

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

Project Title:

ENRTF ID: 083-B

Assessment of Toxic-Algae/Phosphorus/E. coli Entering Minneopa State Park

Category: B. Water Resources

Sub-Category:

Total Project Budget: \$ 327,253

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

Summary:

Water ENTERING Minneopa Park has problems with toxic-algae and E. coli (16 times the stream standard). Due to health concerns we will assess levels/sources and potential controls for these agents.

Name: Beth Proctor

Sponsoring Organization: Minnesota State University - Mankato

Title: Professor

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Location

Region: Statewide

County Name: Blue Earth

City / Township: Lake Crystal and Mankato

Alternate Text for Visual:

Water ENTERING Minneopa State Park (293,908-visitors) has problems with toxic-algae and E. coli (16 times the stream standard). We will assess levels and sources of these agents.

<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?							



PROJECT TITLE: Assessment of Toxic-Algae/Phosphorus and *E. coli* Entering Minneopa Park

I. PROJECT STATEMENT: In 2017 the number of visitors to Minneopa State Park was 293,908. They come to see the bison, enjoy the water, view the water falls, hike the trails, picnic and enjoy the outdoors.

Toxic Blue-Green Algae:

Mankato Free Press June 27, 2017: The downside of summer: Blue-green algae blooms likely soon
“Last summer blue-green algal blooms were reported in lakes across the state, from near the Iowa border all the way to the Canadian border. The MPCA and Department of Health investigated two reported human illnesses and multiple dog deaths following exposure to blue-green algae.”

In July 2013 an intense blue-green algal bloom in Lake Crystal resulted in the waterfalls flowing a brilliant green at Minneopa State Park (video on <https://www.youtube.com/watch?v=jtZSmNfmpns>). Warm temperature and too much phosphorus and nitrogen nutrients cause blue-green algae to grow. **“People are exposed to the toxins by swallowing, or having skin contact with the water or by breathing in tiny droplets of water in the air” (MN Dept. Health).** Blue-green algae blooms usually begin in June. Microcystis is the most common blue-green algae found in Minnesota. The toxin it produces is microcystin, can cause abdominal pain, nausea, diarrhea, and pneumonia (U.S. Environmental Protection Agency, EPA).

Escherichia coli (E. coli)/fecal coliform bacteria:

E. coli indicates that the water contains manure. Potential sources of *E. coli* contamination include wildlife, failing septic systems, feedlots, wastewater treatment plant effluents, and field application of manure and biosolids.

E. coli can cause severe abdominal cramps, bloody diarrhea, vomiting and in severe cases, death (EPA). The state stream standard for *E. coli* is 126 colonies/100 ml of water. One hundred ml is less than half a cup. The segment of Minneopa Creek that flows through Minneopa State Park was listed as impaired for *E. coli* in 2016. In June 2017 in Minneopa Creek just **BEFORE** it entered Minneopa State Park had *E.coli* levels over 2,100 colonies/100ml. That is over **16 times higher** than the state stream standard. Disturbingly, 75% of the *E. coli* tested were resistant to four (4) or more of antibiotics used to treat it. Three of the antibiotics are listed as essential medicines by the World Health Organization.

PURPOSE:

- 1a) Determine levels of the blue-green algae toxin at the Park and inform Park Staff if levels approach WHO levels of concern,
- 1b) At 8 sites including the Park, determine Phosphorus and Nitrogen nutrients and *E. coli* levels
- 2) Identify potential sources of *E. coli*,
- 3) Determine if 12 antibiotics are still effective against *E. coli*, and
- 4) Outreach/ Education and Stakeholder Group Establishment

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1a: Levels of Blue-green Algae Toxin

Number of Sites	3 (Entrance to the Park, Fall’s Bridge in Park and Crystal Lake Outlet)
Frequency	Once per week; if levels start to increase more often, for 3 months per year
# samples/cost	85 samples at \$25 per sample Toxic Algae Kit = \$2,125 supplies only

Activity 1b. Levels of Phosphorus and Nitrogen nutrients*, and *E. coli*

***Nutrients:** Total Phosphorous, Bioavailable Phosphorous, Nitrate-Nitrite-Nitrogen; Ammonia-Nitrogen and unionized ammonia-nitrogen)

Number of Sites:	8 (Park, Crystal and Lily inflows and outlets, wastewater treatment plant, etc.)
Frequency	2 per month, 4-5 storm events per year, April to November; 2 years



**Environment and Natural Resources Trust Fund (ENRTF)
2019 Main Proposal Template**

Samples/cost 352 samples at \$64 per sample = \$22,528
E. coli **requires 4 dilutions** of each sample to assure correct count of bacteria
 352 samples at \$25 per sample including 4 dilutions = \$8,800

All samples will be collected by Minnesota State University-Mankato personnel. Algae Toxin analysis will be done at Minnesota State University-Mankato. Other samples will be transported to a Testing Lab (competitive bid) for phosphorus and nitrogen nutrients and *E. coli* determination. The *E. coli* plates will be returned to Minnesota State University-Mankato for identification of sources and antibiotic sensitivity analyses.

ENRTF BUDGET: \$81,094.66

Outcome	Completion Date
Monitor Blue-green algal toxin, phosphorus and nitrogen nutrients and <i>E.coli</i> levels at 8 locations (44 times) from April to November for 2 years	June 2021

Activity 2: Identification of Sources of *E. coli*

All testing will be done in the Department of Biological Sciences at Minnesota State University-Mankato. Costs are based on analyzing 300 *E. coli* colonies for four (4) host specific biomarkers. **Supply** cost 300 x 4 markers x \$8 = \$9600. Approximately 50% of the samples will be from the Minneopa State Park.

ENRTF BUDGET: \$102,660.00

Outcome	Completion Date
Assess potential sources of <i>E. coli</i> with 4 biomarkers on 300 colonies, 50% at the Park and final documentation/report	June 2021

Activity 3: *E. coli* sensitivity to 12 antibiotics

The antibiotics selected are used to treat *E. coli*: Amoxicillin/Clavulanic Acid, Cefotaxime, Ciprofloxacin, Colistin, Azithromycin, Tetracycline, Neomycin, Rifampin, Ampicillin, Imipenem, Piperacillin and Sulfmethoxazole/Trimethoprim. **Supply costs** 400 colonies (12 antibiotics) x 14.46 = \$5,784. Approximately 50% of the samples will be from the Minneopa State Park. Testing will be done at Minnesota State University-Mankato.

ENRTF BUDGET: \$77,784.00

Outcome	Completion Date
Assess if 12 antibiotics are still effective 300 <i>E. coli</i> colonies/ 50% at the Park	June 2021

Activity 4: Outreach/ Education and Development of Stakeholder Groups

In the third year of this project, meetings will be held with Lake Crystal (2), Lily Lake group (3), Friends of Minneopa State Park (2) and Blue Earth County SWCD (1) to discuss findings and to determine possible solutions. There will be three (3) large group meetings at the Park to educate and discuss the issues. A story map will be developed to illustrate the issues.

ENRTF BUDGET: \$65,713.86

Outcome	Completion Date
Outreach/ Education/ Stakeholder Groups	June 2022

III. PROJECT PARTNERS: NONE

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

Dependent on the outcomes of this project and the success in establishment of different stakeholder groups, a future request for LCCMR funding to inaugurate best management practices to reduce *E. Coli* and phosphorus and nitrogen nutrients will be submitted. The Blue Earth County Soil and Water Conservation District has prioritized Crystal Lake for nutrient reduction. Dependent on sources some surface runoff and drainage management best management practices such as filter strips, water retention/sedimentation basins and treatment wetlands could reduce **both** nutrients and *E. coli*. Final report submitted.

V. TIME LINE REQUIREMENTS:

This pilot project will take place over 36 months from July 2019-June 2022.

2019 Proposal Budget Spreadsheet

Project Title: Assessment of Toxic Algae/Phosphorus/E.coli Entering Minneopa State Park

IV. TOTAL ENRTF REQUEST BUDGET [3] years

BUDGET ITEM (See "Guidance on Allowable Expenses")	AMOUNT
Personnel: Lead Project Director (Dr. Bertha Proctor): \$ 138,180 (25% Salary and 14% Fringe); 100% FTE - 3 summers: 2019 July, Aug; 2020 May, June, July, Aug; 2021 May and June Assistant Project Director (Dr. Secott): \$ 79,860 (25% Salary and 14% Fringe); 100% FTE - 3 summers: 2019 July, Aug; 2020 May, June, July, Aug; 2021 May and June GIS (WRC Staff): \$ 6200 (17% Salary and 39% Fringe); 17% for 3rd year WRC Associate Director: \$18,000 (16% Salary and 14% Fringe) 16% FTE for 3rd year Interns (2): \$ 26,400 (100% Salary and .0766 FICA) 100% FTE - 2 summers	\$ 268,641
Professional/Technical/Service Contracts: Activity 1b: Sampling phosphorus and nitrogen nutrients-352 samples @ 64 each =\$22,528 Activity 1b : Sampling <i>E.coli</i> levels - 352 samples (4 dilutions each) @ \$25 ea = \$8,800 Put out for bid. Have received one quote from MVTL.	\$ 31,328
Equipment/Tools/Supplies: Activity 1a: 85 algal toxin sample kits @ \$25 = \$2,125 Activity 2: Identification of sources <i>E.coli</i> ; 300 colonies tested with 4 markers each @ \$8 = 9,600 Activity 3: <i>E.coli</i> antibiotic sensitivity testing -400 samples @ \$14.46 = \$5,784 Activity 4:Printing of invites, posters, fliers and educational material for all meetings: \$2,568 Postage for meeting invites to all meeting: 900 families @ .45 ea= \$405; \$92 for envelopes and address labels =\$16 for a total of \$512.3 Meeting supplies: Refreshments (includes plates , napkins, cups) at the small meetings - 8@ \$12 ea= \$96; for the large group meetings - 3 * \$660= \$ 1,980 for a total of \$2,076	\$ 22,665
Acquisition (Fee Title or Permanent Easements):	\$ -
Travel: To save money personal vehicles will be used. Dr. Bertha Proctor will be using her vehicle @ IRS rate of \$0.465. Includes \$2,194 for collection of samples and \$2,728 transport to and from lab= \$4,521.66. WRC staff involved in Activity 4 will be using own vehicle for 8 meetings located in the watershed and 3 meetings at Minneopa State Park, for a total of 226 miles @ IRS rate of 0.465= 97.56.	\$ 4,619
Additional Budget Items:	\$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 327,253

V. OTHER FUNDS (This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period:	\$ -	NA
Other State \$ To Be Applied To Project During Project Period:	\$ -	NA
In-kind Services To Be Applied To Project During Project Period: Dr. Proctor - 20 day = \$19,600 WRC Financial oversight and submittals, with liason to MSU, Mankato Business Office (Diane Wiley) WRC Monitoring (Benjamin Von Korff) 12% Indirects MSU: \$39270	\$ 72,370	Secured
Past and Current ENRTF Appropriation: Isolation and Identification of Reed Canary Grass Root Exudate, \$115,000, 2007-2010 with Drs Cook, Secott and Proctor	115,000	Secured
Other Funding History:	\$ -	

ASSESSMENT OF ALGAL-TOXINS/PHOSPHORUS AND *E.coli* ENTERING MINNEOPA PARK



Where the Buffalo Roam.....Bringing in People..... 293, 908 visitors in 2017

PHOSPHORUS FUELED TOXIC ALGAE BLOOM - A HEALTH CONCERN



Upper Minneopa Falls
(MPCA photo)

Algae Microcystin
Toxin
(the most common in
MN) causes
abdominal pain,
headache, sore
throat, vomiting,
diarrhea and
pneumonia.



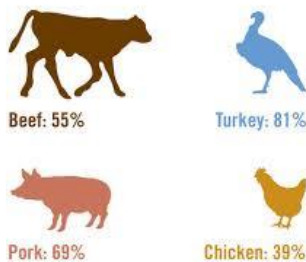
Below Minneopa Falls
(2017)

ELEVATED *E.coli* LEVELS - A HEALTH CONCERN

In June 2017, **BEFORE** Minneopa Creek entered the park, *E. coli* levels were **16 TIMES** the state stream standard and 75% of the *E. coli* tested were resistant to four (4) or more antibiotics. *E. coli* indicate that water is contaminated with fecal material and can cause severe abdominal cramps, bloody diarrhea, vomiting, and in severe cases death.



Antibiotic-resistant bacteria in the US



PROJECT TITLE: Assessment of E. coli levels, antibiotic-resistance and sources.

Project Manager Qualifications and Organization Description

Project Manager: Dr. Beth Proctor

Dr. Beth Proctor has three decades of experience in water quality assessment in Minnesota and management skills. She joined the faculty of MN State University, Mankato (MSUM) in 1987. She has been conducting research in Minneopa Creek Watershed since 1995 including the Crystal Loon Mills Water Quality Improvement Project (1995-1998) and the Water Quality Assessment in Minneopa Creek Watershed Plan (1997). Other projects include: Minnesota River Assessment Project, Middle Des Moines Restoration Project, Lake Shetek Clean Water Partnership Project, High Island and Rush River Assessment Projects as well as the Blue Earth River, LeSueur River and Watonwan River Major Watershed Diagnostic studies. In addition to her faculty responsibilities, she served as the Associate Director Water Resources Center (1990-2000) and Director of the Water Resources Center, Certified Environmental Quality Laboratory (1996-2004).

Water Resources Center, Minnesota State University, Mankato

In 1987 the WRC was created to serve as a regional center for gathering, interpreting, and distributing data of environmental significance. Faculty and students accomplish these tasks through applied research, educational programming, technical assistance, and water resource planning. In addition, we have GIS staff with the capacity to create sophisticated GIS analysis and maps and 3-dimensional landscape visualization. Using the latest data, the WRC works with citizens within the Minnesota River Basin to enhance the quality of regional lakes, rivers, wetlands, and groundwater.

Since its beginning, the WRC has participated in over 100 research, educational, and planning projects involving partnerships with dozens of public and private organizations.