Texas State Soil and Water Conservation Board
CWA §319(h) Nonpoint Source Grant Program
FY 2008 Project 08-04

NONPOINT SOURCE SUMMARY PAGE for the CWA §319(h) Agricultural/Silvicultural Nonpoint Source Grant Program						
Title of Project:	Efficient Nitrogen Fertilization: Accounting for Field Nitrogen Mineralization					
Project Goals:	1) Demonstrate an enhanced soil test methodology that accounts for all sources of plant available N in the soil 2) Improve fertilizer efficiency by considering all sources of plant available N in the soil 3) Demonstrate the potential for reduced N runoff due to reduced N application based on use of this soil test methodology					
Project Tasks:	1) Project Administration 2) Conduct field trials on demonstration sites at the USDA-ARS Grassland, Soil and Water Research Center, Temple, TX 3) Conduct field trials on demonstration sites at the USDA-ARS Watersheds, Riesel, TX. 4) Establish demonstration sites on private lands 5) Conduct soil tests to estimate plant available N at all demonstration sites 6) Quality Assurance 7) Outreach and Education					
Measures of Success:	1) 20-50% reduction in commercial N fertilizer use on demonstration sites 2) 10-20% reduction in runoff N from the Riesel demonstration site 3) 3) Increase or maintenance of on-farm profitability with reduced fertilizer application					
Project Type:	Implementation (x); Education (x); Planning ( ); Assessment ( ); Groundwater (x)					
Status of Water Body: 2004 Texas Water Quality Inventory and 303(d) List	Segment ID: Statewide 304 segments 99 segments	Parameter: nitrate ammonia	Category: Concern for water quality based on screening levels			
Project Location: (Statewide or County and Watershed Name)	Multiple Counties including Hamilton, Archer, Bell, Falls, McLennan, Williamson					
Key Project Activities:	Hire Staff ( ); Surface Water Quality Monitoring (x); Technical Assistance ( ); Education (x); Implementation (x); BMP Effectiveness Monitoring (x); Demonstration (x); Planning ( ); Modeling ( ); Bacterial Source Tracking ( ); Other ( )					
Texas NPS Management Program Elements:	• Element 1 - Explicit short- and long-term goals, objectives and strategies that protect surface and groundwater. • Element 3 - Balanced approach that emphasizes both state-wide nonpoint source programs and on-the-ground management of individual watersheds. • Element 4 - Abatement of water quality impairments from nonpoint source pollution and prevention of significant threats to water quality from present and future nonpoint source activities.					
Project Costs:	Federal:	$293,883	Non-Federal Match:	$198,923	Total:	$492,806
Project Management:	United States Department of Agriculture – Agricultural Research Service (USDA-ARS)					
Project Period:	September 1, 2008 – August 31, 2012					

Part I – Applicant Information

Applicant							
Project Lead	Rick Haney, PhD						
Title	Soil Scientist						
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Applicant							
Project Lead	Daren Harmel, PhD						
Title	Agricultural Engineer						
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Project Partners	
Names	Roles & Responsibilities
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities and ensure coordination of activities with Texas Commission on Environmental Quality (TCEQ).
United States Department of Agriculture – Agricultural Research Service (USDA-ARS)	Project lead, project administration, demonstration activities on federal land, sample collection and analysis, and outreach and education.
Texas A&M AgriLife – Texas Water Resources Institute (TWRI)	Develop and update QAPP. Provide coordination with land grant soil testing laboratories.
Farm operation, Bell County - probable	Conduct demonstration activities on private land
Farm and beef cattle operation, Hamilton County - probable	Conduct demonstration activities on private land
Wheat and beef cattle operation, Archer County - probable	Conduct demonstration activities on private land
Farm operation, Williamson County - probable	Conduct demonstration activities on private land
Other private landowners	Conduct demonstration activities on private land

Part II – Project Information

Project Type							
Surface Water	x	Groundwater	x				
Does the project implement recommendations made in a Watershed Protection Plan or TMDL Report or Implementation Plan?				Yes		No	x
If yes, identify the document. (Approved or Draft)							
If yes, identify the agency/group that developed and/or approved the document.				Year Developed			

Watershed Information				
Watershed Name(s)	Hydrologic Unit Code (8 Digit)	Segment ID	305 (b) Category	Size (Acres)
304 segments	Counties with probable private landowners: Archer, Bell, Hamilton, Williamson. Counties with federal demonstration sites: Bell, McLennan, Falls.		Concern for water quality based on screening levels for nitrate	
99 segments	Counties with probable private landowners: Archer, Bell, Hamilton, Williamson. Counties with federal demonstration sites: Bell, McLennan, Falls.		Concern for water quality based on screening levels for ammonia	

Project Narrative

Problem/Need Statement

The Texas Nonpoint Source Management Program (TCEQ and TSSWCB, 2005) states that "Nutrients, pesticides, and other pollutants can come from a variety of sources including over-fertilized fields, runoff from improperly managed animal operations and waste applications, inaccurate pesticide sprayer settings, and dozens of other sources." This project is directly aimed at reducing the potential for overapplying nitrogen (N) fertilizer based on current soil test methodology in Texas.

Traditional soil nitrogen tests determine only the inorganic N in soil in the form of NO_3-N, but fail to account for plant available NH_4-N, plus a mineralizable portion of the soil organic N pool. Organic matter in the soil provides plant-available N when soil microbes mineralize organic C. Since organic C and organic N are highly linked, organic N is broken down to plant available N. This very important component of soil microbiology has been traditionally under-appreciated because of the difficulty of accurately assessing mineralization with lab techniques, especially its contribution to providing N to enhance crop production. Since traditional soil tests do not recognize the contribution of available NH_4-N or mineralizable soil N in the estimation of plant available N, current soil test recommendations are often higher than necessary, which result in overapplication of N fertilizer.

This excess application increases N inputs into Texas rivers and lakes, which can accelerate eutrophication and substantially increase water treatment costs. Excess N in the Mississippi River, some of which is contributed by Texas watersheds, contributes to a major environmental problem - Gulf of Mexico hypoxia. Steve DiMarco, a Texas A&M researcher, has also recently claimed the existence of a Texas Gulf Coast hypoxic zone. Such hypoxic (low oxygen) areas are absent of most marine life and threaten to inexorably damage important ecosystems.

The Texas Commission on Environmental Quality (TCEQ) is currently in the process of revising Texas Surface Water Quality Standards for the 2009 triennial review. Major revisions to the Standards are being drafted, including the establishment of numeric nutrient criteria for reservoirs and modifications to contact recreation use and bacteria criteria. Numeric nutrient criteria will also be established for major rivers and small streams over the next decade. As a result numerous Texas water bodies which currently have concerns for nutrients will likely be impaired once the nutrient criteria are adopted.

In addition to adverse environmental effects, excess N fertilizer application increases input costs for agricultural producers. Overapplying N fertilizer wastes money on unnecessary inputs and reduces profitability. The problem is that traditional soil test procedures and resulting recommendations fail to account for mineralizable N in the soil that is released and made plant available. Thus, farmers do not knowingly apply excess N; they apply at the recommended N rates. The issue lies with fertilizer recommendations based on conventional soil test results.

Although agriculture is not the only contributor to the problem of excess N in our Nation's waters, agriculture should do its part to reduce N loading. Basing fertilizer application rates on soil tests that more accurately account for the total amount of plant available N in the soil, including mineralizable N, could have tremendous socio-economic and environmental benefits. Very few scenarios present such a likely "win-win" outcome.

The innovative soil test methodology, demonstrated in this project, represents an important agronomic advancement with the potential for major socio-economic and environmental benefits. The environment will benefit as less N will be introduced into streams and rivers. Similarly, input costs will decrease as N fertilizer inputs are reduced. The cost savings should result in increased profitability. The economic incentive associated with the enhanced soil test methodology will increase the broadscale adoption of the methodology by laboratories and landowners alike and thus measurable improvements in runoff water quality. Additional benefits of reduced N application include reduced market demand for N thereby reducing petroleum inputs required to generate N fertilizer.

Project Narrative

General Project Description

Current soil test procedures and fertilizer N recommendations will be adjusted in this project by the inclusion of NH_4-N analysis and a new method (1-day CO_2-C), which uses soil microbial activity to rapidly estimate N mineralization. Since the majority of soil nutrients are cycled through the soil microbial biomass, testing soil microbial activity provides an excellent snapshot of the soil health prior to fertilization. Over many years of research, this method has reliably separated soils by their fertility. The more fertile the soil, the more CO_2-C produced in 24 hr. Consequently, microbial ability to mineralize N from organic N is linked to the fertility of a given soil.

The current project will demonstrate this enhanced soil test methodology that accounts for all sources of plant available N in the soil, including NO_3-N, available NH_4-N, and mineralizable N (Task 5). These soil N sources provide N to crops and represent N that is not adequately accounted for by producers. The project will demonstrate the potential for reduced N runoff due to reduced N application based on this soil test methodology by establishing demonstration sites on research facilities (Tasks 2, 3) and on private land (Task 4). Crop yield, economic throughout, fertilizer cost, and water quality data (Task 6) data will be presented (Task 7) at local and national producer and scientific meetings.

This project is based on the principle that voluntary, practical, and cost-efficient management alternatives can effectively solve nonpoint source problems. Substantial producer buy-in (Tasks 4, 7) is expected based on the potential for increased profitability when using the improved plant available N methodology to adjust N fertilizer recommendations. The practical nature of this enhancement should also appeal to producers; it will simply result in less fertilizer N applied.

A 20-50% reduction in agricultural fertilizer use would have been unthinkable without recent increases in fuel and fertilizer costs. However, dramatic increases in input costs have now forced farmers to consider input costs. Prior to recent increases, fuel and fertilizer costs were relatively low. As a result, farmers assumed that maximizing yield maximized profit and thus applied N fertilizer at rates to ensure N deficiency did not limit yields. In the current economic climate, a more appropriate strategy for maximizing profit and maintaining productivity is balancing input costs with expected yield and commodity prices. This project will demonstrate an innovative soil test methodology for achieving this balance.

Through a separate project, not funded by this or other Clean Water Act §319(h) funds, the water quality impacts of reduced N fertilizer application on demonstration sites (Tasks 3) will be evaluated. Storm and baseflow water quality samples will be collected from USDA-ARS watersheds in Riesel and analyzed for NO_3-N, NH_4-N, and PO_4-P. An expected 10-20% reduction in N runoff will be evaluated with these corroboratory data (Task 3).

Water Quality Impairment

Describe all known causes (pollutants of concern) of water quality impairments from any of the following sources: 2004 Texas Water Quality Inventory and 303(d) List, Draft 2006 Texas Water Quality Inventory and 303(d) List or Other Documented Sources (ex. Clean Rivers Program Basin Summary or Basin Highlights Reports).

2006 Texas Water Quality Inventory - Water Bodies with Concerns for Use Attainment and Screening Levels

304 waterbodies listed for nitrate concerns
99 waterbodies listed for ammonia concerns

Tasks, Objectives and Schedules						
Task 1:	Project Administration					
Costs:	Federal:	$10,350	Non-Federal:	$0	Total:	$10,350
Objective:	To effectively administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.					
Subtask 1.1:	USDA-ARS (Harmel) will prepare electronic quarterly progress reports (QPRs) for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of January, April, July and October. QPRs shall be posted on the project website and provided to all project partners.					
	Start Date:	Month 1	Completion Date:	Month 48		
Subtask 1.2:	USDA-ARS will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.					
	Start Date:	Month 1	Completion Date:	Month 48		
Subtask 1.3:	USDA-ARS will host coordination meetings or conference calls with TSSWCB, and any subcontractors as appropriate, at least bi-annually to discuss project activities, project schedule, communication needs, deliverables and other requirements.					
	Start Date:	Month 1	Completion Date:	Month 48		
Subtask 1.4:	USDA-ARS (Harmel) will develop the project final report for submission to TSSWCB, EPA, and project partners.					
	Start Date:	Month 42	Completion Date:	Month 48		
Deliverables	• Quarterly Progress Reports in electronic format • Reimbursement Forms • Final Report					

Tasks, Objectives and Schedules						
Task 2:	Conduct field trials on demonstration sites at the USDA-ARS Grassland, Soil and Water Research Center, Temple, TX					
Costs:	Federal:	$86,250	Non-Federal:	$0	Total:	$86,250
Objective:	Demonstrate the enhanced soil test method and its ability to predict plant available N resulting in reduced N application at sites in Temple.					
Subtask 2.1:	Land management on demonstration sites. USDA-ARS (Haney) will establish 10 demonstration sites, including 5 control sites. On each site, tillage, weed and insect control, crop production, and fertilizer application including both organic and inorganic formulations, will be performed. The control sites will be treated the same as the other sites, except will receive no fertilizer.					
	Start Date:	Month 4	Completion Date:	Month 48		
Subtask 2.2:	Data collection on demonstration sites. USDA-ARS (Haney) will gather and record land management, crop yield, and economic data to demonstrate the economic benefits of reduced N application.					
	Start Date:	Month 4	Completion Date:	Month 46		
Subtask 2.3:	Soil sampling on demonstration sites. USDA-ARS (Haney) will collect annual soil samples for testing to determine plant available N. Monthly soil samples may also be collected to track within year plant available N changes.					
	Start Date:	Month 4	Completion Date:	Month 42		
Deliverables	• Land management information including crop yields and reduced fertilizer application rates • Economic throughput data for each site					

Tasks, Objectives and Schedules						
Task 3:	Conduct field trials on demonstration sites at the USDA-ARS Watersheds, Riesel, TX					
Costs:	Federal:	$74,750	Non-Federal:	$127,500	Total:	$202,250
Objective:	Demonstrate the enhanced soil test method and its ability to predict plant available N resulting in reduced N application at sites in Riesel.					
Subtask 3.1:	Land management on demonstration sites. USDA-ARS (Harmel) will establish 8 demonstration sites, including a control site. On each site, tillage, weed and insect control, crop production, and fertilizer application including both organic and inorganic formulations, will be performed. The control site will be treated the same as the other sites, except will receive no fertilizer.					
	Start Date:	Month 4	Completion Date:	Month 48		
Subtask 3.2:	Data collection on demonstration sites. USDA-ARS (Harmel) will gather and record land management, crop yield, and economic data to demonstrate the economic benefits of reduced N application.					
	Start Date:	Month 4	Completion Date:	Month 46		
Subtask 3.3:	Soil sampling on demonstration sites. USDA-ARS (Harmel) will collect annual soil samples for testing to determine plant available N. Monthly soil samples may also be collected to track within year plant available N changes.					
	Start Date:	Month 4	Completion Date:	Month 42		
Subtask 3.4	In order to evaluate reductions in N runoff due to use of this enhanced soil test methodology, water quality data will be collected from the Riesel demonstration sites. Storm and base flow water quality samples will be collected and analyzed for NO_3-N, NH_4-N, and PO_4-P. Collection and laboratory analysis of this data is neither federally funded through this project nor utilized as non-federal match for this project. This corroboratory data, critical to documenting the water quality benefits of this project, shall be treated as Secondary Research Data (§B9) in the QAPP.					
	Start Date:	Month 4	Completion Date:	Month 48		
Deliverables	• Water quality data quantifying reductions in N runoff at Riesel demonstration sites • Land management information including crop yields and reduced fertilizer application rates • Economic throughput data for each site					

Tasks, Objectives and Schedules						
Task 4:	Establish demonstration sites on private lands					
Costs:	Federal:	$51,750	Non-Federal:	$67,500	Total:	$119,250
Objective:	Establish 10-20 sites on private land to demonstrate the ability of the enhanced soil test method to determine plant available N.					
Subtask 4.1:	Land management on demonstration sites. Cooperators will perform tillage, weed and insect control, fertilizer application, and crop production on demonstration sites. All cooperators will set up at least on control plot from which to determine plant available N contributed by the soil with no fertilizer addition. Cooperators may also choose to establish plots that will be fertilized with N rates based on the enhanced N soil test.					
	Start Date:	Month 4	Completion Date:	Month 48		
Subtask 4.2:	Data collection on control sites. Cooperators will gather and record land management and crop yield data for the demonstration sites.					
	Start Date:	Month 4	Completion Date:	Month 46		
Subtask 4.3:	Soil sampling on demonstration sites. Cooperators or USDA-ARS (Haney or Harmel) will collect annual soil samples for soil test analysis to determine plant available N.					
	Start Date:	Month 4	Completion Date:	Month 42		
Subtask 4.4:	Compensate cooperator/producers for establishing and managing demonstration sites on private lands. Specifically, cooperators/producers will be partially reimbursed (40%) for costs such as seed, fertilizer, fuel, and custom harvesting incurred to conduct land management and data collection on demonstration sites. Cooperators/producers will provide non-federal match (60%) for demonstration activities.					
	Start Date:	Month 4	Completion Date:	Month 44		
Deliverables	• Land management information including crop yields and reduced fertilizer application rates					

Tasks, Objectives and Schedules						
Task 5:	Conduct soil tests to estimate plant available N at all demonstration sites					
Costs:	Federal:	$34,500	Non-Federal:	$0	Total:	$34,500
Objective:	Conduct soil tests with various methods including H3A, water, and KCl extraction plus 1 day CO_2 to demonstrate differences in their ability to accurately determine plant available N.					
Subtask 5.1:	Soil processing and testing. At the USDA-ARS Grassland, Soil, and Water Research Laboratory in Temple, TX, USDA-ARS (Haney) will process and test soil samples from all demonstration sites.					
	Start Date:	Month 4	Completion Date:	Month 46		
Subtask 5.2:	Comparison of N soil test methods. Plant available N estimates as determined with various N soil test methods will be compared to plant N uptake in control sites without fertilizer.					
	Start Date:	Month 4	Completion Date:	Month 48		
Deliverables	• Alternative and conventional fertilizer recommendations demonstrating reduced rates of fertilizer application					

Tasks, Objectives and Schedules						
Task 6:	Quality Assurance					
Costs:	Federal:	$12,708	Non-Federal:	$3,923	Total:	$16,631
Objective:	Develop and implement data quality objectives (DQOs) and quality assurance/control (QA/QC) activities to ensure data of known and acceptable quality are generated through this project.					
Subtask 6.1:	USDA-ARS will contract TWRI to develop a QAPP for activities in Tasks 2.3, 3.3, 4.3, and 5.1 consistent with *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* (May 2006) and the *TSSWCB Environmental Data Quality Management Plan* (August 2007).					
	Start Date:	Month 1		Completion Date:	Month 3	
Subtask 6.2:	TWRI will submit revisions and necessary amendments to the QAPP as needed.					
	Start Date:	Month 4		Completion Date:	Month 48	
Deliverables	• QAPP for Tasks 2.3, 3.3, 4.3, and 5.1 approved by TSSWCB in both electronic and hard copy formats • Approved revisions and amendments to QAPP					

Tasks, Objectives and Schedules						
Task 7:	Outreach and Education					
Costs:	Federal:	$23,575	Non-Federal:	$0	Total:	$23,575
Objective:	Demonstrate the accuracy of various soil test methods in predicting plant available N. Demonstrate to scientists the need to include all soil N sources in plant available N estimates. Demonstrate to producers the positive profitability effects of the enhanced soil N test method.					
Subtask 7.1:	Conduct field days at Temple (2), Riesel (1), and cooperator demonstration sites (1 each).					
	Start Date:	Month 7		Completion Date:	Month 48	
Subtask 7.2:	Make 3 presentations at local and national scientific meetings (such as ASA and ASABE).					
	Start Date:	Month 1		Completion Date:	Month 48	
Subtask 7.3:	Make presentations at local and regional producer meetings (such as County Farm Bureaus, local soil and water conservation districts, Annual State Meeting of Texas SWCD Directors, seed dealer meetings, fertilizer dealer meetings, and Texas AgriLife Extension Service field days and meetings).					
	Start Date:	Month 1		Completion Date:	Month 48	
Subtask 7.4:	Prepare a refereed publication.					
	Start Date:	Month 25		Completion Date:	Month 48	
Subtask 7.5:	TWRI will develop and maintain a project website.					
	Start Date:	Month 6		Completion Date:	Month 48	
Deliverables	• Field day agendas and attendance estimates • Abstracts of presentations • Refereed publication • Project Website					

Project Goals (Expand from NPS Summary Page)

This project has three main goals: 1) Demonstrate an enhanced soil test methodology that accounts for all sources of plant available N in the soil, 2) Improve fertilizer efficiency by considering all sources of plant available N in the soil, and 3) Demonstrate the potential for reduced N runoff due to reduced N application based on use of this soil test methodology.

These goals have the potential to revolutionize soil testing procedures and resulting fertilizer recommendations. The desired profound change in the scientific and producer mindset in terms of N required to maximize on-farm profitability in cultivated agriculture has the potential to result in substantial reductions in N fertilizer use in Texas. The corresponding environmental and water resource benefits resulting from reduced N application could be tremendous.

Measures of Success (Expand from NPS Summary Page)

1) 20-50% reduction in commercial fertilizer use on demonstration sites - accounting for all plant available sources of N in the soil, not only NO_3-N, will no doubt reduce N application. This enhanced soil test methodology will reduce input costs (thus providing the economic incentive to landowners and increasing the likelihood of the broadscale adoption) and is expected to increase or maintain on-farm profitability.

2) 10-20% reduction in runoff N from the Riesel demonstration site - reduced application of N will very likely translate into reduced N concentrations in runoff. This reduction will be quantified at the Riesel demonstration site; although, similarly, N runoff will likely be reduced on all demonstration sites.

2005 Texas Nonpoint Source Management Program Reference (Expand from NPS Summary Page)

Goals &/or Milestone(s)

The long-term goal of the State of Texas Nonpoint Source Pollution Program is to protect and restore water quality from nonpoint source pollution through assessment, implementation, and education. In particular, the proposed project will support the implementation of state-wide, regional, and local programs to prevent nonpoint source pollution through implementation and education.

The proposed project will abate many water quality impairments from nonpoint source N pollution and will prevent significant threats to water quality from present and future nonpoint source activities (Element 4).

Part III – Financial Information

08-04 "Efficient Nitrogen Fertilization: Accounting for Field Nitrogen Mineralization" Budget Revision 07-13-12			
Federal 319(h)	$293,883	% of total project	60%
Non-Federal	$198,923	% of total project (at least 40%)	40%
Total Cost	$492,806	Total project %	100%

Category	Federal	Non-Federal	Total
Personnel	$0	$102,000	$102,000
Fringe Benefits	$0	$25,500	$25,500
Travel	$2,181	$0	$2,181
Equipment	$4,900	$0	$4,900
Supplies	$200,802	$0	$200,802
Contractual	$0	$3,923	$3,923
Construction	$0	$0	$0
Other	$86,000	$67,500	$153,500
Total Direct Costs	$293,883	$198,923	$492,806
Indirect Costs (≤15%)	$0	$0	$0
Total Project Costs	$293,883	$198,923	$492,806

Budget Justification (Federal)		
Category	Total Amount	Justification
Personnel & Fringe Benefits	$ 0	N/A
Travel	$ 2,181	Outreach and travel to demonstration sites
Equipment	$ 4,900	Farm equipment
Supplies	$ 200,802	Soil testing, field days, project management, and perform land management and data collection of federal demonstration sites.
Contractual	$ 0	N/A
Construction	$ 0	N/A
Other	$ 86,000	Cooperators/producer reimbursement (40%) for costs incurred at demonstration sites. TWRI will develop and update the QAPP and website. Required USDA-ARS headquarters and location costs.
Indirect	$ 0	N/A
Budget Justification (Non-Federal)		
.Category	Total Amount	Justification
Personnel & Fringe Benefits	$ 127,500	Match provided by fulltime Texas AgriLife employee at Riesel.
Travel	$ 0	N/A
Equipment	$ 0	N/A
Supplies	$ 0	N/A
Contractual	$ 3,923	Match provided by TWRI for QAPP development.
Construction	$ 0	N/A
Other	$ 67,500	In-kind match for unreimbursed costs by cooperators/producers for conducting land management and data collection on privately owned demonstration sites.
Indirect	$ 0	N/A