NONPOINT SOURCE SUMMARY PAGE

FY 04 CWA 319(h)

TSSWCB Project # 04-10

1. **TITLE OF PROJECT**: **PHYTOREMEDIATION of EXCESSIVELY HIGH PHOSPHORUS SOILS and SUBSEQUENT REDUCED PHOSPHORUS RUNOFF into the NORTH BOSQUE RIVER**

2. PROJECT GOALS/OBJECTIVES: The general objective of this project is to reduce surface water contamination in the north Bosque River from soil-applied P of dairy manure origin.

3. PROJECT TASKS: (1) Document/demonstrate a measurable rate of P removal via forages from crop fields with histories of excessive dairy waste application. (2) Develop and test easily established vegetative buffer strips that harvest or stabilize soil-P in surface water runoff moving from dairy waste application fields to streams, rivers or other drainages. (3) Based on results from the previous tasks, model and demonstrate forage systems, first tier and second tier buffers to accurately predict maximum soil-P removal and stabilization rates (and, consequently, maximum tolerable additional dairy waste-P) for the soils in the North Bosque. (4) Model the economics associated with implementation of the integrated approaches outlined above. Data collection for this will take place from year 1-3 but final modeling will occur only during year 3.

4. MEASURES OF SUCCESS: (1) We will quantity of manure-P that can be potentially recycled (2) We will measure the decrease in both total and water-soluble soil P on demonstration fields with high P from dairy manure. (3) Edge-of-field P runoff will be reduced on production crop fields that implement the developed and demonstrated BMPs.

5. PROJECT TYPE: Statewide ( ) Watershed (X) Demonstration (X)

6. WATERBODY TYPE: River (X) Lake ( ) Wetland ( ) Ground Water ( ) Other ( )

7. PROJECT LOCATION: North Bosque River Segment 1225 and 1255

8. NPS MANAGEMENT PROGRAM REFERENCE: State of Texas Agricultural/Silvicultural Nonpoint Source Management Program – Approved February 25, 2000.

9. NPS ASSESSMENT REPORT STATUS: Impaired (X) Impacted ( ) Threatened ( )

10. KEY PROJECT ACTIVITIES: Hire Staff (X) Monitoring (X) Technical Assistance ( ) Education (X) BMP Implementation ( ) Demonstration Project (X) Other ( )

11. NPS Management Program Elements: Implementing Milestones from the 1999 Texas Nonpoint Source Pollution Assessment Report and Management Program: (1) Provide technical assistance to Soil and Waters Conservation Districts for the implementation of Water Quality Management Plans to reduce NPS pollution. (2) Coordination with Federal, State, and Local Programs (3) TSSWCB is committed to technology transfer, technical support, administrative support and cooperation between agencies and programs for the prevention of NPS pollution.

12. PROJECT COSTS: Federal $238,859; Local Match: $172,182; Total Project: $411,041

13. PROJECT MANAGEMENT: Texas State Soil and Water Conservation Board

14. PROJECT PERIOD: Three years from start date.

PHYTOREMEDIATION of EXCESSIVELY HIGH PHOSPHORUS SOILS and SUBSEQUENT REDUCED PHOSPHORUS RUNOFF from CROPLANDS RECEIVING DAIRY WASTE on the NORTH BOSQUE RIVER

FY04 CWA Section 319(h)

WORKPLAN

Problem Need/Statement

Historically, dairy waste was applied only on soils adjacent to dairies, fostering the accumulation of soluble phosphorus (P), which will compromise runoff water quality for decades to come. When soluble P exceeds permit requirements, the dairy producer at present has very few options beyond the reduction of herd numbers, development of new application fields, or relocation. And what of dairies that are now defunct yet whose surrounding fields continue to threaten surface water quality? Even if dairies cease to function or stop adding new P-laden wastes to these soils, their run-off will continue to threaten surface water quality for decades to come.

General Project Description

We propose to develop and demonstrate remedial best management practices (BMP) for both abandoned currently used waste application fields that will bring soil P levels back to safe levels. These BMPs may also allow dairymen to harvest P in amounts equal to that contained in dairy waste applied to fields without risking soil-P buildup. In either case, there is an urgent need to intercept P-rich runoff from these fields by establishing permanent vegetation buffer strips between tilled soils and streams.

Year-round forage systems that extract plant available P from soils can reduce, recycle and stabilize excess P in Windthorst soils (the predominant sandy loam used for growing forages in the watershed). Developing and promulgating these crop systems involves maximizing land-occupation time (compatibility of winter and summer crops) and finding species whose high yields and herbage-P concentrations combine to export the greatest possible amount of soluble soil-P.

The goal is to develop and demonstrate year-round forage systems that can reduce P loads on cropping land that soon will or already exceeds safe levels of plant-available P on the North Bosque River drainage. Until soil-P levels are brought down to acceptable levels, vegetative buffer strips will intercept most run-off P. These solutions will be cost-effective and acceptable to TCEQ under permit and TMDL programs. Widespread implementation of these forage systems will promote sustainability of the dairy industry and improve environmental quality of surface water.

Tasks, Objectives, Schedules, and Estimated Costs

Task 1: Document/demonstrate a measurable rate of P removal via forages from crop fields with histories of excessive dairy waste application.

Costs: Federal $177,859; Match $95,182 ; Total $273,041

Objective: To reduce surface water contamination in the North Bosque River from soil-applied P of dairy manure origin.

> **Subtask 1.1:** Locate three crop fields on the upper North Bosque River that have an excess of 200 ppm plant-available P due to historical applications of dairy wastes. Measure all components (both stable and plant-available) of P in the soil.
>
> **Subtask 1.2:** On these fields, determine optimal season length and P-extraction of cool season winter grasses and legumes on small plots by measuring both forage yields and P concentrations. Individual species will be tested years 1-2.

Subtask 1.3: On these same fields but distinct plots, determine optimal season length and P-extraction of warm season winter grasses and legumes on small plots by measuring both forage yields and P concentrations. Individual species will be tested years 1-2.

Subtask 1.4: Based on results from subtasks 1.2 and 1.3, design and demonstrate year-round forage production systems that have compatible growing seasons (do not overlap) and extract the maximum amount of plant-available P from the these crop fields. Determine which systems extract the greatest amount of soil-P and determine if the plant-available P extraction affects stable P in the soils. These systems will be demonstrated in years 2 & 3.

Subtask 1.5: Prepare quarterly and final reports. The final Report will be submitted to the TSSWCB, via CD, at the culmination of the project. The TSSWCB project manager will set dates for the reports. (Month 1 to Month 24)

Subtask 1.6: The technician will attend quarterly meeting with the TSSWCB project manager to review project status, deliverables, etc. (Month 1 to Month 24)

Deliverables

- QAPP and Reports of individual forage or grain crop P concentration.
- Reports of forage systems P extraction (a function of forage P concentration and herbage yield) and the effects on soil P components (both total P and water soluble P fractions.
- Quarterly and final reports documenting project status.
- Semi-annual reports will be developed by the TSSWCB project manager to be submitted to EPA.

Task 2: Develop and test easily established vegetative buffer strips that harvest or stabilize soil-P in surface water runoff moving from dairy waste application fields to streams, rivers or other drainages.

Costs: Federal $40,000; Match $21,000; Total $61,000

Subtask 2.1: Design and test first tier buffers composed of harvestable (hay) material with high soil-P extraction (yield X P concentration) potential that will catch and recycle surface runoff from croplands high in water-soluble P of dairy waste origin. Design and establish demonstrations (at least one site per soil type) will take place year 1; years 2-3 will involve soil, forage, and edge-of-field monitoring.

Subtask 2.2: Design and demonstrate second tier buffer strips for the specific soils, drainages and climate that will foster year-round buffering utilizing mostly (but not exclusively) native vegetation. These will consist of secondary tiers of mostly perennial species with ecologically stable environments. Designing and establishing demonstrations (at least one site per soil type) will take place year 1; years 2-3 will involve soil, forage, and edge-of-field monitoring.

Deliverables:

- Buffer designs, and producer-oriented publications with buffer-establishment and management instructions.

Task 3: Based on results from the previous tasks, model and demonstrate forage systems, first tier and second tier buffers to accurately predict maximum soil-P removal and stabilization rates (and, consequently, maximum tolerable additional dairy waste-P) for the soils in the North Bosque.

Costs: Federal $0; Match $56,000; Total $56,000

Subtask 3.1: Develop, field test, and demonstrate to dairy producers and their neighbors currently accepting dairy wastes on their fields a crop field-to-stream model of how to maximize removal and stabilization of dairy waste P. This will entail utilizing results collected years 1 & 2 and will therefore be developed and field tested year 3.

Deliverables:

- Theoretical models based on concrete experiences and, finally, producer-oriented publications that propose BMP's for bioremediation of high P soils.

Task 4: Model the economics associated with implementation of the integrated approaches outlined above. Data collection for this will take place from year 1-3 but final modeling will occur only during year 3.

Costs: Federal $21,000; Match $000; Total $21,000

Deliverables:

- Producer-oriented documents for scenarios from Tasks 1-3 outlining costs and benefits of the BMP's being promulgated.

Coordination, Roles and Responsibilities:

Participating Agencies and Organizations along with their roles in this project include:

- **Texas Agricultural Experiment Station**. Dr. **Jim Muir**, forage and range ecologist, will coordinate the project as well as provide support for evaluating forage and buffer strip systems for remediating high-P soils, safely applying dairy manure/sludge/compost to cropland, and restricting surface runoff of P from animal wastes. The soil and forage laboratory at the Stephenville can test for phosphorus and other nutrients.

- **Tarleton State University**. Dr. **David Weindorf**, soil scientist, will be in charge of the soils aspects of tasks 1 & 2. His soils lab is also available for any analyses needed in monitored or tested fields. Dr. **Roger Wittie**, range scientist, will contribute his knowledge of buffer strips and native vegetation.

- **Texas Cooperative Extension.** Dr. **Twain Butler** is the agronomist for District 8 and will provide invaluable contacts in the field as well as his crop production knowledge in designing year-round forage systems that optimize P extraction and recycling.

- **Texas Institute for Applied Environmental Research.** Dr. **Anne McFarland** will bring her edge of field monitoring expertise to measure the deliverables resulting from management changes.

Measures of Success:

- We will quantity of manure-P that can be potentially recycled
- We will measure the decrease in both total and water-soluble soil P on demonstration fields with high P from dairy manure.
- Edge-of-field P runoff will be reduced on production crop fields that implement the developed and demonstrated BMPs.

TSSWCB Project Lead:

Name: Lee Munz
Address: Texas State Soil and Water Conservation Board
311 North 5th Street
Temple Texas 76502
Phone #: 254-773-2250 ext. 238
E-Mail: lmunz@tsswcb.state.tx.us

BUDGET

PHYTOREMEDIATION of EXCESSIVELY HIGH PHOSPHORUS SOILS and SUBSEQUENT REDUCED PHOSPHORUS RUNOFF from CROPLANDS RECEIVING DAIRY WASTE on the NORTH BOSQUE RIVER

Object Class Category	Federal Funds	Non-Federal Match	Total Costs
Personnel			
Dr. James Muir, TAES (5%)	0	10,732	10,732
Dr. Twain Butler, TCE (5%)	0	9,357	9,357
Field Technician, Bow, M.S. (20%)	17,241	0	17,241
Graduate Assistant	34,091	0	34,091
Student labor, 2 @ 50%	34,000	0	34,000
Subtotal	85,332	20,089	105,421
Fringe	23,696	4,500	28,196
Subtotal			
Subtotal Personnel	109,028	24,589	133,617
Travel			
In-state mileage	4,000	0	4,000
Subtotal	4,000	0	4,000
Equipment			
Laboratory	0	0	0
Field	0	0	0
Subtotal equipment	0	0	0
Supplies			
Laboratory	18,203	12,000	30,203
Field	20,480	9,000	29,480
Subtotal	38,683	21,000	59,683
Contractual			
Tarleton State University	35,473	31,101	66,574
Subtotal	35,473	31,101	66,574
Other	20,520	0	20,520
Subtotal	20,520	0	20,520
Total Direct Costs	207,704	76,690	284,394
Indirect Costs (15%)	31,155		31,155
Indirect Costs (Disallowed 30.5%)		63,376	63,376
Indirect Costs (TAES 45.5% MTDC)		32,116	32,116
Total Project Costs	**238,859**	**172,182**	**411,041**