Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

General Information

ID Number: 2025-304

Staff Lead: Noah Fribley

Date this document submitted to LCCMR: June 9, 2025

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

Project Budget: $675,000

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

Web Address: https://www.smm.org/scwrs

Project Reporting

Date Work Plan Approved by LCCMR: June 24, 2025

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2028

Final Report Due Date: August 14, 2028

Legal Information

Legal Citation: M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 03ff

Appropriation Language: $675,000 the first year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to map the locations and survey the biological diversity and water quality of Lake Superior coastal rock pools. This appropriation may also be used to develop outreach materials and host programs on rock pool understanding and conservation.

Appropriation End Date: June 30, 2028

Narrative

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.

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.

Project Location

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

Ecological Subsection(s): North Shore Highlands

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

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 preliminary 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 STEM activities 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

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
Our project aims to share data, findings, and resources in ways that maximizes their impact on scientific research, resource management, and public awareness. Our comprehensive plan for dissemination includes: peer-reviewed publications, informing state and tribal resource managers, professional and public presentations and outreach, and geospatial publications.

Peer-Reviewed Publications
At the conclusion of the project (June 2028) we will prepare and submit one or more manuscripts to peer-reviewed journals relevant to our field. These publications will detail our methodology, findings, and implications -- ensuring that our research is rigorously evaluated and accessible to the scientific community.

Conference and Public Presentations
During the funding period, we will present our findings at the MN Water Resources Conference (Fall 2026/7). This presentation will target professional audiences including researchers, policymakers, and practitioners who can directly benefit from our research. Additionally, we will give informal presentations on our findings at public events hosted by the Science Museum of MN furthering the accessibility of research findings.

Geospatial Publications
We will publish our data on the MN Geospatial Commons, an open-source collaborative space for researchers, cartographers, web developers, journalists, and citizens. These data will include detailed spatial information about location, size, and shape, as well as presence/absence data for biological species. We will ensure that any data related to rare, threatened, endangered species is shared with the MN Department of Natural Resources for inclusion in their Natural Heritage Information System rather than listed in the public dataset. Our data will also include comprehensive water chemistry data collected during the sampling and funding period, contributing to a valuable repository for environmental analysis and decision-making.

In addition to these data, we will create Story Maps of select rock pool areas in high-density regions -- integrating photography, narrative, and data visualization. These Story Maps will highlight the ecological and cultural significance and rock pools and their communities, and making the data more accessible and compelling for a broader audience.

Children's Book Publication
Minnesota Children’s Press is a non-profit organization dedicated to empowering young voices through storytelling, publishing, and creative expression. The books created and printed as part of this initiative are not intended for commercial sale. Instead, they are made available to the public often for free or through a "free will donation" model.

This approach ensures accessibility to all community members, fostering inclusivity and encouraging a love for reading and storytelling among Minnesota's youth.

All dissemination efforts related to this project will prominently acknowledge the support of the Environment and Natural Resources Trust Fund (ENRTF) and the Legislative-Citizen Commission on Minnesota Resources (LCCMR). This acknowledgment will be included in all forms of communication, including but not limited to:

Peer-Reviewed Publications and Reports: All scientific publications, technical reports, and white papers will include a statement recognizing ENRTF/LCCMR support in the acknowledgments section.

Conference and Public Presentations: Oral and poster presentations at academic, professional, and public conferences will include the ENRTF/LCCMR logo on presentation materials, and presenters will verbally acknowledge the funding source.

Educational and Outreach Materials: Any educational resources, brochures, or outreach materials produced for community engagement will display the ENRTF/LCCMR logo and a statement of gratitude for their support.

By consistently recognizing ENRTF/LCCMR's contribution, we aim to highlight the critical role this funding plays in advancing environmental research and stewardship in Minnesota.

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

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	Service Contract	HPLC for Sunscreen UV Filters: 50 samples @ $200				0		$10,000
Northwestern University or Competitive Bid	Service Contract	ICP-OES for Trace Element Analysis: 300 samples @ $120				0		$36,000

University of California Davis or Competitive Bid	Service Contract	Isotopical Analysis of Water: 400 samples @ $15.50				0		$6,200
Agilent Technologies Analytic Lab or Competitive Bid	Service Contract	LDIR for Microplastics Analysis: 50 samples @ $200				0		$10,000
SeqCenter or Competitive Bid	Service Contract	Sequencing of algal and bacterial DNA: 50 samples @ $248				0		$12,414
Minnesota Children's Press	Subaward	Production of outreach and education materials including published text to educate on the importance of rock pool environments				-		$10,000
WolfsHead Research Logistics	Service Contract	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
							Sub Total	**$19,322**
Capital Expenditures								
		Aerial Photography Drone	For use in ground truthing and inventory analysis	X				$7,500
							Sub Total	**$7,500**
Acquisitions and Stewardship								

							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	4 Trips (3 days, 2 nights - 3 persons) - 950 miles/trip, $86/day per diem, $0.70/mile, $220/night lodging	Fieldwork to accomplish activity 1					$11,036
	Miles/ Meals/ Lodging	6 Trips (4 days, 3 nights - 3 persons) - 950 miles/trip, $86/day per diem, $0.70/mile, $220/night lodging	Fieldwork to complete activity 2					$16,377
	Miles/ Meals/ Lodging	2 Trips (3 days, 2 nights - 3 persons) - 950 miles/trip, $86/day per diem, $0.70/mile, $220/night lodging	Fieldwork to complete activity 3					$5,518
	Conference Registration Miles/ Meals/ Lodging	Cost to register and attend the water resources conference 5 persons @ $375 registration, 50 miles, $49per diem x2 days	Dissemination of results with colleagues and water resource managers					$2,435
							Sub Total	**$35,366**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Publication: Page charges	Activity 3 milestone and outreach					$1,750
	Printing	Printing Children's Books	Activity 3 milestone and outreach					$250
							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
Capital Expenditures		Aerial Photography Drone	The purchase of a drone is critical to the success of this project. The rock pools of the North Shore, vary in size and are often located in rugged or remote areas. They are not fully visible in existing aerial or plane-derived imagery due to insufficient spatial resolution. Accurate mapping is essential for the proposal and for understanding ecological dynamics, hydrological patterns, and the impacts of climate change on these unique microhabitats. Necessity and Direct Relevance to the Project (1) High-Resolution Mapping The drone provides the precise, high-resolution imagery needed to identify and map rock pools that are otherwise undetectable using available data sources. Without this technology, the project risks incomplete or inaccurate results, undermining both current and future conservation efforts. (2) Efficiency and Accessibility Many rock pools are located in areas that are difficult or hazardous to access on foot. The drone enables rapid, safe data collection across these inaccessible areas, significantly reducing field time and ensuring comprehensive coverage. The drone is not a general-use piece of equipment but an essential tool directly tied to the specific goals of this project and the broader environmental monitoring program along the North Shore. Its continued use will ensure that the initial investment provides long-term benefits to Minnesota's natural resource management efforts. Given the critical role it plays in both the immediate and future success of this work, we seek an explicit exception for its purchase. **Additional Explanation :** Following this project, the drone could continue to be used for environmental monitoring and mapping along the North Shore and similar freshwater ecosystems throughout Minnesota. This includes: (1) Long-Term Monitoring of Rock Pools The drone would support follow-up studies to assess temporal changes in rock pool hydrology, biodiversity, and ecological health. (2) Expansion to Related Ecosystems The equipment has the potential to be used to map and monitor other critical shoreline habitats and freshwater systems, ensuring that the data collected contributes to a broader understanding of Minnesota's natural resources. (3) Educational and Collaborative Use

			The drone may also serve as a tool for engaging local communities, educational institutions, and governmental agencies in environmental stewardship and research, aligning with LCCMR's goals for public engagement and scientific outreach. The drone is not a general-use piece of equipment but an essential tool directly tied to the specific goals of this project and the broader environmental monitoring program along the North Shore. Its continued use will ensure that the initial investment provides long-term benefits to Minnesota's natural resource management efforts. Given the critical role it plays in both the immediate and future success of this work, we seek an explicit exception for its purchase.

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

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Clarified language surrounding outreach in activity 3 milestones & quality of maps created in activity 1 milestones.
Milestone 1 activity 1 : Analyze existing LiDAR data and aerial photography to produce preliminary digital maps. ** Added the word preliminary **
Milestone 3 activity 1: Develop and launch STEM activities across the NE region and state. ** Switched curriculum to activities **
Recategorized aerial imagery to service contract
Recategorized aerial drone equipment as capital (generally ineligible) and added justification statements
Separated pages charges and children's book fees
Included details on recognizing ENRTF funding in various dissemination efforts
Removed gas allocation from the travel budget, updated to 2025 GSA mileage, lodging, per diem values and added additional persons to activity 2 field efforts
Included details regarding revenue generation concerns for the children's book to the dissemination section

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

Yes

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the Commissioner's Plan applies.

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 project:

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

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand