

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 044-B

Responsive Water Quality Monitoring: Southeastern Minnesota Trout Streams

Category: B. Water Resources

Total Project Budget: \$ 583,980

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

Automated stream samplers, citizen scientists, and biological monitoring will be used to develop an improved, more responsive system to protect valuable at-risk trout streams in southeastern Minnesota from polluted run-off.

Name: Neal Mundahl

Sponsoring Organization: Winona State University

Address: 175 Mark St W
Winona MN 55987

Telephone Number: (507) 457-5695

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Web Address _____

Location

Region: Southeast

County Name: Winona

City / Township:

Alternate Text for Visual:

Four figures, including a map of the proposed study watersheds in SE MN, a trout killed by polluted runoff in 2015, a water monitoring station, and a list of agricultural chemicals detected in the Whitewater River in 2015.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



PROJECT TITLE: Responsive Water Quality Monitoring: Southeastern Minnesota Trout Streams

I. PROJECT STATEMENT: This project proposes to develop a more responsive, early-warning system of automated water quality monitoring stations and trained citizen scientists capable of detecting storm-related impairments to at-risk trout streams in the Whitewater River watershed in southeastern Minnesota. SE MN has >700 miles of trout streams. Water quality in many of these top-tier trout streams has been compromised by rain-event run-off, exposing sensitive trout to mixtures of eroded soils, pesticides, urban stormwaters/wastewaters, and animal wastes. Recently, a traditional post-kill investigation of a large, mid-summer, run-off-induced fish kill (>9,000 dead fish spanning >6 stream miles of the South Branch Whitewater River) failed to determine a cause, in part, because of delays in reporting and responding to the kill and the lack of water-quality monitoring infrastructure within the impacted reach. Regional land-use practices are changing and the use of new chemicals is expanding rapidly. Environmental monitoring has to adapt to these changes and be prepared to respond immediately to any and all run-off events, especially those within high-risk areas.

The main goal of this project is to better protect the at-risk trout streams in SE MN by developing an improved water-quality monitoring infrastructure and network within the Whitewater River system (>70 miles of trout waters containing brook, brown, and rainbow trout). This will be achieved by:

- **Automated Water Sampling** - establishing both continuous and rain-event sampling throughout 3 at-risk trout stream reaches (North, South, Middle Branches of the Whitewater River),
- **Citizen Scientists** - training an action network of citizen scientists to respond to episodic run-off events and to monitor water quality and aquatic life in these and additional trout stream reaches, and
- **Baseline Surveys** - conducting inclusive biotic inventories of fish and aquatic invertebrate communities throughout entire at-risk watersheds for broader, complete delineation of baseline conditions.

These activities will demonstrate linkages between watershed activities and water quality in these important regional trout streams, distinguishing between sound land management practices and those that have the potential for causing significant harm to aquatic communities. The results of this project can be expanded to additional watersheds and will significantly benefit and protect a sensitive component of Minnesota’s environment, and help to sustain an important and highly valuable tourist industry within the state.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Establish a network of 9 continuous and rain-event-triggered water quality monitoring stations on 3 trout streams within at-risk watersheds (North, South, Middle Branches Whitewater River; use existing Trout Unlimited-owned station on Garvin Brook as low-risk control; all stations maintained/monitored by professional scientists) Budget: \$429,000

Nine weather/water quality monitoring stations will be established within at-risk sections of 3 streams (3/stream; upper, mid, lower) to gather continuous data and to collect water samples in response to rain events. These will provide baseline condition data and detect any changes in response to rain-induced run-off. Rain-event samples (water and sediment) will detect presence/concentrations of potentially harmful chemicals delivered to stream during run-off.

Outcome	Completion Date
1. 9 continuous weather/water monitoring stations placed in 3 streams (3/stream)	2018
2. Rain-event-triggered (March-Nov) water samplers placed at each station site (#1 above)	2018
3. Analyses of rain-event water samples for nutrients, solids, bacteria by Winona State U	2020
4. Analyses of rain-event water samples, sediments for pesticides by U of MN	2020

Activity 2: Train and deploy citizen scientists to monitor streams in SE MN, sample and Budget: \$51,190



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2017 Main Proposal

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analyze water quality after rain events, and immediately notify MN State Duty Officer (Dept. of Public Safety; single contact point for reporting any environmental threat within MN) of any fish kills observed

Citizen scientists will be trained in basic stream water sampling/analysis, allowing them to regularly monitor streams in the project area and elsewhere throughout SE MN and to analyze water quality changes in response to rain-event run-off. They also will receive MN State Duty Officer information cards (for their use and additional distribution) containing instructions for reporting fish kills. Signs containing State Duty Officer info will be developed and placed along streams at angler access points to better inform the general fishing public about the process for reporting fish kills. Cards and signs to include QR code for cell phone use.

Outcome	Completion Date
1. Training for 15-20 citizen scientists by National Trout Center, Winona State U	2018
2. Development, distribution, placement of MN State Duty Officer contact info, signage	2019
3. Distribution, use of water testing kits by citizen scientists	2020

Activity 3: Conduct baseline surveys of fish and aquatic invertebrates throughout streams within high-risk watersheds

Budget: \$103,790

Fish and aquatic invertebrate communities in at-risk trout streams will be surveyed at regularly spaced reaches (1 site/mile, each site 150 m or more) throughout each stream to determine species presence and relative abundance, providing baseline information in the event of potentially lethal runoff events. Aquatic invertebrate collections made by citizen scientists will provide more baseline info for additional streams/locations.

Outcome	Completion Date
1. Survey and identify fish in multiple stream reaches per stream (~1 reach/mile)	2020
2. Survey and identify aquatic invertebrates in each stream reach (#1 above)	2020
3. Identify aquatic invertebrates collected from other sites by citizen scientists	2020

III. PROJECT STRATEGY

A. Project Team/Partners

Project Team/Partners Receiving Funds

Winona State University: Large River Studies Center - Dr. Neal Mundahl (Aquatic Ecologist, project manager), Dr. Jennifer Biederman (Aquatic Ecologist); Southeastern Minnesota Water Resource Center - New faculty member (Hydrologist/Geomorphologist); Southeast Minnesota Analytical Services - water sample analyses (nutrients, solids, bacteria)

National Trout Center (Preston, MN): Dr. George Spangler (Chair, Board of Directors)

University of Minnesota: Dr. William Arnold (Environmental Chemist/Engineer)

Project Team/Partners Not Receiving Funds

Minnesota Trout Unlimited (Win-Cres, Hiawatha Chapters); Minnesota Trout Association; Whitewater River Watershed Project (Sheila Harmes, Project Coordinator)

B. Project Impact and Long-Term Strategy - The trout streams of SE MN, along with those in neighboring states within the Driftless Area, have a \$1.1 billion annual economic impact on the region. Protecting these resources from contaminated run-off is imperative. Better understanding the threats to these streams and then managing to reduce or eliminate those threats is a critical need not being addressed by present-day stream monitoring and post-kill investigations. This project will develop and test a model for improved environmental risk detection and management. If successful, this framework can be expanded to include a wider geographic area and provide other governmental and private agencies with a better system for stream monitoring and resource protection.

C. Timeline Requirements - 3 years

2017 Detailed Project Budget

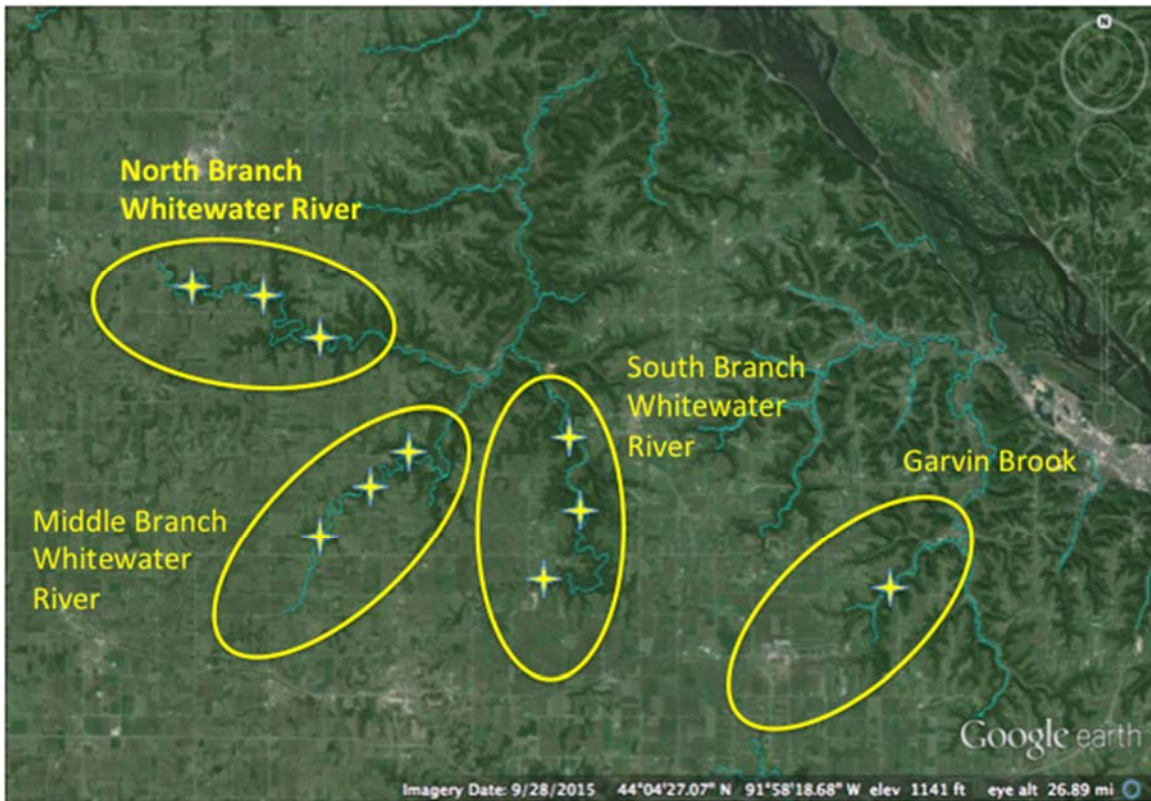
Project Title: Responsive Water Quality Monitoring: Southeastern Minnesota Trout Streams

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
Professor Neal Mundahl, Project Manager (84% salary, 16% benefits); 4 weeks each	\$ 39,000
Professor Jennifer Biederman, Aquatic Ecologist (84% salary, 16% benefits); 4 weeks each summer for 3 years	\$ 29,000
Professor Hydrologist TBD (84% salary, 16% benefits); 4 weeks each summer for 3 years	\$ 29,000
2 Winona State University Graduate Research Assistants, field work and data collection (58% salary, 42% benefits); 50% FTE each for each of 2 years	\$ 104,000
Professional/Technical/Service Contracts:	
William Arnold, U of MN environmental chemist (75% salary, 25% benefits); 2 weeks for	\$ 19,000
1 U of MN Graduate Research Assistant, sample processing and analyses (57% salary, 43% benefits); 50% FTE for each of 2 years	\$ 90,000
National Trout Center (Preston, MN) Intern, citizen scientist training and oversight (90% salary, 10% benefits); 25% FTE for 20 weeks for each of 3 years	\$ 7,200
U of MN Dept. of Civil, Environmental, & Geo-Engineering (pesticide analyses: water, sediment, 400 samples @ ~\$100/sample, with 6-10 chemicals screened/sample)	\$ 40,000
Equipment/Tools/Supplies:	
Water quality/weather monitoring/sampling stations (9 stations, continuous & rain-event-triggered @ \$20,000 each - competitive bid to select vendor)	\$ 180,000
Surface water testing kits and supplies for citizen scientists (20 kits @ \$400 each)	\$ 8,000
Invertebrate sampling gear for citizen scientists (20 sets @ \$100 each)	\$ 2,000
Backpack electrofishing unit combo (Smith-Root LR-24 electrofisher, electrodes, 2 batteries, charger) @ \$9,780	\$ 9,780
Waders for baseline stream surveys (6 @ \$140 each), invertebrate sampling supplies for baseline stream surveys (2 Hess samplers @ \$625 each, 20 gallons ethyl alcohol)	\$ 2,010
Travel:	
Mileage (To maintain monitoring stations, transport water/sediment samples to Minneapolis for analyses, coordinate citizen scientist activities, conduct fish/invertebrate	\$ 7,050
Additional Budget Items:	
Winona State University Southeast MN Analytical Services (nutrient, solids, bacteria analyses, 500 samples @ \$30/sample)	\$ 15,000
Printing informational cards (State Duty Officer info for reporting fish kills): 1000 cards for \$60; informational signs for stream access points: 60 sign/post combos @ \$48 each - \$2,880; both to include QR code for cell phones	\$ 2,940
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 583,980

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period:	N/A	N/A
Other State \$ To Be Applied To Project During Project Period:	N/A	N/A
In-kind Services To Be Applied To Project During Project Period:	\$ 15,000	Secured
Win-Cres Chapter Trout Unlimited: Existing water monitoring station on Garvin Brook @ \$15,000; project personnel will have complete access and control over station for duration of project		
Project manager Neal Mundahl salary/benefits (grad student supervision, 20% academic	\$ 26,000	Secured
National Trout Center: Monitoring volunteers @ \$10,000 Hiawatha and Win-Cres Chapters Trout Unlimited, MN Trout Association: Monitoring volunteers @ \$40,000 (15-20 volunteers, 50 hrs/year, 3 years)	\$ 50,000	Pending
Funding History:	N/A	N/A
Remaining \$ From Current ENRTF Appropriation:	N/A	N/A



Aerial view of Whitewater River project area (9 monitoring stations on 3 branches) in southeastern Minnesota. Garvin Brook will serve as a baseline control station.



MN DNR photo of a dead trout at South Branch Whitewater River, 30 July 2015.



Water monitoring station on Garvin Brook.

List of 23 fungicides, herbicides, and herbicide degradate compounds detected in the South Branch Whitewater River, 2015.

Azoxystrobin	2,4-D	Bentazon	Dimethenamid OXA	Metolachlor OXA
Carbendazim	Acetochlor	DEDI-atrazine	Hydroxyatrazine	Prometon
Fluxapyroxad	Acetochlor ESA	Desethyl atrazine	Imazethapyr	Saflufenacil
Picoxystrobin	Alachlor ESA	Dimethenamid	Metolachlor	
Pyraclostrobin	Atrazine	Dimethenamid ESA	Metolachlor ESA	

Project Manager Qualifications and Organization Description

Project Manager:

Neal Mundahl, Department of Biology, Winona State University

PhD in Zoology, 1984, Miami University, Oxford, OH

MS in Biological Sciences, 1980, Michigan Technological University, Houghton, MI

BA in Biology-Environmental Science, 1978, Winona State University, Winona, MN

1997-present Professor, Department of Biology, Winona State University

1994-1997 Associate Professor, Department of Biology, Winona State University

1989-1994 Assistant Professor, Department of Biology, Winona State University

1984-1989 Visiting Assistant Professor, Department of Zoology, Miami University

Research experience within watershed: 25 years experience within Whitewater River watershed: biological (fish, invertebrates) monitoring, water chemistry, hydrology

Funding: Past 20 years: 14 funded external grants, total funding \$454,360

Teaching: Fishery Biology, Ichthyology, Plant Ecology, Ornithology, Limnology

Supervisory experience: Graduate students: 2; undergraduate student researchers: 176; summer research assistants: 42

Publications: Book chapters: 2; peer-reviewed research articles: 35

Service to field of ecology: Past year: manuscript reviewer for 3 journals; treasurer for Mississippi River Research Consortium; board member for Win-Cres Chapter Trout Unlimited, consultant for Winona County Invasive Species Advisory Group, Whitewater State Park, Whitewater-Winona Watershed, City of Winona (Lake Winona management)

Organization Description:

Founded in 1858, Winona State University (WSU) is a comprehensive, 4-year, public university with approximately 8,500 students. The oldest member of the Minnesota State Colleges and Universities System, WSU offers 80 undergraduate, pre-professional, licensure, graduate, and doctorate programs. The WSU Professional Science Master's Degree Program in Applied Research and Management began in 2012 to integrate hands-on science and technical training with management skill development.

The WSU College of Science & Engineering is committed to furthering advances in science and engineering by promoting research and scholarship across disciplines. In support of these endeavors, the College has established three centers that provide research and environmental services for the Southeastern Minnesota region. The Southeastern Minnesota Water Resources Center (WRC) is dedicated to scientific inquiry into the natural and hydrological resources of the region. The Southeast Minnesota Analytical Service (SEMAS) serves cities, counties, businesses, and corporations that need analytical testing of water, industrial products, and chemicals. Finally, the Large River Studies Center (LRSC) conducts research on river ecosystems and associated bodies of water and disseminates information about these ecosystems to local, regional, and scientific communities.