Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)

LCCMR ID: 147-E2

Project Title:

Statewide Prioritization of Wetland Restorations for Water Quality

LCCMR 2010 Funding Priority:

E. Natural Resource Conservation Planning and Implementation

Total Project Budget: $ $465,683

Proposed Project Time Period for the Funding Requested: 3 years, 2010 - 2013

Other Non-State Funds: $ $0

Summary:

Develop GIS decision system and wetland prioritization tool so managers statewide can rank subwatersheds by the probability for wetland restoration success to improve water quality and habitat in local-scale watersheds.

Name: Valerie Brady

Sponsoring Organization: UMD, NRRI

Address: 5013 Miller Trunk Hwy
Duluth MN 55811

Telephone Number: (218) 720-4279

Email: vbrady@nrri.umn.edu

Fax: (218) 720-4329

Web Address: www.nrri.umn.edu/cwe/water.htm

Location:

Region: Statewide

County Name: Statewide

City / Township:

_____ Knowledge Base _____ Broad App. _____ Innovation

_____ Leverage _____ Outcomes

_____ Partnerships _____ Urgency _____ TOTAL

PROJECT TITLE: Statewide Prioritization of Wetland Restorations for Water Quality

I. PROJECT STATEMENT: Wetlands provide many watershed functions including flood reduction, groundwater recharge, wildlife habitat, and water quality improvement and protection. In most of Minnesota, whether in the bogs and peatlands up north or the prairie potholes in the agricultural region, significant past hydrologic and landscape changes have short circuited wetlands' protective functions. Many of Minnesota's watersheds are facing enormous challenges to stabilize and restore watershed health and integrity; restoring wetlands is often a key part of this watershed restoration (e.g., TMDL efforts).

The Minnesota Statewide Conservation and Preservation Plan calls for improved processes for wetland restoration. Similarly, the recently adopted State Wetland Restoration Strategy identified improved water quality models as a key part of wetland restoration prioritization. In addition, the recently adopted constitutional amendments provide funds for improving water quality and habitat restoration, with few guidelines for selecting among the many potential projects. For wetland restorations to provide the greatest water quality, flood storage, and habitat benefits, restorable wetlands must be evaluated for both the likelihood of restoration success and potential benefits provided by that particular restoration. Such evaluation will assure the restoration will provide improvements and result in a sustainable, healthy wetland. Modern GIS techniques along with models for local-scale watersheds can identify wetland restoration priorities. **This project will apply sound science to develop models and appropriate approaches to proactively identify viable and priority wetland restorations and rehabilitations that will deliver the maximum water quality benefit, along with flood storage and habitat benefits, to impaired waterbodies or watersheds with the greatest likelihood of success. Decision tools (and training) will be made available to state and local managers charged with selecting restoration projects.**

We propose to develop a statewide, three-tiered approach to rank watershed stressors and determine the probability for wetland restoration and rehabilitation success in watersheds of various sizes. Wetland restorations most likely to succeed can then be prioritized for their potential to provide regionally-important water quality, flood storage, and habitat benefits. Existing MPCA data will be used to validate model results. Local-scale water quality models will be refined to rank and define pollution reduction targets for high priority wetland restorations. Field measurements will further inform and refine local-scale watershed water quality models to rank individual wetlands in accord with local watershed management goals and priorities. Pilot watersheds with differing water quality, flood storage, and habitat needs will be selected for local-scale watershed model testing.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: GIS-based decision system to prioritize wetland restorations for water quality and habitat improvement **Budget: $215,175**

We will build on existing watershed boundaries to delineate local subwatersheds within each of Minnesota's 81 major watersheds using automated GIS watershed delineation tools. In each major watershed, we will summarize landscape characteristics (e.g., elevation, surface hydrology, soils, vegetation) and stressors (e.g., land use, population and road density, pollution point sources, agricultural chemical use). Each subcatchment will receive a stress score that is scaled uniquely within each major watershed, allowing ranking of local subwatersheds within each major watershed. Additional data such as TMDL impairment status, wetland classification, and the restorable wetland inventory will be included in the prioritization scoring system. Finally, we will include model variables that predict wetland contributions to water quality and habitat within the local subwatersheds. The resulting GIS-based system will allow managers to identify localized areas where wetland restorations are both most likely to be successful and most needed to improve downstream water quality and local or regional habitat.

Deliverables:

1. **Delineated local-scale watersheds within all 81 major MN watersheds, and summarized stressor scores** **June 2012**
2. **Predicted water quality and habitat response functions** **Sept. 2012**

3. Prioritization scoring system **Nov. 2012**

Result 2: Test GIS-based decision system **Budget**: **$40,100**
The GIS models will be tested in two ways: by using existing MPCA wetland condition data to determine whether GIS-based stressor summaries accurately predict the condition of existing wetlands as determined by field assessments; and by prioritizing local subwatersheds for wetland restoration potential within each of two major and contrasting watersheds. The St. Louis River and Redwood River watersheds represent forested and agricultural conditions, respectively. Based on the outcomes of these two efforts, we will refine the GIS-based decision system.
Deliverable:
1. Refined and validated model with test results from 2 major watersheds **Dec. 2012**

Result 3: Tools for local-scale watershed wetland selection methods **Budget: $157,114**
The local-scale wetland hydrology and water quality model, WET-HAWQ, will be applied and modified to generate critical response criteria for restoration discrimination among wetlands for flood control and water quality benefits. The refined model will be tested with field data from two pilot watersheds (one each from the St. Louis and Redwood watersheds) and the response criteria will be assessed. The final tool will allow managers to identify which wetlands within a small, local watershed are highest priorities for restoration, and assure that these restorations will be successful and provide the desired downstream benefits.
Deliverables:
1. Restorable wetland selection tool **Nov. 2012**
2. User guide for local managers **March 2013**

Result 4: Tools for Local Decision-Makers **Budget: $53,294**
To ensure that state and local managers have access to the decision-support system and restorable wetland selection tool, we will create web-based interfaces for working with each of them. We will generate user manuals for each (see also deliverables for Result 3), and will then provide training for managers to ensure that they understand how to use each tool and how to modify the tools to fit their regional and local priorities.
Deliverables:
1. Web-based interfaces **May 2013**
2. User guide for the decision-support system **May 2013**
2. Training sessions for local resource managers **June 2013**

PROJECT STRATEGY AND TIMELINE

A. Project Partners: Dr. Lucinda Johnson, Natural Resources Research Institute, University of Minnesota Duluth; Dr. John Nieber, Bioproducts and Biosystems Engineering, University of Minnesota Twin Cities; Mark Gernes, Environmental Outcomes Division, Minnesota Pollution Control Agency.
Project Cooperators: Board of Water and Soil Resources; Division of Fish and Wildlife, Minnesota Department of Natural Resources.
B. Time: July 1, 2010 to June 30, 2013
C. Long-Term Strategy: The 2008 constitutional amendment provides a unique window of opportunity for improving Minnesota's environmental resources. To meet the voters' expectations, conservation and watershed restoration require strategically-located restoration projects to renew the natural resource infrastructure. This proposal will apply current technology and sound science in a stepwise approach to prioritize and target restoration activities and optimize water quality, flood storage and habitat benefits, and provide a useful tool for decision makers charged with selecting individual projects. Results from this proposal will contribute directly to optimizing wetland restoration opportunities around the state, while also advancing restoration science and conservation practice and policy.

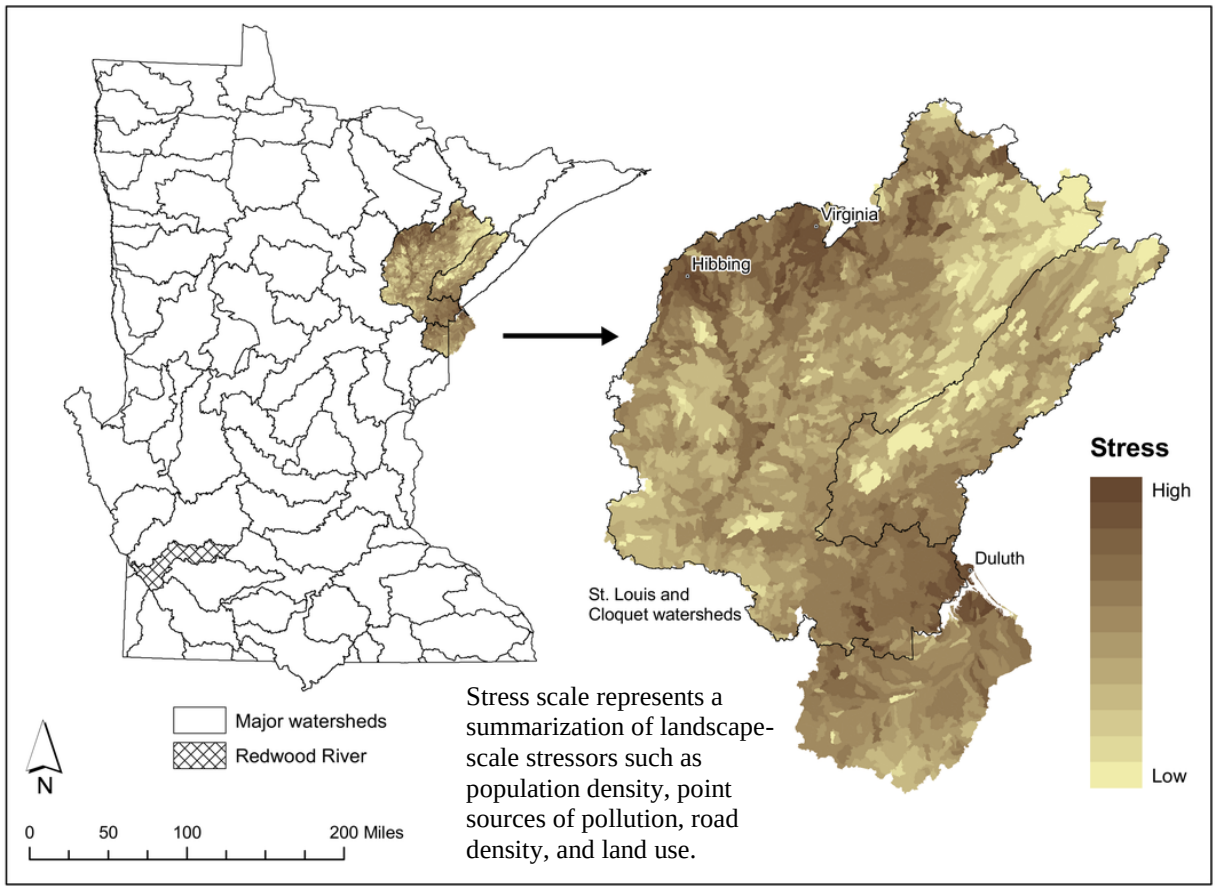
Project Budget

IV. TOTAL PROJECT REQUEST BUDGET (3 years)

BUDGET ITEM	AMOUNT
Personnel:	$ -
Lead PI (10% effort/yr for 3 yrs; fringe rate = 32.3%)	$ 26,515
Co-PI (3.3% effort/yr for 3 yrs; fringe rate = 32.3%)	$ 13,837
Lead GIS specialist/programmer (33% effort/yr each for 3 yrs; fringe rate = 32.3%)	$ 83,560
GIS specialist (33% effort/yr each for 3 yrs; fringe rate = 32.3%)	$ 78,690
1 Programmer (25% effort in year 3; fringe rate = 37%)	$ 19,900
1 Post-doctoral associate (4.3% effort/yr for 3 years; fringe rate 19.75%)	$ 11,954
1 Research fellow (12% effort/yr for 3 years; fringe rate 32.3%)	$ 26,019
Grad asst. 1 (50% 9-mo effort, 75% summer for 2 yrs, fr. 25%)	$ 71,177
Grad asst. 2 (50% 9-mo effort, 75% summer for 2 yrs, fr. 25%)	$ 71,177
1 Undergrad research assistant (65% summer effort for 2 yrs, fr. 8.21%)	$ 10,582
Equipment/Tools/Supplies:	$ -
4 water level recorders ($1000 each)	$ 4,000
Computer GIS software updates	$ 1,000
Travel:	$ -
Field travel to identify and sample wetlands	$ 10,612
In-state travel to project meetings and for workshops	$ 2,500
Travel to present results at Water Resources conference	$ 1,800
Additional Budget Items:	$ -
Water quality sample analysis (367 samples at $60 each)	$ 22,020
NRRI GIS lab user fee ($4.1/hr for 800 hrs/yr for 3 yr)	$ 9,840
Photocopying (workshop materials)	$ 500
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 465,683

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:	$ -	*NA*
Other State $ Being Applied to Project During Project Period:	$ -	*NA*
In-kind Services During Project Period:		Approved
MPCA personnel salary match (15% effort/yr for 3 yrs)	$ 30,000	
4 Sigma automatic water samplers		Approved
Remaining $ from Current Trust Fund Appropriation (if applicable):		*NA*
Funding History:		NA
	$ -	



Our project area includes all 81 major watersheds in Minnesota. We will create a GIS-based decision system to rank local-scale watersheds within each of the state's major watersheds for likelihood of restoration success (e.g., areas with lower stress) and generation of water quality and habitat benefits. To verify and refine our decision-support system, we will test it by prioritizing local-scale watersheds within two major basins, the St. Louis River and Redwood River (highlighted above). Then we will use one high-priority local-scale watershed within each test basin to refine the wetland selection tool for wetland restoration. Both the decision system and the wetland selection tool will ultimately be available to managers through a user-friendly web interface.

LCCMR 2009
Statewide Prioritization of Wetland Restorations for Water Quality
Valerie J. Brady, Natural Resources Research Institute, University of Minnesota Duluth

Key Qualifications
Dr. Brady is a Research Associate at NRRI. She is an aquatic ecologist with 15 years experience investigating human effects on stream and wetland ecosystems around the Great Lakes. Her research focuses on the use of macroinvertebrates as biotic condition indicators for aquatic ecosystems and accurately assessing stream and wetland condition to differentiate between human and "natural" influences.

Education
US EPA Mid-continent Ecology Division, Post-doc. 2000; Michigan State University, Zoology, Ph.D. 1996
Michigan State University, Zoology, M.S. 1982; Taylor University, Environmental Science, B.S. 1988

Selected Grants
Volunteer-assisted water quality/biological monitoring of North Shore Superior streams. Minnesota Pollution Control Agency. Co-PI with R. Axler. 2008-2009. $225,000.
Duluth residential stormwater reduction demonstration project for Lake Superior Tributaries. Minnesota Pollution Control Agency 319 program (US EPA). Co-PI with C. Kleist. 2008-2011. $167,383.
North Shore community futures: aquatic resources and growth scenarios. Minnesota Lake Superior Coastal Program. 2006-2009. PI. $58,043.
Assessing the condition of Lake Superior rocky coastlines. Minnesota Sea Grant College Program. 2005-2008. PI. $80,000.

Selected Publications:
Danz, N.P., G.J. Niemi, R.R. Regal, T. Hollenhorst, L.B. Johnson, J.M. Hanowski, R. Axler, J.J.H. Ciborwoski, T. Hrabik, **V.J. Brady**, J.R. Kelly, J.C. Brazner, R.W. Howe, C.A. Johnston, G.E. Host. 2007. Integrated gradients of anthropogenic stress in the Great Lakes basin. *Envir. Manage*. 39:631-647.
Brazner, J.C., N.P. Danz, G.J. Niemi, R.R Regal, A.S. Trebitz, R.W. Howe, J.M. Hanowski, L.B. Johnson, J.J.H. Ciborowski, C.A. Johnston, E.D. Reavie, **V.J. Brady**, G.V. Sgro. 2007. Evaluation of geographic, geomorphic and human influences on Great Lakes wetland indicators. *Ecolog. Indic.* 7:610-635.
Detenbeck, N.E., **V.J. Brady**, D.L. Taylor, V.M. Snarski, S.L. Batterman. 2005. Relationship of stream flow regime in the western Lake Superior basin to watershed type characteristics. *J. Hydrology* 309 :258-276.
Danz, N.P., R.R. Regal, G.J. Niemi, **V. Brady**, T. Hollenhorst, L.B. Johnson, G.E. Host, J.M. Hanowski, C.A. Johnston, T. Brown, J. Kingston, and J.R. Kelly. 2005. Environmentally Stratified Sampling Design for the Development of Great Lakes Environmental Indicators. *Env. Monit. Assess.* 102:41-65.
Brady, V.J., B.J. Cardinale, J. P. Gathman, and T. M. Burton. 2002. Does facilitation of faunal recruitment benefit ecosystem restoration? An experimental study of invertebrate assemblages in wetland mesocosms. *Rest. Ecol*. 10(4):617-626.

Natural Resources Research Institute is a part of the University of Minnesota Duluth. Its mission is to promote private sector employment based on natural resources, in an environmentally sensitive manner. NRRI scientists have extensive experience in managing large, interdisciplinary projects whose objectives include the development of tools for environmental assessment and resource management. These tools promote citizen education leading to improved understanding of how human activities influence water quality and ecosystem health. Our scientists have been heavily involved in linking landscape influences to the biotic condition of streams and wetlands, in addition to participating as core team members of the MN Statewide Conservation and Protection Plan. Our collaborator, John Nieber and his research team, are experienced in hydrologic and water quality monitoring techniques and in the development and application of hydrologic and water quality models. Nieber and team developed the WET-HAWQ (WETland - Hydrologic and Water Quality) model.