

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 106-B

Maintaining Pollutant Removal in Stormwater Ponds

Category: B. Water Resources

Sub-Category:

Total Project Budget: \$ 306,683

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

This study will develop a simple statistical tool to relate the filling rate of stormwater ponds to their watershed characteristics, enabling more efficient pond maintenance.

Name: Lawrence Baker

Sponsoring Organization: U of MN

Job Title: Research Professor

Department: Bioproducts and Biosystems Engineering

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Location

Region: Statewide

County Name: Statewide

City / Township: St. Paul

Alternate Text for Visual:

1st box: photo of sediment coring; 2nd: map of land cover characteristics; 3rd: graph showing hypothetical relationship between pond life and watershed characteristics

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



PROJECT TITLE: Maintaining pollutant removal in stormwater ponds

I. PROJECT STATEMENT

The goal of this proposal is to address the pressing issue: “*how long do stormwater pond remain effective at removing pollutants?*” This proposal was developed in response to findings from the recently completed **Minnesota Stormwater Research Roadmap**. Specifically, stormwater managers surveyed throughout Minnesota identified “operations and maintenance” of stormwater the highest priority (and the most urgent) research need. Addressing this question falls under LCCMR funding priorities F and B2. The proposed project would have two benefits for cities, watershed districts, and other entities who manage stormwater. First, it would provide a simple method to estimate the lifetime of effective pond life before dredging is required; and second, it would guide source reduction approaches to reduce inputs of sediments and coarse organic material from the watershed.

To accomplish this, we propose developing a simple statistical tool to predict the rate of pond filling in relation to watershed characteristics. To do this we will collect multiple cores sediment cores to determine pond-wide sediment accumulation rates for about 20 ponds and compare pond sediment accumulation rates with watershed characteristics of each pond. Ponds to be studied will be carefully selected to represent a range of watershed characteristics. We will then simple statistical tool to relate watershed characteristics to pond filing rates. Cities and their consultants could then use this statistical tool to estimate the effective lifetime of each of their stormwater ponds and point to ways to extend these lifetimes using upstream source reduction (such as enhanced street sweeping or improved erosion control).

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: Pond coring study

Description: *We will select about 20 stormwater ponds for analysis, based on both pond and watershed characteristics to represent a range of urban conditions. We will leverage this effort using a previously developed inventory of 30,000 stormwater ponds located throughout the state, developed by the U of M in a previous Clean Water Fund project.*

We will collect up to 10 cores per pond to determine overall sedimentation rate (inches/yr, pounds/acre). In addition to sediment accumulation, we will also measure phosphorus accumulation in sediments, allowing improved estimates of removal rates of these nutrients. Watershed characteristics will be determined from a statewide land cover GIS data and a statewide LiDAR (topographic) database. Lake coring will occur over two winters.

ENRTF BUDGET: \$ 212,520

Outcome	Completion Date
1. Pond coring database	May 2022
2. Watershed characteristics database	May 2022

Activity 2 Title: Development of user manual for cities.

Description: *Data collected in activity 1 will be analyzed using multiple regression analysis to develop one or more final equations to relate watershed characteristics to pond filling rates and phosphorus retention rates. We will also analyze watersheds to*



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*determine how production of solids (coarse and fine) could be reduced, for example, by better erosion control and/or enhanced street sweeping. This analysis will be incorporated into a **User Manual for Managing Stormwater Pond Life**.*

ENRTF BUDGET: \$ 94,163

Outcome	Completion Date
1. User manual for managing stormwater pond life	June 2023
2. Presentation at the Minnesota Water Resources Conference	

III. PROJECT PARTNERS AND COLLABORATORS: *We will work with a number of cities to obtain additional data about their stormwater ponds to develop our final pond dataset but do not envision fiduciary relationships.*

IV. LONG-TERM IMPLEMENTATION AND FUNDING: *This is a one-time project that we believe will create a valuable tool by the end of the project, with no follow-ons.*

V. SEE ADDITIONAL PROPOSAL COMPONENTS:

- A. Proposal Budget Spreadsheet - uploaded**
- B. Visual Component or Map - Attached**
- C. Parcel List Spreadsheet - NA**
- D. Acquisition, Easements, and Restoration Requirements - NA**
- E. Research Addendum (Not required at proposal submission stage. Required later in process, if proposal is recommended. Staff will provide further information at that time)**
- F. Project Manager Qualifications and Organization Description- Attached**
- G. Letter or Resolution - NA**
- H. Financial Capacity -**

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet

Legal Citation:

Project Manager: Larry Baker

Project Title: Maintaining pollutant removal in stormwater ponds

Organization: University of Minnesota

Project Budget: \$306,683

Project Length and Completion Date: 3 years, May 30, 2023

Today's Date: April 10, 2019



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		\$ 286,048	\$ -	\$ 286,048
Larry Baker -PI, .08 FTE per year, \$47,000 (73.5% salary/26.5% fringe). Project lead.				
Jacques Finlay - Co-PI, 0.08 FTE per year, \$55,000 (73.5% salary/26.5% fringe).				
Graduate RA - 95,834 (58% salary/42% fringe) for years 1 and 2.				
Undergraduate RA (2,500 hours @ \$14.50/hr)				
Civil Servant - lab technician, 0.33 FTE per year, 52,942, 77% salary/22.7% fringe)				
Equipment/Tools/Supplies				\$ -
Lab/medical supplies (lab supplies for chemical analysis; coring equipment; sample bottles)		\$ 15,000		\$ 15,000
Publication charges for journal article		\$ 2,500	\$ -	\$ 2,500
Travel expenses in Minnesota (for travel to pond sites throughout the state, includes 10 nites hotel&per diem)		\$ 2,635		\$ 2,635
Conference registration (in-state, to present findings at MN Water Resources Conference)		\$ 500	\$ -	\$ 500
COLUMN TOTAL		\$ 306,683	\$ -	\$ 306,683
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT				
	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind: Unrecovered F&A		\$ 145,853	\$ -	\$ 145,853
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS				
	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -

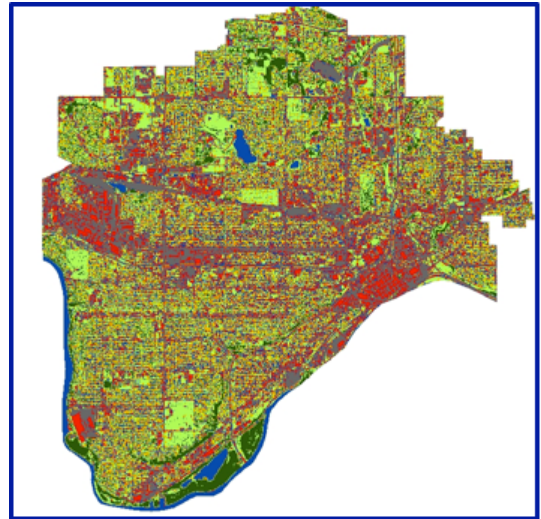


Stormwater ponds can be effective at retaining pollutants, but lose this capacity when ponds become filled with sediment.



We plan to measure sediment and phosphorus accumulation rates in about 20 stormwater ponds.

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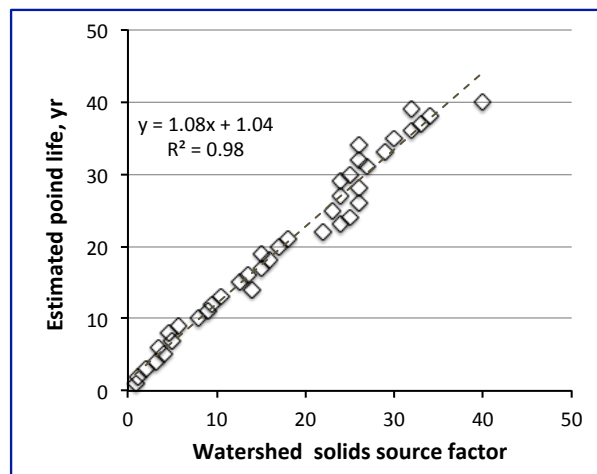


... and compile land cover characteristics for each pond's watershed, using land cover mapping from a previous LCCMR project led by Dr. Marv Bauer (U of M).

Yielding a predictive relationship between a watershed "solids source" factor and pond life. (plot is hypothetical)



Components of our stormwater pond study.





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F. Project Manager Qualifications and Organization Description

The project PI, Dr. Larry Baker, has more than 30 years research experience across a broad range of water quality issues. Since 2000 (at the U of M), he has been the principal or co-principal investigator on research projects with total funding of \$7.5 million. The goal of most of his research is to find solutions to water quality problems. Recent research has included a major study of enhanced street sweeping to remove nutrients, several studies of phosphorus in urban landscapes, a study of urban drought resilience, and an ongoing study of road salting and chloride contamination in Edina. In addition to peer-reviewed publications (which have been cited more than 3,200 times) most of his recent projects include “user manuals” for cities, watershed districts, and other entities seeking to utilize findings to improve water quality management. To reach broader audience, Dr. Baker also frequently writes for *public audiences* and *professional (non-academic) audiences* and is often invited to speak to diverse, non-academic audiences – from city street department workers to watershed boards to “sage-on-the-stage” venues.

This proposal was motivated by the finding in the *Minnesota Stormwater Research Roadmap* (Baker et al., 2019) that two of the most important research needs were “operations and maintenance” and “effectiveness” of structural BMPs, notably stormwater ponds. Dr. Baker has also worked on several closely related stormwater research projects, one to quantify nutrient load reductions from various levels of enhanced street sweeping (an idea that is now becoming an important emerging BMP), and another, the Twin Cities Household Ecosystem Project, the first major project to quantify movement of nutrients through household landscapes. He also authored or co-authored several chapters of the manual *Assessment of Stormwater Management Practices* (2008). Drs. Finlay and Baker have also been involved in several projects to examine the movement of nutrients through urban watersheds in the Twin Cities. Dr. Finlay is also currently conducting research to quantify nutrient dynamics in stormwater ponds (several of these ponds will likely be cored in the proposed LCCMR project). Both Drs. Finlay and Baker are part of an urban ecosystem group at the U of M that is leading knowledge development of urban nutrient dynamics.

The project will be conducted at the **University of Minnesota**, one of the premier water research universities in the country (ranked #2 on the basis of publications). The 250+ faculty working on water-related research have produced nearly 10,000 publications and teach nearly 200 water-related courses.