



***ARKANSAS WATER RESOURCES CENTER***

***113 Ozark Hall***

***University of Arkansas***

***Fayetteville, Arkansas 72701***

***EVALUATION REPORT***

***FY 1987-88 THROUGH FY 1991-92***

***Submitted to***

***Office of External Research  
Mail Stop 424, National Center***

***U.S. Geological Survey  
12201 Sunrise Valley Drive  
Reston, Virginia 22092***

***August, 1993***

## Preface

The Arkansas Water Resources Center receives an annual Federal matching grant as authorized by section 104 of the Water Resources Research Act of 1984 (Public Law 98-242) as amended by Public Law 101-397. Section 104 of the Act requires that the Secretary of the Interior "shall conduct a careful and detailed evaluation of each institute at least once every 5 years to determine that the quality and relevance of its water resources research and its effectiveness as an institution for planning, conducting, and arranging for research warrants its continued support under this section." The U.S. Geological Survey (USGS), Department of the Interior, administers the provisions of the Act. This evaluation report describes, in the format prescribed by the USGS, the research, training, and information transfer activities supported by the section 104 grants to this institute over the period 1988 through 1992.

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 EVALUATION REPORT  
 FY 1988 - FY 1992

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## INTRODUCTION

Since the beginning of the Arkansas Water Resources Center the overall program has been focused on helping local, state and federal agencies learn to manage Arkansas' water resources. AWRC has contributed substantially to the State's water resources via research and training of students. Through the years, projects have included topics concerned with irrigation, ground water modeling, non-point source pollution (including sediment erosion), water quality, efficient septic tank design, and ecosystems. Information on water research and other water-resource information is disseminated by the Center through public presentations, conferences, and publications. Since 1980, an average of more than 15 principal investigators a year have participated in AWRC projects. In addition, approximately eight undergraduate students and 15 graduate students have gained valuable training and experience through AWRC projects each year. Many of these students have participated in environmentally related work across the State. An advisory committee, composed of representatives from state and federal agencies, industry and academia, provides guidance for the Center. AWRC helps insure pure, adequate water for Arkansas today and tomorrow.

The objectives of the Center are to plan and conduct component water resources research, either basic or applied; promote the dissemination and application of research results; provide for the training of scientists and engineers; cooperate closely with colleges and universities within the state that have demonstrable research capabilities; and cooperate with other institutes to effectively confront regional water and land related challenges.

To formulate a research program responsive to State water issues, the Center works closely with state and federal agencies and academic institutions. The Technical Advisory Committee plays an important role in insuring that the water institute program (section 104) funds address current State and regional issues. Priority research categories are:

Water quality - protection of surface and ground water.

Water management - legal institutional and financial aspects.

Water quantity - water use, surface-water flow, aquifer characterization and modeling.

Aquatic and environmental assessment - ecological system studies, fish and other animal and plant life.

Engineering issues - studies not included in other priority areas but which are directed toward meeting critical water-quality challenges.

## **The Water Resource Issues and Problems of Arkansas.**

During the period 1987-1992 major problems and issues related to water resources in Arkansas were:

1. non-point source pollution of ground and surface water,
2. development of efficient septic systems, and
3. mining of ground water in eastern Arkansas and associated saline water intrusion.

Other problems/issues listed during this time frame were flooding and drought, drainage of wetlands, methods to increase public participation in water resource management and protection, gaps in water resources laws, and financing of water programs. The above problems/issues are not an exhaustive list because many site specific problems are not listed, e.g. contamination from underground tanks or hazardous waste sites.

Pollution of ground and surface water by non-point sources is probably the single largest problem/issue in Arkansas. Nationally, the U.S. Environmental Protection Agency has identified agricultural non-point source pollution as the single largest source preventing accomplishment of the nation's water quality goals. Arkansas has significant agricultural activity and agriculture is probably the major source of non-point source pollution. The State is ranked first in poultry production, sixth in egg production, and swine production has increased 65% in the past 5 years. Most of the poultry, egg, and swine production is located in the western half of the State, and is especially concentrated in northwestern Arkansas. Animal waste from these operations is applied directly to the land surface of pastures as a fertilizer. Northwestern Arkansas has many streams with high quality water and limestone aquifers that may be contaminated by runoff from these pastures. Research has centered on characterizing this type of contamination, especially nitrate, phosphorus and coliform bacteria, from animal wastes. Plot and edge-of-field studies in conjunction with results from models has led to development of best management practices (BMPs) that protect water quality as animal production expands. Although the State ranks 19th in terms of crop production, the vast majority of the crop production is concentrated in the eastern half of the State. Arkansas is ranked first nationally in rice production, and typically ranks in the top ten in cotton, sorghum, and in soybean production. Production of these crops utilizes significant amounts of pesticides that might contaminate the water.

Nitrate and coliform bacteria contamination not only occurs from land application of animal wastes, but also from septic tanks. Area or regional septic system design is required for efficient operation because of differences in environmental conditions, e.g. differences in water table elevation and soil types.

Irrigation and municipal water demands in eastern Arkansas are greater than that supplied by surface water. Many farmers and municipalities utilize ground water for their water

supplies. For example, the cities of El Dorado, Pine Bluff and Jonesboro are solely dependent upon ground water for their water supplies. This demand for ground water has caused decreases in the ground water levels in this part of the State. In some locations the ground water is being pumped much faster than it is recharged, i.e. it is being mined. Where there is significant decreases in the water table, the problem is further complicated by deeper saline intruding into the overlying freshwater, causing salt water contamination of the aquifer.

### **The Arkansas Water Resources Center: An Overview.**

As stated above AWRC has focused its research on providing local, state and federal agencies with the scientific data and information necessary to protect and manage Arkansas' water resources. Because of AWRC's focus on providing agencies with the data useful for the protection and management of water resources, the Center's research program is heavily weighted toward "applied" rather than "basic" research. AWRC has not only contributed substantially to the State's water resources via training of students and information dissemination, but especially through research. In fact, AWRC's research program is intrinsically interlinked with training of students and information dissemination with the research program. Students receive training from involvement in research projects and conferences. Providing results of research projects is the focus of the information dissemination of the Center. These results are traditionally provided through technical completion reports, the AWRC Newsletter, journal articles, and presentations at public and professional meetings.

Funding for AWRC's program is larger than that provided by the water institute program funds (section 104 program). The additional funds are provided by the University of Arkansas, state and federal agencies, and occasionally private groups and municipalities. AWRC strives to maintain a close, cooperative, working relationship with the agencies. Cooperative research projects with the agencies helps to insure this close relationship. Most of the funds provided by the agencies are used for research, demonstration and monitoring projects. Because of the inter-relationship of research with training and information dissemination, these areas are also supported.

Because of the importance of agricultural non-point source pollution in the State, a large number of AWRC projects have been related to non-point source problems and issues. Because these types of projects often require several years of data collection under different conditions, results have only recently been available to help manage the use of animal wastes and agricultural chemicals. Several 104 projects were ecosystem studies which related to water quality and non-point source issues. The Center recently was involved in development of the State Management Plan (SMP) for the protection of ground water from agricultural chemicals in cooperation with the Arkansas State Plant Board.

The Center has had a long term program, since 1979, for the development of efficient septic tank systems for critical areas of the State where traditional designs fail to protect

the water quality. This program operates in close coordination with the Arkansas Department of Health, and several short courses for sanitarians who inspect septic systems are conducted several times annually by the scientists involved in development of new systems. This close relationship results in rapid technology transfer to the appropriate state agency and its field inspectors. Other studies concerned with human waste included wastewater treatment plant operation and water quality of wastewater receiving streams.

Several projects have addressed mining of ground water in eastern Arkansas and associated saline water intrusion which are exacerbated by droughts indirectly. A major feasibility study for agricultural, industrial, and municipal use of water from the Arkansas River related to both of these studies. As a result of this study several towns and water districts are making plans to use river water. Several projects developed models for conjunctive use of surface water (including ponds) and ground water. Results from one of the models is being used to identify critical areas as part of the State's ground water plan. A model also is being evaluated by the U.S. Soil Conservation Service in Arkansas for its usefulness in determining the optimum size for irrigation ponds for farmers. Another project evaluated the economics of "404 permits" for development of ponds as a source of surface water. These studies have been useful in minimizing the problem of lowering ground water levels. Indirectly, the latter two projects were related to the wetlands issue because they are concerned with creation of wetlands (ponds).

### **Section 104 Objectives**

The major objectives for the 104 (water institute) grant are to provide:

1. continuity for AWRC programs,
2. training for students, and
3. information dissemination.

Continuity of AWRC's water resources program would be virtually impossible without 104 funds, especially in the area of program development which is included in "administration" below. Student training is highlighted by the 25 Masters and 17 Ph.D. degrees completed by students involved in AWRC research. In addition, approximately 8 undergraduates per year were involved in the research program. Although only about 16% of the 104 funds are directly related to support of students (i.e. salaries, wages and tuition), much more support is supplied to the students than this number indicates. Students are heavily involved in research projects, and the vast majority of the funds for these projects are used to support research toward masters or doctoral degrees. Education should include more than student stipends, wages, and tuition listed below under "education." If the additional student support were included the percent of 104 funds for training would increase to about 56% and the research percentage (primarily faculty salaries and travel funding) would drop to about 23%. Dissemination of information by AWRC was wholly dependent upon the 104 grant program during this time

period. Printing of reports, mailing, associated secretarial time including library maintenance, and sponsoring of conferences were solely dependent upon 104 funds.

Estimated Percentage of 104 Funds for Various Categories

	<u>104 Plus Match *</u>	<u>104 Only**</u>
Research	63	26
Information Transfer	7	5
Education	16	56
Administration	14	13

\*Includes tuition and salaries only.

\*\*Includes all student support.



## RESEARCH PROGRAM

### Research Projects.

Category: 6 - Climate and Hydrologic Processes      Year(s): 07/01/87 to 06/30/88

Title: Long-Term Reconstruction and Analysis of White River Streamflow

Focus Categories: DROU, CP, HYDROL

Project Number(s): G-1409-02

Total Funding: Section 104: \$8,270      Other: \$12,547

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
M.K. Cleaveland	Research Associate	Department of Geography Fulbright College of Arts & Sciences University of Arkansas, Fayetteville
D.W. Stahle	Research Associate	Department of Geography Fulbright College of Arts & Sciences University of Arkansas, Fayetteville
J.G. Hehr	Professor	Department of Geography Fulbright College of Arts & Sciences University of Arkansas, Fayetteville

Publications:

Cleaveland, Malcolm K., 1987, White River Streamflow Analyzed from Tree-Ring Data: A.D. 1468-1980 (abstract). In C.W. Bennett, Ed., Proc. Second Arkansas Water Conference. Little Rock: Arkansas Department of Pollution Control and Ecology. p. 14-15.

Cleaveland, Malcolm K. and David W. Stahle. 1989. Tree Ring Analysis of Runoff Extremes in the White River 1700-1980 (abstract). In Abstracts of the Third Arkansas State Water Conf., Arkansas Water Resource Activities. Little Rock: Arkansas Department of Health. 3 p.

Cleaveland, Malcolm K. and David W. Stahle. 1989. Tree Ring Analysis of Surplus and Deficit Runoff in the White River, Arkansas. Water Resources Research 25(6):1391-1401.

Cleaveland, M.K., D.W. Stahle, and J.G. Hehr, 1988, Long-Term Reconstruction and Analysis of White River Streamflow, Publication Number 135, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 41 pgs.

Cleaveland, Malcolm K. and David W. Stahle. 1991. Tree-ring Analysis of White River, Arkansas, Runoff Extremes, 1700-1980 (abstract). In 1991 Annual Meeting Abstracts, Association of American Geographers. Washington, D.C: Assoc. American Geographers. p. 35.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Cyclic "flooding" periods identified of the White River for the past 500 years.

Follow-on Funding: Total of \$322,776 received from National Park Service for a 4 year period.

Number of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

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Category: 3 - Water Quality

Year(s): 07/01/87 to 06/30/88

Title: Estimating Potential Ground and Surface Water Pollution from Land Application of Poultry Litter - II

Focus Categories: NU, WQL, AG

Project Number(s): G-1409-03

Total Funding: Section 104: \$12,000                      Other: \$18,252

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
J.T. Gilmour	Professor	Department of Agronomy University of Arkansas, Fayetteville

D.C. Wolf

Professor

Department of Agronomy  
University of Arkansas, Fayetteville

**Publications:**

Gale, P.M., 1988, Decomposition of Organic Waste Products Under Aerobic and Anaerobic Conditions, Ph.D. Dissertation, Department of Agronomy, University of Arkansas, Fayetteville, Arkansas, 90 pp.

Gale, P.M., J.M. Phillips, D.C. Wolf, and M.L. May, 1988, Variability of Nutrient Concentrations in Hen Manure, In Agronomy Abstracts, Amer. Soc. Agron., Madison, WI, 38 pgs.

Gale, P.M., J.M. Phillips, M.L. May, and D.C. Wolf, 1991, Effect of Drying on the Plant Nutrient Content of Hen Manure, *J. Prod. Agric.* 4:246-250.

Gilmour, J.T., D.C. Wolf, and P.M. Gale, 1988, Land Application of Wastes, In Water Quality - Waste Management, Department of Agronomy, University of Arkansas, Fayetteville, Arkansas, pgs. 53-60.

Johnson, Jr., W.F., and D.C. Wolf, 1990, Nitrogen Transformations in Soil Amended with Poultry Litter, In Southern Branch Agronomy Abstracts, Amer. Soc. Agron., Madison, WI, 7 pgs.

Wolf, D.C., 1992, Impact of Human and Animal Waste on Water Quality, In J.W. Goodwin (ed.) Arkansas and the Natural Environment: Water, Waste, and War, Ark. Agric. Exp. Stn. Spec. Report Number 154.

Wolf, D.C. and T.C. Daniel, 1989, Water Quality, *Arkansas Farm Research* 38(6):4.

Wolf, D.C., J.T. Gilmour, and P.M. Gale, 1988, Estimating Potential Ground and Surface Water Pollution from Land Application of Poultry Litter - II, Publication Number 137, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 34 pgs.

Wolf, D.C., M.L., May, J.M. Phillips, and P.M. Gale, 1987, Ammonia Volatilization from Soil Amended with Hen Manure, In Agronomy Abstracts, Amer. Soc. Agron., Madison, WI, 36 pgs.

Wolf, D.C., R.L. Jackson, P.M. Gale, and J.T. Gilmour, 1987, Ammonia Volatilization from Surface-Applied Poultry Manure, In Southern Branch Agronomy Abstracts, Amer. Soc. Agron., Madison, WI, 6 pgs.

**Awards Received for Work Supported by This Project:** None.



**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R.C. Peralta	Associate Professor	Department of Agricultural Engineering University of Arkansas, Fayetteville
J. Solaimanian	Graduate Assistant	Department of Agricultural Engineering University of Arkansas, Fayetteville
C.F. Griffis	Professor	Department of Chemistry University of Arkansas, Fayetteville

**Publications:**

Cantiller, Rosalinda, and Richard C. Peralta, 1988, Optimal Conjunctive Use-Sustained Yield Pumping Analysis, Department of Agricultural Engineering, University of Arkansas, Fayetteville, Arkansas, 258 pgs.

Cantiller, Rosalinda, and Richard C. Peralta, 1988, VILMA Users Guide, Department of Agricultural Engineering, University of Arkansas, Fayetteville, Arkansas, 198 pgs.

Peralta, R.C., J. Solaimanian, and C.L. Griffis, 1988, Development of a Combined Quantity and Quality Model for Optimal Unsteady Groundwater Management, Publication Number 134, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 43 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Model used to develop state water plan.

Follow-on Funding: \$10,000 received from Arkansas Soil and Water Conservation Commission, and Additional funding through the U.S. Geological Survey and U.S. Army Corps of Engineers in Little Rock.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
		1	



Howard Counties, Arkansas"; \$17,392 received from Arkansas Department of Pollution Control and Ecology on a project titled "Evaluation of the Effect of Chicken Litter Spreading on Nitrate Concentrations in Ground Water in a Limestone Terrain, Northwest Arkansas"; and \$16,000 received from Arkansas Department of Pollution Control and Ecology on a project titled "Reconnaissance Survey of Nitrate Concentrations in Ground Water in Benton and Madison Counties Arkansas" - for a total of \$53,392.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	2		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Geology		

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Category: 4 - Biological Sciences

Year(s): 07/01/87 to 06/30/88

Title: Qualitative and Quantative Aquatic Algal Data Compilation to Determine Macrotrends - IV

Focus Categories: G&G, M&P, WQL

Project Number(s): G-1409-32

Total Funding: Section 104: \$2,750

Other: \$7,995

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
Richard L. Meyer	Professor	Department of Biological Sciences, University of Arkansas, Fayetteville

Publications:

Meyer, Richard L., 1988, Qualitative and Quantitative Aquatic Algal Data Compilation to Determine Macrotrends - IV, Publications Number 133, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 11 pgs.

Toon, Stephen S., 1987, Ultrastructure and Taxonomic Position of Boeklovia, Ph.D. Dissertation, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas, 47 pgs.

Toon, S.P. and R.L. Meyer, 1987, Ultrastructure and Taxonomic Position of Boeklovia, Journal of Phycology. Volume 23:21.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
		1	

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
		Biological Sciences	

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Category: 3. Water Quality

Year(s): 07/01/87 to 06/30/88

Title: Developing a Data Base for Verifying and Modifying Models for Predicting Non-Point Source Pollution from Silviculture

Focus Categories: CP, HYDGEO, MOD

Project Number(s): G-1409-33

Total Funding: Section 104: \$4,500

Other: \$4,956

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R. Scott Beasley	Professor	Department of Forestry University of Arkansas, Monticello



**Publications:**

Beasley, R.S. and A.B. Granillo, 1988, Sediment Losses and Water Yields from Managed Coastal Plain Forests, Water Resources Bulletin. Volume 24(2):361-366.

Miller, E.L., R.S. Beasley, and E.R. Lawson, 1988, Forest Harvest and Site Preparation Effects on Stormflows and Peakflows of Ephemeral Streams in the Ouachita Mountains, Journal of Environmental Quality. Volume 17(2):219-225.

Miller, E.L., R.S. Beasley, and E.R. Lawson, 1988, Forest Harvest and Site Preparation Effects on Erosion and Sedimentation in the Ouachita Mountains, Journal of Environmental Quality. Volume 17(2):219-225.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

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Category: 1. Social Sciences

Year(s): 07/01/87 to 06/30/88

Title: An Inventory of Water Resources Management Expertise in Arkansas and Problems/Research Needs in Latin America

Focus Categories: EDU, M&P, WQL

Project Number(s): G-1409-34

Total Funding: Section 104: \$2,400

Other: \$9,036

**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
John S. Miller	Professor	Department of Anthropology and Gerontology University of Arkansas, Little Rock

**Publications:** None.

**Awards Received for Work Supported by This Project:** None.

**Especially Significant Findings and Notable Achievements:** The data base was shared with Dr. Leslie Mack at Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, and with a consortium of US and Latin American universities which were members of CUIDES (University Council for Social and Economic Development). This information is available to encourage exchange of expertise in the Americas.

**Follow-on Funding:** None.

**Number of Students Supported by the Project:** None.

**Undergraduate:**                      **Masters:**                      **Ph.D.:**                      **Post Ph.D.:**

**Discipline(s) of Students Supported by the Project:** None.

**Undergraduate:**                      **Masters:**                      **Ph.D.:**                      **Post Ph.D.:**

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**Category:** 4 - Biological Sciences

**Year(s):** 07/01/87 to 06/30/88

**Title:** Factor Analysis of Fish Distribution Patterns in Arkansas

**Focus Categories:** ECL, WQL, SW

**Project Number(s):** G-1409-35

**Total Funding: Section 104:** \$4,000

**Other:** \$0

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
Henry W. Robinson	Professor	Department of Biological Sciences Southern Arkansas University, Magnolia

Publications:

Matthews, W.J. and Robinson, H.W., 1988, The distribution of the fishes of Arkansas: a multivariate analysis. *Copeia* 1988(2):358-374.

Matthews, William J., Daniel J. Hough, and Henry W. Robinson. 1992. Similarities in fish distribution and water quality patterns in streams of Arkansas: congruence of multivariate analyses. *Copeia* 1992(2):296-305.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project: None.

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
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Discipline(s) of Students Supported by the Project: None.

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
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Category: 3. Water Quality

Year(s): 07/01/87 to 06/30/88

Title: Evaluation of Salt Water Contamination Problems in Southern Arkansas

Focus Categories: WQL, G&G, M&P

Project Number(s): G-1409-36

Total Funding: Section 104: \$4,000

Other: \$6,561

**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
Kenneth F. Steele	Professor	Department of Geology University of Arkansas, Fayetteville

**Publications:**

Adams, Mark David, 1988, A Microcomputer Assisted Study of the Relationship of Chloride and uranium Concentrations in Groundwater to Geology in the El Dorado 1 x 2 Degree Quadrangle, Arkansas, M.S. Thesis, Department of Geology, University of Arkansas, Fayetteville, Arkansas, 203 pgs.

**Awards Received for Work Supported by This Project:** None.

**Especially Significant Findings and Notable Achievements:** File of NURE data compiled and correlated with geological data.

**Follow-on Funding:** None.

**Number of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

**Discipline(s) of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Geology		

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**Category:** 3 - Water Quality

**Year(s):** 07/01/88 to 06/30/89

**Title:** Determining Pesticide and Nitrate Levels in Spring Water in Northwest Arkansas

**Focus Categories:** GW, NPP, NC

**Project Number(s):** G-1549-02

**Total Funding: Section 104:** \$8,983

**Other:** \$24,516

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
T. L. Lavy	Professor	Department of Agronomy University of Arkansas, Fayetteville
J.D. Mattice	Research Associate	Department of Agronomy University of Arkansas, Fayetteville

Publications:

Cavalier, T.C., T.L. Lavy, and J.D. Mattice, 1989, Assessing Arkansas Ground Water for Pesticides: Methodology and Findings, Fall GWMR, pgs. 159-161.

DeHart, B.A., 1991, The Occurrence and Degradation of Selected Pesticides and the Occurrence of Nitrates and Phosphates in Northwest Arkansas Ground Water, M.S. Thesis, Department of Agronomy, University of Arkansas, Fayetteville, Arkansas, pp. 103.

DeHart, B.A., T.L. Lavy, and J.D. Mattice, 1991, Monitoring Northwest Arkansas Springs for Herbicides, Nitrates, and Phosphates, Arkansas Farm Res., Vol. 40, No. 1, p. 9.

Lavy, T.L., J.D. Mattice and B.A. Dehart, 1989, Determining Pesticide and Nitrate Levels in Spring Water in Northwest Arkansas, Publication Number 138, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 22 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Although sensitivity for the pesticide analyses ranged from 0.1 to 0.9 ppb, no detectable pesticides were found in the study indicating no major problems of contamination have occurred in the springs of this area. This study provided the methodology which became fore-runner to several comprehensive state-wide surface monitoring studies conducted by our research group.

Follow-on Funding: As an aftermath of this study our research group conducted extensive statewide surface water monitoring studies. More than \$97,000 new additional funding has been procured from funding outside the University for related studies in the area.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:  
Agronomy

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Category: 3 - Water Quality

Year(s): 07/01/88 to 06/30/89

Title: Minimizing the Potential for Groundwater Contamination from Agricultural Point Sources

Focus Categories: GW, WQL, AG

Project Number(s): G-1549-03

Total Funding: Section 104: \$15,159

Other: \$27,233

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
T.L. Lavy	Professor	Department of Agronomy University of Arkansas, Fayetteville
J.D. Mattice	Research Associate	Department of Agronomy University of Arkansas, Fayetteville

Publications:

Lavy, T.L., J.D. Mattice and J.H. Massey, 1989, Minimizing the Potential for Groundwater Contamination From Agricultural Point Sources, Publication Number 139, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 44 pgs.

Massey, J.H., T.L. Lavy, and B.W. Skulman, 1992, Field and Laboratory Evaluations of an Activated Charcoal Filtration Unit, In Proceedings of International Workshop on Research in Pesticide Treatment/Disposal/Waste Minimization, T.D. Ferguson (ed.), USEPA Office of Research and Development, EPA/600/9-91/047.

Massey, J.H., T.L. Lavy, and B.W. Skulman, 1993, Pesticide Rinsate Disposal by Activated Carbon Filtration, Arkansas Farm Research 42(4):12-13.

Massey, J.H., T.L. Lavy, and M.A. Fitzgerald, 1992, Biodegradability of Pesticides Sorbed to Activated Carbon, In Pesticide Waste Management: Technology and Management, J. Bourke et al. (eds.). American Chemical Society Symposium Series No. 510, American Chemical Society, Washington, DC.

Awards Received for Work Supported by This Project: J. Massey was awarded the First Place Graduate Student Award by the Arkansas Agricultural Pesticide Association during their 1990 Technical Meeting held in Fayetteville, Arkansas. The paper was titled "Disposal of Pesticide Rinsates Using Activated Charcoal Filtration".

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: Additional funding of \$69,000 over a 2 year period for related research was obtained from the Cooperative States Research Service in September of 1989.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Agronomy		

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Category: 5 - Engineering

Year(s): 07/01/88 to 06/30/89

Title: Improving Irrigation Scheduling and Water Use Efficiency in Cotton

Focus Categories: IG, WU, AG

Project Number(s): G-1549-04

Total Funding: Section 104: \$9,433

Other: \$28,938

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
D.M. Oosterhuis	Associate Professor	Department of Agronomy University of Arkansas, Fayetteville





Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
David G. Parker	Professor	Department of Civil Engineering University of Arkansas, Fayetteville
Sandra C. Parker	Associate Professor	Department of Industrial Engineering University of Arkansas, Fayetteville

Publications:

Parker, David G. and Sandra C. Parker, 1989, An Expert System for Managing an Activated Sludge Wastewater Treatment Plant, Publication Number 141, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 24 pgs.

Parker, David G., Sandra C. Parker and Ashfaq Balagamwala, 1989, A Software Development in Civil Engineering: Linking an Expert System for Wastewater Treatment Control with a Relational Database Management System, in the Proceedings of the Symposium on Expert Systems in Civil Engineering, Atlanta, Georgia.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Linkage of an expert system for wastewater treatment with a relational data management system.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	2	3	

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Civil Engineering	Civil Engineering	

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Category: 3 - Water Quality

Year(s): 07/01/88 to 06/30/89

Title: Simulation of the Fate of Nitrogen From the Disposal of Poultry Litter

Focus Categories: GW, ST, NC

Project Number(s): G-1549-06

Total Funding: Section 104: \$13,662      Other: \$28,167

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
H.D. Scott	Professor	Department of Agronomy University of Arkansas, Fayetteville

Publications:

Scott, H.D., 1989, Simulation of the Fate of Nitrogen From the Disposal of Poultry Litter, Publication Number 142, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 51 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Model and field data contributed to a greater understanding in this area.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Agronomy		

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Category: 4 - Biological Sciences

Year(s): 07/01/88 to 06/30/89

Title: Presentation of Verified Algal Taxa as Reference Sources

Focus Categories: WQL, G&G, M&P

Project Number(s): G-1549-32

Total Funding: Section 104: \$4,679      Other: \$4,907

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R. L. Meyer	Professor	Department of Biological Sciences University of Arkansas, Fayetteville

Publications:

Meyer, R.L. and J. Phillips, 1988, Patterns of Plastid Division and Morphogenesis in Desmids. Journal of Phycology. Volume 24(Supplement):22.

Meyer, R.L., 1989, Presentation of Verified Algal Taxa as Reference Sources, Publication Number 143, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 10 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
		1	

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
		Botany	

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Category: 2 - Ground-Water Flow and Transport Year(s): 07/01/88 to 06/30/89

Title: Analysis, Design, and Implementation of a Pilot Relational Database for Groundwater in the State of Arkansas

Focus Categories: GW, WQL, M&P

Project Number(s): G-1549-33

Total Funding: Section 104: \$9,357 Other: \$19,317

**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
Ray Hashemi-Nassab	Associate Professor	Department of Computer Science University of Arkansas, Little Rock

**Publications:**

Hashemi-Nassab, Ray, 1989, Analysis, Design, and Implementation of a Pilot Relational Database for Groundwater in the State of Arkansas, Publication Number 144, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 73 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

**Number of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
1			

**Discipline(s) of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
Computer Science			

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Category: 5 - Engineering

Year(s): 07/01/89 to 06/30/90

Title: Optimal Reservoir Design Criteria in Conjunctive Use of Surface Water and Ground Water for Soybean Irrigation in Arkansas

Focus Categories: AG, SW, GW

Project Number(s): G-1549-02

Total Funding: Section 104: \$12,000      Other: \$24,518

**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
D.R. Edwards	Assistant Professor	Department of Biological and Agricultural Engineering University of Arkansas, Fayetteville
J.A. Ferguson	Professor	Department of Biological and Agricultural Engineering University of Arkansas, Fayetteville

**Publications:**

Edwards, D.R. 1989. Modeling daily rainfall for east central Arkansas. Arkansas Farm Research 38(5):4.

Edwards, D.R. and J.A. Ferguson. 1990. Analyzing offstream reservoir performance for soybean irrigation. Paper No. 90-2510. American Society of Agricultural Engineers, St. Joseph, MI.

Edwards, D.R. and J.A. Ferguson, 1990, Optimal reservoir design criteria in conjunctive use of surface water and ground water for soybean irrigation in eastern Arkansas, Publication Number 145, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 124 pgs.

Edwards, D.R., J.A. Ferguson, and E.O. Fryar, 1992, Analyzing conjunctive use reservoir performance for soybean irrigation in Arkansas. Part I: Development of a simulation model, Transactions of the American Society of Agricultural Engineers 35(1):129-135.

Edwards, D.R., J.A. Ferguson, and E.O. Fryar, 1991, Assessing feasibility of off-stream reservoirs for soybean production in eastern Arkansas, Arkansas Farm Research 41(2):13-14.

Edwards, D.R., E.O. Fryar, and J.A. Ferguson, 1992, Analyzing conjunctive use reservoir performance for soybean irrigation in Arkansas, Part II: Model application, Transactions of the American Society of Agricultural Engineers 35(1):137-142.

Edwards, D.R. and J.D. Mayfield, 1990, Computer generation of daily weather data for Arkansas, Arkansas Farm Research 39(6):8.

Savdie, I., D.R. Edwards, R.A. Upfold, H.T. Olechowski and J. Myslik, 1992, Determination of optimum irrigation reservoir capacity for soybean production in Ontario: An ARORA model assessment, Internal Report, Bioclimate Division, Climate Adaptation

Branch, Canadian Climate Center, Atmospheric Environment Service, Environment Canada, Downsview, Ontario, Canada.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: U.S. Soil Conservation Service is evaluating the model for use in technological service program to farmers.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
2			

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
Agricultural Engineering			

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Category: 5 - Engineering

Year(s): 07/01/89 to 06/30/90

Title: Virus Reduction by the Stanford Onsite Wastewater Treatment System

Focus Categories: WW, WU, TRT

Project Number(s): G-1549-03

Total Funding: Section 104: \$14,700      Other: \$26,475

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
Mark A. Gross	Assistant Professor	University of Arkansas, Little Rock Graduate Institute of Technology

Publications:

Gross, M.A., E.M. Rutledge, D.C. Wolf, K.E. Earlywine and J.B. Matthews, 1990, Onsite Treatment for Reuse of Domestic Septic Tank Effluent in an Artificially-Drained Soil, Conserv 90, American Society of Civil Engineers, Phoenix, Arizona.



**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
D.G. Parker	Professor	Department of Civil Engineering University of Arkansas, Fayetteville
S.C. Parker	Associate Professor	Department of Industrial Engineering University of Arkansas, Fayetteville

**Publications:**

Cotter, F.E., 1989, An Evaluation of the Water Quality in the Mud Creek Drainage Basin, M.S. Thesis, Department of Engineering, University of Arkansas, Fayetteville, Arkansas, 98 pgs.

Parker, D.G. and S.C. Parker, 1990, An Evaluation of the Effect of Discharging a High Quality Effluent into a Small Ozark Stream, Publication Number 147, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 106 pgs.

**Awards Received for Work Supported by This Project:** None.

**Especially Significant Findings and Notable Achievements:** The evaluation of the Fayetteville wastewater effluent quality was very important to development of the cities split flow system.

**Follow-on Funding:** None.

**Number of Students Supported by the Project:**

<b>Undergraduate:</b>	<b>Masters:</b>	<b>Ph.D.:</b>	<b>Post Ph.D.:</b>
	1		

**Discipline(s) of Students Supported by the Project:**

<b>Undergraduate:</b>	<b>Masters:</b>	<b>Ph.D.:</b>	<b>Post Ph.D.:</b>
	Environmental Engineering		

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**Category:** 3. Water Quality

**Year(s):** 07/01/89 to 06/30/90

**Title:** Fate of Nitrogen from the Disposal of Poultry Litter: A Simulation Approach

**Focus Categories:** NC, WQL, HYDROL



Project Number(s): G-1549-05

Total Funding: Section 104: \$14,900

Other: \$26,208

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
H.D. Scott	Professor	Department of Agronomy University of Arkansas, Fayetteville

Publications:

Scott, H.D., 1990, Fate of Nitrogen from the Disposal of Poultry Litter: A Simulation Approach, Publication Number 148, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 59 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Model and field data were used to provide a greater understanding in this area.

Follow-on Funding: Yes, Arkansas Agricultural Experiment Station in the amount of \$10,000.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
2		1	

Discipline(s) of Students Supported by the Project: None.

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
Agronomy		Agronomy	

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Category: 3. Water Quality

Year(s): 07/01/89 to 06/30/90

Title: Dew Chemistry

Focus Categories: CP, MET, HYDGEO

Project Number(s): G-1549-06

Total Funding: Section 104: \$14,680

Other: \$18,866

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
George H. Wagner	Adjunct Professor	Department of Geology University of Arkansas, Fayetteville

Publications:

Wagner, G.H., 1990, Dew Chemistry, Publication Number 149, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 24 pgs.

Wagner, George H., Kenneth F. Steele, and Mark E. Peden, 1992, Dew and Frost Chemistry at a Midcontinent Site, United States, Journal of Geophysical Research, Vol. 97, No. D18, pages, 20,591-20,597.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: Dew chemistry is not as acidic as rain.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
1			

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
Geology			

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Category: 4. Biological Sciences

Year(s): 07/01/89 to 06/30/90

Title: Presentation of Verified Algal Taxa as Reference Sources-II

Focus Categories: WQL, G&G, M&P

Project Number(s): G-1549-32

Total Funding: Section 104: \$3,500      Other: \$5,048

**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R.L. Meyer	Professor	Department of Botany and Microbiology University of Arkansas, Fayetteville

**Publications:**

Meyer, R.L. and J. Phillips, 1989, Morphological Types in Pleurotaenium and a New Species, Phycology Society of America/American Institute of Biological Sciences Meetings in Toronto, Canada.

Meyer, R.L., 1990, Presentation of Verified Algal Taxa as Reference Sources-II, Publication Number 150, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 8 pgs.

Phillips, J.I.S. and R.L. Meyer, 1989, Morphological Types In Pleurotaenium And A New Species, Journal of Phycology. Volume 25(2 suppl.):20.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

**Number of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
1	3	2	

**Discipline(s) of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
Biology	Biology	Biology	

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Category: 3. Water Quality

Year(s): 07/01/90 to 06/30/91

Title: Evaluation of the Water Quality Impacts of Land Application of Poultry Litter

Focus Categories: WQL, GW, ST

Project Number(s): G-1549-02

Total Funding: Section 104: \$16,500      Other: \$33,771

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
T.C. Daniel	Professor	Department of Agronomy University of Arkansas, Fayetteville
D.R. Edwards	Assistant Professor	Department of Biological and Agricultural Engineering University of Arkansas, Fayetteville

Publications:

Daniel, T.C. and D.R. Edwards, 1991, Evaluation of the Water Quality Impacts of Land Application of Poultry Litter, Publication Number 151, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 15 pgs.

Edwards, D.R., L.D. Norton, E.C. Daniel, J.T. Walker, D.L. Ferguson, and G.A. Duyer, 1992, Performance of a rainfall simulator, Arkansas Farm Research, 41(2):13-14.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: USDA-CSRS for \$130,000; Arkansas Soil and Water Conservation Commission for \$447,908; and Arkansas Soil and Water Conservation Commission for \$67,000 - for a total of \$644,908.

Number of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

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Category: 3. Water Quality

Year(s): 07/01/90 to 06/30/91

Title: Determination of Optimal Timing of Poultry Waste Disposal by Meteorological, Hydrological, and Water Quality Modeling Techniques

Focus Categories: AG, WQL, MOD

Project Number(s): G-1549-03

Total Funding: Section 104: \$16,100      Other: \$33,234

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
D.R. Edwards	Assistant Professor	Department of Biological and Agricultural Engineering University of Arkansas, Fayetteville
T.C. Daniel	Professor	Department of Agronomy University of Arkansas, Fayetteville

Publications:

Edwards, D.R. and T.C. Daniel, 1991, Determination of Optimal Timing of Poultry Waste Disposal by Meteorological, Hydrological, and Water Quality Modeling Techniques, Publication Number 152, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 52 pgs.

Edwards, D.R., T.C. Daniel, and O. Marbun, 1992, Determination of best timing for poultry waste disposal: A modeling approach, Water Resources Bulletin 28(3):487-494.

Edwards, D.R., O. Marbun, and T.C. Daniel, 1991, Use of the EPIC model to identify optimal timing of broiler litter disposal, In Proceedings CIGR International Seminar on Environmental Challenges and Solutions in Agricultural Engineering, The Norwegian Commission of CIGR and Agricultural University of Norway, Department of Agricultural Engineering, p. 139-145.

Marbun, O., 1991, Optimal timing for poultry waste disposal as determined by the erosion productivity impact calculator model, Unpublished M.S. Thesis, Biological and Agricultural Engineering Department, University of Arkansas, Fayetteville, Arkansas, 100 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Biological and Agricultural Engineering		

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Category: 1. Social Sciences

Year(s): 07/01/90 to 06/30/91

Title: A Preliminary Investigation to Determine the Economic Implications of the "404" Permit for Constructing Agriculturally Related Reservoirs in Arkansas

Focus Categories: ECON, AG, WQL

Project Number(s): G-1549-04

Total Funding: Section 104: \$5,450      Other: \$13,672

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R.K. Ford	Professor	Department of Economics University of Arkansas, Little Rock
Charles R. Britton	Professor	Department of Economics University of Arkansas, Fayetteville

Publications:

Ford, Richard K., 1991, A Preliminary Investigation to Determine the Economic Implications of the "404" Permit for Constructing Agriculturally Related Reservoirs in Arkansas, Publication Number 153, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 56 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

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Category: 4. Biological Sciences                      Year(s): 07/01/90 to 06/30/91

Title: The Aquatic Macroinvertebrates of the White River National Wildlife Refuge

Focus Categories: G&G, WQL, M&P

Project Number(s): G-1549-05

Total Funding: Section 104: \$967                      Other: \$0

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
G.L. Harp	Professor	Department of Biological Sciences Arkansas State University

Publications:

Chordas III, S.W., 1991, The Aquatic Macroinvertebrates of the White River National Wildlife Refuge, M.S. Thesis, Department of Biological Sciences, Arkansas State University, State University, Arkansas.

Harp, G.L., 1991, The Aquatic Macroinvertebrates of the White River National Wildlife Refuge, Publication Number 154, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 36 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Biological Sciences		

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Category: 4. Biological Sciences

Year(s): 07/01/90 to 06/30/91

Title: Determination of the Ambient Toxicity of the Tailwater of Nimrod Lake

Focus Categories: WQL, G&G, M&P

Project Number(s): G-1549-06

Total Funding: Section 104: \$12,925      Other: \$22,153

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
John T. Knight	Instructor	Department of Biology Ouachita Baptist University Arkadelphia, Arkansas

Publications:

Knight, J.T., 1991, Determination of the Ambient Toxicity of the Tailwater of Nimrod Lake, Publication Number 155, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 35 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project: None.

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
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Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

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Category: 3. Water Quality                      Year(s): 07/01/90 to 06/30/91

Title: Water Quality as Affected by Pesticides in Rice Production

Focus Categories: WQL, HYDROL, AG

Project Number(s): G-1549-07

Total Funding: Section 104: \$17,300                      Other: \$50,000

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
T.L. Lavy	Professor	Department of Agronomy University of Arkansas, Fayetteville
J.D. Mattice	Assistant Professor	Department of Agronomy University of Arkansas, Fayetteville
B.W. Skulman	Research Associate	Department of Agronomy University of Arkansas, Fayetteville
Ronald E. Talbert	Professor	Department of Agronomy University of Arkansas, Fayetteville
R.J. Smith	Research Agronomist	USDA-ARS University of Illinois

Publications:

Johnson, W.G. and T.L. Lavy, 1990, Persistence Of Triclopyr In A Flooded Rice Soil. Abstract to the Arkansas Agricultural Pesticide Association, Volume 29:9.

Johnson, W.G. and T.L. Lavy, 1991, Persistence of Triclopyr in a Flooded Rice Soil, in Proceedings of the Southern Weed Science Society.

Johnson, W.G. and T.L. Lavy, 1992, Persistence of Selected Pesticides in Paddy-Rice Soil and Water, Arkansas Agricultural Experiment Station Special Report 157, pp. 16-20.

Johnson, W.G., T.L. Lavy, J.D. Mattice, B.W. Skulman, R.J. Smith, Jr., and R.E. Talbert, 1991, Environmental Implications of Pesticides in Rice Production, Progress Report to Arkansas Rice Research and Promotion Board, Arkansas Agricultural Experiment Station.

Johnson, W.G., T.L. Lavy, J.D. Mattice, B.W. Skulman, R.J. Smith, Jr., and R.E. Talbert, 1992, Environmental Implications of Pesticides in Rice Production, Arkansas Agricultural Experiment Station Research Series 422, pp. 59-64.

Johnson, W.G., T.L. Lavy, J.D. Mattice, B.W. Skulman, R.E. Talbert, and R.J. Smith, 1991, Water Quality as Affected by Pesticides in Rice Productions, Report No. 156, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 35 pgs.

Johnson, W.G., T.L. Lavy, J.D. Mattice and B.W. Skulman, 1993, Dissipation of Furadan, Bolero, and Grandstand at Three Depths in a Rice Soil, Arkansas Farm Research 42:(in press).

Johnson, W.G., T.L. Lavy, J.D. Mattice, B.W. Skulman, R.J. Smith, Jr., and C.B. Guy, Jr., 1993, Environmental Implications of Pesticides in Rice Production, Arkansas Agricultural Experiment Station Research Series 431, pp. 73-80.

**Awards Received for Work Supported by This Project:**

Bill Johnson received 1st place graduate student paper at the 1992 Arkansas Agricultural Pesticide Association annual meeting in Fayetteville, Arkansas, for the paper titled "Persistence of 2,4-D and Triclopyr in Rice Culture."

Bill Johnson received 1st place graduate student poster at the 1993 Southern Weed Science Society annual meeting in Charlotte, North Carolina, for the poster titled "In-Situ Dissipation of Benomyl, Carbofuran, Thiobencarb and Triclopyr at Three Soil Depths."

**Especially Significant Findings and Notable Achievements:** None.

**Follow-on Funding:** Additional funding in the amount of \$120,000 over a three year period for related research was obtained from the Rice Research and Promotion Board.

**Number of Students Supported by the Project:**

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

1

**Discipline(s) of Students Supported by the Project:**

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:  
Agronomy

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Category: 4. Biological Sciences                      Year(s): 07/01/90 to 06/30/91

Title: The Association of Water Quality Parameters, Geological Substrates and Periphyton Community Structure

Focus Categories: WQL, G&G, M&P

Project Number(s): G-1549-08

Total Funding: Section 104: \$7,110                      Other: \$14,175

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R.L. Meyer	Professor	Department of Botany and Microbiology University of Arkansas, Fayetteville

Publications:

Meyer, R.L., 1991, The Association of Water Quality Parameters, Geological Substrates and Periphyton Community Structure, Publication Number 157, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 173 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: \$15,000 from the Arkansas Department of Pollution Control and Ecology and \$14,600 from Arkansas Coop Unit.

Number of Students Supported by the Project:

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:  
2

Discipline(s) of Students Supported by the Project:

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:  
Biological Sciences

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Category: 3. Water Quality

Year(s): 07/01/91 to 06/30/92

Title: Effect of Land Application of Poultry Waste on Pesticide Loss

Focus Categories: AG, WQL, ST

Project Number(s): G-1549-02

Total Funding: Section 104: \$17,500

Other: \$35,675

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
T.C. Daniel	Professor	Department of Agronomy University of Arkansas, Fayetteville
D.R. Edwards	Assistant Professor	Department of Biological and Agricultural Engineering University of Arkansas, Fayetteville

Publications:

Daniel, T.C. and D.H. Pote, 1992, Effect of Land Application of Poultry Waste on Pesticide Loss, Report Number 158, Arkansas Water Resources Center, University of Arkansas, Fayetteville, Arkansas, 48 pgs.

Lavy, T.L., S.A. Senseman, J.D. Mattice, B.W. Skulman, and T.C. Daniel, 1992, Pesticides Monitored in Surface and Well Water Samples, Arkansas Farm Research, Volume 41, Number 4, 2 pgs.

Pote, D.H., 1993, Effect of Land-Applied Cages-Layer Manure on Cyromazine Loss, M.S. Thesis, Department of Agronomy, University of Arkansas, Fayetteville, Arkansas, 48 pgs.

Pote, D.H., T.C. Daniel, D.R. Edwards, and J.D. Mattice, 1992, Effect of Land-Applied Caged-Layer Manure on Cyromazine Loss, In Agronomy Abstracts, Agronomy Society of America, Madison, Wisconsin, p. 53.

Pote, D.H., T.C. Daniel, D.R. Edwards, J.D. Mattice, and D.B. Wickliff, 1993, Effects of Drying and Rainfall Intensity on Cyromazine Loss From Surface Applied Caged-Layer Manure, Journal of Environmental Quality, In Press.

Steele, K.F., T.C. Daniel, and D.R. Edwards, 1991, Interaction of Poultry Waste and Limestone Terrain on Water Quality: Professional and Public Information Dissemination, International Symposium on Hydrology and Water Resources Education and Training: The Challenges to Meet at the Turn of the XXI Century, Littleton, Colorado, 8 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: Yes, CIBA GEIGY Corp. for \$30,000.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Agronomy		

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Category: 5. Engineering

Year(s): 07/01/91 to 06/30/92

Title: Computer Simulation Model Calibration and Validation for Prediction of Water Quality Impacts of Poultry Waste Disposal

Focus Categories: WQL, MOD, AG

Project Number(s): G-1549-03

Total Funding: Section 104: \$16,825      Other: \$35,111

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
D.R. Edwards	Assistant Professor	Department of Biological and Agricultural Engineering University of Arkansas, Fayetteville
T.C. Daniel	Professor	Department of Agronomy University of Arkansas, Fayetteville

**Publications:**

Edwards, D.R. and T.C. Daniel, 1992, Effect of Surface-Applied Poultry Waste Source of Infiltration and Runoff, Arkansas Farm Research, Volume 41(3):3-4.

Edwards, D.R. and T.C. Daniel, 1992, Environmental Impacts Of On-Farm Poultry Waste Disposal - A Review. Bioresource Technology. Volume 41:9-33.

Edwards, D.R. and T.C. Daniel, 1993, Computer simulation model calibration and validation for prediction of water quality impacts of poultry waste disposal, In Press, Arkansas Water Resources Center, University of Arkansas, Fayetteville, Arkansas, 73 pgs.

Edwards, D.R., T.C. Daniel, J.F. Murdoch, and P.F. Vendrell, 1992, Moores Creek Monitoring Project Activities, In the Proceedings of the Arkansas Water Resources Research Center Conference, April 14-15, 1992, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, Special Report No. 157, pgs. 9-12.

Edwards, D.R., L.D. Norton, T.C. Daniel, J.T. Walker, D.L. Ferguson, and G.A. Dwyer, 1992, Performance of a Rainfall Simulator, Arkansas Farm Research, Volume 41(2):13-14.

Edwards, D.R., V.W. Benson, J.R. Williams, T.C. Daniel, R.G. Gilbert, and J. Lemunyon, 1993, Use of the EPIC model to predict runoff transport of surface-applied animal manure constituents, Paper No. 932075, American Society of Agricultural Engineers, St. Joseph, MI.

Awards Received for Work Supported by This Project: U.S. Environmental Protection Agency Region VI Environmental Excellence Award (1992).

Especially Significant Findings and Notable Achievements: None

Follow-on Funding: None.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

Discipline(s) of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Engineering		

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Category: 4. Biological Sciences

Year(s): 07/01/91 to 06/30/92

Title: The Influence of Reservoir Basin Morphometry on Phytoplankton Community Structure

Focus Categories: WQL, NU, G&G

Project Number(s): G-1549-04

Total Funding: Section 104: \$14,381      Other: \$17,012

Principal Investigators:

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
R.L. Meyer	Professor	Department of Botany and Microbiology University of Arkansas, Fayetteville

Publications:

Hustead, Lynda E., 1992, Selection and Monitoring of Steanothermal Algae Assemblages in Logan Cave Springs and its Associated Stream, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas, 74 pgs.

Phillips, Jeanette, 1991, Developmental Monphology of Selected Species of the Genus Pleurotaeniu (Conjugatophyta), Ph.D. Dissertation, Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas, 89 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: \$25,421 from Arkansas Game and Fish Commission on project titled "Determination of the Efficacy of Fertilization Practices on Bob Kidd Lake"; \$5,000 from Arkansas Soil and Water Conservation Commission on project titled "Bob Kidd Morph"; and \$10,272 from Arkansas Game and Fish Commission on project titled "Determination of the Seasonal Changes in Nitrate and Phosphate Concentration and in Phytoplankton Composition within Selected Fertilized Lakes" - for a total of \$40,693.

Number of Students Supported by the Project:

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
		1	





Moore, P.A., Jr. and D.M. Miller, 1992, Rice Water Quality Research in Arkansas, Rice Technical Working Group Meeting, Little Rock, Arkansas, February 23-26, 1992, In Proc. Twenty-Fourth Rice Technical Working Group, Texas Agri. Exper. Station, College Station, Texas, 43 pgs.

Moore, P.A., Jr., R.J. Norman, B.R. Wells, R.S. Helms, 1992, Changes in Nutrient Congent of Rice Irrigation Water with Flow Distance Across the Field and With the Addition of Fertilizers to the Crop, In (B.R. Wells, ed.) Arkansas Rice Research Studies 1991, Arkansas Agricultural Experiment Station Research Series 422:83-88.

Moore, P.A., Jr., B.R. Wells, and R.J. Norman, 1992, Nutrient Runoff From Rice Fields, Southern Association of Agricultural Scientists Annual Meeting, Lexington, Kentucky, February 2-5, 1992, In Appendix 1 of Agronomy Abstracts of 1992 Annual Meetings, Am. Soc. Agron., Madison, WI, 11 pgs.

Awards Received for Work Supported by This Project: None.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding: None.

Number of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

Discipline(s) of Students Supported by the Project: None.

Undergraduate:                      Masters:                      Ph.D.:                      Post Ph.D.:

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Category: 3. Water Quality

Year(s): 07/01/91 to 06/30/92

Title: GIS Characterization of Beaver Reservoir Watershed

Focus Categories: WQL, NPP, M&P

Project Number(s): G-1549-06

Total Funding: Section 104: \$16,400                      Other: \$30,915

**Principal Investigators:**

<u>Name</u>	<u>Rank</u>	<u>Affiliation</u>
H.D. Scott	Professor	Department of Agronomy University of Arkansas, Fayetteville

**Publications:**

Scott, H.D., and M. McKimney, 1992, Development of a GIS for the Beaver Lake Watershed, Arkansas Agricultural Experiment Station Bulletin.

Scott, H.D., P.A. Smith, A. Mauromoustakos, M.J. Cochran, and W.F. Limp, 1991, Using a GIS to Characterize Nitrate Water Quality Analysis, The American Society of Agricultural Engineers 1991 International Winter Meeting, Chicago, Illinois, December 17-20, 1992, 9 pgs.

**Awards Received for Work Supported by This Project:**

John W. White Award for Research in the Division of Agriculture in 1992

Named a Fellow of the American Society of Agronomy in 1991.

Especially Significant Findings and Notable Achievements: None.

Follow-on Funding:: \$16,000 from Arkansas Agricultural Experiment Station; \$10,000 from Arkansas Soil and Water Conservation Commission; and \$9,486 - for a total of \$35,486.

**Number of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	1		

**Discipline(s) of Students Supported by the Project:**

Undergraduate:	Masters:	Ph.D.:	Post Ph.D.:
	Agronomy		

### **Summary of Research Projects.**

	<u>Number</u>	<u>Percent of Funds</u>
1. Biological Sciences	8	13
2. Climate and Hydrologic Processes	1	2
3. Engineering	7	29
4. Ground Water Flow and Transport	1	2
5. Social Sciences	2	2
6. Water Quality	15	52
Total:	34	100

Number of Projects that Received Follow-on Funding From Other Sources: 13 for a total of \$1,712,855.

### **Summary of Research Publications.**

Number of Publications, by Type of Publication.

1. Articles in Refereed Scientific Journals	13
2. Book Chapters	17
3. Dissertations	9
4. Water Resources Institute Reports	26
5. Articles in Conference Proceedings	15
6. Other Publications	27
Total:	107

### **Summary of Awards.**

Project No. G-1549-07, 7/1/90-6/30/91 - Bill Johnson received 1st place graduate student paper at the 1992 Arkansas Agricultural Pesticide Association annual meeting in Fayetteville, Arkansas, for the paper titled "Persistence of 2,4-D and Triclopyr in Rice Culture."

Bill Johnson received 1st place graduate student poster at the 1993 Southern Weed Science Society annual meeting in Charlotte, North Carolina, for the poster titled "In-Situ Dissipation of Benomyl, Carbofuran, Thiobencarb and Triclopyr at Three Soil Depths."

Project No. G-1549-03, 7/1/91-6/30/92 - Received the U.S. Environmental Protection Agency Region VI Environmental Excellence Award in 1992.

Project No. G1549-06, 7/1/91-6/30/92 - Received the John H. White Award for Research in the Division of Agriculture in 1992.

### **INFORMATION TRANSFER PROGRAM**

Technology transfer is an integral part of the "Arkansas Onsite Domestic Wastewater Renovation Project." Technology is transferred to Arkansas Department of Health on a quarterly basis. On the average, three short courses/workshops (3-5 days in length) for sanitarians of the Arkansas Department of Health have been held annually across the State. The topics for the short courses/workshops are listed below.

- Basic
- Relationship of Soil Morphology to Filter Field Design
- Rock/Plant Filters
- Pressure Distribution Systems
- Sand Filters
- Limiting Soil Factors of Various Regions

AWRC also provides speakers for USDA Soil Conservation Service, Cooperative Extension Service, Soil Conservation District training/technical transfer sessions. Speakers also address various professional groups and local public community groups (e.g. Ozark Society and Rotary Club).

The Center's research publications are utilized by researchers nationally and internationally, as well as by law citizens concerned with specific water issues. Other Center publications provide overviews of water resource issues that make professionals and the public aware of the issues, as well as sources of additional information.

#### **Publications.**

Daniel, T.C., D.R. Edwards, D.C. Wolf, K.F. Steele and M.J. Cochran, 1991, Nonpoint Source Pollution and Water Quality of Northwest Arkansas, Fact Sheet Number 1, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Mack, Leslie, E., 1988, Arkansas Water Resources Research Center Newsletter, No. 4, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 3 pgs.

Mack, Leslie, E., 1988, Arkansas Water Resources Research Center Newsletter, No. 3, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 3 pgs.

Mack, Leslie, E., 1987, Arkansas Water Resources Research Center Newsletter, No. 2, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Mack, Leslie, E., 1987, Arkansas Water Resources Research Center Newsletter, No. 1, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Steele, Kenneth F., 1991, Annual Report, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 15 pgs.

Steele, Kenneth F., 1992, Proceedings of the AWRRC Research Conference, In Arkansas Agricultural Experiment Station Special Report 157, Arkansas Agricultural Experiment Station, Division of Agriculture, University of Arkansas, Fayetteville, Arkansas, 43 pgs.

Steele, Kenneth F., 1991, AWRRC Newsletter, Fall 1991, No. 16, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 8 pgs.

Steele, Kenneth F., 1992, AWRRC Newsletter, Spring/Summer 1992, No. 18, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 8 pgs.

Steele, Kenneth F., 1991, AWRRC Newsletter, Spring 1991, No. 15, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Steele, Kenneth F., 1991, AWRRC Newsletter, Winter 1991, No. 17, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 8 pgs.

Steele, Kenneth F., 1990, AWRRC Newsletter, No. 14, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 9 pgs.

Steele, Kenneth F., 1990, AWRRC Newsletter, No. 13, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 9 pgs.

Steele, Kenneth F., 1990, Arkansas Water Resources Research Center Newsletter, No. 12, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 7 pgs.

Steele, Kenneth F., 1990, Arkansas Water Resources Research Center Newsletter, No. 11, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 6 pgs.

Steele, Kenneth F., 1989, Arkansas Water Resources Research Center Newsletter, No. 10, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 8 pgs.

Steele, Kenneth F., 1989, Arkansas Water Resources Research Center Newsletter, No. 9, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Steele, Kenneth F., 1989, Arkansas Water Resources Research Center Newsletter, No. 8, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 3 pgs.

Steele, Kenneth F., 1989, Arkansas Water Resources Research Center Newsletter, No. 7, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Steele, Kenneth F., 1988, Arkansas Water Resources Research Center Newsletter, No. 6, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 4 pgs.

Steele, Kenneth F., 1988, Arkansas Water Resources Research Center Newsletter, No. 5, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville, Arkansas, 5 pgs.

**Audio-visual Productions.**

None.

**Newsletter.**

AWRC's newsletter is intended to provide information to the general public, legislatures, and scientists regarding important topics relating to water quality issues in the State of Arkansas.

- (a) 1987-1988 - Newsletters published 9/87, 12/87, 3/88, and 6/88
- 1988-1989 - Newsletters published 9/88, 12/88, 3/89, and 6/89
- 1989-1990 - Newsletters published 9/89, 12/89, 3/90, and 6/90
- 1990-1991 - Newsletters published 9/90, 12/90, 2/91 and 6/91
- 1991-1992 - Newsletters published 9/91 and 3/92

- (b) The 1987-1988 issues were sent to approximately 400 people.  
The 1988-1989 issues were sent to approximately 400 people.  
The 1989-1990 issues were sent to approximately 400 people.  
The 1990-1991 issues were sent to approximately 650 people.  
The 1991-1992 issues were sent to approximately 750 people.

- (c) The AWRC Newsletter is published from 2 to 4 times a year.

- (d) The AWRC Newsletter is paid for 100% from Section 104 funds.

See attached copies of newsletters for fiscal year 1991-92.

## **Conferences.**

### **Lead Sponsor.**

Arkansas Water Resources Research Center's 25th Anniversary and Conference "Nitrate - Water Quality and Sources," May 1-2, 1990

Arkansas Water Resources Research Center "Research Conference," April 1992 (Program Attached)

### **Cosponsor or Supporter.**

Second Arkansas State Water Conference, 1987, Ferndale 4-H Center, Little Rock, Arkansas

Third Arkansas State Water Conference, Arkansas Water Resource Activities, October 4, 1989, Ferndale 4-H Center, Little Rock, Arkansas

American Society of Civil Engineers Water Resources Planning and Management Division, 1991 National Conference on Water Resources Planning and Management and Symposium on Urban Water Resources, May 20-22, 1991, New Orleans, Louisiana

Fourth Arkansas Water Conference, Arkansas Water Resources, September 3-4, 1991, Ferndale 4-H Center, Little Rock, Arkansas

### **Library and Data Base Services.**

AWRC maintains a library of all technical completion reports resulting from projects funded by Section 104 funds. It also contains other water related publications, reference materials, and items.

The AWRC library is supported 100% from Section 104 funds.

### **Awards.**

None.

### **Notable Achievements.**

First "lay" Annual Report, 1990-91. This was the first Annual Report produced by the Center for the non-technical person. This annual report received many compliments.

First Fact Sheet "Nonpoint Source Pollution and Water Quality of Northwest Arkansas", 1991. Because of much confusion and misinformation in the media, this fact sheet was produced to inform the public of the status of the water quality in Northwestern Arkansas.

### **Number of Students Supported.**

3 (1 graduate and 2 undergraduate)

### **EDUCATION**

<b><u>Field of Study</u></b>	<b><u>Undergraduate</u></b>	<b><u>Masters</u></b>	<b><u>Ph.D.</u></b>	<b><u>Post-Ph.D.</u></b>	<b><u>Total</u></b>
Chemistry	1	1			2
Engineering					
Agricultural	6	3	6		15
Civil		1			1
Environmental		3			3
Soils		2	1		3
Systems					
Other					
Geology	1	2			3
Hydrology					
Agronomy	15	2	5	1	23
Biology	6	7	5		18
Ecology	1	3			4
Fisheries, Wildlife, or Forestry	4				4
Computer Science	2				2
Economics					
Geography	1				1
Law					
Resources Planning					
Other (specify)					
Journalism	1				1
Agricultural Business	3				3
Agricultural Mechanization	1				1
Agronomy-Soil		1			1
Total:	42	25	17	1	85

Total number of dissertations and theses that resulted from this student support:

Master's: 25

Ph.D.: 17



## ADMINISTRATION, COORDINATION, AND COOPERATION

### Expenditures Statewide.

<u>Fed. Fiscal Year</u>	<u>Sec. 104 Funds</u>	<u>Matching Ratio</u>	<u>Required Match</u>	<u>Total</u>
1987-88	105,130	1.5	160,628	265,758
1988-89	105,130	1.5	166,694	271,824
1989-90	105,130	2.0	234,958	340,088
1990-91	103,703	2.0	207,422	311,125
1991-92	104,574	2.0	223,811	328,385
<b>Total:</b>	<b><u>523,667</u></b>		<b><u>993,513</u></b>	<b><u>1,517,180</u></b>

### University or College.

<u>Name of University or College</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
Arkansas State University				967	
Ouachita Baptist University				12,925	
Univ. of Ark., Fayetteville*	94,230	95,773	90,430	84,361	93,849
Univ. of Ark., Little Rock	2,400	9,357	14,700	5,450	
Univ. of Ark., Monticello	4,500				10,725
So. Arkansas Univ.	4,000				

\*Includes Program Administration

### Cooperation With Out-of-State Institutions.

#### 1988-89

National Park Service, National Buffalo River (1988-89)

Oklahoma State University, Water Quality Assessment of the Illinois River (1988-1990)

#### 1989-90

Oklahoma State University, Water Quality Assessment of the Illinois River (1988-1990)

U.S. Fish and Wildlife Cooperative Unit at Fayetteville and National Park Service, Global Climate Change Program (1989-90)

U.S. Army Corps of Engineers, Monitoring Plan for Beaver Lake (1989-90)

U.S. Geological Survey, Radium Problem in Deep Northern Arkansas Wells (1989-90)

U.S. Soil Conservation Service (1989-90)

#### 1990-91

Oklahoma State University, Water Quality Assessment of the Illinois River (1988-1990)

U.S. Army Corps of Engineers, Lead Federal Agency in the Arkansas River Study and Interacted with the Center through a project evaluating the monitoring design for 12 reservoirs in Arkansas (1990-91)

U.S. Fish and Wildlife Cooperative Unit at Fayetteville and National Park Service, Global Climate Change Program in the Buffalo National River, Arkansas and the Ozark National Scenic Riverways, Missouri (1990-91)

U.S. Geological Survey (1990-91)

U.S. Soil Conservation Service (1990-91)

1991-92

U.S. Army Corps of Engineers, 12 Reservoirs Project (1991-92)

U.S. Fish and Wildlife Cooperative Unit at Fayetteville and National Park Service, Global Climate Change Program (1991-92)

U.S. Soil Conservation Commission (1991-92)

U.S. Geological Survey (1991-92)

**Institute Directors Over Evaluation Period.**

<u>Name</u>	<u>Academic Discipline</u>	<u>Term</u>
Leslie E. Mack	Geology and Law	1980 to 1988
Kenneth F. Steele	Chemistry and Geology	1988 to Present

**Advisory Committees.**

See Attached Lists.

The Technical Advisory Committee is involved in setting research priorities, selection of research proposals for funding and, it also provides general advice on the Center's program.

The AWRC Technical Advisory Committee met 1 time in 1987-88, 2 times per year in 1988-89 and 1989-90, and 1 time per year in 1990-91 and 1991-92.

**Research Proposal Selection Panels.**

The Technical Advisory Committee serves as the research proposal selection panel. See lists above.

**Peer Review of Institute Publications.**

Each Technical Completion Report is reviewed by the Director. After this review, the Director may request a complete review of the report or portions of the report by researchers with expertise in the report's topic.

**Number of Principal Investigators Supported, by Rank and Year.**

<u>Academic Rank (at initiation of project)</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>Total</u>
Adjunct Professor			1			1
Assistant Professor			2	3	3	8
Associate Professor	1	3	1		2	7
Graduate Assistant	1					1
Instructor				1		1
Professor	10	5	4	8	5	32
Research Agronomist				1		1
Research Associate	2	2		1		5
Total:	14	10	8	14	10	56

ARKANSAS WATER RESOURCES RESEARCH CENTER

TECHNICAL ADVISORY COMMITTEE

1988

Mr. David Burrough  
U. S. Army Corps of Engineers  
P. O. Box 867  
Little Rock, AR 72203

Mr. Thomas C. McRae, President  
Winthrop Rockefeller Foundation  
308 E. Eight Street  
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ARKANSAS WATER RESOURCES RESEARCH CENTER

TECHNICAL ADVISORY COMMITTEE

1989

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