Mississippi Water Resources Research Institute Annual Technical Report FY 2005

Introduction

The FY 2005 Annual Technical Report for the Mississippi Water Resources Research Institute summarizes USGS supported research, education and information/technology transfer activities. Descriptions of two (2) research projects and three (3) information/technology transfer activities that ended on or before February 28, 2006 are included in this summary.

Research Program

Improved Estimation of Nutrient and Pesticide Runoff Losses from Golf Courses and Residential Lawns in the South Atlantic-Gulf Region

Basic Information

Title:	Improved Estimation of Nutrient and Pesticide Runoff Losses from Golf Courses and Residential Lawns in the South Atlantic-Gulf Region
Project Number:	2003MS16B
Start Date:	3/1/2005
End Date:	2/29/2006
Funding Source:	104B
Congressional District:	Third
Research Category:	Not Applicable
Focus Category:	Non Point Pollution, Water Quality, Surface Water
Descriptors:	None
Principal Investigators:	Joseph H. Massey

Publication

1. Massey, Joseph, B. Stewart, C. Smith, P.Ampim, A. Johnson and K. Armbrust, 2006, Improved Estimation of Nutrient and Pesticide Runoff Losses from Golf Courses and Residential Lawns in the South Atlantic-Gulf Region, Mississippi Water Resources Research Institute, Mississippi State University, Mississippi State, MS, 17 pages.

MS WRRI Competitive Grants

Interim Final Report

Project title:

Improved Estimation of Nutrient and Pesticide Runoff Losses from Golf Courses and Residential Lawns in the South Atlantic-Gulf Region

Principal investigator:

Joseph H. Massey, Department of Plant & Soil Sciences, Mississippi State University

Co-Investigators: Barry R. Stewart[1], M. Cade Smith[1], Peter A. Ampim[1], Alton B. Johnson[2], Kevin L. Armbrust[3]

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Project Objectives:

1) Develop a standardized protocol to measure turf chemical runoff in different regions of the United States.

2) Determine the "scalability" of turf runoff events from three runoff plot sizes.

3) Determine if species and mowing height impact pesticide runoff for two warm-season grasses.

Project update:

Objective One: Protocol Development

As reported previously, a field protocol was developed in 2003 and is being used in the conduct of runoff studies in MD, MN, MS and OK. The protocol features the use of three simultaneously-applied pesticides (2,4-D herbicide, flutolanil fungicide, chlorpyrifos insecticide) and rainfall simulation performed under standardized study conditions.

Objective Two: Scalability Effects on Pesticide Runoff

Studies were conducted in 2005 on two of the three plot sizes necessary for completion of objective two. Replicated runoff experiments involving six small (12 x 30-ft) and four medium (20 x 80-ft) plots were performed. The large plot (40 x 125-ft) experiments will be completed in 2006. Figures 1 through 3 show experiments involving the medium-sized plots conducted in 2005. Preliminary statistical comparisons between runoff parameters (e.g., initial slope of chemographs, maximum observed concentration, average observed concentration, percent of applied observed in runoff) of the small and medium plot data are underway.

Objective Three: Effect of Two Grass Species & Two Mowing Heights on Pesticide Runoff

Studies were conducted in 2005 on twelve 12- x 30-ft runoff plots. The plots consisted of six *Mississippi Pride* bermudagrass plots maintained at a height of 0.625-in. or 1.5-in. (three plots each height) or six *Meyers* zoysiagrass plots maintained at heights of 0.625-in or 1.5-in (three plots each height). The Mississippi Pride plots were established by sprigging in August 2003 while the Meyers zoysiagrass plots were established using commercial sod in July 2004. Thus, the runoff plots were at least 13 months (zoysia) to 24 (bermuda) months old at the time of study conduct. The treatments were arranged using a split-plot design with mowing height as the main-plot factor and grass species as the sub-plot factor. Figures 4 though 6 depict some of the small-plot experiments conducted in 2005.

As anticipated, 2,4-D, flutolanil, and chlorpyrifos behaved differently when applied to the two warm-season grasses investigated in this study. 2,4-D was the most prone to runoff of the compounds with an average of 31.9 ± 14.0% of the applied herbicide measured in runoff after 1.5-in/hr simulated rainfall was applied for 1.5 hrs. Chlorpyrifos was the least mobile and averaged 0.1 ± 0.1% of applied while runoff of futolanil fungicide averaged 6.1 ± 1.9% of applied. These values are based on a total of 12 observations for each compound averaged across both grass species and mowing heights. Representative chemo-graphs for the three pesticides are given in Figure 7.

In terms of grass-species and mowing-height effects on pesticide runoff, the total percent of applied 2,4-D herbicide measured in runoff was not impacted by grass species ($p = 0.5075$) or mowing height ($p = 0.2468$) (Table 1). The rising (initial phase) slopes of the 2,4-D chemographs were also unaffected by grass species ($p = 0.8145$) and mowing height ($p = 0.4364$). Thus, the runoff of 2,4-D did not seem to be affected by physical or chemical differences that may exist between the two warm-season grasses investigated in this study.

The total percent of applied flutolanil fungicide measured in runoff was impacted by grass species ($p = 0.0187$) but not mowing height ($p = 0.2446$). On average, 7.2 ± 0.6% of applied flutolanil was lost from the Mississippi Pride bermudagrass plots as compared to 5.0 ± 0.6% loss from the Meyers zoysiagrass plots. The rising (initial phase) slopes of flutolanil's chemographs were also slightly affected by species ($p = 0.0938$) but not height ($p = 0.2015$). These p-values are given in Table 1.

The total percent of applied chlorpyrifos insecticide measured in runoff was affected ($p = 0.0178$) by an interaction that existed between grass species and mowing height (Table 1). Runoff percentages of chlorpyrifos from Mississippi Pride bermudagrass and Meyers zoysiagrass were not different when maintained at the 1.5 in mowing height (average loss = 0.08 ± 0.01% of applied) but diverged when the grasses were maintained at the 0.625-in mowing height (0.1 ± 0.02% vs. 0.2 ± 0.02% runoff for Meyers zoysiagrass and Mississippi Pride bermudagrass, respectively.) Similarly, the rising (initial phase) slopes of chlorpyifos's chemographs were slightly affected by a species x height interaction ($p = 0.0887$).

In terms of water movement across the different grass species- and mowing height-treatments, total runoff volumes (L) estimated for the 12 x 30-ft plots were unaffected by species (p = 0.7426) and height (p = 0.3020). The average total volume of water collected from the plots was estimated to be 1276.9 ± 330.5 L. The theoretical amount of simulated rainfall applied to the plots was 1912 L, suggesting that approximately 67% of the applied rainfall became runoff. Similar to total runoff volumes, rising (initial phase) slopes of the hydrographs were unaffected by species (p = 0.8268) and height (p = 0.6097). This was also true for the effect of grass species (p = 0.7858) and mowing height (p = 0.2309) on steady-state runoff (L/hr). The average rising (initial phase) slope of the hydrographs was 1226.5 ± 590.5 L/hr and the steady-state slope was 19.6 ± 4.2 L/hr when averaged across for both grass species and mowing heights.

Taken together, preliminary analyses suggest that differences in pesticide runoff from the two warm-season turfgrasses investigated result primarily from pesticide- and grass-related factors that affect pesticide sorption/retention rather than differences in water movement (i.e., hydrology) that might exist between the two grass species. These preliminary analyses suggest that future runoff estimations for pesticides having moderate to high sorption to these grasses, such as flutolanil and chlorpyrifos, may need to account for differences in retention that exist between Mississippi Pride bermudagrass and Meyers zoysiagrass. Weakly-bound compounds such as 2,4-D appear to be less affected by pesticide retention properties of the two warm-season grasses.

Adsorption-Desorption Coefficients for 2,4-D, flutolanil, and chlorpyrifos

The soil-water partition coefficients (Kd values) and Koc values measured for the three pesticides on a Brooksville silty clay closely correlated with the actual runoff levels observed in the field experiments (Table 3). Linearized sorption and desorption isotherms, shown in Figures 8 through 10, indicate that 2,4-D was weakly bound and remained in solution, resulting in higher desorption Kd values. Results for flutolanil suggested that the fungicide was strongly adsorbed to soil while chlorpyrifos insecticide was tightly bound to soil. These results suggested that 2,4-D has high runoff potential while that of flutolanil fungicide and chlorpyrifos insecticide are diminished due to strong binding.

Current Efforts

Statistical analyses continue for objectives two and three. Work to complete installation of collection troughs, diverters, and flumes for the four large (40- x 125-ft) plots will continue through Spring 2006, weather permitting. The runoff experiments to complete objective two will resume in summer and will be completed by winter 2006. A detailed description of field and laboratory materials and methods will be provided in the final project report submitted in 2006.

Procurement of Matching Funds

As of May 2006, approximately $192,500 was secured to supplement funding received from the USGS for the conduct of these studies. Funding sources and amounts are given in Table 4.

Table 1. p-values from preliminary statistical analyses of grass species and mowing height effects on pesticide runoff losses from two warm-season turfgrasses.[1]

Compound	**Runoff Parameter Tested**	**Mowing Ht x Species Interaction**	**Grass Species**	**Mowing Height**
2,4-D herbicide	Total Percent of Applied in Runoff	0.4140	0.5075	0.2468
	Total mass Lost	0.8244	0.6242	0.0824
	Rising slope of chemograph	0.9655	0.8145	0.4364
Flutolanil fungicide	Total Percent of Applied in Runoff	0.6295	**0.0187**	0.2446
	Total mass Lost	0.4348	**0.0197**	0.2015
	Rising slope of chemograph	0.3794	**0.0938**	0.2082
Chlorpyrifos insecticide	Total Percent of Applied in Runoff	**0.0178**	0.0114	0.0310
	Total mass Lost	**0.0451**	0.0169	0.0248
	Rising slope of chemograph	**0.0887**	0.1150	0.1909

[1]Results based on three replications per treatment. Factors significant at $p < 0.1$ are in bold.

Table 2. p-values from preliminary statistical analyses of grass species and mowing height effects on hydrological parameters for two warm-season turfgrasses.[1]

Runoff Parameter Tested	**Mowing Ht x Species Interaction**	**Grass Species**	**Mowing Height**
Rising slope of hydrograph (L/hr)	0.5797	0.8268	0.6097
Steady-state runoff of hydrograph (L/hr)	0.3696	0.7858	0.2309
Total runoff Volume (L)	0.5359	0.7426	0.3020

[1]Results based on three replications per treatment.

Table 3. Soil-water distribution (Kd) values and Koc values for three pesticides on the Brooksville silty clay soil.

Pesticide	Kd sorption (ml/g)	Kd desorption (ml/g)	Koc sorption (ml/g)	Koc desorption (ml/g)	Extent of Soil Adsorption	Turf Runoff Potential
2,4-D	1.5	3.6	72.83	177.9	Weakly bound	High
Flutolanil	11.5	13.5	576.1	673.6	Strongly bound	Low
Chlorpyrifos	71.0	52.7	3550.8	2635.4	Tightly bound	Very low

Table 4. Supplemental funding received for study conduct as of May 2006.

Source	Amount	Use
MAFES-Mississippi State University[1]	$95,000[2]	Laser-leveling of site, sprigging, irrigation system, graduate student support, triplex mower, enlargement of equipment shed
U.S. Golf Association	$97,500	Comparison of fairway vs. home lawn runoff
Total	**$192,500**	

[1]Mississippi Agriculture & Forestry Experiment Station (MAFES).
[2]Figure does not included salaries of PI (Massey) or Co-PIs (Stewart, Smith, Armbrust)

Figure 1. Evening application of KBr tracer to 20 x 80-ft plot in October 2005.

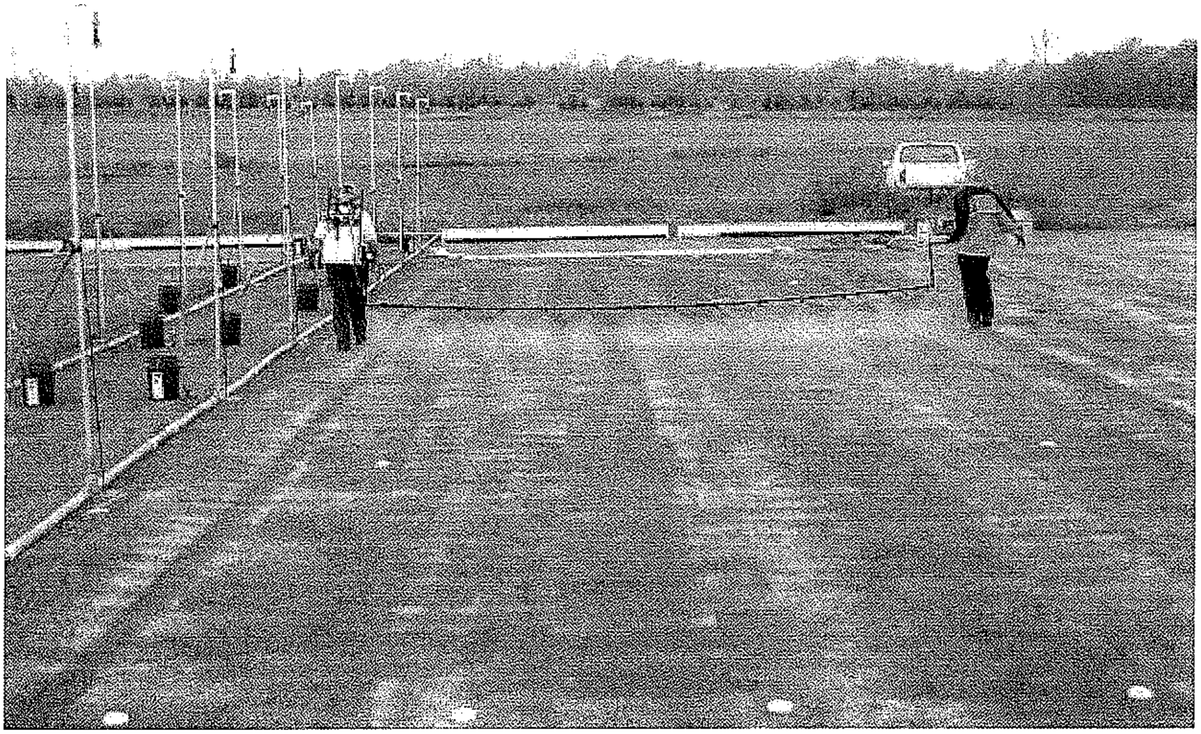


Figure 2. Early morning rainfall simulation event for 20 x 80-ft plots in October 2005.

Figure 3. Collection of runoff from 20 x 80-ft plot in October 2005.

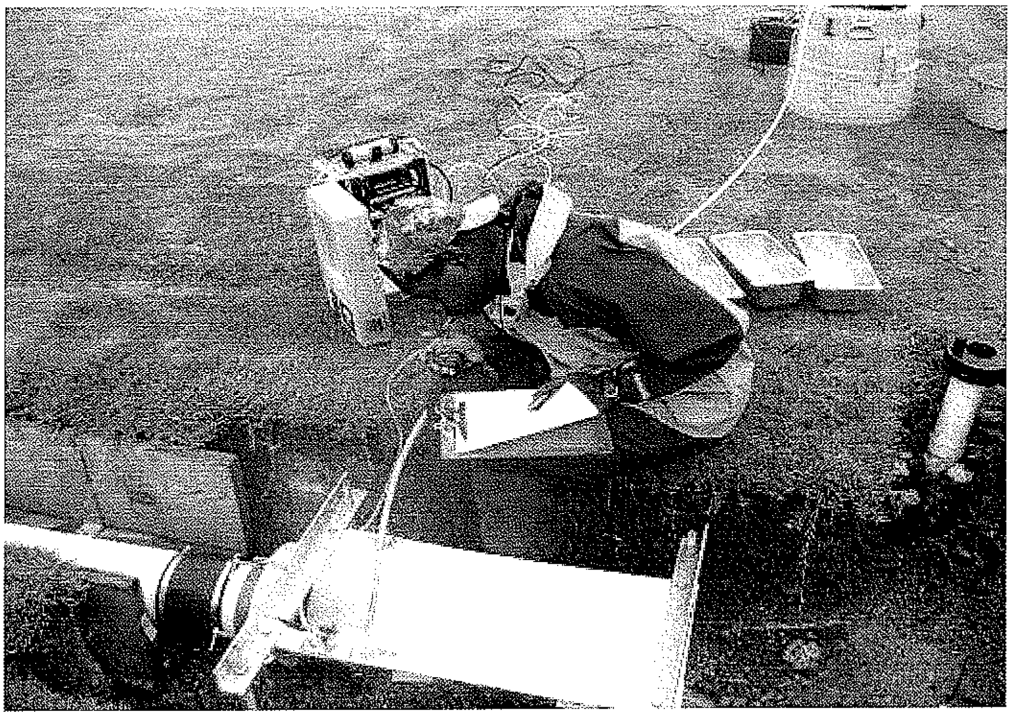


Figure 4. Pesticide application to 12 x 30-ft plot in August 2005.

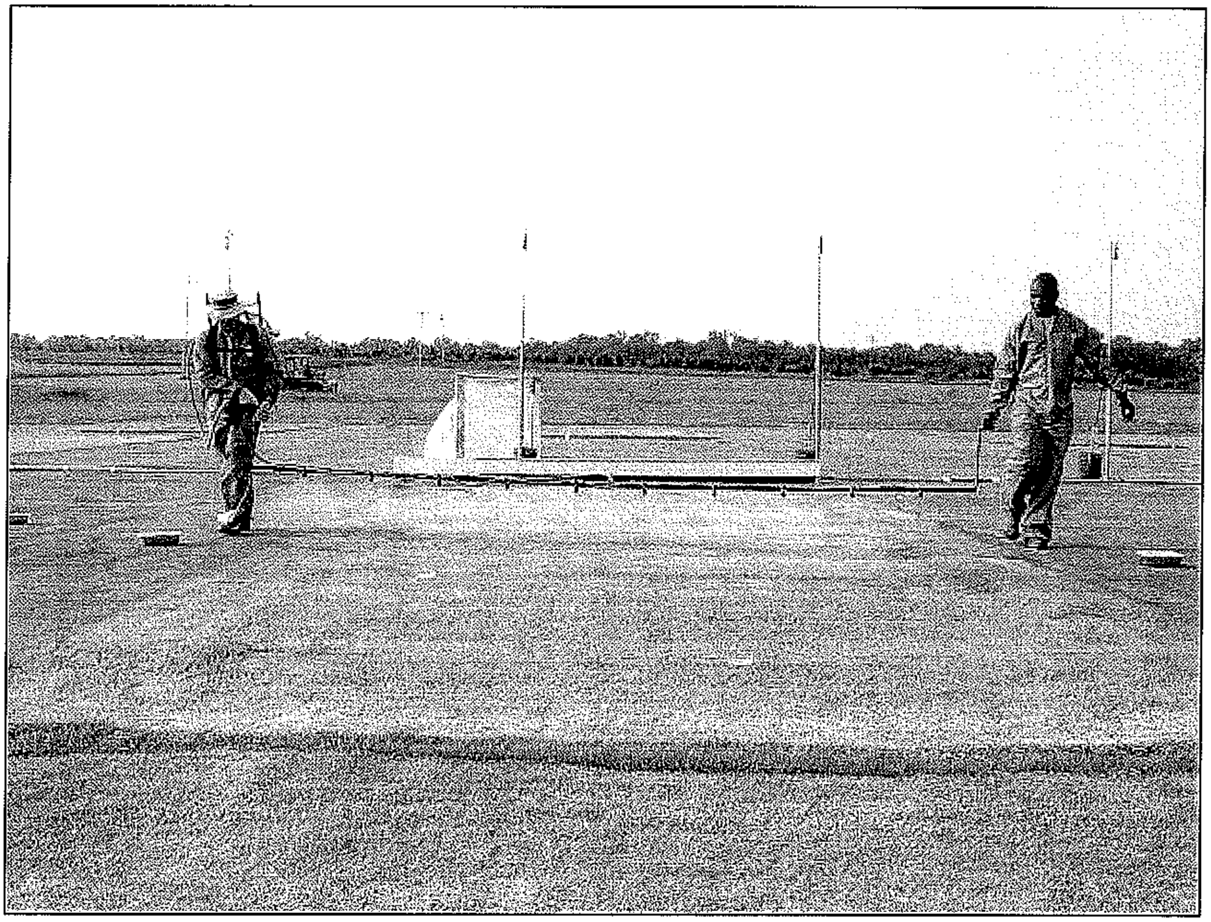


Figure 5. Rainfall simulation event for 12 x 30-ft plots in August 2005. Six rainfall gauges (metal pans) per plot and one plastic tarp (foreground) per block used to confirm actual simulated rainfall application rate.

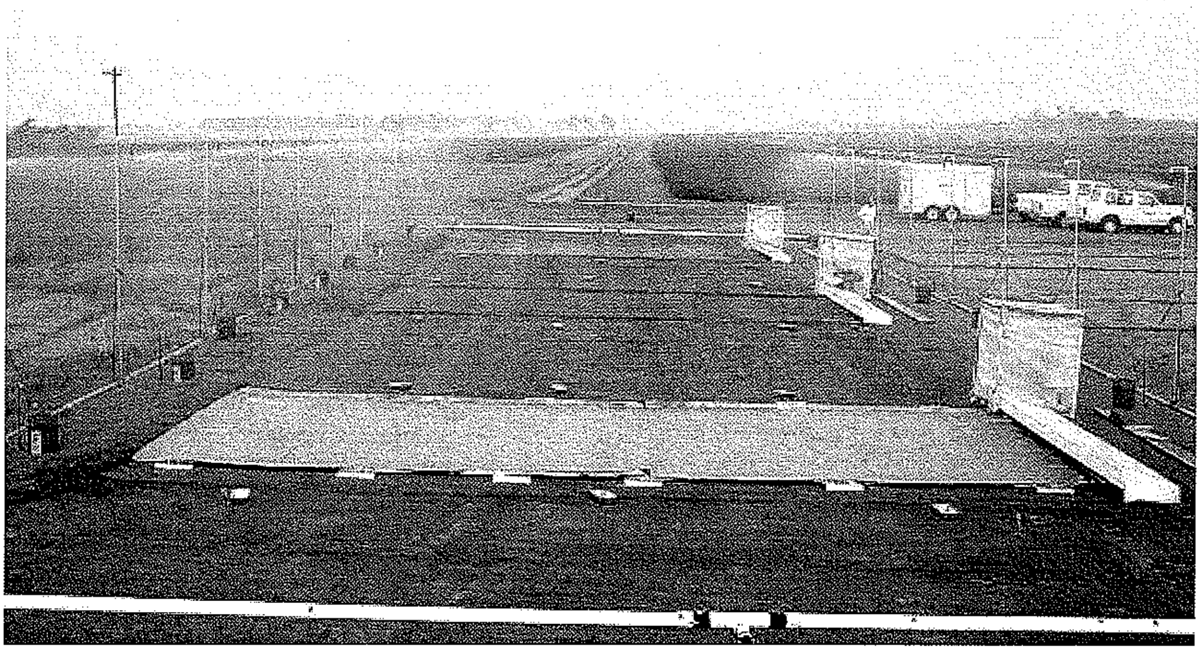


Figure 6. Close-up of runoff collection apparatus used for 12 x 30-ft plots (August 2005).

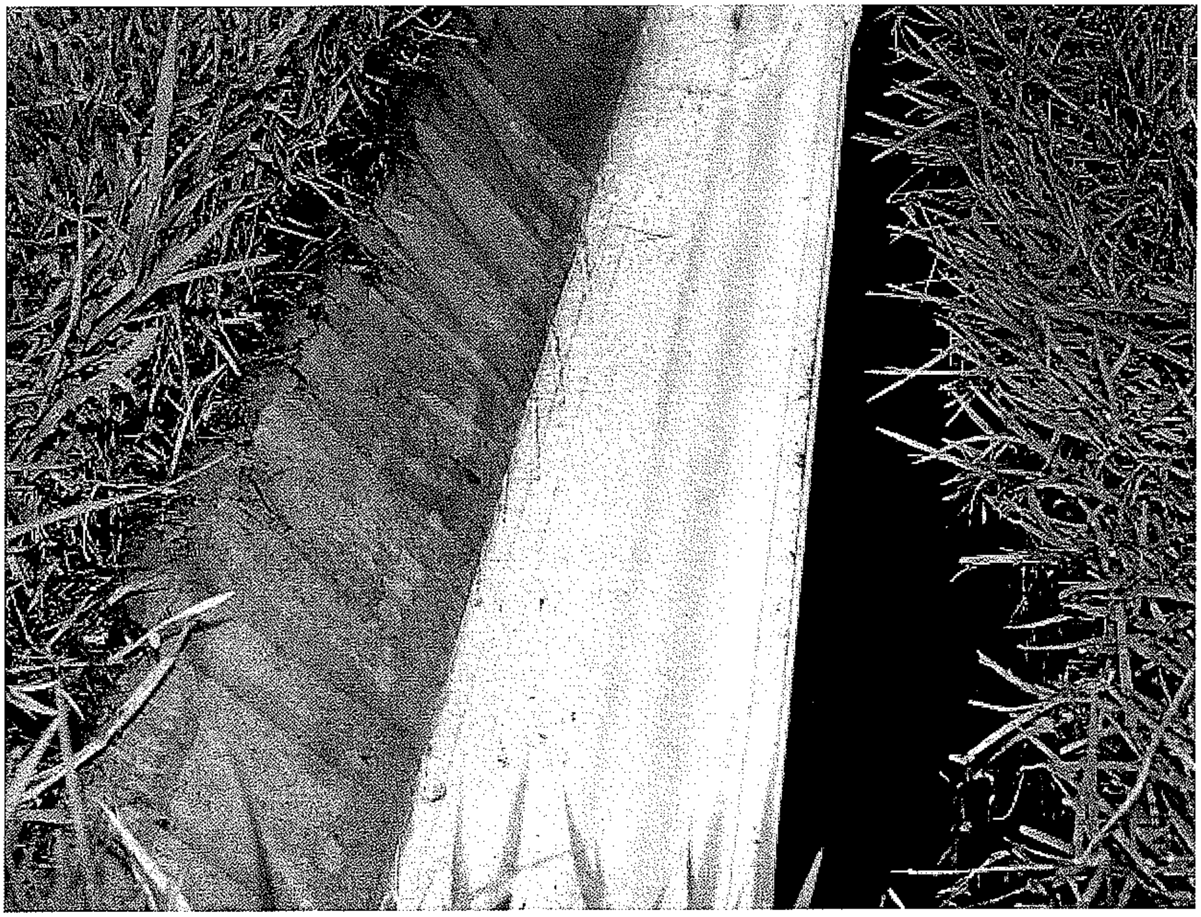


Figure 7. Example chemo-graphs for the runoff of three pesticides applied to 12 x 30-ft warm-season turf plots.

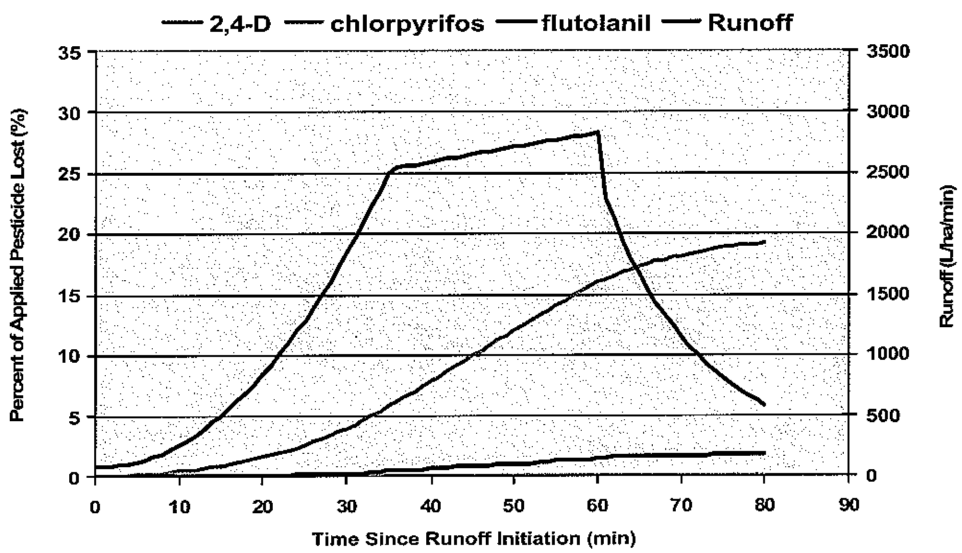


Figure 8. Adsorption-desorption isotherm for ^{14}C-2,4-D herbicide on Brooksville silty clay.

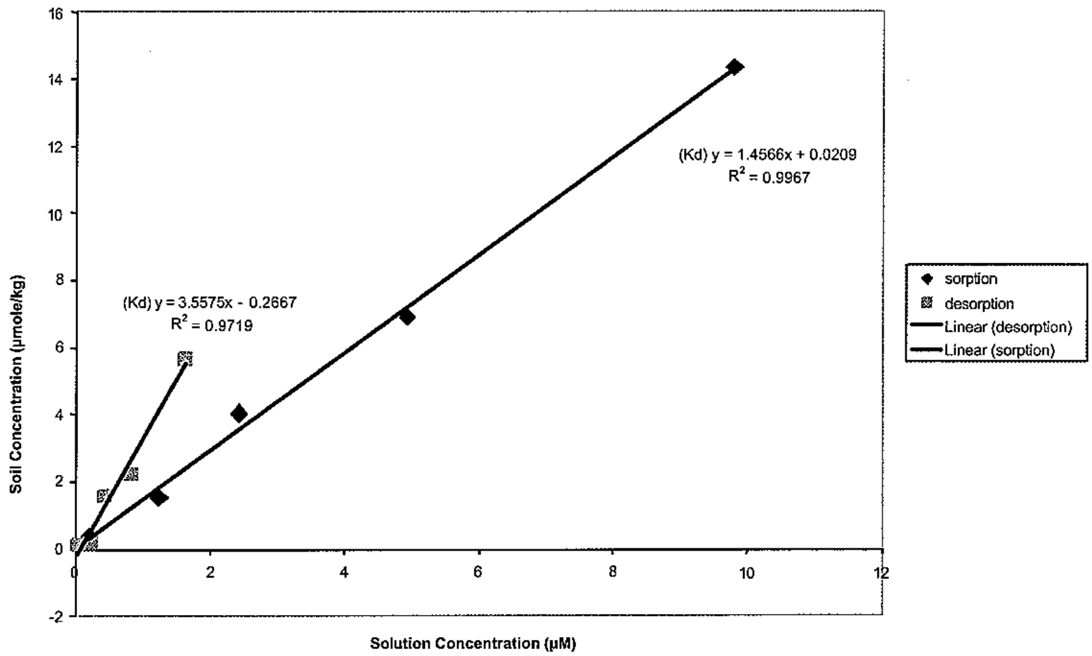


Figure 9. Adsorption-desorption isotherm for ^{14}C-chlorpyrifos insecticide on Brooksville silty clay.

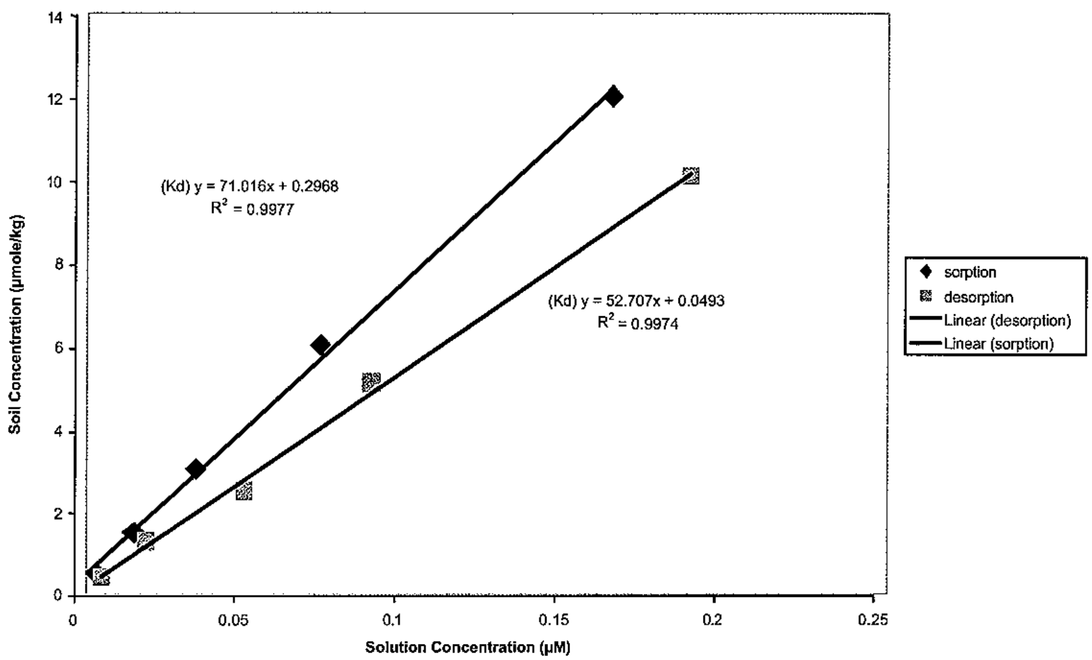
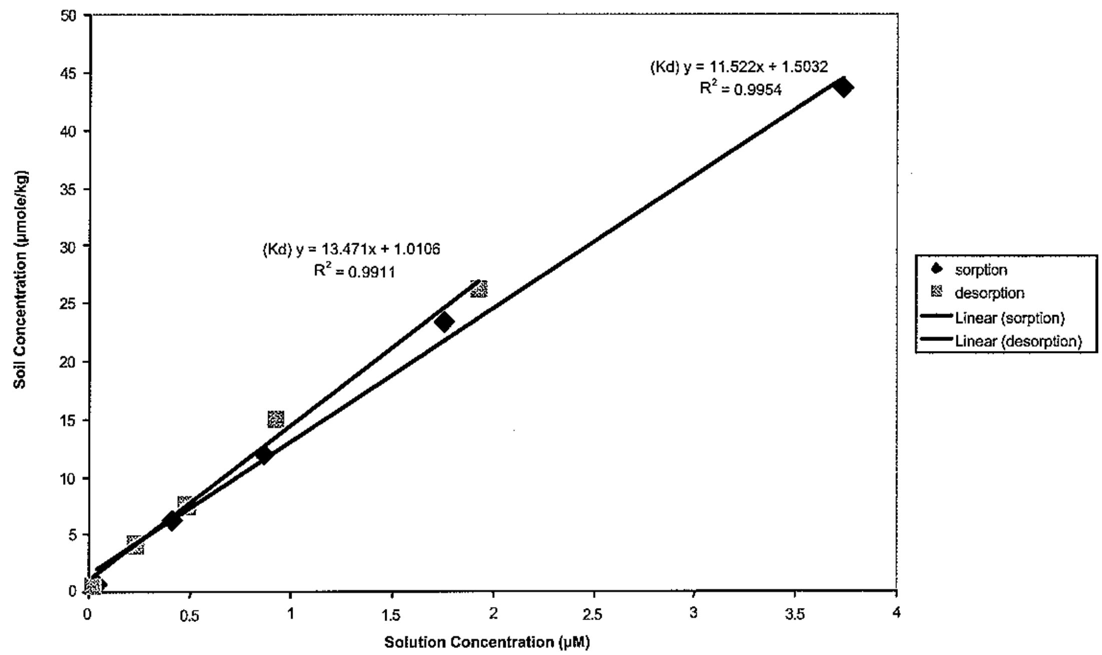


Figure 10. Adsorption-Desorption Isotherm for ^{14}C-Flutolanil on Brooksville silty clay soil.



Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters

Basic Information

Title:	Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters
Project Number:	2004MS24B
Start Date:	3/1/2005
End Date:	2/28/2006
Funding Source:	104B
Congressional District:	Fourth
Research Category:	Water Quality
Focus Category:	Water Quality, Nutrients, Sediments
Descriptors:	
Principal Investigators:	Harriet MacGill Perry

Publication

1. Harriet, Perry and Barbara Viskup, 2006, Final Report, Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters, Mississippi Water Resources Research Institute, Mississippi State University, Mississippi State, MS, 26 pages.

Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters

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Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters

Introduction

Nutrient overenrichment of estuaries and nearshore coastal waters from human-based causes is now recognized as a national problem on the basis of the Clean Water Act 305b reports from coastal States that list waters whose use or uses are impaired. The National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Eutrophication Assessment indicated that about 60% of the estuaries out of 138 surveyed exhibited moderate to serious overenrichment conditions. The Environmental Protection Agency (EPA) has published recommendations of water quality criteria for nutrients under section 304(a) of the Clean Water Act (66 FR 1671). States should develop water quality standards for nutrients by 2006. The EPA has proposed criteria with the intention that they serve as starting points for states to develop more refined nutrient criteria, as appropriate. States, then, have the option to develop nutrient criteria that fully reflect localized conditions and protect specific designated uses with scientifically defensible approaches as supported by EPA technical guidance manuals. To that end, the Mississippi Department of Environmental Quality (MDEQ) has incorporated an aggressive monitoring and data gathering initiative into existing programs in order to provide nutrient data to support nutrient criteria development. While much has been accomplished through leveraging resources and funding from existing monitoring programs, there are still many data gaps remaining. Mississippi's estuaries are perhaps the most vulnerable and valuable of the state's waters and it is crucial that we address water quality issues in a timely and thorough manner. Mississippi's coastal ecosystems form a cornerstone of the state's economy by providing a variety of valuable resources and services. Gulf of Mexico fisheries yield more finfish, shrimp, and shellfish than the South and Mid-Atlantic, Chesapeake Bay, and Great Lakes combined. Water quality and wetlands health are vital to the maintenance of fisheries production and to the other water-dependent activities that operate within the coastal zone.

Nutrient overenrichment is a common thread that ties together a diverse suite of coastal problems including harmful algal blooms (red tides), fish kills, marine mammal deaths, shellfish poisonings, loss of seagrass and bottom shellfish habitats, and hypoxia/anoxia. The "dead zone," an area in the west-central Gulf characterized by seasonal anoxic bottom conditions, grows in size each year and is related to nutrient run-off from the Mississippi River. Thorough assessment of coastal waters and the development of clear numerical criteria will allow discernment of natural nutrient concentrations from heightened anthropogenic concentrations and are critical to the evaluation and management of Mississippi's estuaries. This project provided data on diel and tidal variations in nutrient concentrations and other important water quality parameters. Dissolved oxygen (DO) was monitored because adequate levels are a fundamental requirement for maintenance of populations of benthos, fish, shellfish, and other estuarine biota. Levels of dissolved oxygen are affected by environmental stresses, such as point and nonpoint discharges of nutrients or oxygen-demanding materials. In addition, stresses that occur in conjunction with low DO concentrations may be even more detrimental to biota (e.g., exposure to hydrogen sulfide, decreased resistance to disease and contaminants). Dissolved oxygen levels are highly variable over time, fluctuating widely due to tidal action, wind stress, and biological activity. One of the objectives of this study was to collect data to best represent the DO conditions in the estuaries of the Mississippi Coast. In a pilot study to evaluate the best sampling strategy for DO in Gulf estuaries, continuous meters that measured DO, percent DO saturation, salinity, temperature, water depth, and pH were deployed at eight locations over a 4-month period. Monte Carlo analysis of the eight 4-month records showed that tidal influences during summer months were small and that day-night differences accounted for most of the observed variability with wind stress accounting for most event-oriented phenomena. These analyses revealed that 1, 2, or 3 random instantaneous measures of DO were likely to mis-classify a station with unacceptable DO conditions (*i.e.*, DO <2 ppm for > 20% of time period) as acceptable at a rate of 60-

70%. Furthermore, short-term continuous measures of 24, 48, and 72 hours also tended to mis-classify unacceptable sites although not as often as instantaneous DO measures (i.e., 50%). This project provided information on nutrients and associated water column parameters during high-flow/low-flow periods. Monitoring included: total Kjeldahl nitrogen, ammonia nitrogen, nitrite + nitrate, total phosphate, chl *a*, total suspended solids, and field parameters such as dissolved oxygen, water temperature, turbidity, transparency, salinity, pH, and depth. Activities were focused primarily on the water column using protocols established by MDEQ in sampling activities supporting USEPA's National Coastal Assessment (NCA) Program. Samples were analyzed according to an approved QAPP and defined QA/QC procedures. Following field work in Year 1, personnel worked closely with the State's Estuarine Nutrient Taskforce and the MDEQ to evaluate historical data, integrate current data into the database, statistically analyze the data, and propose reference conditions for Mississippi's coastal waters.

Approach

Project tasks included water quality monitoring, laboratory analyses, database development and analyses, and development of reference conditions for coastal waters. Specific objectives included:

1) collect high flow (spring) and low flow (summer) water samples over a 24 hour tidal cycle at nine sites; one shore and two deep water sites in each of the three coastal counties
2) analyze water samples for nitrite-nitrate, ammonia, Kjeldahl nitrogen, total phosphorus, suspended solids, and chlorophyll *a*
3) take hydrographic profiles of the water column at collection sites to include temperature, salinity, dissolved oxygen, and pH (turbidity and Secchi disc readings will also be taken)
4) evaluate historical or legacy data and integrate these data with current data in concert with the Estuarine Nutrient Taskforce and the MDEQ
5) establish numeric nutrient criteria for coastal waters

Field and laboratory work were carried out by personnel of the Gulf Coast Research Laboratory (GCRL) and MDEQ in accordance with approved EPA/MDEQ methodologies and protocols. A Quality Assurance Project Plan (QAPP) for those field and analytical procedures undertaken during the proposed project is in place at the GCRL. Synoptic samples were taken every 6 hours at nine sites over a 24 hour tidal cycle period during the spring (May 2004) and fall (2005). A shore station and two deepwater stations were selected in each of the three coastal counties from a list of sites with impaired water quality prepared by the Mississippi Estuarine Nutrient Taskforce. Analytical procedures were carried out by the Water Quality Laboratory at the GCRL and by the MDEQ laboratory. An overview of field and laboratory procedures follows.

Field Water Quality Data Collection

A global positioning system was used to locate the sampling sites. The Hydrolab DataSonde 4 water quality probe and the YSI multi-parameter 6920 and 600 XLM datasondes were used to measure pH, temperature, salinity, and dissolved oxygen during each sampling event. Detailed standard operating procedures for water column profiling are outlined in the GCRL Quality Assurance Project Plan for Monitoring to Establish Reference Conditions for Nutrients in Estuarine Waterbodies. Site water from target depths was collected with a horizontal 3-liter Van Dorn sampler. Two liters of water (one liter preserved with 5 ml concentrated sulfuric acid and one un-preserved) were iced in the field and returned to the laboratory for nutrient analyses. The remaining liter of water was used for chlorophyll samples and turbidity. Turbidity was determined with a LaMotte 2020 Turbidimeter.

Samples for water quality analysis were placed and maintained on wet ice in the field. Dissolved nutrient samples were maintained at or below 4^{o}C until transported to the GCRL. Samples were refrigerated upon arrival at the laboratory. Field duplicate and field blank samples were collected at 10%

of the sites to measure any variability associated with sample collection procedures. Sites for duplication were randomly chosen.

Samples for chlorophyll *a* (chl *a*) were filtered through Whatman® GF/F glass fiber filters (0.70 ìm nominal pore size) at the same time dissolved nutrients are collected. Sampling for chl *a* was conducted in the shade. Syringes and forceps were rinsed with deionized water. Site water was placed in a container and the syringe rinsed with this water. The syringe was filled with 60 cc of site water and the sample filtered. This step was repeated 3 more times until 4 filters had been used (30 cc is filtered through 8 filters when the suspended solid load is too high). The filters were placed in a petri dish and the total water filtered was equal to 240 cc. The volume filtered and number of filters used were written on both the petri dish and a protective foil storage bag. The petri dish was placed in the storage bag, sealed, and put in a cooler with dry ice making sure the storage bag was touching the dry ice. Samples for chl *a* were maintained at –50°C until analysis at GCRL. Analytical procedures provided performance criteria equivalent to those of the EPA's EMAP Program and the National Coastal Assessment QAPP, including those for analyses of blanks and standard reference materials. Information was reported on recovery of spiked blanks, analytical precision with standard reference materials, duplicate analyses and blanks. A database was developed to manage sample tracking and laboratory results for the duration of the project.

Sample Handling, Custody Requirements, and Holding Times

Upon arrival at the GCRL, field samples were relinquished to the Water Quality Laboratory where they were logged in by laboratory personnel. The time and date received and the water temperature (temperature check bottle) were recorded on a Chain of Custody Sample Receipt Form. Samples were refrigerated and sample information was recorded on a Sample Login Form for each refrigerator. Station ID, date sampled, and analysis due date were recorded on a master Sample Check List Form. Samples were kept at 4ºC but are not frozen. During sample storage the air temperature of the refrigerator was recorded daily on a Refrigerator Temperature Record Form. Samples were removed from the refrigerator only when aliquots of the sample were taken for analysis. They were placed back in refrigeration as soon as possible in order to minimize temperature change of samples. Samples to be analyzed by the MDEQ Laboratory, Pearl, MS were transported in coolers on ice at 4ºC by GCRL or MDEQ personnel. The samples were transferred to the MDEQ Laboratory along with the appropriate Chain of Custody and Sample Request Forms, as per GCRL and MDEQ protocols. Samples sent to the MDEQ Laboratory were transported as soon as possible. Holding times for chemical analyses are listed in Table a.

Table a. Chemical methods.

Analyte	Analysis Methods	Sample Volume	Holding Times	Method Quantitation Limit
Total Suspended Solids (0.1 mg/L)	EPA Method 160.2 Residue, Non-Filterable (Gravimetric, Dried at 103-105_C)	100 L	7 days	4.0 mg/L
Total Ammonia (mg/L)	EPA Method 350.3 Nitrogen, Ammonia (Potentiometric, Ion Selective Electrode)	50 mL	28 days	0.1 mg/L
Total Nitrite + Nitrate (mg/L)	EPA Method353.3 Nitrogen, Nitrate-Nitrite (Cadmium Reduction Method)	25 mL	28 days	0.02 mg/L
Total Kjeldahl Nitrogen (mg/L)	EPA Method 350.3 Nitrogen, Ammonia (Potentiometric, Ion Selective Electrode)	50 mL	28 days	0.1 mg/L
Total Phosphate (mg/L)	EPA Method 365.2 Phosphorus, All Forms (Colorimetric, Ascorbic Acid Method)	50 mL	28 days	0.01 mg/L

General Laboratory Procedures

Water used to prepare standards and reagents was of the highest purity (18 MΩ-cm). Tap water was passed through odor and sediment filters and distilled in a Corning Megapure Distillation Unit. The distilled water was stored in a Corning Collection System. Distilled water was passed through a Barnstead Deionizer and then polished using a Simplicity Water Purification System. Reagents used in nutrient analyses are analytical grade chemicals meeting ASC specifications. Reagent forms were kept with each analysis. Stock solutions of known concentrations were purchased for use as calibration standards and as reference samples. Glassware was cleaned in a hydrochloric acid solution. Acid-washed glassware was rinsed three times with distilled water.

Instrumentation and Equipment/Data Quality

Instruments and equipment, operation guidelines, and calibration testing procedure for the Genesys 10 Spectrophotometer followed manufacturer's guidelines. Instructions for instrument checkout, calibration, and maintenance were filed in the Laboratory. Analytical balances were calibrated annually, and a low range performance procedure was carried out each time a balance was used. Instrument checkout procedures were performed before each analysis, and calibrations were performed on a periodic basis. Record logs of maintenance, calibration, and performance were kept for instruments used in instrumental analysis of nutrients and solids. All data were recorded on data forms kept in a designated file within the Water Quality Laboratory. Data were recorded in Excel format. These data were checked against original data forms by the analyst, analytical QC leader, and the project manager. Data quality for total suspended solids analyses was evaluated through the use of determinations of total suspended solids on quality control samples. These included laboratory blanks (distilled, deionized water samples), field blanks, laboratory duplicate samples (randomly selected by the analyst), field duplicate samples, and reference (QC) samples. Laboratory duplicate samples were evaluated using percent difference between the duplicates and the mean value. Reference samples were evaluated using percent recovery and/or the manufacturers recommended procedures. The overall number of determinations for each quality control sample type was equivalent to a number equal to 10% of the total number of regular field samples taken.

For nutrient samples, data quality was evaluated by analyzing concentrations of quality control samples. Total ammonia, total phosphate, nitrate-nitrite, and Kjeldahl nitrogen were measured in samples of know concentration. Quality control samples included laboratory blanks (distilled, deionized water samples), laboratory spiked blanks, field blanks, laboratory duplicate and spiked samples (randomly selected by the analyst), field duplicate and spiked samples, and reference (QC) samples. Percent recovery of the analyte was determined on laboratory-spiked blanks, laboratory spiked samples, field spiked samples, and reference samples. Problems and concerns relating to instrument performance and analytical results were brought to the attention of the QA/QC Officer for corrective action. Results of each analysis were reviewed to determine if the analysis met the performance criteria of the analytical method.

Chemical Analysis/Total Suspended Solids

Total suspended solids (mg/L) were determined on 100 ml of sample using EPA Method 160.2 (Residue, Non-filterable; Gravimetric, Dried at 103-105C). Gelman Type A/E glass fiber filters and Gelman filter assemblies were used in sample filtration. The vacuum assembly consisted of a Gast (Model G588DX) vacuum pump and glass manifolds (Houston Glass Co.). Filters and residues were dried in a Precision Economy Oven (Model 51220131). Dried filters were kept in a Sanplatec DryKeeper desiccator or glass desiccator. An OHAUS Voyager Model V1RR80 analytical balance was used to weigh filters and residues to 0.1 mg/L. All data were recorded on a Total Solids Data Form.

Chemical Analysis/Total Ammonia

Total ammonia nitrogen (NH_4-NH_3-N, mg/L) was determined on 50 ml of sample using EPA Method 350.3 (Potentiometric, Ion Selective electrode). An Orion Model EA™ 940 Expandable Ionanalyzer with a Corning Ammonia Electrode (Model 476130) or an Orion Ammonia Electrode (Model

95-12) was used to measure total ammonia concentration of samples. The manufacturer's instruction manuals were followed for instrument check out prior to analysis, for instrument standardization, and for direct measurement of samples. Stock solutions of ammonia were purchased from suppliers and were certified as to concentration. A series of low concentration standards were prepared within the concentration range of 0.00 to 1.00 mg/L. The pH of samples and standards was adjusted immediately prior to analysis by the addition of 1 ml of 10 N sodium hydroxide. A linear regression procedure utilizing five standards was used for instrument calibration. The slope, intercept, and coefficient of determination (r^2) of the regression line was determined. If r^2 is < 0.95, new standard solutions were prepared and the instrument was recalibrated. Measurements were recorded on Ammonia Data Forms.

Chemical Analysis/Total Phosphate

After conversion to orthophosphate by the sulfuric acid-nitric acid digestion procedure (Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998), total phosphate (tPO$_4$-P, mg/L) was determined colorimetrically using the Ascorbic Acid Method (EPA Method 365.2). Fifty milliliters of the water sampled were digested and 25 ml of the digested sample was used for analysis. A ThermoSpectronic Genesys™ 10 Spectrophotometer with a Sipper System (Model 355982) and 1 cm flow-through cell was used to measure total phosphate concentration. Absorbance was read at 880nm. The manufacturer's instruction manual was followed for instrument check out prior to analysis, for instrument standardization, and for direct measurement of samples. Stock solutions of phosphate were purchased from suppliers and were certified as to concentration. A linear regression procedure (absorbance vs. concentration) utilizing a minimum of five standards was used to standardize the spectrophotometer. The slope, intercept, and coefficient of determination (r^2) of the regression line were determined. If r^2 is < 0.98, new standard solutions were prepared and the instrument was recalibrated. Measurements were recorded on Phosphate Data Forms.

Chemical Analysis/Nitrite-Nitrate

Nitrite-nitrate concentration (NO_2-NO3-N, mg/L) was determined by EPA Method 353.3 (Cadmium Reduction Method). Twenty-five milliliters of the water sampled were passed through a reduction column to convert nitrate to nitrite. Nitrite (NO_2-N, mg/L) was measured using a ThermoSpectronic Genesys™ 10 Spectrophotometer with a Sipper System (Model 355982) and 1 cm flow-through cell. Absorbance of standards was read at 543 nm. A linear regression procedure (absorbance vs. concentration) utilizing a minimum of five standards was used to standardize the spectrophotometer. The slope, intercept, and coefficient of determination (r^2) of the regression line were determined. If r^2 is < 0.98, new standard solutions were prepared, and the instrument was recalibrated. Measurements were recorded on Nitrate-Nitrate Data Forms.

Chemical Analysis/Total Kjeldahl Nitrogen

Total Kjeldahl nitrogen was measured using EPA Method 351.4 (Potentiometric, Ion Selective Electrode). Samples (20 ml) were digested on a RapiDigester block digester with fume extraction system (Econolab, Inc.) according to the manufacturer's instruction manual. Previously, the catalyst of choice for digestion has been mercury, however, due to health risks and disposal problems, copper was used as an alternative (Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998). Following digestion, Kjeldahl nitrogen was measured following procedures for total ammonia nitrogen (EPA Method 350.3). Measurements were recorded on Total Kjeldahl Data Forms.

Chemical Analysis/Chlorophyll a

Surface, mid-water and bottom chlorophyll *a* concentrations were determined for each site from known volumes of water filtered. Measurements were made by using 90% acetone to extract chlorophyll from GF/F filters collected at each site. Standard Method 445.0 and a Turner Designs fluorometer unit were used to determine chlorophyll *a* concentrations (this method has been approved by MDEQ and EPA). A spectrophotometer was used to validate chlorophyll standards. Instrument detection limit (IDL) was ± 0.005 µg/l chl *a*; method detection limit using the present fluorometer was estimated to be ± 0.005 µg/l chl *a*; method detection limit was machine dependent. Chlorophyll was extracted from the filters without grinding. Only values for chlorophyll *a* were be calculated and reported.

Quality assurance and control measures for each set of samples included reagent blanks, duplicate reference samples, and calibration standards. Throughout the time frame of the project, all checks of standard reference material were within 5% of the calculated value. Duplicate field samples, provided by the GCRL field crew, had values within 10% of the original duplicate replicate samples. Quality control information included a QC check sample every 10 samples (90 to 110% recovery) and a calibration curve for the start and end of each sample run (minimum 3 point curve and a regression coefficient).

Synopsis of Data

Samples were collected every six hours over a 24-hour period on May 19 and 20, 2004. Hydrographic data for this period (high-flow) is found in Table 1. Water temperature, pH, salinity, and dissolved oxygen are listed for the May sampling period. Table 2 contains the nutrient data by station. Wet weather conditions precluded collection of low-flow samples during the summers of 2004 and 2005. Drought conditions followed Hurricane Katrina, however, the catastrophic destruction of coastal infrastructure, including facilities of the GCRL and MDEQ, prevented sampling until November of 2005. Tables 3 and 4 contain the hydrographic and nutrient data for low-flow time period, respectively. A power failure at the Pearl Laboratory resulted in the loss of the chlorophyll *a* samples.

Project Integration with Existing and Past Research

Data collected during this project will integrate with numerous ongoing and past studies including: 1) a nutrient survey of coastal waters conducted quarterly by the GCRL at selected sites in coastal bays and Mississippi Sound, 2) an ongoing study by MDEQ of Bayou Casotte in Jackson County, a heavily industrialized waterbody characterized by periodic elevations of some nutrients, 3) the EPA National Coastal Assessment Study which provides for the collection of water quality samples from stations in Mississippi Sound and adjacent waters during July of each year, 4) the MDEQ ambient monitoring program that is proposed to be reinstated in 2004, and 5) ongoing MDEQ studies in inland lakes and large rivers and historic data from wadeable streams. The low flow/high flow diel sampling, when integrated into the current quarterly nutrient sampling program, will provide data on a critical water quality component and will ensure that criteria developed for Mississippi's estuarine waters are defensible and based on the best available data.

Table 1. Hydrology Data (May 19-20, 2004) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

					Date	Time	Secchi	Total	Hydrographic profiling					
							Disk	Depth	Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	0.5	28.40	8.23	20.62	129.5	8.97
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	1.0	28.19	8.20	20.73	124.3	8.61
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	1.5	27.78	8.15	21.31	107.2	7.47
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	2.0	27.69	8.13	21.64	102.2	7.12
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	2.5	27.12	8.05	23.07	80.8	5.60
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	3.0	26.50	7.99	24.75	64.9	4.54
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	13:30	0.80	3.70	3.5	26.35	7.97	25.35	58.9	4.07
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	16:06	0.60	3.50	0.5	30.08	8.48	20.53	193.0	13.05
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	16:06	0.60	3.50	1.0	28.69	8.34	20.95	149.5	10.19
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	16:06	0.60	3.50	1.5	27.96	8.18	21.45	109.7	7.63
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	16:06	0.60	3.50	2.0	27.61	8.12	22.25	97.0	6.75
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	16:06	0.60	3.50	2.5	27.49	8.08	22.76	80.5	6.28
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	16:06	0.60	3.50	3.0	27.29	8.06	23.74	84.4	5.88
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	23:50	NA	2.70	0.5	27.22	8.08	17.56	93.8	6.76
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	23:50	NA	2.70	1.0	27.37	8.17	18.54	99.9	7.13
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	23:50	NA	2.70	1.5	27.77	8.04	20.07	113.7	7.99
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/19/2004	23:50	NA	2.70	2.0	28.00	8.27	20.73	119.8	8.38
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	5:50	NA	2.70	0.5	27.28	8.12	20.55	88.6	6.30
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	5:50	NA	2.70	1.0	27.35	8.15	20.83	92.6	6.54
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	5:50	NA	2.70	1.5	27.54	8.17	20.74	96.2	6.76
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	5:50	NA	2.70	2.0	27.24	8.13	22.31	85.9	6.01
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	5:50	NA	2.70	2.5	27.21	8.11	22.68	83.1	5.81
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	10:00	0.85	3.00	0.5	26.97	8.11	18.47	92.2	6.62
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	10:00	0.85	3.00	1.0	27.40	8.10	21.08	89.5	6.29
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	10:00	0.85	3.00	1.5	27.26	8.08	22.03	84.0	5.88
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	10:00	0.85	3.00	2.0	26.99	8.06	23.20	78.1	5.47
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	5/20/2004	10:00	0.85	3.00	2.5	26.86	8.03	23.67	71.9	5.03
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	10:22	1.60	2.36	0.5	27.73	8.06	19.37	106.4	7.51
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	10:22	1.60	2.36	1.0	27.42	8.09	21.05	104.6	7.35
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	10:22	1.60	2.36	1.5	27.37	8.07	21.64	95.8	6.72
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	10:22	1.60	2.36	2.0	27.40	8.08	21.63	96.4	6.76
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	19:00	1.25	1.90	0.5	27.54	8.09	11.35	93.7	6.91
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	19:00	1.25	1.90	1.0	28.81	8.17	16.29	107.3	7.59

Table 1. Hydrology Data (May 19-20, 2004) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

					Date	Time	Secchi Disk	Total Depth	Hydrographic profiling Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	19:00	1.25	1.90	1.5	28.70	8.16	19.59	105.7	7.35
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	22:40	NA	1.80	0.5	26.76	7.30	10.48	73.6	5.60
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	22:40	NA	1.80	1.0	27.07	7.87	16.39	74.8	5.46
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/19/2004	22:40	NA	1.80	1.5	27.67	7.90	21.07	70.7	4.90
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	4:15	NA	2.20	0.5	27.42	7.87	18.70	68.1	4.84
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	4:15	NA	2.20	1.0	28.03	8.06	21.29	83.7	5.81
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	4:15	NA	2.20	1.5	27.95	8.08	21.54	83.4	5.80
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	4:15	NA	2.20	2.0	27.64	8.02	22.10	71.8	4.95
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	11:10	1.55	2.40	0.5	28.06	8.05	17.14	94.1	6.70
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	11:10	1.55	2.40	1.0	28.09	8.09	21.87	96.9	6.71
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	11:10	1.55	2.40	1.5	28.00	8.09	22.24	96.0	6.63
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	5/20/2004	11:10	1.55	2.40	2.0	27.95	8.10	22.40	95.8	6.62
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	0.5	25.84	6.50	0.07	79.9	6.50
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	1.0	25.58	6.36	0.07	78.8	6.43
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	1.5	25.70	6.30	0.07	78.8	6.44
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	2.0	24.84	6.16	0.07	76.0	6.29
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	3.0	24.82	6.13	0.07	75.7	6.28
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	4.0	24.77	6.12	0.07	75.6	6.27
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	5.0	24.69	6.11	0.07	75.3	6.25
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	6.0	24.66	6.09	0.07	75.1	6.24
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	7.0	24.55	6.07	0.07	74.6	6.21
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	8.0	24.55	6.07	0.07	74.4	6.20
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	10:22	0.85	9.21	9.0	24.53	6.06	0.07	74.2	6.18
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	0.5	26.35	6.24	0.07	79.2	6.36
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	1.0	25.15	6.13	0.07	79.7	6.55
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	1.5	25.30	6.04	0.06	81.8	6.70
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	2.0	25.12	5.97	0.06	82.1	6.76
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	3.0	24.87	5.92	0.05	82.4	6.84
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	4.0	25.04	5.92	0.05	81.9	6.77
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	5.0	25.01	5.89	0.05	82.2	6.79
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	6.0	25.00	5.91	0.05	82.4	6.82
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	7.0	24.02	5.75	0.04	82.3	6.93
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	8.0	23.97	5.72	0.04	82.3	6.93

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									Hydrographic profiling					
					Date	Time	Secchi Disk	Total Depth	Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	16:00	0.60	9.22	9.0	24.07	5.76	0.04	82.4	6.93
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	0.5	26.28	6.45	0.09	68.5	5.55
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	1.0	25.70	6.32	0.08	73.3	5.98
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	1.5	25.49	6.28	0.07	74.2	6.07
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	2.0	25.38	6.22	0.07	74.7	6.10
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	3.0	25.18	6.10	0.06	78.5	6.46
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	4.0	25.18	6.03	0.06	79.4	6.54
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	5.0	25.25	6.00	0.06	78.1	6.47
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	6.0	25.04	5.93	0.06	80.6	6.62
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	7.0	24.66	5.85	0.05	82.8	6.87
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/19/2004	22:00	NA	8.03	8.0	24.61	5.76	0.05	82.7	6.87
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	0.5	25.14	6.23	0.07	76.4	6.30
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	1.0	25.13	6.16	0.07	76.3	6.28
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	1.5	25.13	6.13	0.07	76.1	6.27
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	2.0	25.13	6.11	0.07	76.2	6.28
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	3.0	25.13	6.09	0.07	76.1	6.27
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	4.0	25.13	6.08	0.07	76.0	6.26
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	5.0	25.13	6.06	0.07	76.0	6.26
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	6.0	25.13	6.05	0.07	76.0	6.26
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	7.0	25.13	6.04	0.07	75.9	6.26
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	8.0	25.13	6.04	0.07	75.9	6.26
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	4:00	NA	9.55	9.0	25.13	6.04	0.07	75.8	6.25
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	0.5	25.55	6.27	0.07	78.3	6.39
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	1.0	25.42	6.15	0.07	77.4	6.35
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	1.5	25.19	6.08	0.07	76.3	6.28
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	2.0	25.14	6.03	0.07	75.9	6.25
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	3.0	25.11	6.01	0.07	75.7	6.24
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	4.0	25.04	5.98	0.07	75.0	6.19
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	5.0	25.05	5.98	0.07	75.0	6.19
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	6.0	25.02	5.98	0.07	74.8	6.18
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	7.0	25.00	5.98	0.07	74.6	6.16
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	8.0	24.96	5.98	0.07	74.3	6.14
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	9.0	24.96	5.98	0.07	74.2	6.13

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					Date	Time	Secchi Disk	Total Depth	Hydrographic profiling					
									Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
POF08	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	5/20/2004	10:00	0.70	9.61	9.5	24.95	6.00	0.07	73.9	6.11
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	0.5	26.68	6.33	0.09	81.1	
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	1.0	26.10	6.30	0.09	77.7	6.27
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	1.5	25.92	6.27	0.09	76.8	6.24
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	2.0	25.86	6.25	0.09	76.6	6.22
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	3.0	25.84	6.23	0.09	76.1	6.19
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	4.0	24.67	6.21	0.08	69.1	5.73
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	12:35	0.85	5.02	5.0	24.52	6.19	0.08	65.7	5.47
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	18:00	0.60	4.23	0.5	28.32	6.40	0.12	90.1	7.04
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	18:00	0.60	4.23	1.0	27.52	6.40	0.10	80.8	6.38
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	18:00	0.60	4.23	1.5	25.50	6.41	0.06	63.3	5.15
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	18:00	0.60	4.23	2.0	25.41	6.35	0.05	61.4	5.03
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	18:00	0.60	4.23	3.0	25.35	6.31	0.05	60.8	5.00
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	18:00	0.60	4.23	4.0	25.28	6.34	0.05	59.1	4.88
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	23:05	NA	4.03	0.5	26.63	6.21	0.07	74.4	5.96
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	23:05	NA	4.03	1.0	26.26	6.26	0.07	72.1	5.82
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	23:05	NA	4.03	1.5	25.25	6.31	0.05	63.4	5.22
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	23:05	NA	4.03	2.0	25.05	6.31	0.05	61.7	5.10
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	23:05	NA	4.03	3.0	24.85	6.30	0.04	60.2	4.99
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/19/2004	23:05	NA	4.03	4.0	24.81	6.24	0.05	58.6	4.85
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	5:25	NA	4.33	0.5	26.16	6.25	0.08	70.1	5.69
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	5:25	NA	4.33	1.0	25.72	6.25	0.08	69.0	5.62
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	5:25	NA	4.33	1.5	25.52	6.26	0.08	68.7	5.62
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	5:25	NA	4.33	2.0	25.40	6.26	0.08	69.8	5.71
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	5:25	NA	4.33	3.0	25.20	6.25	0.08	71.8	5.91
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	5:25	NA	4.33	4.0	24.90	6.16	0.06	76.2	6.31
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	0.5	28.43	6.28	0.08	79.0	6.13
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	1.0	28.14	6.25	0.08	79.4	6.21
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	1.5	26.03	6.24	0.08	74.5	6.06
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	2.0	25.08	6.21	0.07	73.6	6.06
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	3.0	24.99	6.13	0.07	72.8	6.01
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	3.5	24.94	6.12	0.07	72.1	5.97
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	5/20/2004	11:05	0.80	4.48	4.0	24.94	6.14	0.07	71.6	5.92

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					Date	Time	Secchi Disk	Total Depth	Hydrographic profiling					
									Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	12:00	0.50	3.57	0.5	26.91	7.26	6.49	99.6	8.00
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	12:00	0.50	3.57	1.0	26.90	7.24	6.50	97.3	7.82
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	12:00	0.50	3.57	1.5	26.85	7.22	6.48	94.7	7.61
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	12:00	0.50	3.57	2.0	26.80	7.21	6.48	94.1	7.58
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	12:00	0.50	3.57	3.0	26.82	7.21	6.49	94.0	7.56
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	16:00	0.40	3.92	0.5	27.68	7.69	6.36	105.3	8.35
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	16:00	0.40	3.92	1.0	27.63	7.64	6.42	106.7	8.46
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	16:00	0.40	3.92	1.5	27.49	7.57	6.44	103.6	8.24
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	16:00	0.40	3.92	2.0	27.42	7.54	6.43	100.9	8.03
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	16:00	0.40	3.92	3.0	27.35	7.51	6.45	101.1	8.05
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	16:00	0.40	3.92	3.5	27.32	7.49	6.48	100.2	7.99
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	23:10	NA	3.43	0.5	28.18	6.78	5.38	50.3	3.92
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	23:10	NA	3.43	1.0	28.19	6.80	5.37	47.4	3.72
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	23:10	NA	3.43	1.5	28.19	6.79	5.38	46.8	3.66
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	23:10	NA	3.43	2.0	28.19	6.78	5.38	46.3	3.63
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/19/2004	23:10	NA	3.43	3.0	28.19	6.77	5.38	45.6	3.58
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	4:00	NA	3.05	0.5	27.40	7.13	5.46	56.8	4.46
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	4:00	NA	3.05	1.0	27.28	7.07	5.85	62.2	4.90
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	4:00	NA	3.05	1.5	27.03	7.06	6.23	75.8	6.11
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	4:00	NA	3.05	2.0	27.02	7.07	6.24	75.7	6.07
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	10:45	0.85	3.00	0.5	27.52	7.31	4.77	105.1	8.34
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	10:45	0.85	3.00	1.0	27.46	7.35	4.88	103.7	8.24
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	10:45	0.85	3.00	1.5	27.49	7.37	4.92	102.3	8.23
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	10:45	0.85	3.00	2.0	27.42	7.38	4.90	101.7	8.09
BAC19	Bayou Caddy	O.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	5/20/2004	10:45	0.85	3.00	2.5	27.43	7.37	4.94	100.6	8.01
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	0.5	22.07	7.81	0.01	71.6	6.29
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	1.0	22.09	7.45	0.01	71.1	6.25
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	1.5	22.04	7.31	0.01	70.5	6.20
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	2.0	22.03	7.18	0.01	69.7	6.13
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	3.0	22.03	6.91	0.01	69.9	6.14
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	4.0	22.03	6.88	0.01	69.3	6.10
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	5.0	22.03	6.85	0.01	68.7	6.04
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	6.0	22.04	6.83	0.01	68.3	6.01

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Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	10:00	0.30	7.36	7.0	22.04	6.77	0.01	67.8	5.97
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	0.5	22.52	8.39	0.01	72.0	6.28
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	1.0	22.50	8.14	0.01	71.5	6.24
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	1.5	22.50	8.07	0.01	71.5	6.23
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	2.0	22.50	8.01	0.01	71.3	6.21
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	3.0	22.53	7.88	0.01	71.0	6.19
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	4.0	22.50	7.80	0.01	71.2	6.19
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	5.0	22.49	7.72	0.01	70.9	6.18
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	6.0	22.50	7.55	0.01	70.6	6.15
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	7.0	22.50	7.52	0.01	70.5	6.15
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	17:00	0.25	7.97	7.5	22.50	7.55	0.01	70.4	6.13
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	0.5	22.89	8.13	0.01	72.3	6.26
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	1.0	22.89	7.61	0.01	71.8	6.22
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	1.5	22.88	7.47	0.01	71.8	6.21
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	2.0	22.88	7.36	0.01	71.4	6.18
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	3.0	22.89	7.25	0.01	71.2	6.15
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	4.0	22.89	7.24	0.01	70.9	6.14
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	5.0	22.89	7.16	0.01	70.7	6.12
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	6.0	22.89	7.12	0.01	70.6	6.11
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	7.0	22.89	7.05	0.01	70.4	6.09
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/19/2004	22:00	NA	7.86	7.5	22.89	7.04	0.01	70.2	6.08
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	0.5	22.70	7.88	0.01	67.6	5.85
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	1.0	22.70	7.65	0.01	67.9	5.90
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	1.5	22.70	7.57	0.01	67.3	5.83
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	2.0	22.70	7.46	0.01	66.9	5.81
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	3.0	22.71	7.37	0.01	66.9	5.81
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	4.0	22.70	7.37	0.01	67.0	5.81
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	5.0	22.71	7.32	0.01	66.6	5.77
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	6.0	22.71	7.27	0.01	66.5	5.78
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	7.0	22.71	7.22	0.01	66.2	5.75
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	5:30	0.35	7.68	7.5	22.70	7.20	0.01	65.8	5.71
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	0.5	22.65	8.02	0.01	71.2	6.19
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	1.0	22.61	7.35	0.01	68.8	5.98

Table 1. Hydrology Data (May 19-20, 2004) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

					Date	Time	Secchi	Total	Hydrographic profiling					
							Disk	Depth	Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	1.5	22.61	7.12	0.01	68.3	5.94
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	2.0	22.61	6.98	0.01	67.9	5.91
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	3.0	22.61	6.88	0.01	67.8	5.89
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	4.0	22.60	6.79	0.01	67.4	5.86
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	5.0	22.61	6.77	0.01	67.2	5.85
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	6.0	22.61	6.69	0.01	67.2	5.85
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	7.0	22.61	6.69	0.01	66.8	5.81
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	5/20/2004	10:00	0.30	8.45	8.0	22.60	6.67	0.01	66.4	5.77
DAB23	Davis Bayou	Beach at Holcomb Blvd	30 23' 37.8"	88 48' 37.2"	5/19/2004	10:50	0.60	1.00	0.5	27.86	6.89	7.00	103.1	8.02
DAB23	Davis Bayou	Beach at Holcomb Blvd	30 23' 37.8"	88 48' 37.2"	5/19/2004	16:45	0.45	1.00	0.5	29.55	6.78	6.00	126.0	9.57
DAB23	Davis Bayou	Beach at Holcomb Blvd	30 23' 37.8"	88 48' 37.2"	5/19/2004	22:50	NA	1.00	0.5	26.70	6.85	6.00	81.9	6.52
DAB23	Davis Bayou	Beach at Holcomb Blvd	30 23' 37.8"	88 48' 37.2"	5/20/2004	4:58	NA	1.00	0.5	25.32	7.58	4.00	72.1	5.97
DAB23	Davis Bayou	Beach at Holcomb Blvd	30 23' 37.8"	88 48' 37.2"	5/20/2004	11:03	1.00	1.00	0.5	31.75	7.20	5.00	87.2	6.38
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	5/19/2004	10:00	0.21	1.00	0.5	26.41	7.40	4.96	109.4	8.55
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	5/19/2004	16:00	0.17	1.00	0.5	29.24	7.83	4.98	110.4	8.22
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	5/19/2004	22:00	NA	1.00	0.5	27.18	7.45	5.10	84.6	6.50
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	5/20/2004	4:00	NA	1.00	0.5	26.14	7.27	5.50	60.7	4.79
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	5/20/2004	10:00	0.20	1.00	0.5	27.33	7.02	2.22	94.3	7.38
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	5/19/2004	10:00	1.00	1.00	0.5	26.80	7.00	10.00	136.0	10.44
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	5/19/2004	16:00	0.50	1.00	0.5	34.35	7.59	15.00	125.6	8.91
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	5/19/2004	22:00	NA	1.00	0.5	25.99	8.19	10.00	107.8	8.76
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	5/20/2004	4:00	NA	1.00	0.5	25.60	7.36	6.00	75.5	6.19
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	5/20/2004	10:00	1.00	1.00	0.5	28.10	7.86	12.00	117.8	9.24

Table 2. Nutrient data (May 19-20, 2004) for WRRI project "Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

Station Code	Level	Sample Location	Latitude (° ')	Longitude (° ')	Date	Time	Sample Depth (m)	Turbidity (NTU)	Chlorophyll *a* (ug/L)	Pheo-*a* (ug/L)	Total Ammonia (mg/L-N)	Total Kjeldahl Nitrogen (mg/L-N)	Total Nitrate Nitrite (mg/L-N)	Total Phosphate (mg/L-P)	Total Suspended Solids (mg/L)	County
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	13:30	0.5	9.0	29.58	10.84	0.16	0.72	0.09	0.94	74	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	13:30	0.5		25.25	9.80	0.16	0.66	0.10	0.91	86	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	13:30	1.8	17.0	14.70	11.27	0.35	0.85	0.07	1.37	101	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	13:30	1.8		14.55	11.75	0.44	0.90	0.08	1.34	110	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	13:30	3.2	16.0	4.28	3.07	0.24	0.59	0.03	0.51	114	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	13:30	3.2		5.31	3.94	0.23	0.58	0.03	0.50	112	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	16:06	0.5	12.0	51.28	8.28	0.06	0.64	0.12	1.69	94	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	16:06	1.8	14.0	23.60	9.40	0.25	0.65	0.09	1.32	91	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	16:06	3.0	13.0	14.24	10.61	0.20	0.56	0.06	0.90	104	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	23:50	0.5	9.0	10.27	8.31	0.05	0.40	0.05	0.35	75	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	23:50	1.4	8.0	12.96	10.58	0.06	0.40	0.06	0.51	80	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	05/19/04	23:50	2.2	17.0	28.46	9.02	0.11	0.60	0.07	1.38	98	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	05/20/04	5:50	0.5	8.0	15.02	10.06	0.07	0.44	0.06	0.70	85	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	05/20/04	5:50	1.4	10.0	16.18	7.91	0.10	0.49	0.06	0.97	75	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	05/20/04	5:50	2.2	10.0	16.17	7.67	0.11	0.44	0.06	0.89	90	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	05/20/04	10:00	0.5	9.0	13.26	9.98	0.07	0.52	0.06	0.74	68	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	05/20/04	10:00	1.5	9.0	13.11	7.66	0.11	0.51	0.06	0.75	79	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	05/20/04	10:00	2.5	14.0	10.77	6.54	0.14	0.45	0.05	0.74	93	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	05/19/04	10:22	0.5	5.0	3.52	1.20	0.04	0.37	<0.02	0.03	61	Jackson
ROI06	Middle	Round Island	30 18 36.9	88 32 41.1	05/19/04	10:22	1.2	7.0	3.61	1.71	0.04	0.29	0.02	0.03	68	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	05/19/04	10:22	1.9	8.0	2.82	1.91	0.04	0.28	0.02	0.03	70	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	05/19/04	19:00	0.5	7.0	4.57	2.06	0.04	0.30	0.06	0.03	33	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	05/19/04	19:00	1.5	0.0	5.86	2.93	0.03	0.23	0.02	0.03	68	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	05/19/04	22:40	0.5	8.0	2.57	1.50	0.05	0.28	0.08	0.03	42	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	05/19/04	22:40	1.3	8.0	3.18	2.17	0.07	0.22	0.06	0.04	64	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	05/20/04	4:15	0.5	7.0	3.30	1.99	0.03	0.30	0.05	0.04	55	Jackson
ROI06	Middle	Round Island	30 18 36.9	88 32 41.1	05/20/04	4:15	1.1	7.0	3.66	2.50	0.03	0.26	0.05	0.03	61	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	05/20/04	4:15	1.7	8.0	2.32	1.44	<0.02	0.24	0.03	0.03	75	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	05/20/04	11:10	0.5	0.0	5.61	2.96	0.05	0.25	0.03	0.03	66	Jackson
ROI06	Middle	Round Island	30 18 36.9	88 32 41.1	05/20/04	11:10	1.2	0.0	3.87	1.62	0.05	0.23	0.02	<0.02	69	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	05/20/04	11:10	1.9	0.0	4.41	2.31	0.03	0.24	0.02	0.03	85	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	05/19/04	10:50	0.5	16.0	3.38	2.89	0.12	0.41	0.08	0.03	38	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	05/19/04	16:45	0.5	28.0	10.74	4.99	0.09	0.55	0.07	0.03	46	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	05/19/04	22:50	0.5	18.0	5.99	4.22	0.08	0.54	0.07	0.03	31	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	05/19/04	22:50	0.5		5.68	3.45	0.08	0.54	0.06	0.03	27	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	05/20/04	4:58	0.5	18.0	5.55	3.55	0.14	0.49	0.08	0.04	33	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	05/20/04	11:03	0.5	14.0	4.81	2.19	0.11	0.45	0.08	0.03	26	Jackson
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	10:22	0.5	13.0	1.26	0.81	0.08	0.49	0.04	0.05	<4	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	10:22	4.6	13.0	0.85	0.41	0.08	0.37	0.04	0.04	5	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	10:22	8.7	69.0	1.65	0.98	0.08	0.36	0.05	0.07	77	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	16:00	0.5	15.0	1.16	0.77	0.06	0.38	0.04	0.04	8	Harrison

Table 2. Nutrient data (May 19-20, 2004) for WRRI project "Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

Station Code	Level	Sample Location	Latitude (° ')	Longitude (° ')	Date	Time	Sample Depth (m)	Turbidity (NTU)	Chlorophyll *a* (ug/L)	Pheo-*a* (ug/L)	Total Ammonia (mg/L-N)	Total Kjeldahl Nitrogen (mg/L-N)	Total Nitrate Nitrite (mg/L-N)	Total Phosphate (mg/L-P)	Total Suspended Solids (mg/L)	County
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	16:00	0.5		1.17	0.63	0.06	0.36	0.03	0.03	11	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	16:00	4.6	15.0	1.11	0.69	0.06	0.39	0.03	0.04	8	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	16:00	4.6		1.43	0.74	0.06	0.39	0.03	0.03	6	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	16:00	8.7	86.0	1.71	0.89	0.05	0.35	<0.02	0.06	56	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	16:00	8.7		1.04	0.60	0.04	0.36	<0.02	0.06	83	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	22:00	0.5	26.0	1.72	1.31	0.07	0.61	0.09	0.09	20	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	22:00	4.0	22.0	1.60	1.04	0.05	0.59	0.04	0.05	19	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	05/19/04	22:00	7.5	22.0	1.41	0.91	0.03	0.61	<0.02	0.03	19	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	05/20/04	4:00	0.5	15.0	1.14	0.97	0.05	0.50	0.04	0.04	10	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	05/20/04	4:00	4.8	14.0	1.15	0.71	0.05	0.58	0.05	0.04	5	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	05/20/04	4:00	9.1	15.0	1.09	0.66	0.04	0.56	0.04	0.04	6	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	05/20/04	10:00	0.5	13.0	2.07	1.18	0.04	0.66	0.05	0.04	<4	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	05/20/04	10:00	4.8	14.0	1.02	0.68	0.04	0.54	0.04	0.04	4	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	05/20/04	10:00	9.1	13.0	1.04	0.59	0.06	0.63	0.05	0.04	7	Harrison
BBI14	Surface	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	12:35	0.5	14.0	1.31	0.66	0.05	0.44	0.07	0.05	7	Harrison
BBI14	Middle	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	12:35	2.5	14.0	1.39	0.69	0.05	0.43	0.07	0.05	5	Harrison
BBI14	Bottom	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	12:35	4.5	19.0	0.94	0.54	0.05	0.39	0.07	0.06	15	Harrison
BBI14	Surface	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	18:00	0.5	16.0	2.85	1.42	0.03	0.43	0.09	0.07	9	Harrison
BBI14	Middle	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	18:00	2.1	20.0	1.24	0.75	0.05	0.46	0.15	0.08	13	Harrison
BBI14	Bottom	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	18:00	3.7	22.0	0.88	0.52	0.05	0.42	0.18	0.08	14	Harrison
BBI14	Surface	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	23:05	0.5	19.0	0.67	0.47	0.04	0.40	0.09	0.04	12	Harrison
BBI14	Middle	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	23:05	2.0	26.0	0.72	0.52	0.07	0.47	0.21	0.09	18	Harrison
BBI14	Bottom	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/19/04	23:05	3.5	29.0	0.75	0.54	0.07	0.47	0.22	0.09	22	Harrison
BBI14	Surface	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/20/04	5:25	0.5	17.0	1.64	0.99	0.07	0.45	0.11	0.06	9	Harrison
BBI14	Middle	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/20/04	5:25	2.2	18.0	1.62	0.92	0.05	0.39	0.10	0.06	12	Harrison
BBI14	Bottom	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/20/04	5:25	3.8	17.0	1.47	0.86	0.05	0.46	0.06	0.04	10	Harrison
BBI14	Surface	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/20/04	11:05	0.5	12.0	4.66	2.13	0.04	0.45	0.09	0.05	6	Harrison
BBI14	Middle	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/20/04	11:05	2.3	13.0	3.09	1.61	0.04	0.59	0.07	0.05	10	Harrison
BBI14	Bottom	Bayou Bernard/Indu	30 24 57.3	89 00 13.6	05/20/04	11:05	4.0	19.0	1.10	0.65	0.05	0.72	0.07	0.06	14	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	05/19/04	10:00	0.5	14.0	7.20	4.15	0.03	0.60	0.04	0.04	50	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	05/19/04	16:00	0.5	33.0	6.84	4.44	<0.02	0.54	<0.02	0.03	91	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	05/19/04	22:00	0.5	11.0	6.70	4.25	<0.02	0.50	0.04	0.03	42	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	05/20/04	4:00	0.5	9.0	5.33	3.16	<0.02	0.54	0.06	0.04	27	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	05/20/04	10:00	0.5	11.0	8.79	5.32	<0.02	0.43	<0.02	0.04	40	Harrison
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	12:00	0.5	22.0	7.23	3.32	<0.10	1.01	<0.02	0.05	32	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	12:00	0.5		7.75	3.16	<0.10	1.00	<0.02	0.07	41	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	12:00	1.8	21.0	6.81	3.23	<0.10	0.51	<0.02	0.05	38	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	12:00	1.8		8.10	3.86	<0.10	0.77	<0.02	0.05	38	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	12:00	3.1	22.0	8.66	4.10	<0.10	0.93	<0.02	0.06	44	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	12:00	3.1		8.12	3.90	<0.10	0.88	<0.02	0.06	38	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	16:00	0.5	16.0	8.92	4.07	<0.10	0.89	<0.02	0.05	42	Hancock

Table 2. Nutrient data (May 19-20, 2004) for WRRI project "Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

Station Code	Level	Sample Location	Latitude (° ')	Longitude (° ')	Date	Time	Sample Depth (m)	Turbidity (NTU)	Chlorophyll *a* (ug/L)	Pheo-*a* (ug/L)	Total Ammonia (mg/L-N)	Total Kjeldahl Nitrogen (mg/L-N)	Total Nitrate Nitrite (mg/L-N)	Total Phosphate (mg/L-P)	Total Suspended Solids (mg/L)	County
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	16:00	2.0	17.0	8.02	3.33	<0.10	0.94	<0.02	0.07	42	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	16:00	3.5	21.0	7.24	2.87	<0.10	0.88	<0.02	0.07	45	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	23:10	0.5	22.0	2.34	0.97	<0.10	0.89	<0.02	0.06	43	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	23:10	1.7	28.0	2.36	0.95	<0.10	0.84	<0.02	0.08	50	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/19/04	23:10	2.9	31.0	2.23	0.94	<0.10	0.95	<0.02	0.06	62	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	4:00	0.5	11.0	2.94	1.21	<0.10	0.83	<0.02	0.08	28	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	4:00	1.5	19.0	5.09	2.29	<0.10	0.40	<0.02	0.05	40	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	4:00	2.5	20.0	5.07	2.19	<0.10	0.84	<0.02	0.08	39	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	10:45	0.5	12.0	7.37	3.57	<0.10	0.81	<0.02	0.05	24	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	10:45	0.5		6.74	3.16	<0.10	0.86	<0.02	0.04	27	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	10:45	1.5	12.0	7.09	3.53	<0.10	1.03	<0.02	0.06	29	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	10:45	1.5		7.16	3.39	<0.10	0.88	<0.02	0.05	33	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	10:45	2.5	17.0	6.97	3.28	<0.10	0.75	<0.02	0.10	19	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	05/20/04	10:45	2.5		7.31	3.67	<0.10	0.48	<0.02	0.04	27	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	05/19/04	10:00	0.5	36.0	1.59	0.77	<0.10	1.08	0.12	0.10	29	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	05/19/04	10:00	0.5		0.91	0.48	<0.10	0.97	0.12	0.10	24	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	05/19/04	10:00	3.7	45.0	2.30	1.28	<0.10	0.98	0.12	0.12	25	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	05/19/04	10:00	3.7		1.99	0.98	<0.10	1.05	0.12	0.08	22	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	05/19/04	10:00	6.9	50.0	2.00	1.14	<0.10	0.88	0.12	0.08	32	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	05/19/04	10:00	6.9		2.07	1.11	<0.10	0.88	0.12	0.07	42	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	05/19/04	17:00	0.5	35.0	2.02	0.97	<0.10	1.01	0.13	0.10	21	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	05/19/04	17:00	4.0	34.0	2.10	1.07	<0.10	0.96	0.13	0.09	21	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	05/19/04	17:00	7.5	38.0	2.15	1.23	<0.10	0.91	0.13	0.07	22	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	05/19/04	22:00	0.5	34.0	1.72	1.23	<0.10	0.96	0.13	0.07	25	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	05/19/04	22:00	3.9	39.0	1.96	1.10	<0.10	0.92	0.12	0.11	24	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	05/19/04	22:00	7.4	40.0	1.97	1.12	<0.10	0.84	0.13	0.07	22	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	05/20/04	5:30	0.5	40.0	1.60	1.05	<0.10	0.92	0.13	0.07	24	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	05/20/04	5:30	3.8	55.0	1.75	1.24	<0.10	0.95	0.13	0.07	26	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	05/20/04	5:30	7.2	40.0	1.79	1.19	<0.10	0.98	0.13	0.08	25	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	05/20/04	10:00	0.5	37.0	1.72	1.23	<0.10	0.91	0.13	0.08	21	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	05/20/04	10:00	4.3	40.0	1.12	0.62	<0.10	0.97	0.13	0.08	22	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	05/20/04	10:00	8.0	37.0	1.77	1.09	<0.10	1.03	0.13	0.07	27	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	05/19/04	10:00	0.5	18.0	7.83	3.67	<0.10	0.80	<0.02	0.07	63	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	05/19/04	16:00	0.5	40.0	6.44	3.60	<0.10	0.82	<0.02	0.08	67	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	05/19/04	16:00	0.5		7.19	4.30	<0.10	0.86	0.00	0.10	83	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	05/19/04	22:00	0.5	46.0	4.35	3.56	<0.10	0.71	0.02	0.09	95	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	05/20/04	4:00	0.5	16.0	2.84	2.46	<0.10	0.69	<0.02	0.05	35	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	05/20/04	10:00	0.5	16.0	4.58	1.86	<0.10	0.68	<0.02	0.04	22	Hancock

Table 3. Hydrology Data (Nov. 2-3, 2005) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

					Date	Time	Secchi Disk	Total Depth	Hydrographic profiling					
									Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	14:48	0.50	2.30	0.5	20.4	8.14	28.64	99.7	7.54
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	14:48	0.50	2.30	1.0	20.36	8.14	28.85	95.4	7.27
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	14:48	0.50	2.30	1.5	20.36	8.14	59.74	95.1	7.17
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	14:48	0.50	2.30	2.0	20.35	8.15	30.36	95.0	7.13
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	20:05	NA	2.70	0.5	20.09	8.21	31.58	93.8	7.07
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	20:05	NA	2.70	1.0	20.12	8.21	31.62	93.7	7.06
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	20:05	NA	2.70	1.5	20.13	8.21	31.63	32.8	6.98
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	20:05	NA	2.70	2.0	20.13	8.2	31.62	92.9	6.99
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/2/2005	20:05	NA	2.70	2.5	20.12	8.21	31.66	92.8	6.98
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	2:36	NA	1.90	0.5	18.33	8.22	30.96	91.6	7.1
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	2:36	NA	1.90	1.0	18.65	8.22	30.94	92.0	7.14
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	2:36	NA	1.90	1.5	18.69	8.22	30.95	91.7	7.12
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	8:00	1.00	1.51	0.5	19.24	8.2	21.17	92.8	7.12
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	8:00	1.00	1.51	1.0	19.09	8.21	31.1	92.3	7.1
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	8:00	1.00	1.51	1.5	19.34	8.21	31.28	91.3	6.98
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	14:00	1.00	1.79	0.5	20.22	8.15	30.94	100.3	7.55
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	14:00	1.00	1.79	1.0	20.26	8.14	31.37	98.2	7.38
BCA03	Bayou Casotte	North of Launch	30 21' 20.5"	88 30' 23.3"	11/3/2005	14:00	1.00	1.79	1.5	20.11	8.14	31.37	96.1	7.24
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	17:26	2.13	2.13	0.5	19.08	8.21	30.47	109.9	8.49
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	17:26	2.13	2.13	1.0	19.07	8.21	30.47	110.5	8.54
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	17:26	2.13	2.13	1.5	19.05	8.21	30.46	111.9	8.66
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	17:26	2.13	2.13	2.0	19.03	8.21	30.45	112.6	8.71
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	21:25	NA	2.24	0.5	18.78	8.22	30.55	103.5	8.04
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	21:25	NA	2.24	1.0	18.78	8.22	30.54	103.9	8.07
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	21:25	NA	2.24	1.5	18.78	8.23	30.54	104.1	8.09
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/2/2005	21:25	NA	2.24	2.0	18.78	8.23	30.53	104.2	8.09
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	3:50	NA	1.76	0.5	17.78	8.25	30.16	101.0	8.01
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	3:50	NA	1.76	1.0	17.78	8.25	30.15	101.4	8.05
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	3:50	NA	1.76	1.5	17.79	8.25	30.15	101.3	8.04
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	9:10	void	1.70	0.5	18.59	8.2	29.6	107.3	8.4
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	9:10	void	1.70	1.0	18.54	8.2	29.75	105.2	8.24
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	9:10	void	1.70	1.5	18.51	8.2	29.78	104.3	8.17
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	14:50	1.94	1.94	0.5	19.12	8.2	30.01	116.4	9.02

Table 3. Hydrology Data (Nov. 2-3, 2005) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

					Date	Time	Secchi Disk	Total Depth	Hydrographic profiling					
									Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	14:50	1.94	1.94	1.0	19.09	8.21	30.43	117.1	9.05
ROI06	Round Island	Marker 3	30 18' 36.9"	88 32' 41.1"	11/3/2005	14:50	1.94	1.94	1.5	19.17	8.22	30.52	117.8	9.08
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	void	7.00	0.5	19.2	7.9	13.08	112.2	9.6
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	1.0	19	7.89	13.31	109.5	9.38
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	1.5	18.91	7.88	13.43	108.6	9.32
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	2.0	18.9	7.89	13.5	108.7	9.33
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	3.0	18.71	7.86	13.79	103.9	8.95
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	4.0	18.33	7.77	14.41	97.1	8.36
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	5.0	18.23	7.74	14.54	92.2	7.96
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	6.0	18.22	7.73	14.57	91.1	7.87
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	15:50	NA	7.00	6.5	18.21	7.72	14.58	90.7	7.84
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	0.5	18.14	7.91	12.45	102.9	9.01
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	1.0	18.37	7.83	13.56	99.2	8.56
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	1.5	18.35	7.85	14.68	98.5	8.48
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	2.0	18.3	7.85	15.13	96.2	8.25
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	3.0	18.27	7.85	15.61	94.2	8.09
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	4.0	18.25	7.86	15.76	93.7	8.04
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	5.0	18.24	7.87	16.05	93.2	7.97
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	6.0	18.24	7.87	16.07	93.1	7.97
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/2/2005	21:20	NA	7.50	6.5	18.24	7.87	16.15	92.6	7.92
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	0.5	19.04	7.7	10.98	136.4	11.75
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	1.0	18.71	7.65	12.2	130.1	11.33
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	1.5	18.62	7.63	11.49	127.8	11.15
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	2.0	18.48	7.62	12.39	126.7	11.04
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	3.0	18.33	7.6	11.92	126.0	11.03
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	4.0	18.25	7.6	12.27	127.7	11.16
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	5.0	18.32	7.61	12.68	126.6	11.03
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	6.0	18.27	7.65	13.01	129.0	11.25
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	3:30	NA	7.00	6.5	18.25	7.66	13.17	130.9	11.42
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	0.5	18.68	7.66	10.64	183.5	16.79
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	1.0	18.42	7.57	10.88	188.3	16.96
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	1.5	18.42	7.56	10.97	186.1	16.02
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	2.0	18.47	7.57	11	171.6	16.31

Table 3. Hydrology Data (Nov. 2-3, 2005) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

							Secchi	Total	Hydrographic profiling					
					Date	Time	Disk	Depth	Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	3.0	18.25	7.49	11.27	161.6	14.1
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	4.0	18.2	7.46	11.43	159.1	14
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	5.0	18.2	7.46	11.67	156.9	13.79
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	6.0	18.23	7.45	11.96	131.7	12.13
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	10:20	void	7.00	6.5	18.27	7.44	12	121.2	11.25
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	0.5	19.23	7.76	12.25	107.2	4:19
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	1.0	18.79	7.68	12.34	96.3	8.31
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	1.5	18.73	7.64	12.57	89.9	7.77
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	2.0	18.73	7.64	12.67	87.4	7.54
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	3.0	18.82	7.68	13.02	85.9	7.36
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	4.0	18.74	7.71	13.35	84.3	7.25
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	5.0	18.36	7.66	13.98	77.3	6.64
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	6.0	18.29	7.64	14.13	73.6	6.36
PODO8	Popp's Ferry	Mouth of Big Lake	30 24' 57.3"	88 58' 40.6"	11/3/2005	15:25	void	7.00	6.5	18.22	7.63	14.29	71.6	6.19
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	14:00	void	10.00	0.5	20.83	8.22	10.49	126.8	10.81
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	14:00	void	10.00	1.0	20.07	8.2	10.47	129.9	11.07
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	14:00	void	10.00	1.5	19.24	7.22	11.18	102.6	8.88
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	14:00	void	10.00	2.0	18.8	7.51	11.67	86.5	7.53
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	14:00	void	10.00	2.5	18.75	7.49	11.69	86.0	7.51
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	20:00	void	12.00	0.5	20.15	7.89	10.81	112.1	9.55
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	20:00	void	12.00	1.0	19.38	7.77	11.6	103.3	8.89
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	20:00	void	12.00	1.5	18.88	7.73	12.4	99.1	8.85
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	20:00	void	12.00	2.0	18.61	7.67	13.01	93.5	8.07
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	20:00	void	12.00	3.0	18.52	7.69	13.5	93.6	8.08
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/2/2005	20:00	void	12.00	3.5	18.52	7.69	13.51	92.8	8.03
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	2:15	void	4.00	0.5	18.87	8.02	10.06	108.0	9.48
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	2:15	void	4.00	1.0	18.91	7.78	11.44	96.1	8.21
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	2:15	void	4.00	1.5	18.82	7.63	12.44	86.8	7.48
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	2:15	void	4.00	2.0	18.72	7.61	12.79	83.3	7.2
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	2:15	void	4.00	3.0	18.33	7.66	14.76	83.2	7.17
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	2:15	void	4.00	3.5	18.27	7.73	15.13	82.9	7.12
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	8:05	void	3.00	0.5	18.51	8.13	9.83	207.7	18.35
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	8:05	void	3.00	1.0	18.47	8.04	9.93	201.3	17.78

Table 3. Hydrology Data (Nov. 2-3, 2005) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

							Secchi	Total	Hydrographic profiling					
					Date	Time	Disk	Depth	Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	8:05	void	3.00	1.5	18.68	8.03	9.99	192.5	16.96
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	8:05	void	3.00	2.0	18.59	7.66	10.45	183.3	16.05
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	8:05	void	3.00	2.5	18.94	7.48	11.84	162.4	14
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	14:00	0.35	4.00	0.5	20.08	8.05	10.64	123.6	10.69
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	14:00	0.35	4.00	1.0	19.83	7.94	10.62	117.1	9.93
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	14:00	0.35	4.00	1.5	19.21	7.7	10.97	99.0	8.53
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	14:00	0.35	4.00	2.0	18.88	7.56	11.16	90.3	7.82
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	14:00	0.35	4.00	3.0	18.84	7.53	11.28	85.0	7.37
BBI14	Bayou Bernard	Industrial Seaway Mouth	30 24' 57.3"	89 00' 13.6"	11/3/2005	14:00	0.35	4.00	3.5	18.83	7.53	11.38	83.8	7.29
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	15:15	1.25	3.30	0.5	18.96	7.97	17.43	109.7	9.09
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	15:15	1.25	3.30	1.0	19.02	7.97	17.49	109.0	9.12
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	15:15	1.25	3.30	1.5	19.06	7.97	17.48	108.5	9.07
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	15:15	1.25	3.30	2.0	19	7.97	17.49	108.5	9.09
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	15:15	1.25	3.30	3.0	18.91	7.98	17.53	108.2	9.06
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	21:15	NA	3.18	0.5	18.19	8.07	17.54	101.8	8.66
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	21:15	NA	3.18	1.0	18.13	8.07	17.55	102.3	8.7
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	21:15	NA	3.18	1.5	18.12	8.08	17.55	102.6	8.74
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	21:15	NA	3.18	2.0	18.11	8.08	17.55	102.9	8.76
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/2/2005	21:15	NA	3.18	3.0	18.11	8.08	17.55	102.8	8.75
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	2:30	NA	3.68	0.5	17.58	7.94	17.47	96.2	8.26
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	2:30	NA	3.68	1.0	17.59	7.96	17.47	95.4	8.2
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	2:30	NA	3.68	1.5	17.58	7.98	17.48	95.5	8.21
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	2:30	NA	3.68	2.0	17.59	7.98	17.48	95.6	8.22
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	2:30	NA	3.68	3.0	17.58	7.99	17.48	95.6	8.22
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	9:30	0.90	1.96	0.5	15.64	7.44	15.97	79.4	7.05
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	9:30	0.90	1.96	1.0	15.64	7.45	15.97	73.2	6.59
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	9:30	0.90	1.96	1.5	15.71	7.45	15.98	72.5	6.54
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	13:45	0.90	2.14	0.5	16.38	7.53	15.64	85.3	7.54
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	13:45	0.90	2.14	1.0	15.94	7.43	15.74	77.6	6.98
BAC19	Bayou Caddy	0.2 mi up Bayou from Mouth	30 14' 16.5"	89 25' 41.1"	11/3/2005	13:45	0.90	2.14	1.5	15.93	7.38	15.9	74.4	6.67
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	0.5	19.64	8.15	3.61	118.5	10.64
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	1.0	19.52	7.93	3.69	111.7	10.03
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	1.5	19.37	7.85	3.82	109.5	9.71

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							Secchi	Total	Hydrographic profiling					
					Date	Time	Disk	Depth	Depth	Temperature	pH	Salinity	DO	DO
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	(m)	(C)	(units)	(ppt)	(%)	(mg/L)
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	2.0	19.3	7.75	3.93	104.3	9.4
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	3.0	18.97	7.57	5.42	95.7	8.66
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	4.0	18.68	7.48	7.02	88.1	7.85
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	5.0	18.6	7.42	8.24	80.9	7.17
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	6.0	18.54	7.41	8.88	78.3	6.96
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	7.0	18.53	7.4	9.24	76.6	6.77
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	8.0	18.55	7.4	9.49	74.8	6.62
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	16:30	0.70	9.00	8.5	18.55	7.4	9.54	73.6	6.51
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	0.5	19.35	7.78	3.71	108.7	9.8
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	1.0	19.32	7.75	3.75	108.5	9.78
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	1.5	19.29	7.71	3.78	107.0	9.65
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	2.0	19.29	7.7	3.84	106.7	9.63
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	3.0	19.09	7.65	4.16	103.6	9.34
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	4.0	18.72	7.52	5.6	92.5	8.3
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	5.0	18.56	7.41	7.92	83.0	7.35
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	6.0	18.52	7.4	9.04	78.0	6.91
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	7.0	18.52	7.41	9.12	86.3	6.77
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	8.0	18.54	7.4	9.34	74.6	6.59
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/2/2005	20:00	NA	8.79	8.5	18.56	7.39	9.52	72.4	6.4
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	0.5	18.81	7.78	3.14	98.3	8.98
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	1.0	18.83	7.65	3.15	98.3	8.96
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	1.5	18.96	7.6	3.21	99.0	9.04
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	2.0	19.08	7.58	3.29	99.7	9.05
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	3.0	19.03	7.54	4.33	98.7	8.9
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	4.0	18.33	7.5	7.16	91.9	8.24
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	5.0	18.22	7.52	7.98	87.5	7.85
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	6.0	18.38	7.5	8.98	82.7	7.3
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	7.0	18.44	7.47	8.67	77.6	6.91
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	8.0	18.58	7.4	9.33	67.2	5.95
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	4:00	NA	9.55	9.0	18.66	7.34	9.63	63.3	5.57
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	0.5	18.58	7.57	3.22	92.3	6.48
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	1.0	18.53	7.47	3.27	88.5	6.13
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	1.5	18.68	7.4	3.5	87.0	7.96

Table 3. Hydrology Data (Nov. 2-3, 2005) for the WRRI Project " " Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

					Date	Time	Secchi Disk	Total Depth	Hydrographic profiling					
Site #	Name	Description	Latitude	Longitude	Collected	Collected	(m)	(m)	Depth (m)	Temperature (C)	pH (units)	Salinity (ppt)	DO (%)	DO (mg/L)
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	2.0	18.97	7.36	3.85	86.9	7.89
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	3.0	18.66	7.31	5.2	83.4	7.5
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	4.0	18.54	7.29	7.79	76.4	6.83
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	5.0	18.52	7.32	8.42	73.3	6.51
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	6.0	18.51	7.34	8.55	72.8	6.48
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	7.0	18.51	7.35	8.74	72.0	6.4
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	8.0	18.55	7.34	8.95	70.3	6.22
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	8:10	0.70	9.05	8.5	18.59	7.33	9.11	67.4	5.96
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	0.5	19.91	8.02	3.3	125.8	11.32
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	1.0	1917	7.81	3.66	103.9	9.34
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	1.5	19.08	7.44	4.22	84.8	7.65
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	2.0	19	7.34	5.08	79.4	7
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	3.0	18.66	7.24	7.18	75.1	6.73
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	4.0	18.48	7.28	7.68	77.8	6.97
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	5.0	18.36	7.3	8.2	78.2	7
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	6.0	18.25	7.32	8.57	79.2	7.1
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	7.0	18.33	7.33	8.78	77.2	6.88
PER20	Pearl River	North of Hw 90 Bridge	30 14' 24.7"	89 36' 52.1"	11/3/2005	14:40	0.65	8.07	7.5	18.35	7.31	8.91	74.3	6.62
DAB23	Davis Bayou	Beach at Holcomb Blvd.	30 23' 37.8"	88 48' 37.2"	11/2/2005	14:00	0.70	1.00	0.5	18.63	7.85	11.2	111.4	9.74
DAB23	Davis Bayou	Beach at Holcomb Blvd.	30 23' 37.8"	88 48' 37.2"	11/2/2005	21:00	NA	1.00	0.5	17.94	8.14	12.23	96.4	8.49
DAB23	Davis Bayou	Beach at Holcomb Blvd.	30 23' 37.8"	88 48' 37.2"	11/3/2005	2:45	NA	1.00	0.5	17.22	8.04	23.15	94.8	7.93
DAB23	Davis Bayou	Beach at Holcomb Blvd.	30 23' 37.8"	88 48' 37.2"	11/3/2005	9:10	1.00	1.00	0.5	17.05	7.96	22.5	96.7	8.16
DAB23	Davis Bayou	Beach at Holcomb Blvd.	30 23' 37.8"	88 48' 37.2"	11/3/2005	14:45	1.00	1.00	0.5	19.73	8.17	21.35	120.4	9.7
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	11/2/2005	14:00	0.85	0.85	0.5	21.9	7.7	18.41	107.8	8.98
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	11/2/2005	20:00	N/A	1	0.5	13.2	7.79	18.73	94.7	7.98
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	11/3/2005	2:00	N/A	0.88	0.5	18.27	7.84	20.24	99	8.25
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	11/3/2005	8:00	0.82	0.82	0.5	17.38	7.72	19.29	93.6	7.97
WAV27	Waveland Beach	Beach at St. Claire Church	30 16' 37.1"	89 22' 25.2"	11/3/2005	14:00	0.86	0.86	0.5	19.64	7.86	18.08	109.3	8.99
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	11/2/2005	14:00	void	void	void	void	void	void	void	void
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	11/2/2005	20:00	NA	1.00	0.5	18.41	8.21	12.56	115.8	10.09
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	11/3/2005	2:00	NA	1.00	0.5	16.86	8.2	12.48	106.0	9.6
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	11/3/2005	8:15	1.00	1.00	0.5	16.11	8.17	25.89	105.5	8.88
ROA28	Rodenberg Ave.	Beach at Rodenberg Ave.	30 23' 32.6"	88 56' 17.5"	11/3/2005	14:00	void	void	void	void	void	void	void	void

Table 4. Nutrient data (Nov. 2-3, 2005) for WRRI project "Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

Station Code	Level	Sample Location	Latitude (º ')	Longitude (º ')	Date	Time	Sample Depth (m)	Turbidity (NTU)	Chlorophyll *a* (ug/L)	Pheo-*a* (ug/L)	Total Ammonia (mg/L-N)	Total Kjeldahl Nitrogen (mg/L-N)	Total Nitrate Nitrite (mg/L-N)	Total Phosphate (mg/L-P)	Total Suspended Solids (mg/L)	County
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	14:48	0.5	9.0	void	void	0.14	1.02	0.03	3.68	21	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	14:48	0.5		void	void	0.14	0.64	< 0.02	4.19	20	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	14:48	1.3	10.0	void	void	0.11	1.14	0.03	4.53	32	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	14:48	1.3		void	void	0.12	0.91	0.02	3.51	25	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	14:48	2.0	8.0	void	void	< 0.10	0.69	0.02	2.17	49	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	14:48	2.0		void	void	< 0.10	0.97	0.03	2.54	18	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	20:05	0.5	4.0	void	void	< 0.10	0.90	0.04	1.82	25	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	20:05	1.3	4.0	void	void	< 0.10	0.67	0.03	1.41	10	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	11/02/05	20:05	2.0	6.0	void	void	< 0.10	0.61	0.02	1.50	31	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	2:36	0.5	5.0	void	void	0.14	1.07	0.02	3.75	31	Jackson
BCA03	Middle	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	2:36	1.0	8.0	void	void	0.15	0.83	0.02	3.94	14	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	2:36	1.5	5.0	void	void	0.15	0.72	0.02	3.39	21	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	8:00	0.5	8.0	void	void	0.11	0.31	< 0.02	2.36	19	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	8:00	1.0	9.0	void	void	0.10	0.62	0.02	2.75	32	Jackson
BCA03	Surface	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	14:00	0.5	6.0	void	void	0.15	0.70	0.03	2.81	17	Jackson
BCA03	Bottom	Bayou Casotte	30 21 20.5	88 30 23.3	11/03/05	14:00	1.0	9.0	void	void	0.11	0.42	< 0.02	2.77	23	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	11/02/05	17:26	0.5	3.0	void	void	< 0.10	0.72	0.04	0.06	47	Jackson
ROI06	Middle	Round Island	30 18 36.9	88 32 41.1	11/02/05	17:26	1.0	4.0	void	void	< 0.10	0.41	0.04	0.05	38	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	11/02/05	17:26	1.5	2.0	void	void	< 0.10	0.60	0.04	0.06	22	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	11/02/05	21:25	0.5	2.0	void	void	< 0.10	0.56	0.02	0.06	37	Jackson
ROI06	Middle	Round Island	30 18 36.9	88 32 41.1	11/02/05	21:25	1.0	2.0	void	void	< 0.10	0.55	0.04	0.05	72	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	11/02/05	21:25	1.5	2.0	void	void	< 0.10	0.46	0.03	0.05	35	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	11/03/05	3:50	0.5	2.0	void	void	< 0.10	0.33	0.04	0.04	20	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	11/03/05	3:50	0.5	2.0	void	void	< 0.10	0.31	0.04	0.06	13	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	11/03/05	3:50	1.0	2.0	void	void	< 0.10	0.76	0.04	0.04	9	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	11/03/05	3:50	1.0	2.0	void	void	< 0.10	0.58	0.03	0.10	11	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	11/03/05	9:10	0.5	3.0	void	void	< 0.10	0.48	< 0.02	0.05	5	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	11/03/05	9:10	1.0	3.0	void	void	< 0.10	0.28	0.03	0.04	13	Jackson
ROI06	Surface	Round Island	30 18 36.9	88 32 41.1	11/03/05	14:50	0.5	3.0	void	void	< 0.10	0.43	0.04	0.09	10	Jackson
ROI06	Bottom	Round Island	30 18 36.9	88 32 41.1	11/03/05	14:50	1.0	3.0	void	void	< 0.10	0.48	0.02	0.06	22	Jackson
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	11/02/05	15:50	0.5	6.0	void	void	< 0.10	0.60	0.04	0.06	13	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	11/02/05	15:50	3.5	7.0	void	void	< 0.10	0.79	0.03	0.08	14	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	11/02/05	15:50	6.5	7.0	void	void	< 0.10	0.76	0.03	0.06	21	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	11/02/05	21:20	0.5	6.0	void	void	< 0.10	0.87	0.07	0.13	23	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	11/02/05	21:20	3.5	6.0	void	void	< 0.10	0.87	0.04	0.09	24	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	11/02/05	21:20	6.5	7.0	void	void	< 0.10	0.78	< 0.02	0.07	25	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	3:30	0.5	9.0	void	void	< 0.10	0.45	0.07	0.06	10	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	3:30	3.5	9.0	void	void	< 0.10	0.58	0.07	0.05	13	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	3:30	6.5	9.0	void	void	< 0.10	0.61	0.04	0.04	9	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	10:20	0.5	10.0	void	void	< 0.10	0.60	0.08	0.05	11	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	10:20	3.0	8.0	void	void	< 0.10	0.71	0.04	0.05	6	Harrison
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	10:20	6.5	8.0	void	void	< 0.10	0.51	0.05	0.08	11	Harrison
POF08	Surface	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	15:25	0.5	11.0	void	void	< 0.10	0.61	0.13	0.10	15	Harrison
POF08	Middle	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	15:25	3.0	11.0	void	void	< 0.10	0.64	0.05	0.20	18	Harrison

Table 4. Nutrient data (Nov. 2-3, 2005) for WRRI project "Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

							Sample				Total	Total Kjeldahl	Total Nitrate	Total	Total Suspended	
POF08	Bottom	Popp's Ferry	30 24 57.3	88 58 40.6	11/03/05	15:25	6.5	11.0	void	void	< 0.10	0.61	0.04	0.06	14	Harrison
BBI14	Surface	Bayou Bernard	30 24 57.3	89 00 13.6	11/02/05	14:00	0.5	15.0	void	void	< 0.10	1.16	0.25	0.09	39	Harrison
BBI14	Middle	Bayou Bernard	30 24 57.3	89 00 13.6	11/02/05	14:00	4.5	13.0	void	void	< 0.10	0.44	0.18	0.10	15	Harrison
BBI14	Bottom	Bayou Bernard	30 24 57.3	89 00 13.6	11/02/05	14:00	9.5	11.0	void	void	< 0.10	0.28	0.11	0.06	19	Harrison
BBI14	Surface	Bayou Bernard	30 24 57.3	89 00 13.6	11/02/05	20:00	0.5	10.0	void	void	< 0.10	0.93	0.04	0.08	19	Harrison
BBI14	Middle	Bayou Bernard	30 24 57.3	89 00 13.6	11/02/05	20:00	5.5	9.0	void	void	< 0.10	0.38	0.05	0.06	17	Harrison
BBI14	Bottom	Bayou Bernard	30 24 57.3	89 00 13.6	11/02/05	20:00	11.5	9.0	void	void	< 0.10	0.66	0.06	0.09	14	Harrison
BBI14	Surface	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	2:15	0.5	11.0	void	void	< 0.10	0.90	0.16	0.11	20	Harrison
BBI14	Middle	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	2:15	2.0	9.0	void	void	< 0.10	0.46	0.06	0.07	15	Harrison
BBI14	Bottom	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	2:15	3.5	9.0	void	void	< 0.10	0.61	0.05	0.07	9	Harrison
BBI14	Surface	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	8:05	0.5	12.0	void	void	< 0.10	0.93	0.08	0.09	22	Harrison
BBI14	Surface	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	8:05	0.5	12.0	void	void	< 0.10	0.85	0.14	0.09	9	Harrison
BBI14	Middle	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	8:05	1.5	12.0	void	void	< 0.10	0.72	0.14	0.08	11	Harrison
BBI14	Middle	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	8:05	1.5	12.0	void	void	< 0.10	0.73	0.08	0.16	17	Harrison
BBI14	Bottom	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	8:05	2.5	20.0	void	void	< 0.10	0.99	0.12	0.14	23	Harrison
BBI14	Bottom	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	8:05	2.5	20.0	void	void	< 0.10	1.18	0.12	0.16	38	Harrison
BBI14	Surface	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	14:00	0.5	16.0	void	void	< 0.10	0.45	0.18	0.10	19	Harrison
BBI14	Middle	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	14:00	2.0	21.0	void	void	< 0.10	1.14	0.13	0.11	13	Harrison
BBI14	Bottom	Bayou Bernard	30 24 57.3	89 00 13.6	11/03/05	14:00	3.5	25.0	void	void	< 0.10	0.79	0.12	0.09	20	Harrison
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	15:15	0.5	6.0	void	void	< 0.10	0.75	< 0.02	0.12	9	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	15:15	1.5	8.5	void	void	< 0.10	0.43	< 0.02	0.12	30	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	15:15	3.0	7.7	void	void	< 0.10	0.69	< 0.02	0.04	18	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	21:15	0.5	4.2	void	void	< 0.10	0.47	< 0.02	0.05	37	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	21:15	0.5		void	void	< 0.10	0.46	< 0.02	0.05	10	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	21:15	1.5	4.3	void	void	< 0.10	0.49	< 0.02	0.04	18	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	21:15	1.5		void	void	< 0.10	0.51	< 0.02	0.03	26	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	21:15	3.0	6.1	void	void	< 0.10	0.49	< 0.02	0.07	24	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	11/02/05	21:15	3.0		void	void	< 0.10	0.61	< 0.02	0.05	18	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	2:30	0.5	6.2	void	void	< 0.10	0.47	< 0.02	0.04	11	Hancock
BAC19	Middle	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	2:30	1.5	12.4	void	void	< 0.10	0.41	< 0.02	0.08	13	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	2:30	3.0	11.2	void	void	< 0.10	0.33	< 0.02	0.05	19	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	9:30	0.5	7.5	void	void	< 0.10	0.43	< 0.02	0.09	14	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	9:30	1.5	13.6	void	void	< 0.10	0.56	< 0.02	0.09	18	Hancock
BAC19	Surface	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	13:45	0.5	6.6	void	void	< 0.10	0.91	< 0.02	0.08	16	Hancock
BAC19	Bottom	Bayou Caddy	30 14 16.5	89 25 41.1	11/03/05	13:45	1.5	8.0	void	void	< 0.10	0.78	< 0.02	0.05	18	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	11/02/05	16:30	0.5	6.4	void	void	< 0.10	0.92	< 0.02	0.06	10	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	11/02/05	16:30	4.5	7.0	void	void	< 0.10	0.66	< 0.02	0.06	9	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	11/02/05	16:30	8.5	9.9	void	void	< 0.10	0.49	< 0.02	0.07	14	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	11/02/05	20:00	0.5	6.0	void	void	< 0.10	0.78	< 0.02	0.04	7	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	11/02/05	20:00	4.5	6.3	void	void	< 0.10	0.88	< 0.02	0.13	10	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	11/02/05	20:00	8.5	9.0	void	void	< 0.10	0.57	< 0.02	0.10	15	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	11/03/05	4:00	0.5	6.5	void	void	< 0.10	0.69	< 0.02	0.07	4	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	11/03/05	4:00	0.5		void	void	< 0.10	0.56	< 0.02	0.05	10	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	11/03/05	4:00	5.0	6.9	void	void	< 0.10	0.40	< 0.02	0.06	6	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	11/03/05	4:00	5.0		void	void	< 0.10	0.85	< 0.02	0.06	10	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	11/03/05	4:00	9.0	8.4	void	void	< 0.10	0.36	< 0.02	0.08	13	Hancock

Table 4. Nutrient data (Nov. 2-3, 2005) for WRRI project "Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters"

							Sample				Total	Total Kjeldahl	Total Nitrate	Total	Total Suspended	
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	11/03/05	4:00	9.0		void	void	< 0.10	0.74	< 0.02	0.07	9	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	11/03/05	8:10	0.5	6.9	void	void	< 0.10	0.63	< 0.02	0.04	10	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	11/03/05	8:10	4.5	5.9	void	void	< 0.10	0.55	< 0.02	0.04	13	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	11/03/05	8:10	8.5	11.1	void	void	< 0.10	0.48	< 0.02	0.06	15	Hancock
PER20	Surface	Pearl River	30 14 24.7	89 36 52.1	11/03/05	14:40	0.5	8.8	void	void	< 0.10	1.04	< 0.02	0.08	8	Hancock
PER20	Middle	Pearl River	30 14 24.7	89 36 52.1	11/03/05	14:40	3.5	5.6	void	void	< 0.10	0.71	< 0.02	0.04	6	Hancock
PER20	Bottom	Pearl River	30 14 24.7	89 36 52.1	11/03/05	14:40	7.5	8.7	void	void	< 0.10	0.37	< 0.02	0.13	13	Hancock
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	11/02/05	14:40	0.5	10.0	void	void	< 0.10	0.57	0.03	0.10	23	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	11/02/05	21:00	0.5	5.0	void	void	< 0.10	0.45	< 0.02	0.04	17	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	11/03/05	2:45	0.5	5.0	void	void	< 0.10	0.91	< 0.02	0.05	21	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	11/03/05	9:10	0.5	8.0	void	void	< 0.10	0.51	< 0.02	0.10	22	Jackson
DAB23	Surface	Davis Bayou	30 23 37.8	88 48 37.2	11/03/05	14:45	0.5	10.0	void	void	< 0.10	0.61	< 0.02	0.05	12	Jackson
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	11/02/05	14:00	0.5	4.0	void	void	< 0.10	0.77	< 0.02	0.08	17	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	11/02/05	20:00	0.5	5.0	void	void	< 0.10	0.75	< 0.02	0.05	11	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	11/03/05	2:00	0.5	3.0	void	void	< 0.10	0.61	0.02	0.10	11	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	11/03/05	8:00	0.5	4.0	void	void	< 0.10	0.51	< 0.02	0.05	6	Hancock
WAV27	Surface	Waveland Beach	30 16 37.1	89 22 25.2	11/03/05	14:00	0.5	3.0	void	void	< 0.10	0.27	< 0.02	0.06	8	Hancock
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	11/02/05	14:00	0.5		void	void	< 0.10	0.65	< 0.02	0.05	60	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	11/02/05	20:00	0.5	3.0	void	void	< 0.10	0.24	< 0.02	0.08	46	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	11/03/05	2:00	0.5	2.0	void	void	< 0.10	0.39	< 0.02	0.05	14	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	11/03/05	8:00	0.5	3.0	void	void	< 0.10	0.29	< 0.02	0.05	8	Harrison
ROA28	Surface	Rodenberg Avenue	30 23 32.6	88 56 17.5	11/03/05	14:00	0.5		void	void	< 0.10	0.67	< 0.02	0.07	5	Harrison

*Chlorophyll a samples were stored in an ultralow freezer that failed. Samples had to be discarded.

Analysis of Stream Bank Erosion by Lateral Ground Water Flow

Basic Information

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ANALYSIS OF STREAM BANK EROSION BY LATERAL GROUND WATER FLOW

FINAL TECHNICAL REPORT

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ABSTRACT

Subsurface flow is known to contribute significantly to stream flow but its contribution to streambank failure, a process which may contribute significantly to sediment loading in streams, is not well known. Research is needed in understanding the contribution of concentrated, lateral subsurface flow to streambank failure and the hydraulic properties controlling seepage erosion. Laboratory experiments were conducted with two-dimensional soil lysimeters to observe subsurface flow induced erosion of bank faces under controlled conditions. Experiments were performed with single-layer sediment and also layered profiles to mimic streambanks where seepage erosion has been observed. The lysimeter experiments were compared to in-situ measurements of seepage discharge and erosion at field sites in Northern Mississippi. The soil and hydraulic conditions controlling seepage erosion were investigated. Changes in soil water pressure were monitored and modeled using a two-dimensional variably-saturated flow code to deduce information regarding soil water pressures at the time of bank failure and tension crack formation. A seepage erosion sediment transport model is proposed for the long-term goal of incorporation into a combined bank stability/ground water flow models for predicting streambank failure by seepage.

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ANALYSIS OF STREAM BANK EROSION BY LATERAL GROUND WATER FLOW

INTRODUCTION

There exists an incomplete understanding of one of the basic mechanisms governing sediment loading to streams by streambank failure: erosion by concentrated lateral, subsurface flow. This research hypothesizes that erosion by subsurface flow is important in promoting stream bank failure and sediment loading to streams in numerous geographical locations. Subsurface flow is known to contribute significantly to stream flow. Flow through large macropores or pipes, commonly referenced to as pipeflow (Jones, 1997), can cause subsurface flow to dominate overland flow in some catchments. High infiltration rates can cause the development of perched water tables above water-restricting horizons in riparian soils (Wilson et al., 1991). As perched water tables rise on these less permeable layers, large hydraulic gradients can initiate towards stream channels, causing fairly rapid subsurface flow (interflow or throughflow) to streams (Figure 1). Hagerty (1991a, 1991b) reports that even seemingly slight changes in soil texture can result in considerable hydraulic conductivity contrasts between layers and form perched water tables in layered soils. Subsurface flow over perched water tables can contribute in gully formation, as shown in Figure 2 (Istanbulluoglu et al., 2005; Bryan, 2000; Romkens et al., 1997; Froese et al., 1999). Shallow subsurface flow plays a critical role in erosion in interacting with surface runoff mechanisms.

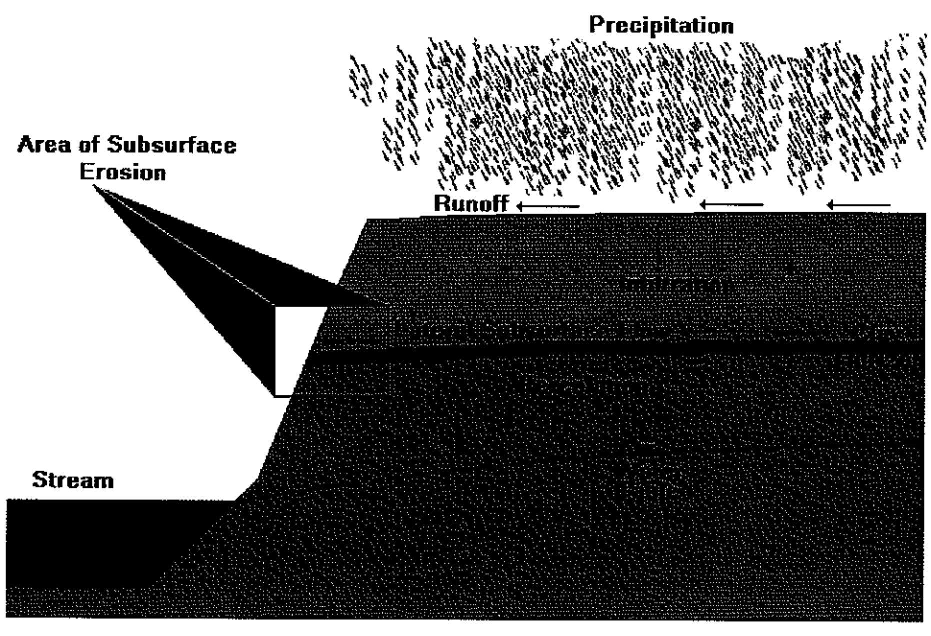

Figure 1 - Depiction of subsurface flow erosion mechanism of infiltrated water flowing in perched water tables in riparian zones adjacent to streams. Source: Fox et al. (2006).

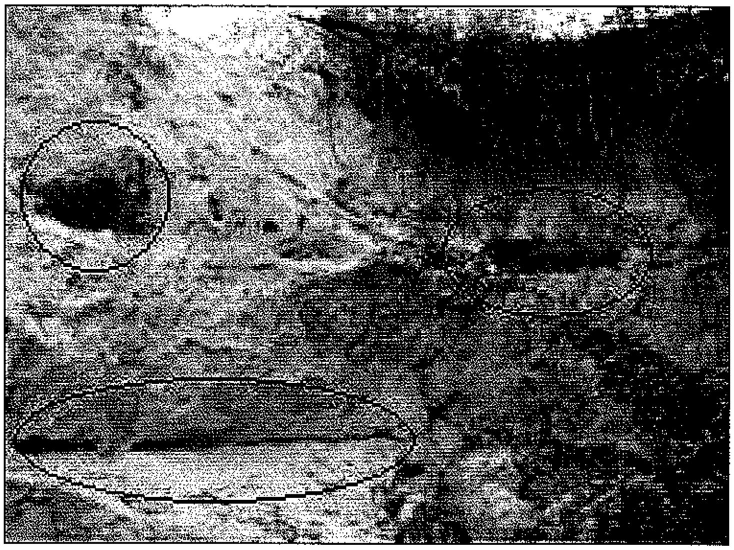

Figure 2 - Example of typical liquefaction of streambank sediment and headward migration of gully face along Little Topashaw Creek (LTC) in Northern Mississippi.

Research has begun to investigate the interaction of surface erosion, fluidization, and slumping whereby the onset of erosion was controlled not only by surficial flows but also hydrodynamic stress from groundwater seepage (Lobkovskey et al., 2004; Jones, 1997). Indoor flume studies indicate that surface erosion rates increase by an order of magnitude when groundwater increased unsaturated pore-water pressures thereby decreasing soil shear strength (Rockwell, 2002; Owoputi and Stolte, 2001). Most researchers investigating the role of seepage on erosion and undermining of hillslopes have focused on the seepage pressure as a body force acting on some representative sediment volume (Howard and McLane, 1988; Iverson and Major, 1986). Iverson and Major (1986) analyzed the physical effects of groundwater seepage on slope stability. They proposed that the force vector proportional to the hydraulic gradient is responsible for hillslope failure (Iverson and Major, 1986). Howard and McLane (1988) suggested that surface grains of cohesionless sediment eroded by groundwater are acted upon by three forces: gravity, a traction force defined as the sum of all forces on the seepage face, and a seepage force exerted on the sediment grain by groundwater seepage. Seepage forces predominate in a narrow "sapping zone" at the flow discharge, and erosion occurs by bulk sediment movement in this zone. Howard and McLane (1988) expressed the seepage force (F_s) and tractive force (F_t) as:

layer at the bottom and a 10 cm thick LS layer. The small lysimeter utilized a 40 cm SiL topsoil layer. Two SiL layer thicknesses were investigated in the large lysimeter: 50 cm and 80 cm. Before the start of the experiments, the lysimeters were saturated for 24 hours to achieve a consistent antecedent moisture condition. Following the 24 hour period, the lysimeters were drained for 24 hours to achieve field capacity. Two cameras were installed to monitor the experiments. One camera captured the front view of the lysimeters and another camera captured the discharge end of the lysimeters focused on the LS layer. Water was added to the inflow reservoir to achieve the desired head. The time water first discharged through the LS layer into the outlet flume was recorded. As the LS layer eroded and the undercutting occurred, flow and sediment samples were collected in sampling bottles at regular intervals. The undercutting of the LS layer was recorded by measuring the distance of undercutting from the end of the lysimeter. Experiments were performed until bank collapse occurred. In total, two experiments were performed for the single noncohesive soil layer with a constant inflow water head of 30 cm, horizontal lysimeter, and vertical bank face. Eleven lysimeter experiments were performed with reconstructed LTC streambank profiles by varying the inflow water head (30, 40, 60, or 90 cm), bank height of SiL (40 cm, 50 cm or 80 cm), and lysimeter slope (0%, 5%, or 10%). The bank face was cut to vertical for the 5 and 10% slopes. Discharge and sediment concentrations measured during seepage erosion in the lysimeter experiments were used to derive a sediment transport model that related discharge over perched water tables to sediment discharge.

Objective 3: Modify an existing conceptual model for stream bank instability to include the effects of erosion by lateral, subsurface flow

Initial bank stability modeling was performed during the reporting period; however, the third objective of the original proposal (i.e., modify an existing conceptual model for stream bank instability) was not accomplished during the reporting period. The PI and collaborators are continuing to work on development of such a model that incorporates the theoretical developments on seepage erosion described in this report. It is expected that development of a combined streambank stability and seepage erosion model will be released in the next two years.

The USDA-ARS Streambank Stability model (Simon and Curini, 1998; Simon and Thomas, 2002) was run for the lysimeter morphology using default properties for the materials. The friction angle, ϕ, and maximum angle, θ_c, were set to 15° and 25°, respectively. Measured soil water pressures for the top soil and restrictive layer were used and the water pressure imposed upon the conductive layer was varied to determine the impact of variable heads of water perched within the conductive layer. As an alternative to using measured soil water pressures with depth, the model was run by varying the depth of the static water table with the water pressures in the soil profile set to be in equilibrium with the water table (Wilson et al., 2006).

RESULTS AND DISCUSSION

Bank Characterization

Soil bank profiles were generally described as a thick (1.5 m) surface layer of silt loam (SiL) material that transition into a sandy loam (SL) from 1.5 to around 2 m depth (data not shown). The profile below this depth generally exhibited a sequence of alternating thin (10-15 cm) layers of contrasting texture reflecting the alluvial deposition. The samples taken in the conductive layer over restrictive layer seeps revealed the conductive layer to be a loamy sand (LS) with over 85% sand made up of predominately (98%) medium to very fine sand. The restrictive layer below had only a 16% increase in clay content such that the actual texture was a loam (L). Hagerty (1991a) reports that even seemingly slight changes in soil texture can result in considerable hydraulic conductivity contrasts between layers. This was clearly seen at these seeps as the saturated hydraulic conductivity decreased by two and a half orders of magnitude for the LS (1.4 x 10^3 cm d^{-1}) to the L (5.4 cm d^{-1}), Table 1.

Table 1 - Soil properties determined at selected seep locations.

Texture	Sand	Clay	Bulk Density	K_s	θ_s	θ_r	α	n
	%	%	g cm^{-3}	cm d^{-1}	cm^3 cm^{-3}	cm^3 cm^{-3}	cm^{-1}	
SiL	33	15	1.39	63.9	0.39†	0.06 †	0.006 †	1.6 †
LS	87	5	1.50	1453.1	0.40	0.03	0.012	2.0
L	39	21	1.61	5.4	0.44	0.05	0.009	1.7

K_s is the saturated hydraulic conductivity, θ_s is the saturated water content, and θ_r is the residual water content, and parameters, α, and n coincide with the van Genuchten water retention model with the Mualem approach. SiL is silt loam, LS is loamy sand, and L is loam.

† These values were derived from the pedotransfer function developed by Schaap et al. (1998) based upon the measured sand, silt, clay and bulk density.

In Situ Measurements

Seepage erosion was observed on several occasions at eight seeps along a 800 m reach of the LTC following storm events (Table 2, two seeps not listed). One of the seeps occurred as preferential flow through an open crack in a thick clay layer and another seep appeared to be preferential flow through a crack that was filled with silt loam material translocated from layers above. The remaining seeps occurred as subsurface flow through a conductive layer above a water restrictive layer.

Table 2 - Flow and sediment concentration characteristics of seeps along LTC.

			Sediment Concentration ($g L^{-1}$)			Flow Rate ($L d^{-1}$)		
Seep	**Description†**	**n**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**
1	LS over restrictive layer	5	50.1	138.1	0.4	110	317	17
2	LS over restrictive layer	7	472.1	659.4	294.0	187	330	119
3	LS over restrictive layer	4	96.5	205.1	3.5	142	239	34
4	silt filled fracture	4	369.0	642.9	137.5	111	203	9
5	open fracture	4	10.8	21.4	2.1	462	931	35
6	SiL over restrictive layer	5	96.8	388.1	1.1	68	175	4

n is the number of measurements made with time, LS is Loamy Sand, and SiL is Silt Loam.
† Textures were estimated in the field by the feel method.

Measurements of seep flow and sediment concentrations were made on multiple occasions between February and July of 2003 (Table 2). Due to the hazardous conditions of measuring seepage erosion from unstable banks, measurements were made between two to five days following rainfall events depending upon the magnitude of the event causing the subsurface flows. Therefore, these seepage measurements may under-estimate the flow rates and thus the seepage erosion rates experienced during storms.

Overall, seepage flow rates ranged by two and a half orders of magnitude (4 to 931 $L d^{-1}$) with an average of 174 $L d^{-1}$ and a coefficient of variation (CV) of 119%. Seeps (1-3), characterized as flow through a conductive layer over a restrictive layer, had similar flow rates that averaged 152 $L d^{-1}$ and the lowest variability of the different type seeps (CV=62%). The seep (5) through an open fracture exhibited the highest flow rates averaging 462 $L d^{-1}$. This seep also had the greatest range in flow rates with values from 35 to 931 $L d^{-1}$ and a CV of 99%. In contrast, the seep (4) through a fracture filled with silt loam material had about one forth the flow rate of the open fracture (averaged 111 $L d^{-1}$) and lower variability with a CV of 77%. The texture of the conductive layer clearly had a significant effect on the flow rate as the seep (6) occurring through a silt loam layer over a restrictive layer had the lowest flow rates which averaged 68 $L d^{-1}$ but the highest variability with CV of 115% of the different type seeps.

The sediment concentrations were even more variable than the flow rates with concentrations ranging by three and half orders of magnitude (Table 2). Surprisingly, seeps (1-3) occurring through a loamy sand (LS) conductive layer over a restrictive layer exhibited the lowest (0.4 $g L^{-1}$) and the highest (660 $g L^{-1}$) individual sediment concentrations. Seepage erosion from these seeps exhibited liquefaction of the LS conductive layer with sediment concentrations averaging 246 $g L^{-1}$ and a CV of 93%. The individual sediment concentrations were correlated to the flow rates by a power law relationship, with an r^2 value of 0.68, for the three conductive over restrictive layer seeps combined. Seeps 1 and 3 exhibited high correlations with r^2 values of 0.82, and 0.64, respectively. Seep 2 had the highest flow rates of the three conductive layer seeps, and consistently high sediment concentrations which, as a result, did not exhibit a correlation. In fact, seep 2 had the highest average sediment concentration of all the seeps, Table 2. In contrasts, the seep through a silt loam (SiL) layer over a restrictive layer (seep 6) had similar sediment concentrations to seeps 1-3 but with lower flow rates due to the less conductive material over the restrictive layer (Figure 4). The result was a weak power law relationship (r^2 value of 0.11) for seep 6.

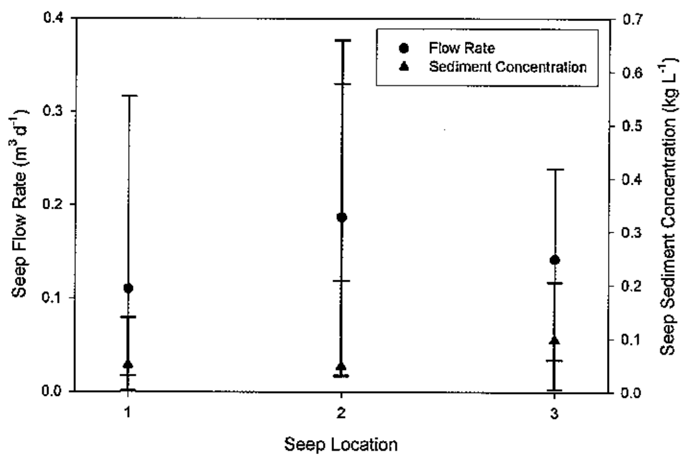

Figure 4 - Flow rate and sediment concentrations measured at selected seep locations along Little Topashaw Creek. Flow rate and sediment concentrations were sampled five times at seep 1, seven times at seep 2, and four times at seep 3.

The second highest mean sediment concentration was for seep 4 which occurred as flow through a fracture that was filled with silt material. As the sediment concentration in seep 4 increased the flow rate was restricted, thereby resulting in a negative relationship to flow rate (negative exponent of -0.2). In contrasts, seep 5 appeared as flow through an open fracture. Seep 5 had the highest flow rates of all seeps but the lowest sediment concentrations. Since this open-fracture seep was supply limited, the higher the flow rate the greater the detachment thereby, producing a high correlation to flow rate (r^2 value of 0.95). It is possible that the seep 5 fractures were filled at some time but the silt had flushed from within their fracture volumes prior to these measurements.

Hydrologic differences among seeps resulted in an overall power law relationship (equation in Figure 4) that had an r^2 value of 0.13, however, if the two high flow rates for seep 5 are omitted as outliers, the overall r^2 increases to 0.28. The high sediment concentrations exhibited by the sapping zone for LS conductive layers over restrictive layers rapidly undercut the overlying soil profiles. Sapping erosion left the soil above unsupported which fostered streambank failure, thereby ending the seep measurements.

Laboratory Lysimeter Experiments

The small lysimeter (40 cm tall) experiments were unable to mimic flow rates observed in the field due to its limited head range at the inflow water reservoir (i.e., 40 cm). Small lysimeter flow rates averaged 0.013 m^3 d^{-1} to 0.037 m^3 d^{-1} for the 0, 5, and 10% slope experiments. However, sediment concentrations due to seepage erosion (1.1-1.3 kg L^{-1}) were higher than concentrations measured in situ due to the inability to mimic macroscopic soil structure due to organic and Fe-oxides that formed interparticle bridges. The small lysimeter was unable to mimic bank failure processes. Bank failure was not consistently observed despite significant undercutting of the bank. A 0% slope experiment failed to produce bank failure by the end of the experiment (60 minutes) while only one of two experiments at the 5% and 10% slopes produced minimal failure. Bank failures occurred prior to the establishment of positive pore water pressures in the SiL, suggesting that bank failure occurred under unsaturated conditions and that bank failure, which has a propensity to occur during the recession limb of hydrographs, may be due more so to interflow seepage erosion than deceased in bank shear strength due to the loss of matrix suction.

The large lysimeter allowed greater inflow water heads which were capable of mimicking hydraulic profiles through relatively thick SiL layers (i.e., 1.5-2.5 m) in the field and therefore seepage erosion, tension crack formation, and bank failure (Figure 5). Discharge in the eight lysimeter experiments averaged 0.12 m^3 d^{-1} with a CV of 46% and was within field measured rates. Seepage erosion rates averaged 1.87 kg L^{-1} with a CV of 16% and were again larger than observed in the field.

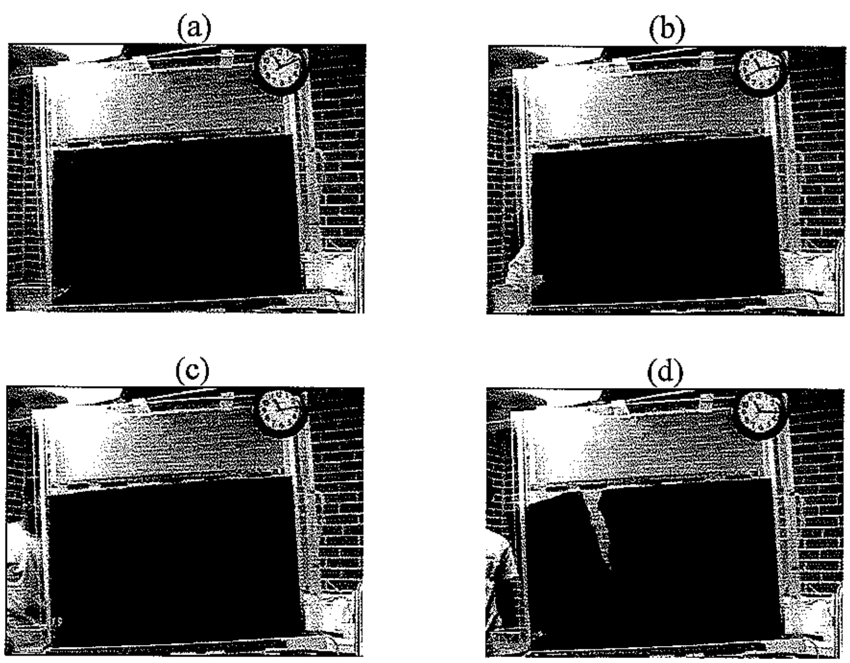

Figure 5 - Typical time series of bank failure of reconstructed streambank profiles due to subsurface erosion: (a) sapping erosion, (b) undermining, (c) tension crack formation, and (d) collapse.

Definitive patterns were observed between bank collapse and perched water table height and bank height (Table 3). Bank failure time correlated to the depth of the perched water table. Bank failure occurred 660, 570, and 300 s after the initiation of the experiment for the 30, 60, and 90 cm inflow water heads, respectively. However, the response of cumulative seepage erosion was inconsistent. Seepage erosion was greater for shallower banks prior to bank failure as expected. Slope insignificantly impacted bank failure time: bank failure occurred at approximately the same time for the 0, 5, and 10% slopes.

Table 3 - Summary of boundary conditions and measured flow and seepage erosion characteristics during the lysimeter experiments.

Boundary Conditions			Lysimeter Measurements					
Bank Height (cm)	Water Head (cm)	Slope (%)	Time to failure (s)	Seepage Erosion (kg)	Tension Crack (cm)	Bank Erosion (kg)	Undercut (cm)	Soil-Water Pressure* (cm H2O)
80	30	0	660	0.53	35.5	24.3	9	-28
80	60	0	570	1.07	21.5	23.1	14	-37
80	90	0	300	0.19	12.4	23.5	4	-33
80	60	5	600	2.20	11.5	7.5	14	-36
80	60	10	645	1.42	32.0	56.3	10	-19
50	60	0	840	3.17	9.0	4.7	13	-29
50	60	5	900	2.00	28.5	33.6	15	-44
50	60	10	1050	3.76	35.0	36.8	28	-22

* Soil-water pressure refers to the pressure reading at Tensiometer 1 (15 cm from streambank face and 30 cm from the bottom of the lysimeter in the SiL) at the end of the experiment (i.e., bank failure time).

Tensiometer data again suggested collapse of the banks prior to the removal of negative pore-water pressures in the SiL (Figure 6). This tensiometer data was modeled using a two-dimensional, variably-saturated ground water flow code: VS2D (Healy, 1990). The model was calibrated based on measured pore-water pressures during the lysimeter experiments with initial values of soil parameters from the field experiments (Figure 7). VS2D also demonstrated that tension cracks formed in streambank sediment where pressures were equivalent to initial starting pressures of -40 to -50 cm H_2O (Figure 8). Researchers have suggested that since the bank angle exceeds critical angles for noncohesive sediment that any flow depth will result in seepage erosion. However, flow depths on the order of 1-4 cm were required to initiate seepage erosion as determined from the calibrated VS2D models. These results suggest that it may not be appropriate to assume LS as noncohesive. Bank undercutting of 15-35 cm was generally required prior to bank failure. Following the suggested hypothesis of Howard and McLane (1988), seepage erosion rate correlated to seepage discharge based on a power law relationship with an average correlation coefficient (r^2) of 0.9. A dimensionless seepage erosion sediment transport model has also been derived based on the dimensionless sediment flux

(q_s*) and shear stress (τ*), where shear stress was assumed to be dependent on the seepage force proposed by Howard and McLane (1988):

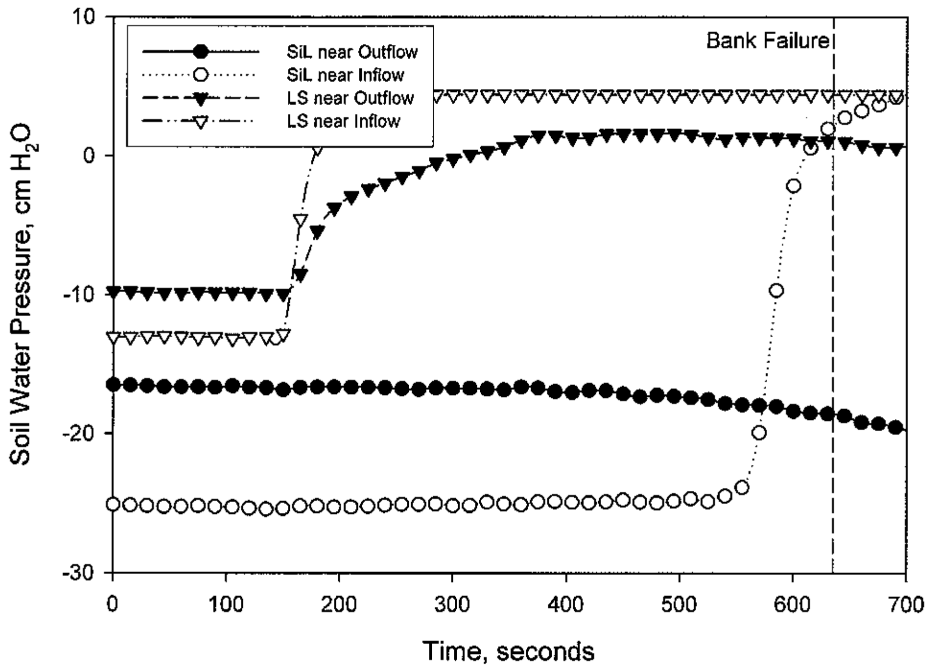

Figure 6 - Typical tensiometer data in loamy sand (LS) and silt loam (SiL) streambank layers. Data shown are for experimental boundary conditions of 80 cm bank height, 60 cm inflow water head, and 10% slope.

$$q_s^* = a\,\tau^{*\,b} \tag{3}$$

$$q_s^* = \frac{q_s}{\sqrt{(s-1)gd^3}} \tag{4}$$

$$\tau^* = \frac{C_2^{''} q}{(s-1)nK} \tag{5}$$

where a and b are empirical regression parameters, $C_2^{''}$ is an empirical parameter that depends on the packing coefficient, q is Darcy's velocity or discharge per unit flow area (assumed equal to the width of the lysimeter times the average flow depth at the lysimeter outlet), K is the hydraulic conductivity, θ is the bank angle, n is the porosity, and s is the ratio of solid to fluid density. Data from the seven lysimeter experiments fit the proposed seepage erosion sediment transport model (a = 584, b = 1.04) with an r^2 of 0.86 (Figure 9). Fox et al. (2005) discuss more details on the development of the seepage erosion sediment transport model and large lysimeter experiments.

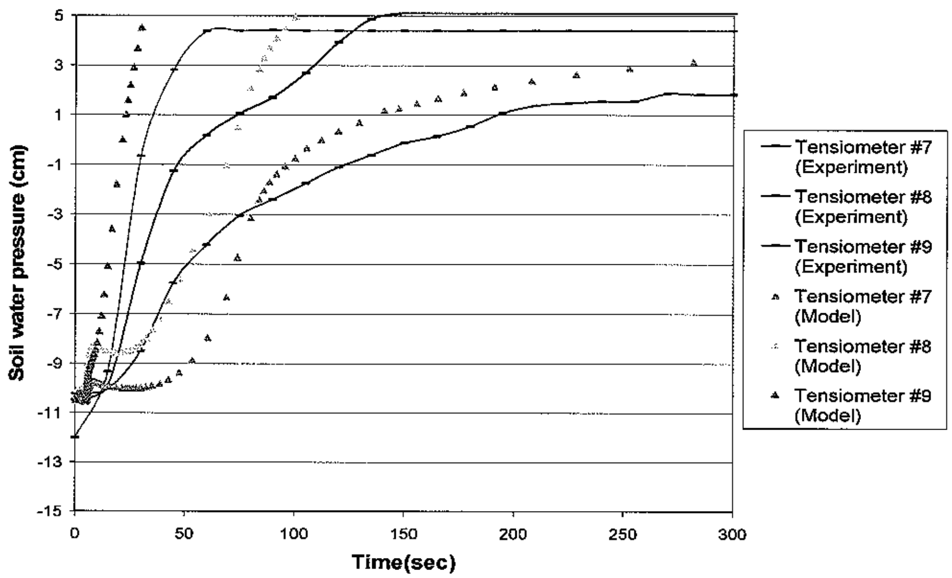

Figure 7 - Comparison of simulated pore-water pressure with tensiometer experimental data within the loamy sand layer for the large lysimeter experiment with 10% slope, 60 cm inflow water head, and 50 cm bank height.

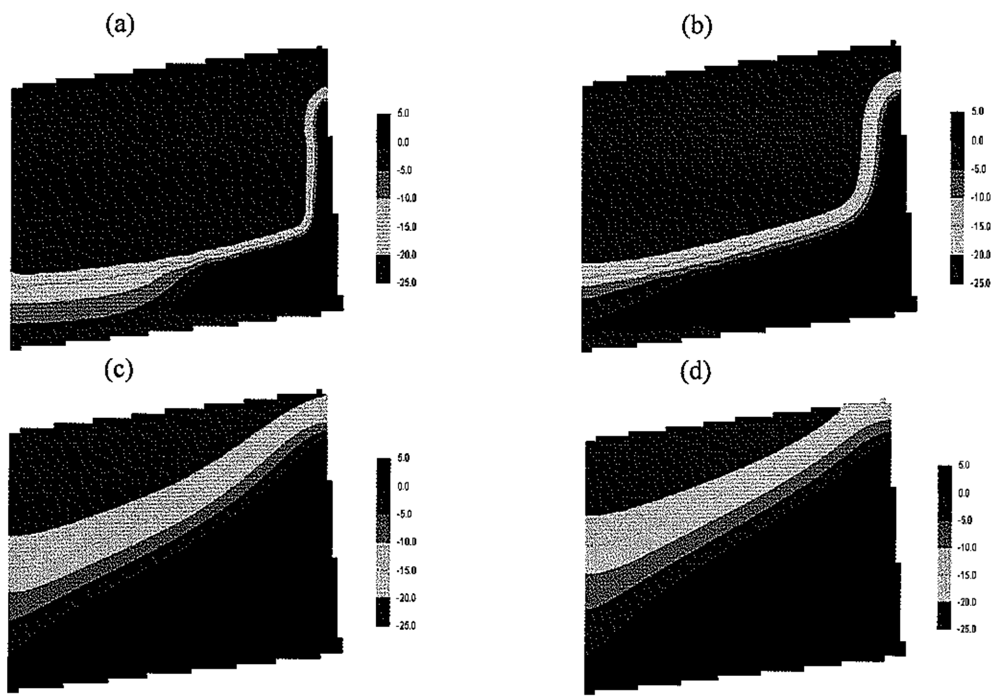

Figure 8 - VS2D predicted pore-water pressures during the 10% slope, 60 cm inflow water head, and 50 cm bank height lysimeter experiment: (a) after 25 s, (b) time to flow, (c) after 500 s, and (d) at bank collapse. Red = -25 cm H_2O, Blue = 5 cm H_2O.

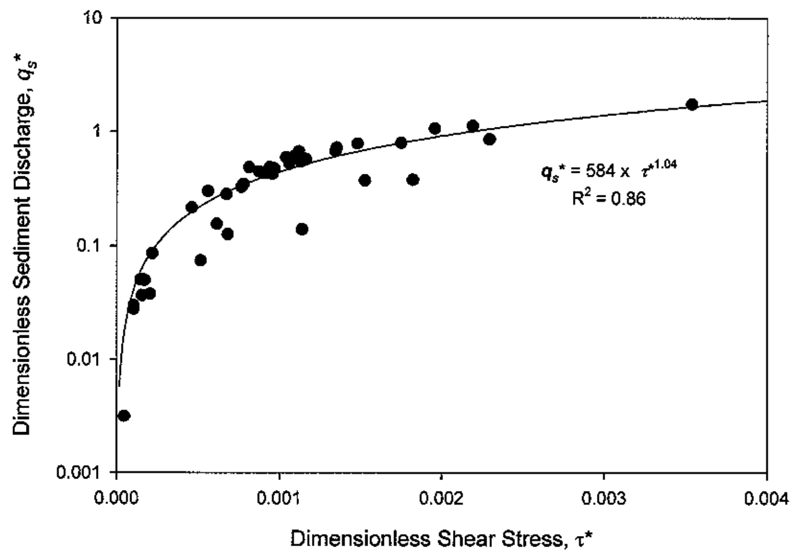

Figure 9 - Dimensionless sediment flux (q_s*) versus dimensionless shear stress (τ*) as measured from the lysimeter experiments.

It has been concluded that further laboratory experimentation is needed to fully explain the soil and hydraulic controls on seepage erosion. Using the large lysimeter, experiments are currently underway with single layered LS by packing 40 cm LS at field measured bulk density. Tensiometers have been repositioned near the outflow face to obtain more detailed information regarding flow depths required to initiate significant seepage erosion. Initial results from these experiments suggest that tensiometer data may be able to detect failures in the single LS layer and therefore provide a clearer picture as to the pore-water pressure profiles at the time of seepage erosion and bank failure. Experiments will also be performed with numerous streambank angles to verify the seepage erosion sediment transport model with slopes ranging from vertical to the critical seepage angles predicted by existing theoretical models.

Streambank Stability Modeling

A static water table would need to be at the soil surface (0 depth) to cause unstable conditions. In contrast, the condition of an unsaturated 30 cm thick top soil but with water perched in a conductive layer below was much more stable. The factor of safety (Fs) prior to establishing a perched head within the conductive layer was 1.65. According to the Streambank Stability model, the bank would remain stable under a 40 cm head, with an Fs value of 1.41. The head would have to reach around 120 cm before the Fs is less than 1. Conditionally stable conditions were predicted to occur under a perched head of around 70 cm and the sediment load predicted to be lost was 20 kg. However, the model failed to account for the sediment load from the sapping zone when the bank remained stable and it over estimated the sediment load when failure did occur. More importantly, when failure was observed it only required a 40 cm head of water perched in the conductive layer as compared to the predicted value of 70 to 120 cm (Wilson et al., 2006).

SUMMARY

This research has indicated the importance of seepage erosion at one streambank site in Northern Mississippi. Seepage erosion rates measured in situ and simulated in the laboratory provided initial evidence as to the potential role of seepage erosion during the recession limbs of stream flow hydrographs. Seepage erosion may play a more important role compared to decreased shear strength due to the loss of matrix suction, especially in layered stream banks. For predicting seepage erosion effects on streambanks, detailed characterization of soil profile lithology is critical for accurate seepage erosion prediction. Future research is aimed towards extending lysimeter studies to simulate in-field streambank conditions, including low-stage seepage erosion and high-stage streambank storage return. Future research will evaluate the empirical sediment transport model. An existing process-based model of stream evolution (CONCEPTS) will be modified in the near future to include seepage erosion. Such a combined model will allow sensitivity analyses to be performed with the model to evaluate the importance of soil, hydraulic, and geotechnical parameters on seepage erosion and mass wasting of banks.

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Wilson, G.V., Periketi, R.K., Fox, G.A., Cullum, R.F., and Shields, F.D. (2006). "Seepage erosion properties contributing to streambank failure." *Earth Surface Processes and Landforms*, In Review.

LIST OF PUBLICATIONS/CONFERENCE PROCEEDINGS

The following is a list of all reports submitted for publication or published as a conference proceedings paper during the reporting period.

Wilson, G.V., R. Periketi, G.A. Fox, S. Dabney, D. Shields, and R.F. Cullum. Seepage erosion properties contributing to streambank failure. *Earth Surface Processes and Landforms* (Accepted with Minor Revisions, February 2006).

Fox, G.A., G.V. Wilson, R.K. Periketi and B.F. Cullum. A sediment transport model for seepage erosion of streambanks. *Journal of Hydrologic Engineering – ASCE* (Accepted with Minor Revisions, February 2006).

Fox, G.A., G.V. Wilson, R. Periketi, and R.F. Cullum. 2005. Developing a sediment transport model for the seepage erosion of streambank sediment. *Proceedings of the American Water Resources Conference*, Nov 7-10th, Seattle, WA, 4 pages (CD-ROM).

Fox, G.A., G.V. Wilson, R. Periketi, L. Gordji, and R.F. Cullum. 2005. The Role of Subsurface Water in Contributing to Streambank Erosion. *Proceedings of the US-China Workshop on Advanced Computational Modeling in Hydroscience and Engineering*, August 2-5, Oxford, Mississippi, USA, 10 pages (CD-ROM).

Fox, G.A. 2006. Can Subsurface Flow Erode Streambanks? USDA Cooperative State Research, Education, and Extension Service Water Quality Conference, February 5-9: San Antonio, TX.

Fox, G.A., G.V. Wilson, and R. Periketi. 2005. Simulating the erosion of streambanks by lateral, subsurface flow. 35th Mississippi Water Resources Conference, April 26-27: Jackson, MS.

Fox, G.A., R. Periketi, and G.V. Wilson. 2005. Laboratory simulation and numerical modeling of streambank seepage erosion. 2005 Spring Section Meeting of the Mississippi Section of the American Society of Civil Engineers, Friday, April 22nd, Oxford, MS.

INFORMATION TRANSFER PLAN

Results of this research will be disseminated by the research team through publication in a number of diverse, nationally recognized research journals and by presentation at several interdisciplinary local, state, and national conferences. Two manuscripts have already been submitted for publication as a result of this project. These manuscripts will highlight the importance of considering seepage erosion in streambank stability analysis. We have attempted to make results from this research directly transferable to other agricultural watersheds. This research is also being used by USDA-ARS National Sedimentation Laboratory scientists in conjunction with NSL CEAP activities to assist in developing non-technical fact sheets for distribution to water agencies and landowners.

STUDENT SUPPORT

This research supported the research activities of one Master of Science student in the Department of Civil Engineering at the University of Mississippi. This student worked intricately with Dr. Wilson at the National Sedimentation Laboratory and has assisted in documenting their research findings in collaboration with NSL CEAP knowledge transfer activities.

Information Transfer Program

Information Transfer Program - Conferences

Basic Information

Title:	Information Transfer Program - Conferences
Project Number:	2004MS40B
Start Date:	3/1/2004
End Date:	2/28/2006
Funding Source:	104B
Congressional District:	Third
Research Category:	Not Applicable
Focus Category:	None, None, None
Descriptors:	
Principal Investigators:	David R. Shaw

Publication

1. 1. 2005, Mississippi Water Resources Conference Proceedings, Mississippi Water Resources Research GeoResources Institute, Mississippi State, MS, CD ROM.
2. 2. 2005, Mississippi Water Resources Conference Program and Abstracts, Mississippi Water Resources Research GeoResources Institute, Mississippi State, MS, 77 pgs.

1. 2005, Mississippi Water Resources Conference Proceedings, Mississippi Water Resources Research – GeoResources Institute, Mississippi State, MS, CD ROM.
2. 2005, Mississippi Water Resources Conference Program and Abstracts, Mississippi Water Resources Research – GeoResources Institute, Mississippi State, MS, 77 pgs.

Informaiton Transfer Program - Newsletter

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Principal Investigators:	David R. Shaw

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1. None during reporting period.

None during reporting period.

Information Transfer Program - Publications

Basic Information

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Focus Category:	None, None, None
Descriptors:	Publications
Principal Investigators:	David R. Shaw

Publication

1. Fox, Garey, 2006, Analysis of Stream Bank Erosion by Lateral Ground Water Flow, Mississippi Water Resources Research Institute, Mississippi State University, Mississippi State, MS, 24 pages.
2. Massey, Joseph, Barry Stewart, Cade, Smith, Peter Ampim, Alton Johnson, and Kevin Armbrust, 2006, Improved Estimation of Nutrient and Pesticide Runoff Losses from Golf Courses and Residential Lawns in the South Atlantic-Gulf Region, Mississippi Water Resources Research Institute, Mississippi State Univesity, Mississippi State, MS, 17 pages.
3. Harriet, Perry and Barbara Viskup, 2006, Final Report, Water Quality Standards: Establishing Nutrient Criteria for Mississippi’s Coastal Waters, Mississippi Water Resources Research Institute, Mississippi State University, Mississippi State, MS, 26 pages.

Fox, Garey, 2006, Analysis of Stream Bank Erosion by Lateral Ground Water Flow, Mississippi Water Resources Research Institute, Mississippi State University, Mississippi State, MS, 24 pages.

Massey, Joseph, Barry Stewart, Cade, Smith, Peter Ampim, Alton Johnson, and Kevin Armbrust, 2006, Improved Estimation of Nutrient and Pesticide Runoff Losses from Golf Courses and Residential Lawns in the South Atlantic-Gulf Region, Mississippi Water Resources Research Institute, Mississippi State Univesity, Mississippi State, MS, 17 pages.

Harriet, Perry, 2006, Interim Final Report, Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters, Mississippi Water Resources Research Institute, Mississippi State University, Mississippi State, MS, 4 pages.

Student Support

Student Support					
Category	**Section 104 Base Grant**	**Section 104 NCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	2	0	0	0	2
Masters	5	0	0	0	5
Ph.D.	2	0	0	0	2
Post-Doc.	0	0	0	0	0
Total	9	0	0	0	9

Notable Awards and Achievements

2004MS23B: Jason Bried was selected as the Best Student Presenter at the Spring 2005 meeting of the South Central and South Atlantic Chapters of the Society of Wetlands Scientists for a presentation on use of dragonflies as conservation umbrella species. That paper is currently under review with the Journal of Applied Ecology.

2003MS16B: Ampim, Peter, J.Massey, B. Stewart, M. Smith, A. Andrews, A. Johnson, and K. Armbrust. 2005. Factors Influencing Runoff of Pesticides from Warm-Season Turfgrasses. Mississippi Academy of Science. Oxford, MS. (3rd place graduate oral presentation award).

Publications from Prior Projects

1. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Dissertations - Bried, Jason, 2005, Community and conservation ecology of dragonfly and damselfly adults in Mississippi wetlands, MS Thesis, Department of Biological Sciences, College of Arts and Sciences, Mississippi State Univeristy, Mississippi State, Mississippi, 159 pages.
2. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Dissertations - Herman, Brook, 2005, Testing the Floristic Quality Assessment Index in natural and created wetlands in Mississippi, USA, MS Thesis, Department of Biological Sciences, College of Arts and Sciences, Mississippi State Univeristy, Mississippi State, Mississippi, 104 pages.
3. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Articles in Refereed Scientific Journals - Bried, Jason, Gary Ervin, 2006, Abundance patterns of dragonflies along a wetland buffer gradient, Wetlands, In press.
4. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Articles in Refereed Scientific Journals - Gary Ervin, M. Smothers, C. Holly, C. Anderson, and J. Linville, 2006, Relative importance of wetland type vs. anthropogenic activities in determining site invisibility, Biological Invasions. In press.

5. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Articles in Refereed Scientific Journals - Bried, Jason and Gary Ervin, 2005, Distribution of adult Odonata among localized wetlands in east-central Mississippi, Southeastern Naturalist 4: 731-744.
6. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Articles in Refereed Scientific Journals - Ervin, Gary, 2005, Spatio-temporally variable effects of a dominant macrophyte on vascular plant neighbors, Wetlands 25: 317-325.
7. 2004MS23B ("Evaluation of Wetland Floristic Quality Indices as Indicators of Ecological Integrity in North Mississippi Wetlands") - Articles in Refereed Scientific Journals - Bried, Jason, L Bennett, and G. Ervin, 2005, Live mass allometric analyses of adult dragonflies collected in east-central Mississippi, USA, Odonatologica 34: 111-122.