Environment and Natural Resources Trust Fund
2009 Phase 2 Request for Proposals (RFP)

LCCMR ID: 047-B1

Project Title: Integrating Soil Erosion Prevention in Agricultural Watershed Management

Total Project Budget: $ $584,471

Proposed Project Time Period for the Funding Requested: July 2009 - June,2012

Other Non-State Funds: $ $0.00

Priority: B1. Reduce Soil Erosion

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Sponsoring Organization: U of M

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Region:	County Name:	City / Township:
SE	Martin	Elm Creek Township

Summary: This project will measure the impact of BMP's on water quality and peak flows on a watershed to provide information on integrating a variety of BMP's for the greatest impact.

Main Proposal: 1008-2-035-proposal-2009 LCCMR Proposal - UMN - RA.doc

Project Budget: 1008-2-035-budget-LCCMR 2009_Project Budget-Current.xls

Qualifications: 1008-2-035-qualifications-LCCMR Manager Qualificationss - ElmCreek.doc

Map: 1008-2-035-maps-LCCMR-2009-Map-UMN-RA.doc

Letter of Resolution:

Integrating Soil Erosion Prevention in Agricultural Watershed Management

I. PROJECT STATEMENT

Addressing pressing issues related to sediment loading and peak flows on a watershed basis requires integrating best management practices on annual croplands as well as practices which mitigate the delivery of sediments and chemicals to surface waters. Tributary watersheds in the Elm Creek basin, a tributary of the Blue Earth Basin, have been instrumented to measure gully runoff, tile drainage flow (from corn-soybean crops), and inflow-outflow from restored wetland – CRP complexes. This monitoring was partially supported by LCMR, as well as MPCA through an EPA program.

The proposed research expands upon the earlier monitoring and will include watershed-level treatments that can be quantified using a paired watershed approach. To date, we have established that (1) the gullies from upland corn-soybean fields (usually with headcuts where either a tile is broken or where a culvert concentrates flow) contribute the majority of sediment to the wetland sites; (2) tile flow contributes little sediment and P but large amounts of nitrate-N; (3) the interceptor wetlands (between the tile outflows and Elm Creek) are effective in attenuating peak (flood) flows and reducing nitrate-N loading to Elm Creek, but are not as effective in reducing P; and channel instability of Elm Creek remains a major problem in contributing sediment loads from in-channel scour and streambank erosion.

This research considers additional treatments of the gullies and the cropland areas to determine if perennial crops, cover crops with corn-soybeans, buffers and gully control measures can reduce flow volumes and velocity as well as sediment and P transport downstream. The research proposed is the logical next step allowing us to examine more closely BMP's for annually cropped land as part of an integrated watershed approach to dealing with sediment and peak flow issues which will allow us to determine which practices and, more importantly, which combination of practices will be more effective in dealing with water quality and peak flow issues at a watershed scale.

We propose to 1) continue to monitor outflow from annually cropped fields and restored wetland; 2) establish trials using cover crops, gully control, and perennial cropping systems in areas previously annual crops to be able to measure the impact on sediment and peak water flows coming off of those systems and entering Elm Creek; 3) continue to monitor research plots measuring runoff and tile flow at the Southern Research and Outreach Center in Waseca on which perennial crops have become established; and 4) take basic economic information on practices and cropping systems established and develop outreach activities (field days, publications) for landowners and researchers.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Determine impact of BMP's and crops on water quality and quantity. Budget: $ 245,471

1) 2009 -- Continue monitoring of the wetland outflows upstream in the SHEEK watershed (Figure 1) and the subwatersheds (F and G in Figure 2) that are tile drained corn-soybean fields in the Kittleson watershed as well as the wetland outflow;
2) Establish monitoring on three of the subwatersheds (from the four locations, B,C,D and E in Figure 1) on the SHEEK watershed;
3) 2010 -- Keeping one of the Kittleson corn-soybean subwatersheds as a control (no change in cropping system), apply treatments to the second Kittleson subwatershed and the three SHEEK subwatersheds: the four treatments to be investigated are:
    a) Cover crop and buffer – gully control -- corn- cover crop with a perennial vegetative buffer at the gully headcut area and gully stabilization with vegetative (grasses and woody shrubs) measures;
    b) Bioenergy crop -- convert watershed to a bioenergy crop (woody or herbaceous perennial) based on the preference of the landowner, and stabilize gully headcut as in (a).
    c) Buffer Only -- continue existing cropping practices but establish a perennial vegetative buffer at the gully headcut and plant perennial vegetation within the gully to reduce flows and soil erosion,
    d) Cover crop – without gully stabilization.

Monitoring would continue through 2010 – 2012 to obtain sufficient data to evaluate these practices. In addition, water flows and nutrient conditions through the CRP – wetland complexes would be monitored and evaluated to determine the fate of N and P though these systems.

Deliverable	**Completion Date**
Analysis of impact of treatments on sediment and peak flows	June, 2012

Result 2: Measurement of tile flow and runoff at Waseca UMN - SROC. Budget: $ 204,000

Existing crops will be monitored for their long-term effect on tile flow, and other crops will be added to compare crops with potential for providing environmental quality enhancement as well as a productive option for landowners. The crops compared will include: 1) alfalfa, 2) native perennial prairie, 3) willow, 4) hybrid poplar, 5) corn stover, 6)-winter rye cover crop, and 6) false

indigo. Crops are established over draintile and water quantity and quality is continually monitored coming out of the draintile. Each crop is grown in a 15 m wide by 38 m long plot. Subsurface tile drainage systems (perforated, plastic 10-cm tubing) were~~is~~ installed to a 1.2 M depth beneath each plot and the tiles connected to a collection outlet. Each plot is isolated to a depth of 1.8 m by trenching around plot borders and installing a .3 mm thick plastic sheet. Tile flow rates are determined daily by measuring the amount of water running from each tile line. Water samples for nitrate analysis are collected manually three times a week and subject to laboratory analysis at the University of Minnesota Plant and Soil Analytical Lab.

Cropping effects on erosion and runoff: Experimental plots have been instrumented to monitor naturally occurring runoff from snowmelt and rainfall. Plots originally established in 2005 have been expanded to include: (1) an agroforestry system of willows, (2) a native grass-native legume mixture, (3) a conventional corn-soybean rotation that serves as a control, (4), alfalfa, and a (5) corn-rye cover crop system. Crops are established in isolated plots from which runoff and water quality measurement are taken including sediment in runoff water. Plot size is 3 m wide by 10 m long. Flumes are used to channel water runoff using a CR10 data acquisition system. Water will be sampled to measure sediment and nutrient content via laboratory analysis at the University of Minnesota Plant and Soil Analytical Lab**.**

Deliverable	**Completion Date**
Analysis of impact of treatments on runoff/erosion and tile drainage/peak flows	June, 2012

Result 3: Coordination, economics research and outreach**.** Budget: $ 135,000

CINRAM and Rural Advantage will coordinate project activities. CINRAM will coordinate project research while Rural Advantage will be responsible for coordination with landowners and the SWCD and other outstate partners. Rural Advantage in coordination with UMN Extension will provide informational materials for landowners and copies of those materials will be on the CINRAM and Rural Advantage websites. Rural Advantage will initiate meetings for landowners or incorporate project material into their existing set of meetings starting in 2011. Data on the financial aspects of productions of crops and establishment of BMP's will be gathered from project sites and complemented by information from conservation organizations who regularly establish BMP's with landowners. That information will be incorporated into a report on the costs and benefits of establishing BMP's in the 3rd year of the project.

Deliverable	**Completion Date**
CINRAM will provide coordination throughout the project and a final report on the economics of tested BMP's will be prepared at the end of the project. Outreach materials and meetings will begin in 2011	June, 2012

III. PROJECT STRATEGY AND TIMELINE

A. Project Partners

The Center for Integrated Natural Resources and Agricultural Management (UMN) and Dept. of Forest Resources - Responsible for coordination and the hydrology and economics components. The Department of Agronomy and Plant Genetics (UMN) will be responsible for the field plot research at the Waseca Southern Research and Outreach Center. Rural Advantage will be responsible for coordination with landowners, SWCD, and outreach activities which will be coordinated with UMN Extension

B. Project Impact

(1) Provide quantitative information on effectiveness of BMP alternatives

(2) Provide information on environmental and financial costs and benefits of cropping alternatives

(3) Acquire data that can be used to calibrate and test hydrologic models (e.g., SWAT, modified PHIM – WetHawk model, and others) to scale up the study to further examine these land use and stream channel responses with larger acreages and differing BMPs.

(4) Provide information on strategies for integrating BMP's into watershed scale management to address erosion, water quality and peak flow issues.

C. Time

Because funding will be received well into the cropping season in 2009, the project will initiate monitoring of water quality and flows in 2009 but crop and cover crop establishment will be take place in the 2010 growing season and be monitored through 2012.

C. Long term strategy

Due to the number of years required to establish a perennial crop, we are requesting funding to pay land rent through 2014 and will be working on obtaining funding for 2013 and 2014 for monitoring the sites. Through a complementary grant from Xcel Energy we have some funding through August of 2013 but will need some additional funding.

Project Budget

IV. TOTAL PROJECT REQUEST BUDGET

BUDGET ITEM	AMOUNT	% FTE
Personnel:	$ -	%
2 Graduate Assistants (to manage and analze data from hydrology and agronomic research at Elm Creek and Waseca)	$210,321	50%
2 undergraduate students to assist project scientists and graduate students will field and office work.	$ 37,500	50%
Research Associate to manage project and carry out economic assessment	$60,000	20%
Research Scientist to manage field plots at Waseca on a permanent basis and assist with data analysis and reporting	$66,000	50%
Contracts:	$ -	
Rural Advantage: to coordinate with landowners and Martin County SWCD and also to provide outreach services (Field Days, Development of informational	$ 60,000	
Equipment/Tools:	$ -	
Water quality monitoring equipment for new catchment monitoring in Elm Creek Wateshed	$ 32,000	
Other:	$ -	
Water quality and soils analysis - Services paid to laboratory	$ 39,000	
Supplies for maintaining field plots	$ 2,400	
Travel	$ 8,000	
Costs of establishing perennial crops and cover crops	$ 9,250	
Land Rent for establishing BMP's (60 acres x $200/acre x 5 years)	$ 60,000	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 584,471	

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Remaining $ From Previous Trust Fund Appropriation (if applicable):	$ -	
Other Non-State $ Being Leveraged During Project Period:	$ -	
Other State $ Being Spent During Project Period:	$ -	
In-kind Services During Project Period:	$ -	
Past Spending:	$ -	

Project Manager Qualifications and Organization Description

PROJECT TITLE: Integrating Soil Erosion Prevention in Agricultural Watershed Management

University Cooperators

- Ken Brooks is professor of Watershed Management and has directed research on the hydrologic impacts of trees and perennial crops in agricultural landscapes. Dr. Brooks has been managing and directing research on the hydrologic impact of perennial crops in the Minnesota River Basin which has included modeling of those impacts as well as instrumenting and monitoring impacts for the last 5-7 years.
- Don Wyse is a professor in the Department of Agronomy and Plant Genetics and was the first director of the Minnesota Institute for Sustainable Agriculture and was also instrumental in establishing the Regional Sustainable Development Partnerships in Minnesota. Dr. Wyse has extensive experience with cover crops and perennial cropping systems and recently has organized a group of scientists to research the productive potential of perennial native prairie plants.
- Dean Current, a forest economist with social science background has extensive experience coordinating interdisciplinary and multinational research teams researching the costs and benefits of agroforestry systems and constraints to adoption of those systems.
- Craig Sheaffer is an agronomist with extensive experience with cover crops and forage crops, and recently initiated work on native prairie plants and has extensive experience managing research projects.
- Gary Wyatt, Extension with the Minnesota Extension Service has experience promoting agroforestry systems in rural communities. Mike will assist the project in developing outreach activities to disseminate project results to different audiences and stakeholder groups.

Citizen Groups

- Rural Advantage has a long history of implementation of conservation practices to improve water quality. These practices include traditional agricultural BMP's and innovative practices addressing high priority non point source pollution issues within the region. BERBI will be working with stakeholders to identify cooperators, disseminate information and coordinate discussion groups within their region.

Management

The CINRAM office on the University of Minnesota St. Paul Campus will handle overall project management. CINRAM receives financial support from the College of Food, Agriculture and Natural Resource Sciences (CFANS) and administrative support from the Department of Forest Resources.

Watershed modeling

Watershed models will be calibrated and applied in the Department of Forest Resources that operates computer as well as GIS facilities that will be used for developing and running the model and measuring landscape change. Office space and support for a graduate student will be supplied by the Department of Forest Resources.

Education, extension and the development of informational materials and events

Education, extension and the development of informational materials will be shared by the UM Extension Natural Resource Management Specialist in Mankato Minnesota with support from UM Extension office, the Center for Integrated Natural Resources and Agricultural Management at the University and Rural Advantage in Fairmont. Rural Advantage will be responsible for working with landowners and the local SWCD office.

Figure 1 SHEEK subwatersheds, Elm Creek drainage, MN

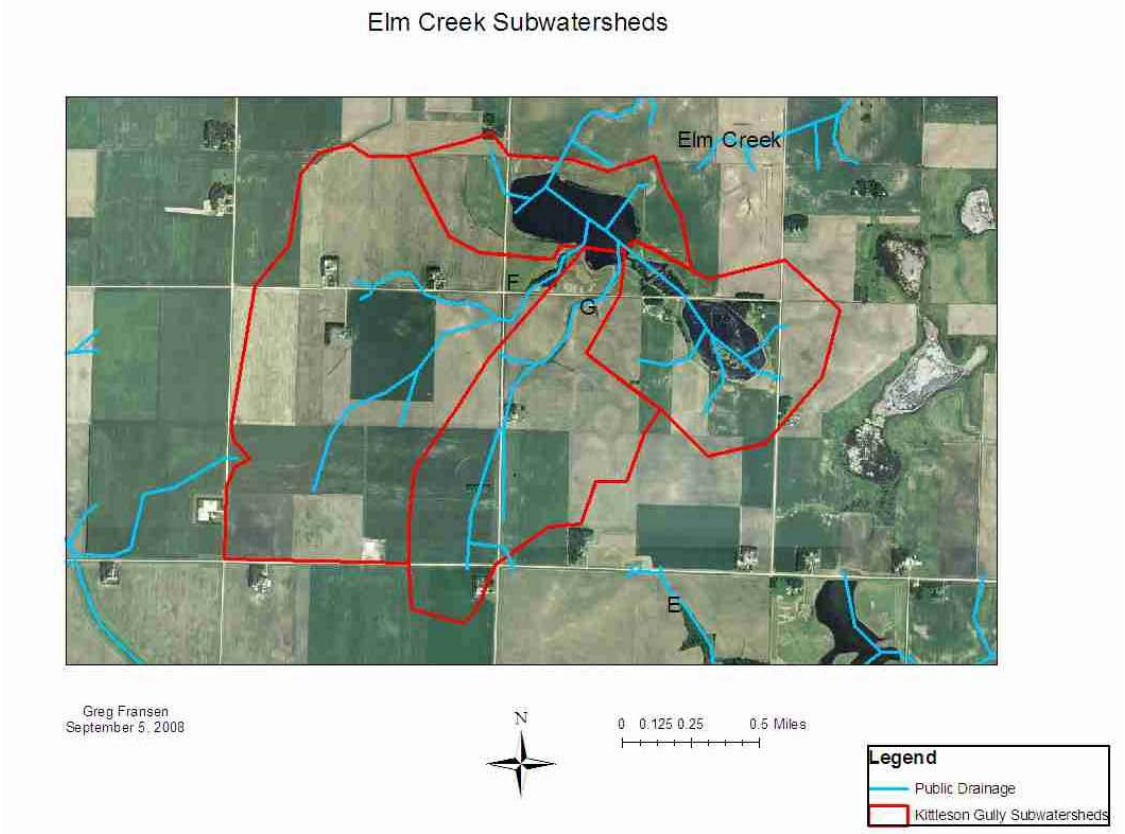

Figure 2. Kittleson subwatersheds in Elm Creek drainage, MN.