Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-304

Proposal Title: Superior Shores: Protecting Our Great Lakes Coastal Habitats

Project Manager Information

Name: Hailey Sauer

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

Office Telephone: (920) 379-1149

Email: hsauer@smm.org

Project Basic Information

Project Summary: The "Superior Shores" project aims to map, monitor, and conserve Lake Superior's rock pools, enhancing our North Shore's ecosystem health through scientific research, public engagement, and targeted conservation strategies.

ENRTF Funds Requested: $675,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Foundational Natural Resource Data and Information (A)

Project Location

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

Region(s): NE

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.

Renowned for its vast beauty, the rugged shoreline of Lake Superior teems with unexplored biodiversity. Carved by relentless weather and waves, the shoreline is pocked with numerous pool-like features known as rock pools. These ecologically dynamic habitats are crucial for supporting local and regional biodiversity – providing sanctuary and breeding grounds for a myriad of organisms. While previous LCCMR efforts have helped monitor and conserve rare plants that depend on the Lake Superior rock pool ecosystem, the pools themselves remain largely overlooked, with no comprehensive inventory detailing their location, habitat quality, or the multitude of organisms they sustain. Studying these ecosystems is essential for understanding the intricate life that depends on them. Given our love for the North Shore, understanding rock pools' resilience and vulnerability is imperative. These pools face ongoing pressure from weather and climate, increased human activity, and are located along shipping lanes, which all pose risks to shoreline ecosystems and Lake Superior. Ultimately through a comprehensive study of Lake Superior's rock pools we hope to guide the development of targeted conservation strategies that ensure the protection of the rock pools' unique biodiversity and the health of the broader ecosystem.

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.

We have an immense opportunity to explore and expand our knowledge of the biodiversity along the Lake Superior shoreline. Using a subset of pools from regions of interest along the north shore we aim to determine the impact of environmental and human stressors on rock pool habitat quality for common and rare species.

We will provide insights into the distribution, overall macro- and micro- diversity, and stressors to Lake Superior rock pool community assemblage. Ultimately our work will yield valuable data for use by resource managers and conservationists dedicated to preserving the ecological integrity of Lake Superior's coastal habitat through three major efforts:

1) High resolution mapping of Lake Superior's coastal rock pools using existing Light Detection and Ranging data and aerial imagery, corroborated through ground truth verification.

2) Water quality monitoring and biological surveys aimed at measuring the effects of natural (e.g., temperature, pH) and human (e.g., sunscreen UV filters, microplastics) parameters on habitat viability for algae, invertebrate, and amphibian species.

3) Communication of results with resource managers and collaborations with the public on the importance of rock pool habitats as biodiversity hotspots, rare species sanctuaries, and critical nursery habitats.

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?

Rock pools exemplify the interconnectedness within ecosystems, where the health and diversity of these habitats can have cascading effects on the broader ecological community. We will highlight important North Shore habitats and advocate for the preservation and conservation of these ecosystems for the enjoyment of all Minnesotans by:

1) Developing a comprehensive understanding of the biodiversity and ecological dynamics of rock pools along the Lake Superior shoreline.
2) Identifying parameters that drive community assembly and persistence in rock pool ecosystems.
3) Provide insight into the resilience of rock pool communities to environmental and human stressors, guiding future conservation and management.

Activities and Milestones

Activity 1: Delineation and physical characterization of rock pools along the Lake Superior shoreline.

Activity Budget: $125,000

Activity Description:
We will map and characterize rock pools at five potential locations along Lake Superior (e.g., Horseshoe Bay, Artist Point, Temperance River State Park, Gooseberry Falls State Park, Two Harbors). Our focus will be on documenting individual rock pool location, depth, area, and proximity to Lake Superior through three integrative approaches.

LiDAR Data Analysis: We use existing LiDAR (Light Detection And Ranging) to create detailed depression maps of the area, allowing us to identify rock pool locations providing precise elevation data.

Aerial Photography: We will supplement LiDAR data with aerial photographs, generated through previous LCCMR efforts, to visually identify rock pools, especially those not immediately apparent in LiDAR data due to their size or obscured location.

Ground Truthing: We will then verify both LiDAR and aerial photographic data on-site. This ensures that rock pools are correctly identified and physically measured to confirm their dimensions (i.e., area, depth) and proximity to the Lake.

Through integration of advanced technology and traditional fieldwork we'll enhance our understanding of the physical landscape and ecological features of Lake Superior's shoreline. The production of high resolution maps of these areas will be crucial for ongoing studies that will conserve the Lake Superior costal habitat.

Activity Milestones:

Description	Approximate Completion Date
Analyze existing LiDAR data and aerial photography to produce digital maps.	October 31, 2025
Conduct field visits to identify pool locations and collect physical measurements.	August 31, 2026
Integrate data, produce high-resolution maps, and make publicly available datasets.	June 30, 2028

Activity 2: Water quality monitoring and biological surveys of Lake Superior's rock pools.

Activity Budget: $485,000

Activity Description:
We will evaluate the effects of environmental and human stressors on rock pool ecosystems through temporal water quality monitoring and comprehensive biological surveys – focusing on the interplay between these stressors and aquatic life.

Water Quality: We will collect samples from select pools in each region of interest to analyze for nutrients from natural sources, trace metals from earth minerals, and human-made substances like sunscreen chemicals and microplastics. Examining these across seasons will allow us to construct a detailed picture of water quality over time and identify areas of concern.

Biological Surveys: Complementing our water quality analysis, we'll conduct extensive biological surveys. We will catalog species across all domains of life within rock pools—from bacteria and algae to animals. Our surveys will not only document the presence of species but also their life stage – from egg to adult. Seasonal documentation of species and life stages will better our understanding of ecosystem dynamics and provide insight into reproductive success and

survival rates of species.

The culmination of this activity, alongside the spatial data, will be the production of comprehensive biological (DNR - NHIS) and water quality datasets coupled with high-resolution maps highlighting areas of significant biodiversity and potential ecological impact.

Activity Milestones:

Description	Approximate Completion Date
Survey invertebrate and vertebrate communities for one year (2026) across regions of interest	December 31, 2026
Measure nutrients, UV filters, microplastics, trace elements for one year (2026) across regions of interest	May 31, 2027
Survey algal and bacterial communities for one year across regions of interest (2026)	May 31, 2027
Survey invertebrate and vertebrate communities for one year (2027) across regions of interest	December 31, 2027
Measure nutrients, UV filters, microplastics, trace elements for one year (2027) across regions of interest	May 31, 2028
Survey algae and bacterial communities for one year across regions of interest (2027)	May 31, 2028

Activity 3: Engaging stakeholders, the general public, and youth in rock pool conservation efforts.

Activity Budget: $65,000

Activity Description:
We will guide future management, conservation, and protection efforts of rock pools by partnering with local, regional, state, tribal, and national partners (letters of support). We'll share findings at regional resource meetings, via annual webinars highlighting project results, and through targeted communication and outreach materials. All data products will be accessible online and synthesized through scientific publication, maps and databases, reports, and outreach materials.

To highlight rock pools' ecological significance, we will launch the "Rock Pool Explorers'' program. Partnering with a local children's publishing company in Grand Marais, we will encourage young minds to explore the vibrant world of rock pools. Ultimately, they will transform their scientific observations into published books. By melding the explorative nature of science with the creative process of storytelling, children will become ambassadors of ecological awareness, spreading the message of conservation through their unique perspectives.

As a museum, we'll develop a STEM curriculum on ecological importance of rock pools. This curriculum will focus on the biodiversity of rock pools, their role in local and regional ecosystems, and the challenges they face from environmental and human-induced stressors. Through interactive experiences, participants will gain a deeper understanding of the ecological dynamics at play in rock pools.

Activity Milestones:

Description	Approximate Completion Date
Develop and launch in classroom STEM curriculum across the NE region and state.	September 30, 2026
Host workshops and programming for children, families, and stakeholders throughout the 2026-2028 academic years	May 31, 2028
Publish children-authored books on rock pools	May 31, 2028
Present findings with professional colleagues.	May 31, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Alex Egan	National Park Service	Rock Pool Specialist, Chironomid Specialist	No
Anne Brataas	Minnesota Children's Press	Outreach Support	Yes
Randy Beebe	WolfsHead Research Logistics	Pilot, Aerial Photography Support	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?

The comprehensive datasets, including high-resolution maps and biological surveys, will inform resource managers and conservationists. This ongoing effort will be supported by partnerships with governmental (National Park Services, MN DNR) and non-governmental organizations, ensuring the sustained protection and preservation of rock pool biodiversity. Additionally, educational programs and public engagement initiatives will evolve based on new findings, fostering community involvement in conservation efforts and enhancing ecological awareness.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Invasive Didymosphenia Threatens North Shore Streams	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 06g	$197,000
Unprecedented Change Threatens Minnesota's Pristine Lakes	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 20a1	$482,000
Salt Threatens Minnesota Water Quality and Fisheries	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04l	$1,228,000
Didymo II – The North Shore Threat Continues	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 04k	$394,000

Project Manager and Organization Qualifications

Project Manager Name: Hailey Sauer

Job Title: Researcher

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

Dr. Hailey Sauer has a comprehensive and specialized academic background. She holds bachelor's degrees in Education, Environmental Science, and Geographical Information Science, along with a Ph.D. in Geomicrobiology. Her work has focused on lakes and rivers, giving her a solid understanding of aquatic ecosystems, biodiversity, and their challenges.

Throughout her career, Hailey has researched aquatic systems, focusing on nutrient dynamics and microbial interactions. This research has contributed to the scientific community and practical environmental conservation. Her Geographical Information Science skills are vital for this project, providing essential spatial analysis and mapping capabilities.

Her doctoral work in Geomicrobiology, examining microorganisms in aquatic environments, demonstrates her ability to manage complex projects. This makes her well-suited for leading efforts to monitor and enhance the ecological health of

rock pool habitats, a main goal of the Superior Shores project.
Hailey's dedication to education and outreach, highlighted by her education degree and her participation in various initiatives, supports the project's objectives to educate the public on coastal habitat protection. Her leadership is expected to promote scientific progress and increase awareness and care for Lake Superior's ecosystems.

Hailey Sauer's blend of scientific and educational expertise makes her an excellent choice for Project Manager of the "Superior Shores" project. She will lead a team with diverse expertise in rock pool studies (Edlund), diatoms and algae (Burge), water quality analysis (Hu), chironomids (NPS Partner Eagan), and STEM education (Farzhad), positioning the project for success.

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

Organization Description:
The Science Museum of Minnesota (SMM) is a private, non-profit 501(c)3 institution dedicated to encouraging public understanding of science through research and education. The St. Croix Watershed Research Station is the environmental research center of the SMM with the mission “we do the science that helps make our rivers and lakes clean” through research and outreach. The SCWRS supports an active year-round program in environmental research and graduate-student training, guided by a dedicated in-house research staff with direct ties to area universities and colleges. It collaborates closely with federal, state, and local agencies with responsibility for managing the St. Croix and upper Mississippi rivers and is a full partner with the National Park Service for resource management in parks of the western Great Lakes region. Its research has played a central role in setting management policy for the state and tribal waters, for establishing water-quality standards for Minnesota lakes, and for developing long-term monitoring plans for the National Park Service.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Hailey Sauer		Project Management, Spatial Analysis, Fieldwork, Genomics, Water Quality, Analysis, Reporting, and Outreach			26%	1.65		$129,402
Mark Edlund		Project Coordination, Fieldwork, Diatom Analysis, Reporting, and Outreach			26%	0.66		$96,554
Science Museum of MN - Education Specialist		Curriculum development and dissemination			26%	0.21		$20,530
Field Technician I - Biological Specialist		Fieldwork, Analysis, Data Management			26%	0.24		$54,388
Field Technician II - Mapping Specialist		Fieldwork, Analysis, Data Management			26%	0.02		$17,244
David Burge		Fieldwork, Diatom and Algae Analysis			26%	1.14		$115,200
Kui Hu		Fieldwork, Water Quality Analysis, Diatom Analysis			26%	0.33		$25,880
							Sub Total	**$459,198**
Contracts and Services								
SCWRS - Analytical Lab	Internal services or fees (uncommon)	Water Quality analytical costs, 300 samples, analysis for TN/TP, DIN/SRP, DSi, DOC, DIC, benthic chlorophyll a, ash free dry mass, TSS/VSS: 300 samples @ $210				0		$63,000
University of Minnesota or Competitive Bid	Professional or Technical Service Contract	HPLC for Sunscreen UV Filters: 50 samples @ $200				0		$10,000
Northwestern University or Competitive Bid	Professional or Technical Service Contract	ICP-OES for Trace Element Analysis: 300 samples @ $120				0		$36,000

University of California Davis or Competitive Bid	Professional or Technical Service Contract	Isotopical Analysis of Water: 400 samples @ $15.50				0		$6,200
Agilent Technologies Analytic Lab or Competitive Bid	Professional or Technical Service Contract	LDIR for Microplastics Analysis: 50 samples @ $200				0		$10,000
SeqCenter or Competitive Bid	Professional or Technical Service Contract	Sequencing of algal and bacterial DNA: 50 samples @ $248				0		$12,414
Minnesota Children's Press	Sub award	Production of outreach and education materials including published text to educate on the importance of rock pool environments				-		$10,000
WolfsHead Research Logistics	Sub award	Support for collecting aerial imagery for ground truthing activities in activity 1				0		$4,000
							Sub Total	**$151,614**
Equipment, Tools, and Supplies								
	Tools and Supplies	Fieldwork and Sampling Supplies	Expendable supplies for sampling (bottles, vials, syringes), DNA extraction and microplastic sorting supplies, identification guides					$14,322
	Equipment	GPS or other navigational System	For use in ground truthing and inventory mapping					$5,000
	Equipment	Aerial Photography Drone	For use in ground truthing and inventory analysis					$7,500
							Sub Total	**$26,822**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	4 Trips (3 days, 2 nights - 3 persons) - 900 miles/trip, $43/day per diem, $0.67/mile, $315/trip gas, $200/night lodging	Fieldwork to accomplish activity 1					$11,208
	Miles/ Meals/ Lodging	6 Trips (4 days, 3 nights - 2 persons) - 900 miles/trip, $43/day per diem, $0.67/mile, $315/trip gas, $200/night lodging	Fieldwork to complete activity 2					$16,554
	Miles/ Meals/ Lodging	4 Trips (3 days, 2 nights - 3 persons) - 900 miles/trip, $43/day per diem, $0.67/mile, $315/trip gas, $200/night lodging	Fieldwork to complete activity 3					$5,604
	Conference Registration Miles/ Meals/ Lodging	Cost to register and attend the water resources conference 4 persons @ $375 registration, 50 miles, $43 per diem	Dissemination of results with colleagues and water resource managers					$2,000
							Sub Total	**$35,366**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Publication: page charges and children's book	Activity 3 milestone and outreach					$2,000
							Sub Total	**$2,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$675,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**-**

Total Project Cost: $675,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 06ee43cc-1b1.pdf

Alternate Text for Visual Component

Not just for splashing about, Lake Superior's rock pools are thriving ecosystems. We aim to develop comprehensive geospatial and biological databases that characterize the importance of these coastal habitats and advocate for their conservation. Especially given they may be crucial nursery and refuge habitats....

Supplemental Attachments

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

Title	File
National Park Service Letter of Support	2b3390b1-fdb.pdf
Minnesota Children's Press Letter of Support	e86c21ba-b9b.pdf
Science Museum of MN Letter of Support	1684150b-bd6.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?

No

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")?

Yes

Do you certify that background checks are performed for background check crimes, as defined in Minnesota Statutes, section 299C.61, Subd. 2, on all employees, contractors, and volunteers who have or may have access to a child to

whom children's services are provided by your organization?

Yes

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

Mark Edlund, St. Croix Watershed Research Station and Science Museum of Minnesota