

**Environment and Natural Resources Trust Fund  
2012-2013 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 155-I**

Watershed-Wide Identification and Remediation of Endocrine Active Compounds

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**Topic Area:** I. Water Resources

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**Total Project Budget:** \$ 289,535

**Proposed Project Time Period for the Funding Requested:** 3 yrs, July 2013 - June 2016

**Other Non-State Funds:** \$ 0

**Summary:**

Identification and quantification of sources of endocrine active compounds in the Sauk River Watershed will result in remediation efforts and methodology that can be applied to Minnesota watersheds.

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**Location**

**Region:** Central

**County Name:** Douglas, Meeker, Morrison, Pope, Stearns, Todd

**City / Township:**

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



# Environment and Natural Resources Trust Fund (ENRTF)

## 2012-2013 Main Proposal

**PROJECT TITLE: Watershed-Wide Identification and Remediation of Endocrine Active Compounds**

### I. PROJECT STATEMENT

**Identification and quantification of sources of endocrine active compounds (EACs) in the Sauk River Watershed will result in remediation efforts and a methodology that can be applied to watersheds across Minnesota.**

The Sauk River watershed is an excellent location for this study as: (i) previous state-wide sampling events consistently identified this watershed as being impacted by EACs; (ii) the current upgrade of the Sauk Center Wastewater Treatment Plant provides unique opportunity to compare its future EAC removal efficiency with data we gathered in 2009 and 2010; (iii) the Sauk River Watershed has developed a comprehensive data for river quality that will provide the foundation for the identification of study sites; and (iv) the Sauk River is very representative of Minnesota watersheds in its size, characteristics and multitude of EAC sources.

To achieve the above stated goals we will first quantify relative contribution of EAC Sources in the Sauk River Watershed using a combination of widely accepted methodologies (fish and cell assay-based estimation of types and quantities of EACs) our labs are well-versed in. Second, we will determine whether these exposures are actually detrimental to aquatic life (fish) by establishing causal relationships between sources of EACs and adverse effects on the fish in the field. Finally, we will develop and implement the education and remediation efforts that will result in the improved water quality.

### II. DESCRIPTION OF PROJECT ACTIVITIES

#### **Activity 1: Identification of EAC Sources in the Sauk River Watershed. Budget: \$145,000**

Two complementary approaches will be used to unequivocally identify and quantify sources of EACs in the Sauk River Watershed: (i) we will expose fathead minnows, a model study species for EACs recommended by the US EPA, at 10-12 sites throughout the Sauk River watershed **to assess the induction of vitellogenin, a prominent biological indicator for the presence of EACs.** Furthermore, we will assess effects of the exposure on the multitude of other genes that are indicators of reproductive failure and immune suppression (typical effects of EACs) using microarray analyses. (ii) We will collect 24-hour composite water samples from the same sites and **analyze for estrogenic (female hormone mimicking) and androgenic (male hormone mimicking) activity** using cell-based assays developed by the US EPA for field applications. Sampling locations will be determined based on existing ancillary data sets (ammonia, coli form bacteria counts, sources of effluent, land use, etc.) collected over several years by the Sauk River Watershed District and geographic information system (GIS) tools to identify potential source and reference location (we applied this approach successfully in a test study in the Redwood River Watershed in SW Minnesota). **This dual approach was designed to provide maximum likelihood of detecting estrogenic and androgenic compounds** through the long-term integration by on-site exposed fathead minnows and the specificity of the cell assay. Sampling will be repeated across three seasons. Sampling sites will be re-assessed for the 2<sup>nd</sup> year using information gained during the 1<sup>st</sup> season.

Outcome	Completion Date
1. Selection of Sampling Sites by GIS	7/15/13
2. Sampling of water and fish exposures	7/15/13 - 4/31/15
3. Analysis of fish (vitellogenin) and water samples (androgenic and estrogenic activities)	8/1/13 - 6/30/15
Analysis and reporting	6/30/15

**Activity 2 Establishing Causal Relationships Between Sources of EACs and Effects. Budget: \$60,000**

Once our sampling has identified sites with particularly strong endocrine active signatures (based on previous studies, we anticipate to determine at least 4-6 different sources in the watershed that fit these characteristics), we will deploy the Mobile Exposure Laboratory Trailer (MELT), a unique mobile laboratory build by the St. Cloud State University Aquatic Toxicology laboratory with previous funding from the State of Minnesota. , MELT is a self-sufficient laboratory platform that allows for flow-through exposures of fathead minnows at field sites. This setup also allows the establishment of dilution series of exposure further solidifying the causal relationship and endocrine disrupting potential of source water.

<b>Outcome</b>	<b>Completion Date</b>
<b>1. Mobile Exposure Laboratory Trailer (MELT) Exposures</b>	<b>5/1-9/30/2015</b>
<b>2. Effects (vitellogenin, histology) Evaluation</b>	<b>6/1/15 – 4/30/16</b>
<b>3. Analysis and reporting</b>	<b>6/30/2016</b>

**Activity 3. Development and Implementation of Education and Remediation Efforts. Budget: \$85,000**

Results from Activities 1 & 2 will be used to develop strategies for source mitigation. Given the likely diverse range of sources, we will develop and disseminate educational approaches in partnership with the Sauk River Watershed District to highlight efforts the public can take to minimize EACs in effluents. We will also use survey tools from this study to identify stream reaches to benefit most from additional best management practices and remediation efforts. Recent legislative action by the US Congress and the MN legislation has opened new opportunities to inform the public about appropriate disposal of expired medications – this effort could be enhanced to include the farming community, which uses large quantities of pharmaceuticals. Furthermore, agricultural management practices are being developed to limit the effects of EAC runoff into streams and will be applied to the Sauk River watershed.

<b>Outcome</b>	<b>Completion Date</b>
<b>1. Assessing source mitigation options</b>	<b>1/1-5/30/2015</b>
<b>2. Pilot implementation of education and remediation efforts</b>	<b>6/1/15 – 4/30/16</b>
<b>3. Analysis and reporting</b>	<b>6/30/2016</b>

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

This project is a continuing partnership between Dr. Heiko L. Schoenfuss, Professor and Director of the Aquatic Toxicology Laboratory, St. Cloud State University, the Sauk River Watershed District and Dr. Dalma Martinovic at the University of St. Thomas. Team members from SCSU will manage field deployment of fish, and the analysis of fish tissues including histopathology and vitellogenin concentrations. Team members from the Sauk River Watershed will use existing data sets and GIS to identify potential field sites and will assist in sampling efforts. Team members at the University of St. Thomas will provide EAC expertise, cell-assay analysis, and gene expression assays to this study.

**B. Timeline Requirements**

This is a three-year proposal. Fish deployment and sampling events will occur in the first 18 months of the study and will be followed by mobile exposure laboratory deployment in the 2<sup>nd</sup> summer. Data analysis and remediation efforts will occupy most of the third year of the study.

**C. Long-Term Strategy and Future Funding Needs n/a**

## 2012-2013 Detailed Project Budget

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

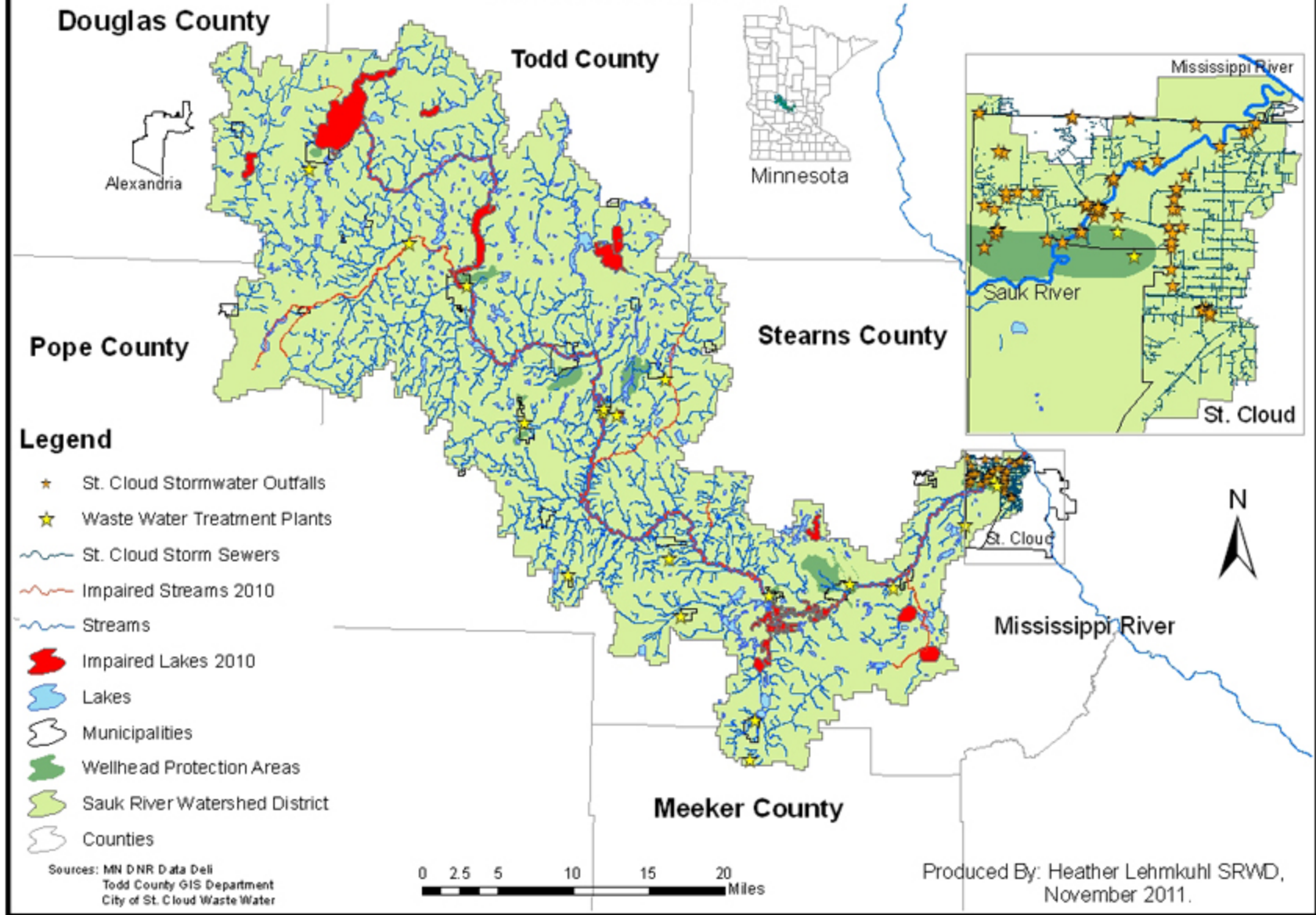
<b>BUDGET ITEM</b> (See list of Eligible and Non-Eligible Costs, p. 11)	<b>AMOUNT</b>
<b>Personnel:</b> Schoenfuss (study oversight; 8%/year of full time employment, incl 26% benefits)	\$ 17,411
<b>Personnel:</b> Graduate student (2 years 100% incl. 7.65% FICA; data collection & analysis)	\$ 39,828
<b>Personnel:</b> Undergraduate student (250hrs/year at \$8.00/hr for two years, incl. 7.65% FICA)	\$ 7,200
<b>Contracts:</b> Subcontract to University of St. Thomas (Martinovic - salary, benefits & supplies)	\$ 74,297
<b>Contracts:</b> Subcontract to Sauk River Watershed District (salaries & benefits)	\$ 88,500
<b>Equipment/Tools/Supplies:</b> Fish exposures experiments (fish purchase, cages, maintenance)	\$ 25,000
<b>Equipment/Tools/Supplies:</b> Vitellogenin protein analysis	\$ 16,300
<b>Equipment/Tools/Supplies:</b> Histological analysis of fish tissues	\$ 15,800
<b>Acquisition (Fee Title or Permanent Easements):</b> In this column, indicate proposed number of acres and name of organization or entity who will hold title.	N/A
<b>Travel:</b> Field site visits along Sauk River by Schoenfuss and graduate students	\$ 5,200
<b>Additional Budget Items:</b> In this column, list any additional budget items that do not fit above categories. List by item(s) or item type(s) and explain how number was reached. One row per type/category.	N/A
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 289,536</b>

### V. OTHER FUNDS

<b>SOURCE OF FUNDS</b>	<b>AMOUNT</b>	<b>Status</b>
<b>Other Non-State \$ Being Applied to Project During Project Period:</b> Indicate any additional non-state cash dollars to 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.	N/A	N/A
<b>Other State \$ Being Applied to Project During Project Period:</b> Indicate any additional state cash dollars (e.g. bonding, other grants) to 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.	N/A	N/A
<b>In-kind Services During Project Period:</b> Indicate any in-kind services to be provided during the funding period. List type of service(s) and estimated value. In-kind services listed must be specific to the project.	N/A	
<b>Remaining \$ from Current ENRTF Appropriation (if applicable):</b> Specify dollar and year of appropriation from any current ENRTF appropriation for any directly related project of the project manager or organization that remains unspent or not yet legally obligated at the time of proposal submission. Be as specific as possible. Describe the status of funds in the right-most column.	N/A	N/A
<b>Funding History:</b> Indicate funding secured prior to July 1, 2013, for activities directly relevant to this specific funding request. State specific source(s) of funds.	N/A	

# Watershed-Wide Identification and Remediation of Endocrine Active Compounds

Sauk River Watershed District



## **Project Manager Qualifications and Organization Description**

### **PROJECT TITLE: Watershed-Wide Identification and Remediation of Endocrine Active Compounds**

#### **St. Cloud State University - Heiko L. Schoenfuss, PhD**

Dr. Heiko Schoenfuss is the *Professor of Anatomy* and the *Director of the Aquatic Toxicology Laboratory at St. Cloud State University*. He received his Bachelor's degree in biology in 1991 from the University of Bayreuth, Germany and was concurrently awarded an MS in Veterinary Anatomy and a PhD in Evolutionary Biology from Louisiana State University in 1997. After three years of post-doctoral training at the University of Minnesota, he joined the faculty at St. Cloud State University in 2001. Dr. Schoenfuss has published over 50 manuscripts detailing the effects of environmental changes on anatomical structure. He has focused for the past 15 years on the effects of endocrine active compounds (EACs) on aquatic ecosystems. He has served on the *EPA Science Advisory Board* (2008), an EAC review committee for the *National Institute for Environmental Health* (2009), and on the *MN Health Advisory Board* (2010).

St. Cloud State University (SCSU), is the largest of the Minnesota State Colleges and Universities (MnSCU) system as well as the second largest university in Minnesota, with 18,300 students enrolled in 2011 and approximately 600 faculty members. St. Cloud State offers more than 200 majors, minors and pre-professional programs as well as more than 60 graduate programs. The key elements of St. Cloud State education include community engagement, active learning, sustainability, and globalization. St. Cloud State strives to support active and applied learning through a variety of initiatives including the university-wide Student Research Colloquium, funding research and projects with Student Research Funds, and supporting faculty research to engage undergraduate and graduate students to faculty research funds.

#### **The University of St. Thomas - Dalma Martinovic, PhD**

Dr. Dalma Martinovic is an assistant professor at the University of St. Thomas, St. Paul, MN since 2009. She received her BS in Ecology from the University of Zagreb, Croatia (1994), her MS in Biological Sciences from the University of Mississippi (1999) and her PhD in Fisheries Science from the University of Minnesota (2005). She joined the faculty at the University of St. Thomas after three years of post-doctoral training the US Environmental Protection Agency in Duluth, MN. Dr. Martinovic has published approximately 30 manuscripts developing techniques to assess the effects of endocrine active compounds (EACs) on fish and to describe resulting impacts on aquatic ecosystems. Drs. Martinovic and Schoenfuss have collaborated for 10 years and have successfully completed several complex, large-scale research projects.

The University of St. Thomas was founded in 1885 and emphasizes values-centered, career-oriented education. The largest private university in Minnesota, St. Thomas offers bachelor's degrees in over 85 major fields of study and more than 45 graduate degree programs including master's, education specialist, juris doctor and doctorates. St. Thomas is a member of the Associated Colleges of the Twin Cities, a consortium of five private liberal arts colleges. Other members are Augsburg, St. Catherine, Hamline and Macalester. U.S. News & World Report's placed St. Thomas in the top 10 of 125 Midwest colleges and universities.

#### **The Sauk River Watershed District**

The Sauk River Watershed District was established in 1986 and extends from the Mississippi River near St. Cloud into the eastern portions of Douglas County to within 3 miles of Alexandria. The overall watershed is about 75 miles in length with some areas being up to 20 to 30 miles in width and is one of 16 major watersheds in the Upper Mississippi River Basin. The districts' staff includes experienced aquatic biologists, environmental monitoring coordinators and public outreach coordinators.