

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

Project Title:

ENRTF ID: 148-I

Effectiveness of Stormwater Ponds at Reducing PAH Toxicity

Topic Area: I. Water Resources

Total Project Budget: \$ 398,501

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

Other Non-State Funds: \$ 0

Summary:

PAH removal and bioavailability in stormwater ponds will be assessed to calculate the efficiency of the ponds at reducing PAH loads and toxicity to urban water bodies.

Name: Sarah Elliott

Sponsoring Organization: U.S. Geological Survey

Address: 2280 Woodale Dr
Mounds View MN 55112

Telephone Number: (763) 783-3130

Email: selliot@usgs.gov

Web Address: <http://mn.water.usgs.gov/>

Location

Region: Statewide

County Name: Statewide

City / Township:

_____ 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: Effectiveness of Stormwater Ponds at Reducing PAH Toxicity

I. PROJECT STATEMENT

The goals of this project will be to assess the effectiveness of stormwater best management practices at reducing PAH loads and toxicity from stormwater runoff entering urban lakes. This project will aim to provide guidance on how to properly dispose of sediment collected from stormwater infrastructure by determining if PAHs contained in sediments are bioavailable. While the project will be conducted on lakes within the Twin Cities Metropolitan Area, results will be widely applicable to urban areas throughout the state of Minnesota that employ stormwater best management practices connected to lakes (e.g. stormwater ponds that discharge directly into lakes).

A subset of Twin Cities Metropolitan Area lakes that receive both direct stormwater runoff and pre-treated runoff will be assessed. The project will aim to gather data corresponding to 4 rain events over 2 years. Water and sediment will be collected from inflow, within the structure, outflow, and littoral area of the lake near the discharge point. Water and sediment will be analyzed for a suite of over 30 PAH parent compounds and degradates. A mass balance of PAH compounds will be calculated to evaluate the efficiency of the best management practices at removing these compounds from incoming stormwater runoff. Sediment toxicity will be evaluated using a common benthic organism (*Chironomus spp.*), measuring survivability as the endpoint. Biological partitioning of the compounds will also be evaluated by collecting emerging aquatic insects and analyzing tissues for PAHs to provide an estimate of PAH dispersal over the landscape.

Stormwater detention ponds are often employed by municipalities to pre-treat stormwater runoff before it enters urban water bodies. Current metrics for assessing the effectiveness of this infrastructure at improving water quality are focused on phosphorus, nitrogen, and solids. No metrics are currently in place to assess the effectiveness of these structures at reducing organic contaminant loads or toxicity to aquatic biota. Polycyclic aromatic hydrocarbons (PAH) are ubiquitous in the urban environment and are of concern because several are suspected or known carcinogens. A recent synoptic survey of Minneapolis Lakes conducted by US Geological Survey and Minneapolis Park and Recreation Board revealed PAH concentrations at levels potentially toxic to benthic organisms, with higher concentrations near direct inputs of runoff. Additionally, recent investigations conducted by the Minnesota Pollution Control Agency and Metropolitan Council Environmental Services have shown that PAHs accumulate in bottom sediments of stormwater ponds, often at levels above screening criteria; however, it is unclear how bioavailable the compounds are to aquatic organisms. Maintenance of best management practices often involves dredging sediment that has accumulated over time to prevent the structures from filling. Due to high concentrations of PAHs, these sediments need to be disposed of and treated as toxic waste. Unfortunately, many municipalities await guidance on proper disposal of these toxic sediments because guidelines are currently lacking.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Calculate removal efficiency of PAH compounds by stormwater ponds.

Budget: \$244,191

1. Water and sediment will be collected from urban lakes that have stormwater inputs from both a stormwater pond and direct input.
2. Water and sediment will be analyzed for over 30 PAH compounds.
3. PAH removal efficiency by the stormwater ponds will be calculated using in- and outflow concentrations.

Outcome	Completion Date
1. Site selection and instrumentation	September 2013
2. PAH characterization of water and sediment samples	October 2015
3. Mass balance of PAH removal by best management practice	January 2016
4. Data analysis and final report write-up	June 2016

Activity 2: Assess the biological integrity and sediment toxicity within stormwater ponds and lakes.

Budget: \$64,000

1. Benthic and emergent aquatic invertebrate samples will be collected from each stormwater pond and lake, sorted and identified.
2. Sediment will be collected from each stormwater pond and lake (near runoff inflow) and analyzed for toxicity using a common benthic organism once after spring runoff and once in mid-late summer.

Outcome	Completion Date
1. Calculate biotic indices for each site	November 2015
2. Estimate toxicity of sediments based on lethality of benthic organisms	November 2015
3. Data analysis and final report write-up	June 2016

Activity 3: Assess the biological partitioning of PAHs in aquatic invertebrates. **Budget:** \$77,250

1. Benthic and emergent aquatic invertebrates will be collected within each stormwater pond and lake.
2. Invertebrate tissues will be analyzed for PAH concentration to estimate the bioavailability of the compounds.

Outcome	Completion Date
1. Collect invertebrates and analyzed for PAH concentration	September 2015
3. Data analysis and final report write-up	June 2016

III. PROJECT STRATEGY

A. Project Team/Partners

All partners involved will receive money from Environment and Natural Resources Trust Fund:

Minnehaha Creek Watershed District: James Wisker (Director of Planning) will serve as fiscal agent for the project.

U.S. Geological Survey: Sarah Elliott (Hydrologist) will serve as project manager, conduct sampling, data analysis, and report write-up; Richard Kiesling (Water Quality Specialist) will assist in sampling planning and QA/QC.

University of Minnesota: Leonard Ferrington, Jr., (Professor) and two graduate students will manage invertebrate sampling and processing, and conduct sediment toxicity tests; Matt Simcik (Associate Professor) and 2 graduate students will conduct PAH analyses of water, sediment, and tissue samples.

B. Timeline Requirements

This project requires 3 years to complete. Site selection and instrumentation will occur during the first year. Data collection will be conducted during the first two years of the project. Data analysis and writing of the final report will be completed during the last year. Results will be communicated to municipalities and the scientific community through presentations and a written report.

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. ADD OR DELETE ROWS AS NECESSARY. If a category is not applicable write "N/A", leave it blank, or delete the row.)

IV. TOTAL ENRTF REQUEST BUDGET: 3 years

BUDGET ITEM <i>(See list of Eligible and Non-Eligible Costs, p. 11)</i>	AMOUNT
Personnel:	\$ -
USGS Hydrologist (GS-13): 1 position at 5% time for project management and report review; 75% salary, 25% benefits	\$ 11,282
USGS Hydrologist (GS-9): 1 position at 10% time to assist with site set up and maintenance and sample collection; 1 position at 50% time for site set up and maintenance and sample collection, data analysis, and report write-up; 75% salary, 25% benefits	\$ 75,157
USGS Hydrologic Technician (GS-7): 1 position at 10% time to assist with sites set up, maintenance, and sample collection; 75% salary, 25% benefits	\$ 11,215
University of Minnesota Graduate Students: 4 positions: 2 half-time graduate students for macroinvertebrate sample processing and toxicity tests, 2 half-time graduate students for sediment, water, and tissue PAH analysis; 44% salary, 14.5% benefits, 41.5% tuition	\$ 216,032
UM Professor: 1 position at 5% time; 74% salary, 26% benefits	\$ 11,181
Equipment/Tools/Supplies:	\$ -
Rental fees and supplies for ISCO automatic samplers	\$ 16,240
Supplies for extraction and analysis of 225 samples for suite of 32 PAHs	\$ 45,000
Sampling supplies	\$ 2,186
Travel:	\$ -
Mileage for travel to sites for maintenance, sample collection, and sample delivery	\$ 928
Additional Budget Items:	\$ -
Publishing Costs	\$ 9,280
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 398,501

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period: USGS Cooperative Match	\$ 72,068	Pending
Other State \$ Being Applied to Project During Project Period: <i>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.</i>	N/A	
In-kind Services During Project Period: Project management from Minnehaha Creek Watershed District	\$ 12,000	Pending
Remaining \$ from Current ENRTF Appropriation (if applicable): <i>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.</i>	N/A	
Funding History: Minneapolis Park and Recreation Board and U.S. Geological Survey cooperative contaminant study in Minneapolis Chain of Lakes 2009-2010	\$ 20,000	Spent

SARAH M. ELLIOTT

U.S. Geological Survey, 2280 Woodale Drive, Mounds View, MN 55112
VOICE 763-783-3130; FAX 763-783-3103; EMAIL selliott@usgs.gov

EDUCATION

University of Minnesota, Minneapolis, MN

M.S. in Water Resources Science

2010

Thesis: "Water Quality Characteristics of Three Rain Gardens Located Within the Twin Cities Metropolitan Area, Minnesota"

University of Minnesota, Minneapolis, MN

B.S. in Environmental Science, Policy, and Management

2008

Area of Concentration: Hydrology

RELATED EXPERIENCE

U.S. Geological Survey

Hydrologist

March 2009 – Present

Minneapolis Park and Recreation Board

Water Quality Intern

June 2007 – November 2007

PUBLICATIONS

"Water Quality Characteristics of Three Rain Gardens Located Within the Twin Cities Metropolitan Area, MN"

Cities and the Environment (CATE): Vol. 4: Iss. 1, Article 4. <http://digitalcommons.lmu.edu/cate/vol4/iss1/4> 2011

PRESENTATIONS

"Assessing the Vulnerability of Lake Fish Communities to Endocrine Disruption Using a Controlled Mesocosm Approach"

Presented at the Annual Meeting of Midwest Society of Environmental Toxicology and Chemistry, Minneapolis, MN

2012

"Polycyclic Aromatic Hydrocarbon Concentrations and Sources in Five Minneapolis, MN Lakes"

Presented at the Annual Minnesota Water Resources Conference, Minneapolis, MN

2011

"Water Quality in the Southern Basin of Lake of the Woods: 2010"

Presented at the Annual Lake of the Woods Water Quality Forum, International Falls, MN

2011

ORGANIZATION DESCRIPTION

The U.S. Geological Survey forms partnerships with federal, state, and local agencies, and other public organizations to conduct relevant and useful science. We operate networks to collect high-quality data that define hydrologic conditions and analyze hydrologic processes through investigations and research to promote informed decision making.

