



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-293

Proposal Title: Impacts of Winter Angling on Tribal Water Quality

Project Manager Information

Name: Bonnie Keeler

Organization: U of MN - Water Resources Center

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Project Basic Information

Project Summary: Contaminant sampling and fish tissue analysis to determine environmental impacts of human waste from winter angling on Tribal lakes. Program evaluation and recommendations for improved waste disposal and fish consumption.

ENRTF Funds Requested: \$492,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Water (B)

Project Location

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

Region(s): NW, 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.

Winter angling is a popular recreational activity, bringing tourism and economic development to Minnesota communities. Lakes on Tribal lands and ceded territories are especially popular ice fishing destinations - Upper Red Lake alone will attract 65,000 to 85,000 anglers during a typical winter season. At the same time, anglers leave behind trash and improperly disposed human waste, potentially introducing pharmaceuticals, hormones, PFAS/PFOS, phenols, and other contaminants of emerging concern (CEC) with unknown effects on water quality, fish health, and human exposure to contaminants.

Indigenous communities are uniquely vulnerable to the impacts of environmental contamination due to their cultural reliance on these ecosystems for sustenance and economic stability. Tribal communities and local governments also face significant costs associated with waste disposal and management and insufficient resources for monitoring and enforcement. The impacts extend beyond Tribal members, as recreationists who visit and harvest fish from popular ice fishing lakes may also be exposed to elevated contaminants in fish tissue. Without additional investigation, waste management from ice fishing remains a serious environmental and health concern for the communities who depend on northern lakes for cultural and recreational uses.

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.

Previous contaminant studies have raised awareness of the presence of contaminants in the environment but have not investigated winter angling as a potential source. In partnership with the Red Lake Band of Chippewa and the Fond du Lac Band of Lake Superior Chippewa, the project will focus on multiple lakes representing a gradient of angler pressure from lower to greater use intensity. Funds will support sampling and analysis of pharmaceuticals, hormones, PFAS/PFOS, phenols, and other environmental toxicants in water and fish tissue. Sampling will be designed to differentiate between on-lake and on-shore sources of contamination. Researchers will conduct fish tissue analysis to determine impacts of contamination on fish health with a focus on species of cultural importance. Results of contaminant and fish analyses will be compared to state and federal health based guidelines, leveraging partner expertise in toxicology and environmental health. Researchers will evaluate existing "Keep it Clean" campaigns and other programs designed to reduce the impacts of winter angling through focus groups and interviews with outfitters and resource managers. In consultation with Tribal communities, project partners will make recommendations for mitigating human exposure to contaminants via revised fish consumption guidelines and improved waste management policies or programs.

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?

Project outcomes include recommendations and best practices to reduce human waste contamination of lakes from winter angling, new datasets on the distribution and quantity of environmental contaminants in culturally-valuable northern Minnesota lakes, and insights into how human activities contribute to the distribution of observed contamination. Tribal resource managers will assess potential impacts on fish health and develop recommendations to reduce human exposure to contaminants. The project will advance Tribes' ability to mitigate or prevent contamination while supporting stewardship and cultural values, honoring and protecting Tribal sovereignty, and building capacity for long-term Tribal leadership in water resource management.

Activities and Milestones

Activity 1: Contaminant sampling and analysis

Activity Budget: \$175,500

Activity Description:

A previous LCCMR-funded study (2017 059-b) demonstrated the presence of emerging contaminants in water, subsistence fish tissues, and lake sediments in Northern Minnesota. However, earlier research was not designed to isolate the contributions of winter angling on observed levels of contamination.

In the proposed work, sampling will be designed to differentiate sources of contamination from on-lake and on-shore activities. Selected lakes represent a gradient of winter angling intensity with multiple sampling locations on Upper and Lower Red Lake (Red Lake Reservation) and Big Lake and Prairie Lake (Fond du Lac Reservation and 1854 Treaty Area). Water samples will be collected during the ice-out period to isolate CEC loads from winter angling, additional samples will be collected in late summer at sites corresponding to varying on-shore use intensities. Samples will be sent to EPA-certified labs to be analyzed for pharmaceuticals, hormones, and PFAS/PFOS. Samples will also be analyzed for components of laundry detergents, such as phenols, that will be used to discriminate on-lake from on-shore sources. Tribal resource managers will lead the sample collection, processing costs will be covered by the project budget, and university researchers will support data analysis, visualization, and interpretation.

Activity Milestones:

Description	Approximate Completion Date
Sites identified, sampling plans finalized, lab contract secured, and supplies rented from approved suppliers	February 28, 2028
Samples collected, processed, and sent to approved labs for analysis	September 30, 2028
Sampling results received, data cleaned and visualized, and results shared with research team	December 31, 2028

Activity 2: Fish tissue contamination and fish health analysis

Activity Budget: \$177,906

Activity Description:

Contaminant sampling (Activity 1) will determine the source of and prevalence of CECs in Tribal and state waters with greater to lower ice fishing intensity. Activity 2 will assess contaminant levels in fish tissue collected from the same lakes. Tribal Resource Managers will collect and process walleye from Upper and Lower Red Lake, yellow perch from Prairie Lake, and black crappie from Big Lake. Fillet samples will be shipped to an EPA-certified lab to be analyzed for CECs, including pharmaceuticals, hormones, and PFAS/PFOS. During the summer of 2028 through winter of 2029 Bemidji State University researchers will assess the health of sampled fish through an assessment of whole organisms and specific tissues, such as the gonads and livers, as well as biomolecular endpoints. This work will provide tribal resource managers guidance on how waste disposal during ice-fishing activities is impacting fish health and the extent to which tribal members who practice ancestral lifeways on these lakes are exposed to CECs.

Activity Milestones:

Description	Approximate Completion Date
Fish samples collected, processed and sent to approved labs for analysis	September 30, 2028
Fish samples collected, processed and prepped for bioassays	October 31, 2028
Fish CEC analysis complete, bioassays completed, data analyzed, and shared with project team	March 31, 2029

Activity 3: Risk assessment and education

Activity Budget: \$64,488

Activity Description:

Contaminant sampling will yield detection data on hundreds of compounds, very few of which have health based guidelines. Understanding and interpreting these data require consultation with toxicologists, public health experts, and reviewing peer and agency literature on the distribution and potential impacts of these emerging contaminants. This activity will focus on the interpretation, analysis, visualization and dissemination of results from Activities 1 and 2, including the creation and communication of education materials designed for Tribal communities. First, results of water and fish contaminant sampling will be compared to previous ambient sampling in Minnesota and surrounding regions, placing observed contaminant levels in context. Next, researchers will synthesize existing health-based guidelines from state, federal, and international sources. Working with partners in the Department of Health, Pollution Control Agency, and US EPA, the research team will consult with Tribal Resource Managers to create public communication tools that contextualize findings and interpret potential risks to environmental or public health. An extension educator with expertise in developing risk-based public health curriculum will collaborate with Tribes to develop culturally appropriate educational materials and programming.

Activity Milestones:

Description	Approximate Completion Date
Synthesize existing health-based guidelines and ambient levels of contamination from previous sampling efforts	December 31, 2028
Preparation and dissemination of a research brief that contextualizes findings, compares results to published guidelines	December 31, 2028
Development of presentations, fact sheets, webpages, and curriculum for Tribal community leaders	April 30, 2029
Visits to Tribal communities to share findings and implications for human exposure and environmental health	May 31, 2029

Activity 4: Program evaluation and policy recommendations to mitigate impacts of winter angling

Activity Budget: \$74,106

Activity Description:

Project findings will inform the development of tools and decision-making strategies to promote Tribal capacity to address the challenge of human waste and trash from winter angling. The project team will conduct a retrospective analysis of existing “Keep it Clean” campaigns on northern Minnesota lakes based on document review and interviews with outfitters, resource managers, anglers, and municipal staff. Similar waste management policies and programs in other states will also be reviewed and summarized. Building on past program evaluation, researchers will assess the costs and potential benefits of alternative policies or programs designed to improve safe and efficient disposal of waste and make recommendations to Tribal, county, and state officials. Potential actions to be evaluated include revised fish consumption guidelines, alternative protocols for human waste disposal or management, compliance or enforcement alternatives, pharmaceutical disposal programs, and public outreach or communication campaigns. Work will support future preparedness for Tribal Resource Managers to address emerging issues and build awareness of current and potential threats to water quality and human exposure to CECs.

Activity Milestones:

Description	Approximate Completion Date
Evaluation of past “Keep it Clean” campaigns based on interviews, focus groups, and web-based survey	January 31, 2028

Development of a memo summarizing findings, including evaluation of campaigns in Minnesota and other states	June 30, 2028
Policy memo and recommendations to mitigate health and environmental impacts of winter angling	January 31, 2029
Presentation of findings to agencies, Tribal leaders, and legislative committees	February 28, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Rachel Nichols	Minnesota Pollution Control Agency	Agency advisor on contaminant policy, regulatory perspectives, and program analysis. Will assist in policy and program evaluation and development of recommendations.	No
Carl Isaacson	Bemidji State University	Advise on water and fish sampling design and execution, develop and oversee fish health analyses, co-supervise graduate student.	No
Shane Bowe	Red Lake Department of Natural Resources	Consult on the design and execution of Red Lake sampling activities and co-supervision of Bemidji State graduate student.	No
Tyler Orgon	Red Lake Department of Natural Resources	Project management for Red Lake research, including design and collection of fish and water samples, data interpretation and dissemination, and co-supervision of graduate student. Assist in overall project coordination and reporting. Consult on program evaluation and policy recommendations.	Yes
Joshua Schrope	Fond du Lac Band of Lake Superior Chippewa Environmental Program	Design and conduct water sampling and collect fish for analysis at Fond du Lac. Advise on program evaluation and policy analysis. Assist in dissemination and coordination for project outreach at Fond du Lac.	No
Kelsy Federico	Fond du Lac Band of Lake Superior Chippewa Environmental Program	Design and conduct water sampling and collect fish for analysis at Fond du Lac. Advise on program evaluation and policy analysis. Assist in dissemination and coordination for project outreach at Fond du Lac.	No
Mark Ferrey	Minnesota Pollution Control Agency	Advise on sampling design, interpretation, and state policy analysis. Assist in the development of recommendations based on findings.	No
Mark Jankowski	U.S. Environmental Protection Agency	Advise on sampling design, interpretation, and federal policy analysis. Assist in the development of recommendations based on findings.	No

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.

The project includes dedicated funding for the dissemination of findings with a focus on risk communication to tribal communities and the development of policy recommendations to mitigate contamination from human waste and trash associated with winter angling (Activities 3 & 4). An experienced UMN extension educator will consult with Tribal Resource Managers and partners in the Minnesota Department of Health and Pollution Control Agency to create public communication tools that contextualize findings and interpret potential risks to environmental or public health. Researchers will develop and share policy memos evaluating existing Keep it Clean campaigns and related programs designed to reduce negative impacts of winter angling and propose recommendations for additional state, county or Tribal programs to further reduce contamination from human waste and trash. These policy memos and recommendations will be shared with LCCMR and published on the open access University of Minnesota Digital Conservancy. All water quality and fish data will be governed by a data sharing agreement designed to protect data

sovereignty where Tribal Resource Managers determine how data are stored, disseminated, and published during and after project completion.

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?

Our approach is Tribally-centered, where university researchers work under the guidance of Tribal resource managers with the expertise and cultural knowledge to identify data and decision support tasks that align with Tribal needs. The project includes dedicated funding for the dissemination of findings with a focus on programming and risk communication to Tribal communities. Project partners in state and federal agencies are committed to consulting on all aspects of project design, including considering state and federal policy recommendations that emerge based on project findings.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Visitor Perceptions of Water Quality to Aid Lake Management	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 04h	\$379,000

Project Manager and Organization Qualifications

Project Manager Name: Bonnie Keeler

Job Title: Director, Water Resources Center

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

Dr. Bonnie Keeler is the Director of the Water Resources Center at the University of Minnesota. In this role, she guides the interdisciplinary center, encourages and strengthens the links among University water resources research and extension, and promotes graduate training in water resources science and policy. Dr. Keeler began her faculty career at the University of Minnesota's Humphrey School of Public Affairs, where she shared the Charles M. Denny Endowed Chair in Science, Technology, and Environmental Policy and co-directed the Center for Science, Technology, and Environmental Policy. Prior to joining the Humphrey School in 2018, Keeler was a program director and lead scientist for the Natural Capital Project at the Universities Institute on the Environment.

Keeler is an expert in water resources science and management with a focus on environmental justice, community engaged scholarship, and the evaluation of water quality programs and policies. She has served on numerous state and federal advisory boards and has led dozens of external grants including large interdisciplinary networks comprised of national and international academics, scholars, and practitioners. Keeler is an experienced project manager with demonstrated success leading teams of researchers, community members, agency experts, and water resource professionals. Keeler has led previous LCCMR-funded proposals and currently serves as the lead investigator on an University of Minnesota-funded research project with Tribal partners investigating the environmental and policy implications of contaminants in Tribal waters and subsistence foods.

Organization: U of MN - Water Resources Center

Organization Description:

The Water Resources Center (WRC) is an interdisciplinary unit of the University of Minnesota’s College of Food, Agricultural and Natural Resource Sciences and University of Minnesota Extension. As one of 54 National Institutes for

Water Resources, the WRC serves as Minnesota’s trusted water hub, bridging research and practice to advance water science and policy. The Water Resources Center ensures Minnesota’s water decisions are grounded in rigorous, locally relevant research—delivered through trusted relationships and informed by practitioner needs. WRC researchers and educators work toward a Minnesota where every water decision—from farm fields to state policy—is made in the interest of all who depend on Minnesota water. A national leader in water research, education, and extension, the WRC’s investments in networks of researchers and practitioners has led to demonstrable impacts in evidence-based management of critical water infrastructure, urban stormwater, drinking water, aquatic ecosystems, and agricultural landscapes.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Project Lead		Administer and oversee project funds, including supervising the project manager social scientist, and extension educator. Ensure the project meets deadlines and reporting requirements. Coordinate communication between project partners, participate in the development and dissemination of knowledge products, and provide policy analysis expertise.			36.6%	0.02		\$5,655
Project manager		Project management, reporting, lab contracting, purchasing, administration and budgeting, supervision of data analyst, oversight of dissemination.			36.6%	0.8		\$105,107
Extension educator		Develop curriculum and other communication tools to support risk assessment and education related to contamination in water and fish on Tribal lands. Liaison with agencies and Tribal Resource Managers to ensure programming is culturally appropriate and respectful of traditional lifeways.			36.6%	0.25		\$26,448
Social scientist		Lead program evaluation of existing Keep it Clean campaigns. Conduct interviews and focus groups with key stakeholders. Draft program evaluation memos and consult on the development of public communication tools.			36.6%	0.25		\$34,815
Data analyst		Clean and process data from fish and water contaminant sampling. Develop visuals to communicate and disseminate findings. Conduct statistical tests for source attribution. Assist in the development of reports, presentations, and public communication products.			36.6%	0.25		\$35,123
							Sub Total	\$207,148
Contracts and Services								
Bemidji State University	Subaward	A graduate research assistant (2 years, 50% FTE per year, total of \$69,000) will assist with water and fish sampling and conduct fish analysis and detergent				1		\$77,342

		analysis (cost of for detergent analysis materials and supplies = \$1,545, cost of tissue dissection = \$1,854, and plates and assays = \$4,943).						
Red Lake Department of Natural Resources	Subaward	Tribal Resource Manager Orgon (salary + 40% fringe for two years at .25FTE = \$78,866) will provide project management support, assist with supervision of graduate student, design and oversee water and fish sampling and analysis, and assist with data synthesis, and dissemination.				0.5		\$78,866
SGS AXYS or other laboratory	Service Contract	Analysis of tissues and POCIS/water. Costs based on EPA-approved methods for PPCP (Tissue) at \$2,720/sample, PPCP (POCIS) at \$2,767/sample, PFAS (Tissue/POCIS) at \$470/sample, Hormones (Tissue/POCIS) at \$938/sample, and Surfactant (POCIS) at \$780/sample for 15 tissue samples and 11 POCIS/water.				0		\$116,421
							Sub Total	\$272,629
Equipment, Tools, and Supplies								
	Tools and Supplies	Sampling equipment consumables and rental fees	Water samples will be collected using canisters and holders that contain sampling membranes (POCIS disks). Assumes 8 canisters needed at ice out and 14 canisters for late summer sampling for a rental period of 2 months each. Estimated per month rental fee is \$142 x 44 units = \$6,254. Each canister contains multiple POCIS discs which cost \$72 each. 50 discs are needed = \$72 x 50 = \$3,605.					\$9,859
	Tools and Supplies	Shipping of samples and rental of sampling equipment	Estimated cost of shipping fish and water samples for lab analysis plus shipping costs to return rented sampling equipment. Based on quoted fees from current contracts with environmental testing labs and rental fees for canisters and holders.					\$414
							Sub Total	\$10,273

Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Cost of two overnight trips with two project staff to visit with Tribal partners and present findings. Assuming RT mileage from St. Paul to Red Lake and Fond du Lac at \$0.67/mile, plus overnight lodging, and per diem for three days.	Presentation of research and policy recommendations (Activities 3 & 4)					\$1,950
							Sub Total	\$1,950
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$492,000

Classified Staff or Generally Ineligible Expenses

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

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

Total Project Cost: \$492,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [69922b95-fc8.pdf](#)

Alternate Text for Visual Component

Map shows northern Minnesota with outlines around Red Lake Nation and the Fond du Lac Band of Lake Superior Chippewa territories. Pins are on Upper and Lower Red Lakes, Prairie Lake, and Big Lake as the sampling sites for this project....

Supplemental Attachments

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

Title	File
UMN Letter of Support	3c098564-7a6.pdf
Bemidji State Letter of Commitment	9a43b476-5de.pdf
Red Lake Nation Letter of Commitment	21496fae-0c3.pdf
List of contaminants to be analyzed	40a12833-538.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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 UMN Policy on travel 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?

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:

Jodi Rahn and Erin Niehoff, University 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