



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2017 LCCMR Work Plan

Date of Submission: September 14, 2016
Date of Next Status Update Report: January 1, 2018
Date of Work Plan Approval: 06/07/2017
Project Completion Date: June 30, 2020
Does this submission include an amendment request? No

PROJECT TITLE: Water Quality Monitoring in Southeastern Minnesota Trout Streams

Project Manager: Neal Mundahl
Organization: Department of Biology, Winona State University
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Location: Winona, Wabasha, Olmsted, Fillmore, Houston, Goodhue

Total ENRTF Project Budget:	ENRTF Appropriation:	\$500,000
	Amount Spent:	\$0
	Balance:	\$500,000

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 04d

Appropriation Language:
\$500,000 the first year is from the trust fund to the Board of Trustees of Minnesota State Colleges and Universities, Winona State University, to develop a system of biological monitoring for water quality protection of trout streams in southeastern Minnesota. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

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

II. 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 runoff, 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, runoff-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 Forks 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.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of January 1, 2018:

Project Status as of July 1, 2018:

Project Status as of January 1, 2019:

Project Status as of July 1, 2019:

Project Status as of January 1, 2020:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Establish a network of 6 continuous and rain-event-triggered water quality monitoring stations on 3 trout streams within at-risk watersheds (North, South, Middle Forks Whitewater River; use existing Trout Unlimited-owned station on Garvin Brook as low-risk control; all stations maintained/monitored by professional scientists)

Description: Six stream gauge stations, equipped to monitor weather and water quality, will be established within at-risk sections of 3 streams (2/stream) to gather continuous data and to collect water samples in response to rain events. These streams (North Fork, Middle Fork, South Fork of the Whitewater River; Olmsted and Winona counties, Minnesota) are high-quality coldwater trout streams that lie within an agricultural landscape, and all 3 are at high risk from runoff of agricultural chemicals during strong rain events because of hilly terrain. Monitoring stations will be located at sites potentially at greatest risk because of 1) high proportion of row-crop agriculture within the drainage basin, 2) steep terrain, and 3) large population of susceptible brown or brook trout.

These monitoring stations will provide baseline water quality data, including background (base flow) levels of nutrients, bacteria, and a variety of common agricultural chemicals, and detect any changes in water chemistry in response to rain-induced run-off. Rain-event samples (both stream water and event-deposited sediment) will detect presence/concentrations of potentially harmful chemicals delivered to streams during runoff. Based on weather patterns during recent years, we anticipate sampling during 4 to 5 rain events each year during the project period, once monitoring stations are in place and functional. This activity will provide information on how stream water chemistry changes in response to storm-event runoff, specifically whether concentrations of agricultural chemicals in stream water and/or transported sediments reach levels dangerous to trout during and after these storm events.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 361,750
Amount Spent: \$ 0
Balance: \$ 361,750

Outcome	Completion Date
1. 6 continuous weather/water monitoring stations placed in 3 streams (2/stream)	May 31, 2018
2. Rain-event-triggered (March-Nov) water samplers placed at each station site (#1 above)	May 31, 2018
3. Analyses of rain-event water samples for nutrients, solids, bacteria by Winona State U	June 30, 2020
4. Analyses of rain-event water samples, sediments for pesticides by U of MN	June 30, 2020

Activity 1 Status as of January 1, 2018:

Activity 1 Status as of July 1, 2018:

Activity 1 Status as of January 1, 2019:

Activity 1 Status as of July 1, 2019:

Activity 1 Status as of January 1, 2020:

Final Report Summary:

ACTIVITY 2: Train and deploy citizen scientists to monitor streams in SE MN, sample and 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

Description: Citizen scientists will be trained in, and equipped for, basic stream water sampling and analysis. This will enable 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 runoff. Each citizen scientist will receive a surface water testing kit and supplies that will allow them to monitor their chosen stream location within the project area, supplementing the data gathered by the automated monitoring systems. Citizen scientists also will have the

option to monitor water quality on other streams in SE MN. These trained individuals also will be an extremely important group for spotting fish kills immediately, mobilized during and after rain events when runoff-induced fish kills typically occur.

Citizen scientists will receive MN State Duty Officer (Department of Public Safety) information cards for their use and for additional distribution to landowners and the angling public. These information cards will contain instructions for reporting fish kills. This information is greatly needed by the public, as most people are unaware of how, or to whom, to report a fish kill. The MN State Duty Officer provides a single contact available 24 hours/day, who will then notify all other appropriate agencies/personnel that need to respond to the fish kill. The Duty Officer provides a service analogous to a 911 call center, but for reporting environmental threats rather than threats to life and property.

In addition to information cards, signs containing State Duty Officer info will be developed and placed along streams at angler access points within the project area to better inform the general fishing public about the process for reporting fish kills. Cards and signs will include the appropriate QR code for cell phone use.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 43,940
Amount Spent: \$ 0
Balance: \$ 43,940

Outcome	Completion Date
1. Training for 15-20 citizen scientists by National Trout Center, Winona State U	May 31, 2018
2. Development, distribution, placement of MN State Duty Officer contact info, signage	May 31, 2019
3. Distribution, use of water testing kits by citizen scientists	June 30, 2020

Activity 2 Status as of January 1, 2018:

Activity 2 Status as of July 1, 2018:

Activity 2 Status as of January 1, 2019:

Activity 2 Status as of July 1, 2019:

Activity 2 Status as of January 1, 2020:

Final Report Summary:

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

Description: Without adequate baseline information on stream fish and aquatic invertebrate communities, the full effects of potentially lethal runoff events can never be determined. In this activity, fish and aquatic invertebrate communities in at-risk trout streams (North Fork, Middle Fork, South Fork of the Whitewater River) 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. Fish will be identified and counted on site before being returned alive to the stream. Invertebrates will be preserved for later identification and counting in the laboratory at WSU. If a fish kill occurs, this baseline information can be used in a “before/after” comparison to assess the effects of the kill.

In conjunction with the systematic sampling described above, additional aquatic invertebrate collections will be made by citizen scientists, providing more baseline info for additional streams/locations. Citizen scientists will be trained in proper collection techniques and provided with collecting equipment and supplies. Collections will be returned to WSU for identification and counting.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 94,310
Amount Spent: \$ 0
Balance: \$ 94,310

Outcome	Completion Date
1. Survey and identify fish in multiple stream reaches per stream (~1 reach/mile)	June 30, 2020
2. Survey and identify aquatic invertebrates in each stream reach (#1 above)	June 30, 2020
3. Identify aquatic invertebrates collected from other sites by citizen scientists	June 30, 2020

Activity 3 Status as of January 1, 2018:

Activity 3 Status as of July 1, 2018:

Activity 3 Status as of January 1, 2019:

Activity 3 Status as of July 1, 2019:

Activity 3 Status as of January 1, 2020:

Final Report Summary:

V. DISSEMINATION:

Description: Products resulting from this project will be disseminated via a web site, training workshops for citizen scientists, news releases, community presentations, on-site signage at stream access sites, and presentations at regional science meetings. These diverse methods are intended to reach a variety of audiences, allowing us to share information with local and visiting anglers, citizen scientist volunteers, the broader regional citizenry, and the scientific community.

A web site to be developed for the project (<http://course1.winona.edu/nmundahl/WhitewaterProject.htm>) will provide a key link between the project and the interested public. The web site will provide a source for all information about the project, from schedules of proposed activities to photos, videos, and reports of project happenings. Links will be provided for connecting with project personnel, to access news releases, and to volunteer as a citizen scientist.

News releases will be produced and disseminated through the Winona State University Communications and Marketing office. This office prepares and distributes information and news items to regional newspapers, radio, and television, as well as preparing web content and a periodic news magazine.

Project updates and community presentations will be prepared and delivered by project personnel throughout the project cycle and beyond. These updates and presentations will be directed at citizen scientists, regional Trout Unlimited chapters, the Minnesota Trout Association, the National Trout Center, and other interested members of the regional community.

Finally, the scientific findings of the project (e.g., water quality data, linkages between land use and water quality, patterns in baseline survey data, citizen scientist participation and findings) will be presented at regional science meetings by project leadership and graduate and undergraduate students. Potential venues may include state meetings of the American Fisheries Society, the Mississippi River Research Consortium, and undergraduate science symposia hosted by Winona State University, Saint Mary’s University of Minnesota, and Viterbo University. Ultimately, we hope to produce one or more scientific manuscripts describing any linkages that we may discover between watershed activities and water quality in these important regional trout streams.

Status as of January 1, 2018:

Status as of July 1, 2018:

Status as of January 1, 2019:

Status as of July 1, 2019:

Status as of January 1, 2020:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview:

***This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.**

Budget Category	\$ Amount	Overview Explanation
Personnel:	\$ 176,750	- Neal Mundahl, Project Manager (84% salary, 16% benefits); 3 weeks each summer for 3 years (\$29,250) - Jennifer Biederman, Aquatic Ecologist (84% salary, 16% benefits); 3 weeks each summer for 3 years (\$21,750) - Dylan Blumentritt, Hydrologist (84% salary, 16% benefits); 3 weeks each summer for 3 years (\$21,750) - 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:	\$ 149,000 \$ 7,200	- U of MN Dept. of Civil, Environmental, and Geo-Engineering (graduate research assistant for 2 years [\$90,000], faculty supervision [\$19,000], pesticide analyses of water & sediment samples [\$40,000]) - National Trout Center intern (citizen scientist training, oversight)
Equipment/Tools/Supplies:	\$ 12,280	Surface water testing kits and supplies (\$8,000), and invertebrate sampling gear (\$2,000) for citizen scientists; waders and invertebrate sampling supplies for baseline stream surveys (\$2,280)
Capital Expenditures over \$5,000:	\$ 120,000 \$ 9,780	- Water quality/weather monitoring/sampling stations (6 stations @ \$20,000 each – competitive bid to select vendor) - Backpack electrofishing combo
Printing:	\$ 2,940	Informational cards (State Duty Officer info for reporting fish kills); informational signs for stream access points
Travel Expenses in MN:	\$ 7,050	Mileage (maintain monitoring stations, transport samples to Minneapolis for analyses,

		coordinate citizen scientist activities, conduct baseline surveys)
Other:	\$ 15,000	WSU Southeast Minnesota Analytical Services (water quality analyses: nutrients, solids, bacteria)
TOTAL ENRTF BUDGET:	\$ 500,000	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than \$5,000:

- Water quality/weather monitoring/sampling stations (6 stations @ \$20,000 each): These stations will be established during the first year of the project and will continue in service throughout the project period and beyond. Oversight and maintenance after the project period will be provided by staff from WSU, with possible assistance from MN DNR and USDA-NRCS staff. Equipment may be relocated to other streams as needed after the project period to provide additional data on other watersheds.
- Backpack electrofishing combo: This equipment will be used throughout the project period and beyond for fish surveys within the project area. After the end of the project period, fish surveys will continue within the project area to keep baseline data updated and current. These continuing surveys will be conducted by WSU staff and students as class activities and undergraduate/graduate student research projects. Equipment likely will be used outside of the project area for similar surveys, providing additional baseline data for streams within other watersheds.

Total Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation: 2.3 FTE

Total Number of Full-time Equivalent (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 1.4 FTE

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
TU Win-Cres Chapter (in-kind)	\$ 15,000	\$ 0	Full use of Garvin Brook water monitoring station
National Trout Center (in-kind)	\$ 10,000	\$ 0	Citizen scientist volunteers
TU Hiawatha, Win-Cres Chapters (in-kind)	\$ 40,000	\$ 0	Citizen scientist volunteers
State			
WSU Project Manager (in-kind)	\$ 26,000	\$ 0	Graduate student supervision
TOTAL OTHER FUNDS:	\$ 91,000	\$ 0	

VII. PROJECT STRATEGY

A. Project Partners

Partners Receiving ENRTF funding

- Neal Mundahl (Aquatic Ecologist, Professor of Biology, WSU Department of Biology), \$29,250, program manager, graduate student supervision
- Jennifer Biederman (Aquatic Ecologist, Assistant Professor of Biology, WSU Department of Biology), \$21,750, field crew & citizen scientist training and oversight

- Dylan Blumentritt (Hydrologist/Geomorphologist, Assistant Professor of Geoscience, WSU Department of Geoscience), \$21,750, monitoring station installation, maintenance, and sample collection
- WSU graduate students (PSM program, WSU Departments of Biology and Geoscience), \$104,000, field work, sample & data collection
- WSU Southeast Minnesota Analytical Services (WSU Department of Chemistry) \$15,000, water sample analyses: nutrients, solids, bacteria
- Intern (National Trout Center [Preston, MN]), \$7,200, citizen scientist training and oversight
- University of Minnesota, Department of Civil, Environmental & GeoEngineering, \$40,000, pesticide analyses: water & sediment
- U of MN graduate student (U of MN Department of Civil, Environmental & Geo-Engineering), \$90,000, pesticide sample processing and analyses
- William Arnold (Environmental Chemist/Engineer, U of MN Distinguished McKnight University Professor and Joseph T. and Rose S. Ling Professor, U of MN Department of Civil, Environmental & Geo-Engineering), \$19,000, graduate student supervision and pesticide analysis oversight

Partners NOT Receiving ENRTF funding

- TU Win-Cres and Hiawatha Chapters (Minnesota Trout Unlimited), providing citizen scientists and full access to Garvin Brook monitoring station
- MTA members (Minnesota Trout Association), providing citizen scientists
- Area landowners (Whitewater River Watershed Project), providing citizen scientists
- Minnesota Duty Officer (Minnesota Department of Public Safety), providing call center for environmental threat reporting

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.

Winona State University, the National Trout Center (Preston, MN), the Win-Cres and Hiawatha Chapters of Trout Unlimited, and the Minnesota Trout Association are committed to protecting the valuable coldwater stream resources of southeastern Minnesota by developing an improved approach for environmental risk detection and management for these streams. Using the Whitewater River system as a “prototype” model, project partners will apply information and methodology gained from this project to assist other regional natural resource agencies in their efforts to protect similar waters within their jurisdiction. Monitoring stations will be maintained in their original locations by WSU staff (with possible assistance from MN DNR and USDA-NRCS staff), or relocated as needed to other at-risk streams to gather additional data for other watersheds. WSU classes (e.g., Fishery Biology, Ichthyology, Watershed Science) and undergraduate and graduate research projects will be able to continue modest monitoring and management efforts on a regular schedule beyond the project period. Citizen scientists will be able to continue their water quality and stream invertebrate monitoring efforts, assuming that project partners can acquire modest funding for supplies from other sources.

C. Funding History: N/A

VIII. REPORTING REQUIREMENTS:

- The project is for 3 years, will begin on 07/01/17, and end on 06/30/20.
- Periodic project status update reports will be submitted January 1 and July 1 of each year.
- A final report and associated products will be submitted between June 30 and August 15, 2020.

IX. VISUAL COMPONENT or MAP(S): See attached visual component

**Environment and Natural Resources Trust Fund
M.L. 2017 Project Budget**



Project Title: Water Quality Monitoring in Southeastern Minnesota Trout Streams

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 04d

Project Manager: Neal Mundahl

Organization: Winona State University

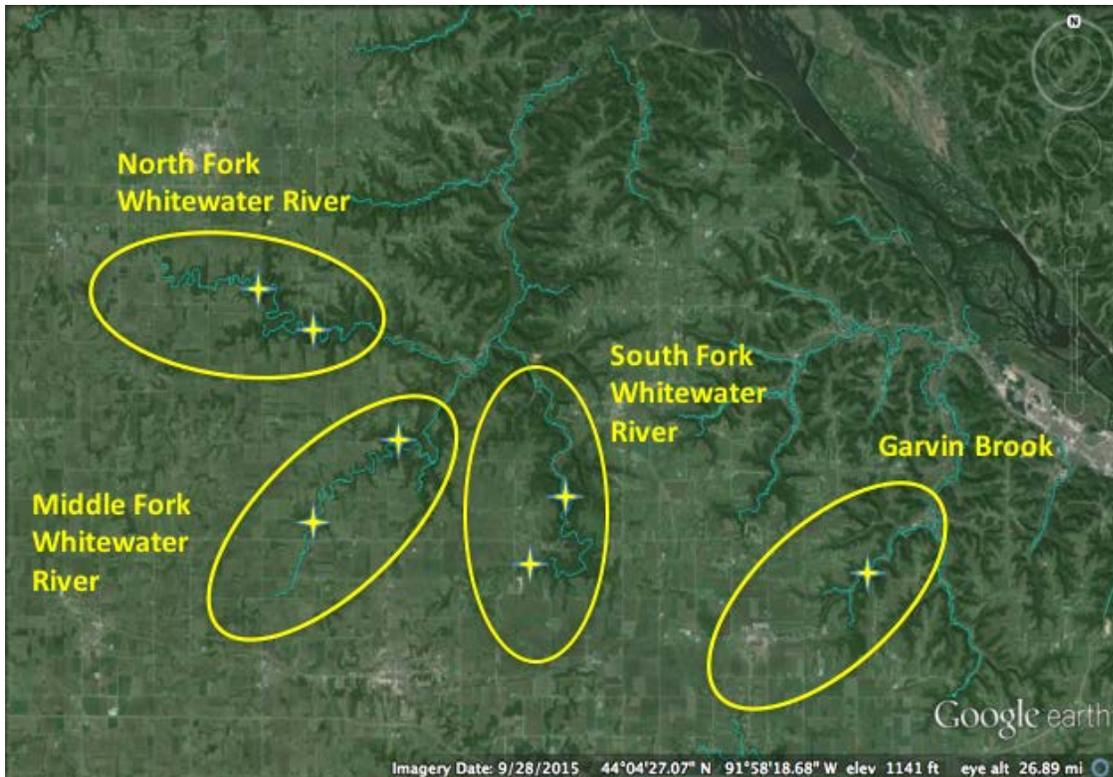
M.L. 2017 ENRTF Appropriation: \$500,000

Project Length and Completion Date: 3 Years, June 30, 2020

Date of Report: 9/14/2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Establish monitoring stations			Train and deploy citizen scientists			Conduct baseline surveys				
Personnel (Wages and Benefits)	\$73,750	\$0	\$73,750	\$21,750	\$0	\$21,750	\$81,250	\$0	\$81,250	\$176,750	\$176,750
Professor Neal Mundahl, Project Manager: \$29,250 (84% salary, 16% benefits); 3 weeks each summer for 3 years											
Professor Jennifer Biederman, Aquatic Ecologist: \$21,750 (84% salary, 16% benefits); 3 weeks each summer for 3 years											
Professor Dylan Blumentritt, Hydrologist: \$21,750 (84% salary, 16% benefits); 3 weeks each summer for 3 years											
2 Winona State University Graduate Research Assistants, field work and data collection: \$104,000 (58% salary, 42% benefits); 50% FTE each for each of 2 years											
Professional/Technical/Service Contracts											
William Arnold, U of MN environmental chemist: \$19,000 (75% salary, 25% benefits); 2 weeks for each of 2 years	\$19,000	\$0	\$19,000							\$19,000	\$19,000
1 U of MN Graduate Research Assistant, sample processing and analyses: \$90,000 (57% salary, 43% benefits); 50% FTE for each of 2 years	\$90,000	\$0	\$90,000							\$90,000	\$90,000
National Trout Center (Preston, MN) Intern, citizen scientist training and oversight: \$7,200 (90% salary, 10% benefits); 25% FTE for 20 weeks for each of 3 years				\$7,200	\$0	\$7,200				\$7,200	\$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	\$40,000	\$0	\$40,000							\$40,000	\$40,000
Equipment/Tools/Supplies											
Surface water testing kits and supplies for citizen scientists (20 kits @ \$400 each)				\$8,000	\$0	\$8,000				\$8,000	\$8,000

Invertebrate sampling gear for citizen scientists (20 sets @ \$100 each)				\$2,000	\$0	\$2,000				\$2,000	\$2,000
Waders for baseline stream surveys (2 @\$135 each), invertebrate sampling supplies for baseline stream surveys (2 Hess samplers @\$625 each, 20 gallons ethyl alcohol preservative @\$190/5 gallons)							\$2,280	\$0	\$2,280	\$2,280	\$2,280
Capital Expenditures Over \$5,000											
Water quality/weather monitoring/sampling stations (9 stations, continuous & rain-event-triggered @\$20,000 each - competitive bid to select vendor)	\$120,000	\$0	\$120,000							\$120,000	\$120,000
Backpack electrofishing unit combo (Smith-Root LR-24 electrofisher, electrodes, 2 batteries, charger) @\$9,780							\$9,780	\$0	\$9,780	\$9,780	\$9,780
Printing											
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	\$0	\$2,940				\$2,940	\$2,940
Travel expenses in Minnesota											
Mileage (To maintain monitoring stations, transport water/sediment samples to Minneapolis for analyses, coordinate citizen scientist activities, conduct fish/invertebrate surveys; ~15,000 miles @ \$0.47/mi)	\$4,000	\$0	\$4,000	\$2,050	\$0	\$2,050	\$1,000	\$0	\$1,000	\$7,050	\$7,050
Other											
Winona State University Southeast MN Analytical Services (nutrient, solids, bacteria analyses, 500 samples @ \$30/sample)	\$15,000	\$0	\$15,000							\$15,000	\$15,000
COLUMN TOTAL	\$361,750	\$0	\$361,750	\$43,940	\$0	\$43,940	\$94,310	\$0	\$94,310	\$500,000	\$500,000



Aerial view of Whitewater River project area (6 monitoring stations on 3 forks, specific locations to be determined) 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	