Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-191

Proposal Title: Citizen Scientists Capture Microplastic Pollution Around State

Project Manager Information

Name: Melissa Maurer-Jones

Organization: U of MN - Duluth

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Project Basic Information

Project Summary: This project would develop adaptable methodologies and leverage citizen scientists to survey microplastic pollution throughout the state to allow for data-driven risk management decisions and solutions.

ENRTF Funds Requested: $450,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Water Resources (B)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Microplastics are small plastic particles, measuring less than 5 mm in diameter, that are found in nearly all bodies of water. These particles enter our environment through various pathways, including stormwater runoff, wastewater effluent, other municipal activities, and atmospheric deposition. They range from unaltered plastics, such as plastic manufacturing nurdles, to fragments from the degradation of larger plastic items like ship coatings or environmental plastic pollution. The presence of plastic pollution, including microplastics, in our aquatic systems poses significant challenges to ecosystem health. These particles can be ingested by all organisms, leading to detrimental effects. Given the potential impact on both ecosystem and human health, it is imperative to assess the extent of microplastic pollution in our state's waters. Minnesota lakes serve diverse purposes, ranging from recreational to urban and some even serving as sources of drinking water. Our project aims to design straightforward methods and engage citizen scientists in the collection and analysis of water samples to evaluate microplastic pollution. Additionally, we aim to establish a publicly accessible database to facilitate water quality management efforts.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

The scope of microplastic pollution in our lakes has not been widely studied and, in general, the microplastic community is still working to understand the threshold values where a water body may be considered impaired. One of the challenges to accessing and assessing the relationships between plastics in Minnesota lakes with various use-levels (i.e., urban vs rural vs remote) is that the process of surveying the wide-ranging locations and seasons is unsustainable for a small team of PIs from the perspectives of both time and money. There is a clear need to expand the network of samplers to allow the collection of more samples from a greater number of lakes, which will substantially strengthen our datasets tracking the distribution and amounts of microplastics in MN waters and improve our predictions about the potential impacts of microplastics in the environment. We will develop a kit for microplastic sampling and detection that will be deployed through collaborations in high school science classrooms and expanded to other stakeholders as the kits are vetted and improved. Further, we propose to develop a public-access database of the field data using an open-source relational database management system MySQL.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

This project will provide data on microplastics in Minnesota lakes, and those data could be used by stakeholders to determine management strategies for microplastic pollution. Further, this work will also develop educational tools that can be used by high school science teachers to fulfill the MN science standards. Lastly, the microplastic collection and analysis tools built for this study could be deployed by stakeholders throughout the state, such as county water quality managers and lake association boards, to help build strategies for remediation if necessary.

Activities and Milestones

Activity 1: Development of detection device and validation of microplastic samples collected by citizen Scientists

Activity Budget: $219,787

Activity Description:
The objective of this activity is to develop a detection strategy for microplastics that overcomes the need for expensive detection tools typically afforded microplastic researchers. A major challenge in identifying microplastics in environmental samples is distinguishing between plastic and naturally occurring particles and plant-based fibers like cotton and cellulose. Capitalizing on expertise of the team, we aim to develop a small, portable device that can image the filters on which the microplastics are collected and automate counting. The success of this tool will require validation and quality assurance / quality control (QA/QC) of results using traditional microplastic detection strategies including the hot needle test and Fourier Transform Infrared microscopy.

Activity Milestones:

Description	Approximate Completion Date
building prototype for microplastic imaging	May 31, 2026
validation of microplastics counts with new tool against standards in the microplastic community	December 31, 2026
writing software for automatic detection of microplastic particles	May 31, 2027

Activity 2: Deploying kits to citizen scientist through high school science classrooms and development of public database

Activity Budget: $230,213

Activity Description:
The objective of this activity is to obtain data from at least ten MN lakes and rivers by partnering with high school teachers and their students. We will recruit teachers through already established connections with teachers in Minnesota public schools, including Janesville Pemberton Waldorf, Proctor, Duluth and Minneapolis. Additionally, we will expand our network of participants through collaborating with the outreach specialist at MN Sea Grant. The new kits will include the device developed in activity one. For our first few sampling trips, we will work with teachers who have gained experience sampling for microplastics using the previously established methods. The teachers and their students will collect parallel samples for processing using the old and new methods, which will enable assessment of the effectiveness of the new kits. Subsequent sampling trips will use only the newly developed kits. Finally, this activity will build the mechanisms of collecting the citizen-science datasets, validating the results, and building the publicly accessible database.

Activity Milestones:

Description	Approximate Completion Date
recruitment of teachers and deploying sampling kits to high school science classes	June 30, 2027
development of mechanisms to collect data from classrooms	June 30, 2027
validation of data collected by citizen scientists	December 31, 2027
dissemination of results in peer-reviewed publications and with state stakeholders (e.g., DNR or MPCA)	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Lee Penn	University of Minnesota - Twin Cities	Dr. Lee Penn will be a secondary project manager and is faculty in the Chemistry Department at UMN (also graduate faculty in Water Resource Science and Earth Sciences) and an expert in studying how microplastics change under environmental conditions. Dr. Penn will supervise graduate and undergraduate students.	Yes
Matt Simcik	University of Minnesota - Twin Cities	Dr. Simcik is in the Division of Environmental Health Sciences in the School of Public Health. Dr. Simcik is an expert in the fate and transport of organic contaminants in the environment. Dr. Simcik will co-advise graduate assistants at UMN and UMD.	Yes
Margaret Elmer-Dixon	Milwaukee School of Engineering	Dr. Margaret Elmer-Dixon was a post-doc at UMD and will start as a faculty in MSOE in the department of physic. Dr. Elmer-Dixon is an expert on spectroscopic characterization of the degradation of soft materials and will build the detection tool for microplastic analysis.	Yes
Giniw (Colin Eagle)	Leech Lake Tribal College	Giniw will lend his expertise to coordinate and implement field sampling and testing and supervise and mentor undergraduate students at the Leech Lake Tribal College. Giniw will recruit undergraduate students for summer positions during this project.	Yes

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

One of the aims of this work is to develop a publicly accessible database, with continued access even after the completion of this funding. The database will be hosted on a UMN-system server, and the public will have access to existing data and can submit new data. Further, the results will be published in peer-reviewed journals and presented at regional and national conferences.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Sinking and Suspended Microplastic Particles in Lake Superior	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 04e	$412,000

Project Manager and Organization Qualifications

Project Manager Name: Melissa Maurer-Jones

Job Title: Associate Professor

Provide description of the project manager's qualifications to manage the proposed project.

Dr. Melissa Maurer-Jones will be the primary project manager and is an associate professor in the Department of Chemistry and Biochemistry at University of Minnesota Duluth. Dr. Maurer-Jones has a research group that typically ranges from 1-4 graduate students and 3-4 undergraduate students and regularly collaborates with people from across the state on topics related to the fate and transformation of pollutants in our natural and engineered systems. Dr. Maurer-Jones has collaborated with Drs. Penn and Simcik, including on a projected that was the basis for this proposal. The addition of Giniw has grown out of our collaborative effort to expand our Citizen Science microplastic project to a engaged partners across the state.

Dr. Maurer-Jones studies the transformation and fate of plastics in the environment, including how microplastic particles form from larger pieces of plastic under environmentally relevant conditions. She is expert in the application of analytical and physical chemistry methods to elucidating the impact of synthetic materials on environmental systems.

Organization: U of MN - Duluth

Organization Description:
University of Minnesota Duluth and specifically the Swenson College of Science and Engineering brings together engineering, sciences, and math. In addition to the college, Duluth is home to the Large Lakes Observatory and the Natural Resource Research Institute. Together, this poises Duluth to have resources and expertise in wide ranging topics around water and the environment. UMD is ranked as one of the top research institutions for the size of school and we offer graduate work in most of the college's departments (MS degrees) and PhD degrees from University system programs such as the Water Resource Sciences program.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Melissa Maurer-Jones		PI			27.1%	0.24		$43,218
Matt Simcik		Co-I			27.1%	0.24		$90,692
R. Lee Penn		Co-I			27.1%	0.24		$72,174
Undergrad researcher		Undergraduate researchers, mentored by Giniw, Maurer-Jones, and Penn, will work over summer 2026 and 2027 to process samples, expand our lake sampling sites, and beta-test the database. Budget allows for ~900 h of work ($15-18/h), most of which will be over the summer.			0%	0.15		$16,000
GRA		2 graduate research assistants (mentored by Maurer-Jones, Penn, and Simcik) will be supported over the course of this grant to validate new detection strategies to standard methods in addition to developing the database and analyzing student survey data.			47%	0.69		$76,574
							Sub Total	**$298,658**
Contracts and Services								
Giniw Colin Eagle, Leech Lake Band of Ojibwe	Professional or Technical Service Contract	Giniw, a member of Leech Lake Tribal College, will aid in expanding our network of citizen science participants, especially in regions outside metro and Duluth areas, in addition to recruiting and mentoring undergraduate researchers.				0.24		$43,272
K12 activity participants	Professional or Technical Service Contract	In asking high school science teachers to participate in the development of this kit, we will provide an honorarium to support the time they use to develop curriculum materials. Additionally, we will offset the cost of transportation that may be required to get classrooms to sampling sites.				0		$13,500
Margaret Elmer-Dixon via MSOE	Sub award	Dr. Elmer-Dixon is an expert on the fluorescent analysis tool we plan to employ for detection of microplastics. She is actively working on developing a easy-to-transport device and writing software for				0.24		$37,458

		the analysis. Her responsibility will be to support that portion of Activity 1.						
							Sub Total	**$94,230**
Equipment, Tools, and Supplies								
	Tools and Supplies	Prototype detector supplies	$13,000 will be used in year 1 to develop a new device to detect microplastics which includes purchasing 3D printer resin, detectors, optics, light sources, and electronic connectors. Upon development, $12,000 will be used to create more devices that can be lent to classrooms for their analysis of the samples.					$25,000
	Tools and Supplies	Other supplies	$8000 is requested in year 1 to assemble the necessary components on the sampling kits (including sieves, USB microscopes, wash bottles, tweezers, and filters). Other supplies include fluorescence dyes, solvents, and lab consumables (e.g., gloves, kimwipes, etc). $5806 is requested for both year 2 and year 3 to cover supplies in the PIs labs included replacement pieces for kits and additional lab consumables.					$19,612
							Sub Total	**$44,612**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								

	Miles/ Meals/ Lodging	Travel to classrooms and sampling locations ~$1400 (1-2 people per trip, estimated number of trips total for 3 years = 15, estimated mileage per trip = 150 miles, estimated mileage reimbursement = $0.655)	Travel is provided to support PI and student travel in the course of this grant to and from sampling locations and classrooms to support the development of the kit.					$1,400
							Sub Total	**$1,400**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Travel to conferences for 2 people over the course of grant - ~$9600 (including travel (mileage), lodging, meals, and conference registration).	Fund grad student or PI travel to conferences to present findings from this work.	X				$9,600
							Sub Total	**$9,600**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Shipping	When PI or student travel to classrooms is not possible, we will ship the kits and samples. Expenditures expected per shipment of kit = ~$50 per shipment, which would be shipping kits to 15 classrooms and having them sent back.					$1,500
							Sub Total	**$1,500**
							Grand Total	**$450,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Travel to conferences for 2 people over the course of grant - ~$9600 (including travel (mileage), lodging, meals, and conference registration).	The microplastic community is an international community of researchers, management organizations, and policy makers. We will aim to attend local conferences (MN based) if possible. However, most relevant conferences are out of state. Students/PIs can bring important attention to their work through participation in these conferences. This includes Regional and National American Chemical Society meetings, Regional and National Association for the Sciences of Limnology and Oceanography, and Joint Aquatic Sciences meetings.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	UMN unrecovered indirect costs are calculated at the UMN negotiated rate for research of 55% modified total direct costs.	Indirect costs are those costs incurred for common or joint objectives that cannot be readily identified with a specific sponsored program or institutional activity. Examples include utilities, building maintenance, clerical salaries, and general supplies. (https://research.umn.edu/units/oca/fa-costs/direct-indirect-costs)	Secured	$226,228
			Non State Sub Total	**$226,228**
			Funds Total	**$226,228**

Total Project Cost: $676,228

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: c5acf638-e42.pdf

Alternate Text for Visual Component

Leveraging citizen scientists increases our ability to study a wide variety of geographically and use-level water bodies across Minnesota....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
LCCMR Transmittal letter - Mauer-Jones	8571db43-9d9.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

UMN Sponsored Project Administration