P. O. BOX 3167
LAS CRUCES, NEW MEXICO 88001
(505) 646-4337

MEMORANDUM OF AGREEMENT
BETWEEN
UNIVERSITY OF NEW MEXICO
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY
AND
NEW MEXICO STATE UNIVERSITY

THIS MEMORANDUM OF AGREEMENT entered into this 8th day of July, 1966, between New Mexico State University at University Park on behalf of the New Mexico State Water Resources Research Institute, hereinafter called the "Institute", the University of New Mexico at Albuquerque, and the Institute of Mining and Technology at Socorro, is set forth to confirm certain understandings relative to the water resources research program to be undertaken under Public Law 88-379 as specified by the Act and under Public Law 89-404, as may be cooperatively arranged by agreement between the Institute, and the University of New Mexico and/or New Mexico Institute of Mining and Technology.

WITNESSETH THAT:

WHEREAS, The Water Resources Research Act of 1964, Public Law 88-379, hereinafter called the "Act", in part provides for fund distributions to assist in the establishment in each state of a water resources research institute or center at one college or university in each state, and

WHEREAS, The Institute has entered into a memorandum of agreement dated March 9, 1965, with the United States of America through its Director, Office of Water Resources Research, Department of Interior, hereinafter called the "USA", which sets forth the general terms and conditions of the co-operative program under which allotments and matching grants will be provided to the Institute, and

WHEREAS, The University of New Mexico and New Mexico Institute of Mining and Technology have qualified staff members, specialized equipment, and other facilities necessary to conduct investigations with regard to the water resources research.

NOW THEREFORE, the parties hereto do mutually agree as follows:

1. SCOPE OF AGREEMENT

(a) The University of New Mexico and/or the Institute of Mining and Technology shall:

1. Comply with all present and subsequent federal requirements in connection with the allocation. See copies of documents in attached as follows:

   Appendix A - Public Law 88-379, entitled "Water Resources Research Act of 1964." Approved July 17, 1964.

   Appendix B - Public Law 89-404, entitled "Amendment of Section 200 of the Water Resources Research Act of 1964." Approved April 19, 1966. Where and when applicable.

   Appendix C - Rules and Regulations pursuant to the Water Resources Research Act of 1964 (PL-88-379) Published in the Federal Register December 3, 1964.

   Appendix D - Policy Statement issued by the Office of Water Resources Research, Department of Interior, March 31, 1965.

2. Conduct the research as set forth in Appendixes and approved project plans in a workmanlike manner.

3. Provide timely reports to the Director of the Institute for transmittal to the Department of the Interior.

4. Provide a detailed billing of reimbursable disbursements.

5. Reimburse the Institute for any items disallowed by federal audit.

(b) The Institute shall:

1. Fulfill its responsibilities as set forth in its agreements with USA dated March 9, 1965, and in federal laws and regulations.

2. Provide official liaison with the Office of Water Resources Research, Department of Interior, in matters covered by this agreement.

3. Reimburse the University of New Mexico and/or the Institute of Mining and Technology for all quallfied disbursements.

II. PERIOD

This agreement shall be effective as of July 1, 1966. The agreement may be terminated on ninety days notice in writing from either or any of the parties, and may be amended as required by laws or regulations and as mutually agreed in writing.

III. PAYMENTS

(a) The Institute agrees to reimburse the University of New Mexico and/or the Institute of Mining and Technology for appropriate actual expenses incurred directly in furtherance of the program, under Title I of PL-88-379. It is mutually understood and agreed that fringe benefits and indirect costs are not allowable for reimbursement from federal funds under Title I. Itemized expense vouchers representing costs incurred by the University of New Mexico and/or the New Mexico Institute of Mining and Technology in connection with this research program and which have been approved by the appropriate authority shall be kept on file subject to review and audit until the expiration of three years after the last disbursement - (Rules and Regulations 505.6 C). Reimbursement vouchers summarizing the above expense vouchers will be forwarded quarterly to the Director, New Mexico Water Resources Research Institute, New Mexico State University, University Park, New Mexico. Details to be included with each billing shall include: date paid, payee, item description, voucher or check number, amount paid, and a total for the quarter.

Reimbursement checks will be made payable to the University of New Mexico and mailed to John Perovich, Comptroller, University of New Mexico, Albuquerque, New Mexico 87106. Reimbursement checks will be made payable to the New Mexico Institute of Mining and Technology and mailed to Business Manager, New Mexico Institute of Mining and Technology, Socorro, New Mexico 87801.

(b) Advanced reimbursement may be made for any quarter based on estimated expenditures for the quarter, if requested in writing to the Director. The advance reimbursement would correspond and be less than the amount budgeted for the quarter in which advances are requested.

(c) The amount authorized by this agreement is set forth in the authorized and approved projects which are current in any period.

IV. GENERAL PROVISIONS

(a) This agreement is subject to all the terms, requirements, and restrictions of the agreements between the Institute and USA dated March 9, 1965, of the Acts and of Rules and Regulations pursuant to the Act and of other requirements of the Office of Water Resources Research, all as now outstanding or which may be retroactively promulgated. See Appendix A, B, C, D.

(b) The University of New Mexico and/or the New Mexico Institute of Mining and Technology are encouraged to publish the results of their research findings in referred professional

journals but due acknowledgement must always be given to the support under Public Law 88-379. A copy of the suggested acknowledgement is attached as Appendix E. Sixty copies of each publication shall be submitted to the Institute.

(c) The University of New Mexico and Institute of Mining and Technology shall prepare a report annually on each project embodying the research findings funded by basic allotment or matching fund grants, and shall submit six copies of each report to the Institute. A final closing report shall also be prepared for each project when terminated. This closing report may be submitted in place of the annual report for the final year of the project.

(d) The University of New Mexico and/or the New Mexico Institute of Mining and Technology agrees that the Program Development and Review Board of the Institute shall act as a referee of all the research effort performed under this agreement and further agrees to submit any or all publications and reports to the Institute for review before publication as may be required by this Board.

(e) This agreement may be amended at any time but only in writing.

(f) Funds received under Title I of the Act may not be used for the cost of retirement, health, or other employee fringe benefits, or for indirect or overhead cost items.

(g) The Acts, and Rules and Regulations pursuant to the Acts, are by reference included herein and made a part hereof as though recited in detail.

(h) Transfers to or from a cost classification category within a project and transfers between projects may not be made without advising the Director of the Institute in order that such changes will be in accordance with the Rules and Regulations.

(i) Title to all non-expendable property purchased with federal funds appropriated under Title I, Section 100, of the Act shall be vested in New Mexico State University for the use and benefit of the New Mexico Water Resources Research Institute as provided for under Sec. 505.5 of the Rules and Regulations pursuant to the Act; if purchased with federal funds under Section 101 the ownership will rest with the Office of Water Resources Research, unless specific action is taken to transfer title under 505.5 (a) of the Rules and Regulations.

Appendix M

SUPPLEMENT TO THE
JULY 8, 1966
MEMORANDUM OF AGREEMENT
BETWEEN
UNIVERSITY OF NEW MEXICO
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY
AND
NEW MEXICO STATE UNIVERSITY

WHEREAS, The New Mexico State Legislature in its 1970 session for the first time appropriated funds ($104,000) as a line item in the New Mexico State University budget for Water Resources Research Institute directed research.

IT IS THEREFORE necessary to supplement the July 8, 1966 Agreement between the above institutions to provide for the allocation, administration and accounting of the New Mexico State University budget line item.

This 1970 appropriation of $104,000 will (1) provide up to $16,000 to each of the three units - University of New Mexico, New Mexico Institute of Mining and Technology, and New Mexico State University for water resources research projects, recommended by the Water Resources Research Institute's Program Development and Review Board and approved by the Institute Director. These funds may be used by the above institutions of higher education to match Title I Section 101 Matching Grant projects approved by the Office of Water Resources Research, Department of the Interior, or for other approved projects.

The 1970 appropriation also (2) provides $48,000, which may be allocated on the basis of quality, to any of the above higher educational units or to other New Mexico universities submitting water research projects to the Institute. The funding of these projects, for either partial or full support, must be recommended by the Water Resources Research Institute's Program Development and Review Board and approved by the Institute Director.

Also, (3) the remaining $8,000 is allocated to the Institute Director's Office for costs required in conduct of the research program, for publication costs, and costs of information exchange to make the research results available to the public and to specific users of the research.

In future years, the appropriated funds, whether increased or decreased, will be allocated on about the same division as for 1970 above; that is, (1) 15.5% to each of the three institutions, (2) 46% to any water research project approved on the basis of quality, and (3) 7.5% to the Director's Office for conduct of research and for information exchange.

The Program Development and Review Board of the New Mexico Water Resources Research Institute composed of research personnel from three or more higher educational units, will review each of the research projects proposed for funding from this State appropriation, and recommend those projects which on the basis of quality may qualify for support.

The Water Resources Research Institute may submit some of the projects to the Office of Water Resources Research or other Federal, State, local or private agencies where matching grants may be available for water research.

Some approved projects, particularly those of specific importance to New Mexico and/or those of less than one year duration, may be supported directly from State funds. These projects shall be recommended by the Institute's Program Development and Review Board and approved by the Institute Director.

Publication of research results in some cases may be paid for from these appropriated funds.

All of the research projects shall be administered by the Director of the Water Resources Research Institute. However, the Principal Investigators who have projects supported by these funds shall be members of the faculty of their respective departments, and the projects shall operate through their respective departments.

Quarterly progress reports by the Principal Investigators and expenditures vouchers from the business offices shall be the basis for transferring funds, in accordance with project budgets, from New Mexico State University to the cooperating university units.

All accounting for the funds shall be done by the Director of the Water Resources Research Institute through the New Mexico State University Business Office.

This supplement shall be effective as of July 1, 1970 and will be effective until either amended or terminated.

NEW MEXICO STATE UNIVERSITY

By H. R. Stucky Date June 1, 1970

Title Director
New Mexico Water Resources Research Institute

By R. B. Corbett Date June 2, 1970

Title President

UNIVERSITY OF NEW MEXICO

By Ferrel Heady Date June 23, 1970

Title President

NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

By Stirling A. Colgate Date June 23, 1970

Title President

Appendix N

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Appendix O

WATER RESOURCES RESEARCH INSTITUTE PROJECTS

1965

ANNUAL ALLOTMENT

A-001
2-1-65 Synthetic Hydrology

NMSU W. Viessman, Civil Engineering

OBJECTIVES:

1. To develop prediction equations which will permit the construction of the hydrograph of storm runoff for small urban drainage areas based on a knowledge of the physical features of these areas and the causative storm patterns.
2. To reproduce, within reasonable limits, the hydrograph of runoff for an urban area if the physical features of the area are known and the rainfall distribution is provided.

A-002
2-1-65 Gas Chromatographic Evaluation of Bacterial Stream Pollution

NMSU W. Garner, Sanitary Science

OBJECTIVES:

1. To develop techniques for the use of gas chromatography to rapidly detect bacterial pollution of natural waters.

A-003
2-1-65 A Study of the Effects of Water Quality and Environmental Factors Affecting Freshwater Vertebrates

NMSU W. G. Whitford, Biologist
J. R. Dixon, Wildlife Management

OBJECTIVES:

1. To measure fluctuations in water temperature, pH, ion concentration, trace elements, and dissolved oxygen over a one-year period at several stations along a watershed and in nearby water impoundments.
2. To determine temperature tolerance, and the effect of ion concentration on temperature tolerance of freshwater vertebrates from the areas studied.
3. To determine critical oxygen tension for vertebrates from the areas studied.

A-004
2-1-65 The Effects of Soil Properties on the Retention, Percolation and Run-Off of Precipitation

NMSU J. U. Anderson, Agronomist

OBJECTIVES:

1. To evaluate the effects of soil profile characteristics on the retention, percolation, and run-off of precipitation.
2. To evaluate the relationship of run-off to sediment production (by erosion) for soils of varying profile characteristics.

A-005
2-1-65 Plant Composition and Soil Properties as Affected by Irrigation Water Quality

NMSU H. E. Dregne, Agronomist

OBJECTIVES:

1. To determine the effect of lime and gypsum in the soil upon leaching requirement of carbonate and sulfate irrigation waters and exchangeable sodium percentage of the soil.
2. To determine the relation of ionic composition of the soil solution to inorganic composition of barley and alfalfa when irrigating with carbonate and sulfate waters of moderate salinity.

A-006
2-1-65 The Effect of Irrigation Method, and Moisture and Fertility Levels Upon Maximizing Water-Use Efficiency and Quality Cotton Fiber Production

NMSU E. G. Hanson, Agricultural Engineering
B. C. Williams, Agronomist

OBJECTIVES:

1. To measure the amount of water which may be saved by minimizing evaporation with sub-irrigation as compared to surface irrigation practices.
2. To determine the influence of moisture level and fertility level on yield and quality of acala cotton.
3. To determine the influence of irrigation and fertilizer practices upon production of quality cotton fiber.
4. To determine a suitable design of a sub-irrigation system and recommended depths of placement for selected soils in New Mexico.

A-007
2-1-65 Inventory of Irrigated Areas and Determination of Consumptive Uses by Areas

NMSU D. C. Henderson, Economist

OBJECTIVES:

1. To prepare and publish maps of New Mexico illustrating (a) the location of the irrigated land in the state, and (b) show the water right status on these lands.

2. To prepare and publish maps of New Mexico showing the consumptive use of water in the various areas.
3. To compute and publish data on consumptive use by river basins in New Mexico.
4. To tabulate, analyze, and publish figures on the total available supplies of both ground and surface water by river basins and certain closed areas of New Mexico.

A-008
2-1-65 Hydrology of the Lower Rio Grande and Adjacent Intermontane Areas of New Mexico

NMSU W. E. King, Earth Science

OBJECTIVES:

1. To study the alluvial and bedrock geology as it is specificially related to groundwater conditions in the Lower Rio Grande Valley and adjacent Intermontane Areas.
2. To use the hydrogeologic information gained for better definition of aquifer systems.
3. To inventory all of the available subsurface information as a means of arriving at the above stated objectives.

A-009
2-1-65 Economics of Alternative Pricing Systems to Allocate Scarce Water Supplies

NMSU R. B. Long, Economist

OBJECTIVES:

1. To determine the present pattern of water use in the Portales Valley with respect to costs and economic benefits.
2. To develop a model pricing system for each user of water in the Portales Valley that could be used in the high plains area, in order to conserve water and encourage economic growth.

A-010
2-1-65 A Comparison of the Aquatic Beetles in the Five Major Watersheds of New Mexico with Speical Emphasis on the Family Dytiscidae

NMSU J. R. Zimmerman, Biologist

OBJECTIVES:

1. To compare species in the genera of the aquatic beetle family Dytiscidae in the five major watersheds of New Mexico. The comparison would attempt to show that the separate drainages serve as significant dispersal pathways and/or isolating barriers in the geographical distribution of the various species.

MATCHING GRANTS

B-001
8-1-65 Recreational Value of Water in the Major Reservoirs of New Mexico

NMSU J. R. Gray, Economist

OBJECTIVES:

1. To determine recreational demand schedules and demand price elasticities at Elephant Butte and Navajo reservoirs.
2. To measure the changes in demand schedules for the major recreational activities as reservoir levels change from one season to subsequent seasons.

B-002
9-1-65 Study of Socioeconomic Use of New Mexico's Thermal Waters

NMIMT K. Summers, Ground Water Geologist
W. E. Bertholf, Economist

OBJECTIVES:

1. To locate and inventory the physical and chemical properties of New Mexico's thermal waters.
2. To appraise the present and potential use-value of New Mexico's hottest thermal waters for geothermal power and the probable relationship of the jurisprudential doctrine of waste on such use.

1966

ANNUAL ALLOTMENT

A-011
7-1-66 U-Tube Aeration

NMSU R. E. Speece, Civil Engineering

OBJECTIVES:

1. To evaluate the parameters optimizing oxygen transfer by the U-Tube Aeration method.
2. To determine the amount of oxygen which can be transferred per horsepower-hour input to the system under optimum conditions.

MATCHING GRANTS

B-003
2-1-66 Gross Systems Analysis - Pecos Basin

NMSU J. W. Hernandez, Civil Engineering

OBJECTIVES:

1. To inventory the available water resources.
2. To inventory thw water resources information and literature available for the Pecos River in New Mexico.
4. To prepare a comprehensive research proposal designed to generate a decision-making, mathematical model which will permit the optimal redevelopment of the water resources of the basin.

B-005
7-1-66 Geohydrologic Factors Affecting Rate of Evaporation from Moist Playas

NMIMT F. B. Titus, Hydrologist

OBJECTIVES:

1. To evaluate the effectiveness of several hydrogeologic factors that control rates of evaporation. These factors include vertical permeability of the near-surface sediment to flow induced by hydraulic pressure gradient, capillary flow potential, evaporation potential from the soil surface for waters of differing salinities, and formation of a salt crust on the soil surface.

B-006
7-1-66 Resources Analysis of a Typical Overdrawn Basin in an Irrigated Semiarid Area - Pecos River Basin

NMSU H. R. Stucky, WRRI Director, Coordinator
J. W. Hernandez, Civil Engineering
R. Lansford, Agricultural Economist
H. E. Dregne, Soils
UNM N. Wollman, Economist
W. H. Ellis, Law
NMIMT C. E. Jacob, Hydrologist
K. Summers, Geologist

OBJECTIVES:

1. Determine the kind, scope, reliability, and availability of hydrologic, geologic, economic, agricultural, climatolgoical, meteorological, legal, engineering, political, and social data which are related to the water resources problems of the basin.
2. Develop an analysis of the surface and subsurface hydrologic systems by use of digital and analog computations using the techniques of systems analysis and linear programming.
3. Develop a mathematical decision-model for the design and operation of an overdeveloped water supply system, specificially the Pecos River System in New Mexico. This model could be used to generate an optimal plan for the reapportionment and management of the waters of this system.
4. Establish a preliminary economic land classification of the Pecos River Basin of New Mexico which would serve as a guide for present and future water use in the basin.
5. Develop a method of economic and legal analysis appropriate for a region in which surface and groundwaters must be administered with due regard to the legal rights and to maximization of a region's economic welfare.
6. To coordinate and compile the findings of the five principal areas into two basic studies: one on the soi-eco-legal factors and one on the physical factors. These two basic studies would then be combined into a single final report.

OTHER PROJECTS

5700-306
7-1-66 Water Requirements for Crop Production in the Roswell Underground Water Basin

NMSU R. R. Lansford, Economist
A. A. Baltensperger, Agronomist
R. S. Freeburg, Agricultural Engineer
W. J. Russell, Agronomist
C. E. Barnes, Agronomist

OBJECTIVES:

1. To assemble and analyze existing cropping patterns, water use, water quality, soil quality and crop yields for the Roswell Underground Water Basin.
2. To determine the water requirements by crops, by farms and the basin under various irrigation methods, efficiencies and cropping patterns.
3. To determine farm and basin income effects from various irrigation methods, efficiencies and cropping patterns.

OBJECTIVES:

1. To assemble and analyze existing cropping patterns, water use, water quality, soil quality and crop yields for the Roswell Underground Water Basin.
2. To determine the water requirements by crops, by farms and the basin under various irrigation methods, efficiencies and cropping patterns.
3. To determine farm and basin income effects from various irrigation methods, efficiencies and cropping patterns.

1967

ANNUAL ALLOTMENT

A-012
7-1-67 History of Water Utilization in New Mexico and the Southwest With Particular Reference to the Impact of Legal and Institutional Controls of Water Management

NMSU I. G. Clark, History

OBJECTIVES:

1. To trace historically the manner in which the various Southwestern cultures have approached this problem, with particular emphasis on the period following its acquisition by the United States.
2. To trace man's approach to effective water utilization from as many facets as possible, including such problems as the search for available water, the collecting and husbanding of water, varied customs and laws regarding water rights, technical advances, the use to which the available supply should be put, and conflicting philosophies regarding the approach to the subject and the means of implementing policies.

A-013
7-1-67 Nitrogen Removal from Natural Waters

NMSU R. E. Speece, Civil Engineer

OBJECTIVES:

1. To develop a reliable and economical method for removal of nitrogen from waters. This method of nitrogen removal is intended to be applied to: (1) effluents from wastewater treatment plants, (2) drinking water supplies for livestock, individual homes, municipalities, and industries and (3) surface impoundments.

A-014
7-1-67 Fluctuations in Water Droplet Evaporation Rates

UNM H. C. Bryant, Phsicist

OBJECTIVES:

1. To make an experimental study of water-droplet evaporation rates using a proven optical technique in which the droplet acts as an interferometer.

A-015
7-1-67 Solar Heating of Water to Very High Temperatures

NMSU M. H. Cobble, Mechanical Engineer

OBJECTIVES:

1. To extend the analysis in distilling fresh water from salt water by using a transparent slab to develop very high temperatures; and to solve the resulting equations, using complex methods and residue theory for temperature in the slab and temperature in the fluid.

MATCHING GRANTS

B-007
7-1-67 Determination of Sensitivity of United States Water Demand-Supply Models to Specified Changes in Conditions

UNM N. Wollman, Economist

OBJECTIVES:

1. To make revisions and extend U. S. Senate Select Committee Report No. 32 on National resources to more accurately analyze the "sensitivity" of water supplies and demands by river basins in the United States.

B-008
7-1-67 Irrigable Acreage in New Mexico and Projected Demand for Irrigation Water

NMSU M. L. Hanson, Agricultural Economist
D. C. Henderson, Agricultural Economist

OBJECTIVES:

1. To classify the irrigated and potentially irrigable land areas of New Mexico according to productivity of irrigated farming under assumptions of unlimited capital, labor and water.

2. To estimate the productivities of additional water supplies to maintain or increase irrigation development in all areas of the state when allocated to highest agricultural uses based on projected production coefficients, price relationships, and discount rates. The demands for irrigation water will be estimated in the context of economic development or growth.

1968

ANNUAL ALLOTMENT

A-016
7-1-68 Model Study to Predict Salt Distribution and Concentration of Water in Soil Profiles

NMSU J. F. Alfaro, Agricultural Engineer

OBJECTIVES:

1. To study the possibility of predicting the salt concentration curves from stratified soil profiles by using physical models.
2. To investigate the possibilities of predicting salt distribution, within uniform and nonuniform soil profiles, from effluent concentration curves.
3. To determine the effect of initial salt concentration of the soil solution, Cs, initial soil moisture content, i, salt concentration of irrigation water, Ciw, on the movement and distribution of salt within the soil profile and on the accuracy of the prediction.
4. To model soil profiles from the main saline affected areas of New Mexico to investigate their response to irrigation with various quality water.

A-017
7-1-68 Decision Models for Minimizing the Cost of Information or Error in Estimating Benefit-Water Relationships with Speical Applications to Irrigation

UNM d'Arge, Economist

OBJECTIVES

1. To develop a decision model or set of decision rules which under alternative "a priori" assumptions will minimize the cost of estimating net-benefit functions subject to specified degrees of accuracy.
2. To construct net benefit functions for several agricultural crops from secondary data and budgets for obtaining costs of information on benefits. The resulting estimates will be utilized to test systematically the applicability of alternative information decision rules, and to allow some degree of realism in interpretation.

3. To review recent developments in information theory and sequential sampling theory to determine if these methods offer alternative ways of solving the problem of high costs in net benefit estimation for agricultural crops.

A-018
7-1-68 Feasibility of Treating and Recycling Used Fish Hatchery Water

NMSU R. E. Speece, Civil Engineer

OBJECTIVES:

1. To develop an appropriate water treatment system which would restore the quality of used fish hatchery water for recycle. A process for removal of ammonia nitrogen and proteinaceous metabolites is needed.
2. To develop a means to prevent any disinfectant residual from carrying through in the finished recycle water.
3. To determine the set of conditions which would make recycle economically feasible.

A-019
7-1-68 Comparative Productivities of Small Bodies of Water in Desert a Montane Areas of Southern New Mexico

NMSU W. G. Whitford, Biologist

OBJECTIVES:

1. Determination of biomass and productivity of photo- and zooplankton during all seasons of the year.
2. To develop techniques for quantifying the role of these organisms in the energy relationships of the pond ecosystem.
3. To determine the role of rooted aquatics and determine the total biomass by harvesting and weighing.
4. To measure the rates of ingestion, egestion, respiration and efficiency of assimilation and growth.
5. To determine the role of the vertebrate top consumer by obtaining estimates of population density and structure.
6. Develop and analyze a model of energy relationships and trophic structure of small desert and montane ponds.

A-020
7-1-68 Development of a Froth Process for the Treatment of Sour Water

NMSU D. B. Wilson, Chemical Engineer

OBJECTIVES:

1. To develop a process for the removal of sulfur compounds from water, permitting the water to be subsequently used for either secondary oil recovery operations or other industrial applications.

MATCHING GRANTS

B-011
7-1-68 A Comprehensive Water Resources Analysis of a Typical Overdrawn Basin in an Irrigated Semiarid Area - Pecos River Basin, New Mexico

NMIMT	C. E. Jacob, Hydrologist
UNM	N. Wollman, Economist
	R. d'Arge, Economist
	W. Ellis, Law
NMSU	J. W. Hernandez, Civil Engineer
	R. R. Lansford, Agricultural Economist
	B. J. Creel, Agricultural Economist
	H. E. Dregne, Agronomist

OBJECTIVES:

1. Determine the kind, scope, reliability, and availability of hydrologic, geologic, economic, agricultural, climatological, meteorological, legal, engineering, political, and social data which are related to the water resources problems of the basin.
2. Develop an analysis of the surface and subsurface hydrologic systems by use of digital and analog computations using the techniques of systems analysis and linear programming.
3. Develop a mathematical decision-model for the design and operation of an overdeveloped water supply system, specificially the Pecos River System in New Mexico. This model would be used to generate an optimal plan for the reapportionment and management of the waters of this system.
4. Establish a preliminary economic land classification of the Pecos River Basin of New Mexico which would serve as a guide for present and future water use in the basin.
5. Develop a method of economic and legal analysis appropriate for a region in which surface and groundwaters must be administered with due regard to the legal rights and to maximization of a region's economic welfare.
6. To coordinate and compile the findings of the five principal areas into two basic studies; one on the soo-eco-legal factors and one on the physical factors. These two basic studies would then be combined into a single final report.

B-012
7-1-68 Patterns of Policy Making in Water Development

UNM H. Ingram, Political Scientist

OBJECTIVES:

1. To set up a model of how the political system in an arid western state responds to problems of water as a scarce natural resource.

2. To test the model for predictive accuracy and explanatory power of the propositions it generates. The propositions growing out of an adequate model of water policy making will generally order and explain specific policy decision.

B-013
7-1-68 A Comprehensive Analysis of the Tularosa Basin Saline Water Resources - Their Availability and Potential Economic Development

NMIMT W. K. Summers, Geologist

OBJECTIVES:

1. To define to the extent feasibile (a) the extent and volume of saline water of different ranges in concentration and (b) the ease with which saline water can be recovered; that is, the yield of wells and the reliability of the supply.
2. To make specific study of the hydrology of Lake Lucero and its relationship to the White Sands Monument in connection with the recreational aspect involved in this National Park area of the basin.
3. to determine the potential significance of these saline water resources to the basin and surrounding areas.

B-014
7-1-68 Irrigability Classification of New Mexico Lands as a Guide for Water Importation

NMSU J. U. Anderson, Agronomist

OBJECTIVES:

1. To classify the soils of New Mexico according to suitability for irrigation on the basis of soil survey information and accepted irrigability class standards.
2. To report distribution of the soils of the various irrigability classes and to identify the limitations of the various soil associations for irrigation.

OTHERS

C-1361 (II)
8-1-68 Soil and Water Management for Salinity Control

NMSU H. E. Dregne, Agronomist

OBJECTIVES:

1. To determine the amount of soluble salt movement in unsaturated soils.

2. To devise irrigation regimes that will minimize water requirements for maintaining a suitable salinity status of soils.
3. To reduce pollution of water supplies by soluble salts, including nitrates and phosphates.
4. To formulate equations to predict soluble salt movement in unsaturated soils.

5700-304 (OSW)
8-1-68 An Analysis of the Saline Water Resources of the Tularosa Basin

NMSU W. E. King, Geologist
H. R. Stucky, Economist
NMIMT C. E. Jacob, Hydrologist

OBJECTIVES:

1. To assemble pertinent information on the saline water resources of the Tularosa Basin, and make a summary report of the quantity and quality, and depths by location from available information.
2. Analyze the information secured under objective 1 and make a determination of the amount of additional information needed to permit an economic evaluation of New Mexico's total saline water resources.
3. To make specific study of the hydrology of Lake Lucero and its relationship to the White Sands Monument in connection with the recreational aspect involved in the National Park area.
4. Develop a prospectus on the potential uses by industry, recreation, and agriculture of the saline resources available in the basin as revealed following work on objectives 1, 2 and 3.
5. To outline research and investigations needed to secure an adequate inventory of the saline water resources and to determine the potential significance to the immediate areas surrounding the basin.

5700-305 (BR)
6-1-68 Research of the Possibilities of Biological Control of Tamarisk and Other Phreatophytes

G. Watts, Botany and Enthomology
C. R. Maier, Biology

OBJECTIVES:

1. To identify and obtain biological information on the species of insects and pathogenic organisms that attack the foliage, roots, stems and seeds of salt cedar.
2. To measure salt cedar growth and reproductive response to attack by selected species of insects and disease organisms, both separately and in combination.

ANNUAL ALLOTMENT

A-021
7-1-69 An Investigation of Primary Productivity and an Analysis of Nitrients in Elephant Butte Reservoir Using the 14^C Method

UNM G. V. Johnson, Biologist
D. E. Kidd, Biologist

OBJECTIVES:

1. Determination of primary productivity at various depths in Elephant Butte Reservoir throughout the year.
2. Determination of the species composition and number of producer organisms at various depths in Elephant Butte Reservoir throughout the year.
3. To determine the concentration of nitrates and phosphates in the waters.
4. To compare the productive capacity of Elephant Butte Reservoir to that of other lakes throughout the United States.
5. To establish primary productivity, population and nutrient concentration data for Elephant Butte Reservoir that may be compared in future studies of this lake as a base line to detect modification of this environment.

A-022
7-1-69 Applying Linear Programming Models for Estimating the Agricultural Demand Function for Water

UNM M. Gisser, Economist

OBJECTIVES:

1. To develop a linear programming model with which demand functions for water in agricultural areas can be generated. This model should be tested on a limited agricultural area for which data on agricultural production are available. The Pecos Area would be suitable for this test.

A-023
7-1-69 An NMR and Calorimetric Study of the Interactions Between Lanthanide Ions and Water

NMSU E. R. Birnbaum, Physicist

OBJECTIVES:

1. To develop a new procedure for determining the reaction of the various salts in water to metals.

A-024
7-1-69 Cloud Chamber Study of Water Evaporation

NMSU W. B. Good, Physicist

OBJECTIVE:

1. To develop the cloud chamber as a tool for the examination of parameters important to the study of evaporation of water.
2. To investigate the rate of evaporation of pure water as a function of various parameters, including temperature, pressure, molecular weight of gas environment, polar structure of the liquid contaminant, etc.
3. To establish a quantitative relationship between the evaporation rate and the various parameters.

MATCHING GRANTS

B-015
7-1-69 Irrigability Classification of New Mexico Lands as a Guide for Water Importation

NMSU J. U. Anderson, Agronomist

OBJECTIVES:

1. To complete the classification of the soils of New Mexico according to suitability for irrigation on the basis of soil survey information and accepted irrigability class standards.
2. To report distribution of the soils of the various irrigability classes and to identify the limitations of the various soil associations for irrigation.

B-016
7-1-69 An Analytical Interdisciplinary-Evaluation of the Utilization of the Water Resources of the Rio Grande in New Mexico

NMSU J. W. Hernandez, Civil Engineering
T. G. Gebhard, Civil Engineering
R. R. Lansford, Economist
B. J. Creel, Economist
C. Eastman, Sociologist
H. E. Dregne, Soils
NMIMT C. E. Jacob, Hydrologist
UNM S. Ben-David, Economist
W. Ellis, Law

OBJECTIVES:

1. To develop methodology and criteria which may make a major contribution to the efficient allocation, management and consumptive use of the water supply of the Rio Grande in New Mexico and to similar arid areas of the United States and the world.

2. To apply the newly developed techniques of several research disciplines in a coordinated and unified interuniversity project to the present and future management and allocation of water in New Mexico.
3. To establish a set of alternative goals and to develop and analyze alternative designs which may be used to achieve these alternative goals.
4. To determine the water use pattern which would evolve as a result of the selection of alternative goals.
5. To project the pattern of agricultural development or decline assuming specific goals, population growths, and increasing or decreasing water supplies.
6. To analyze the social, economic, political and legal characteristics of the area and to project the impact of selected alternative goals of these factors.

B-017
7-1-69 Estimation of Capital-Water Elasticities of Substitution in United States Manufacturing

UNM R. d'Arge, Economist
L. M. Falkson, Economist
F. L. Brown, Economist

OBJECTIVES:

1. To develop, using econometric methods, estimates of elasticities of substitution between capital investment and water loss for varying water qualities, for selected SIC industrial groups, and for selected water resources regions and states.
2. To construct specific mathematical relationships of the production function type between vectors embodying dimensions on water and investment.

C-1630 (II)
8-1-69 Soil and Water Management for Salinity Control - Phase II

NMSU P. J. Wierenga, Agronomist

OBJECTIVES:

1. To determine the magnitude and nature of soluble salt movement in unsaturated soils.
2. To devise irrigation regimes that will minimize water requirements for maintaining a desired salinity level in soils.
3. To reduce pollution of groundwater supplies by soluble salts, including nitrates and phosphates.
4. To develop computer simulation programs for predicting salt movement under unsaturated flow conditions in soils.

ANNUAL ALLOTMENT

A-025
7-1-70 Estimation of Capital - Water Elasticities of Substitution in U. S. Manufacturing

UNM F. L. Brown, Jr., Economist

OBJECTIVES:

1. To develop reliable estimates of capital investment, water losses, water recirculation rates, and output classified according to water resource region, state (when possible) and SIC industry.
2. To analyze alternative mathematical formulations of manufacturing production functions leading to statistically reliable estimates of the elasticities of substitution in manufacturing between water and capital in the various regions and industries.
3. To interpret the results of 2) with respect to the formulation of suggested policy implications for such problems as pollution abatement.

A-026
7-1-70 The Impact of Water Technology on the History of New Mexico.

NMIMT P. W. Christiansen, Humanities

OBJECTIVES:

1. To collect data throughout the state of New Mexico to determine the level of technology applied to the quest for or the development of water, and to determine the scientific principles applied, consciously or unconsciously.
2. To review the evolution of scientific ideas in the field of geology, blending this into the more specialized and modern fields of hydrology and groundwater hydrology, and to measure the impact of these ideas upon the history of water resource development in New Mexico.
3. To integrate the data collected regarding technology and levels of application with the scientific patterns into a synthesis of the historic impact of these areas upon the State of New Mexico.

A-027
7-1-70 Utilization of Water in a Semi-Arid Region - No. P-1

NMSU H. D. Fuehring, Agronomist.

OBJECTIVES:

1. To develop a system of water concentration whereby the normal rainfall of the High Plains area would be sufficient

for dependable dryland cropping thereby resulting in more efficient utilization of rain water.
2. To determine the size and shape of micro-watersheds and growing beds needed for most efficient water utilization and to develop a formula relating the optimum combination of watershed and growing bed to the average rainfall pattern and soil conditions of an area.

A-028
7-1-70 Simulation of Coupled Leaky Aquifers and A Surface-Water System

NMIMT Z. A. Saleem, Hydrologist

OBJECTIVES:

1. To develop and establish techniques for the simulation of complex coupled leaky aquifers and a surface-water system on digital and hybrid computers for the identification and verification of the parameters of the aquifers in order to validate the optimal management models.
2. To investigate and evaluate the response of the complex flow system to cyclic pumping operations and programming of efficient pump cycle schedules for the optimal utilization of groundwater. Results of the theoretical analysis are to be applied to Roswell groundwater basin in New Mexico.

A-029
7-1-70 Bioassays of Quality in Water Resources of Major Importance to New Mexico

NMSU G. S. Smith, Animal, Range and Wildlife Sciences

OBJECTIVES:

1. To survey the major water resources of New Mexico and characterize them in terms of quality for usage by ruminant and non-ruminant animals, including humans.
2. To identify water resources with potential hazards to animal and human health; and,
3. To derive quantitative relationships from the data by which effects (both harmful and beneficial) from various combinations of chemical constituents can be identified in terms of animal performance.

A-030
7-1-70 Environmental Controls on Groundwater Chemistry: I. The Effect of Phreatophytes

NMIMT F. B. Titus, Hydrologist

OBJECTIVES:

1. To determine the distribution and concentration of soluble salts in groundwater beneath a shallow water table under conditions of consumptive use by phreatophytes.

3. To investigate the relative influence of dispersion/ diffusion versus lateral groundwater flow in removing the concentrated water from the water table zone.
4. To determine whether monitoring of water levels and water chemistry in a single piezometer nest, or a group of nests, will allow calculation of transpiration

MATCHING GRANTS

B-019
7-1-70 An Analytical Interdisciplinary Evaluation of the Utilization of the Water Resources of the Rio Grande in New Mexico

NMSU	T. G. Gebhard, Civil Engineer
	R. R. Lansford, Economist
	B. J. Creel, Economist
	C. Eastman, Sociologist
	W. C. Arnwine, Industrial Engr.
NMIMT	W. Brutsaert, Hydrologist
UNM	S. Ben-David, Economist
	W. H. Ellis, Law
	W. Parr, Law
	J. Borrego, Architect

OBJECTIVES:

1. To rank alternative water uses on the basis of economic and social efficiencies to the regions of the Rio Grande Basin in New Mexico.
2. To determine the changes in water-use patterns which could evolve as a result of various selections between water use alternatives.
3. To analyze the effects of selection between alternative water-use patterns on the physical, social, economic, political and legal characteristics of the area.
4. To evaluate the social and economic costs of irrigated agricultural growth or decline on the basis of changing water supplies, population, and alternative uses of water.
5. To evaluate the social and economic needs of the population for water-based recreation in the Rio Grande Basin of New Mexico.
6. To construct a model of the interchange between groundwater and surface-water on various reaches of the Rio Grande.
7. To evaluate management alternatives on the control of sediment discharge.
8. To construct quality of water models for the Rio Grande in order to properly evaluate the effects of management decisions on water quality.
9. To determine the quality degradation characteristics of various existing and potential users of waters of the system and to establish the cost-effectiveness of these uses by computing the costs of treating and/or disposing of the waste-water from these uses.

B-021 (027)
7-1-70 A Comparison of Rates of Water Loss Through Transpiration of Several Southern New Mexico Phreatophyte Species

NMSU G. L. Cunningham, Biologist

OBJECTIVES:

1. To develop regression models which will allow quantitative predictions of the rates and amounts of water loss through transpiration for several phreatophyte species occuring in the Rio Grande valley of southern New Mexico.

B-025
7-1-70 Management of Replacement Flows in Agricultural Areas

UNM M. Gisser, Economist

OBJECTIVES:

1. To provide a workable model which will help the government to manage the supply of replacement water flows in order to avoid the cost of fluctuations in the use of improved water.

OTHER

C-2165 (II)
8-1-70 Soil and Water Management for Salinity Control

NMSU P. J. Wierenga, Agronomist

OBJECTIVES:

1. To determine the magnitude and nature of soluble salt movement in unsaturated soils.
2. To devise irrigation regimes that will minimize water requirements for maintaining a desired salinity level in soils.
3. To reduce pollution of groundwater supplies by soluble salts, including nitrates and phosphates.
4. To develop computer simulation programs for predicting salt movement under unsaturated flow conditions in soils.

GLM-308 (EPA)
9-1-70 Quality and Quantity of Return Flow as Influenced by Trickle and Surface Irrigation

NMSU P. J. Wierenga, Department of Agronomy
T. C. Patterson, Agricultural Engineering

OBJECTIVES:

1. To determine, under surface and trickle irrigation management practices, the effects of amount and frequency of irrigation water application on water and solute movement in field soil profiles during three successive irrigation seasons, and the feasibility of minimizing percolation losses by trickle irrigation.

3109-114 (S)
12-1-70 Tritium as a Tool in the Determination of Hydrologic Parameters in the Roswell Basin

NMIMT G. W. Gross, Geoscience

OBJECTIVES:

1. To evaluate tritium fractionation by exchange with minerals, and the isotopic exchange rate by means of column flow experiments.

3109-115 (S)
12-1-70 History of the Water Utilization in New Mexico and the Southwest--With Particular Reference to the Impact of Legal and Institutional Controls on Water

NMSU I. G. Clark, History

OBJECTIVES:

1. To write the history of water law and its administration in New Mexico.

3109-116 (S)
7-1-70 Bioassays of Quality in Water Resources of Major Importance to New Mexico

NMSU G. S. Smith, Animal, Range and Wildlife Sciences

OBJECTIVES:

1. To survey the major water resources of New Mexico and characterize them in terms of quality for usage by ruminant and non-ruminant animals, including humans.
2. To identify water resources with potential hazards to animal and human health; and,
3. To derive quantitative relationships from the data by which effects (both harmful and beneficial) from various combinations of chemical constituents can be identified in terms of animal performance.

ANNUAL ALLOTMENT

A-031
7-1-71 The Development and Field Testing of School Learning Materials on Water Problems of New Mexico and Southwest

NMSU Chris Buethe, Education

OBJECTIVES:

1. To determine the present state of knowledge and feeling about specific water concepts on the part of three distinct groups of learners.
2. To produce tested learning packages for utilization by these learners. Each learning package is based upon a hierarchy of water concepts and problems identified by the project advisors and revealed by literature on the state of the art.

A-032
7-1-71 A Technico-Economic Feasibility Study of Thermal Pollution Abatement by Adiabatic Degassing

NMSU D. B. Wilson, Chemical Engineering

OBJECTIVES:

The objective of the proposed research is to evaluate the economic feasibility of thermal pollution reduction through adiabatic degassing of water streams. Three water streams will be considered:
1. Sea water which has been used to absorb SO_2 from power plant stack gas;
2. Sour (H_2S) water which has been generated either in normal refinery operations or has been produced from natural supplies and;
3. Sewage effluent containing ammonia.

A-033
7-1-71 A Method of Demineralization Using Strongly Basic Ion Exchange Resins

NMSU W. S. Midkiff, Civil Engineering

OBJECTIVES:

1. To investigate the characteristics of various strong base resins to determine if these characteristics are specific or general.

2. To compare strong and weak base resins.
3. To apply objective No. 2 to ion exchange of marginally salty ground waters.

A-034
7-1-71 Pollution Studies of the Regional Ogallala Aquifer at Portales, New Mexico

ENMU R. G. Taylor, Biological Sciences

OBJECTIVES:

1. To examine the regional Ogallala Aquifer at Portales, New Mexico for chemical and biological pollution.

A-035
7-1-71 A Proposal to Study Phosphate Induced Algal Growth in Order to Suppress or Eliminate this Phenomena

UNM N. E. Vanderborgh, Chemistry

OBJECTIVES:

1. To conduct a theoretical analysis of the problem of phosphate-induced algae growth.
2. To determine which phosphate or polyphosphate or combination of phosphates offers optimum inducement for algae growth.
3. To determine the activation energy for the growth process.
4. To compare activation rates with calculable or known values and identify mechanism for phosphate-induced algal growth.
5. To postulate a mechanism for this process.

A-036
7-1-71 Inventory of Water Diversions and Rite Structure for Cities, Towns and Villages in New Mexico.

NMSU A. Randal, Agricultural Economics

OBJECTIVES:

1. To develop a current inventory of water diversions and rate structures for cities, towns and villages in New Mexico

A-037
7-1-71 Tritium as a Tool in the Determination of Hydrologic Parameters in the Roswell Basin

NMIMT G. W. Gross, Geoscience

OBJECTIVES:

1. To obtain experimental information about the interaction of tritium with the aquifer materials of the Roswell basin.

MATCHING GRANTS

B-026
7-1-71 An Analytical Interdisciplinary-Evaluation of the Utilization of the Water Resources of the Rio Grande in New Mexico

NMSU	R. R. Lansford, Economist
	B. J. Creel, Economist
	T. G. Gebhard, Civil Engineering
	J. W. Hernandez, Civil Engineering
UNM	S. Ben-David, Economist
NMIMT	W. Brutsaert, Hydrologist

OBJECTIVES:

1. To identify the set of primary regional goals to be achieved through the utilization of the water resources of the Rio Grande; a set of goals that may be used in the planning of the future use of all of the resources of the basin.

B-029
7-1-71 Utilization of Water in a Semi-Arid Region

NMSU H. D. Fuehring, Agronomist

OBJECTIVES:

1. To develop a system of water concentration whereby the normal rainfall of the High Plains area would be sufficient for dependable dryland cropping thereby resulting in more efficient utilization of rain water.
2. To determine the size and shape of micro-watersheds and growing beds needed for most efficient water utilization and to develop a formula relating the optimum combination of watershed and growing bed to the average rainfall pattern and soil conditions of an area.

B-032
7-1-71 Analysis of Water Characteristics of Manufacturing Industries and their Adaptability to Semi-Arid Regions

NMSU	W. C. Arnwine, Industrial Engineer
UNM	S. Ben-David, Economist

OBJECTIVES:

1. To isolate and separate the water connected characteristics of manufacturing firms from the overall question of the

desirability of the firm's locating in a semi-arid region and seek to make operational judgments about the relative abilities of the various industries to adjust to the water use conditions of such a region.

2. To study the interaction among the three factors (effluent, withdrawal and consumptive use of water), e.g., increased reuse of water and consequent withdrawal demand usually implies a higher concentration of pollutants in the final effluent of the firm.

OTHER

3109-120 (S)
7-1-71 Hydrologic-Nutrient Cycle Interactions in Undistrubed and Man-Manipulated Ecosystems (Watersheds)

UNM J. R. Gosz, Biologist

OBJECTIVES:

To understand mineral cycling and stream water chemistry of watershed ecosystems as influenced by:

1. Vegetational communities
2. Climatic conditions
3. Weathering of soil minerals
4. Man

3109-121 (S)
7-1-71 Environmental Controls on Groundwater Chemistry in New Mexico: I. The Effect of Phreatophytes

NMIMT F. B. Titus, Hydrologist

OBJECTIVES:

1. To determine the distribution and concentration of soluble salts in groundwater beneath a shallow water table under conditions of consumptive use by phreatophytes.
2. To investigate the hypothesis of seasonal, cycle variation in this concentration.
3. To investigate the relative influences of dispersion/diffusion versus lateral groundwater flow in removing the concentrated water from the water table zone.
4. To determine whether monitoring of water levels and water chemistry in a single piezometer nest, or a group of nests, will allow calculation of transpiration.

3109-122 (S)
7-1-71 A Study of the Effects of Contaminants from Birds on the Chemical and Biological Character of Rio Grande Water

NMIMT D. K. Brandvold, Chemistry
J. A. Brierley, Biology
C. J. Popp, Chemistry

OBJECTIVES:

1. To study the effects of Contaminants from Birds on the Chemical and Biological Character of Rio Grande Water

3109-123 (S)
7-1-71 Analysis of Mercurials in Elephant Butte Reservoir

UNM J. Garcia, Biology
D. Kidd, Biology

OBJECTIVES:

1. To determine the concentration of mercurials in water, sediments, and trophic levels of Elephant Butte Reservoir.
2. To determine the extent to which primary productivity may be inhibited by mercurials.

3109-124 (S)
7-1-71 Measurement of Groundwater Flow Using an In-Situ Therman Probe

NMIMT M. A. Reiter, Geoscience
A. R. Sanford, Geoscience

OBJECTIVES:

1. To build the thermal probe and test it in the Rio Grande valley near Socorro where rate of flow has been or can be determined by conventional procedures.

3109-125 (S)
7-1-71 Water as a Limiting Factor in Indian Economic Development

UNM S. Ben-David, Economics
J. Borrego, City and Regional Planner
F. Lee Brown, Economics

OBJECTIVES:

1. To estimate the effect of water availability on the economic welfare of the Southwest Indian nations, with major emphasis on the Pueblo communities in New Mexico.
2. On the basis of the information obtained under objective (1) determine the feasibility of implementing changes in water use on Indian lands and the economic effects of such changes.

ANNUAL ALLOTMENT

A-038
7-1-72 Chemical and Biological Character of Rio Grande Water in the Bosque Del Apache Wildlife Refuge

NMIMT D. K. Brandvold, Dept. of Chemistry
J. A. Brierly, Dept of Biology
C. J. Popp, Dept. of Chemistry

OBJECTIVES:

1. To study the effects of a waterfowl refuge on water quality by monitoring the physical, chemical, and biological character of the water in the Bosque del Apache Wildlife Refuge along the Rio Grande in Socorro County, New Mexico.

A-039
7-1-72 Hydrologic Nutrient Cycle Interactions in Undisturbed and Manipulated Ecosystems (Watersheds)

UNM J. R. Gosz, Dept. of Biology

OBJECTIVES:

1. To understand the mineral cycling and stream water chemistry of forested watersheds in New Mexico as influenced by vegetational communities, climatic conditions, weathering of soil minerals, and man.

A-040
7-1-72 Analysis of Nutrient Supplies for Algae in Elephant Butte Reservoir and an Analysis of Mercurials in the Elephant Butte Ecosystem

UNM G. V. Johnson, Biologist
D. E. Kidd, Biologist

OBJECTIVES:

1. To determine the conditions limiting algae growth in Elephant Butte Reservoir.

A-041
7-1-72 Water Resource Problems and Research Needs of New Mexico

NMSU B. J. Creel, Economist

OBJECTIVE:

1. To inventory federal, state, and local agencies, institutions, and organizations interested in water

resources research to determine the State water research needs and problems, and to establish a priority ranking of the needed resources research.

A-042 (044)
7-1-72 Measurement of Groundwater Flow Using an In-Situ Thermal Probe

NMIMT M. A. Reiter, Dept. of Geosciences
A. R. Sanford, Dept. of Geosciences

OBJECTIVES:

1. To determine rates of groundwater flow using an in-situ thermal probe with a full-scale califration of probes and determination of probe response under various conditions.

MATCHING GRANTS

B-037
7-1-72 An Interdisciplinary Analysis of the Water Resources of the High Plains of New Mexico

NMSU R. R. Lansford, Dept. of Agricultural Economics
B. J. Creel, Water Resources Research Institute
NMIMT W. Brutsaert, Dept. of Geosciences
F. B. Titus, Dept. of Geohydrology

OBJECTIVES:

1. To estimate availabilities and interchange of ground water and surface water in the High Plains by mathematical model analysis.
2. To simulate current and future optimal water use for irrigated agricultural and other uses (industrial, domestic, and recreational) through parametric programming.

B-038
7-1-72 Aquifer Parameters by a Chemical Tracer Technique

NMIMT A. Mercado, Dept. of Geosciences
G. K. Billing, Dept. Geosciences
G. W. Gross, Dept. of Geophysics

OBJECTIVES:

1. To develop a mathematical model so that it is capable of reproducing more faithfully actual aquifer conditions.
2. To investigate the effect of physical and chemical variables (such as discharge rates, grain size distribution, effective pore area, cation exchange) on the dissolution process.
3. To investigate the usefulness of this method as a tracing technique by applying it to the Roswell Basin in southeastern New Mexico.

OTHER

3109-133 (S)
7-1-72 Preliminary Evaluation of Professor C. E. Jacob's Contributions in the Field of Water Resources of New Mexico

NMIMT W. Brutsaert, Dept. of Geosciences

OBJECTIVES:

1. To evaluate the late Professor C. E. Jacob's works related to the field of water resources leading to the eventual publication of his contributions.

3109-134 (S)
7-1-72 Cropland Uses and Agricultural Water Depletions in New Mexico

NMSU R. R. Lansford, Dept. of Agricultural Economics

OBJECTIVES:

1. To inventory irrigated cropland acreage and sources of water used for irrigation in New Mexico, by county.
2. To obtain accurate estimates of the amounts of acreage that are planted, follow, idle, and diverted.

3109-136 (S)
7-1-72 Prediction of the Quality of Irrigation Return Flow

NMSU P. J. Wierenga, Dept. of Agronomy

OBJECTIVES:

In order to predict the effects of management practices on the quality of irrigation return flow, it is necessary to develop computer models which describe the quantity and quality of subsurface return flow. Such models should be capable of handling reactions during the non-steady flow of water through soils. The objectives of this research, which is being continued from last year, are:

1. To develop a computer simulation model for predicting the quality of irrigation return flow; and
2. To test the computer model under field conditions on measurement of the quality and quantity of return flow.

C-4060 (II)
9-1-72 Reduction of Peak Water Consumption in Urban Areas

NMSU D. J. Cotter, Dept. of Horticulture
D. B. Croft, Director, Dove Learning Center
J. W. Clark, Director, Water Resources Research Inst.
B. R. Corley, Dept. of Horticulture

OBJECTIVES:

1. To measure water application of existing landscapes which represent a range of water utilization.
2. To evaluate existing techniques which have potential for water conservation (e.g., mulching with decorative bark, rock material, and the use of xerophytic plants).

1973

ANNUAL ALLOTMENTS

A-043
7-1-73 Predicting Consumptive Water Use with Climatological Data

NMSU E. G. Hanson, Agricultural Engineering
E. J. Gregory, Agricultural Experiment Station

OBJECTIVE:

1. To determine the quantity and rate of moisture depletion by consumptive use throughout the growing season of selected crops grown in San Juan and Dona Ana Counties, New Mexico.

A-045
7-1-73 Analysis of Alternative Water Use Futures for the Rio Grande Region in New Mexico

NMSU R. R. Lansford, Dept. of Agricultural Economics
T. G. Gebhard, Jr., Dept. of Civil Engineering
B. J. Creel, Dept. of Agricultural Economics
UNM S. Ben-David, Dept. of Economics

OBJECTIVES:

1. To utilize a socioeconomic model developed under an earlier study on the Rio Grande Region to analyze the effects of alternative population growths, interregional transfers of water, alternative industrial water-use patterns, and alternative patterns of per capita consumption of water upon the water resources of the Rio Grande Region.

A-046
7-1-73 The Determination of Contents and Origin of Lead in Surface and Ground Waters of Northeastern New Mexico

NMHU S. Maestas, Dept. of Chemistry
A. F. Gallegos, Special Services for Disadvantaged Students

OBJECTIVES:

1. To study the distribution, origin, and ultimate fate of lead in surface and ground water systems in northeastern New Mexico.

2. To assess the effect of the metal on aquatic systems, and determine the rate at which lead contamination of waters in this remote region is increasing.

A-047
7-1-73 Improved Wastewater Treatment in Arid Areas

NMSU W. A. Barkley, Dept. of Civil Engineering

OBJECTIVES:

1. To obtain a recommended procedure for use of hydrolyzed aluminum ion-polyelectrolyte flocculant agents (coagulants) in colloidal destabilization processes.
2. To define the chemical mechanism operating in dual coagulant systems.

A-048
7-1-73 Calcium Carbonate Equilibria in Soils and Irrigation Waters

NMSU G. A. O'Connor, Dept. of Agronomy

OBJECTIVES:

1. To develop chemical equations to describe the calcium carbonate-carbon dioxide-water system in irrigation waters and soil sollutions.
2. To model the tested against data from calcareous soils irrigated with waters of various compositions and against calcium carbonate solubility data in irrigation water alone.

MATCHING GRANTS

B-040
7-1-73 Water Use and Urban Development in the Albuqueruqe, New Mexico, S.M.S.A.: A Study of User Practices, Attitudes, and Priorities

NMSU P. A. Lupsha, Dept. of Political Sciences
UNM D. P. Schegel, Dept. of Architecture

OBJECTIVES:

1. To clarify the relationship of water use to land use in the Albuquerque, New Mexico, S.M.S.A. (Standard Metropolitan Statistical Area): it will identify major consumers and consumer categories and provide an effective tool for the evaluation of change in land use in terms of water consumption.
2. To assess information, practices, attitudes, and goals of a representative sample of water consumers.
3. To state the dynamics of the present situation and to develop a key to the acceptable paths of change.

B-041
7-1-73 Application of Environmental Tritium in the Measurement of Recharge and Aquifer Parameters in a Simi-Arid Limestone Terrain

NMIMT G. W. Gross, Dept. of Geoscience

OBJECTIVES:

1. To develop tritium tracing methods further and extend them into the central (Artesia) and southern (Carlsbad) sub-regions of the Roswell groundwater basin.

OTHER

3109-145
7-1-73 The Impact of Water Quality Standards on Water Utilization in the Rio Grande Basin of New Mexico

UNM S. Ben-David, Dept. of Economics
W. Schulze, Dept. of Economics
NMIMT W. Brutsaert, Dept. of Hydrology

OBJECTIVES:

1. To investigate the impacts of surface water quality standards on various aspects of water use.
2. To project the effects of these standards to ascertain the least cost solutions for achieving a given level of environmental quality over time.

3109-146
7-1-73 Stream Organics to Evaluate Land Management

UNM J. R. Gosz, Dept. of Biology
M. L. Barr, Dept. of Biology

OBJECTIVES:

1. To evaluate the quality and quantity of organics from different vegetation types, and will evaluate any changes in surface water organics as a result of watershed management procedures in the Tesuque watersheds.

3109-147
7-1-73 Sources of Groundwater Contamination in the Ogallala Aquifer of Eastern New Mexico

ENMU R. G. Taylor, Dept. of Biological Sciences
T. W. Russell, Dept. of Chemistry

OBJECTIVES:

1. To examine the effects of agricultural activities and hydrologic characteristics on the water quality of the Ogallala Aquifer.

3109-151 (159)
7-1-73 Development of a Colorado River-Great Basin Regional Framework for Water Research

3109-152 (160)
7-1-73 Systematic Analysis of Priority Water Resources Problems to Develop a Comprehensive Research Program for the Southern Plains and Gulf Basins Region

NMSU J. W. Clark, Director, Water Resources Research Inst.
G. E. Carruthers, Acting Director, Water Resources Research Institute
T. G. Bahr, Director, Water Resources Research Inst.

OBJECTIVES:

The continental United States has been divided into seven study areas for purposes of regional analyses of water research problems and priorities. New Mexico is involved in two of these studies: the Southern Plains and Gulf Basins Region, and the Colorado River and Great Basin Region.

In both studies the State water research institute will work with agencies of federal, state, and local government, water user organizations, and concerned citizens. Analysis of problems will be accomplished through workshops involving scientists and professionals knowledgeable in the field of each problem. This will result in a water research framework which identifies the principal problems to be solved within each region, potential alternative solutions and combinations of alternatives for solving those problems, and knowledge gaps (research tasks) which need to be filled before viable alternative solutions can be implemented. Specific research tasks which must be accomplished to produce the required new knowledge will then be established, along with a schedule of timing, insofar as possible, for each research task in order to coordinate with expected implementation schedules.

1974

A-049
7-1-74 Protein Production by Russian Thistle: Effect of Water and Nitrogen on Protein Yields

NMSU J. H. Hageman, Dept. of Chemistry
J. L. Fowler, Dept. of Agronomy

OBJECTIVES:

1. To study the effects of irrigation management and nitrogen application on the water use efficiency and nitrative value of russian thistle.

A-050
7-1-74 Effect of Chili Wastewaters on Sewage Treatment Biological Processes

NMSU W. J. Barkley, Dept. of Civil Engineering

OBJECTIVES:

1. To gain reliable information on the effect of chili waste on a completely mixed activated sludge waste water treatment process.

A-051
7-1-74 Use of Brackish Water for Coal Gasification

NMSU D. B. Wilson, Dept. of Chemical Engineering

OBJECTIVES:

1. To examine salt deposition when brackish water is used in a coal gasification reaction.

A-052
7-1-74 Migration and Survival of Enteric Viruses in Soil and Groundwater

NMSU R. T. O'Brian, Dept. of Biology

OBJECTIVES:

1. To study the survival characteristics of human interoviruses in groundwater of the lower Rio Grande.
2. To study migration of viruses through soils, virus adsorption to soil, and virus survival in the soil environment.
3. To determine the microbiological quality of groundwater in the lower valley.

A-053
7-1-74 Trophic Status of Selected Northern New Mexico Lakes

UNM G. V. Johnson, Dept. of Biology
L. L. Barton, Dept. of Biology

OBJECTIVES:

1. To examine conditions which preceed algal blooms, to characterize the blooms.
2. To examine the role of bacteria in the production of algal blooms, and to explore the use of bacteria to indicate trophic level.

A-054
10-1-74 Feedlot Runoff and Sewage Effluents as Potential Water Pollutants with Emphasis on Nitrogen and Phosphate Levels and Oxygen Depletion

NMIMT D. Brankvold, Chemistry Department
J. Brierley, Biology Department

OBJECTIVES:

1. To measure the effects of a sewage plant and feedlot on dissolved oxygen levels and BOD values of a small drainage ditch.
2. To determine the nitrogen contribution of the above and what chemical forms of nitrogen are present.
3. To assay the effect of the drainage ditch on the water quality of the main diversion canal.
4. To evaluate the storm runoff water from the feedlot as to probable harmful effects.
5. To carry out a characterization of microorganisms present and to use this as a means of identifying input source.

MATCHING GRANTS

B-046
1-1-74 Regional Water Management with Full Consumptive Use

NMSU R. R. Lansford, Dept. of Agricultural Economics
UNM S. Ben-David, Dept. of Economics
TEXAS A&M J. W. Adams, Dept. of Agricultural Economics
L. L. Jones, Dept. of Agricultural Economics
W. L. Trock, Dept. of Agricultural Economics
S. Stewman, Dept. of Sociology and Anthropology
C. Shun Shih, Dept. of Industrial Engineering
D. L. Reddel, Dept. of Agricultural Economics

OBJECTIVES:

1. To evaluate the social and economic impacts of alternative water-uses policies by employing a socio-economic analysis for the evaluation of alternative water-use patterns in the regional economic development.

B-048
7-1-74 Chemical Dynamics of a Confined Aquifer

NMIMT V. LeFebre, Dept. of Physics

OBJECTIVES:

1. To develop a mathematical model which describes the origin, transport, and discharge of the chemical substances found in the groundwater flowing through the confined Roswell aquifer.

B-053
7-1-74 Terrestrial Contribution of Nitrogen to Stream Water in Managed and Undisturbed Forested Watersheds

UNM J. R. Gosz, Dept. of Biology

OBJECTIVES:

1. To understand the physical mechanisms responsible for the release of organic N, NO_3-, and NH_4+ from terrestrial ecosystems to streams.

OTHER

3109-143 (S)
7-1-74 Evaluation of Deep Groundwater for Future Use by the Coal Industry in the Central San Juan Basin, New Mexico

NMIMT J. W. Shomaker, Geologist
R. C. Lease, Geologist
F. E. Kottlowski, Senior Geologist
W. W. Kelly, Editor and Geologist
W. E. Arnold, Scientific Illustrator

OBJECTIVES:

1. To evaluate the availability of groundwater in the San Juan Basin.
2. To make an economic assessment of the potential groundwater development.

3109-401 (BEF)
9-1-74 Feasibility Study for Establishment of an Energy Water Complex in the Tularosa Basin

NMSU R. R. Lansford, Dept. of Agricultural Economics
W. D. Gorman, Dept. of Agricultural Economics
T. H. Stevens, Dept. of Agricultural Economics
B. J. Creel, Dept. of Agricultural Economics
R. J. Supalla, Dept. of Agricultural Economics
D. B. Wilson, Dept. of Chemical Engineering
NMIMT L. Gelhar, Dept. of Geosciences
A. R. Sanford, Dept. of Geosciences
UNM S. E. Logan, Dept. of Chemical and Nuclear Engineering
R. Mead, Dept. of Chemical and Nuclear Engineering
W. Schultz, Dept. of Economics
F. Roach, Dept. of Economics
S. Ben-David, Dept. of Economics

OBJECTIVES:

1. To obtain a preliminary evaluation of the economic feasibility for a proposed nuclear desalting complex

in the Tularosa basin of New Mexico producing 2,000 megawatts of electricity and desalting a half-million acre-feet of saline groundwater.

3109-201
7-1-74 Trickle Irrigation of Cotton for Optimizing Water Use Efficiency and Energy Conservation

NMSU P. Wierenga, Dept. of Agronomy
J. Fowler, Dept. of Agronomy

OBJECTIVES:

1. To determine the long term effects of the use of trickle irrigation in combination with minimum tillage on crop yields, water use and energy consumption

3109-202
7-1-74 Regional Water Management with Full Consumptive Use, Economic-Environmental Relations

NMSU R. R. Lansford, Agricultural Economics

OBJECTIVES:

1. To estimate the economic-environmental relationships among types of water pollutants and the cost of reducing of pollutants for output each sector of the economy.

2. To project economic growth and estimate the impact of this growth on the amount, type, and costs of reducing projected water pollutants.

1975

A-055
7-1-75 A Geochemical and Hydrological Investigation of Groundwater Recharge in the Roswell Basin of New Mexico

NMIMT L. W. Gelhar, Geoscience Department
G. W. Gross, Geoscience Department

OBJECTIVES:

1. To investigate selected observation wells, flowing wells, springs, and surface streams in the recharge area of the Roswell basin with the purpose of determining the sources of recharge, their distribution in time and space, the infiltration transmit time, and favored infiltration routes.

A-056
7-1-75 Minimizing the Salt Burden of Irrigation Drainage Water in the Pecos Valley of New Mexico

NMSU G. A. O'Connor, Dept. of Agronomy

OBJECTIVES:

1. To evaluate the effect of minimized leaching on soil solution and drainage water salinities.
2. Evaluate the effect of minimized leaching on soil permeability and soil $CaCO_3$ and $CaSO_4 \cdot 2H_2O$ contents.
3. Evaluate the effect of minimized leaching and resultant increased soil salinity on selected crops common to the Pecos Valley.

MATCHING GRANTS

B-054
7-1-75 Predicitng Consumptive Use with Climotological Data

NMSU E. G. Hanson, Agricultural Engineering
T. W. Sammis, Agricultural Engineering

OBJECTIVES:

1. To determine the quantity and rate of moisture depletion by consumptive use throughout the growing season of selected crops grown in Eddy.
2. To concurrently measure pan evaporation, temperature, solar radiation, precipitation, wind movement, and humidity at the sites where consumptive use is being determined.
3. To use these data to refine the coefficients used presently in the Blaney-Criddle method and extend the application of this formula in consumptive use estimates.
4. To examine other methods of estimating consumptive use of irrigated crops such as methods developed by Christiansen, Jensen-Haise, Penman, and others.
5. To publish and make available the above assembled data.

OTHER

3109-203
7-1-75 History of the Elephant Butte Irrigation District

NMSU P. A. Lester, Graduate Student, History

OBJECTIVES:

1. To write a history of the Elephant Butte Irrigation District

3109-204
7-1-75 Evaluation of Remote Sensing Techniques Applied to Water Resources Problems of New Mexico

UNM S. A. Morain, Dept. of Geography

OBJECTIVES:

1. To match published remote sensing research results to stated problems and needs for the water resources of New Mexico.
2. To evaluate the most promising applications resulting from this match.

3109-312 (BR)
1-1-75 Rio Grande Water Quality Base Line Study for the Rio Grande, Canals and Associated Drains from San Marcial, New Mexico to Fort Quitman, Texas

NMSU J. W. Hernandez, College of Engineering

OBJECTIVES:

1. To provide a baseline for water quality in the drains, in wastewater return flows, and in the river of the waters of the Rio Grande Project in Texas and New Mexico

3109-206
7-1-75 A Systematic Investigation of Watershed Runoff

NMIMT V. Singh, Dept. of Geosciences

OBJECTIVES:

1. To develop a systematic approach to watershed runoff modeling based on kinematic wave theory.

3109-313 (EPA)
2-17-75 Demonstration of Irrigation Return Flow Salinity Control in the Upper Rio Grande

NMSU R. R. Lansford, Agricultural Economics
P. J. Wierenga, Agronomy Department
T. Sammis, Agricultural Engineering
C. M. Hohn, Agricultural Engineering
G. Ott, Farm Management Special Extension Services
NMIMT L. Gelhar, Geoscience Department

OBJECTIVES:

1. To show the feasibility of alternative water management practices on the quality of drainage return flow and soil salinity in the Upper Rio Grande basin.

ANNUAL ALLOTMENTS

A-057
7-1-76 Influence of Road Salting on Nutrient and Heavy Metal Levels in Streams

UNM J. Gosz

OBJECTIVES:

1. To quantify the effects of road salting on levels of nutrients, heavy metals, and sediment in stream water.
2. To identify road and topographic characteristics which modify the effects of road salt on water quality.
3. To quantify the influence of soil additives and revegetation on water quality improvement in areas of road salting.

A-058
7-1-76 Characterization of Nutrients and Algal Blooms at Abiquiu and Cochiti Reservoirs

UNM L. Barton, Department of Biology
G. Johnson, Department of Biology

OBJECTIVES:

1. To determine the cause of the algal blooms on Cochiti and Abiquiu Reservoirs and what can be done to prevent their reoccurrence.

MATCHING GRANTS

B-055
7-1-76 Pueblo Water Rights on the Upper Rio Grande

NMSU J. Clark, Civil Engineering

OBJECTIVES:

1. An independent engineering evaluation of Pueblo lands that could be irrigated by river diversion and gravity flow.
2. Calculate the water right necessary for this maximum condition at each Pueblo.
3. Compare this calculated water right with the present appropriation and with the Pueblo's desires.
4. Analyze the effects of non-Indian water right holders.

OTHER

T-0009 (OWRT, ISC)
7-1-76 Water Treatment for Small Public Supplies

NMSU B. Wilson, Chemical Engineering
H. Folster, Chemical Engineering

OBJECTIVES:

1. To develop operating conditions and information for an engineering evaluation of two primary treating methods and their associated secondary support processes, e.g.
   a. Reverse osmosis - several membrane types
   b. Electrodialysis
2. To develop specific cost data.
3. To expend available water treatment technology in the area of single solute removal from drinking water containing a large number of ionic and dissolved species.
4. To provide the necessary material for assimilation of this unit or comparable equipment into the educational activities of water supply and water treating; specifically for
   a. engineering and technology students, and
   b. operator training.
5. To evaluate brine disposal methods in compliance with New Mexico ground water regulations.

3109-208 (S)
7-1-76 Improved Method of Estimating Crop Consumptive Use and Distribution of Soil Water in Irrigation Soil Profiles

NMSU P. J. Wierenga, Agronomy Department

OBJECTIVES:

1. Obtain experimental data on evaporation, transpiration, and the depthwise distribution of soil water with simultaneous measurement of leaf area, leaf dry weight and climate parameters with cotton and grain sorghum.
2. Develop the proper crop coefficients for use in the irrigation scheduling program in southern New Mexico.

3109-209 (S)
7-1-76 Forecasting Future Market Values for Water Rights in New Mexico

UNM F. L. Brown, Economist

OBJECTIVES:

1. To formulate a quantitative model capable of providing assessment of the future path of market prices for water rights.

3109-210 (S)
7-1-76 Proposal for Study of Institutional Alternatives for the Management of Groundwaters Shared by New Mexico and Mexico

UNM A. Utton, School of Law

OBJECTIVES:

1. To research and analyze accumulated international practice and the practice in selected federal nations to determine developed patterns. Strengths and weaknesses and to prepare possible alternatives in managing those aquifers shared binationally by Mexico and New Mexico

3109-211 (S)
7-1-76 Alternative Analytical Procedure for Chemical Oxygen Demand Testing

NMSU G. J. Ewing, Chemistry Department
W. A. Barkley, Civil Engineering

OBJECTIVES:

1. To identify promising substitute catalysts and reaction conditions.
2. To evaluate the resulting modified COD analytical procedures with fresh and septic sewage.

3109-212 (S)
7-1-76 Environmental Impact of Septic Tanks in New Mexico

NMSU J. Clark, Civil Engineering

OBJECTIVES:

1. To evaluate the environmental impact of septic tank effluents on shallow groundwater.

3109-213(S)
7-1-76 Denitrification in Small Aerobic Wastewater Treatment Systems

NMSU W. Barkley, Civil Engineering

OBJECTIVES:

1. To investigate operating conditions in a four stage, pilot-scale biological reactor such that denitrification of the wastewater occurs. Acceptable wastewater treatment normal to the treatment unit would be a necessary additional objective.

3109-214 (S)
7-1-76 An Examination of the Possible Toxic Effect of Chili Wastewaters on Biological Processes of Sewage Treatment

NMSU W. P. Isaacs, Civil Engineering

OBJECTIVES:

1. To determine the means by which chile wastewater adversely affects the biological treatment process of sewage.

3109-316
12-1-76 Impact of Recreational Development on Water Quality and Yield

NMSU G. E. Carruthers, Agricultural Economics
TEXAS A&M J. D. Mertes, Agricultural Science

OBJECTIVES:

1. To obtain historical data on water quality and yield of selected developed and undeveloped watershed areas in the Davis Mountains of Texas, and the Sacramento and Sangre de Cristo Mountains of New Mexico.
2. To describe and categorize recreational land use development occurring in these areas since 1950.
3. To determine the relationship between changes in water quality and yield and the incidence of specific recreational land use developments.
4. To provide estimates of public cost to restore water quality and yield levels in the areas where degradation or yield reduction has occurred.

3109-408 (PSCNM)
1-1-76 Manual for Public Service Company of New Mexico

NMSU W. Barkley, Civil Engineering

OBJECTIVES:

1. To develop a standard operating manual for monitoring groundwater quality; specifically for application to groundwater quality monitoring work operated by the Public Service Company of New Mexico.

ANNUAL ALLOTMENTS

A-059
10-1-77 Influence of Oasis Conditions on Consumptive Use

NMSU A. E. Stewart, Agricultural Experiment Station
E. J. Gregory, Agricultural Experiment Station

OBJECTIVES:

1. To determine the rate of change of consumptive use (evapotranspiration) with distance from the desert edge of irrigated cropland.
2. To determine the width of irrigated cropland along the desert edge which is influenced by oasis conditions.

A-060
10-1-77 Chemical and Biological Survey of the Gila River System: Study of Nutrient Sources in Snow and Quemado Lakes

NMIMT D. K. Brandvold, Chemistry Department
J. A. Brierley, Biology Department
C. J. Popp, Chemistry Department

OBJECTIVES:

1. To provide a larger number of analyses in areas already monitored and add sampling areas to the monitoring network in order to establish the present baseline conditions of the water.
2. To evaluate the specific effects of modifiers or uses on the character of the water.
3. To determine the background levels of plant nutrients and chemical species toxic to plants in water which may be used for irrigation. To determine the source of nutrients, etc...
4. To determine the levels of common bacteriological parameters of water quality and to evaluate the suitability of this information in determining water quality and water modification.

MATCHING GRANTS

B-058
10-1-77 The Influence of Irrigation Water Salinity on the Primary Productivity and Water Use Efficiency of a Potential Forage Crop, Distichlis Spicata (L.) Greene, (Salt Grass)

NMSU G. L. Cunningham, Biologist

OBJECTIVES:

1. To develop a simulation model which will allow the prediction of rates of net photosynthesis, dark respiration, transpiration, and water use efficiency of D. Spicata as a function of soil solution salinity, plant water potential, irradiance temperature, and vapor pressure deficit and which will compare the physiological variation in genetic stocks.

OTHER

3109-215 (S)
7-1-77 Factors Contributing to the Natural Denitrification of the Ogallala Aquifer in New Mexico

ENMU T. W. Russel, Chemistry Department
R. G. Taylor, Biological Sciences Department

OBJECTIVES:

1. To examine the physical characteristics of the Portales Valley Water Basin, e.g. vertical constant head permeability values, nitrate percolation values, and drawdown and channeling charactersitics with respect to nitrate contamination.
2. To establish logical and/or casual connections between chemical and microbiological charactersitics of the water and the charactersitics of the Basin, e.g. nitrate-nitrate reduction.
3. To determine definitively the fate of surface-applied nitrogen, and the mechanism of natural dentrification occurring in the aquifer.
4. To provide background information on the present quality of the regional Ogallala aquifer which can be used to demonstrate future changes in its quality as a result of surface and land usage activities.
5. To relate the effects of agricultural paractices in an agro-economic area to the parameters of aquifer water quality.
6. To determine the applicability and limitation of these data to other water systems.

3109-216 (S)
10-1-77 Evaluation of Landsat - Based Area Measurement Accuracies for Surface Water Area in New Mexico

UNM S. A. Morain, Geography Department

OBJECTIVES:

1. To investigate the accuracies of reservoir surface area measurements taken from Landsat imagery by various analog, digital and standard areal measuring methods.

2. To identify the data accuracies for lake area and reservoir volume presently required by the agencies involved in monitoring the states' water resources.

3109-217 (S)
10-1-77 Role of Nitrogen, Phosphorus, and Iron, in Occurrence of Algal Blooms at Abiquiu and Cochiti Reservoirs

UNM G. V. Johnson, Biology Department
L. L. Barton, Biology Department

OBJECTIVES:

1. Determine the limiting nutrients for algal blooms in Cochiti and Abiquiu Reservoirs.
2. Evaluate the contribution of algal blooms to the nitrogen budget and productivity of the reservoirs.
3. Determine the reservoirs' nutrient budgets for nitrogen, phosphorus and iron.
4. Characterize the bloom producing organisms in the laboratory

3109-218 (S)
10-1-77 Public Law 92-500 and Alternative Treatments of Waste Water Effluents in Albuquerque

UNM J. R. Mathews, Civil Engineering
M. Gisser, Economic Department

OBJECTIVES:

To study alternative tertiary treatments that could satisfy the specific standards set by Public Law 92-500. The alterantive tertiary treating methods that theoretically could be suitable for Albuquerque are:

a. Irrigation
b. Overland flow and
c. Infiltration-percolation.

3109-407
1-1-77 Consumptive Use and Salt Accumilation with Trickle Irrigation on Row Crops

NMSU P. J. Wierenga, Agronomy Department

OBJECTIVES:

1. To determine the long term effects of the use of trickle irrigation on water use, crop yields and soil salinity.

OTHER

3109-409 (ISC)
1-1-78 Evaluation of the Potential to Improve Alfalfa for Production Under Less than Optimum Moisture Conditions

NMSU B. Melton, Agronomy Department
M. Wilson, Agronomy Department

OBJECTIVES:

1. To evaluate the genetic variability in alfalfa for performance under less than optimum moisture conditions
2. To determine yield levels that can be expected.
3. To develop rapid and efficient plant breeding procedures for utilization of the potential to produce economic yield levels under conditions of moisture limitations.

3109-410
1-1-78 The Energy Impact on Irrigated Agricultural Production in New Mexico

NMSU R. R. Lansford, Agricultural Economics
G. V. Sabol, Civil Engineering
B. J. Creel, Agricultural Economics

OBJECTIVES:

1. The primary objective of this proposed research is to evaluate the impact of energy prices and supplies on the agricultural production base in New Mexico utilizing groundwater for irrigation as the primary source for water.
2. The specific objective is to determine when an aquifer can no longer be an effective source of supply in a given geographical area.

Appendix P

Breakdown of Income Sources
W.R.R.I.
From Initial Funding for FY 1964-65 thru Fy 77-78 1/*

	Title I Annual Allotment	Title I Matching Grants	Title II 2/	State Appropriations	Other 3/ Federal	Other, State 4/ Or Private	Total
Fy 64-65	$ 75,000					$ 5,550	$ 80,550
Fy 65-66	87,500	$ 21,184				19,000	127,684
Fy 66-67	87,500	70,095				22,225	179,820
Fy 67-78	100,000	105,195				31,173	261,088
Fy 68-69	100,000	76,820	$ 46,680		$ 22,380	54,200	300,080
Fy 69-70	100,000	80,474	46,223		23,500		250,197
Fy 70-71	100,000	87,139	46,101	$104,000	22,000	140,000	373,240
Fy 71-72	100,000	66,848	43,716	108,000	84,929		403,493
Fy 72-73	100,000	62,199	41,200	113,000	4,200	3,000	221,899
Fy 73-74	110,000	34,083	50,301	118,000	196,142		508,526
Fy 74-75	110,000	74,934		126,000	257,940	100,000	668,874
Fy 75-76	110,000	86,395		142,000	190,000	620,000	1148,395
Fy 76-77	110,000	119,768		154,000	243,859	72,600	700,227
Fy 77-78	110,000	133,294		161,000	17,000	100,000	521,294

*The above figures do not include the $150,000 allocated from the states' University Bond issue for the construction of the Water Resources Research Institute building on the New Mexico State University Campus.

1/ Fiscal information obtained thru various Institute records.

2/ Title II monies were discontinued effective FY 74-75

3/ Federal grants received from Office of Saline Water, Bureau of Reclamation, Title I - Higher Education, Bureau of Land Management, Environmental Protection Agency, U.S. Forest Service - Eisenhower Consortium.

4/ State and Private grants received from Pecos Valley Conservation District, State Engineer's Office Interstate Streams Commission, Board of Educational Finance, and Public Service Company of New Mexico.