

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

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**Project Title:**

**ENRTF ID: 156-I**

Evaluating Effluent Reuse in the Minnesota River Basin

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**Topic Area:** I. Water Resources

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**Total Project Budget:** \$ 338,467

**Proposed Project Time Period for the Funding Requested:** 2 yrs. July 2013 - June 2015

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

**Summary:**

Wastewater treatment plants in the Minnesota River Basin will be required to reduce phosphorus discharges. We propose a study to evaluate effluent reuse as an alternative to expensive treatment upgrades.

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**Name:** Larry Baker

**Sponsoring Organization:** U of MN

**Address:** Department of Bioproducts and Biosystems Engineering  
St. Paul MN 55108

**Telephone Number:** (763) 370-1796

**Email** baker127@umn.edu

**Web Address** http://larrybakerlab.cfans.umn.edu/

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**Location**

**Region:** SW, SE

**County Name:** Statewide

**City / Township:**

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<input type="checkbox"/>	Funding Priorities	<input type="checkbox"/>	Multiple Benefits	<input type="checkbox"/>	Outcomes	<input type="checkbox"/>	Knowledge Base
<input type="checkbox"/>	Extent of Impact	<input type="checkbox"/>	Innovation	<input type="checkbox"/>	Scientific/Tech Basis	<input type="checkbox"/>	Urgency
<input type="checkbox"/>	Capacity Readiness	<input type="checkbox"/>	Leverage	<input type="checkbox"/>	Employment	<input type="checkbox"/>	TOTAL <input type="checkbox"/> %



# Environment and Natural Resources Trust Fund (ENRTF) 2012-2013 Main Proposal

## PROJECT TITLE: EVALUATING EFFLUENT REUSE IN THE MINNESOTA RIVER BASIN

### I. PROJECT STATEMENT

***1. WHY THIS PROJECT NEEDS TO BE DONE:*** Parts of the Minnesota River are impaired by low oxygen concentrations, caused by phosphorus (P) inputs. Treated wastewater (*effluent*) from municipal and industrial wastewater treatment plants (*point sources*) account for one-third of the total P loading (input) to the Minnesota River. Under mandated TMDL (total maximum daily load) plans, many of these facilities will soon be required to reduce their P loading during the summertime. Reducing P loadings in wastewater treatment is generally accomplished by upgrading the P-removal capacity of treatment plants, but this is expensive, especially for small dischargers. ***An alternative is to divert treated effluent away from the river, reusing it for irrigation and industrial purposes.*** Effluent reuse is very common in the arid western U.S., but according to MPCA, only 32 wastewater treatment plants reused their effluent in 2009. In the west, the main motivation for effluent reuse is water conservation. ***In Minnesota, effluent reuse may be an innovative tool for accomplishing P load reductions efficiently, while providing water and nutrients for farmers and other irrigators.***

The proposed project addresses LCCMR Priorities #2 - Research to increase effectiveness of environmental protection; #3- Collection and analysis of information to assist in developing policy; #4 -Enhancement of education; and #6-Activities to preserve resources.

***2. GOALS OF THE PROJECT.*** ***The goal of this project is to evaluate the potential of effluent reuse in the Minnesota River Valley, taking into account policy, environmental, economic, and legal perspectives.*** This project expands upon LCMR05-07d, which identified the potential of wastewater reuse for industrial purposes only (not irrigation) and would utilize economics data from LCCMR2003-07e1 (see Activity #3), which examined the costs of various types of P removal (but not effluent reuse) to reduce P levels in wastewater effluent. Conducting this research now would enable municipalities and industries to utilize results as new permit limits for P become tighter.

***3. HOW THE PROJECT WILL ACHIEVE GOALS.*** Our interdisciplinary team will analyze the potential for effluent reuse throughout the Minnesota River Valley Basin. Based on environmental, economic, policy and legal criteria we will evaluate the potential for effluent reuse for various sizes and types of wastewater treatment facilities, and conduct basin-wide optimization to determine minimum cost to meet various P load reduction goals.

### II. DESCRIPTION OF PROJECT ACTIVITIES

**Activity 1:** *Develop database of wastewater dischargers & irrigation potential* **Budget:** \$94,336  
We will first determine the location, size, current P loading, and future/potential P limits for each of the 200+ wastewater discharges in the MN River Valley. This step will also analyze proximity of dischargers to potential irrigation sites (cropland; golf courses; parks) and potential industrial users (mainly cooling water) and include an analysis of the capacity for effluent reuse near each wastewater treatment plant. **Outcome:** Publicly available database showing capacity for effluent reuse at various distances from each effluent source in the Minnesota River Valley.

**Activity 2:** *Analyze policy, legal and social structures and constraints.* **Budget:** \$81,136  
We will identify the relevant policy, legal and social structures that could facilitate or constrain effluent reuse for various types of irrigation, including how reuse could be incorporated into NPDES load reduction requirements. We will also explore innovative policy approaches, including the potential for using effluent reuse for pollution trading throughout the Valley. Through interviews and other policy research methods, we will identify and analyze attitudes, knowledge, and

perceived barriers to reuse of treated wastewater for irrigation. Outcome: Section of report summarizing potential barriers to effluent reuse and how these might be overcome.

**Activity 3. Economic analysis.**

**Budget:** \$85,440

We will examine both the cost of upgrading various types of treatment systems to meet future actual or anticipated P reduction levels (using cost evaluation findings from LCCMR2003-07e1) and the cost of implementing effluent reuse (e.g., pipelines to convey water) to determine circumstances in which wastewater reuse would be the preferred alternative. We will also analyze benefits to farmers with respect in increased crop harvest, reduction in fertilizer use, etc. We will then use this dataset to find the lowest basin-wide cost solution to the mandated P load reduction *economic optimization* and to examine the potential for *pollution trading* to lower the Basin-wide costs. Outcome: Report section on cost-trade offs to meet new P limits, plus basin-wide analysis.

**Activity 4. Reporting and Translation**

**Budget:** \$77,556

Activities 1-3 will be integrated into a single report “Potential for Effluent Reuse for Irrigation in the Minnesota River Valley”. To make our results useful to local decision-makers and the public, we plan two translational activities: (1) two half-day workshops to communicate findings from the research to policy makers and local officials; and (2) a professionally made, 25 minute film that summarizes research. Outcome: Final report, two workshops + a film on effluent reuse.

<b>Outcome</b>	<b>Completion Date</b>
1. Database on potential sites for effluent reuse near each wastewater discharger in the MN River Valley and total irrigation potential.	June 30, 2014
2. Summary of analysis of policy, legal and social structures and constraints.	June 30, 2014
3.. Report section describing economic analysis, including basin-wide optimization; database of wastewater treatment plants with estimated costs to reduce P loadings	June 30, 2015
4. Final report, film, and two workshops	June 30, 2015

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

The University of Minnesota project team includes Dr. Lawrence A. Baker (Research Professor, Department of Bioproducts and Biosystems Engineering); **Steve Kelley**, JD (Senior Fellow, Humphrey School and Director, Center for Science, Technology and Public Policy; and **Dr. Steve Taff** (Associate Professor in the Department of Applied Economics). The proposed film would be subcontracted to filmmaker John Whitehead.

**B. Timeline Requirements**

The timeline in the table below does not depend on external contingencies. Activities 1 and 2 can be done at the same time; activity 3 must follow activity 1 because it utilizes the database from activity 1. Activity 4 naturally occurs at the end of the project.

**C. Long-Term Strategy and Future Funding Needs**

Potential local sources include Clean Water Legacy funds as well as regional foundations. We are planning to integrate effluent reuse into a broader proposal on societal waste reuse targeted to the National Science Foundation.

## 2012-2013 Detailed Project Budget

INSTRUCTIONS AND TEMPLATE (1 PAGE LIMIT)

*Attach budget, in MS-EXCEL format, to your "2012-2013 LCCMR Proposal Submit Form".*

*(1-page limit, single-sided, 10 pt. font minimum. Retain bold text and DELETE all instructions typed in italics.*

### IV. TOTAL ENRTF REQUEST BUDGET *Two years*

BUDGET ITEM	
<b>PERSONNEL: wages and benefits</b>	
Larry Barker, PI, 2 months per year	\$ 52,042.00
Stephen Kelley, Co-PI, 1 month per year	\$ 30,532.00
Research Associate, TBA, 100% time, Year 1	\$ 61,200.00
Research assistant, 25% time academic year; 50% summer, 2 years	\$ 50,605.00
Research assistant, 50% time, 2 years	\$ 85,438.00
<b>Contracts -</b>	
Film maker to produce film on effluent reuse	\$ 40,000.00
<b>Equipment/Tools/Supplies</b>	
Supplies and services - software license, copies, advertising	\$ 5,000.00
Workshops in year 2 - 2 with 50 attendees, refreshments, meals, room rental, and other materials	\$ 3,500.00
<b>Acquisition (Fee Title or Permanent Easements):</b>	
Travel expenses in Minnesota	\$ 10,150.00
<b>Other</b> ( <i>Describe the activity and cost</i> ) <span style="float: right;"><i>be specific</i></span>	
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 338,467.00</b>

### V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period:	\$ -	<i>Indicate: Secured or Pending</i>
Other State \$ Being Applied to Project During Project Period:		<i>Indicate: Secured or Pending</i>
In-kind Services During Project Period:	\$ -	
Remaining \$ from Current ENRTF Appropriation (if applicable):	\$ -	<i>Indicate: Unspent? Not Legally Obligated? Other?</i>
Funding History:	\$ -	



Map of the Minnesota River Basin, showing watersheds and counties

## **PROJECT MANAGER QUALIFICATIONS**

**Dr. Lawrence Baker** is a Research Professor in the Department of Bioproducts and Biosystems Engineering at the University of Minnesota. He will provide overall project leadership and will lead Activities #1 and #5. His extensive project leadership, extensive writing experience, and public engagement contribute to both the success of the proposed research and the translation of this research for the public.

1. Project leadership. Dr. Baker has managed about 40 research projects from diverse sponsors, including the Minnesota Pollution Control Association, EPA, the National Science Foundation, the McKnight Foundation, and others. A hallmark of his research is his ability to develop solutions-oriented, multidisciplinary projects with strong public outreach.

2. Extensive writing. He has authored or co-authored more than 120 publications. In addition to journal articles and book chapters, he has contributed to numerous scientific assessment reports, practice guidance manuals, and magazine articles targeted to practitioner audiences. He has also written many columns on environmental issues in the *Minneapolis Star and Tribune*, the *Minnesota Journal*, and other newspapers.

3. Public engagement. Dr. Baker has organized several recent conferences on urban sustainability (in 2010 and 2011) to bridge the gap between academics and practitioners. He is also frequently invited to give public talks, seminars, and guest lectures. He served on the Citizens League Water Policy Study Committee (2008-2009) and was Chair of Friends of the Sunrise River (2007-2010), named Outstanding River Community by Minnesota Waters in 2010.

**Dr. Steve Taff**, an Associate Professor and Extension Economist in the Department of Applied Economics at the U. of M. will conduct the economic analysis (Activity #3). Dr. Taff's research focuses on land economics, agricultural and environmental policy, and public finance in Minnesota. In addition to dozens of journal articles, he has also written many dozens of U of M Extension publications and other reports dealing with Minnesota's land and resource economics.

**Steve Kelley, J.D.**, is a former legislator, is now a Senior Fellow and Director of the Director of Center for Science, Technology, and Public Policy at the Humphrey School. His areas of expertise include science, technology, engineering and mathematics education policy; innovation policy, especially the application of design thinking to public policy issues; science and technology policy, telecommunications and information technology issues; green chemistry policy; and public budgeting. He will lead Activity #2 (legal, policy, and social analysis).

**John Whitehead**, who would be developing the outreach film (Activity #5) is an experienced film maker whose credits include co-development of the 5-part PBS series "Minnesota: History of the Land".