Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)

Subd: 05j

Project Title: Wastewater Phosphorous Filtration Using Recycled By-Products

Category: B. Water Resources

Total Project Budget: $ $170,000

Proposed Project Time Period for the Funding Requested: 2 yrs, July 2011 - June 2013

Other Non-State Funds (secured): $ 0

Summary:

Evaluate the use of recycled iron by-products or waste products to create a waste water filtration method that will remove phosphorous to state acceptable surface water levels.

Name: Larry Zanko

Sponsoring Organization: U of MN - NRRI

Address: 5013 Miller Trunk Hwy

Duluth MN 55811

Telephone Number: 218-720-4274

Email lzanko@nrri.umn.edu

Web Ad

Location:

Region: Statewide

Ecological Section: Northern Superior Uplands (212L)

County Name: Statewide

City / Township:

2011-2012 MAIN PROPOSAL
CONFIDENTIAL FOR LCCMR ONLY

PROJECT TITLE: Waste Water Phosphorous Filtration Using Recycled By-Products

I. PROJECT STATEMENT

Phosphorous from house hold activities can end up in either municipal waste water treatment plants or septic systems and eventually in surface and ground water. If the level of phosphorous becomes elevated in surface waters, it can create increased algal blooms, reduction of available oxygen in aquatic habitats, and degrade waters for recreational use. Human waste, dishwashing, and garbage disposals contribute up to 17% of the total phosphorous load in Minnesota from point source discharges. Waste water treatment facilities receive not only house hold waste water, but also receive waste water from commercial and industrial sources contributing another 14% of the total phosphorous discharge in Minnesota. In order to improve/preserve water quality, Minnesota's allowable phosphorous limit is being reduced to 0.3 mg/L. Elevated levels of phosphorous are a state wide concern for our lakes and rivers.

The goals of this study are to evaluate the use of different forms and quantities of iron with several different filter media and to construct a waste water treatment filter that will benefit Minnesota by reducing the amount of phosphorous discharged to the new limit of 0.3 mg/L.

In an effort to create an improved filtration media or method for municipal waste water as well as septic systems, materials evaluated will include recyclables, waste by-products, and natural first use products like peat and sand. Some of the materials to be evaluated include mattress cotton enmeshed with steel wool, prepared finely ground steel recovered from mattress springs, waste construction and horticultural perlite fines, conventional iron filings, and taconite tailings.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Select several iron bearing by-products and filtration material for testing. Characterize physical and chemical properties of material. Complete column tests and evaluate material for its ability to remove phosphorous from waste water. **Budget:** $ 73,625

Outcome	Completion Date
1 A progress report that reviews data produced by Activity 1 and recommends combination of materials to be used together for Activity 2 based on best filtering properties and best phosphorous removal properties.	April 2012

Activity 2: Evaluate best texture for phosphorous filter using by-products. Test phosphorous filter materials to compare the effect of granular texture and fibrous texture on phosphorous removal. Analyze both water samples and the filter materials for phosphorous content. Also compare flow rates when textures are used together. **Budget:** $ 28,700

Outcome	Completion Date
1. Compile data from Activity 2 into a progress report that also contains evaluation of best filtering properties based on texture, and recommendations for the next phase of testings based on results from Activities 1 and 2.	April 2013

Activity 3: Evaluate best combination of materials. Construct test columns and test the best combinations of by-products and filtration materials from Activities 1 and 2 for phosphorous removal. Use chemical analyses of water samples to determine effectiveness of filters. Analyze the filter materials to determine where the removed phosphorous goes. Use water flow similar to that of typical waste water treatment systems. **Budget:** $ 64,675

Outcome	Completion Date
1. Produce a progress report that contains data from all three Activities and provides recommendations for the best phosphorous filter based on material, texture and combinations. The materials will be considered successful based on physical performance and phosphorous removal. 2. Captured phosphorous will be evaluated for disposal either at landfills or as an amended fertilizer; other project materials will be similarly assessed for final disposition.	December 2012

Activity 4: Host an informational meeting to presentation of results to regional and state agency representatives. **Budget:** $3,000

Outcome	Completion Date
1. An educational workshop will be held to present findings to a select audience.	June 2013

III. PROJECT STRATEGY

A. Project Team/Partners

Larry Zanko, NRRI, Principle Investigator/Project Manager, LCCMR Funding
Tim Hagen, NRRI, Materials Engineer, LCCMR Funding
Marsha Meinders Patelke, NRRI, Geologist/Research Scientist, LCCMR Funding

Other project participants/collaborators
Steve Hauck, NRRI, Technical Review, LCCMR funding
Technician/Scientist (To Be Determined): NRRI/UMD, SEM, XRD, XRF Technician, LCCMR Funding
Brett Ballavance, MPCA – Regulatory Compliance Evaluation, time donated in kind
Two Harbors, Beaver Bay Waste Water Treatment, contribute waste water

B. Timeline Requirements

This project will require 2 years to complete. Activity 1 will be completed in the first three quarters (July 2011 – March 2012) of the project. Activities 2 – 4 completed between April 2012 and the end of June 2013. An informational meeting will be held at the conclusion of the project to share an overview of the project and its findings with local waste water professionals.

C. Long-Term Strategy and Future Funding Needs

Positive test results of the new filter will demonstrate the ability to reduce phosphorous. The next step in filter development will be to scale up testing. Fielding test to assist in filter design for smaller personal property septic systems would be the first task. Once accomplished larger commercial property septic systems could then be created. The ultimate goal is to scale the filter up for use at municipal waste water treatment systems. For example, NRRI and MPCA have already discussed the potential for taking advantage of Beaver Bay's tertiary filter rehab project as a field testing location. Beaver Bay's system is oversized and could allow for part of one filter being used as a demonstration cell for various media using actual municipal wastewater.

2011-2012 Detailed Project Budget

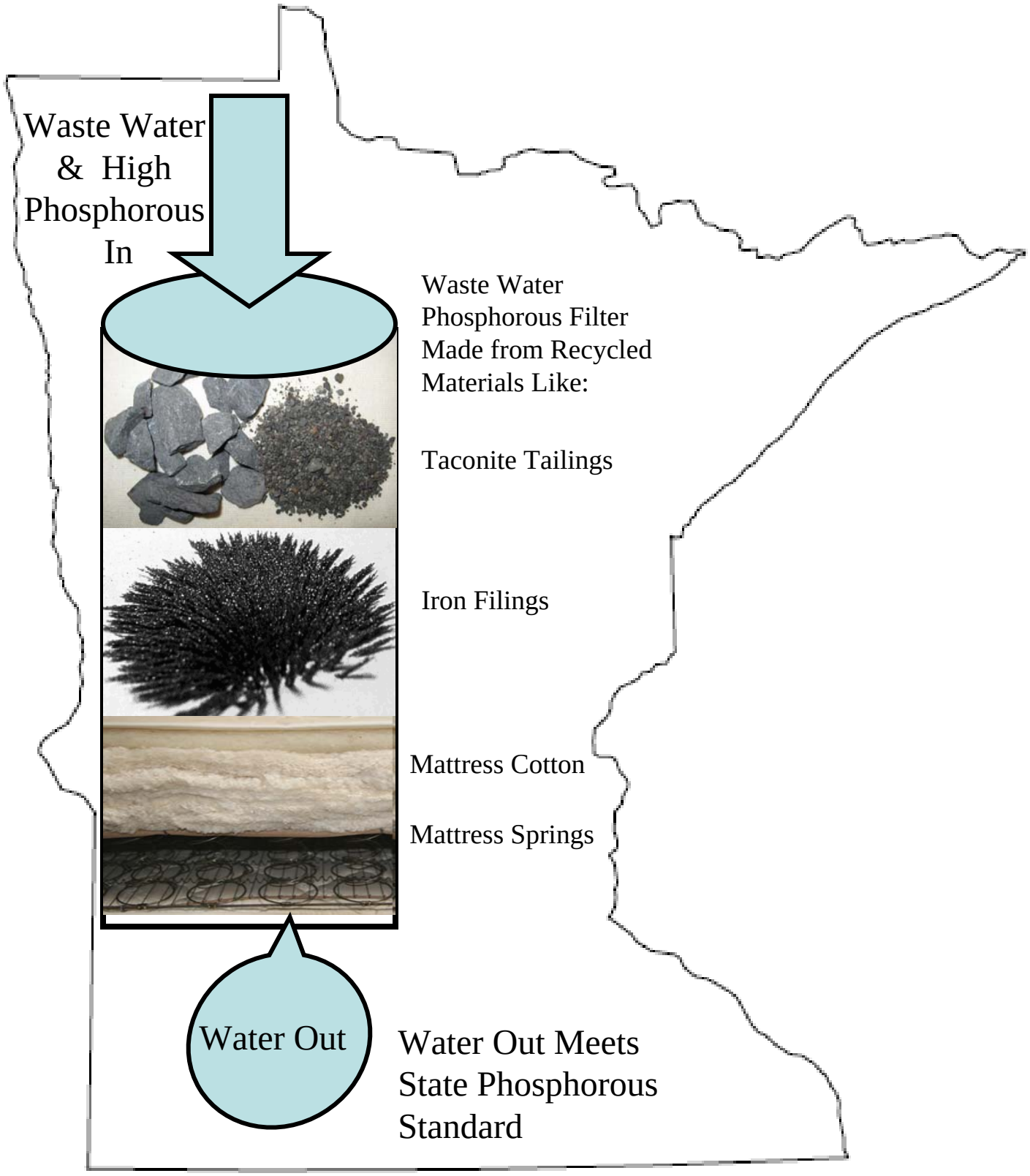
revised

IV. TOTAL TRUST FUND REQUEST BUDGET - 2 years

BUDGET ITEM	AMOUNT
NOTE: NRRI researchers, including the project manager and project team listed below, rely entirely on soft-money support for conducting research	
Personnel: Lawrence Zanko, Project Management, 5% FTE, 33.3% Fringe	$ 9,222
Steve Hauck, Technical Review, 1% FTE, 33.3% Fringe	$ 2,682
Tim Hagen, Senior Composite Materials Engineer, 25% FTE, 33.3% Fringe	$ 51,206
Marsha Meinders Patelke, Project Scientist/Researcher, 20% FTE, 40.1% Fringe	$ 20,854
Igor Kolomitsyn, Project Chemist, 10% FTE, 33.3% Fringe	$ 14,748
Lab Technician, 10% FTE, 40.1% Fringe	$ 9,138
Student Worker, 50% FTE, 0% fringe, up to 2 part time students for total of 75% FTE	$ 16,310
Total Personnel Budget	$ 124,160
Contracts:	
ERA Laboratories, Duluth, Minnesota, Chemical analyses of water samples including total phosphorous, dissolved phosphorous, total suspended solids, metals.	$ 23,600
Precision Testing, Virginia, Minnesota, grain size analyses & Hydraulic Conductivities	$ 2,030
Equipment/Tools/Supplies: Test columns,apparatus for conducting phosphorous flow experiments, includes pumps, tubing, and sample collection containers.	$ 5,710
Safety Equipment	$ 500
Travel: Travel to local waste water treatment facilities	$ 1,000
Additional Budget Items: Attend and present at waste water Treatment/Phosphorous Conference/meeting	$ 3,000
UMD Scanning Electron Microscope Lab (SEM) services - characterize material size, morphology, chemical composition, and element mapping.	$ 10,000
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	$ 170,000

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:	none	*none*
Other State $ Being Applied to Project During Project Period: MPCA and Lake County have indicated a willingness to provide non-cash (in-kind) advisory/site support to the project. Two Harbors, Beaver Bay Waste Water Treatment, contribute waste water and site support (see below)	none	*Pending*
In-kind Services During Project Period: MPCA: Regulatory Compliance Evaluation, time donated in kind, etc; and Two Harbors/Beaver Bay waste water and site support	not determined	*Pending*
Remaining $ from Current ENRTF Appropriation (if applicable):	n/a	*Other*
Funding History: (This is a new project)	none	n/a

Waste Water Phosphorous Filtration Using Recycled By-Products



UNIVERSITY OF MINNESOTA DULUTH
NATURAL RESOURCE RESEACH INSTITUTE
Michael Lalich, Director

NATURAL RESOURCES RESEARCH INSTITUTE

2010 LCCMR Project Manager Qualifications

Larry Zanko - NRRI

Mr. Zanko is a research fellow in the Economic Geology Group at the Natural Resources Research Institute (NRRI), based at the University of Minnesota Duluth. He has worked in the minerals field and has conducted geological, mineral resource and minerals industry-related applied research for most of his 26-year career. Since his start with NRRI in 1988, he has worked on a broad spectrum of research projects, often conducted in cooperation with private industry, dealing with non-ferrous minerals, ferrous minerals, industrial minerals (most recently focusing on construction aggregates), contaminated sediment remediation and reuse, and related policy issues. He regularly interacts and collaborates with public and private sector professionals and academicians in the minerals, transportation, and environmental fields, inside and outside Minnesota. He is a graduate of the University of Minnesota – Twin Cities, where he received bachelor degrees in Geological Engineering and Microbiology, and a Masters degree in Geological Engineering.

Since 2000, Mr. Zanko has also worked on projects related to the remediation and beneficial reuse of contaminated and uncontaminated sediment and soil, experience that is particularly relevant to this proposal to LCCMR. Project collaborators have included the U.S. Army Corps of Engineers (Detroit District and Duluth Area Office) via the United States Environmental Protection Agency; state agencies; local entities like the Duluth Seaway Port Authority; and the private sector. Much of this work has focused on evaluating innovative technologies related to soil, sediment, and water cleanup.

Organization Description

Natural Resources Research Institute (NRRI) is a research facility associated with the University of Minnesota Duluth that was develop to foster economic development of Minnesota's natural resources and to promote private sector employment. Focus areas have included minerals, forest products, peat, water quality, biomass, and chemical extractives. Recently, NRRI scientists have been evaluating utilization of industrial waste and by-product materials for marketable products.
http://www.nrri.umn.edu/default/about.htm