Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-277

Proposal Title: Protecting Minnesota's Waters from Climate-Driven Antibiotic Resistance

Project Manager Information

Name: Byeonghwa Jeon

Organization: U of MN - School of Public Health

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Project Basic Information

Project Summary: Build Minnesota's comprehensive genomic monitoring network for antibiotic resistance in lakes, rivers, and stormwater; create a climate-driven early-warning map for watersheds; and engage over 2,000 Minnesotans through community science.

ENRTF Funds Requested: $1,621,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Water (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.

Antibiotic resistance is an emerging contaminant in Minnesota's surface waters, yet it remains absent from state monitoring. Resistant bacteria and resistance genes have been detected in lakes, rivers, and stormwater statewide. The state's more than 11,000 lakes and thousands of stream miles sustain aquatic ecosystems and the swimming, fishing, and boating that connect Minnesotans to their waters. These waters receive continuous inputs from urban runoff, agricultural drainage, and wastewater, all documented resistance sources. Currently, the state has no way to assess whether resistance impairs water quality.

Earlier research showed resistance levels are higher near cities and discharge points. The next step is resistome profiling (cataloging all resistance genes in a sample) paired with microbiome analysis (identifying which microorganisms are present) to reveal where resistance is concentrated, what sources drive it, and how conditions change.

Climate change intensifies this threat. Minnesota's annual precipitation has increased 3.5 inches since 1895, and extreme rain events have more than doubled since 2000. Heavier rainfall flushes contaminants into lakes and rivers, while warmer water accelerates resistance transfer among bacteria. Without an antibiotic resistance baseline, the state cannot detect whether resistance is rising, identify vulnerable watersheds, or evaluate whether current practices protect water quality.

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.

Our team will build three components addressing RFP Water priorities B.1, B.3, B.6, and B.7 that give Minnesota the ability to detect and respond to antibiotic resistance in its waters.

First, we will establish the state's comprehensive multi-year antibiotic resistance monitoring network, sampling 25-35 sites across lakes, rivers, and stormwater outfalls over three years. Across water types, seasons, and regions, we will use resistome and microbiome profiling (resistance gene and microbial community analysis) to create a statewide baseline revealing where resistance is concentrated, whether host-associated microbial markers suggest predominant influence from human or agricultural contamination, and how conditions change over time. Archived resistant bacteria will be preserved in a strain bank at UMN.

Second, we will combine resistance data with climate and weather records to build a risk model and interactive online map on Minnesota Geospatial Commons. This tool will show state agencies which watersheds are most vulnerable and how extreme weather events drive resistance into waterways, supporting proactive management decisions.

Third, we will bring this science directly to Minnesotans through community education programs. Using portable sequencing at lakeshores, the State Fair, and classrooms, we will make this invisible contaminant visible and foster long-term water stewardship.

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 protects Minnesota's waters by creating a resistance monitoring database, a resistant-bacteria strain bank, and standardized protocols adoptable by MPCA, enabling early detection of hotspots before they threaten water quality. It conserves aquatic ecosystems through a climate-driven risk map that helps agencies direct resources to the most vulnerable watersheds. It enhances Minnesotans' connection to their waters by making an invisible contaminant visible to over 2,000 residents through community science events, K-12 education modules, and a public dashboard showing resistance conditions in local waters. Together, these outputs help ensure Minnesota's waters are not substantially impaired by this emerging contaminant.

Activities and Milestones

Activity 1: Build Minnesota's comprehensive statewide antibiotic resistance monitoring network for lakes, rivers, and stormwater

Activity Budget: $1,139,094

Activity Description:
This activity establishes the sampling infrastructure, analytical pipelines, and data systems needed to produce Minnesota's comprehensive multi-year antibiotic resistance baseline across surface waters.

We will sample 25-35 sites spanning lakes (urban-to-pristine gradients across ecoregions), rivers (gradient transects on the Mississippi, Minnesota, Blue Earth, and St. Louis Rivers with upstream/downstream pairing around wastewater discharge points), and stormwater outfalls (event-based sampling during rainfall in metro and agricultural catchments). Six sampling rounds over three years will capture seasonal and interannual variation.

At each site, filtered water and sediment will be collected with physicochemical metadata. Shotgun metagenomic sequencing (sequencing all DNA in a sample) at the University of Minnesota Genomics Center (UMGC) will characterize the resistome (full set of resistance genes) and microbiome (microbial community); pairing both helps assess potential contamination sources through host-associated microbial markers. Oxford Nanopore long-read sequencing will determine whether resistance genes reside on mobile elements capable of spreading between organisms. Culture-based isolation will target key resistant bacteria for archiving.

Outputs include an open-access resistance dataset, a resistant-bacteria strain bank at the University of Minnesota (UMN), and a monitoring protocol for MPCA and other state agencies. These outputs address RFP priority B.7 by establishing long-term water monitoring capacity.

Activity Milestones:

Description	Approximate Completion Date
Establish sampling sites, finalize protocols with Advisory Committee, and complete equipment procurement	December 31, 2027
Complete Year 1 sampling (two rounds, 25 - 35 sites); begin DNA extraction and sequencing	June 30, 2028
Complete Year 2 sampling; process Year 1 sequences; establish resistant-bacteria strain bank	June 30, 2029
Complete Year 3 sampling; finalize multi-year resistance dataset and open-access monitoring bank	December 31, 2029
Deliver standardized monitoring protocol to MPCA and other interested state agencies	June 30, 2030

Activity 2: Create a climate-driven spatial risk model and early-warning map for Minnesota's watersheds

Activity Budget: $149,885

Activity Description:
Extreme precipitation flushes resistant bacteria into waterways, while rising temperatures accelerate resistance transfer. Existing models omit these weather-driven factors. This activity integrates resistance data from Activity 1 with climate, land use, and wastewater variables to identify vulnerable watersheds.

Co-PI Berman will construct a multivariate spatial model layering climate data from the Minnesota State Climatology Office and NOAA with resistance gene and microbial community data from Activity 1. Integrating both datasets helps distinguish pollution-driven resistance hotspots from natural background, as elevated resistance co-occurring with

contamination-associated microbial signatures suggests anthropogenic influence. He will lead statistical modeling to identify the best risk model and watershed vulnerability characteristics, bridging environmental and spatial teams. Collaborator Adam (U-Spatial) will conduct spatial work, including web map development. Collaborator Noe (U-Spatial) will provide quality assurance. Collaborator Klucas (MnTAP) will contribute water quality GIS expertise to validation.

Outputs include an interactive GIS risk map on Minnesota Geospatial Commons displaying sampling sites, resistance profiles, and watershed vulnerability, plus climate-scenario policy briefs for MPCA and other state agencies. These address RFP priority B.1 by developing solutions for understanding contaminant impacts on water quality and B.3 by increasing understanding of climate impacts on water resources.

Activity Milestones:

Description	Approximate Completion Date
Compile and integrate baseline climate, land use, wastewater, and demographic GIS layers	June 30, 2028
Build a preliminary spatial model using Year 1 resistance data and historical climate records	December 31, 2028
Refine model with Year 2 data; quantify runoff-resistance pulse relationship from stormwater events	December 31, 2029
Publish an interactive GIS risk map on Minnesota Geospatial Commons	March 31, 2030
Deliver climate-scenario policy briefs and an early-warning framework to MPCA and other interested state agencies	June 30, 2030

Activity 3: Make the invisible visible: engaging Minnesotans in water resistance monitoring through community science and education

Activity Budget: $332,021

Activity Description:
Antibiotic resistance in recreational waters is invisible: unlike algal blooms, resistant bacteria cannot be seen, smelled, or tasted. This activity builds a community science and education program that makes resistance tangible to Minnesotans and fosters water stewardship.

The program has three components. First, a public-facing GIS dashboard will display Minnesota sampling sites, resistance profiles, and temporal trends. Second, community science sampling events at recreational lakeshores and boat landings will allow attendees to observe water collection, filtration, and portable DNA sequencing in real time. Third, educational workshops and demonstrations will be delivered at high-impact venues, including the Minnesota State Fair, water quality events, and schools. Curriculum-aligned K-12 field modules will be developed with the University of Minnesota Water Resources Center and Minnesota Sea Grant and offered to metro and rural districts. Events will be co-hosted with local lake improvement districts and soil and water conservation districts.

Outputs include a live public GIS dashboard, portable sequencing demonstration protocols, K-12 classroom modules, and pre-/post-survey data measuring changes in knowledge and stewardship intentions. We will engage over 2,000 Minnesotans. These outputs address RFP priority B.6 by providing educational opportunities on protecting water resources.

Activity Milestones:

Description	Approximate Completion Date
Develop portable sequencing demonstration protocols and educational materials	December 31, 2027
Develop K-12 classroom field modules in partnership with Water Resources Center	June 30, 2028
Year 1 demonstrations: at least 4 public events and 2 classroom modules piloted	June 30, 2028

Year 2 demonstrations: at least 6 public events; partnerships with 4+ lake associations/SWCDs established	June 30, 2029
Reach 2,000+ Minnesotans; launch public GIS dashboard; publish educational materials and survey analysis	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Byeonghwa Jeon	University of Minnesota	PI: Project manager overseeing all activities, timelines, and budget. Leads resistome and microbiome analysis (genomic profiling of antibiotic resistance genes and microbial communities) using shotgun metagenomics to characterize resistance and microbial community composition in Minnesota's surface waters. Oversees isolation and archiving of resistant bacteria in the resistant-bacteria strain bank.	Yes
Jesse Berman	University of Minnesota	Co-PI: Bridges the environmental and spatial research teams for Activity 2. Leads statistical modeling to identify the best spatial risk model and watershed vulnerability characteristics. Integrates climate and weather data with resistance monitoring results to identify Minnesota's most vulnerable watersheds.	Yes
Yoshika Crider	University of Minnesota	Co-PI: Directs field water sample collection protocols across lakes, rivers, and stormwater sites statewide. Leads the community science and education program, including public engagement events, K-12 classroom modules, and partnerships with lake associations and soil and water conservation districts across Minnesota.	Yes
Jonathan Oliver	University of Minnesota	Co-I: Oversees Oxford Nanopore long-read sequencing to determine whether resistance genes reside on mobile genetic elements capable of transferring between organisms. Leads portable DNA sequencing demonstrations at community science events, making resistance in Minnesota's waters visible in real time.	Yes
Ryan Noe	U-Spatial, UMN	Collaborator: Provides spatial expertise and quality assurance oversight for Adam's spatial outputs. Works with the environmental research team to guide spatially optimal site selection for environmental sampling.	Yes
Shaam Adam	U-Spatial, UMN	Collaborator: Conducts the hands-on spatial work for Activity 2, including interactive web map development, spatial data gathering and cleaning, and preparation of communications materials for presenting project results.	Yes
Kelsey Klucas	MnTAP, UMN	Collaborator: Contributes water quality GIS expertise to Activity 2, supporting spatial data integration and risk map validation based on experience with water pollution geospatial analysis in Minnesota.	No
Mark Ferry	Minnesota Pollution Control Agency	Advisor: Guides alignment of project outputs with state water quality monitoring frameworks and pollution control priorities. Ensures monitoring protocols and the GIS risk map support future integration into MPCA programs and state operations.	No
Bonnie Keeler	Water Resources Center, UMN	Consultant: Advises on the outreach and education aspects of the proposed project, providing connections to practitioner networks as appropriate.	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.
This project is designed so that every major output reaches the audiences who can use it to protect Minnesota's waters, and so that data, collections, and tools persist beyond the funding period. All dissemination materials will acknowledge the Environment and Natural Resources Trust Fund using the required logo and attribution language per the ENRTF Acknowledgment Guidelines.

Data and Results Sharing. The multi-year resistance monitoring dataset will be released as an open-access resource, making resistance gene profiles, microbial community data, and site metadata freely available to researchers, state agencies, and the public. Peer-reviewed publications (4 articles budgeted across all three activities) will be published in open-access journals so that findings are available without subscription barriers. Resistance data and sampling metadata

will also be deposited in established public repositories (e.g., NCBI Sequence Read Archive) following federal data sharing standards.

Engagement with Entities That Can Use the Results. MPCA serves on the project Advisory Committee and will be consulted throughout protocol development, ensuring that the standardized monitoring protocol, GIS risk map, and climate-scenario policy briefs are directly usable within existing state water quality programs. We will present results to MPCA staff and other interested state agencies and share the early-warning framework so it can inform watershed prioritization and management decisions.

Longevity of Collections and Products. The resistant-bacteria strain bank will be maintained at the University of Minnesota through laboratory operating funds and will remain available to researchers for ongoing and future studies. The interactive GIS risk map and public dashboard will be hosted on Minnesota Geospatial Commons, a state-maintained platform that requires no additional cost to sustain and can be updated as new data are generated. K-12 educational modules and portable sequencing demonstration protocols will be posted online as freely downloadable resources.

Promoting Behavioral Change. The community science and education program is specifically designed to make antibiotic resistance in water visible to Minnesotans and foster long-term water stewardship. Portable DNA sequencing demonstrations at lakeshores, boat landings, the Minnesota State Fair, and classrooms will show participants resistance in their local waters in real time. Pre- and post-event surveys will measure changes in knowledge and stewardship intentions, allowing us to evaluate and improve the program over three years. Partnerships with lake improvement districts and soil and water conservation districts will extend outreach to communities across the state.

Accessible Communication. The public-facing GIS dashboard will display sampling sites, resistance profiles, and temporal trends in a format accessible to non-specialists. Co-PI Berman will serve as the primary communication lead, and Collaborator Adam (U-Spatial) will prepare communications materials to present project results in clear, visual formats for both technical and general audiences.

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 standardized monitoring protocol will be developed in consultation with MPCA through the project Advisory Committee, with the goal of integration into existing state water quality programs. The resistant-bacteria strain bank will be maintained at the UMN through laboratory operating funds. The GIS risk map and dashboard, hosted on Minnesota Geospatial Commons, require no additional cost to maintain and can be updated as new data are generated. Educational materials will remain freely available online. Expanded monitoring and source-tracking studies will be pursued through future ENRTF proposals and federal grants, building on the baseline and infrastructure this project establishes.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Wastewater Chloride Reduction through Industrial Source Reduction Assistance	M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 04r	$247,000

Project Manager and Organization Qualifications

Project Manager Name: Byeonghwa Jeon

Job Title: Associate Professor

Provide description of the project manager's qualifications to manage the proposed project.
This project addresses the growing threat of antibiotic resistance in Minnesota's water systems, protecting millions of residents who depend on these resources. As climate change intensifies extreme weather, understanding how environmental shifts accelerate antibiotic resistance spread is critical. Our team will establish the state's comprehensive genomic monitoring network for antibiotic resistance in surface waters and a climate-informed early-warning system for state agencies.

This work requires a multidisciplinary team. Co-PI Jesse Berman, an environmental epidemiologist at UMN, will bridge the environmental and spatial research teams, lead the statistical modeling for the spatial risk model, and serve as the primary lead for disseminating results. Co-PI Yoshika Crider, an environmental health scientist in water safety and community engagement, will lead the community education program. Co-I Jonathan Oliver contributes genomics and nanopore sequencing expertise essential for tracking resistance gene mobility. Collaborator Shaam Adam (U-Spatial, UMN) will conduct hands-on spatial work, including interactive web map development, spatial data gathering and cleaning, and communications materials. Collaborator Ryan Noe (U-Spatial) will oversee and quality-assure spatial outputs and guide spatially optimal sampling locations. Collaborator Kelsey Klucas (MnTAP, UMN) contributes water quality GIS expertise to the risk model. The Minnesota Pollution Control Agency (MPCA) has committed to an advisory role, ensuring outputs align with state water quality frameworks.

Project Manager and PI Byeonghwa Jeon, Associate Professor of Environmental Health Sciences at UMN, will oversee all project activities. His laboratory specializes in antibiotic resistance and maintains the infrastructure for building the antibiotic resistant-bacteria archive. A recent publication in Nature Communications (2025) from his group demonstrated how resistance-carrying genetic elements simultaneously increase bacterial harm and drug resistance, directly informing this project's approach to tracking resistance spread in Minnesota's waters. With over 15 years of experience in antibiotic resistance and microbial genomics, Dr. Jeon provides the core scientific expertise for this initiative.

Organization: U of MN - School of Public Health

Organization Description:
The Division of Environmental Health Sciences (EnHS) within the University of Minnesota (UMN) School of Public Health conducts collaborative research to identify environmental risks, reduce hazards, and inform policies that protect Minnesota's environment and communities. EnHS is uniquely suited to lead this project because its faculty hold the specific expertise the work demands. The division houses researchers in antibiotic resistance and microbial genomics, climate and extreme weather impacts on environmental systems, and water safety and community engagement, all areas directly central to this proposal. The PI and all Co-PIs are EnHS faculty, enabling seamless coordination across the project's three integrated activities. Division laboratories support microbial culture, archiving, and GIS-based spatial analysis, while the UMN Genomics Center provides metagenomic (whole-community DNA) sequencing capacity, ensuring readiness from day one. EnHS faculty have established working relationships with Minnesota state agencies, including the MPCA, and with the UMN Water Resources Center and Minnesota Sea Grant, partners essential for statewide water outreach. The division's track record of federally funded, interdisciplinary environmental research, combined with its focus on translating findings into actionable tools for decision-makers, makes it the natural home for a project designed to deliver comprehensive monitoring infrastructure for protecting Minnesota's waters.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Byeonghwa Jeon		PI			36.6%	0.6		$143,402
Jesse Berman		Co-PI			36.6%	0.39		$87,651
Yoshika Crider		Co-PI			36.6%	0.3		$55,991
Jon Oliver		Co-I			36.6%	0.3		$64,915
Ryan Noe		Collaborator			36.6%	0.15		$20,544
Shaam Adam		Collaborator			32.3%	2.19		$36,190
Postdoctoral Associate		Lead day-to-day resistome and microbiome bioinformatic analysis, manage the Illumina metagenomic sequencing pipeline, curate the resistance gene database and resistant-bacteria strain bank under PI Jeon			26.1%	3		$252,268
Postdoctoral Associate		Coordinate field sampling logistics, conduct Nanopore long-read sequencing and mobile element analysis, and support community science program delivery under Co-I Oliver and Co-PI Crider			26.1%	3		$252,268
Graduate Research Assistant (PhD student)		Assist with field water sample collection, culture-based isolation of resistant bacteria, and community science event logistics. Amount includes stipend, 24.2% fringe, and tuition remission (390 hrs/yr).			24.2%	0.75		$93,945
Graduate Research Assistant (PhD)		Assist with Nanopore long-read sequencing, mobile genetic element analysis, and portable sequencing demonstrations. Amount includes stipend, 24.2% fringe, and tuition remission (390 hrs/yr).			24.2%	0.75		$93,945
							Sub Total	**$1,101,119**
Contracts and Services								
							Sub Total	**-**

Equipment, Tools, and Supplies								
	Tools and Supplies	Illumina shotgun metagenomic sequencing (198 samples/yr, library prep + sequencing)	Characterize the resistome and microbiome at each sampling site to identify resistance genes and microbial community composition					$89,100
	Tools and Supplies	Whole-genome sequencing of resistant isolates (40/yr, Illumina short-read)	Obtain complete genomes of archived resistant bacteria for detailed resistance characterization					$18,000
	Tools and Supplies	Short-read mapping to AMR databases	Identify and quantify antibiotic resistance genes from metagenomic sequence data					$16,518
	Tools and Supplies	Nanopore long-read sequencing (flow cells, barcoding kits, ligation reagents; 40 samples/yr)	Determine whether resistance genes reside on mobile genetic elements capable of transferring between bacteria					$102,585
	Tools and Supplies	High-performance computing (MSI or AWS cloud)	Process and analyze large-scale metagenomic datasets					$15,000
	Tools and Supplies	Isolate, confirm, and archive key resistant bacteria (ESBL-producing, carbapenem-resistant, vancomycin-resistant, methicillin-resistant) from water samples into a resistant-bacteria strain bank	Isolate, confirm, and archive key resistant bacteria (ESBL-producing, carbapenem-resistant, vancomycin-resistant, methicillin-resistant) from water samples into a resistant-bacteria strain bank					$52,693
	Tools and Supplies	DNA extraction & molecular: PowerWater and PowerSoil DNA extraction kits, filtration supplies (0.22 µm), Qubit/NanoDrop quantification reagents, PCR reagents for microbial source tracking markers and resistance gene confirmation.	Extract and prepare DNA from water and sediment samples for metagenomic sequencing; confirm resistance genes and contamination source markers by PCR					$88,842
	Tools and Supplies	Chemicals & general reagents: buffers (PBS, TAE, TBE), solvents (ethanol, DMSO), agarose, glycerol, SDS, NaOH	Support routine molecular and microbiological laboratory procedures including gel electrophoresis, DNA purification, and cryo-preservation					$8,913
	Tools and Supplies	Disposables & consumables: petri dishes, pipette tips (3 sizes), conical tubes (15 and 50 mL), microcentrifuge tubes, 96-well plates, sample bags, syringes, gloves	Provide single-use laboratory supplies for culture work, DNA processing, and field sample collection					$21,253
	Tools and Supplies	Field sampling materials: YSI multi-parameter water quality sonde, MinION portable sequencer starter pack, sample bottles (500 mL and 10 L), coolers, insulated bags, ice packs, shipping with dry ice	Equip field teams to collect water and sediment samples with real-time physicochemical measurements and					$25,027

			transport samples to the laboratory under cold-chain conditions					
	Tools and Supplies	Community outreach & events: sampling demonstration materials ($1,500/event), Minnesota State Fair Driven to Discover tent fees and printed materials	Support public community science events and State Fair demonstrations where attendees observe portable DNA sequencing of local water samples					$13,800
							Sub Total	**$451,731**
Capital Equipment								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Field sampling mileage: 1 person (Co-PI Crider), 15,000 miles/yr × $0.67/mile, 3 years	Drive to 25–35 lake, river, and stormwater sampling sites across Minnesota for water and sediment collection during six seasonal sampling rounds					$30,150
	Miles/ Meals/ Lodging	Field sampling per diem and lodging: 1 person (Co-PI Crider), 30 days/yr × $150/day, 3 years	Overnight stays for multi-day sampling trips to outstate sites beyond single-day driving distance					$13,500
							Sub Total	**$43,650**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Conference travel (PI Jeon): 1 person, $2,500/trip (airfare $600, lodging $774, meals $316, local transport $110, registration $700), Years 2-3	Present project findings at a national scientific conference to disseminate resistance monitoring results	X				$5,000
	Conference Registration Miles/ Meals/ Lodging	Conference travel (Co-PI Berman): 1 person, $2,500/trip, Year 3	Present spatial risk model and climate-resistance findings at a national conference	X				$2,500
	Conference Registration	Conference travel (Co-PI Crider): 1 person, $2,500/trip, Year 3	Present community science program outcomes at a national conference	X				$2,500

	Miles/ Meals/ Lodging							
	Conference Registration Miles/ Meals/ Lodging	Conference travel (Co-I Oliver): 1 person, $2,500/trip, Year 3	Present nanopore sequencing and mobile genetic element findings at a national conference	X				$2,500
							Sub Total	**$12,500**
Printing and Publication								
	Publication	Open-access publication fees for peer-reviewed journal articles (Activity 1: 1 article in Year 2 + 1 in Year 3, reporting resistance monitoring results)	Publish statewide resistance baseline data and monitoring protocols in open-access journals so findings are freely available to state agencies, researchers, and the public					$6,000
	Publication	Open-access publication fee (Activity 2: 1 article in Year 3, reporting spatial risk model and climate-resistance findings)	Publish the climate-driven watershed vulnerability model and policy recommendations in an open-access journal					$3,000
	Publication	Open-access publication fee (Activity 3: 1 article in Year 3, reporting community science program outcomes and educational evaluation)	Publish community engagement results, K-12 module effectiveness, and survey findings in an open-access journal					$3,000
							Sub Total	**$12,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,621,000**

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	Conference travel (PI Jeon): 1 person, $2,500/trip (airfare $600, lodging $774, meals $316, local transport $110, registration $700), Years 2-3	We understand that conference attendance is generally ineligible for reimbursement. However, the RFP (page 10, item i) explicitly permits an exception for conference travel when the purpose is "to participate in formal presentation of project findings." All four conference trips in our budget are specifically for oral or poster presentations of project results at national scientific meetings. No funds are requested for attendance-only conference travel.
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Conference travel (Co-PI Berman): 1 person, $2,500/trip, Year 3	We understand that conference attendance is generally ineligible for reimbursement. However, the RFP (page 10, item i) explicitly permits an exception for conference travel when the purpose is "to participate in formal presentation of project findings." All four conference trips in our budget are specifically for oral or poster presentations of project results at national scientific meetings. No funds are requested for attendance-only conference travel.
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Conference travel (Co-PI Crider): 1 person, $2,500/trip, Year 3	We understand that conference attendance is generally ineligible for reimbursement. However, the RFP (page 10, item i) explicitly permits an exception for conference travel when the purpose is "to participate in formal presentation of project findings." All four conference trips in our budget are specifically for oral or poster presentations of project results at national scientific meetings. No funds are requested for attendance-only conference travel.
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Conference travel (Co-I Oliver): 1 person, $2,500/trip, Year 3	We understand that conference attendance is generally ineligible for reimbursement. However, the RFP (page 10, item i) explicitly permits an exception for conference travel when the purpose is "to participate in formal presentation of project findings." All four conference trips in our budget are specifically for oral or poster presentations of project results at national scientific meetings. No funds are requested for attendance-only conference travel.

Non ENRTF Funds

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

Total Project Cost: $1,621,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 3682db90-c4b.pdf

Alternate Text for Visual Component

One-page visual summarizing three project activities: (1) statewide antibiotic resistance monitoring across 25-35 lake, river, and stormwater sites with genomic profiling and a resistant-bacteria strain bank; (2) climate-driven GIS risk map integrating resistance, climate, and land-use data; (3) community science and K-12 education engaging over two thousand Minnesotans....

Supplemental Attachments

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

Title	File
Authorization Letter	0ce7b346-6f4.pdf
Letter of Support - MnTAP	506cbe70-769.pdf
Letter of Support - Water Resources Center	853e5e51-e0c.pdf
Letter of Support - UM Sea Grant	a8ac18df-4ff.pdf
Letter of Support - UM Genomics Center	86eadcb1-f78.pdf
Letter of Support - Minnesota Pollution Control Agency	dbd23db2-929.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?

Yes, Sponsored Projects Administration

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:

N/A

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

N/A