QUALITY ASSURANCE PROJECT PLAN

Analysis of the Best Management Practices in Cotton Production on Runoff Water Quality

CONTRACTOR

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Name: Dr. Ron Smith
Title: Dean, College of Pure and Applied Science
Signature and Date: 11/20/95

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LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Signature and Date: 1/3/96

Name: Louis Johnson
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Signature and Date: 1-4-96

U. S. ENVIRONMENTAL PROTECTION AGENCY

Name: Timothy D. Herfel
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Analysis of the Effects of Best Management Practices in Cotton Production on Runoff Water Quality

A Research Proposal Submitted to the
Louisiana Department of Environmental Quality

PRINCIPAL INVESTIGATORS

Dr. Kathy McLean
Plant Pathologist
Department of Agriculture
Northeast LA University
Monroe, LA 71209

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LA State Cotton BOPS Come.
Acadia Parish County Agent
Louisiana State University
West Monroe, LA 71291

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Geologist/Paleoecologist
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Dr. Gary W. Lawrence
Nematologists
Department of Entomology
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A3 Distribution List

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A4 Project/Task Organization

Ms. Jan Boydstun
State of Louisiana
Department of Environmental Quality
Water Quality Management Division
P.O. Box 82215
Baton Rouge, LA 70884-2215

Ms. Boydstun heads the project for the Louisiana Department of Environmental Quality (LaDEQ). Her primary concerns include but are not limited to project oversight, on site inspections of project procedures, project progress toward completion, and project content. She also acts as a liaison between the Environmental Protection Agency and the project managers.

Ms. Susan Vullo
State of Louisiana
Department of Environmental Quality
Water Quality Management Division
P.O. Box 82215
Baton Rouge, LA 70884-2215

Ms. Vullo is an assistant to Ms. Boydstun at LaDEQ. In addition to assisting with project oversight activities, Ms. Vullo will provide advice and counsel to project co-managers for the duration of the project.

Mr. Bruce Fleming
City of Monroe
Planning and Zoning Director
Planning and Urban Development Department
P.O. Box 123
Monroe, LA 71210-0123

Mr. Fleming is an employee of the city of Monroe. The city donated the land on which the project will be performed. He is responsible for evaluating the content and progress of the project for the city.

Dr. Kathy McLean
Northeast Louisiana University
Department of Agriculture
310 CNSB
Monroe, LA 71209

Dr. McLean is a co-manager of the project. She is responsible for project oversight and progress in general and for the production processes occurring on Northeast Louisiana University Farms. She will also be responsible for oversight of field samples and laboratory activities. Dr. McLean will co-author reports filed with Ms. Boydstun and Ms. Vullo.

Dr. Darrin Webb
Northeast Louisiana University
Department of Agriculture
310 CNSB
Monroe, LA 71209

Dr. Darrin Webb is a co-manager of the project. He is responsible for project oversight and progress in general and for the cost/benefit analysis of the best management practices. He will also act as the comptroller for the project. Dr. Webb will co-author reports filed with Ms. Boydstun and Ms. Vullo.

Mr. John Barnett
County Agent
Louisiana State Cotton Specialist
Ouachita Parish County Agent
Louisiana State University
West Monroe, LA 71291

Mr. John Barnett is responsible for coordinating the demonstration aspects of the project. These demonstrations will be targeted to area cotton producers, agribusinesses, citizens and school groups. Mr. Barnett will coordinate activities with Dr. Webb.

Mr. Steve Nipper
Water Quality Specialist
Natural Resource Conservation Service
United States Department of Agriculture
District office
Monroe, LA 71201

Mr. Nipper is expected to provide advice and oversight for field sample procedures and other field activities. He is also expected to advise Ms. Brotherton on laboratory problems when they fall within his area of expertise. Mr. Nipper will coordinate activities with Dr. Kathy McLean.

Dr. Mervin Kontrovitz
Geologist/Paleoecologist
Department of Geosciences
Northeast Louisiana University
Monroe, LA 71209

Dr. Charles Allen
Ecological Botanist
Department of Biology
Northeast Louisiana University
Monroe, LA 71209

Dr. Kontrovitz and Dr. Allen will conduct an annual survey of the community along the watershed to establish baseline data. Data will include a floristic listing of species (including sensitive or rare species), and a description of communities and populations. Drs. Kontrovitz and Allen will report results to Dr. McLean who will incorporate their findings with Dr. Webb into the appropriate quarterly report.

Ms. Debbie Brotherton
Director Soil and Plant Analysis Lab
Northeast Louisiana University
CNSB 117
Monroe, LA 71209

Ms. Debbie Brotherton will be responsible for accepting field samples and for performing pollution tests and evaluations. She is also responsible for the calibration, maintenance and oversight of all laboratory equipment. Ms. Brotherton will coordinate activities with Dr. McLean.

Dr. Gary W. Lawrence
Nematologists
Department of Entomology and Plant Pathology
Mississippi State University
Mississippi State, MS 39762

Dr. Lawrence will provide advice and oversight for cotton soil sample procedures and other field activities. He will collect, extract, and identify the nematode populations of each cotton production practice. Dr. Lawrence will coordinate activities with Dr. McLean.

Organization Chart

Ms. Jan Boydstun
Louisiana Department of Environmental Quality

Ms. Susan Vullo
Louisiana Department of Environmental Quality

Dr. Kathy McLean
N.E. Louisiana University
Project Co-Manager

Ms. Debbie Brotherton
N.E. Louisiana University
Laboratory Director

Mr. Steve Nipper
Natural Resource Conservation Service
Water Quality Specialist

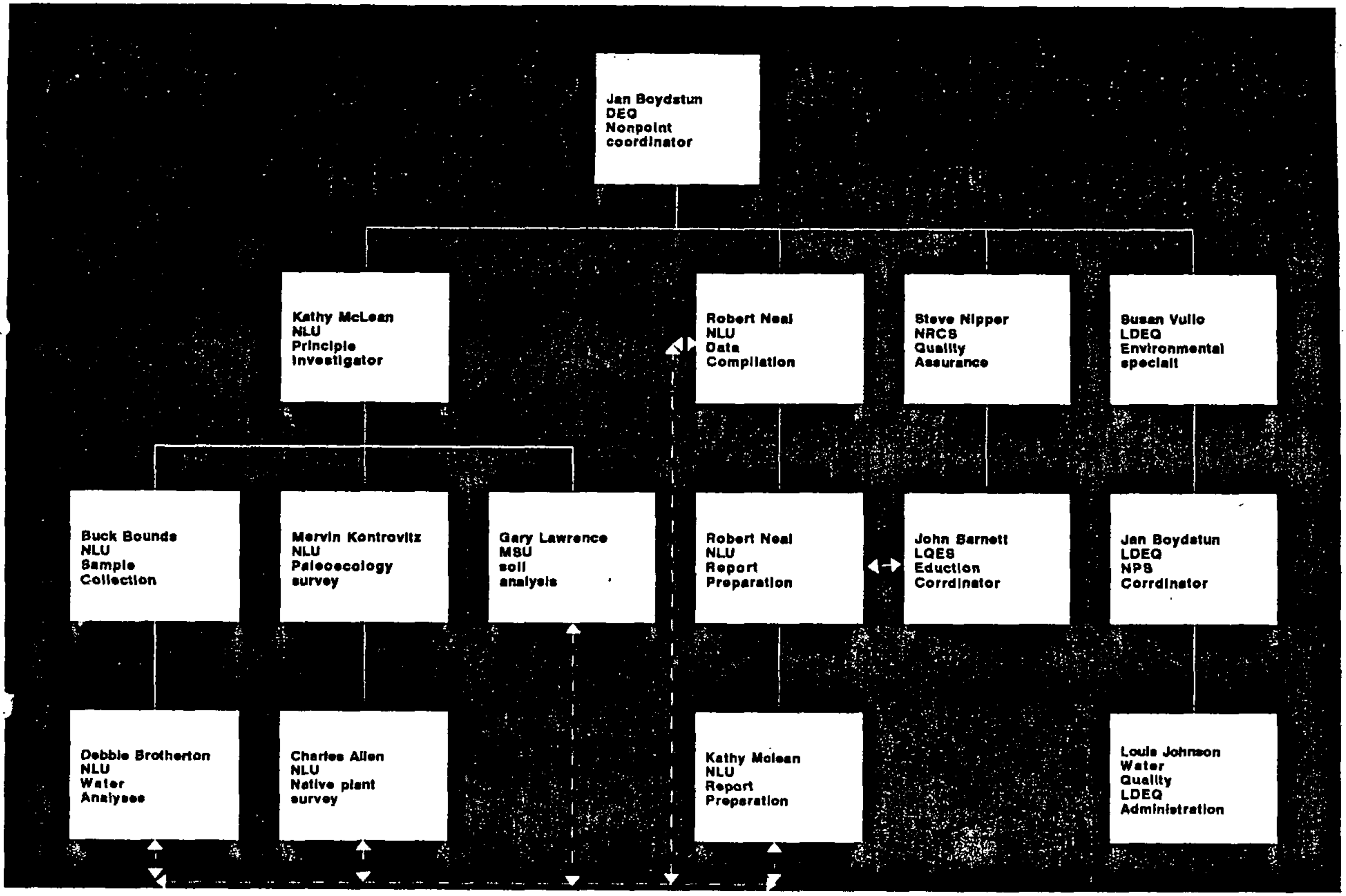
Dr. Gary Lawrence
Mississippi State University
Nematologists

Dr. Darrin Webb
N.E. Louisiana University
Project Co-Manager

Dr. Charles Allen
N.E. Louisiana University
Botanist

Dr. Mervin Kontovitz
N.E. Louisiana University
Paleoecologist

Mr. John Barnett
L.S.U.
County Agent



Project organization chart indicating lines of communication.

A5 Problem Definition/Background

The contamination of our water resources by agricultural chemicals is a key issue now shaping agricultural production practices and related governmental policies. Cotton is considered a chemical-intensive crop, including fertilizer, insecticides, herbicides, and defoliants. Essentially all cotton production acres are treated with fertilizers and/or pesticides. These production practices have been determined primarily by profit potential with little consideration of environmental effects. Pollution-prevention strategy tests have indicated possible alternatives to highly leachable pesticides. Recently work has been conducted on developing production practices which reduce environmental damage. These practices are referred to as "Best Management Practices".

Best Management Practices (BMPs) are production practices aimed at solving a specific resource problem. The main primary function of these practices is to improve the ecosystem and ensure sustainable agricultural production through reducing soil erosion, nutrients, and pesticides and improving ground or surface water. In 1992 a coalition of producers, state and federal agencies, and the Louisiana State University Agricultural Center developed a detail report on Best Management Practices for Cotton. This report outlined a set of BMPs for cotton and research and demonstration projects needed to implement the BMPs. This project will use the recommendations of this group to establish, implement, and evaluate the selected BMPs demonstration projects concerning runoff water quality.

Currently, there is a need for large farm demonstration in the Mississippi delta region that will examine the differences in runoff water quality between varying BMPs utilizing delta cotton production practices. This project will analyze runoff water quality from selected established BMPs in cotton production. The project will be conducted on cotton land adjacent to Bennetts Bayou in eastern Ouachita Parish (Killoden Plantation). The Bennetts Bayou drains into Bayou Lafouche. Bayou Lafouche has been documented as an impaired waterway by the environmental protection agency. A map of the proposed site is included in Appendix A.

The Bennetts Bayou watershed, of which this plantation is a part of includes, runoff from several different land uses which consist of approximately 10 percent urban land, 10 percent forest land, 5 percent pasture land and 75 percent cropland. Cotton is the primary crop of the cropland of the Killoden Plantation. The geology of the project area consists of level to nearly level Holocene flood plain sediments. This soil was formed from loam and clay sediments deposited primarily by the Arkansas River and is a Herbert complex loam soil common to the cotton production region of

the state. Drainage in the project area varies from well to poorly drained soil. Bennetts Bayou is on the east side of the project area and serves as the outlet for the water to drain into Bayou Lafouche.

Suspected sources of water pollution include irrigated crop production, pasture land, and sources unrelated to agricultural. Suspected causes are pesticides, nutrients, suspended solids, pathogen indicators and organic enriched DO. Data was obtained form the state of Louisiana Water Quality Management Plan Water Quality Inventory (1992) Section 305 (b).

A6 Project Description:

The objectives of this project are (1): to conduct a best management practice demonstration project on cotton production considering pesticide and fertilizer applications, tillage practices effects on runoff water quality; (2): to determine the economic benefits of the selected best management practices; (3) and to educate area producers, industry, and consumers on the effects of best management practices on runoff water quality.

The production systems to be established are:

1. Conventional tillage cotton production system.

2. Conventional tillage cotton production system with nutrient management and integrated pest management.

3. Conservation tillage system with a cover crop and nutrient management and integrated pest management.

4. Conservation tillage system with nutrient management, integrated pest management and transgenic cotton.

A description of the treatments is as follows:

1. Conventional tillage cotton production system.

Preparation:
In late March to early April the field is disked twice. By mid April a preplant DNA herbicides are broadcast and incorporated by disking to control grasses and some broadleaf weeds. Immediately following herbicide applications, the field is again disked and rows are formed with a hipper. In later April to early May, immediately before planting, and the rows are smoothed with a bed conditioner. Fertilizer will be applied if recommended by the soil analysis.

Planting:
Cotton will be planted on 40 inch rows with a 800 series International planter at a seeding rate of 6 seed/ft row (78,000 seed/A). An in-furrow granule insecticide (Aldicarb) and fungicide (Terraclor) will be incorporated one inch above and to the side of the seed furrow during planting. Preemergence herbicides (Fluometuron and Metolachlor) will be applied as a broadcast spray behind the planter.

Early Season:

Fertilizer will be applied two weeks after planting either as a dry formulation broadcast on the surface or as a liquid knifed in 10 inches from the center of the row. Plots will be cultivated and post emergence herbicides (fluometuron and MSMA or prometryn + MSMA) applied twice until layby (approximately July 1st).
Early season insect populations if observed by the field consultant will be controlled by insecticide applications applied at maximum levels following the Louisiana Cooperative Extension Service Cotton Insect Control Guide 1994 (Appendix A).

Mid Season:
Mid season insecticide application will be applied as recommended by the field consultant. Insecticide applications of methyl parathion for cotton boll weevil control will be applied twice weekly. Cotton bollworms and tobacco budworms will be controlled with pyrethroids applied once a week. Insecticides will be applied as a broadcast spray by a ground rig.

Late Season:
Late season insecticide application will be applied as recommended by the field consultant. Insecticide applications of methyl parathion for cotton boll weevil control will be applied twice weekly. Cotton bollworms and tobacco budworms will be controlled with organophosphates applied once a week. Insecticides will be applied as a broadcast spray by a ground rig. When plants mature to approximately 60% open bolls the cotton will be defoliated (approximately September 1st) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples will be taken after harvesting following the methods described in Louisiana Cooperative Extension Information Sheet included in Appendix B.

2. Conventional tillage cotton production system with nutrient management and integrated pest management.

Preparation:
In late March to early April, the field is disked twice. By mid April preplant DNA herbicides are broadcast and incorporated by disking to control grasses and some broadleaf weeds. Immediately following herbicide applications, the field is again disked and rows are formed with a hipper. In later April to early May, immediately before planting, and the rows are smoothed with a bed conditioner. Fertilizer will be applied if recommended by the soil analysis.

Planting:
Cotton will be planted on 40 inch rows with a 800 series International planter at a seeding rate of 6 seed/ft row (78,000 seed/A). In-furrow granule insecticide (Aldicarb) and fungicide

(Terraclor) will be incorporated one inch to the side of the seed furrow during planting. Preemergence herbicides (Fluometuron and Metolachlor) will be applied as a broadcast spray behind the planter.

Early Season:
Fertilizer will be applied two weeks after planting as recommended by a soil analysis. Plots will be cultivated and post emergence herbicides (Fluometuron and MSMA or Prometryn + MSMA) applied twice until layby (approximately July 1st). Early season insects will be controlled following the integrated pest management recommended by the field consultant following the Louisiana Cooperative Extension Service Cotton Insect Control Guide 1994 (Appendix A).

Mid Season:
Mid season insecticide application will be applied as recommended by the field consultant. Integrated pest management techniques will be used to control insect pests when their populations reach economic thresholds. The cotton boll weevil will be controlled with applications of methyl parathion only when weevil populations reach economic thresholds. Cotton bollworms and tobacco budworms will be controlled with pyrethroids only if populations reach economic thresholds. Insecticides will be applied as a broadcast spray by a ground rig or as spot treatments to infested areas. Cotton petioles will be samples to determine if nutrients are limited and a fertilizer application will be applied if necessary.

Late Season:
Late season insecticide application will be applied as recommended by the field consultant following the Louisiana Cooperative Extension recommended integrated pest management scheme. The cotton boll weevil will be controlled with applications of methyl parathion only when weevil populations reach economic thresholds. Cotton bollworms and tobacco budworms will be controlled with organophosphates only if populations reach economic thresholds. Insecticides will be applied as a broadcast spray by a ground rig or as spot treatments to infested areas. When plants mature to approximately 60% open bolls the cotton will be defoliated (approximately September 1st) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples will be taken after harvesting following the methods described in Louisiana Cooperative Extension Information Sheet included in Appendix B.

3. Conservation tillage system with a cover crop and nutrient management and integrated pest management.

Preparation:

In early March the field is inspected for weeds and a burndown herbicide (Roundup or Paraquat) will be applied to kill winter annual weeds if necessary. By late March to early April the rows will be rehip. By mid April a preplant DNA herbicides are broadcasts and incorporated using a rolling cultivator or bed conditioner adjusted to incorporate herbicides without knocking off much soil from the row. Fertilizer will be applied at this time if recommended by a soil analysis. In later April to early May immediately before planting the rows are smoothed with a bed conditioner.

Planting:
Cotton will be planted on 40 inch rows with a 800 series International planter at a seeding rate of 6 seed/ft row (78,000 seed/A). An in-furrow granule insecticide (Aldicarb) and fungicide (Terraclor) will be incorporated one inch above and to the side of the seed furrow during planting. Preemergence herbicides (Fluometuron and Metolachlor) will be applied as a broadcast spray behind the planter.

Early Season:
Fertilizer will be applied two weeks after planting if recommended by a soil analysis. Plots will be cultivated and post emergence herbicides (Fluometuron and MSMA or Prometryn + MSMA) applied only if weed pressure is present. Early season insects will be controlled following the integrated pest management scheme recommended by the field consultant following the Louisiana Cooperative Extension Service Cotton Insect Control Guide 1994 for thresholds and insecticides (Appendix A).

Mid Season:
Mid season insecticide application will be applied as recommended by the field consultant following integrated pest management techniques to control insect pest when their populations reach economic thresholds. The cotton boll weevil will be controlled with applications of methyl parathion only when weevil populations reach economic thresholds. Cotton bollworms and tobacco budworms will be controlled with pyrethroids only if populations reach economic thresholds. Insecticides will be applied as a broadcast spray by a ground rig or as spot treatments to infested areas. Cotton petioles will be samples to determine if nutrients are limited and a fertilizer application will be applied if necessary.

Late Season:
Late season insecticide application will be applied as recommended by the field consultant again following the Louisiana Cooperative Extension Service integrated pest management scheme. The cotton boll weevil will be controlled with applications of methyl parathion only when weevil populations reach economic thresholds.

Cotton bollworms and tobacco budworms will be controlled with organophosphates only if population reach economic thresholds. Insecticides will be applied as a broadcast spray by a ground rig or as spot treatments to infested areas. When plants mature to approximately 60% open bolls the cotton will be defoliated (approximately September 1st) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples will be taken after harvesting following the methods described in Louisiana Cooperative Extension Information Sheet included in Appendix B.

Fall:
Mid-October to early November the winter cover crop seed will be broadcast over the top. The cotton stalks will be shredded immediately after seeding the cover crop. Stalks will be cut at least 10 inches above the soil surface to hold the residue in place.

4. Conservation tillage system with nutrient management and integrated pest management.

Preparation:
In early March the field is inspected for weeds and a burndown herbicide (Roundup or Paraquat) will be applied to kill winter annual weeds if necessary. By late March to early April, the rows will be rehip. By mid April, preplant DNA herbicides are broadcast and incorporated using a rolling cultivator or bed conditioner adjusted to incorporate without knocking off much soil from the row. Fertilizer will be applied at this time if recommended by a soil analysis. In later April to early May immediately before planting, the rows are smoothed with a bed conditioner.

Planting:
Cotton will be planted on 40 inch rows with a 800 series International planter at a seeding rate of 6 seed/ft row (78,000 seed/A). In-furrow granule insecticide (Aldicarb) and fungicide (Terraclor) will be incorporated one inch above and to the side of the seed furrow during planting. Preemergence herbicides (Fluometuron and Metolachlor) will be applied as a broadcast spray behind the planter.

Early Season:
Fertilizer will be applied two weeks after planting if recommended by a soil analysis. Plots will be cultivated and post emergence herbicides (Fluometuron and MSMA or Prometryn + MSMA) applied only if weed pressure is present. Early season insects will be controlled following the integrated pest management recommended by the field consultant following the Louisiana Cooperative Extension Service Cotton Insect Control Guide 1994 for thresholds and

insecticides (Appendix A).

Mid Season:
Mid season insecticide application will be applied as recommended by the field consultant. Integrated pest management techniques will be used to control insect pest when their populations reach economic thresholds. The cotton boll weevil will be controlled with applications of methyl parathion only when weevil populations reach economic thresholds. Cotton bollworms and tobacco budworms will be controlled with pyrethroids only if populations reach economic thresholds. Insecticides will be applied as a broadcast spray by a ground rig or as spot treatments to infested areas. Cotton petioles will be samples to determine if nutrients are limited and a fertilizer application will be applied if necessary.

Late Season:
Late season insecticide application will be applied as recommended by the field consultant again following the integrated pest management scheme. The cotton boll weevil will be controlled with applications of methyl parathion only when weevil populations reach economic thresholds. Cotton bollworms and tobacco budworms will be controlled with organophosphates only if populations reach economic thresholds. Insecticides will be applied as a broadcast spray by a ground rig or as spot treatments to infested areas. When plants mature to approximately 60% open bolls the cotton will be defoliated (approximately September 1st) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples will be taken after harvesting following the methods described in Louisiana Cooperative Extension Information Sheet included in Appendix B.

Fall:
Mid-October to early November the cotton stalks will be shredded. Stalks will be cut at least 10 inches above the soil surface to hold the residue in place.

The site on which the plots will be established will be precision leveled to ensure each plot will drain to the determined collection point. The area around the plot will also be leveled to ensure no cross drainage from the remainder of the field. The site for the plot will be approximately 10 acres of which approximately 2 acres will be in production. Plots will be arranged in a randomized complete block design and replicated three times. The plots will be partitioned by 12" levees placed on twelve row sections of a cotton field with less than a 1% slope. Each plot will empty into one grass waterway which empties into Bennetts Bayou. This bayou drains into Bayou Lafouche which has been documented as an impaired waterway due to pesticide contamination in the DEQ 305B report.

Water samples will be taken directly from Bennetts Bayou both above and below the cotton production area to establish baseline data. Sampling will be done by Kirk Cormier Northeast DEQ Water Quality Management Division. Grab samples will be collected with a stainless steel water sampler and preserved following EPA Standard Methods 17ed protocol. Water samples will be analyzed by the NLU Soil Plant Analysis Lab for nitrates, nitrites, phosphorus, total dissolved solids, total suspended solids and selected pesticides following processing procedures described in the Quality Assurance (QA) Project plan for Surface Water Monitoring and Analysis. Water quality will also be monitored by 10 minute readings for 24 hours on dissolved oxygen, pH, conductants, and temperature.

This plot marks the initial source of agricultural runoff. All runoff above the site originates from urban sources. These samples will also be analyzed to determine the possible origin of any bayou chemical contamination. Data from the conventional system will be compared to that of the alternative systems and compared to the samples collected from the different surface sources in Bennetts Bayou. The Bouef River Soil and Water Conservation District and the Natural Resource Conservation Service will provide much of the technical direction for the development of the experimental sites, collection system, sampling methods, and crop management.

Cotton seedling stand will be monitored to determine tillage practice affects on seedling disease. Plant height, yield, and fiber quality will also be determined. Nematode populations will be determined by Dr. Gary Lawrence. He will be collecting soil samples at plant, mid-season, and at harvest from each tillage treatment to determine nematode levels. Soil samples will be taken with a modified cone sampler. Ten random soil cores 6 inches deep will be combined and mixed from each plot. Appendix A gives a general description of the soil sample technique. All parameters will be correlated with cotton yield and water residues. A diagnostic soil analysis will be competed fall each year to determine the effects of best management production practices on soil structure, organic matter, nutrient content, and cation exchange capacity. The soil samples will be taken as described previously.

Demonstrations of the project will be targeted to two distinctive groups: producers and agribusinesses and the regional citizens and youth. Mr. John Barnett, Louisiana Cooperative Extension Quachita Parish Agent will coordinate the demonstration aspects of the projects. Bi-annual producer meetings and tours will be established to demonstrate the project. Youth tours and education programs will be offered at the project location via the 4-H program and Louisiana Educational Systemic Initiate Program.

Northeast Louisiana University will use the project for class tours and demonstration in the department of Agriculture, biology, Geo-Science, and Toxicology. Tours will be made available to any organizations or class as requested.

Project Duration:

This project will be conducted over a three year period including the 1995, 1997, and 1998 cotton crop years. During this period additional funds will be solicited to continue the project.

Schedule of Task for 1995:

June 1995	Site Survey
June 1995	Begin Community Survey
June/August 1995	Land Leveling
July/September 1995	Plots Established Flumes Installed Water Sampling Equipment Installed Begin Runoff Sampling Report on Baseline Data
September/ October 1995	Plant Cover Crops Collect and Analyze Soil Samples
March 1995	Survey Plots for Weeds and Cover Crop Apply Burndown Herbicides
April/May 1996	Sample Bayou for Baseline Data
April/May 1996	Begin Cultivation Practices (Preparation)
April/May 1996	Apply Herbicides and Fertilizers
April/May 1996	Plant Cotton Plots (Planting)
April/May 1996	Proceed with Treatments as Previously Described
April/May 1996	Report on Baseline Data
April/May 1996	Early Season Production Practices
June/July 1996	Mid Season Production Practices
August/ September 1996	Late Season Production Practices
September/ October 1996	Harvest Cotton Plots Plant Cover Crops Collect and Analyze Soil Samples
December 1996	Report on Year on Results
Conduct Year 2	
December 1997	Report Year two Results
Conduct Year 3	
December 1998	Final Report

A7 Data Quality Objectives for Measurement Data

The purpose of this project are (1): to conduct a best management practice demonstration project on cotton production considering pesticide and fertilizer applications, tillage practices and filter zones effects on runoff water quality; (2): to determine the economic benefits of the selected best management practices; (3) and to educate area producers, industry, and consumers on the effects of best management practices on runoff water quality. These cotton best management practices will be evaluate by runoff water quality, surface water quality of Bennetts Bayou, soil nutrient samples, nematode population samples, cotton yields, the natural vegetation/community survey, ostracolds survey, and economic analysis of the cotton production practices.

The plots will be arranged in a randomized complete block design with three replications. Flow weighted runoff sample from selected rain events will be collected during each cotton production practice from planting through harvest and including the winter. A total of a minimum of seven to a maximum of ten samples will be collected. One samples will be taken during each of the following production practices: Preparation, Planting, Early Seasons, Mid Season, Late Season, Defoliation and Harvest, and Mid winter. Rain events specifically following chemical or fertilizer applications will be collected by ISCO samplers donated by DEQ (Appendix C). One sample (1) from each production system (4) for each production stage (7) for each replication (3) will be 84 water samples taken each year for the three year project equalling approximately 252 water samples for the entire project. Locates will be analyzed by the NLU Soil Plant Analysis Lab for nitrates, nitrites, phosphorus, total dissolved solids, total suspended solids, and selected pesticides (scan for priority pollutants) following processing procedures described in the Quality Assurance (QA) Project Plan for Surface Water Monitoring and Analysis. The quantities of these water quality non point source pollutants will be analyzed statistically by ANOVA and treatments compared at the 0.95 level of significance. Results from the ANOVA will statistically indicate the effectiveness of minimum tillage, nutrient management system, and integrated pest management systems in reducing non-point source pollutants from entering the bayou compared to conventional production systems.

An economic analysis will also be conducted on all data collected to determine the cost effectiveness of each production practice as it relates to water quality non-point source pollutants. This will be accomplished by calculating the cost of production for each system. A cost/benefit analysis will be conducted to evaluate the advantages and disadvantages of the economic impact of the Best Management Practices's and cover crops as they relate to the runoff water quality and soil condition. The economic analysis of the project will be conducted by Dr. Darrin Webb.

Table A7-1. Techniques of analysis for water quality parameters.

Parameter	Procedures	Limit of Detectants	Measures
Ammonia Nitrogen	EPA Method 350.1	0.01 mg/l	Total ammonia nitrogen
Nitrate	EPA Method 352.1	0.01 mg/l	Nitrate Nitrogen
Nitrite	EPA Method 354.1	0.01 mg/l	Nitrite Nitrogen
TKN	EPA Method 351.3	0.05 mg/l	Free Ammonia and organic nitrogen
Total Phosphorus	EPA Method 365.3	0.01 mg/l	Organic phosphorus polyphosphates and ortho-phosphorus
pH	EPA Method 150.1	0.01 pH units	Hydrogen ion concentration
Total Suspended Solids	EPA Method 160.2	1.0 mg/l	Weight of solid material retained by glass fiber filter
Volatile Suspended Solids	EPA Method 160.4	1.0 mg/l	Weight of solid material combustible at 550 C
Nematodes	Gravity screening and sucrose centrifugation	95% recovery	Plant parasites Free living

All sampling procedures will follow the recommendation in Standard Methods (APHA, 1985).

A8 Project Narrative:

Cotton is considered a chemical-intensive crop, including fertilizer, insecticides, herbicides, and defoliants applied throughout the growing season. These production practices have been determined primarily by profit potential with little consideration of environmental effects. Previous research on pollution-prevention strategy have indicated possible alternatives to the use of highly leachable pesticides. In 1992 a coalition of producers, state and federal agencies, and the Louisiana State University Agricultural Center developed a detail report on Best Management Practices for Cotton. This report outlined a set of BMPs for cotton and research and demonstration projects needed to implement the BMPs. This project will use the recommendations of this group to establish, implement, and evaluate the selected BMPs demonstration projects concerning runoff water quality.

The project will be conducted on cotton land adjacent to Bennetts Bayou in eastern Ouachita Parish (Killoden Plantation). The Bennetts Bayou drains directly into Bayou Lafouche. Bayou Lafouche has been documented as an impaired waterway by the environmental protection agency.

The Bennetts Bayou watershed, of which this plantation is a part of includes, runoff from several different land uses which consist of approximately 10 percent urban land, 10 percent forest land, 5 percent pasture land and 75 percent cropland. Cotton is the primary crop of the cropland of the Killoden Plantation. The geology of the project area consists of level to nearly level Holocene flood plain sediments. This soil was formed from loam and clay sediments deposited primarily by the Arkansas River and is a Herbert complex loam soil common to the cotton production region of the state.

Suspected sources of water pollution include irrigated crop production, pasture land, and sources unrelated to agricultural. Suspected causes are pesticides, nutrients, suspended solids, pathogen indicators and organic enriched DO. Data was obtained form the state of Louisiana Water Quality Management Plan Water Quality Inventory (1992) Section 305 (b).

The objectives of this project are (1): to conduct a best management practice demonstration project on cotton production considering pesticide and fertilizer application, tillage practices and filter zones effects on runoff water quality; (2): to determine the economic benefits of the selected best management practices; (3) and to educate area producers, industry, and consumers on the effects of best management practices on runoff water quality.

Four basic systems will be evaluated: conventional production, minimum tillage, nutrient management system, and integrated pest management systems. The conventional system will be based on historical production practices in the region. The minimum tillage system includes a cover crop that will be broadcast into a re-hipped cotton residue in mid-October following harvest each year. The cover crop will be burned down in the spring by herbicides allowing cotton planting. The nutrient management system will include soil and petiole analysis to determine specific quantities of nutrients required by the crop. Timing and application methods will be selected to minimize nutrient runoff. The integrated pest management system will include insecticides applied only when the pests have reached economic damaging levels and a appendix cotton plot.

Water leachate will be collected after selected storm events (7 estimated collections) for chemical analysis from each of the plots. Samples will be collected, sealed and labeled. Labels will contain an identification code indicating plot and replication, collection date and time, location, and water analysis required. Sample collection identification codes will also be documented in a field laboratory book. Samples will be immediately transferred to the laboratory and custody will be transferred to the lab analyst recording time and date of receipt, analyses required and sample contents. The Northeast Louisiana University Plant and Soil Analysis Lab records the sample number, date, and time, calibration data, calculation and concentration in their data file. Water samples will be analyzed by the NLU Plant and Soil Analysis Lab for nitrates, nitrites, phosphorus, total dissolved solids, total suspended solids, and selected pesticides (scan for priority pollutants) following processing procedures described in the Quality Assurance (QA) Project Plan for Surface Water Monitoring and Analysis.

Analysis, preparation, preservation and volume requirements of all water quality samples are included in Table B2-1. Laboratory water sample analyses will follow the procedures recommended in the Standard Methods (APHA, 1989) unless stated otherwise. Water sample analytical methods were given in Table A7-1.

Gas chromatograph/Electron Capture Dectecture, Gas Chromatograph/Ion Trap, and/or the Mass Spectrophotometer will be utilized to determine the presence of the compounds listed in A6. Calibration and quality control will be maintained by including the specific standard and blanks for every chemical compound analyzed and will be included in each run of 20 samples. The percent recovery from the standard and the zero from the blank will maintain our minimum intervals for each chemical compound standards. Through this procedure the instruments will be calibrated approximately every hour.

Assessment of performance will be conducted regularly and randomly to ensure stipulated field and laboratory data procurement and measurement procedures are adhered to strictly. The Louisiana Department of Environmental Quality will also conduct periodic on site inspections to ensure project guidelines and procedures are strictly followed and that satisfactory progress is made toward project completion.

A9 Special Training Requirements:

No specialized training or certification will be required by university personnel to successfully complete the project. The scientists evolved in the analysis of the effects of best management practices in cotton production on runoff water quality project have obtained Ph.D. in their areas of expertise.

A10 Documentation and Records:

All runoff water quality data will be compiled in a laboratory manual and copies kept in the NLU Plant and Soil Analysis Lab. Data will include all raw data, instrument printouts, and calibration curves. Laboratory analysis of each rainfall event will require one to two weeks turnaround time.

All data will be filed and stored in the Chemistry and Natural Science Building room 310 for five years.

B1 Sampling Process Design:

The plots will be arranged in a randomized complete block design with three replications. A runoff water sample will be collected during each of the stages of cotton production through the growing season and during the winter during selected rain events. One samples will be taken during each of the following production practices: Preparation, Planting, Early Seasons, Mid Season, Late Season, Defoliation and Harvest, and Mid winter. The time increments between runoff water sampling will be approximately 3 to 4 weeks during the preparation through the harvest stages and then approximately 8 weeks between harvest and mid winter and preparation the following year. Runoff water samples will be collected during selected storm events. Composite runoff flow weighted samples will be collected by ISCO samplers donated by DEQ (Appendix C). Please see the following calculations on page 30 and 31 for further explanation. Water samples will be analyzed by the NLU Soil Plant Analysis Lab for nitrates, nitrites, phosphorus, total dissolved solids, total suspended solids, and selected pesticides (scan for priority pollutants) following processing procedures described in the Quality Assurance (QA) Project Plan for Surface Water Monitoring and Analysis. The volume amounts of the runoff hydrograph sampled in indicated in Table B2. The quantities of these water quality non point source pollutants will be analyzed statistically by ANOVA and treatments compared at the 0.95 level of significance. Results from the ANOVA will statistically indicate the effectiveness of minimum tillage, nutrient management system, and integrated pest management systems in reducing non-point source pollutants from entering the bayou compared to conventional production systems.

The cotton field plots will be arranged in a randomized complete block design with three replications. Water samples will be taken at selected rain events as previously described corresponding with the cotton growth cycle and pesticide or fertilizer applications. Samples will be labeled with an identification code indicating plot and replication, collection date and time, location, and water analysis required. Sample collection identification codes will also be documented in a field laboratory book. Samples will be collected immediately after the rainfall event or at 8 am in the morning on week days and week ends. A graduate student will have the responsibility of collecting the water samples and delivering them to the lab.

A floristic survey to determine the effects of cotton production on the natural vegetation in and along the edge of Bennetts Bayou will include two areas: the upstream point above the cotton production plots and the downstream point below where water from the cotton production enters the bayou. The upstream area will serve as the control.

Thirty samples will be randomly located in the center of the stream in both areas. A 0.56 meter radius (area = one square meter) sample will be conducted around each sampling point. All plants within the sample will be identified, the number of individuals counted, and the percent cover determined. The sampling would be conducted three times per year corresponding with the cotton production practices of Preparation and Planting, Mid-Season, and Defoliation and Harvest.

The data will be entered into a computer spreadsheet program (Lotus 123 and/or SAS) and this will be used to make all calculations. The diversity will be determined by species presence in the samples. The density will be based on individuals rather than stems because of the difficulty in determining stems in herbaceous plants. The frequency will be calculated as the percent of samples occurrence compared to the total number of samples. Cover will be the percent of shade produced by the species in the sample. All relative values will be calculated by dividing the value for a species by the total for all species. Importance value will be the total of the three relative values (relative frequency, relative density, and relative cover). All relative values will be converted to a percent by multiplying by 100. Floristic surveys of the area in an adjacent to Bennetts Bayou (the floodplain) will also be conducted during each sampling period and a list of all plants seen in each area will be produced.

Statistical comparisons will be made between the control and the downstream area before the cotton production begins to ensure that the two areas are similar. Of course, the same comparisons will be conducted after the cotton production practices begin to detect any effects, if any. The total and mean diversity per sample plus mean density and cover percent per sample will be compared between the two areas. The frequency, relative frequency, density, relative density, cover, relative cover, and importance value will be calculated for all species in both areas. Appropriate statistical comparisons will be made using these values for the species in common before cotton production and after. The two communities will also be compared using the three community coefficients of Jaccard, Sorensen, and Whittaker.

Antecedent Moisture Conditions: [1]Exclude any samples collected within 5 days after a rainfall event that exceeds 8 inches within a 24-hour duration period, [2]or within 3 days after a rainfall event that exceeds 3 inches within a 1 hour duration period.

1. This length of time is for the long duration, low intensity rainfall events that typically occur in the late fall and winter seasons. This value is based on personal knowledge of the runoff,

infiltration, and percolation characteristics of the specific soil type on the site.

2. This length of time is for the shor duration hight intensity rainfall events that typically occur during the late spring and summer seasons. This value is based on personal knowledge of runoff, infiltration, and percolation characteristics of the specific soil type on the site.

Rainfall Events Allowed For Sampling: 0.5 inches to 3.5 inches inclusive within a 1-hour duration period, not to exceed a cumulative rainfall depth for the event of 8 inches within a 24-hour duration period.

Methods for Sampling Methods: Two different sampling methods will be utilized. One for low intensity long duration rainfall events that typically occur during the winter season. Sampling will take place during the entire runoff event until the samimum amount of sampling volume is obrained approximately 4000 ml.

The sampling method for high intensity short duration rainfall events that typically occurs during the spring and summer monthes should be as follows. It is prosed that sixteen eight ounce samples be taken approximately every thirty seconds. this amount will be approximately 4000ml.

The sampling process will begin only after runoff has passed through the sampling devises for a period of ten minutes.

Runoff samples will be composite total runoff flow.

Precipitation (volume) limit to qualify/disqualify runoff sample. The travel distance for the water to flow from the upper reaches of each plot to the lower reaches of each plot is three minutes. The time concentration is based on the same 100 year 1 hour duration rain for Monroe as the runoff hydrograph. The collection of samples will begin as soon as water passes through the flumes and will be collected throughout the storm event.

Calculations:
Ouachita Parish, LA
BBH 10/12/94
Flume Capacity Design

<u>GIVEN:</u>

Plot Length = 100′
Plot Width = 20′ (6 - 40" rows)
Plot Slope = 0.2′ per 100′

REQUIRED:

Determine the maximum peak discharge from each plot where the chance of discharge exceeding the flume capacity is 1% or less.

DESIGN:

Determine the approximate velocity of water flowing down each row middle.

```
|<------40"------>|
```

Assume: d = 3.1 inches n = 0.0225 s = 0.001 ft/ft

$A = Zd^2 = 3\ 1/3(3.1"/12)^2 = 0.222\ ft^2$

$Wp = (Z)[(3.1/12)^2+3\ 1/3(3.1/12)^2]^{1/2} = 1.075\ ft$

$R = A/Wp = 0.222\ ft^2/1.075\ ft = 0.206\ ft$

$V = 1.486/0.0225\ (0.206)^{2/3}(0.001)^{1/2} = 0.73\ fps$

DESIGN:

Estimated Time of Concentration

Adjust length and width of plot to include runoff from separation levees and end levees:

```
----->| 4'|<-----                         ---->| 4'|<----
  Border Levee                             Border Levee

            <------6 - 40" rows------>
                   (20 ft)

      <-----------------28'------------------>
```

Use Weff = 28'

Similarly, for Length

```
Outlet               Rowfall                Diversion
 End         <--------------------          Channel

     --->| 4'|<-----------100'----------->| 8'|<---

          <--------------112'--------------->
```

Travel distance = 112 ft
Estimated Time of Concentration = 112 ft/0.73 fps = 153 sec.

153 sec/60 (sec/min)= 2.55 min
Use T_c = 3 min.

100 year, 1 hr duration rain for Monroe, LA is 3.88 inches
(Reference SCS TP-40)

Adjust this rainfall for 3-minute duration (Appendix A, "Soil and Water Conservation Engineering, 1966", Schwab)

$I_3 = I_{60} \times C.F$
$= 3.88$ inches X 0.2
$= 0.78$ inches

Converting to cfs:

Qp = (0.78in/3 min)(ft/12 in)(min/60 sec)(112ft)(28ft)
<u>Qp = 1.13 cfs</u>

B2 Sampling Methods Requirements

Samples will be collected with ISCO composite water samplers. ISCO sample containers of glass only will be used in collection efforts. Appendix C includes a description of the ISCO sampler. These samplers will be implemented with teflon lines in an effort to avoid using plastics for pesticide collections. Before the initial collection and between each subsequent collection, the ISCO teflon sampling line will be cleaned by rinsing with distilled deionized water. The lines will be rinsed with pesticide quality hexane, followed by an additional distilled deionized water rinse.

Glass collection bottles from the ISCO sampler will be washed in chronic acid and rinsed in distilled deionized water. They will then be hand washed in non-residual soapy water, rinsed with water, rinsed in acetone and placed in a hot water bath for a minimum of one hour. The bottles will then be removed, rinsed with water, rinsed with acetone and allowed to briefly air dry. Before storage all openings will be covered with foil. The foil will be removed before use and the containers will be rinsed with pesticide quality hexane.

Samples will be transferred to holding containers for transport and storage at the lab in the following containers. For pesticide samples, four liter brown jugs which formerly held pesticide quality hexane will be used. For the nutrient tests requiring acidification, one liter plastic bottles will be used and several milliliters of sulfuric acid will be added to each bottle prior to usage. The same one liter bottles will be used to transport samples from the additional analyses which requires no acidification. All samples will be transported on ice. All containers used for transport and storage will be discarded after one use.

Samples collected in the field will be placed on ice and transported to the laboratory. The Northeast Louisiana University Soil-Plant Analysis laboratory is equipped with seven refrigerators, all of which can be temperature controlled. However, the environmental room at the facility measures 110" wide by 65" deep by 100" high. It is computer controlled to hold samples at a constant 4 C, and shelves are built in the room form top to bottom and on both sides. To date, this room has been sufficient to house all samples received at the lab during their holding period.

Samples are analyzed as soon as possible after collection. The times listed in Table B2 are the maximum times samples may be held before analysis and still considered valid by EPA definition. For samples from non-chlorinated drinking water supplies, concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample then can be held for us to 14 days. All pesticides will be extracted within 24 hours of delivery to the lab. Extracts will be stored in refrigerator freezers until they are analyzed for 14 days. Where feasible, all extracts will be held for a minimum of 30 days past the report date.

One extra water sampler, monitor, and battery will be purchased by DEQ and assigned to this project to replace a sampler should it fail for what ever reason. Thus a substitution can be made quickly and effectively without the loss of data.

B2 Sampling Methods Requirements

Table B2-1. Analysis, preparation, preservation, and volume requirements for samples.

Analysis	Volume (ml)	Container[2]	Holding Times	Preservative
Ammonia Nitrogen	400	P, G	28 days	Cool 4 C; H_2SO_4 to Ph < 2
Nitrate Nitrogen	100	P, G	48 hours	Cool 4 C
Nitrite Nitrogen	50	P, G	48 hours	Cool 4 C
TKN	500	P, G	28 days	Cool 4 C; H_2SO_4 to pH < 2
Total Phosphorus	100	P, G	28 days	Cool 4 C; H_2SO_4 to pH < 2
pH	25	P, G	None	None Required
Total Suspended Solids	200	P, G	7 days	Cool 4 C
Volatile Suspended Solids	200	P, G	7 days	Cool 4 C
Pesticide/ Herbicides	4000[1]	G only	14 days	Cool 4 C

(1) Usually 1000 ml will suffice for extraction. In this case, more than one extraction may be required, depending upon the pesticide chosen for analysis;
(2) Plastic (P) or glass (G).

B3 Sample Handling and Custody Requirements

Samples will be collected, sealed and labeled. Labels will contain an identification code indicating plot and replication, collection date and time, location, and water analysis required. Sample collection identification codes will also be documented in a field laboratory book. Samples will be immediately transferred to the laboratory and custody will be transferred to the lab analyst recording time and date of receipt, analyses required and sample contents. The NLU Plant and Soil Analysis Lab records the sample number, date, and time, calibration data, calculation and concentration in their data file. A copy of the standard Change of Custody form is included in Appendix A.

B4 Analytical Methods Requirements

Laboratory water sample analyses will follow the procedures recommended in the Standard Methods (APHA, 1989) unless stated otherwise. Water sample analytical methods were given in Table A7-1.

B5 B6 B7 Instrument Testing, Inspection, Calibration and Quality Control Requirements.

Gas chromatograph/Electron Capture Dectecture, Gas Chromatograph/Ion Trap, and/or the Mass Spectrophotometer will be utilized to determine the presence of the compounds listed in A6. Calibration and quality control will be maintained by including the specific standard and blanks for every chemical compound analyzed and will be included in each run of 20 samples. The percent recovery from the standard and the zero from the blank will maintain our minimum intervals for each chemical compound standards. Through this procedure the instruments will be calibrated approximately every hour.

B9 Data Acquisition Requirements (Non-direct Measurements)

Non-direct data will be primarily economic in nature and will be used only in the cost/benefits section of the project. Data will be acquired from data bases maintained by the Commodity Economics Division of the Economics Research Service (United States Department of Agriculture).

Literature concerning previous studies will continue to be compiled using AGRICOLA as the primary data base index.

B10 Data Management

Sample data taken from the field will be filed with the Laboratory Manager immediately after the samples are taken. Field sample information and pollutant measurements will be compiled in a manual in the Plant and Soil Laboratory. Copies of this data will be made and stored in room 310 of the Chemistry and Natural Science Building. The data will also be stored on computer disks in room 310 CNSB and on the mainframe IBM computer at Northeast Louisiana University. Data reduction will be minimized because statistical tests will be performed using the Statistical Analysis System on the IBM mainframe computer. Hydrologic data will be retrieved from the sampling equipment if the computer is available from DEQ. This data will stored on computer disks along with the water analysis data in 310 CNSB.

C1 Assessments and Response Actions:

Procedures will be reviewed and analyzed with all project employees prior to project commencement. After systems are operational, performance audits will be conducted regularly and randomly to ensure stipulated field and laboratory data procurement and measurement procedures are adhered to strictly.

The Laboratory Manager will supervise pollution parameter measurements. Equipment precision and accuracy will be ensured by cross checking random samples using equipment at LSU-Baton Rouge and by analyzing sample with known parameters. Dr. Kathy McLean will supervise data acquisition and measurement activities and will retain the authority to order a work stoppage if proposal work guidelines are not strictly followed.

Dr. Darrin Webb and Kenneth Bowman will regularly review data measurements. He will perform a variety of statistical tests, including but not limited to t, F, and Chi-Square tests to detect irregularities in data generated by project employees and samples used to cross check laboratory procedures. Statistical data analysis will be performed using Quality Control methods available on the Statistical Analysis System. He will also retain authority to request a work stoppage if data analysis procedures are violated or if equipment measurements are judged to be inaccurate or imprecise.

The Louisiana Department of Environmental Quality will also conduct periodic on site inspections to ensure project guidelines and procedures are strictly followed and that satisfactory progress is made toward project completion. They too may order a cessation of project activities.

C2 Reports to Management

Sample acquisition reports will be filed with the Laboratory Manager and Project Manager immediately after the samples are taken from the field.

Pollution parameter measurements will be reported to the Project Manager immediately after they are completed.

Watershed reports will be made to the Project Manager quarterly but not less than one month prior to the end of the quarter.

Any problems arising that might affect the validity of the samples taken or the data generated by pollution parameter measurement will be reported to the Project Manager immediately.

Quarterly reports will be written by the two Project Managers and will be filed with the Louisiana Department of Environmental Quality. The status of the project will be documented in these reports as well as a description and summary of data and findings to date. A discussion of any problems and how these problems were resolved will also be included in the quarterly reports.

A final and comprehensive report will be submitted by the Project Managers to the Louisiana Department of Environmental Quality upon completion of the project.

D1 Data Review, Validation and Verification Requirements

Data will be considered acceptable for use when samples are taken according to project guidelines and equipment measures pollutant levels with accuracy and precision according to instrument calibration cross-checks. Data will be used in an objective and consistent manner.

Project hypotheses will be accepted or rejected at stated levels of significance. A variety of statistical tests will be performed on each pollution parameter. These tests will include but not be limited to, t, F, Chi-Square, Analysis of Variance and others.

D2 Validation and Verification Methods

Data will be reviewed for both precision and accuracy. Acceptable quality control limits, as a percentage of standard deviation are stipulated in Standard Methods (APHA, 1985). Comparisons will allow Project Managers to detect deviations from these standards. In addition, data will be contrasted with values from similar experiments with known parameters taken from historical data collection. Values in question will be resampled to ensure reliability.

Statistical procedures will be performed using the Statistical Analysis System to detect systematic and transmittal errors.

Equipment will be cross checked and calibrated using known samples to ensure reliability.

All data will be complied in a laboratory manual and copies will be kept in the Plant and Soil Analysis Lab. Data will include raw data, instrument print-outs and calibration curves. All original data will be stored in the Chemistry and Natural Science Building room 310 for five years.

D3 Reconciliation with Data Quality Objectives

Results from field samples and measurements will be combined with farm production records and external information to form a comprehensive data base. This data set will be evaluated with a variety of econometric methods to determine possible economic benefits of best management practices when pesticides, fertilizer, tillage, cover crops, transgenic cotton and water quality are considered.

While the focus of the project is runoff water quality, we will also evaluate the ecosystems in the area of the watershed (Bennetts Bayou). This phase of the project will be conducted by Drs. Charles Allen and Mervin Kontrovitz. A survey of the community along the watershed will be conducted to establish baseline data. This data will include: a floristic listing of species, a listing of sensitive or rare and endangered species, and a comparison of this freshwater mussel community to other communities. The survey will be taken annually and compared to baseline data to determine if changes occur.

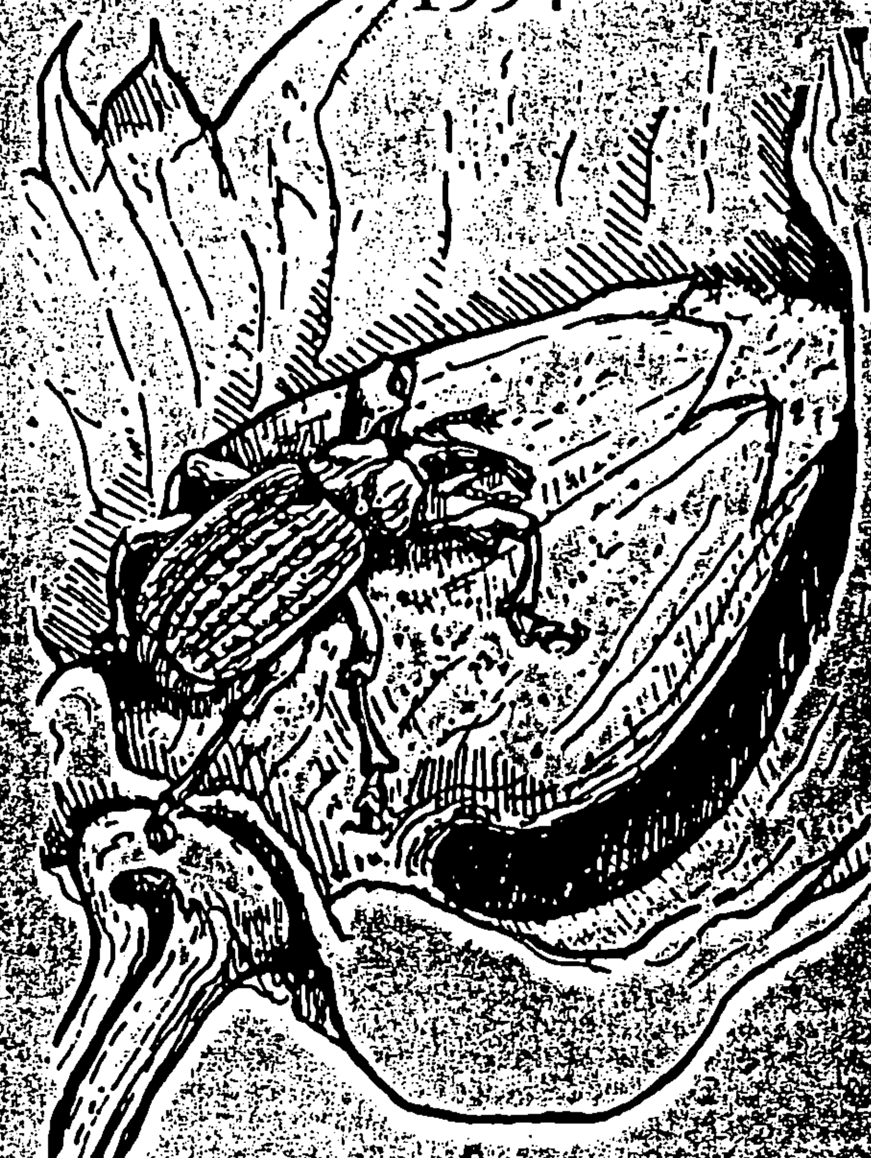
Another environmental parameter to be monitored will be Ostracodes. Ostracodes, microscopic crustaceans, are sensitive to their aquatic environments therefore are excellent indicators of disturbances in that environment. We will use ostracodes as a means of monitoring the waterways of Bennetts Bayou during the study period. Samples will be taken and analyzed above the project site, at the project site, below the project site and at the point where Bennetts discharges into Bayou Lafouche. After establishing what compromises the baseline ostracode assemblage we will be able to determine if any changes take place in the current fauna in Bennetts Bayou.

Information from the study will be extended to include the entire watershed. This will be accomplished by combining information from watershed examination by project employees with pollutant measurements and the cost/benefit section of the study. Statistical and mathematical techniques will then be used to forecast the impact of using best management practices over the entire watershed area. All project information will be included in the final report sent to the Louisiana Department of Environmental Quality. Decision makers will also be informed, within the report, regarding the reliability of project findings through a narrative explanation and through a report of parameter t, F and Chi Square statistics, project probability levels, confidence limits and coefficients of determination. Project Managers will also meet with decision makers to discuss the progress of the project and/or any findings or results related to it.

APPENDIX A

Louisiana Cooperative Extension Pest Management Guides

Control Cotton Insects 1994



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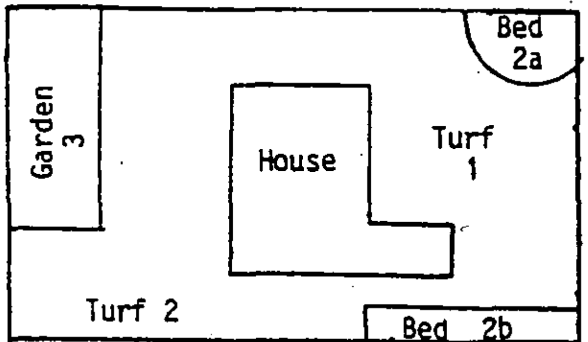
Louisiana State University
Agricultural Center
Louisiana Cooperative Extension Service

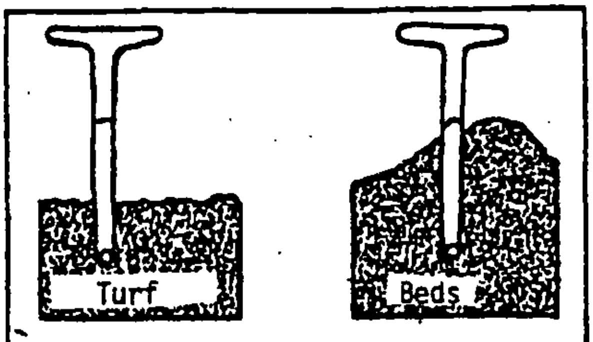
APPENDIX B

Louisiana Cooperative Extension Soil Sample Guide

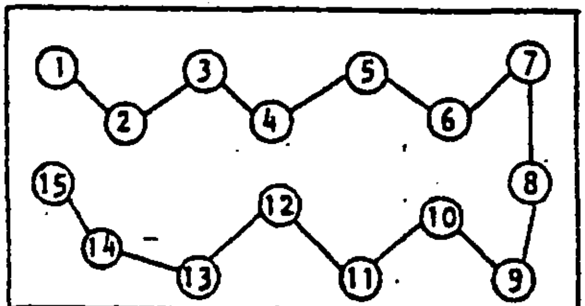
HOW TO TAKE A SOIL SAMPLE



1 Divide into areas for sampling on basis of slope, type of plants grown, etc.

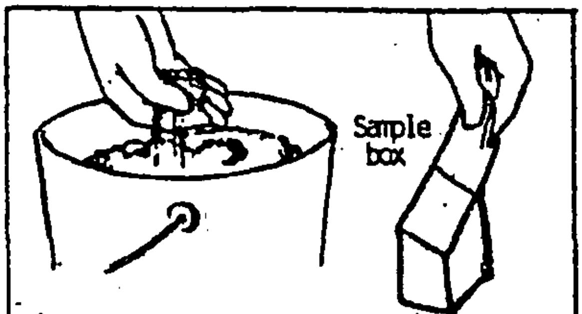


2 Sample to depth of 6 " inches for turf and beds.

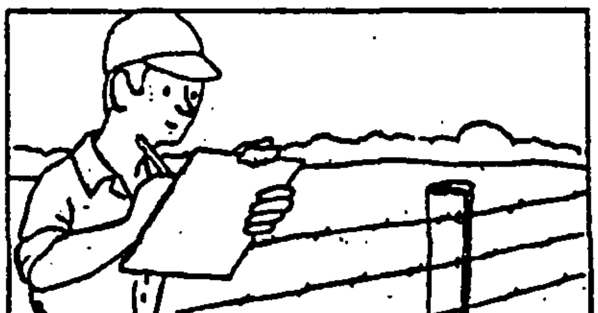


3 Take soil from at least 10 places in each area to obtain representative sample.

4 Mix soil thoroughly.



5 Remove one pint for laboratory sample. Label with identification number. Sample boxes available from County Agent.



6 Fill out information sheet and take it by your County Agent's office to be sent to LSU for your laboratory analysis.

Louisiana State University
Agricultural Center
Louisiana Cooperative Extension Service

APPENDIX C

ISCO Samples Catalogs

Model 3700 Sampler

The world's most advanced sequential/composite sampler

The full-featured Isco 3700 Sampler sets new standards in accuracy and dependability. It collects sequential or composite samples based on either time, flow rate, or storm conditions.

Exclusive STORM Program

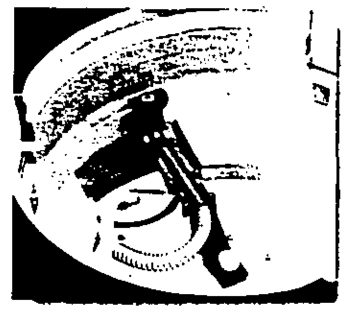
The new STORM program allows your Isco 3700 Sampler to collect separate first flush samples and flow-weighted composite samples. This unique program allows one or more timed samples to be taken after a programmed time delay. While this first flush sample is being collected, the sampler also monitors flow signals from a connected flow meter. Each time a preset volume of runoff water has passed the monitoring point, a flow-weighted sample is collected in bottles separate from the first flush sample.

Built-in Multiplexer

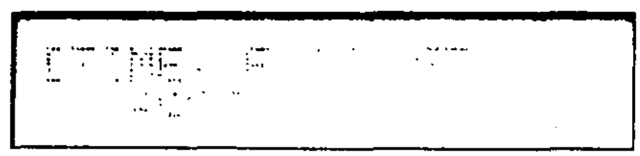
The built-in multiplexing feature expands sampling versatility. It allows multiple samples to be placed in individual bottles, or samples to be placed into multiple bottles at each sampling interval. Additional multiplexing modes allow you to quickly and easily set up a sampling routine to fit your application.

Rugged Distributor

The Geneva drive distributor locks the distributor arm into position over the sample bottles for accurate sample delivery. The distributor arm is constructed of polypropylene for corrosion resistance. At the heart of this distribution system is the Isco peristaltic pump which meets EPA requirements for representative sample flow velocity.



A rugged, corrosion resistant polypropylene distributor arm combined with the exclusive Geneva drive provides accurate positioning time after time.



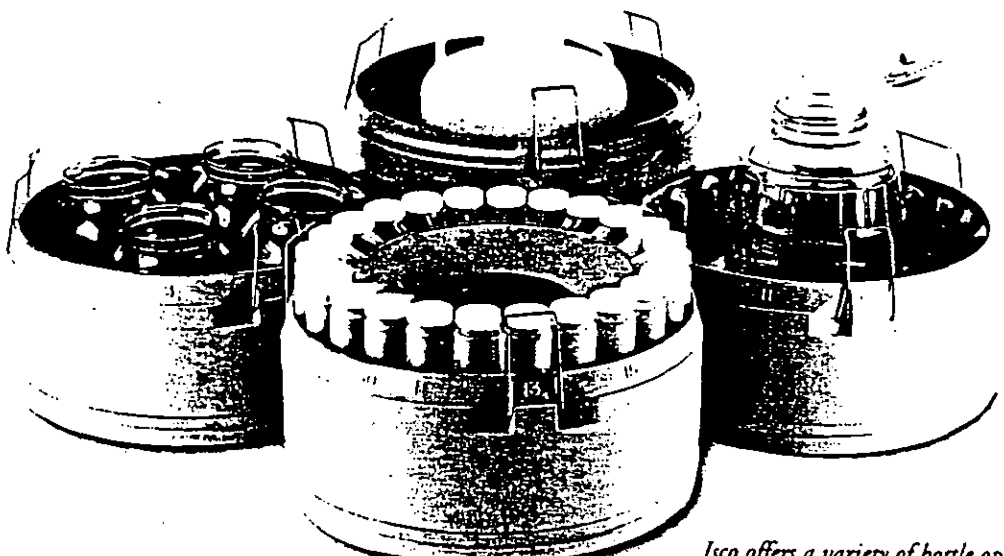
The alphanumeric LCD makes programming fast and easy.

Large, 2 row, 40 Character LCD

The 3700 Series Samplers effectively communicate with the first time user or experienced professional. The large, 2 row, dot matrix Liquid Crystal Display provides self-prompting, easy to follow programming instructions for fast and convenient sampler setup. It continuously displays sampling program status for quick, convenient reference.

APPENDIX D

DIAGRAM OF THE PROJECT PLOT



Versatile Bottle Options

You can collect sequential samples in 24 (350 ml) glass or (1000 ml) polypropylene, or four 1-gallon glass bottles. The 3700 also allows you to collect composite samples in a 2 $^{1}/_{2}$ gallon glass or polyethylene bottle. An optional composite base with a 4 gallon polyethylene bottle is available for larger composite samples.

Isco offers a variety of bottle options for both composite or sequential sampling. Choices range from 350 ml glass to four gallon polyethylene bottles.

Model 3700 Technical Specifications

[illegible]

Sampler [illegible] capacity:
Sequential Base: [illegible] polypropylene (1000 ml), 24 glass (350 ml), 4 glass (1 gallon or 3780 ml) bottles, [illegible] polyethylene 2 1/2 gallon or 9450 ml or one glass (2 1/2 gallon or 9450 ml) bottle.
Optional Composite Base: One polyethylene (4 gallon or 15,120 ml) bottle.

Liquid presence detection: Non-wetted non-conductive sensor detects when liquid sample reaches the pump to automatically compensate for changes in head height.

Controller watertightness: Self certified NEMA 4x and 6 ratings (submersible, watertight, dust-tight, and corrosion resistant.)

Programming modes: Basic, extended, STORM.

Sampling modes:
Sample pacing: Uniform time, non-uniform time, flow, flow paced/time switched, STORM (time and flow paced sampling during sample collection). (Flow modes are controlled by external flow meter pulses.)

Sample distribution: Sequential, composite.

Multiplexing: Samples per bottle (1 to 50 with 1000 ml bottles; 1 to 17 with 350 ml bottles), bottles per sample (1 to 24), multiple bottle compositing.

[illegible]

Flow meter signal requirements: [illegible] DC pulse or isolated contact closure of at least 25 milliseconds duration. (4 to 20 ma analog or pulse duration signal may be used with optional interface unit.)

Rinse cycles: Suction line automatically rinsed with source liquid before sample collection; 0 to 3 rinses.

Sample retries: Sampling cycle automatically repeated if sample not obtained on initial attempt, 0 to 3 retries.

Program lock: Provides password protection for input displays.

Program storage: Stores up to 3 programs.

Sampling stop/resume: Up to 24 real time/date sample stop/resume commands.

Master/slave: Allows the automatic start of second (slave) sampler.

Interface port: 8 pin connector; data output at 2400 baud in ASCII RS-232 format with handshake. Allows transfer of Program Setting Report (PSR) and Sample Results Report (SRR) to Field Printer or personal computer.

[illegible]

Sample volume: [illegible] ml in 1 ml increments. (Automatically limited by programmed bottle size and sampling mode.)

Sample volume repeatability: ±10 ml, typical.

Real time clock accuracy: 1 minute per month, typical.

Suction tubing (intake): 3 ft. to 99 ft. length of 1/4" ID vinyl, 3/8" ID vinyl, or 3/8" ID Teflon lined tubing.

Suction lift: 26 ft. (7.9 m), maximum.

Pumping rate (at 3 ft. head):
1/4" ID suction tubing: 3000 ml per minute.
3/8" ID suction tubing: 3500 ml per minute.

Line transport velocity (at 3 ft. head):
1/4" ID suction tubing: 5.1 ft. per second.
3/8" ID suction tubing: 2.5 ft. per second.

[illegible] bottles full of [illegible] of the test) [illegible] sample is [illegible] below ambient. [illegible] hours [illegible] sample is 2[illegible] below ambient.

Icing capacity: 30 lbs of ice with 24 glass (350 ml) bottles.

Base insulation: Standard thermal resistance factor of R-11.

Sampler power requirements: 12 volts DC. (Supplied by battery or AC power converter.)

Sampler standby current: 10 milliamps, maximum.

External Isco nickel cadmium battery capacity: 7 standard sampling programs. (24 samples at a rate of one 200 ml sample per hour, using 10 ft. of 3/8" vinyl suction line at a 5 ft. head.)

Controller internal lithium battery life (maintains internal logic and user selected settings): 5 years minimum.

Model 3700 Sampler

The world's most advanced sequential/composite sampler

The full-featured Isco 3700 Sampler sets new standards in accuracy and dependability. It collects sequential or composite samples based on either time, flow rate, or storm conditions.

Exclusive STORM Program

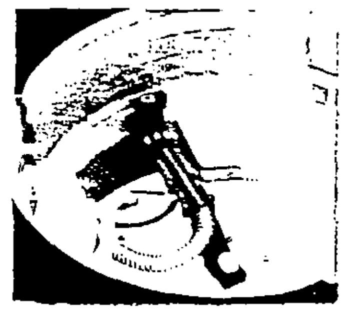
The new STORM program allows your Isco 3700 Sampler to collect separate first flush samples and flow-weighted composite samples. This unique program allows one or more timed samples to be taken after a programmed time delay. While this first flush sample is being collected, the sampler also monitors flow signals from a connected flow meter. Each time a preset volume of runoff water has passed the monitoring point, a flow-weighted sample is collected in bottles separate from the first flush sample.

Built-in Multiplexer

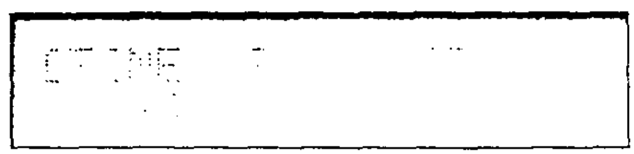
The built-in multiplexing feature expands sampling versatility. It allows multiple samples to be placed in individual bottles, or samples to be placed into multiple bottles at each sampling interval. Additional multiplexing modes allow you to quickly and easily set up a sampling routine to fit your application.

Rugged Distributor

The Geneva drive distributor locks the distributor arm into position over the sample bottles for accurate sample delivery. The distributor arm is constructed of polypropylene for corrosion resistance. At the heart of this distribution system is the Isco peristaltic pump which meets EPA requirements for representative sample flow velocity.



A rugged, corrosion resistant polypropylene distributor arm combined with the exclusive Geneva drive provides accurate positioning time after time.



The alphanumeric LCD makes programming fast and easy.

Large, 2 row, 40 Character LCD

The 3700 Series Samplers effectively communicate with the first time user or experienced professional. The large, 2 row, dot matrix Liquid Crystal Display provides self-prompting, easy to follow programming instructions for fast and convenient sampler setup. It continuously displays sampling program status for quick, convenient reference.

4230 Bubbler Flow Meter

Isco 4230 Bubbler Flow Meters use an internal air compressor to force a metered amount of air through a bubble line submerged in the flow channel. By measuring the pressure needed to force air bubbles out of the line, the level of the water is accurately determined.

Versatile and Accurate

The 4230 provides accurate measurement in a variety of conditions. It is not affected by wind, steam, foam or turbulence. And, because only the bubble tube contacts the flow, corrosive chemicals are not a problem. The 4230 also resists damage by lightning and debris, making it ideal for storm water applications.

Automatic Drift Compensation allows the 4230 to compensate for transducer drift. This makes our bubbler flow meters the most accurate level measurement technology. In standby applications such as storm water runoff monitoring, Automatic Drift Compensation also allows the 4230 to maintain its level calibration indefinitely.

Dependable Operation

The 4230 is not affected by suspended solids and rapidly changing head heights that can cause problems for some bubbler flow meters. Automatic bubble line purging prevents clogging. And, Isco Super Bubble Software senses rapidly rising heads and increases the bubble rate to maintain maximum accuracy.

A 4230 Bubbler paces an Isco 3700 Sampler to collect flow proportioned samples.

Isco 4230 Specifications

Flow Meter

Size *(H x W x D)* *(without power source)*	17.0 in. x 11.5 in. x 10.5 in.	43.2 cm x 29.2 cm x 26.7 cm
Weight *(without power source)*	19.1 lbs.	8.6 kg
Material	High-impact molded polystyrene structural foam	
Enclosure *(self-certified)*	NEMA 4X	IP65
Power	12 to 14V DC, 16 mA average at 12.5V DC (printer set at 1 in./hr (2.5 cm/hr), 1 bubble per second, 15 minute purge, and continuous level reading interval)	
Typical Battery Life	*(printer set at 1 in./hr (2.5 cm/hr), 1 bubble per second, 15 minute purge, and continuous level reading interval)*	
934 Nickel-Cadmium Battery	7 to 10 days	
946 Lead-Acid Battery	10 to 15 days	
948 Lead-Acid Battery	2 to 3 months	
Program Memory	Non-volatile, programmable flash; can be updated via interrogator port without opening the enclosure	
Display	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)	
Level-to-Flow Rate Conversions		
Weirs	V-notch, rectangular with and without end contractions, Cipolletti, Isco Flow Metering Inserts	
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco, Trapezoidal, H, HS, HL	
Manning formula	Round, U-channel, rectangular, trapezoidal	
Data Points	Four sets of 50 level-flow rate points	
Equation	Two-term polynomial	
Totalizers		
LCD	9-digit, floating decimal point, resettable	
Mechanical *(optional)*	7-digit, non-resettable	
Rain Gauge Input	Contact closure, normally open	
Resolution	0.01 or 0.004 in.	0.25 or 0.1 mm
Parameter Inputs	pH and temperature *(with optional Isco 201 Parameter Module)*, or dissolved oxygen and temperature *(with optional Isco 270 Parameter Module)*	
Sampler Activation Conditions	Enabled, disabled, AND and OR combinations of any two of level, flow rate, rainfall, pH or DO, and temperature	
Sampler Pacing Output	12V pulse	
Sampler Input	Event mark, bottle number	
Printer		
Recording Modes	Up to 3 graphs of level, flow rate, pH or DO, and temperature vs time; includes totalized flow. Rainfall and sampler events (time and bottle number) are also recorded	
Speed	Off, 0.5, 1, 2, 4 inches per hour	Off, 1.25, 2.5, 5, 10 cm per hour
Recording Span	User selectable with multiple over-ranges	
Resolution	1/240 of recording span	
Reports Printed	Flow meter program, 2 independent time interval reports, flow meter history, sampler history	
Interval Report Contents	Site number; time interval; total flow; minimum, maximum, and average flow rate; level; pH or DO, and temperature, and time of occurrence; interval flow; total rainfall; number of samples, flow meter history and sampler history	
Character Size	0.09 in. high x 0.07 in. wide (2.4 mm x 1.7 mm), 12 pitch	
Paper	4.5 in. wide x 65 ft. (11.4 cm x 19.8 m) plain white paper, replaceable roll	
Ribbon	19.7 ft. (6.0 m) black nylon, replaceable	
Data Storage Memory		
Capacity	80,000 bytes (approximately 40,000 readings) divided into a maximum of 6 memory partitions; equal to 120 days of level, rainfall, pH or DO, and temperature readings at 15 minute intervals, plus 2,500 sample events	
Setup and Data Retrieval	IBM PC or compatible computer with Isco Flowlink Software Version 3.1	
Communication	Direct connection, optional internal 2400 baud telephone modem with voice messaging, or optional internal short haul modem	
Voice Messaging *(with optional internal telephone modem)*		
Activation conditions	AND and OR combinations of any two of level, flow rate, rainfall, pH or DO, and temperature	
Telephone Numbers	5 with programmable delay between calls	
Voice Message	Site number, request for acknowledgment	
Acknowledgment	Touch tones or call back	
Analog Output	4 to 20 mA based on flow rate *(with optional 4 to 20 mA Output Interface)*	
Relay Outputs	2 form C relays with field selectable trip points based on flow rate *(with optional High/Low Alarm Relays)*	
Operating Temperature	0° to 140°F	-18° to 60°C
Storage Temperature	-40° to 140°F	-40° to 60°C

Bubbler

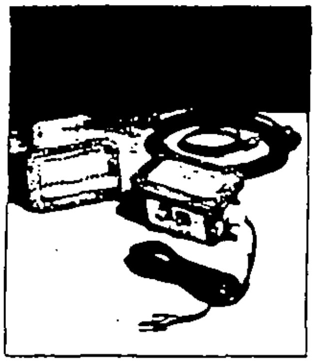
Range	0.01 to 10 ft.		0.003 to 3.05 m	
Level Measurement Accuracy *Linearity, Repeatability, and Hysteresis at 72°F (22°C)*	Level*	Error	Level*	Error
	0.01 to 1.0 ft.	±0.005 ft.	0.003 to 0.31 m	±0.002 m
	0.01 to 5.0 ft.	±0.010 ft.	0.003 to 1.52 m	±0.003 m
	0.01 to 10 ft.	±0.035 ft.	0.003 to 3.05 m	±0.011 m
Temperature Coefficient *Maximum error within compensated temperature range (per degree of temperature change)*	±0.0003 x level x temperature change from 72°F *where level is measured in feet*		±0.0009 x level x temperature change from 22°C *where level is measured in meters*	
Automatic Drift Correction	After a 5 minute warm-up period, zero level is corrected to ±0.002 ft. (±0.0006 m) at intervals between 2 and 15 minutes			
Long-Term Level Calibration Change	Typically 0.5% of reading per year			
Ambient Operating Temperature Range	0° to 140°F		-18° to 60°C	
Compensated Temperature Range	32° to 140°F		0° to 60°C	

* *Actual vertical distance between the end of the bubble line and the liquid surface*

4200 Series Flow Meter Accessories

674 Rain Gauge

Tipping bucket design accurately measures on-site rainfall.



High/Low Alarm Relays

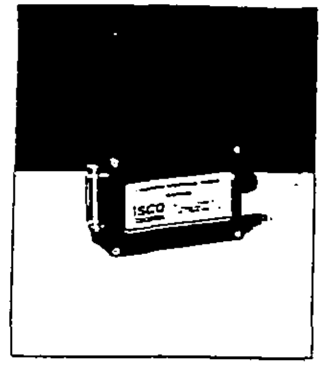
Two isolated contacts to control external equipment or alarms.

4 to 20 mA Output Interface

Provides 4 to 20 mA analog signal for process control.

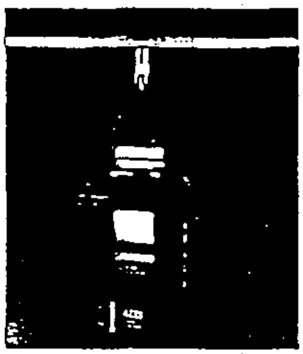
Chart Roller

Makes it easy to view and mark flow meter chart paper.



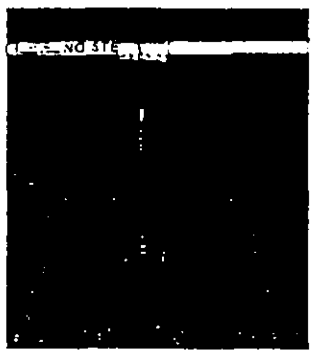
Computer Short Haul Modem

Allows communication with a flow meter up to five miles (8 km) away.



Spreader Bar

For suspending flow meter in a manhole in portable flow monitoring applications.

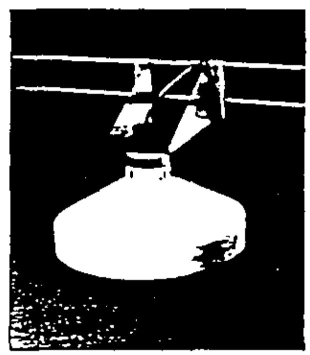


Ultrasonic Sensor Cable Clamp

Suspends sensor by its cable from Spreader Bar.

Ultrasonic Sensor Cable Straightener

Straightens ultrasonic sensor when suspended by cable.

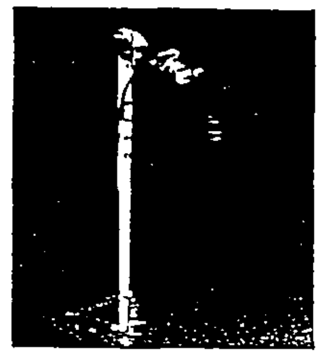


Ultrasonic Sensor Mounting Bracket

Allows sensor to be secured to a vertical surface.

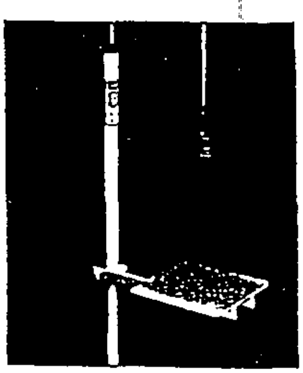
Ultrasonic Sensor Sunshade

Ensures accurate temperature compensation.



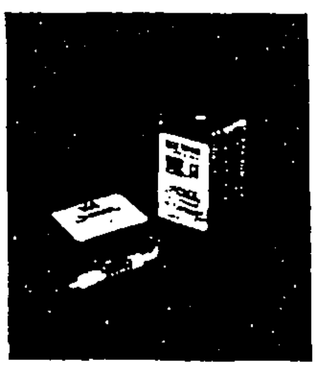
Ultrasonic Sensor Floor Mount

For convenient mounting of the ultrasonic sensor to a horizontal surface.



Ultrasonic Calibration Target

For calibration of an ultrasonic sensor without entering the manhole.

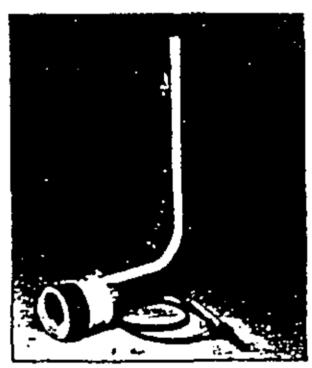


Quick Disconnect Box

Extends distance between submerged probe and flow meter.

Intrinsically Safe Barrier

Allows submerged probe to be installed in hazardous locations.



Flow Metering Inserts

Allows Isco bubbler flow meter to measure flow in sewer pipes without entering the manhole.

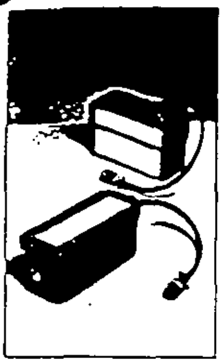
Spring Rings

To install flow and parameter sensors in small round pipes.

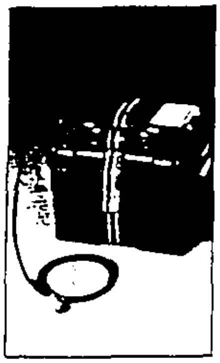
Scissors Rings

To install sensors in large round pipes and manhole inverts.

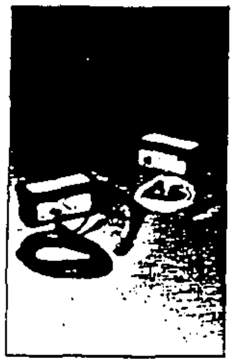
Power Products



934 Nickel-Cadmium Battery and 946 Lead-Acid Battery
Sealed rechargeable batteries provide power in portable flow monitoring applications.

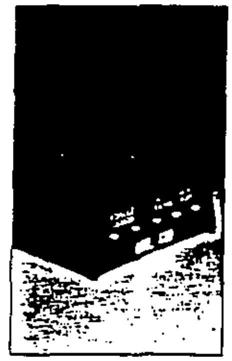


948 Lead-Acid Battery
45 amp-hour battery with a convenient carrying case and connect cable.



High Capacity Power Packs
Converts AC power into 12 volts DC to power flow meter or recharge batteries.

Battery Backed Power Packs
AC power packs with built-in battery to power flow meter without interruption in the event of a power outage.



965 Five-Station Battery Charger
Charges up to five Isco 934 Nickel-Cadmium or 946 Lead-Acid Batteries at one time. Powered by 120 or 240V AC.

954 Solar Panel Battery Charger
Charges Isco lead-acid batteries in locations where AC line power is not available.

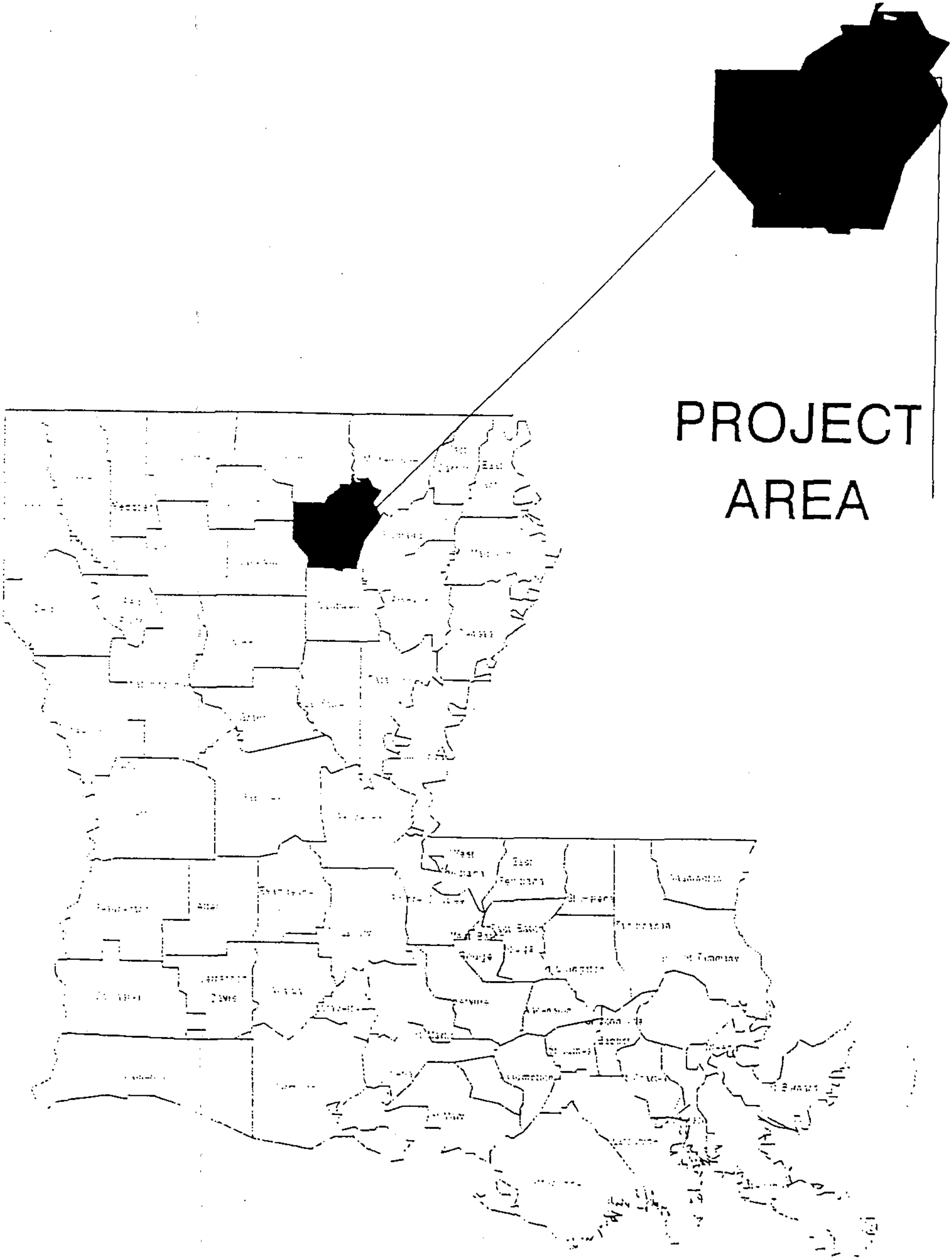
Ordering Information

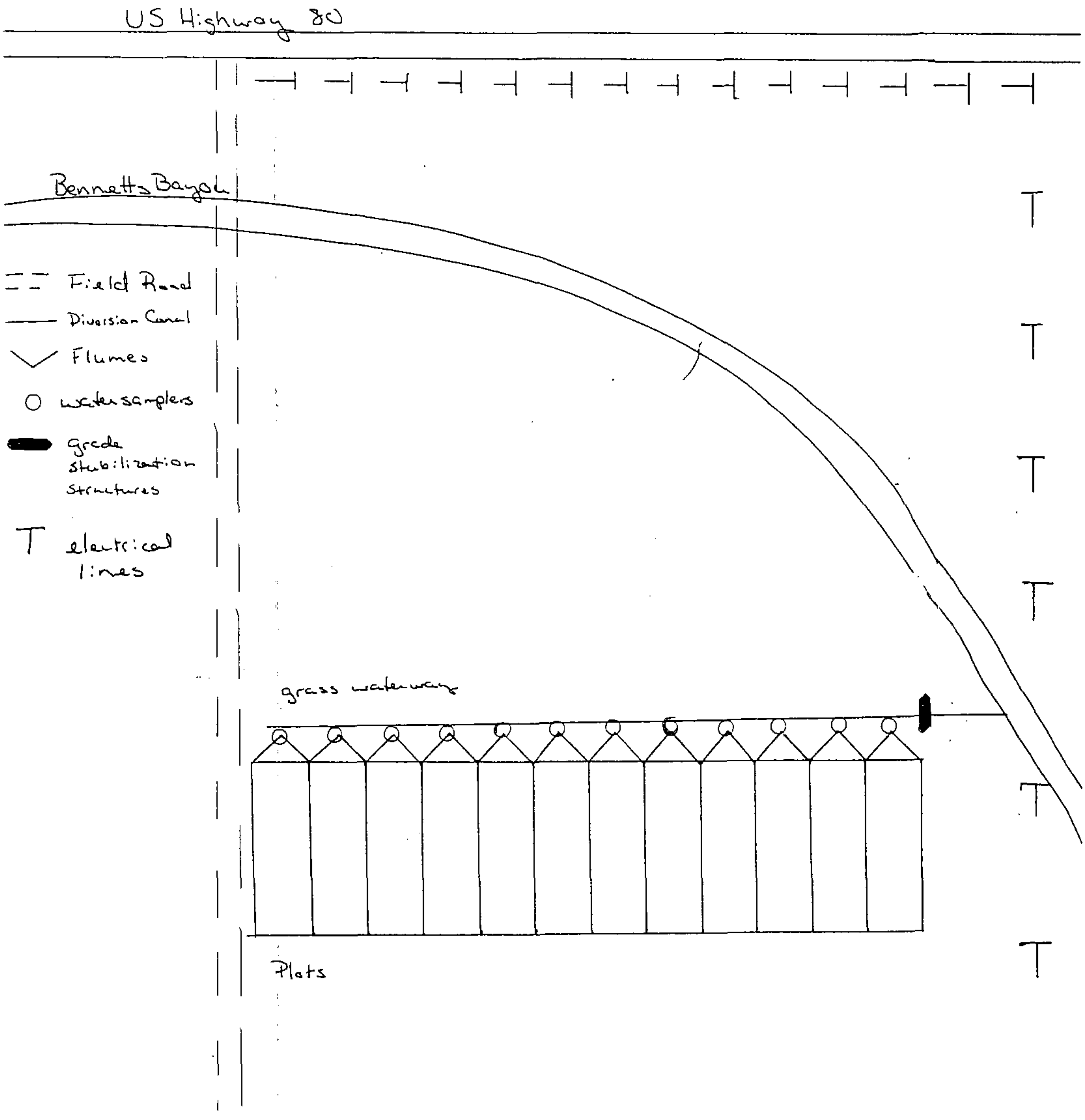
Model	Part Number
4210 Ultrasonic Flow Meter	68-4210-001
4210 Accessories	
Sensor Cable Clamp	60-3004-129
Sensor Cable Straightener	60-3213-061
Sensor Mounting Bracket	60-2443-092
Sensor Sunshade	60-3004-142
Sensor Floor Mount	60-3004-117
Calibration Target	60-3004-143
4220 Submerged Probe Flow Meter	
with 10 ft. (3.05 m) level measurement range	68-4220-001
with 30 ft. (9.14 m) level measurement range	68-4220-002
4220 Accessories	
Quick Disconnect Box	60-3224-003
Intrinsically Safe Barrier	60-3404-060
4230 Bubbler Flow Meter	
with 1/16 in. x 25 ft. (1.6 mm x 7.62 m) Teflon bubble line	68-4230-001
with 1/8 in. x 50 ft. (3.2 mm x 15.2 m) vinyl bubble line	68-4230-002
4230 Accessories	
Flow Metering Inserts	
6" (150mm) Insert	68-3230-005
8" (200mm) Insert	68-3230-006
10" (250mm) Insert	68-3230-007
12" (300mm) Insert	68-3230-008
4250 Area Velocity Flow Meter	
with 10 ft. (3.05 m) level measurement range	68-4250-001
with 30 ft. (9.14 m) level measurement range	68-4250-002
4250 Accessories	
Quick Disconnect Box	60-3254-004

Model	Part Number
4200 Series Options	
Telephone Modem with Voice Messaging	68-4200-004
Short Haul Modem	68-3210-009
Mechanical Totalizer	60-3214-134
4200 Series Accessories	
201 pH/Temperature Module	
with single junction pH probe	68-4200-001
with double junction pH probe	68-4200-002
270 DO/Temperature Module	68-4200-003
674 Rain Gauge	
0.01"	60-3284-001
0.1 mm	68-3280-001
High/Low Alarm Relays	60-3404-028
4 to 20 mA Output Interface	60-1784-039
Chart Roller	60-3004-156
Flowlink Software Version 3	60-2544-043
Computer Short Haul Modem	60-3214-080
Spreader Bar	60-3004-110
Power Products	
934 Nickel-Cadmium Battery	60-1684-040
946 Lead-Acid Battery	60-3004-106
948 Lead-Acid Battery	68-3000-948
High Capacity Power Packs	
Model 913 120V AC	60-1684-088
Model 923 240V AC	60-1684-093
Battery Backed Power Packs	
Model 914 120V AC	60-3004-130
Model 924 240V AC	60-3004-160
965 Five-Station Battery Charger	68-3000-965
954 Solar Panel Battery Charger	68-3000-027

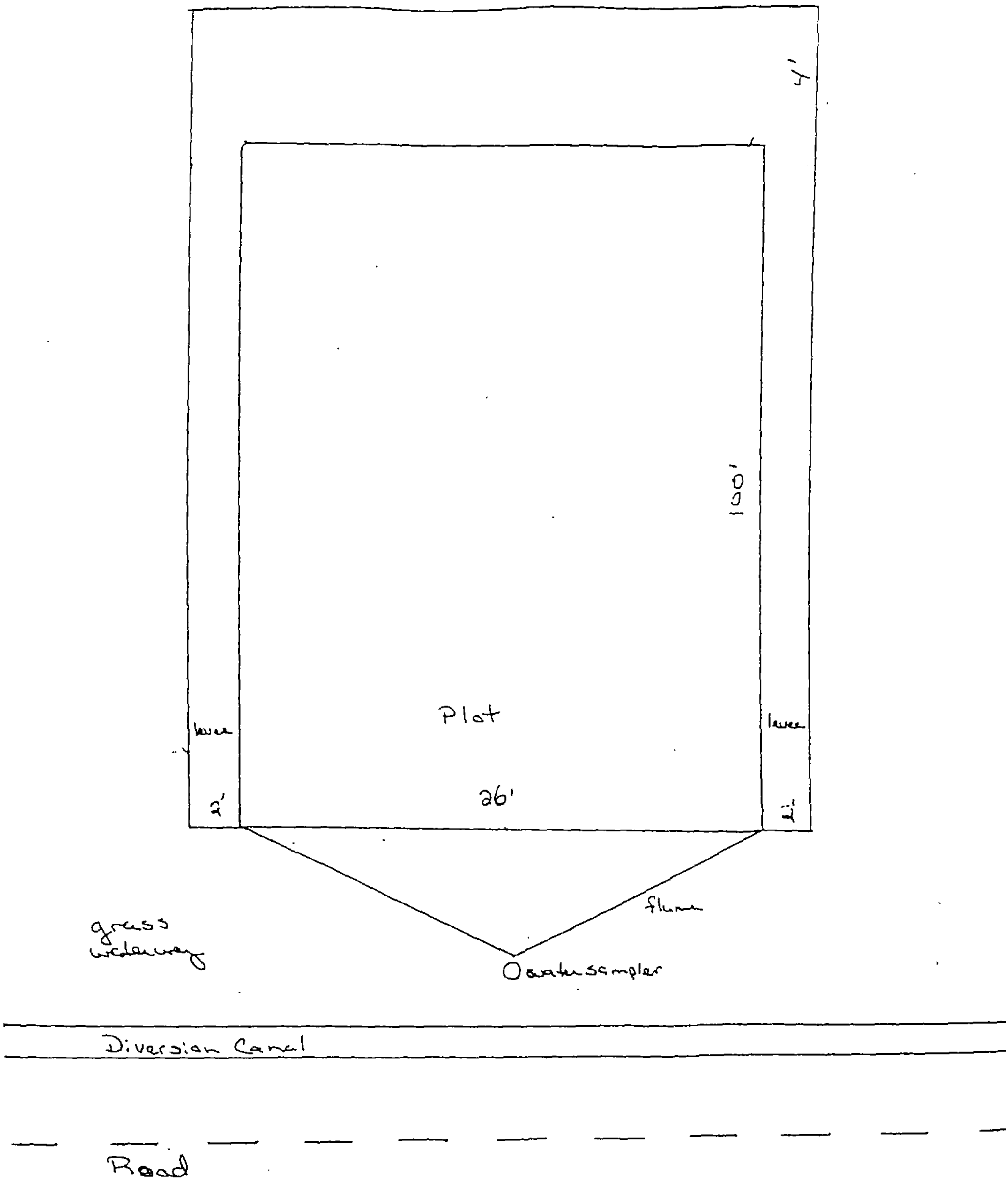
APPENDIX D

DIAGRAM OF THE PROJECT PLOT


PROJECT
AREA



US Highway 80
Bennetts Bayou
Field Road
Diversion Canal
Flumes
watersamplers
grade stabilization structures
electrical lines
grass waterway
Plots


4'
100'
Plot
levee
levee
2'
26'
2'
flume
grass waterway
O water sampler
Diversion Canal
Road

APPENDIX E

LIST OF PESTICIDES TO BE USED IN THE COTTON MANAGEMENT PROJECT

Herbicides:

Trade name	Active Ingredient
Roundup	Glyphosate
Treflan	Trifluralin
Cotoran	Fluometuron
Zorial	Norflurazon
Fusilade	Fluazifop

Fungicides:

Terraclor	Pentachloronitrobenzene

Insecticides:

Methyl Parathion	Methyl Parathion
Temik	Aldicarb
Baythroid	Cyfluthrin
Bolstar	Sulprofos
Lorsban	Chlorphyrifos
Guthion	Azinphos methyl

Pesticides methodology including the analysis, volume required, containers, holding times, and preservatives will be taken from EPA suggested methods and protocols established in the FDA Pesticide Analytical Methods published by the Food and Drug Administration and the Manual of Chemical Methods for Pesticides and Devices.

Budget years 1-3, Requested funds: DEQ and Matching Funds

Department of Environmental Quality--Cotton Best Management Practices

		7-95 - 7-96		7-96 - 7-97		7-97 - 7-98	
A.	Salaries	DEQ	MATCH	DEQ	MATCH	DEQ	MATCH
A1.	Primary Investigator-NLU						
	McLean	12000	16000	12000	12000	12000	12000
	Neal	4000	12000	4000	4000	4000	4000
	Allen	1000	1000	1000	1000	1000	1000
	Kontrovitz	0	4500	0	500	0	500
	Bounds	4500	9000	4500	4500	4500	4500
	Total PI Salaries	21500	42500	21500	22000	21500	22000
	Secretarial Salaries	0	2000	0	2000	0	2000
	Total Salaries	21500	44500	21500	24000	21500	24000
B.	Student Labor	2000	3300	2000	3300	2000	3300
C.	Graduate Students and/or Hired Labor						
	Farm labor	2000	2000	2000	2000	2000	2000
	Full Time PI	9000	2322	9000	2322	9000	2322
	Summer Biology	900	744	900	744	900	744
	Summer Geosciences	900	744	900	744	900	744
D.	Fringe Benefits	5160	9350	5160	4840	5160	4840
	Total Salaries, Wages and Fringes	41460	62960	41460	37950	41460	37950
E.	Land Leveling and Site Preparation	14000	2000	0	0	0	0
F.	Crop Production Cost	6750	2000	7750	2000	7750	2000
G.	Water Collection Equipment	40000	0	0	0	0	0
H.	Analytical Service						
	Water Samples	40000	0	40000	0	40000	0
	Nematode Analysis- Dr. Gary Lawrence Mississippi State	2000	0	2000	0	2000	0
	Soil/Petiole Samples	1000	0	1000	0	1000	0
	Mathematical Modeling and Project Design- Dr. Kenneth Bowman Murray State Univ.	2000	0	2000	0	2000	0
	Total Analytical	45000	0	45000	0	45000	0
I.	Supplies and Expendable Equipment	5000	5500	5000	5500	5000	5500
J.	Publications, Phones and Postage	1000	2000	1000	2000	1000	2000

K.	Travel	2000	3000	2000	3000	2000	3000
L.	Land	0	4000	0	5000	0	4000
M.	Agriculture lab space	0	5000	0	5000	0	5000
N.	Biology lab space	0	6000	0	6000	0	6000
O.	Environmental Cold Chambers	0	4500	0	4500	0	4500
P.	Construction lab space	0	5000	0	0	0	0
Q.	Subcontracted Personnel						
	LSU Extension	4000	2931	4000	2931	4000	2931
	Soil Conservation Service	3450	0	3450	0	3450	0
R.	Tractor Rental	4000	0	5000	0	5000	0
S.	Total Direct Cost	166660	104891	114660	73881	114660	72881
T.	Indirect Costs	10365	15740	10365	9488	10365	9488
U.	Total Cost	177025	120631	125025	83368	125025	83368
V.	Percent Match		0.4005		0.4000		0.4000

Budget years 1-3, Requested funds: DEQ and Matching Funds

Department of Environmental Quality--Cotton Best Management Practices

		7-98 - DEQ	9-99 MATCH
A.	Salaries		
A1.	Primary Investigator-NLU		
	McLean	4000	4000
	Neal	8000	8000
	Allen	0	500
	Kontrovitz	0	500
	Bounds	0	500
	Total PI Salaries	12000	13500
	Secretarial Salaries	0	1000
	Total Salaries	12000	14500
B.	Student Labor	1000	1100
C.	Graduate Students and/or Hired Labor		
	Full Time PI	4000	1000
	Summer Biology	0	0
	Summer Geosciences	0	0
	Total Graduate Students	4000	1000
D.	Fringe Benefits	3840	3984
	Total Salaries, Wages and Fringes	20840	16600
E.	Land Leveling and Site Preparation	0	0
F.	Crop Production Cost	1000	500
G.	Water Collection Equipment	0	0
H.	Analytical Service		
	Water Samples	10000	0
	Nematode Analysis- Dr. Gary Lawrence Mississippi State	0	0
	Soil/Petiole Samples	0	0
	Mathematical Modeling and Project Design- Dr. Kenneth Bowman Murray State Univ.	0	0
	Total Analytical	10000	0
I.	Supplies and Expendable Equipment	1000	500
J.	Publications, Phones and Postage	500	500

K.	Travel	1000	500
L.	Land	0	0
M.	Subcontracted Personnel		
	LSU Extension	0	0
	Soil Conservation Service	0	0
N.	Tractor Rental	1000	0
O.	Total Direct Cost	34340	18600
P.	Indirect Costs	5210	4150
Q.	Total Cost	39550	22750
R.	Percent Match		0.5752