

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

LCCMR ID: 048-B1

Project Title: Reducing Stream Bluff Erosion through Hydrologic Management

Total Project Budget: \$ \$480,161

Proposed Project Time Period for the Funding Requested: July 2009 to 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:

Central, SE

County Name:

Blue Earth, Le Sueur, Nicollet,
Rice, Waseca

City / Township:

Summary: Relationships between slumping stream bluffs, river discharge, precipitation and drainage will be examined through modeling and field measurements. Outcomes facilitate better targeting of practices to control in-stream sources of sediment.

Main Proposal: 0908-2-018-proposal-Sands-LCCMR 08 Proposal.pdf

Project Budget: 0908-2-018-budget-Sands-LCCMR 08 UM budget form.pdf

Qualifications: 0908-2-018-qualifications-Sands-LCCMR 08 manager-institution.pdf

Map: 0908-2-018-maps-Sands-LCCMR 08 MAP.pdf

Letter of Resolution:

MAIN PROPOSAL

PROJECT TITLE: Reducing stream bluff erosion through hydrologic management

I. PROJECT STATEMENT

Lake Pepin is impaired for sediment and a total maximum daily load (TMDL) is being prepared by the Minnesota Pollution Control Agency (MPCA) to reduce sediment loading to Lake Pepin. Sediment coring and dating research shows that at current rates, Lake Pepin will fill with sediment in only 300 years. Over 85% of the sediment entering Lake Pepin originates in the Minnesota River Basin. From 2000-2005, water quality monitoring data showed that 35% of the sediment load in the Minnesota River was generated by the Le Sueur River watershed, which is classified as being impaired for sediment. Preliminary GIS analysis shows that nearly half of the sediment load in the Le Sueur River watershed is contributed by slumping stream bluffs. Additionally, 10-15% of the sediment load is generated from ravines. Taken as a whole, these analyses indicate that one-fifth of the sediment load entering Lake Pepin originates in the stream bluffs and ravines of the Le Sueur River watershed.

There is a pressing need to reduce sediment load entering Lake Pepin. The Le Sueur River watershed is a major contributor of sediment. Increased sediment loading from slumping stream bluffs is directly related to increased discharge in the Le Sueur River. There are two main factors that could produce increased discharge, namely; increased precipitation and increased subsurface tile drainage of agricultural land. This proposal seeks to determine the relationships between slumping stream bluffs, river discharge, precipitation and tile drainage. Understanding this relationship is important, because it will help identify the types of water management practices that will be most effective at reducing slumping stream banks. These management practices could include drainage management practices directed at subsurface water, wetland restoration practices directed at surface and subsurface water, or ditch and channel management practices.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Evaluate impacts of changes in tile drain intensity on stream discharge in the Beauford minor watershed **Budget:** \$ 103,510

The Soil Water Assessment Tool (SWAT) will be used to evaluate the impact of a doubling of sub-surface tile drainage in the Beauford minor watershed between 1992 and 2005 on discharge and peak flows in the Beauford minor watershed. The model will be calibrated and validated using over 32 years of years of peak flow data (1959-1985 and 2000-2007) and eight years of 15-minute discharge data (2000-2007) collected on CD86, at the mouth of the watershed where it meets Highway 22. In addition there are hourly flows for May-October of 1998 and daily flows for most of 1996-1997.

Deliverable

Completion Date

1. Evaluation of the performance of SWAT model at predicting impacts of tile drainage on stream discharge

June 1, 2010

Result 2: Extrapolation of calibrated SWAT model to entire Le Sueur River watershed. The SWAT model will be used to evaluate the impacts of increasing sub-surface tile drain density and other upland water management practices at the scale of the Le Sueur River watershed, with and without climatic trends.

Budget: \$151,622

Deliverable**Completion Date**

2. Analysis of relative impacts of changing tile drainage, upland water retention management practices, and precipitation on stream discharge in the Le Sueur River watershed

December 30, 2010

Result 3: Link stream bluff slumping model with stream discharge results from SWAT model for Le Sueur River watershed

Budget: \$225,029

The stream bluff slumping model (Bank Stability and Toe Erosion Model - BSM) developed at the National Sedimentation Laboratory in Mississippi will be linked with the Le Sueur River discharge results from the SWAT model. This will allow impacts of changing stream discharge and bluff toe slope armoring on stream bank slumping to be quantified under conditions of changing sub-surface tile drain density versus changing precipitation patterns. Field measurements of stream bluff sediments and stream bluff pore water pressures will be made to calibrate and validate the BSM model.

Deliverable**Completion Date**

3. Analysis of impacts of changing tile drain density and precipitation on stream bluff stability and erosion with different levels of bank protection.

June 30, 2012

III. PROJECT STRATEGY AND TIMELINE**A. Project Partners**

This project is a collaborative effort between the University of Minnesota and Minnesota State University at Mankato. Gary Sands and David Mulla at the University of Minnesota will be responsible for modeling impacts of tile drainage, upland water management, and precipitation on stream discharge with the SWAT model. They will also be responsible for linking stream discharge under various management and climatic scenarios from the SWAT model with the bluff stability and toe erosion (BSM) model in order to evaluate the impact of these scenarios on sediment loads from slumping stream bluffs. Shannon Fisher and Scott Matteson of Minnesota State University at Mankato will be responsible for the portion of the project that involves collecting field data to calibrate and validate the SWAT and BSM models, including water table depths, stream discharge data, stream bluff sediment characteristics and pore water pressures.

B. Project Impact

It is absolutely critical to be reasonably certain about the potential impact of various upland water management strategies on stream bluff slumping before embarking on massive cost sharing and BMP implementation strategies that may or may not be effective at reducing sediment loads in the Le Sueur River watershed. If upland water management strategies are shown to be effective at reducing stream bluff slumping, it makes economic sense to use these strategies to address the sediment impairments in the Le Sueur River watershed and Lake Pepin.

C. Time

The estimated cost of this project is \$480,161. It is anticipated that the project can be completed in three years. Half of the project will be devoted to evaluating the impact of precipitation and upland water management practices on stream discharge (annual, monthly average, base flows, and peak flows). The other half of the project will be devoted to evaluating the impact of stream discharge patterns on stream bluff stability and sediment losses from slumping stream bluffs in the Le Sueur River watershed.

Project Budget

INSTRUCTIONS AND TEMPLATE (1 PAGE LIMIT)

(One page limit, single-sided, 10 pt. font minimum Retain the bold text and remove all instructions typed in italics. Add or delete rows as is necessary. If a category is not applicable you may write "N/A", leave it blank, or delete the row.)

IV. TOTAL PROJECT REQUEST BUDGET

BUDGET ITEM	AMOUNT	% FTE
Personnel: <i>Post-doc</i>	\$ 177,802	100%
Graduate Research Assoc.	\$ 113,941	50%
Faculty	\$ 11,369	3%
Contracts: for updated maps of changes in tile drain density, field data collection	\$ -	
Minnesota State University at Mankato	\$ 147,049	
	\$ -	
Equipment/Tools: Bluff pore pressure monitoring equipment	\$ 15,000	
Acquisition (Including Easements): <i>List # of acres and who will hold title (e.g., DNR, Non-profit)</i>	\$ -	
Restoration: <i>List # of acres.</i>	\$ -	
Other: <i>List by item and explain.</i>	\$ -	
Travel (visits to field and MSU for meetings)	\$ 15,000	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 480,161	

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Remaining \$ From Previous Trust Fund Appropriation (if applicable): <i>How much Trust Fund money remains not spent or legally obligated from any previous Trust Fund appropriation for any directly related project of the proposing project, project manager, or project organization? Specify the appropriation.</i>	\$ -	<i>Unspent or Not Legally Obligated</i>
Other Non-State \$ Being Leveraged During Project Period: <i>What additional non-state cash \$ will be spent on the project during the funding period? For each individual sum, list out the source of the funds, the amount, and indicate whether the funds are secured or pending approval.</i>	\$ -	<i>Secured or Pending</i>
Other State \$ Being Spent During Project Period: <i>What additional state cash \$ (e.g. bonding, other grants) will be spent on the project during the funding period? For each individual sum, list out the source of the funds, the amount, and indicate whether the funds are secured or pending approval.</i>	\$ -	<i>Secured or Pending</i>
In-kind Services During Project Period: <i>What in-kind services will be provided during the funding period? List type of service(s) and estimated value. In-kind services listed should be specific to the project.</i>	\$ -	
Past Spending: <i>List money spent or to be spent on this specific project, cash and/or in-kind, for 2-year timeframe prior to July 1, 2009</i>	\$ -	

Project Manager Qualifications and Organization Description

Dr. Gary Sands is an associate professor and extension engineer in the Department of Bioproducts and Biosystems Engineering, College of Food, Agricultural and Natural Resource Sciences, University of Minnesota. Dr. Sands has over 25 years of experience in soil and water engineering in several states and countries. His experience includes research, development and application of drainage models for the design and analysis of subsurface drainage systems and their impacts on the environment. During his tenure at the University of Minnesota, Dr. Sands has published extensively on the application of drainage models in hydrology and water quality. Model application is supported by field experimentation at several University of Minnesota Research and Outreach Centers through collaboration with other research faculty. Dr. Sands also leads an Extension program in water management and conducts drainage design and water quality workshops throughout the state. In addition to his work in Minnesota, Dr. Sands collaborates with research and Extension faculty across the upper Midwest on drainage and water quality issues. He and his colleagues participate in the Agricultural Drainage Management Systems Task Force whose aim is to accelerate the adoption of drainage best management practices in the upper Midwest to reduce Gulf Hypoxia.

The University of Minnesota's cutting-edge research and creation of new knowledge significantly contributes to world understanding and learning as the state's primary research institution. The University of Minnesota has almost 20 colleges with active research programs. In addition, within these colleges and in some administrative units at the University, research is performed at numerous centers and institutes. The College of Food, Agricultural and Natural Resources Sciences is a large and diverse community with about 1800 undergraduate students, 800 graduate students, 253 faculty, and 800 staff members that operate through 14 academic departments, 7 research centers throughout the state, and 30+ campus based interdisciplinary centers. We benefit from vital partnerships with the University's academic health center, institute of public affairs, institute of technology, law school, and business school, as well as government agencies, industry, and nonprofit organizations. This rich context allows faculty to conduct strong, cross-disciplinary research programs across a wide spectrum of interests related to agriculture and natural resources. The college receives over 350 grant awards annually, totaling \$33 million.

MAP

The following images show the location and subwatershed breakdown of Le Sueur River Watershed, and the Beauford minor watershed.

