

**Environment and Natural Resources Trust Fund  
2019 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 116-BH**

Spring Biological Nitrate Removal to Protect Drinking Water

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**Category:** H. Proposals seeking \$200,000 or less in funding

**Sub-Category:** B. Water Resources

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**Total Project Budget: \$** 175,000

**Proposed Project Time Period for the Funding Requested:** June 30, 2022 (3 yrs)

**Summary:**

Fairmont's drinking water safety is threatened by high springtime nitrate levels. Fairmont intends to build an experimental passive biological treatment system to reduce nitrates that enter its source water supply.

**Name:** Troy Nemmers

**Sponsoring Organization:** City of Fairmont

**Title:** City Engineer

**Department:** \_\_\_\_\_

**Address:** 100 Downtown Plaza  
Fairmont MN 56031

**Telephone Number:** (507) 238-3942

**Email** tnemmers@fairmont.org

**Web Address** www.fairmont.org

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**Location**

**Region:** Southwest

**County Name:** Martin

**City / Township:** Fairmont

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**Alternate Text for Visual:**

Visual shows the potential area to be treated with this project and proximity to City's source water. Two images of treatment concept shown with an aerial image of the City.

<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"/>		TOTAL	<input type="checkbox"/> %
<input type="checkbox"/> If under \$200,000, waive presentation?							



**2019 Environment and Natural Resources Trust Fund (ENRTF)  
Spring-Season Biological Nitrate Removal to Protect Drinking Water**

**PROJECT TITLE: Spring-Season Biological Nitrate Removal to Protect Drinking Water**

**I. PROJECT STATEMENT:**

The City of Fairmont, Minnesota’s drinking water supply is threatened by high nitrates in spring runoff. Because conventional bioreactors are ineffective during the spring, the City of Fairmont needs an alternative design – a spring-season biological nitrate removal system – to reduce the load of nitrates entering Budd Lake during this time-critical season that can provide reliably safe drinking water for its 10,000 residents.

Without an environmentally based mechanism to reliably reduce nitrate, the City of Fairmont would likely need to spend several million dollars to upgrade its drinking water treatment system. In 2016, the City was forced to issue a public health notice that Fairmont’s drinking water exceeded EPA’s maximum contaminant level (10 mg/L). High nitrates in drinking water can cause methemoglobinemia, or “blue baby disease”, which is lethal to infants. The City currently uses blending and mechanical treatment to attenuate high nitrate spikes, but the capacity of these tools is limited.

Fairmont’s drinking water comes from a chain of lakes fed by agricultural watersheds – the City’s surface water intake is on Budd Lake (see Figure 1). Dutch Creek is one of the largest tributaries to the Fairmont chain of lakes, with a watershed covering over 9,000 acres. Dutch creek is also a significant source of nitrate to the City’s drinking water supply. Data collected since 2000 show periodic high nitrate occurrences in Dutch Creek, with peaks over three times the EPA maximum contaminant levels. During warmer months of the year, natural nitrate removal processes in the lakes help to prevent nitrates from reaching the City’s drinking water. However, in the spring, when nitrates are more easily flushed out of the agricultural watersheds, the natural limnologic removal mechanisms are ineffective. Recent SWAT modeling completed for the MPCA and USEPA supports this seasonal variation<sup>1</sup>. In fact, the results of the modeling suggest that both spring flushing and summer removal mechanisms are underestimated for the Dutch Creek watershed. This reinforces the need to better adapt nitrate removal technologies to work when nitrate removal is most needed – namely in the spring.

Fairmont is working with the University of Minnesota to evaluate a large passive nitrate removal system<sup>2</sup>. The focus of this ENRTF-funded project will be to optimize a portion of the proposed plan to work more effectively in during the spring season by employing passive solar technology and bioadaptation. The benefits of a new spring-season biological nitrate removal system over a conventional bioreactor system will be demonstrated at field-scale over the next three years.

**II. PROJECT ACTIVITIES AND OUTCOMES**

	<b>Activity</b>	<b>Completion Date</b>	<b>Budget</b>
<b>1</b>	Design and install nitrate removal system	November 1, 2019	\$100,000
<b>2</b>	Research and install cold weather bio adaptation technologies	September 1, 2020	\$50,000
<b>3</b>	Operate and monitor bioreactor - ongoing	June 1, 2022	\$17,000
<b>4</b>	Complete project report summarizing system effectiveness	June 30, 2022	\$8,000
	<b>TOTAL ENRTF BUDGET:</b>		<b>\$175,000</b>

<sup>1</sup> *Dutch Creek and Hall Lake SWAT Modeling Report*, Prepared for Minnesota Pollution Control Agency and USEPA. Prepared by Tetra Tech, Updated March 13, 2018.

<sup>2</sup> *Dutch Creek Watershed Implementation Plan*



**2019 Environment and Natural Resources Trust Fund (ENRTF)  
Spring-Season Biological Nitrate Removal to Protect Drinking Water**

The goals of this project are to 1) implement a passive nitrate removal system optimized for cold weather, and 2) demonstrate its effectiveness. The proposed activities and outcomes are described in the above table, based on a project start date of July 1, 2019.

The basic design of the system will be based on work previously completed for the Dutch Creek watershed nitrogen reduction plan<sup>3</sup>. Temperature control strategies will be based on concepts for passive solar heating as well as local expertise on the subject of greenhouse technology with assistance from the University of Minnesota Extension<sup>4</sup>. Temperature control will be employed for all three years of operation. Potential bioadaptation strategies may include either the addition of nutrients or the cultivation of site-specific bacteria more tolerant of low temperatures that could be used further enhance the rate of nitrate removal. Bioadaptation strategies will be added for the second and third season of operation. Additional details on the scope of these activities will be developed in the Project Work Plan. The proposed project site is on city property along Dutch Creek, per attached Figure 1.

**III. PROJECT PARTNERS:**

**A. Partners receiving ENRTF funding**

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Role</b>
Troy Nemmers	Director of Public Works/ City Engineer	City of Fairmont	Project Lead
Joe Magner	Professor	UMN-BBE	Advisor

**B. Partners NOT receiving ENRTF funding**

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Role</b>
Martin County SWCD		Soil and Water Conservation District	Advisor

**IV. LONG-TERM- IMPLEMENTATION AND FUNDING:** Section 319 funds will be used in the Dutch Creek Watershed over a 10-year time frame to complete a larger nitrate reduction plan in the watershed. Along with actions from ongoing MDA, MPCA, MDH and Martin County SWCD studies that are in progress.

**V. TIME LINE REQUIREMENTS:**

<b>Activity</b>	<b>Completion Date</b>
1. Prepare project work plan and design pilot-scale bioreactor with temperature control	August 30, 2019
2. Contract and install pilot scale bioreactor	November 1, 2019
3. Operate and monitor bioreactor – Spring of Year 1	June 1, 2020
4. Research bioadaptation strategies	June 1, 2020
5. Implement preferred bioaugmentation strategy	September 1, 2020
6. Operate and monitor bioreactor – Spring of Year 2	June 1, 2021
7. Operate and monitor bioreactor – Spring of Year 3	June 1, 2022
8. Complete Project Report	June 30, 2022

<sup>3</sup> Dutch Creek Watershed Implementation Plan

<sup>4</sup> Cold Climate Greenhouse Resource, A guidebook for designing and building a cold-climate greenhouse. University of Minnesota, Center for Urban and Regional Affairs, 2013. <https://www.extension.umn.edu/rsdp/community-and-local-food/production-resources/docs/cold-climate-greenhouse-resource.pdf>

## 2018 Detailed Project Budget

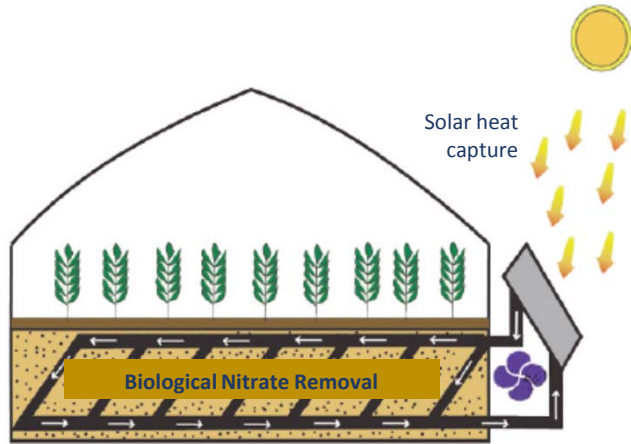
Project Title: *Spring-Season Biological Nitrate Removal to Protect Drinking Water*

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
<b>Personnel:</b>	
Troy Nemmers, City of Fairmont (1% FTE for three years)	\$ 10,000
Joe Magner, University of Minnesota Professor (3% FTE for three years)	\$ 30,000
Undergraduate student researcher (13% FTE for three years)	\$ 25,000
<b>Professional/Technical/Service Contracts:</b>	
Bioreactor Installation and Operation, TBD	\$ 58,000
Engineering Consultant, TBD	\$ 40,000
Analytical Laboratory Costs (\$2,000/year for three years)	\$ 6,000
<b>Equipment/Tools/Supplies:</b>	
N/A - Tools and Equipment Included in Professional Services	
<b>Acquisition (Fee Title or Permanent Easements):</b>	
N/A	
<b>Travel:</b>	
Travel Monitoring and Upkeep (\$2,000/year for three years)	\$ 6,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST</b>	<b>\$ 175,000</b>

### V. OTHER FUNDS

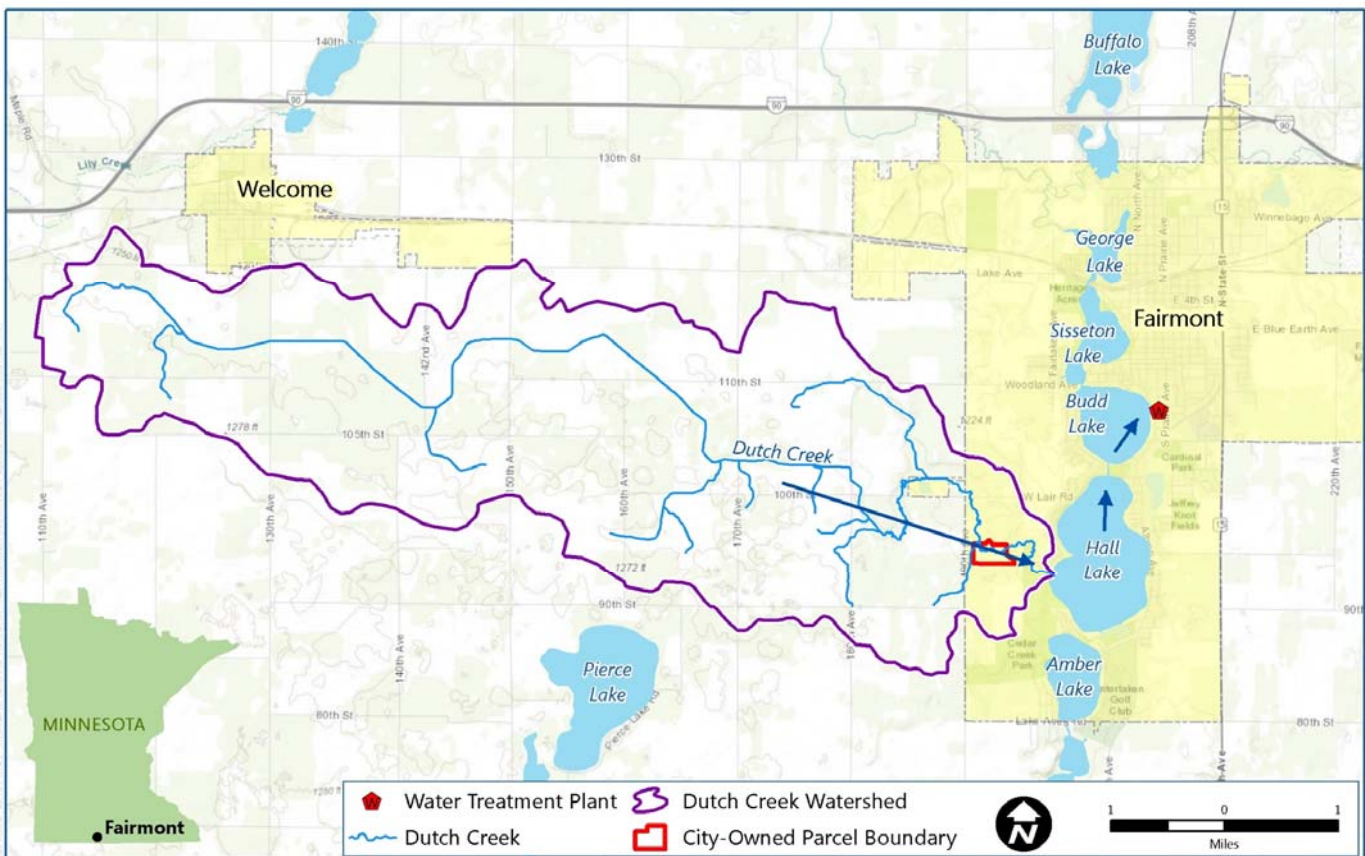
<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>In-kind Services To Be Applied To Project During Project Period:</b> staff time for project management and assistance.	City \$10,000	<i>Secured</i>
<b>Past and Current ENRTF Appropriation:</b>	N/A	
<b>Other Funding History:</b>	N/A	



Source: Loobeek, Kristi. *Solar-Powered Season Extension: High Tunnel Heating Research*. 2013



- Protecting drinking water from nitrate
- Innovative passive treatment





April 10, 2018

**CITY OF FAIRMONT**

<http://fairmont.org/>

Fairmont, the City of Lakes, is a community of 11,000 located in the heart of southern Minnesota. The community provides an array of recreation, educational, and health care services supporting a regional service area population of over 20,000 and is the county seat for Martin County. Centrally located along I-90 and Highway 15, the City is noted for its hospitality, friendly residents, unique specialty shops, and picturesque lakes, making Fairmont “Southern Minnesota’s best kept secret.”

The City’s five lakes provide a valuable community resource and afford residents and visitors alike with recreational areas for swimming, pleasure boating, water skiing, and fishing. Other attractions include the Fairmont Aquatic Park, a variety of public and private 18-hole golf courses and several historic venues for artistic endeavors and enrichment opportunities.

**PROJECT MANAGER**

Troy Nemmers, P.E.  
Director of Public Works/City Engineer

Troy is currently the Director of Public Works and City Engineer for the City of Fairmont, MN.

He oversees staff and operations in several departments, including engineering, water, wastewater, streets, parks, electric distribution, and also has oversight of the municipal airport.

He has been involved in the planning and design of several projects in the 9 years he has worked for the City.