1998 Proposal Title Page
Southern Region SARE

1. **Project Title:**

Accountability at local, state, and federal levels for impacts of agricultural conservation practices on water quality.

2. **Project Coordinator:**

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II. Abstract

Conservation programs and subsidies within USA agriculture have long relied on a voluntary approach to conservation on privately owned lands. The policies of the 1996 Farm Bill have increased local control of identification and prioritization of natural resource problems and sustainable land management solutions. The Farm Bill addressed a broad range of natural resource concerns while mandating programs to support animal based agriculture and grazing lands management. Through the Soil and Water Conservation Districts (SWCD), Local Work Groups were convened to identify high priority natural resource problems and propose solutions using funding provided by the Environmental Quality Improvement Program (EQIP). The efficacy of EQIP subsidized conservation practices on a watershed basis has not been well defined. Under the Government Performance Reform Act, federal conservation programs must evaluate their activities based on measurements relating to the quality of natural resources. There is a need to access how these substantive policy changes impact programs designed to improve or protect the quality of our natural resource base. Our objectives are; 1) to work within two FY97 EQIP Priority Watersheds to monitor impact on water quality (biological, chemical, and physical properties) as funded conservation practices are installed, 2) to examine monitoring methods at three geographic scales (~400,000 acres, ~40,000 acres, and ~700 acres) to develop sampling strategies for use by local, state, and federal agencies, and 3) to conduct training for SWCD supervisors, farmers, and staff members of the Natural Resource Conservation Service, Georgia Environmental Protection Division, and other agencies to demonstrate sampling strategies designed to meet varied objectives. Water quality analyses will include microbiological testing for fecal coliforms, E. coli, and enterococci as well as tests for turbidity, pH, conductivity, temperature, dissolved oxygen, ammonium, nitrate, and phosphorus.

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VI. Proposal Narrative

A. Statement of Problem, Rationale, and Significance

Conservation programs and subsidies within USA agriculture have long relied on a voluntary approach to conservation on privately owned lands. The success of these programs depends on the working relationships of individual landowners with technical support staff of government agencies such as the USDA – Natural Resource Conservation Service. The policies of the 1996 Farm Bill have increased local control of identification and prioritization of natural resource problems and sustainable land management solutions. The Farm Bill also broadened natural resource issues to address soil, water, wetlands, wildlife, and species preservation concerns while mandating programs to support animal based agriculture and grazing lands management (Zinn, 1997). Through the Soil and Water Conservation Districts, Local Work Groups were convened to identify high priority natural resource problems and propose solutions using the Environmental Quality Improvement Program (EQIP). The EQIP combines functions of the Agricultural Conservation Program, Water Quality Incentives Program, Great Plains Conservation Program, and the Colorado River Basin Salinity Control Program.

Pressure is increasing on the Environmental Protection Agency (EPA) and associated state agencies to improve water quality under the provisions of the 1972 Clean Water Act. In Georgia, a recent settlement of a law suit by the Sierra Club, Trout Unlimited, and others will require that the state Environmental Protection Division (EPD) set pollution limits in Georgia's 14 river basins over the next 8 years (Soto, 1997; Editor, 1997). Nearly 600 waterways in Georgia have been identified as impaired and each of those waterways requires a plan to establish Total Maximum Daily Loads (TMDL) for various pollutants. There are major non-point sources of pollutants in many waterways and agricultural sources are included. The types

of water quality problems being identified by the EQIP Local Work Groups under the 1996 Farm Bill are of great concern to the EPD and EPA, as relates to the water quality standards.

As the EPA and EPD develop water quality standards for lakes and steams, agricultural producers may be identified as contributing to impairments and charged to reduce their inputs to acceptable levels. Voluntary conservation practices and appropriate management can reduce impairments to waterways in some situations. However, except for sediments and some nutrients there are few data demonstrating the efficacy of subsidized practices. For example, the effects of conservation practices on levels of fecal bacteria associated with animal based agriculture are relatively unknown. In addition, intensification of agricultural systems challenges efforts to minimize agricultural impacts off the farm and increases the importance of developing effective means of creating sustainable agricultural systems (Matson et al., 1997). However, from the 1970s until 1992, less than 0.2% of the $500 billion spent through the Clean Water Act was spent to test for effectiveness of abatement programs (Hart, 1994).

In addition, under the Government Performance Reform Act, all federal agencies must develop new methods of evaluating outcomes of their activities (Zinn, 1997). Historically, agencies providing technical support to conservation programs have been evaluated based on numbers of clients served, numbers of plans written, miles of a practice installed, etc. A rational basis for gauging progress that provides an index of ecosystem health is essential for working with non-point sources of pollution (Courtemanch, 1994; Hart, 1994). Congress wants evaluation of conservation programs to be based on measurements relating to the quality of air, water, and soil resources, and on numbers and diversity of wildlife and at-risk species.

B. Objectives

These substantial structural changes are affecting the way in which federal and state policies address natural resource issues and the way that individual farmers interact with the agency technical staff. The changes are also leading to different types of conservation practices being implemented in different ways on private lands. There is a need for tools to access the impact of results-based evaluation of government programs designed to improve or protect the quality of our natural resource base. Specific objectives of the research and education project are:

1) To work within two FY97 EQIP Priority Watersheds to monitor impact on surface water quality (biological, chemical, and physical properties) discharged from the watersheds as EQIP subsidized conservation practices are installed. Other changes in land use over the period of the experiment will be characterized via GIS/GPS to determine which changes that are observed can be attributed to changes in agricultural management versus other changes.

2) To examine monitoring methods at three geographic scales (~400,000 acres, ~40,000 acres, and ~700 acres) to develop cost effective and scientifically defensible sampling strategies for use by local, state, and federal agencies for evaluation of outcomes of EQIP funded practices.

3) To conduct traditional (field days and training sessions) and nontraditional (email lists and world wide web pages) outreach for soil and water conservation district supervisors and members, farmers, and staff members of Natural Resource Conservation Service, Georgia Environmental Protection Division, and other agencies. These outreaches would communicate sampling stategies and compare the costs and benefits of EQIP subsidized land management strategies designed to meet natural resource conservation objectives while offering opportunities for participatory evaluation by stakeholders on the utility and relevance of the SARE project.

C. Literature Review

The proposed site for the project is the Upper Oconee Watershed (HUC 03070101) on the northern half of the Oconee River Basin of Georgia in the Southern Piedmont physiographic region (Fig. 1). The Oconee River Basin is divided into the upper and lower hydrologic units near the Lake Sinclair Dam.

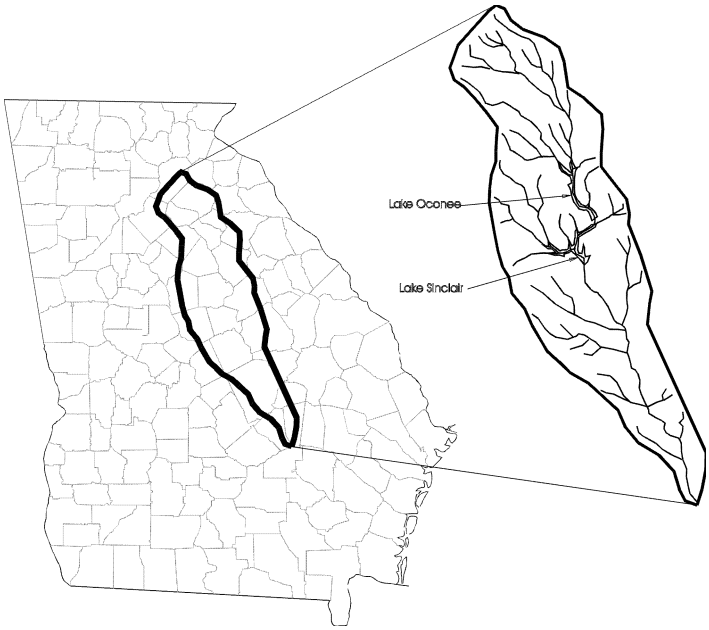


Figure 1. Upper and Lower Oconee Watersheds, Georgia.

The Upper Oconee Watershed covers 1,872,172 acres and includes 2,518 miles of continuously flowing streams (EPA, 1997). The population of the watershed was estimated to be 269,286 in 1990 and, based on observed trends, is now over 300,000. Total withdrawals of water were 1094 Mgal/d in 1990 and that total was 98% surface water. Although agriculture accounts for <1% of the water withdrawn from the watershed, the potential agricultural impact on the watershed is large with many confined animal production systems and extensive grazing lands. The current increase in urban land use makes this an important time to gather information on water quality and find effective means of maintaining water quality to minimize agricultural and urban conficts.

The headwaters of the Oconee River are in southern Hall County, GA. The Oconee basin continues through the mid-Piedmont to a major regional city (Athens). South of Athens, the Oconee River flows through predominantly agricultural watersheds to Lake Oconee and Lake

Sinclair. Lake Oconee is a Georgia Power reservoir located near the beginning of the Sand Hills and provides hydroelectric power, real estate development, and recreation for a large region.

In the proposed research area, animal-based agricultural provides by far the largest agricultural income and many processing jobs in the communities. Many animal production systems use imported feeds with various manure disposal strategies that could lead to nutrient enrichment and degradation of watersheds. Changes in land use may also result in loss of farmland, fragmentation of habitat, and decreased populations of at-risk species (Dobson, et al., 1997). All sectors of the economy are concerned about water-related issues such as recreation, tourism, safety of the water supply as related to human health, and the effects of water quality on fishing, real estate values, and wildlife habitat.

Methods must be defined that are cost-effective and scientifically defensible for the evaluation of broad based natural resource programs such as the 1996 Farm Bill or those that might be mandated to achieve TMDL levels for impaired watersheds. We propose activities that bring researchers and educators together with EQIP Local Work Groups, Soil and Water Conservation Districts, state and federal agencies, and non-governmental organizations to develop better evaluation tools and methodologies. These methods can then be adapted for local use in implementing new federal policies and state programs relating to sustainable agriculture and natural resource management. Involvement of lead farmers and farm groups, often through their involvement in the Local Work Groups, will be essential to success of our goals. "Each owner's actions are important, not just because they affect that particular piece of land, but also because they affect neighboring land and the health of the larger ecosystems and watersheds in which they occur" (USDA, 1996).

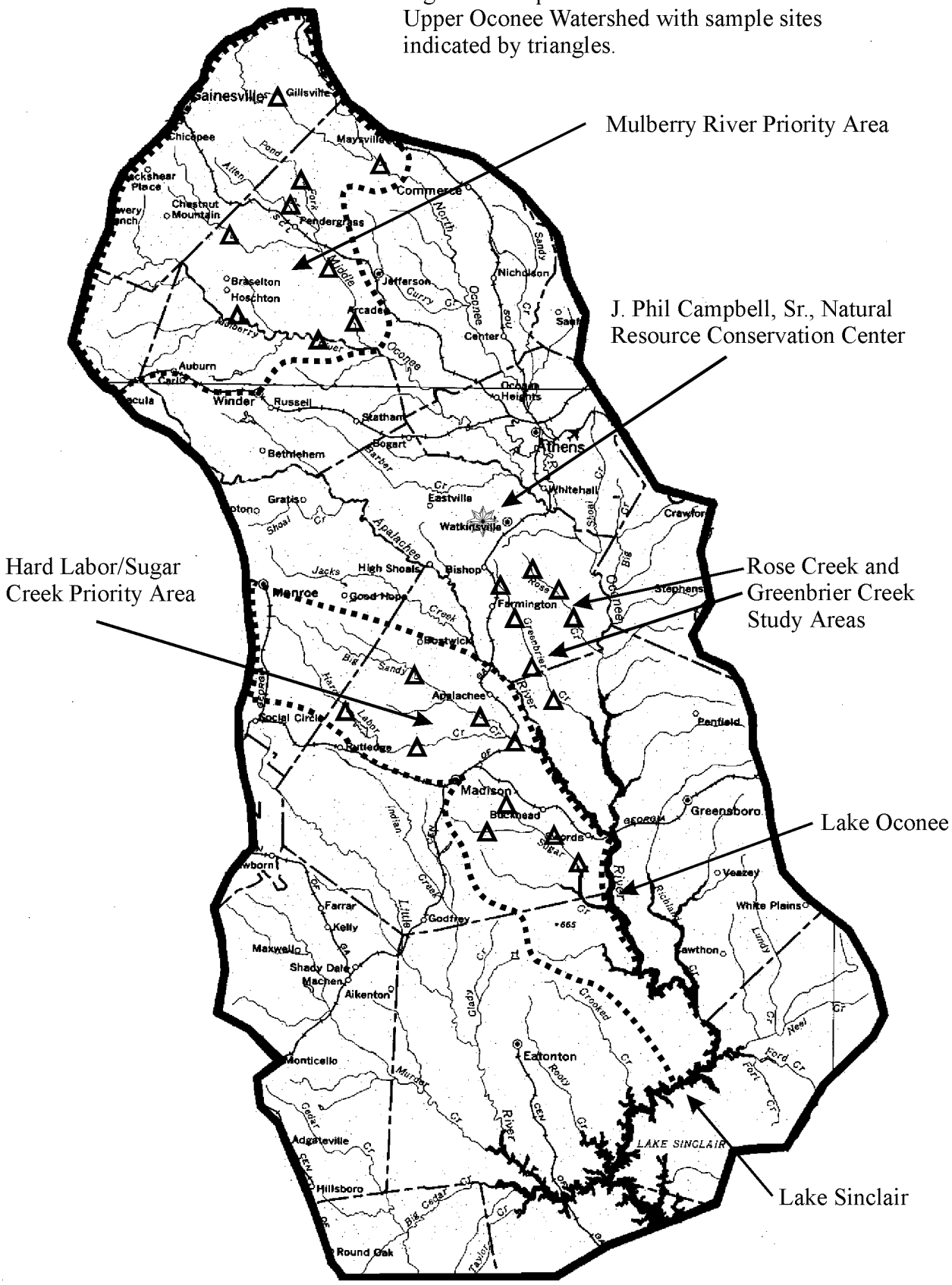
D. Approach and Methods

Objective 1: Two watersheds in the Upper Oconee Basin with impaired water quality have been identified as EQIP Priority Areas (Figure 2). The approximate location of sampling sites for water quality in the Mulberry River Priority Area and the Hard Labor/Sugar Creek Priority Area are indicated in Figure 2. The precise location of sites within the watersheds will be defined by Geographic Information Systems (GIS) analysis of the EQIP priority area. The mapping of the watersheds via GIS/GPS will be used to describe the area and land use present in the portion of watershed represented by collection site. Sampling will be conducted during the expenditure of EQIP funds and will be continued through the installation of conservation practices. Strategies developed within EQIP for remediation of water quality degradation will be evaluated for their effectiveness within these selected sites using a time series analysis (Izuno et al., 1996; Tremwell et al., 1996).

Water Quality Variables: Water samples collected from the watersheds will be subjected to microbial tests will be performed to determine most probable number per 100 ml (cfu/100ml) for fecal coliforms, E. coli, and enterococci (E. faecium and E. faecalis) bacteria. These tests will be performed using the Colilert (IDEXX, Maine) and Enterolert (IDEXX, Maine) proceedures. Using this procedure counts as high as 2419 cfu/100 ml can be made without dilution. Dilutions to keep E. coli and the enterococci within this range will be made.

Samples will also be tested for turbidity, pH, conductivity, temperature, and dissolved oxygen using meters specifically designed for each variable. Temperature will be determined at the sample collection site. Concentrations of ammonium, nitrate, and phosphorus will also be determined. Ammonium and nitrate will be estimated with ion selective electrodes and phosphorus will be estimated spectrophotometrically.

Figure 2. Proposed research locations in the Upper Oconee Watershed with sample sites indicated by triangles.



Mulberry River Priority Area: This area represents the northern portions of the Upper Oconee Watershed (Figure 2) and accounts for 250,460 acres. It is located in parts of Barrow, Hall, Gwinnett, and Jackson Counties, Georgia. Total agricultural acres are estimated to be 50,020. The principal agricultural enterprises include beef, poultry, and timber production. There are approximately 550 poultry operations in the area producing 64 million broilers per year and managing 2 million layers. More than 33, 000 beef cattle are grazed in the watershed. These operations produce enough nitrogen in waste each year to apply 408 lbs. per agricultural acre per year.

The Mulberry River Watershed was submitted by the Local Work Groups of Barrow, Gwinett, Hall, and Jackson Counties. It is located in the Gwinnett, Hall, and Oconee County Soil and Water Conservation Districts and was approved as a Priority Area and funded though EQIP for Fiscal Year 1997. Due to the large response during sign up, and limited funding, a large amount of land will remain for treatment in future years. The 1997 EQIP Financial Assistance allocation was $174,335. During the initial signup period, 124 applications were received with a total estimated funding of $1,100,000. This would total over $900,000 in unfunded applications in the 1997 fiscal year. Local support has been good in the priority area meetings and the use of management and structural practices are estimated to have the potential of reducing pollution of the drainage area by 60%.

The primary goals of the Work Groups in the Mulberrry River Priority Area are to; 1) reduce pollution of surface and ground water through improved livestock, pasture, and streambank management, 2) increase landowners knowledge of effects of agricultural activities on water quality, and 3) evaluate the effectiveness of the project activities.

The potential for improvement and likelihood of adoption of improved practices makes the Mulberry River Watershed an excellent site to test the efficacy of EQIP funding for reducing nonpoint sources of pollution. In order to characterize the water quality moving out of this area 9 sample sites are proposed. The Mulberry River would be sampled approximately 2 miles and 7 miles above its confluence with the Middle Oconee River (Fig. 2). The Middle Oconee would be sampled 2 miles, 6 miles, and 12 miles above its confluence with the Mulberry River. Allen Creek would be sampled 2 miles and Pond Fork 3 miles above the Middle Oconee River. The North Oconee would be sampled approximately 2 miles and 10 miles into the priority area.

These nine grab samples would be collected every 2 weeks and the water quality tested as indicated previously. Additional samples would be added after rainfall events in which it is estimated that over 50% of the watershed received more than 1 inch of rain in 24 hours.

Hard Labor/Sugar Creek Priority Area: This area is located in the central portion of the Upper Oconee Watershed (Figure 2) and accounts for 205,803 acres and is located in parts of Walton, Morgan, and Putnam Counties, Georgia. Total agricultural acres are estimated to be 64,563. The principal agricultural enterprises include dairy, beef, poultry, and timber production. There are approximately 30 dairies and 30 poultry operations in the area. More than 21,017 beef cattle are grazed in the watershed. These operations produce enough nitrogen in waste each year to apply 182 lbs. per agricultural acre per year. In the 1989 Section 319 Report of the Georgia Environmental Protection Division the Hard Labor Creek sub-unit was listed as impaired by agricultural non-point source pollution.

The Hard Labor/Sugar Creek Watershed was submitted by the Walton, Morgan, and Putnam County Local Work Groups in the Walton County and Piedmont Soil and Water Conservation Districts. It was approved as a Priority Area and funded though EQIP for Fiscal

Year 1997. Sign up in this EQIP Priority Area also demonstrated a very high level of interest by producers and, due to limited funding, a large amount of land remains for future treatment. The 1997 EQIP Financial Assistance allocation was $182,308. During the initial signup period, 74 applications were received with a total estimated funding of over $1,200,000. This would total over $1,000,000 in unfunded applications in the 1997 fiscal year. The Strong local support has been shown in the priority area meetings and the use of management and structural practices are estimated to have the potential of reducing pollution of the drainage area by 60%. The primary goals of the Hard Labor/Sugar Creek Priority Area Proposal are similar to those listed for the Mulberry River Proposal. Expenditures to improved livestock, pasture, and streambank management have been requested and combined with educational goals and tests of effectiveness.

Once again, the potential for improvement and likelihood of adoption of improved practices in the future makes the Hard Labor/Sugar Creek Watershed another excellent site to test the efficacy of EQIP funding for reducing nonpoint sources of pollution. In order to characterize the water quality moving out of this area nine sample sites are proposed. Sugar Creek would be sampled approximately 1.5 and 3 miles from Lake Oconee (Figure 2). South Sugar Creek would be sampled 7 miles from Lake Oconee and North Sugar Creek sampled 8 miles from the lake. Hard Labor Creek would be sampled 1, 6.5, and 11.5 miles from Lake Oconee. Big Sandy Creek would be sampled 4 miles and 11 miles from lake

These nine grab samples would be collected every 2 weeks and tested as previously indicated for water quality. Additional samples would be added after rainfall event in which it is estimated that over 50% of the watershed received more than 1 inch of rain in 24 hours.

Rose Creek and Greenbrier Creek Study Areas: Another Southern Region SARE project is currently underway in this study area and can provide additional information for the interpretation of water quality data. These two adjacent watersheds include approximately 40,000 acres and GIS/GPS analysis is already underway. Seven additional sampling sites are proposed for characterizing the water quality draining from these two watersheds. Rose Creek will be sampled 3, 6.5, and 8.0 miles above its confluence with the Oconee River. Greenbrier Creek will be sampled 2, 4.5, 7, and 10 miles above Lake Oconee. Because of their proximity to Lake Oconee, improving the water quality in these two watersheds can have a significant impact on the water quality in the northern portions of the lake. Because we will have more detailed information about management practices in these watersheds our ability to correlate land use and water quality will be enhanced.

Although by a narrow margin, the predominant land use in the Rose and Greenbrier Watersheds is agriculture (including forestry). However, urbanization and small ranchettes are beginning to occupy almost as much of the land base. This is an important time to be gathering information on land use, stream discharge rates, and water quality. The proposed sampling sites would complement those sites already being sampled for nutrient and sediment concentrations by producers as part of another SARE project. Our project would add tests for Fecal Coliform, E. coli, and enterococci bacteria in stream samples and we would solicit farmer's approval to conduct biological analysis of samples collected from their farms.

Objective 2: This objective will be addressed at three levels. First, we will work at the level of the EQIP Priority Areas. These two areas total over 400,000 acres and provide the largest test for developing sampling strategies to meet the needs of agencies as well as landowners and citizen groups. Secondly, we will work at the level of the smaller watersheds

level (Rose and Greenbrier Creeks). These two areas total over 40,000 acres and provide an excellent opportunity for synergy because of additional testing already underway. Thirdly, we will work at the level of 2 miniature watersheds located primarily on the J. Phil Campbell, Sr., Natural Resource Conservation Center. These two areas total approximately 700 acres. The intensity (proximity and frequency) of sampling will increase at each reduction in scale and provide increased detail on the sources of pollution and efficacy of practices for controlling it. Land use patterns will be associated with water quality and used to identify important non-point source pollution problems. The results of sampling work both at the Conservation Center and out in other parts of the Upper Oconee Watershed will be used to design sampling methods and evaluate practices based upon both economics and scientific validity (Abtew et al., 1997).

EQIP Priority Areas: The extensive and frequent sampling conducted on the Mulberry River and Hard Labor/Sugar Creek will provide the first level at which to test sampling protocols. It is anticipated that grab sampling every 2 weeks at sites covering such an extensive portion of the watershed would not normally be required to demonstrate the efficacy of expenditures for conservation practices funded by the EQIP program. Based on this data, we will evaluate less frequent and less extensive sampling for the characterization of the water quality in the specified area. The use of GIS will provide additional information for designing rational alternative and economically feasible sampling in these areas.

Rose and Greenbrier Creeks: The density of information on water quality and land use in these two smaller watersheds will be greater because of the proposed greater sampling density and also because of the information that will available from the other Southern Regional SARE project in these two watersheds. Sampling frequency and water quality analysis will be similar to that proposed for the EQIP Priority Areas except for the additional samples for microbial

analysis. The additional samples will be collected from producers participating in the other Southern Regional SARE proposal who volunteer for the additional testing.

J. Phil Campbell, Sr., Natural Resource Conservation Center: Two small watersheds are proposed for detailed study on the JPCS Natural Resource Conservation Center. The first area is comprised of approximately 600 acres with 390acres in urban use and 210 acres in agricultural use. All but 40 of the agricultural acres are located on the Conservation Center and additional in-stream sampling will be utilized to isolate contributions to water pollution from urban and agricultural inputs on and off the Conservation Center. The second area is comprised of approximately 130 agricultural acres. All animals in this watershed are managed by the Conservation Center.

Research areas located on land managed by the Conservation Center for wintering cow-calf herds will provide rigorous tests of the efficacy of agricultural practices funded within EQIP Priority Areas for reducing nutrient runoff and water pollution. The efficacy of EQIP incentive practices such as filter strips, grassed waterways, streambank and shoreline protection, various alternative animal watering systems, and riparian forest buffers will be tested for reducing pollutant loads. Both these small watersheds have ponds and riparian areas that have been impacted by cattle managed by the Conservation Center.

Cattle will be removed from portions of degraded riparian zones and be allowed limited access to riparian zones at replicated sites on the Conservation Center with water quality samples collected at sites above and below riparian treatment sites. Estimates of plant species diversity as the zones are rehabilitated will be made monthly using transects. Degraded sites will be compared with adjacent control sites that have not been exposed to cattle. The exclusion of cattle from riparian zones will be integrated with research into alternative management strategies

for cattle production including placement of watering sources further up the landscape with and without excluding animals from the riparian zone. Replicated buffer strips will be planted on waterways and water samples collected during run-off events. These data will be evaluated in concert with records of animal movements.

Automatic sampling equipment will be installed on both small watersheds located on the Conservation Center. This approach will require the development of a GIS database at sufficient resolution to determine individual field contributions of pollutants to streams. Appropriate data layers will include topography, soils, hydrography, wetlands, land cover, field locations, and animal farm operations. This database can then be used to refine sample site location and for subsequent spatial analysis. Data loggers will automatically sample for tests of ammonium, nitrate, phosphorus, dissolved oxygen, temperature, and pH. Samples for analysis of turbidity and fecal coliform bacteria will be collected weekly and with significant runoff events. Combinations of chronologically based and event based sampling will be tested.

E. Education and Outreach:

To accomplish Objective 3, participatory evaluation will be a critical part of the process (Aaker and Shumaker, 1994; Narayan, 1993) allowing for diverse stakeholders to identify early in the program "how they will know" that the program is succeeding. Two way dialogs will be established through traditional channels such as regular meetings and field days but it will also be established through email lists and the use of World Wide Web pages. At each stage of communicating results to the stakeholders, we will provide opportunities for input. Stake holders will comment on what they perceive to be working well, what is working less well, and what actions need to be taken to make the program better. This allows for a greater ownership of the program by all the parties/stakeholders involved. Finally, the evaluation component will

include process documentation. We will document the process of the program including lessons learned and recommendations for improvement through out the program and use semi-annual evaluations of our progress on our timeline (Bennett, 1996). This process will be open and stakeholders will have access summarized results. Through this approach, we feel that we will be able to demonstrate our accountability, provide for constant self-assessment, document the process and, therefore, make it repeatable.

Some of the research areas on the Conservation Center are located near roads and signs will be installed to indicated progress by briefly summarizing the work. This would be done to provide outreach to interested groups and private citizens not reached by the traditional and nontraditional outreach methods mentioned earlier.

Through the Sustainable Agriculture Training Coordinator of the Georgia Cooperative Extension Service, statewide training projects will be developed. This component will also provide skills in on-farm training, FARM*A*SYST, and the agricultural pollution prevention database. This active and effective program provides a natural outlet for the results from this proposal.

The participation of the Sustainable Agriculture and Natural Resource Management (SANREM) Collaborative Research and Support Program (CRSP) provides strong linkages to rural sociology, anthropology, and community. The SANREM-CRSP will provide expertise in outreach activities and educational materials. This broad-based partnership will be used to build bridges through Local Work Groups to producers to communicate priority conservation practices and land use hazards in watersheds. The linkage with on-going international watershed research sites will provide a unique mechanism for information exchange that benefits both domestic and developing country policy and local groups dealing with similar issues.

VI. Appendix A – (Literature Cited)

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VI. Appendix B – (Timetable)

Activity	Year 1 by Qtr.				Year 2 by Qtr.				Year 3 by Qtr.			
	1	2	3	4	1	2	3	4	1	2	3	4
Objective 1												
Site Selection – EQIP sites	**X**											
Water Quality Sampling	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
GIS Analysis of Watersheds		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**			
Data Analysis and Summary				**X**				**X**				**X**
Objective 2												
Site Selection on Rose Creek and Greenbrier Creek	**X**											
Data Collection on Rose Creek and Greenbrier Creek	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Site Selection on J.P. Campbell Sr., Natural Res. Cons. Cntr.	**X**											
Install Samplers at Cons. Cntr.		**X**										
Install Best Management Practices at Cons. Cntr.		**X**	**X**			**X**	**X**			**X**	**X**	
Data Collection at Cons. Cntr.		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Data Analysis and Summary				**X**				**X**				**X**
Objective 3												
Stakeholder Input Session	**X**			**X**				**X**				**X**
WWW Pages (Estab., Update)		**X**		**X**		**X**		**X**		**X**		**X**
Email List (Estab., Transmit)		**X**		**X**		**X**		**X**		**X**		**X**
Presentation of Results (Formal)								**X**				**X**

VI. Appendix C – (Project Investigators and Participants)

Coordinator

Dwight Fisher - Dr. Fisher is a Rangeland Scientist at the J. Phil Campbell Senior Natural Resource Conservation Center, in Watkinsville GA with experience in grazing systems and mathematical modeling. Dr. Fisher is responsible for whole farm planning at the USDA-ARS Research Center at Watkinsville. The ARS research program at Watkinsville takes an interdisciplinary approach to problem solving and we are addressing issues of informed decision making at the whole farm level and interface of agricultural practices with other activities in watersheds using simulation, GIS, and information management technologies to achieve these goals. Dr. Fisher will coordinate research site maintenance and incorporation of conservation practices within the context of the entire grazing system. He will contribute to educational programs in plant and animal interactions and animal impacts on water quality.

Co-Coordinators

Constance Neely - Dr. Neely is the Assistant Program Director of the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP). Her training is in agroecosystems and she has experience both domestically (USDA-NRCS) and internationally (USAID) in the development and implementation of natural resource management strategies. She has experience in working with interdisciplinary and inter-sectoral (government, university, non-government, and community) teams. She leads the participatory monitoring and evaluation efforts for the SANREM CRSP. Dr. Neely will co-coordinate the project with Drs. Fisher and Steiner.

Jean Steiner - Dr. Steiner is Research Leader and Director at the J. Phil Campbell Senior Natural Resource Conservation Center and has experience studying soil and plant

microenvironments. Dr. Steiner will contribute to team building, research planning and research sampling strategies, new monitoring methods, and comparisons of efficiencies of alternative methods. Dr. Steiner will co-coordinate the project with Drs. Fisher and Neely.

Co-Investigators (listed alphabetically)

Anthony Dillard – Mr. Dillard is an Agricultural Engineer with skills in GIS/GPS and field level mapping. He is located at the J. Phil Campbell Senior Natural Resource Conservation Center. Mr. Dillard will be instrumental in the detailed mapping conducted on the Conservation Center and will provide his skills in the Greenbrier and Rose Creek Watersheds.

Dinku Endale - Dr. Endale is an Agricultural Engineer with skills in hydrology at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Endale will provide expertise in hydrologic flows relevant to the watersheds under study.

Dory Franklin – Ms. Franklin is a Graduate Research Assistant at the University of Georgia and a collaborator on a SARE project in progress on Greenbrier and Rose Creeks in the Upper Oconee Watershed. Ms. Franklin is a Geographer and will assist in coordination of data collection within these watersheds to maximize the synergy between the two projects.

A.J. Franzluebbers - Dr. Franzluebbers is a Soil Ecologist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Franzluebbers will provide expertise on soils aspects of the land use patterns in the experimental watersheds.

J.E. Houston - Dr. Houston is an economist in the Department of Agricultural and Applied Economics of the University of Georgia. He has experience with the determination of the acceptability and trade-offs of cost-sharing BMPs and has a comprehensive background in production, marketing, and natural resources economics. Dr. Houston will assist in evaluation and documentation of the impact of EQIP expenditures on conservation practices.

L.M. Risse - Dr. Risse is an Agricultural Engineer in charge of preventing agricultural pollution with the University of Georgia. Dr. Risse will provide assistance in outreach and in relating the database to farming operations such as land applications of waste.

H.H. Schomberg - Dr. Schomberg is a Crop Ecologist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Schomberg will provide expertise in the integration of field crops with animal agriculture and in the impact of field crops on water quality.

J.A. Stuedemann - Dr. Stuedemann is an Animal Scientist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Stuedemann will provide expertise in characterizing animal management and production practices as related to the methodologies evaluated to assess the impact of various conservation practices.

Lynn Usery - Dr. Usery is a member of the Geography Department at the University of Georgia. Dr. Usery has extensive experience developing GIS databases and in the utilization of GIS for description and modelling of watersheds, sources of pollutants, water quality, and spatial analysis. Dr. Usery would bring these skills and research results from other portions of the state, to the research team and assist in development of the geographic description of the watersheds.

Producers and Natural Resource Organizations

Tom Bell - Mr. Bell is President of the Oconee River Resource Conservation and Development Area, Inc. The Oconee River RC&D Council will be instrumental in the identification of priority areas and producer cooperators in the watersheds of interest.

Earl Brantley - Mr. Brantley is the USDA-NRCS Area Conservationist in our study area. Mr. Brantley will provide essential links to the Local Work Groups in priority setting and helping characterize the resource base by providing access to NRCS databases.

T. David Cheek - Mr. Cheek is the Lake Resources Manager, Georgia Power and will bring the industry perspective to the planning process. Georgia Power's operations on Lake Oconee give them a vested interest in the water quality produced by the Upper Oconee Basin.

Earl Cosby - Mr. Cosby is the State Conservationist with USDA-NRCS and provides a vital link to the Natural Resources Conservation Service activities in Georgia. Interaction with the NRCS will help establish priorities in the location and installation of conservation practices.

Frank. Henning - Mr. Henning is the Special Extension Agent with responsibilities for water quality in the Little River/Rooty Creek watershed located in parts of Morgan, Putnam, Jasper, Walton, and Newton Counties. Mr. Henning will be involved in the planning and outreach activities of the project.

David Jackson - Mr. Jackson is Chairman of the Oconee River Soil and Water Conservation District. The conservation district supervisors will provide local input on priorities from local work groups in Barrow, Clarke, Jackson, and Oconee Counties.

Graham Liles - Mr. Liles is Executive Director of the Georgia Soil and Water Conservation Commission and has a great interest in the efficacy of best management practices. Mr. Liles will also be involved in identification of priority areas and producer cooperators.

D. Perkins - Mr. Perkins is the Owner and Operator of the Dove Creek Farm in Winder, GA. Mr. Perkins will serve to represent the point of view and needs of the cattlemen located in the watershed. Mr. Perkins is outgoing President of Clarke-Oconee Cattlemen's Association and was runner-up for the Southern Region, National Association of Conservation Districts, Educator of the Year Award.