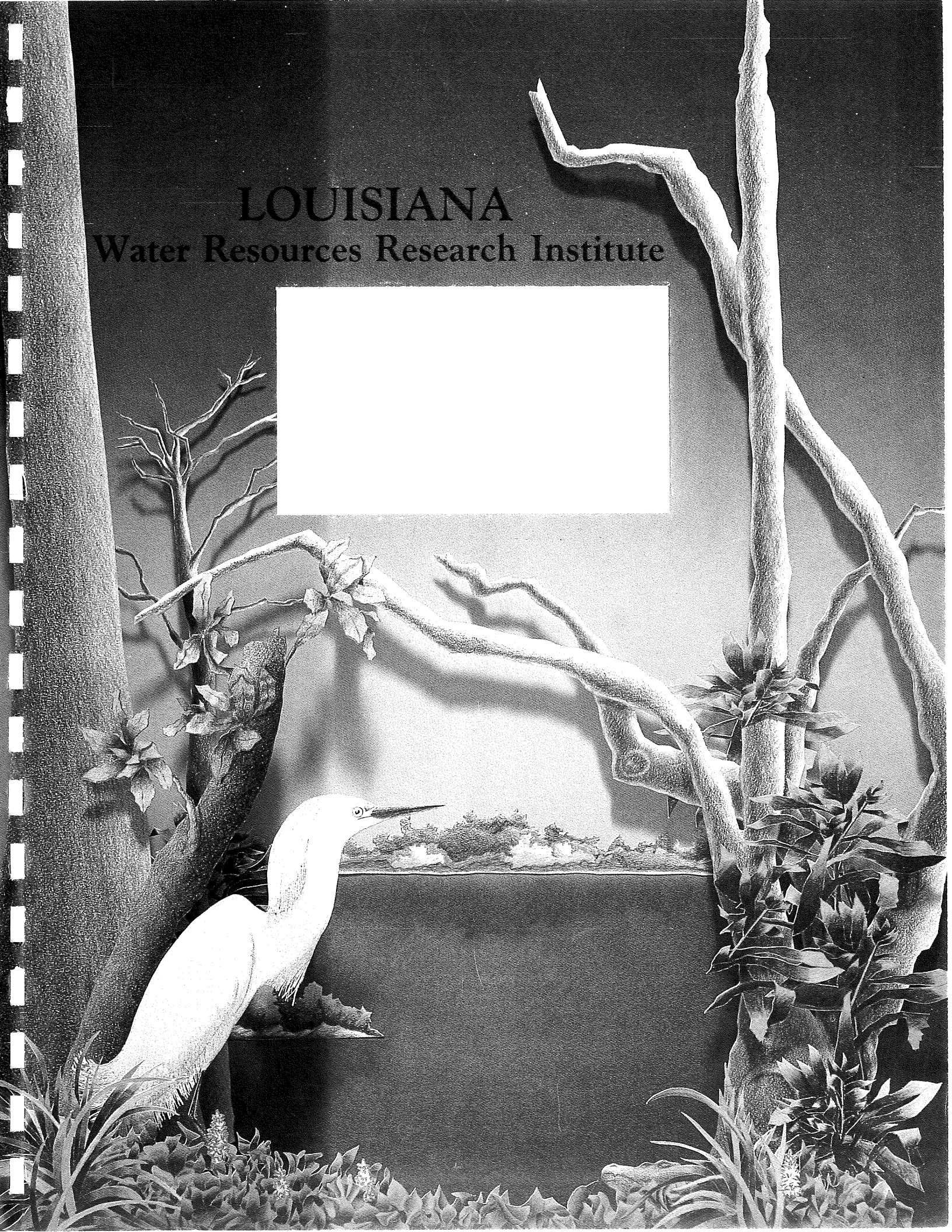
LOUISIANA
Water Resources Research Institute



FISCAL YEAR 1988
PROGRAM REPORT
GRANT NO. 14-08-0001-G1565-01

Report No. G 1565-01

Fiscal Year 1988 Program Report
Grant No. 14-08-0001-G1565-01

for

U.S. Department of the Interior
Geological Survey

by

Louisiana Water Resources Research Institute
Louisiana State University
Baton Rouge, LA 70803

Marty Tittlebaum, Director

September 1989

The activities on which this report is based were financed in part by the Department of the Interior, U.S. Geological Survey, through the Louisiana Water Resources Research Institute.

ABSTRACT

The 1988 cooperative research program of the Louisiana Water Resources Research Institute addressed priority water resources problem areas identified for Louisiana - management of surface water supplies, ground water control and restoration, and wastewater treatment alternatives.

Four research projects funded to address these priority issues were: (1) Determination of Rock-Reed Filter Volume Requirements for Small Domestic Wastewater Flows, (2) Identification of High Risk Atmospheric and Surface Conditions for Urban Flash Flooding in Louisiana, (3) Pathways, Mechanisms, and Rates of Solute Transport Across the Base of the Fresh Water Zone, South Louisiana, (4) A Water Quality Training Program for the LSU Cooperative Extension Service.

Cooperative efforts, both in research and in information transfer, were expanded in Fiscal Year 1988. Joint activities between the institute and state agencies and between the institute and other university organizations were developed.

TABLE OF CONTENTS

Water Problems & Issues of Louisiana

Louisiana is blessed with an abundance of water resources and occasionally plagued with severe flooding. Key water resources issues, therefore, become managing the resources present and protecting the quality of those resources to assure continued availability and useability for future generations. Important water resources issues include the problems associated with wetlands and coastal zones, water resources planning and management, and water quality protection.

Louisiana's vast wetlands make up approximately 40% of the nations wetlands. These areas are composed of very sensitive, often delicately balanced ecosystems and are, therefore, particularly vulnerable to contamination or destruction due to man's activities and natural occurrences. Understanding these threats and finding management alternatives for these unique resources are priority issues needing attention.

Resource planning and management are also ever-present issues for Louisiana. Flooding of urban and residential areas periodically causes severe economic loss and human suffering. Yet through flood water control and diversion, valuable sediment load previously available to nourish the state's coast line is diminished or unavailable to the areas most in need. Water resources and environmental issues are intricately interconnected, therefore changes in one aspect produce a corresponding responsive change in another. To effectively manage these resources, holistic strategies need to be developed.

Water quality protection, particularly of ground water resources, is an emerging issue of concern in Louisiana. Delineating aquifer recharge areas, understanding the impacts of industrial activities on these water resources, and exploring protection alternatives are issues at the forefront of researchers and citizens minds alike.

PROGRAM'S GOALS AND PRIORITIES

The primary goal of the Louisiana Water Resources Research Institute (LWRRI) for the Fiscal Year (FY) 1988 was to help meet the present and future water resources research needs of the state and region, with the research contributing to national water research needs. Specific objectives of the Institute were to encourage and support research efforts that help provide answers or alternative solutions to protect and properly manage the state's valuable surface and ground water resources, to train students to be water resources scientists and engineers capable of solving present and future water resources problems, and to transfer research results and findings and provide technical assistance to governmental and industrial personnel as well as the citizens of Louisiana.

The priority problems addressed by the Institute in its FY 1988 program were:

* Management of Surface water supplies,
* Ground water quality control, especially that research related to the fate of hazardous materials,
* Aquifer restoration techniques, disposal and treatment systems, and
* Legal and institutional issues for water resources management and development.

These priority problems for Louisiana were specified in the survey conducted by the National Association of Water Institute Directors (NAWID) during 1987. The Louisiana priority problems were also identified as mutual Southern Plains Region problems; therefore, research to address one will benefit all.

Other priorities of the Institute have been and continue to be the restoration of the Institute to a position of leadership within Louisiana for water resources issues and concerns. Objectives through which this is being achieved are to increase operational efficiency of the Institute, to increase funds available to faculty researchers, and to develop and implement an aggressive information transfer program that will bring recognition to the Institute and its researchers while providing valuable information and education to Louisiana's citizens.

Research Project Synopsis

The Institute's FY 1988 cooperative program addressed the specific research priorities identified above. Four projects were funded. Projects addressed: wastewater treatment (02), urban flash flooding (03), groundwater hydrology (04), and a water quality training program (22). The projects were:

02 Determination of Rock-Reed Filter Volume Requirements For Small Domestic Wastewater Flows -
Walter H. Zachritz

03 Identification of High Risk Atmospheric and Surface Conditions for Urban Flash Flooding in Louisiana -
Katherine K. Hirschboeck

04 Pathways, Mechanisms, and Rates of Solute Transport Across the Base of the Fresh Water Zone, South Louisiana -Jeffrey S. Hanor

22 A Water Quality Training Program for the LSU Cooperative Extension Service -
Brenda G. Kelly and William Branch

A synopsis of each project follows.

SYNOPSIS

Project Number: 02

Start: 09-01-88
End: 08-31-89

Title: Determination of Rock-Reed Filter Volume Requirements for Small Domestic Wastewater Flows

Investigator: Dr. Walter H. Zachritz II, Department of Civil Engineering, Research Associate

COWRR: 5D

Congressional District: Sixth

Key Words: Wastewater, plants, filter

Problem and Research Objectives:

This research is part of a two-phase project, the overall objective of which is to determine volume requirements for Rock-Reed filters in domestic wastewater treatment applications. The first phase is a bench-scale study wherein the organic and hydraulic loading is varied systematically in order to access the operation of the filters. To obtain a constant organic loading and to decrease material handling requirements, synthetic wastewater is being used for this phase. The second phase will be a field verification study and will employ existing domestic filters comparable in design to the bench-scale filters. Also, as a part of phase two, existing municipal filters will be examined for comparison to the bench and pilot scale units.

Methodology:

Three bench-scale filters were constructed by filling three 5 foot long by 1.5 foot wide by 2.5 feet deep aluminum tanks (coated inside with polyurethane) to a depth of 2 feet with 1" to 3" gravel. A 6" layer of pea gravel was then placed on top of the gravel to allow establishment of plants. Tanks 1 and 2 were planted with ten plants each of Sagittaria lancifolia and Scirpus validus, respectively. For five months the systems were allowed to acclimate by recycling a flow of nutrients. During this time, the filters were seeded with activated sludge mixed liquor and given a constant supply of dextrose.

After acclimating, the systems were converted from recycling flow to continuous flow-through systems. Also, the nutrient plus dextrose feed was replaced with synthetic wastewater. Several recipes were tried before one was settled on in early June. A major change in this recipe was the substitution of Difco nutrient broth for glucose and ammonium sulfate, the carbon and nitrogen substrates, respectively.

With the preliminary adjustments made, experimentation began with

a flowrate of approximately 80 ml/min (theoretically, 1.75 days detention) and a BOD loading of about 40 mg/l. The TKN of the initial feedwater was 10 mg/l. After 5 weeks, the BOD loading was changed to approximately 150 mg/l with a TKN of about 35 mg/l.

Principal Findings and Significance:

During June and July, the flows through systems 1 and 2 varied from 74 to 92 ml/min, except for two days of flow through system 1 rising above 100 ml/min due to apparent tampering. System 3 experienced pump failure and replacement by a different pump causing the pumping rate to vary form 60 to 93 ml/min. These variations in flowrate were in synchrony with the percentage of COD removal, in many cases. Currently, the flowrate is being monitored much more closely; therefore, it will become apparent whether the oscillations in removal are due to flowrate changes or if they are due to other factors such as sloughing of biofilm. The BOD removal percentages followed a more steady path; however, these data points were fewer and variations may have escaped detection. Another possibility is that the inorganic constituents which create an oxygen demand are more mobile and, therefore, more variable with flowrate; while the organic components adsorb to biofilm and plant roots more strongly and, thus, are not as easily swept away.

Another factor which may be creating uncontrolled variability in the systems is the variation in pH of the feedwater from 7.0 to 8.7. Adjustment of feedwater pH to between 7.0 and 7.5 has been added to the experimental protocol since the variation was noted. The effluents from systems 1 and 2 (both of which contained plants) was consistently between 7.2 and 7.7, whereas the control system (3) effluent ranged from 7.6 to 8.7. A rise in control system effluent on several days is a reflection of the algae on the surface of this filter.

Although the COD removal percentages were unstable, an ANOVA performed on data from the last eight days indicted a very significant difference in at least one system within a 99.5% confidence level. An F-test between data sets indicated a significantly lower removal rate in the control relative to the plant system but no significant difference between the two systems containing plants. The average removal rates using this data were 64%, 67%, and 30% for systems 1,2, and 3, respectively. It should be noted, however, that a t-test performed on this data revealed data points above and below the 95% confidence range for each system. This observation spurs questions as to whether a steady-state had been reached. Once the flowrate and pH are normalized, a criterion for steady-state can be determined.

Publications and Professional Presentations: Paper in progress for submittal to the Journal of the WPCF.

M.S. Thesis: None

Ph.D. Dissertation: A Ph.D. dissertation, based in part on this research effort, will be completed in August 1990.

SYNOPSIS

Project Number: 03

Start: 09-01-88
End: 08-31-89

(NOTE: A non-fund extension has been requested for completion of this project.)

Title: Identification of High-Risk Atmospheric and Surface Conditions for Urban Flash Flooding in Louisiana

Investigator: Dr. Katherine K. Hirschboeck, Department of Geography & Anthropology, Louisiana State University

COWRR: 2 E

Congressional District: Sixth

Key Words: Urban flash flooding, atmospheric processes, Louisiana

Problem and Research Objectives:

Flash flood "warnings" and "watches" are issued frequently in Louisiana by the National Weather Service due to the state's great potential for experiencing high-intensity, short-duration convectional precipitation events. Because of generally low relief, ample vegetative cover, and well-developed soils, rural areas of Louisiana have the ability to accommodate many of these intense rainfall events without exhibiting excessively "flashy" streamflow regimes. The hydrographs of catchments in urbanized areas of the state, however, tend to exhibit the steep rising and falling limbs characteristic of hydrographs in more arid regions because of impervious surfaces, reduced infiltration capacity, and artificial drainage networks consisting of canals, storm sewers, culverts, and ditches. As urbanization continues, the potential for severe flash flooding in cities throughout the state will increase. The purpose of this study is to identify "high-risk scenarios" of both atmospheric and surface conditions that are likely to produce severe flash flooding in each of the seven main urban centers of Louisiana.

Research Objectives:

1. To identify and catalog significant flash floods that have occurred in the seven main urban centers of Louisiana over the last 30 years.

2. To define and describe the synoptic atmospheric environment and the antecedent surface conditions of each catalogued urban flash flood.

3. To adapt, refine, and modify the flash flood classification scheme developed by R. A. Maddox specific to Louisiana.

4. To compare and contrast the atmospheric and surface conditions that develop into urban flash floods in different parts of the state.

5. Based on objectives (1) through (4), to define and describe high-risk scenarios for the development of flash floods in each of the seven main urban center of Louisiana.

Methodology:

The objectives of this project are being accomplished through the following research tasks: (1) the development of a catalog of significant flash floods that have occurred in the seven main urban centers of Louisiana over the last 30 years, (2) the adaption of the Maddox flash flood classification scheme to Louisiana, (3) the development of an inventory of vegetation cover, soils, and land use in selected urban catchments using the Thornthwaite water balance model, (5) a comparative analysis of the spatial and temporal differences in atmospheric input and surface conditions that have generated urban flash floods in different parts of the state, and (6) the synthesis of the results of tasks #1 through #5 to construct high-risk scenarios for the generation of flash floods in each of the state's main municipalities.

Principal Findings and Significance:

Task #1 - Catalog of significant flash floods in Louisiana urban areas.

The catalog was developed by using the Storm Data publication of the National Weather Service (which reports occurrences of flash floods) and additional criteria based on days receiving greater than 2.00 inches of rainfall. Over 150 major flash floods were catalogued throughout the state for the period covering the last 30 years. Additionally, within each major urban center, about 200-300 days with heavy rainfalls having potential for street flooding were recorded during the period 1930-1985. Baton Rouge and Alexandria recorded the most days with heavy rainfalls and Shreveport recorded the fewest.

In the summer of 1989, during the course of the project, some major flash flood events occurred in Monroe, Lake Charles, and Baton Rouge, with Shreveport and Lafayette also experiencing some flooding. The impact of the Baton Rouge storm and floods during June 28-29, 1989 was substantial, and some of the emphasis of the project was changed to include a special analysis of these floods.

Task #2 - Synoptic classification of flash floods.

The flash flood classification scheme of Maddox was found to be useful for many of the flash floods occurring in Louisiana, but a few new categories were identified for application to the local situation. Fronts and upper level disturbances were the most common features associated with floods, especially if the large-scale circulation resulted in the stalling of a rain-producing feature. Some of the greatest floods developed from the remnants of dissipating tropical storm systems, such as Tropical Storm Allison in June 1989.

Task #3 - Development of surface condition maps.

Large amounts of project time were devoted to data collection and computer mapping of surface conditions in selected urban water sheds, and some of this work is still in progress. All of this information is being entered into a Geographic Information System on the Intergraph at Louisiana State University's CADGIS (Computer Aided Design - Geographic Information System) Laboratory. The completed map files will serve as excellent baseline conditions for future comparison studies, as well as for the development of high-risk scenarios.

Task #4 - Antecedent soil moisture conditions.

Continuous daily water balances have been computed for stations at or near seven main urban areas of the state for the times prior to many of the floods. As expected, flash flooding appears to be more severe for a given rainfall event when soil moisture levels are not significantly depleted.

Task #5 - Spatial comparison causes of floods across the state.

The spatial comparison of flash floods from one part of the state to another is still underway. Thus far, only subtle spatial differences in the nature of flooding across the state appear to exist, while the differences in stalled fronts and dissipating tropical storms can have both a widespread or local impact, depending on the specific track of each feature.

Task #6 - High-risk scenarios.

The high-risk scenarios are under development and depend in part on completion of Tasks #3 and #5. The 1989 floods that occurred during the course of the project are being analyzed and will be used to illustrate specific case studies for different parts of the state.

Overall Significance

The results of the study and the occurrence of several severe urban flash flood events during the course of the project point to an ongoing flooding problem in the state. Natural climatic

variability is responsible for the various categories of storms and floods that occur in different parts of the state, and future climatic scenarios that are more severe than any that have occurred thus far are possible. Continued urbanization and loosely enforced zoning will only exacerbate the problem, hence citizens, planners, and law-makers should all be made aware of the future flooding potential of the urban areas in the state.

Publications and Professional Presentations:

A manuscript is in preparation for submission to Water Resources Bulletin. The results to date will be reported at the Fall 1989 conference titled: "Louisiana's Environment in the 1990's." Final results will be presented in 1990/91 at a national geography or water resources conference.

M.S. Thesis:

"Causes and Consequences of the June 28-29, 1989 Storm and Floods in Baton Rouge: by Mattie Ann Fincher, Department of Geography & Anthropology, Louisiana State University. (thesis in progress)

Ph.D. Dissertations: none

SYNOPSIS

Project Number: 04

Start: 09-01-88
End: 08-31-89

Title: Pathways, Mechanisms, and Rates of Solute Transport Across the Base of the Fresh Water Zone, South Louisiana

COWRR: 5B

Congressional District: Sixth

Key Words: Ground Water, Louisiana, Contamination, Solute Transport, Brines

Problem and Research Objectives: Shallow ground water is the principal source of municipal, industrial, and agricultural water in many areas of south Louisiana. The fresh water zone is underlain by sands and shales containing brines having salinities in excess of 100 g/L. The local occurrence of saline waters at shallow depths has compromised use of some ground water supplies.

To help develop an understanding of the processes which control the occurrence of saline waters at shallow depths in the region, including vertical mixing, a one-year investigation was undertaken as the start to a longer-term project to define the nature of the transition zone between fresh and saline waters in a five-parish area south of Baton Rouge.

Methodology: Information on pore water salinity, temperature, and pressure and on sediment lithology was derived from examination of over 100 wire-line spontaneous potential and resistivity logs. From this information, maps and cross sections have been constructed showing the spatial variation in pore fluid and sediment properties useful in delineating hydraulic and solute transport regimes over a depth interval of approximately 3 km. Work was also begun on techniques to improve the calculations of pore water salinity in brackish water zones from spontaneous potential and resistivity wire line logs.

Principal Findings and Significance: Of great interest is the discovery that the configuration of the base of the fresh water zone in southeast Louisiana is influenced both regionally and locally by processes originating at depths as much as 3 km or more in the subsurface. The base of the topographically-driven shallow meteoric ground water system which is recharged in the vicinity of the Louisiana-Mississippi border north of Baton Rouge shallows dramatically to the south at the northern margin of the south Louisiana salt dome province. Presumably, lateral ground water flow is being affected not only by the presence of major growth fault systems but also by the masses of dense, saline waters which typically surround shallow salt domes in the region. The topographically-driven fresh waters are not able to displace these dense brines and must rise and discharge at the surface. The

transition between the shallow fresh waters and underlying brines represents a regional zone of vertical and lateral mixing.

The local configuration of the base of the regional ground water system is also influenced by deep-seated phenomena. For example, there are no potable waters over the St. Gabriel and Darrow salt domes in Iberville and Ascension parishes south of Baton Rouge. The brackish waters which exist above these domes are not the result of activities related to oil and gas production but apparently are the product of the natural transport of dissolved salt derived from the two domes, the tops of which are situated at depths of approximately 3.4 and 1.4 km, respectively.

The driving mechanisms, preferred pathways, and rates of fluid flow and solute transport are not yet known in quantitative detail in the region. Hydraulic processes appear to include the topography-driven flow of meteoric fluids at very shallow depths, density-driven overturn around some salt domes, and pressure-driven flow up faults, at least one of which extends to within 100 m of the surface. There is little evidence of significant vertical compartmentalization of fluids above a depth of approximately 3 km, at least on a regional basis. The results of this preliminary phase of the study and its continuation will be of interest and use to those involved in the removal and introduction of aqueous fluids and the remediation of degraded water supplies in the region.

Publications and Professional Presentations: Two manuscripts for publication are currently being written. Professional presentations which include the results of this work have been given at Texas A & M University in September, 1989, and are planned for the Society of Exploration Geophysicists Annual Meeting in October, 1989; at the Geological Society of America Annual Meeting in November, 1989; and the Gulf Coast Association of Geological Societies Meeting in October, 1990.

M.S. Theses: Spatial variations in subsurface port fluid properties in a portion of southeast Louisiana: implications for fluid migration and solute transport. R.B. Bray, Department of Geology and Geophysics, Louisiana State University.

Ph.D. Dissertations: K.M. McManus, in progress. Department of Geology and Geophysics, Louisiana State University.

SYNOPSIS

Project Number: 22

Start: 09-01-88
End: 08-31-89

Title: A Water Quality Training Program for the Louisiana Cooperative Extension Service

Investigators: Brenda G. Kelly, Assistant Director
La. Water Resources Research Institute
Louisiana State University

Bill Branch, Engineering Specialist
La. Cooperative Extension Service
Louisiana State University

COWRR: 09 B

Congressional District: Sixth

Key Words: Water Quality, Drinking Water, Louisiana, Education, Information Dissemination

Problem and Research Objectives: Louisiana's citizens are becoming increasingly aware of water quality problems and issues and are turning with ever increasing regularity to the Louisiana Cooperative Extension Service (LCES) state and parish offices for assistance. Most LCES staff members are not adequately prepared for or trained to effectively address these questions, and are in need of additional technical training in water quality issues.

The goal of this project was to develop and conduct an intensive water quality training program designed specifically for the LCES state and parish staff. Specific objectives were to (1) design a 2-3 day water quality education program for the target audience; (2) identify and document the most frequently needed informational and reference materials readily available to LCES staff, and (3) conduct ten (10) training programs throughout the state.

Methodology: A water quality workshop was designed by the project investigators to address drinking water quality issues for Louisiana. Workshops were planned specifically for the needs of the staffs of the LCES state office and for each of ten district offices.

The investigators and other technical experts presented detailed sessions on topics including natural ingredients to water quality, water quality standards, health effects of water quality, home treatment devices, and area agency responsibilities over water quality. These experts came from universities and state and federal governmental offices in-state.

Available information resources were searched, and appropriate materials, brochures and reports addressing the drinking water quality topics were gathered. Additional printed and audio-visual

materials were developed, as needed, for distribution at the workshops.

Principal Findings and Significance: Workshops were designed and scheduled, and informational literature gathered and prepared for distribution to workshop participants. To date, four workshops have been conducted with one of the four serving two districts. A realignment of LCES districts reduced the number of districts from ten to seven thus reducing the number of workshops to be scheduled. With four workshops completed, others are scheduled for fall 1989.

Staff participation in the workshops exceeded expectations. To date a total of 220 LCES staff members have attended. The workshop format was altered to compress the time schedule to a one-day program, making it more conducive to many people by limiting time away from the office.

More than ten state and federal agencies contributed to the water quality training workshops. These agencies were eager to provide state members as speakers, to explain their agency's water quality responsibilities, and to offer information and technical assistance to LCES staff for future program development.

Through this program, the LCES information disseminators are now more aware of the presence of these resource people and have been familiarized with the types of assistance available through agencies and their staff. The resources are primarily in the form of staff members of the various agencies. Limited printed materials appropriate for the general public are readily available. The efforts of the project investigators and other individuals are contributing to the reservoir of readily available information, yet much work remains to be done. Additional water quality topics need to be addressed for the public's awareness and understanding.

The primary objectives of this project, to increase the awareness and understanding of issues on the part of information disseminators throughout the state, has been met through this water quality training program. The LCES staff members will be better able to respond to questions and to develop educational programs for the general public designed to improve citizens' understanding of water quality issues. Parish Advisory Committees are being organized to help LCES parish staff develop and implement relevant new programs of local interest. The new programs will receive continued support form the LCES state office staff, who will be available to provide technical assistance and develop additional supportive materials.

The development of a Water Quality Reference Manual was begun as a byproduct of this project. Upon completion of the manual, copies will be distributed to each of the LCES district offices for ready reference on many major water quality topics. Materials incorporated into the manual will include those prepared for this workshop series, other materials developed throughout the national

U.S. Department of Agriculture Cooperative Extension network, as well as materials available from other sources.

Publications and Professional Presentations:

- Water Quality Reference Manual, 1989. To be published by the Louisiana Cooperative Extension Service, currently in draft form.

- "A Water Quality Training Program for the Louisiana Cooperative Extension Service", Conference: Louisiana's Environment in the 1990's, Sponsored by the Louisiana Department of Environmental Quality, Louisiana Water Pollution Control Association, Louisiana American Water Resources Association, Louisiana Chemical Association, Louisiana Association of Business and Industry, and the Louisiana Water Resources Research Institute, November 15, 1989.

M.S. Theses: None

Ph.D. Dissertations: None

Information Transfer Activities

The information transfer activities of the Institute were continued during Fiscal Year 1988.

Initial activities have included in-house organizational activities to collect and document all works published during the history of the Institute and to present faculty and students with water resources news and information of the Institute, previously only partially documented, has been compiled and will be annually updated. The resulting list, now available for public distribution, provides ordering information for requesting the water resources information and publications and is found in Appendix A. A water resources bulletin board is now being maintained to announce upcoming meeting, job opportunities for both students and faculty, award opportunities for students, and calls for papers.

A major information transfer activity of the Institute for FY 1988 was co-sponsorship of the conference "Louisiana's Environment in the 1990's" in conjunction with the Louisiana Department of Environmental Quality, Louisiana Chapter of AWRA, LWPCA, Louisiana Chemical Association, and the Louisiana Association of Business and Industry. The conference was held on November 14-16, 1989 at the Bellemont Hotel in Baton Rouge. Participation in this event provided a mechanism to communicate the research plans and accomplishments of the Institute. FY 1988 faculty researchers summarized the results of their recently completed research, and FY 1989 researchers (work just beginning) presented highlights of their proposed work. Presentations were made on day 3 of the conference in the concurrent session "Water Resources Research Papers". The program for the conference is contained in Appendix B. Attendance at the conference was by invitation with one thousand persons from state and federal government, regional regulatory agencies, industry, consulting firms, professional organization and universities invited to attend. Approximately five invited groups attended the conference, and between 175 and 250 persons were in attendance daily. This co-sponsorship and presentation of Institute activities will be an annual event and is anticipated to follow a similar format in future years.

The Institute also annually co-sponsors the "Ground Water Seminar", working closely with several Louisiana Departments, private companies, AWRA, other Louisiana State University units, and the USGS District Office in Baton Rouge. Presentations comprising the session moderated by the Institute Director are solicited from outside the current Institute projects, which enhances information transfer both to and from the Institute into related areas.

The Institute's staff has, in FY 1988, placed particular emphasis on acquainting Louisiana's research community with the research funding opportunities through the U. S. Geological Survey

Sections 104 and 105 research programs. Announcements for both research programs were widely distributed to Louisiana's colleges and universities and to research organizations throughout the state. In addition, public announcements were made at professional and faculty meetings to help assure wide participation in the programs. This increase appears to be evidence of the success of these efforts. Table 1 depicts this in participation.

Table 1. Louisiana's Participation in Section 104 and 105 Research Programs, Proposals Submitted

Year	Section 104	Section 105
1989	14	8

Presentations by the Director and Assistant Director have been given to civic and professional organizations to help acquaint these audiences with the activities of the Institute. These were given to the Louisiana Environmental Health Association (January, 1988) and the Louisiana Federation of Garden Clubs (August, 1988). The poster and exhibit materials have been displayed at other meetings attended by research faculty and are currently displayed throughout the College of Engineering building on campus.

An advanced wastewater treatment short course was developed and was conducted for Gulf States Utilities personnel at the Riverbend Nuclear Power Plant on August 29 and 30, 1988. The Louisiana Department of Health and Hospitals recertification requirements for wastewater treatment plant operators, was attended by fifteen professionals. The course addressed the specific wastewater characteristics of the nuclear power plant.

The Institute co-sponsored a conference, Ground Water Protection in Louisiana: Quality, Risk Assessment and Remediation, held on May 12, 1988. The conference program was structured to provide timely information about the latest technological advancements, to identify and assess new issues and concerns, recent developments and new problems facing Louisiana and to enhance understanding of current approaches to solving critical and politically sensitive environmental issues. More than 175 persons with professional interests in Louisiana's ground water resources attended.

Two information/fact sheets were prepared for distribution at professional meetings and at other times when opportunities for publicizing the Institute are appropriate. The first provides general information about the Louisiana institute, its goals and its history. A second fact sheet receiving wide distribution identifies the Louisiana agencies with water resources regulatory and/or management authority and briefly describes their responsibilities.

Future information transfer activities include the development of a brochure about the Institute and the regular circulation of the Institute's newsletter "Louisiana Water Research."

To assist in these transfer activities and administrative tasks, the College of Engineering provided the Institute with an IBM Personal System/2 Computer and a Proprinter.

Training Accomplishments

The LWRRI is committed to training science and engineering students to assume leadership roles in current and future water resources and environmental problem solving. Research projects that incorporate extensive student training elements in the proposed research are given preferential consideration over proposed research involving faculty participation only. Table 2 summarizes the student training benefits of the current program.

Table 2. Training Accomplishments

	Academic Level				
	Undergraduate	Master's Degree	Ph.D. Degree	Post-Ph.D.	Total
Field of Study					
Chemistry					
Engineering					
- Agricultural - Civil - Environmental - Soils - Systems	4		1		5
- Other *		1			1
Geology		2	1		3
Hydrology					
Agronomy					
Biology					
Ecology					
Fisheries, Wildlife and Forestry					
Computer Science					
Economics					
Geography		1			1
Law					
Resource Planning					
Other (specify)					
TOTAL:	4	4	2		10

* Less than 6 students in any one field of study

APPENDIX A

Publications List

PUBLICATIONS

OF THE

LOUISIANA WATER RESOURCES RESEARCH INSTITUTE

Dr. Marty E. Tittlebaum
Director

2401 A CEBA Building
Louisiana State University
Baton Rouge, Louisiana 70803
Telephone: (504)388-8508

December 1989

LWRRI PUBLICATIONS: Bulletins

Handbook of Basic Water Law	Bulletin 1	June 1966
The Measurement and Comparison of Costs for Alternative Water Replacement Projects	Bulletin 2	October 1966
Salt-Water Encroachment Into Aquifers	Bulletin 3	October 1968
Water-Resources Manpower Supply and Demand Patterns to 1980	Bulletin 4	May 1970
The Present and Future Ground-Water Supply of the Baton Rouge Area	Bulletin 5	February 1970
Subsidence and Ground-Water Offtake in the Baton Rouge Area	Bulletin 6	October 1970
An Economic Reappraisal of the Toledo Bend Multiple-Purpose Water Project	Bulletin 7	October 1970
Geochemical Hydrology of the Baton Rouge Aquifers	Bulletin 8	March 1972
The Mississippi River - A Water Source for Texas?	Bulletin 9	March 1973
Cyclic Storage of Fresh Water in Saline Aquifers	Bulletin 10	May 1975
Aquifers as Processing Plants for the Modification of Injected Water	Bulletin 11	August 1980
If the Old River Control Structure Fails?	Bulletin 12	September 1980
Alternate Water Sources for the Baton Rouge - New Orleans Industrial Corridor	Bulletin 12A	September 1980
A Change in the Course of the Lower Mississippi River: Description and Analysis of Some Economic Consequences	Bulletin 12B	September 1980

LWRRI PUBLICATIONS: Technical Reports

The Recent Alluvium of Thomas and Duncan Points	Technical Report 1	June 1967
The Present and Future Ground Water Supply of the Baton Rouge Area	Technical Report 2	Sept 1967
A Summer Limnological Study of Lake Pontchartrain, Louisiana	Technical Report 3	Sept 1968
Physical, Chemical, Bacterial, and Plankton Dynamics of Lake Pontchartrain, Louisiana	Technical Report 4	Sept 1969
Epifaunal Invertebrates as Indicators of Water Quality in Southern Lake Pontchartrain, Louisiana	Technical Report 5	May 1975
Demonstration Project to Store Fresh Water in a Saline Water-bearing Formation: City of Houma, Louisiana	Technical Report 6	Feb 1979
Water Related Problems in the Coastal Zone of Louisiana	Technical Report 7	Nov 1980
Plan of Study for Evaluating the Effects of Lignite Mining in Louisiana on Water Resources	Technical Report 8	Aug 1981
Use of Twin Wells and Water-Source Heat Pumps for Energy Conservation in Louisiana	Technical Report 9	Dec 1981

LWRRI PUBLICATIONS: GT Series

The Flood Control Capabilities of the Atchafalaya Basin Floodway	Bulletin GT-1	April 1967
Hydrology of Neogene Deposits in the Northern Gulf of Mexico Basin	Bulletin GT-2	April 1969
Economic Aspects of Ground-Water Basin Control	Bulletin GT-3	February 1970
Geohydrology of the Shallow Aquifers of Baton Rouge, Louisiana	Bulletin GT-4	October 1969
Possible Failure of the Low-Sill Control Structure at Old River, Louisiana: Economic and Physical Consequences	Bulletin GT-5	July 1976

PROJECT COMPLETION REPORTS

TITLE	AUTHOR(S)	QUANTITY
Algae Removal by Induced Air Flotation (May 1982)	Tittlebaum, Holtman	5
Application to the Principle of Maximum Entropy (POME) to Hydrologic Frequency Analysis (1984)	Singh, Rajagopal	18
Biodegradation of Hazardous Chemical Wastes (1984)	Pelon, Murray	28
Biological Removal of Chlorinated Hydrocarbons from Water (Oct 1985)	Templet	19
Chemical Quality of Surface and Sediment Pore Water in Louisiana and Mississippi Estuaries (Oct 1973)	Snowden, Otvos	1
Comparative Evaluation of Estimators of Some Flood Frequency Models Using Monte Carlo Simulation	Vijay P. Singh, Kishore Arora	3
A Continuum Mechanics Approach to Streamflow Modeling (July 1983)	V. Singh, S. Prasad, L. Ubertini	2
Co-treatment of Water Softening and Wastewater Sludges (May 1982)	Bowie, Gautreaux	6
Design of Rainfall Networks Using Entropy (Oct. 1986)	Vijay P. Singh, P.K. Krstanovic	3
Development of a Methodology for Evaluating Waste Disposal Sites (August 1982)	J. Hill, R. Malone, S. R. Alston	14
Development of a Simplified Chlorinated Hydrocarbon Screening Technique for Water and Sediment (August 1984)	Templet	8

PROJECT COMPLETION REPORTS

TITLE	AUTHORS	QUANTITY
A Discrete Kernel Model for Simulation of Multilayered Aquifers (1984)	Illangasekare	17
The Dispersion of Continuously Injected Effluents in Open Channels (Feb 1973	Harrison, Wehe	3
Effect of Diverting Mississippi River Water To Texas on Sedimentation in the River (March 1974)	Alawady	2
Effect of Viscosity Ratio on the Recovery of Fresh Water Stored in Saline Aquifers (April 1977)	Kimbler, Whitehead	10
Evaluation of Parameter Estimation Methods for Flood Frequency Analysis: Computer Programs	Vijay P. Singh, Kishore Arora	3
Evaluation of Some Empirical Methods for Flood Frequency Analysis 2. Data and Computer Programs (March1987)	Vijay P. Singh, Deepak Jain	3
Fate of PCB and Dioxin in Louisiana's Aquatic Environment (Sept 1983)	Pardue, DeLaune, Patrick	6
Floodwater Nutrient Processing in a Louisiana Swamp Forest Receiving Agriculture Runoff (Dec 1981)	Kemp, Day	1
A Geomorphic Approach to Hydrograph Synthesis, with Potential for Application to Ungaged Watersheds (June 1983)	V. Singh	4

PROJECT COMPLETION REPORTS

TITLE	AUTHOR(S)	QUANTITY
Hydraulic Conductivity of Rockfill (July 1983)	A. A. Hannoura, K. McManis	35 Vol I 5 Vol II
Information Dissemination for a Better Understanding of Louisiana's Water Resources (Sept 1984)	Worm	7
An Investigation Into the Removal of Algae by Fine Sand/Silt Filtration (Nov 1981)	Naghavi, Malone	8
Mathematical Models for Ungaged Watersheds with Potential for Quantifying the Effect of Land Use Changes on Streamflow (Oct 1984)	Singh	3
A Method of Determining the Quality of Irrigation Water to Achieve Optimum Growth of Bottomland Hardwoods in North Louisiana (Feb 1970)	Wilson, Miller, Banks	1
A Multivariate Approach to the Investigation of Nutrient Interaction in Barataria Basin, Louisiana (April 1983)	A. Witzig, J. Day	10
Nutrient Assimilation Capacity of Shallow Coastal Lakes (1983)	Delaune, Smith, Patrick, Sarafyan	8
Optimum Treatment for Coal Pile Runoff in Louisiana (August 1984)	Hendershot, Tittlebaum	5
Oxidation of Trace Contaminants in Drinking Water (Dec 1985)	F. Groves	20

PROJECT COMPLETION REPORTS

TITLE	AUTHOR(S)	QUANTITY
Prediction of Hydrothermal Regimes in the Proposed Darlington Reservoir (Sept 1986)	Field	5
Prediction of Hydrothermal Regimes in the Proposed Darlington Reservoir Volume Supplement (Sept 1986)	Field	4
Radioactivity in Mississippi River Water (April 1977)	Iddings, Knaus	5
Reaeration Rate Estimation Using the LAG in Dissolved Oxygen Concentration (Jan 1983)	M. Waldon	4
Reclamation of Polluted Farm Ponds (July 1977)	Robbins, Nelson	19
Reliability Analysis of BOD Kinetics in a Small Southern Stream Governed by the Discharge of an Oxidation Pond (1981)	Crane, Malone	3
Role of Mycorrhizae in Land Application of Municipal Wastewaters (August 1983)	J. Robbins	5
Sucrose Removal From Cane Sugar Mill Waste Streams by Ion Exchange (Oct 1976)	F. Groves	12
THM Precursors Removal From Surface Waters Using Ozone-Hydrogen Peroxide Oxidation (July 1982)	Fernandes	10
A Trophic State Index for the Louisiana Coastal Zone (April 1983)	A. Witzig, J. Day	4

PROJECT COMPLETION REPORTS

TITLE	AUTHOR(S)	QUANTITY
Wastewater Treatment by Ligand Exchange (June1983)	F. Groves	5
Water Quality Variation in the Potable Water of Grand Isle, Louisiana During Periods of Water Shortage (Feb 1983)	M. B. Walsh, R. Malone, E. Dantin	5
A Multivariate Stochastic Flood Analysis Using Entropy (October 1986)	Vijay P. Singh, P.K. Krstanovic	3
Reduction of Trihalomethane and Other Chlorinated Hydrocarbons in Drinking Water	B. Boyden J.B. Fernandes	
Use of Stable Nitrogen Isotopes in Determining Nitrogen Sources Entering Louisiana Surface Waters	R.D. DeLaune C.W. Lindau W.H. Patrick	
Rock-Reed Filters for Treatment of Small Domestic Wastewater Flows	R.F. Malone	
Identification of High-Risk Atmospheric and Surface Conditions for Urban Flash Flooding in Louisiana (December 1989)	K. Hirschboeck	
Pathways, Mechanisms, and Rates of Solute Transport Across the Base of the Fresh Water Zone, South Louisiana (October 1989)	J. Hanor	
Determination of Rock-Reed Filter Volume Requirements for Small Domestic Wastewater Flows (October 1989)	M. Tittlebaum	
A Water Quality Training Program for the Louisiana Cooperative Extension Service (October 1989)	B. Kelly B. Branch	
Nature and Rates of Bacterial Metabolism in the Aquifers of Southeastern Louisiana	P. Aharon	

Aquaculture/Marine Fisheries Process Wastewaters	J. Bankston
The Importance of Denitrification Efficiency of Wastewater Treatment in Forested Wetlands	R. Twilley
Field Testing of Rock/Reed Filters for Small DOmestic Wastewater Flows	M. Tittlebaum

LWRRI THESES

TITLE	AUTHOR	QUANTITY
Analog Simulation of Anisotropic Permeability (May 1974)	Ronald E. Rinard	1
Black Willow (Salix Nigra Marsh) as a Bioaccumulator of Radioactive Pollutants in Fresh Water Ecosystem (Dec 1976)	Lynn R. Curry	1
The Design, Construction, and Testing of Consolidated Anisotropic Sand Models (May 1972)	D. L. Hinners	1
Dispersion & Gravity Segregation of Miscible Fluids in Porous Media for Stratified Radial Flow Systems (Jan 1968)	Anil Kumar	2
Effect of Dip on the Subsurface Storage or Disposal of Fluids in Saline Aquifers (August 1975)	Joseph A. D'Amico	1
Effect of Failure of the Old River Control Structure on Municipal and Industrial Water Supplies (May 1977)	Howard J. Redmond	1
The Effect of Flux & Gravitational Forces on Miscible Displacement in a Thin Homogeneous Bed (August 1973)	Walid J. Esmail	1
The Effect of Mixed Zone Length on the Growth of Viscous Fingers During a Miscible Displacement (August 1977)	Calvin C. Barnhill	1
Effect of Viscosity Ratio on the Recovery of Fresh Water Stored in Saline Aquifers (Dec 1975)	Bipin K. Agrawal	1

LWRRI THESES (Cont.)

TITLE	AUTHOR	QUANTITY
Environmental Factors Affecting the Properties & Precipitation of Coloring Colloids in Aquatic Habitats (August 1973)	Billy R. Bordelon	1
Enzyme Process Design for Water Treatment (Dec 1976)	Steven W. Johnston	1
An Evaluation of Twin Wells for Use with Water Source Heat Pumps (May 1981)	Joseph R. Buller	1
Experimental Study of Multi-Cation Diffusion in an Artificial Quartz Sandstone (Dec 1974)	Ronald K. Stoessell	2
Geological Factors Influencing Recharge to the Baton Rouge Ground-water System, with Emphasis on the Citronelle Formation (August 1967)	Brian E. Parsons	2
The Influence of Brackish-Water Intrusion on Macro-invertebrate Associations of the Lower Tchefuncte River, Louisiana (August 1975)	Maureen M. Mulino	2
Investigation of the Technical Feasibility of Storing Fresh Water in Saline Aquifers (August 1966)	Omar J. Esmail	1
Measurement of & Calibration for Gamma Spectroscopy of Mississippi River Water (August 1976)	Orren W. Williams	1
The Relationship Between the Presence of Dissolution Features at the Salt-Caprock Interface & Saline Plumes in Aquifers Surrounding Salt Domes (Dec 1982)	Martin L. Wouch	2

LWRRI THESES (Cont.)

TITLE	AUTHOR	QUANTITY
The Simulation of Whole Core Permeameter Flow Geometry (August 1974)	Louis O. Chemin Jr.	1
A Study of the Technical and Economic Feasibility of Using Sewage Effluent for Irrigation in Lincoln Parish (August 1967)	Robert P. Cantrell	5
A Study of the Technical and Economic Feasibility of Using Sewage Effluent for Irrigation in Quachita Parish (Nov 1968)	Fernando A. Calvo	2
A Technique for Irrigating Bottomland Hardwood Trees with Papermill Effluent in North Louisiana (May 1970)	Ishtiaq Ahmed	6
The Transport of Chlorinated Hydrocarbons in Dilute Aqueous Solution Through Saturated Cohesive Deposits of Southern Louisiana (August 1987)	Laqique Haider	1
Unequal Density Miscible Displacement in Thin Homogeneous Tilted Beds (Dec 1971)	Thomas R. Painter	1
The Use of Bounding Wells to Control Flux in Underground Water Storage Projects (August 1974)	Edmond J. Langhetee	1
The Use of Bounding Wells to Counteract the Effects of Gravity in Dipping Aquifers (May 1978)	Thomas E. Williams	1
Use of Bounding Wells to Negate the Effects of Gravity and Pre-Existing Groundwater Movement in Dipping Aquifers Used for Storage (August 1979)	Paul J. Abadie	1

LWRRI THESES (Cont.)

TITLE	AUTHOR	QUANTITY
Zonation of Lake Pontchartrain Invertebrates in a Polluted New Orleans Outfall Canal (August 1978)	Michael F. Rayle	2

LWRRI DISSERTATIONS

TITLE	AUTHOR	QUANTITY
Discharge Model of the Mississippi River Evaluation of the Impact of Diversion of Water to Texas (May 1972)	O. Arguello	1
Economic Aspect of Ground-Water Basin Control (May 1979)	Larry Falk	1
Storage of Fresh Water in Saline Aquifers Using a Well Field (August 1974)	W. Whitehead	1
Geochemical Hydrology of Ground Water in Baton Rouge, Louisiana (Jan 1971)	Rashid A. Khan	3
Movement in an ACHM Overlay in the Vicinity of Overlaid Joints on a PCC Pavement (1978)	Terry J. Dantin	1

APPENDIX B

Research Symposium Program

ANNOUNCEMENT OF FALL 1989 CONFERENCE
"LOUISIANA'S ENVIRONMENT IN THE 1990'S"

Strategies to Control Toxics
Changing Perspectives and Opportunities in Water Resources Management
November 14-16, 1989 (2 1/2 days)
BELLEMONT HOTEL, GREAT HALL
7370 Airline Highway, Baton Rouge, LA

sponsored by:

La. Dept. of Environmental Quality
(La. Chapter) American Water Resources Association
La. Water Pollution Control Association
La. Water Resources Institute
La. Chemical Association
La. Association of Business & Industry

General Session:

DEQ Environmental Update
Offices of the Secretary, Air & Nuclear Energy, Water Resources, Hazardous and Solid Waste, Legal & Enforcement

Concurrent Sessions:

- **Strategies to Control Toxics in Water**
  Risk-Based vs. Technology-Based Approaches to Water Quality Regulations and Monitoring Capabilities (Bio-Monitoring & Toxicity Reduction Evaluations)
- **Assessment, Modeling and Communication of Risks**
- **Pollution Prevention/Waste Minimization Techniques**
  Source Reduction, Waste Reduction and Recycling Alternatives
- **Water Resources Management**
  Federal & State Agency Roles, Water Project Updates, Water Resources Research Reports
- **Coastal Restoration**
- **On-line Monitoring of Discharges**

Conference Planning Committee:

AWRA — Paul Kemp
LWPCA — Pat Jordan
LWRI — David Constant
LCA — Henry T. Graham, Jr.
DEQ — Robert Hannah
Exhibitors — Ken Keffer (504) 893-7920
Registration — Jim Joyce or Terry Snell (504) 835-4252

LOUISIANA'S ENVIRONMENT IN THE 1990'S
BELLEMONT HOTEL GREAT HALL
DAY 1 November 14, 1989

8:00 a.m. - Registration Begins, (Rotunda)
Exhibits Open (Ballrooms 1 & 2)
(Refreshments in the Exhibit Area)

General Session
DEQ Environmental Update
Ballroom 3

9:00 a.m. - Welcome, Introduction
Glen Daigre, President, La. AWRA
Henry Graham, Jr., President, LWPCA

9:10 a.m. - Keynote Address - Office of Water Resources Activities
Maureen O'Neill, Asst. Secretary DEQ

9:30 a.m. - Office of the Secretary Activities

10:10 a.m. - Question & Answer

10:30 a.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

11:00 a.m. - Office of Air Quality & Nuclear Energy Activities
Mike McDaniel, Asst. Secretary DEQ

11:20 a.m. - Office of Solid & Hazardous Wastes Activities
Tim Hardy, Asst. Secretary DEQ

11:40 a.m. - Question & Answer

12:00 noon - Lunch - (Ballroom 4)
Guest Speaker - Dan Borne', President
Louisiana Chemical Association

Afternoon General Session - Ballroom 3

1:30 p.m. - Citizens Environmental Activities
Leonard Knapp, Chairman, DEQ Citizens Advisory Panel

1:50 p.m. - Safe Drinking Water Program Activities
Jay Ray - Dept. of Health & Hospitals

2:10 p.m. - Office of Conservation Activities
James H. Welsh - Dept. of Natural Resources

2:30 p.m. - Question & Answer

2:50 p.m. - Overview of Conference Concurrent Sessions

3:00 p.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

3:00 p.m. - Poster Session Begins (Exhibit Area, Ballrooms 1 & 2)

4:00 p.m. - Adjourn

5:00 p.m. - Hospitality Hour Begins (Exhibit Area, Ballrooms 1 & 2)

LOUISIANA'S ENVIRONMENT IN THE 1990'S
Bellemont Hotel Great Hall
DAY 2 November 15, 1989

8:00 a.m. - Registration Begins (Rotunda)
Exhibits Open (Ballrooms 1 & 2)
(Refreshments in the Exhibit Area)

Concurrent Session On Strategies to Control Toxics in Water
Morning Session

9:00 a.m. - Introduction of Session - Moderator

9:10 a.m. - Development of Risk-Based Water Quality Standards to Control Toxics 304(1)
Cheryl Overstreet, EPA Region VI

9:40 a.m. - Development of Risk-Based Water Quality Standards
Dugan Sabins, DEQ

10:10 a.m. - Question & Answer

10:30 a.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

11:00 a.m. - Implementing 304 (1) in Permitting and EPA Biomonitoring Policy
Robert Vickery, Aquatic Biologist, EPA Region VI

11:30 a.m. - Toxicity Reduction Evaluations
Drew Fillingame, C.K. Associates

12:00 noon - Lunch (Ballroom 4)
Guest Speaker on Coastal Restoration
Senator Ben Bagert

Concurrent Session on Risk Assessment
Afternoon Session

1:30 p.m. - Introduction of Session - Moderator

1:40 p.m. - What is Risk Assessment?
Dr. Luann White
Tulane University School of Public Health & Tropical Medicine

2:00 p.m. - Risk Modeling
Jacqueline "Ruddie" Clarkson
J.M. Montgomery Consulting Engineers

2:20 p.m. - Case Study of Risk Assessment
Dr. Barbara Shane, LSU Inst. for Envir. Studies

2:40 p.m. - Question & Answer

3:00 p.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

3:30 p.m. - Quantitative Risk Assessment - National Perspective
Dr. Robert Sielken, Sielken and Associates

4:00 p.m. - Predicting Flow, Time of Travel & Mixing Zones
Mike Waldon, USL Center for Inland La. Water Studies

4:30 p.m. - Adjourn

4:30 p.m. - Hospitality Hour (Exhibit Area, Ballrooms 1 & 2)

LOUISIANA'S ENVIRONMENT IN THE 1990'S
Bellemont Hotel Great Hall
DAY 2 November 15, 1989

8:00 a.m. - Registration Begins (Rotunda)
Exhibits Open (Ballrooms 1 & 2)
(Refreshments in the Exhibit Area)

Concurrent Session on Pollution Prevention/Waste Reduction
Morning Session

9 a.m. - Introduction of Session - Moderator

9:10 a.m. - EPA's Pollution Prevention Program
John Atcheson, EPA Pollution Prevention Office, Washington, D.C.

9:30 a.m. - EPA's Pollution Prevention Research Program
Paul Randall, EPA Risk Reduction Engineering Laboratory, Cincinnati, Ohio.

9:50 a.m. - Chemical Release Reduction Policy
Ann Mason, Chemical Manufacturers Association

10:10 a.m. - Panel Discussion
Question & Answer

10:30 a.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

11:00 a.m. - Development of a Waste Reduction Program
Rosalind Segesta, LSU Hazardous Waste Research Center

11:20 a.m. - Overview of Waste Reduction Research in La.
Dr. Louis Thibodeaux, LSU Hazardous Waste Research Center

11:40 a.m. - Question & Answer

12:00 noon - Lunch (Ballroom 4)
Guest Speaker on Coastal Restoration - Senator Ben Bagert

Concurrent Session on Pollution Prevention/Waste Reduction
Afternoon Session

:30 p.m. - Introduction of Session - Moderator

1:40 p.m. - Managing A Waste Reduction Program
William B. Beck, E.I. DuPont

:00 p.m. - Dow's Waste Reduction Always Pays Program (WRAP)
Chris Hamm, Dow Chemical

:20 p.m. - Source Reduction, Process Modifications to Reduce Wastes
Ken Nelson, Dow Chemical

2:40 p.m. - Question & Answer

:00 p.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

3:30 p.m. - Justifying Waste Reduction Projects
Ken Schroeder, ERM Southwest

3:50 p.m. - New Technologies in Waste Reduction and Recycling Alternatives
Dr. Douglas Hahn, Woodward-Clyde Consultants

:10 p.m. - Question & Answer

4:30 p.m. - Adjourn

30 p.m. - Hospitality Hour (Exhibit Area, Ballrooms 1 & 2)

LOUISIANA'S ENVIRONMENT IN THE 1990's
Bellemont Hotel Great Hall
DAY 2 November 15, 1989

8:00 a.m. - Registration Begins (Rotunda)
Exhibits Open (Ballrooms 1 & 2)
(Refreshments in the Exhibit Area)

Concurrent Session on Water Resources Management
Morning Session

9:00 a.m. - Introduction of Session - Moderator

9:10 a.m. - La. Port Development
Ed Breckwoldt, Dept. of Transportation & Development

9:30 a.m. - Groundwater Resources
Bo Bolourchi, Dept. of Transportation & Development

9:40 a.m. - Federal Projects in Louisiana
Dave Grouchy, Dept. of Transportation & Development

9:50 a.m. - La. Water Resources Information Center
Sharon Balfour, Dept. of Transportation & Development

10:00 a.m. - La. Statewide Flood Control Program
Curtis Patterson, Dept. of Transportation & Development

10:20 a.m. - Question & Answer

10:30 a.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

11:00 a.m. - La. Scenic Rivers Program
M.B. "Blue" Watson, Dept. of Wildlife and Fisheries

11:20 a.m. - Wetlands Determination
Dr. Thomas Davidson, U.S. Corps of Engineers, New Orleans

11:40 a.m. - Coastal Restoration
Dave Chambers, Dept. of Natural Resources

12:00 noon - Lunch (Ballroom 4)
Guest Speaker on Coastal Restoration - Senator Ben Bagert

Concurrent Session on River-Management for Coastal Wetlands Restoration
Afternoon Session

1:30 p.m. - Introduction of Session - Moderator
Dr. G. Paul Kemp, Coalition to Restore Coastal La.

1:40 p.m. - Recent Developments in Wetlands Loss Research
Del Britsch, Waterways Experiment Sta., Corps.

2:00 p.m. - EPA Initiatives on Wetlands Loss and Restoration
Norm Thomas, EPA, Region VI

2:20 p.m. - Creative Engineering Approaches to Wetlands Restoration
Dr. Joseph Suhayda, Dept. Civil Eng., LSU

2:40 p.m. - Case Study in Sediment and Water Diversion for Wetlands Restoration
Mr. Jack Mager, P.E., Brown & Root Construction

3:00 p.m. - BREAK (Refreshments/Visit Exhibits - Ballrooms 1 & 2)

3:30 p.m. - River Management for Wetlands Restoration
Capt. Richard Gorski, U.S. Corp of Engineers

4:00 p.m. - Panel Discussion - Question and Answer

4:30 p.m. - Adjourn

4:30 p.m. - Hospitality Hour (Exhibit Area, Ballrooms 1 & 2)

LOUISIANA'S ENVIRONMENT IN THE 1990's
DAY 3 November 16, 1989
Concurrent Session On
Water Resources Research Papers
Fiscal Year 1988 Projects

9:00 a.m. - Introduction of Session - Moderator

9:10 a.m. - Identification of High-Risk Atmospheric and Surface Conditions for Urban Flash Flooding in Louisiana.
Dr. Katherine Hirschboeck, LSU Geography Dept.

9:30 a.m. - Pathways, Mechanisms, and Rates of Solute Transport Across the Base of the Fresh Water Zone, South Louisiana
Dr. Jeffery S. Hanor, LSU Geology Dept.

9:50 a.m. - A Water Quality Training Program for the Louisiana Cooperative Extension Service
Bill Branch - La. Cooperative Extension Service
Brenda Kelly - La. Water Resources Research Institute

10:10 a.m. - Determination of Rock Reed Filter Volume Requirements for Small Volume Domestic Wastewater Flows
Dona Skipper, LSU Civil Engineering Dept.

10:30 a.m. - BREAK (Refreshments)

Fiscal Year 1989 Projects

10:50 a.m. - Field Testing of Rock/Reed Filters for Small Domestic Wastewater Flows
Dr. Mary Tittlebaum & Donna Skipper,
LSU Civil Engineering Dept.

11:00 a.m. - Nature and Rates of Bacterial Metabolism in the Aquifers of Southeastern Louisiana
Dr. Paul Aharon, LSU Geology Dept.

11:10 a.m. - Aquaculture/Marine Fisheries Process Wastewaters
Dr. J. David Bankston
La. Cooperative Extension Service

11:20 a.m. - The Importance of Denitrification to Efficiency of Wastewater Treatment in Forested Wetlands
Dr. Robert Twilley, USL Biology Dept.

Other Research

1:30 a.m. - Fate and Effect of Produced Waters in the Estuarine Environment
Dr. A.T. Knecht and Dr. M. Porrier
UNO Center for Bio-organic Studies

12:00 noon - Adjourn

November 14 - 16, 1989
Registration Form

Name/Title _____

Company/Agency _____

City _____ State _____ Zip _____

Registration Fees		Early Registration (By Oct. 30, 1989)	Late or On-Site Registration
Member:	☐ AWRA (La.)	$65	$85
(check if applicable	☐ LWPCA	$65	$85
Non-Member:		$85	$105
*Exhibitor (includes 1 full registration)		$250	
Additional Exhibitors (Exhibit Area Only)		$10 each	

In order to assist in determining attendance at the concurrent sessions, please indicate which concurrent session you will most likely attend (non-binding preference). Please check one.

DAY 2 Morning Session

- ☐ Strategies to Control Toxics
- ☐ Pollution Prevention
- ☐ Water Resources Management

DAY 2 Afternoon session

- ☐ Risk Assessment
- ☐ Waste Reduction
- ☐ Coastal Restoration

DAY 3 Morning Session

- ☐ On-line Monitoring of Discharges
- ☐ Risk Communication & Management
- ☐ Water Resources Research Reports

Please make check payable to LWPCA.
Contact Jim Joyce or Terry Snell at (504) 835-4252 for further registration information.
*Contact Ken Keffer at (504) 893-7920 for exhibitor information.

PLACE STAMP HERE

Jim Joyce
James M. Montgomery Consulting Engineers
3501 North Causeway Boulevard, Suite 300
Metairie, Louisiana 70002

APPENDIX C

State Advisory Board

STATE ADVISORY BOARD
Louisiana Water Resources Research Institute

Purpose: To assist the Director, Louisiana Water Resources Research Institute (LWRRI), in identifying water resources research needs for the State of Louisiana

Membership: Board members represent the water resources professional communities of the State of Louisiana, and are selected for their knowledge of and active participation in an area of water resources management or research. The Board consists of 13 members who are appointed by the President, LSU. Each member represents a distinctly different water resources focus area and serves a 5 year term.

Requirements: Each member shall participate in the annual meeting of the Board. This meeting shall be called by the Institute Director and shall be held at the convenience of all Board members.

Benefits: An opportunity to guide the research activities of Louisiana Water Resources Research Institute

An opportunity to communicate with fellow water resources professionals in the State, sharing ideas and expressing research needs.

Service to Louisiana

MEMBERSHIP
STATE ADVISORY BOARD

Number of Representatives	Agency or Interest Group	Representative
2	City/Parish Govt.	
	o Mayor, New Orleans	Sidney Barthelemy
	o Mayor, Shreveport	John Hussey
3	Federal Governm. Agencies	
	o US Army Corps of Engin.	Arthur Williams, Maj. Gen. Mississippi River Div.
	o US Dept. of Agriculture	Harry Hawthorne Soil Conservation Service
	o US Geological Survey	Darwin Knochenmus District Chief
1	Industry	Jerry Daigre Dow Chemical Co. Plaquemine
2	Professional Organizations	
	o American Water Resources Assn. - Louisiana Chapt.	Glen Daigre, President Baton Rouge
	o Louisiana Marine Consortium	Don Boesch, Director Chauvin
4	State Agencies	
	o Dept. of Environ. Quality	Maureen O'Neill, Asst. Sec.
	o Dept. of Health & Hospitals	Bobby Savoie, Env. Consult.
	o Dept. of Natural Resources	Chip Groat, Director La. Geol. Survey
	o Dept. of Transportation & Development	Neil Wagoner, Secretary
1	University	Bobby Price, Director Water Resources Center, La. Tech Univ., Ruston

13 Members

APPENDIX D

University Advisory Board

UNIVERSITY ADVISORY BOARD
Louisiana Water Resources Research Institute

Purpose: To develop specific task-oriented Request for Proposals statements from the research needs listing identified by the State Advisory Board

To assist the Director in prioritizing the identified research areas

To identify potential investigators who can participate in the priority research areas

To identify and promote areas where cooperative research programs can be developed between LWRRI and other campus organizations

Membership: Board members are selected from the Louisiana State University faculty, and are selected for their knowledge of and active participation in an area of water resources research. The Board consists of eight members appointed by the President, LSU. Each member represents a distinctly different water resources focus area and serves a 5 year term.

Requirements: Each member shall participate in the annual meeting of the Board. This meeting shall be called by the Director, Louisiana Water Resources Research Institute, and shall be held at the convenience of all Board members.

Benefits: Service to LSU

Service to Louisiana

An opportunity to guide the research activities of Louisiana Water Resources Research Institute

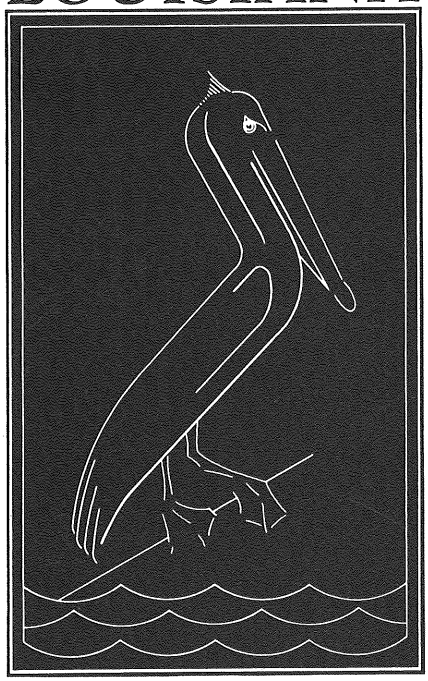
An opportunity to communicate with fellow water resources professionals in the university and state, sharing ideas and expressing research needs.

UNIVERSITY ADVISORY BOARD MEMBERSHIP

Number of Representatives	Discipline	Representative
1	Agriculture	Hussein Selim Dept. of Agronomy
1	Biological Sciences	Not Yet Designated
1	Business	Steve Farber Dept. of Economics
1	Engineering	W. David Constant Director, LWRRI Dept. of Chem. Engr.
1	Physical Sciences	Robert Muller Dept. of Geog.
3	Special Research Interests	
	. Coastal Studies	John Day
	. Environmental Studies	Ed Overton, Director
	. Wetlands Resources	Flora wang

8 Members

LOUISIANA



Water Resources Research Institute

3418 CEBA
Louisiana State University
Baton Rouge, Louisiana 70803
(504) 388-8508