Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-321

Proposal Title: Protecting Groundwater Through Optimized Municipal Green Infrastructure

Project Manager Information

Name: Eric Watkins

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: We will transform the National Sports Center into a living laboratory for demonstrating how to mitigate the environmental impact of municipal green infrastructure and then develop three toolkits for stakeholders.

ENRTF Funds Requested: $980,000

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

Narrative

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

Minnesota municipalities and schools manage thousands of acres of heavily-used natural turfgrass. Operating with limited budgets, managers apply fertilizer and water based on short-term needs of function and aesthetics without considering potential environmental and health costs such as nitrate leaching into groundwater. Further, fear of natural turfgrass failure, along with stakeholder pressure, drives costly conversions to artificial turf, introducing permanent environmental liabilities such as microplastic shedding, potential PFAS contamination, and negative outcomes associated with plastics disposal. Managers and decision-makers don't know what to do to improve the health and environmental outcomes associated with sports fields. This project addresses this gap. Utilizing the National Sports Center on the highly permeable Anoka Sand Plain as a living laboratory, we will quantify the groundwater protection benefits of reduced inputs (fertilizer/water) and deeper rooted species while assessing surface safety and playability. Finally, we will compare the lifecycle costs of natural versus synthetic surfaces to deliver data-driven toolkits to policy makers, local decision makers, and field managers. These resources will empower municipalities and other entities to optimize these vital pieces of local green infrastructure, preserving living soil systems, protecting state waters, and preventing unnecessary and costly conversions to artificial turf.

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 will transform the National Sports Center (NSC) into a living laboratory to test how to mitigate the environmental impact of municipal green infrastructure, specifically high-traffic recreational spaces. Situated on the vulnerable Anoka Sand Plain, the NSC operates over 35 natural grass and 17 artificial turf fields, making it the ideal whole-field experimental unit. We will implement controlled, low-input turf management regimens (reduced nitrogen, drought-tolerant grasses, optimized irrigation) across active tournament fields to pinpoint the minimum sustainable inputs required to protect groundwater without compromising field function. Environmental impact will be quantified by measuring nitrate leaching (via subsurface lysimeters), volumetric soil moisture, and surface infiltration rates. Concurrently, we will verify field functionality through rigorous playability metrics, including surface hardness (Clegg hammer), rotational shear strength, and turf density. Finally, we will synthesize this agronomic data into a public-facing lifecycle cost-benefit web tool. By contrasting the true economic and environmental costs of optimized natural grass against the compounding liabilities of artificial turf (microplastic pollution, PFAS, end of life disposal), this tool will empower local decision-makers to preserve living soil systems and protect Minnesota's water resources.

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?

Protect Groundwater: Quantifiable reduction of nitrate leaching into vulnerable aquifers and significant decreases in municipal irrigation demands on high-permeability soils.

Preserve Water: Best management practices that sustain natural soil systems under high traffic, preventing conversions to artificial turf that introduce microplastics, heavy metals, and PFAS runoff into local watersheds.

Improve Water Quality: Deliver data-driven toolkits equipping municipalities, school districts, and other stakeholders across Minnesota to manage large acreages of green infrastructure to prioritize clean aquifer recharge and mitigate polluted runoff.

Deliver New Recommendations: Identify best practices for maintaining highly used green spaces including optimized seed mixtures and soil aerification schedules.

Activities and Milestones

Activity 1: Establishing a living laboratory for municipal green infrastructure

Activity Budget: $145,291

Activity Description:
The NSC is a massive amateur sports facility operating 50+ athletic fields. Sitting on the highly permeable Anoka Sand Plain, it provides the environmental vulnerability needed to study groundwater protection. Operating a mix of both natural grass and artificial turf fields under intense tournament traffic, the NSC offers an unparalleled, real-world site at scale to test these practices.

We will delineate 15 distinct whole-field experimental units. To isolate the environmental and functional impacts of specific management decisions, these fields will be divided into five distinct groupings (3 fields each): (1) artificial field control, (2) higher input management to maintain aesthetic (current control), (3) tall fescue overseeding, (4) lower input management (optimized reductions in water and nutrients), (5) aggressive aerification.

We will install 15 environmental sensing nodes (1/field). These continuous sensor nodes will track microclimate and soil moisture data across the test plots. Concurrently, we will install subsurface lysimeters beneath the root zones of the fields to physically capture and measure nitrate leaching into the sand plain.
We will pilot additional, novel sensor capabilities including exploration of real-time compaction sensing by fusing ground sensors with multi-spectral data from the PlanetScope satellite constellation to continuously monitor physical stress on green infrastructure.

Activity Milestones:

Description	Approximate Completion Date
Delineate the 15 whole-field experimental units and finalize treatment structure (which fields receive which interventions).	September 30, 2027
Install 15 UMN GEMS environmental sensor nodes and the subsurface lysimeters across the active fields	May 31, 2028
Collect baseline soil chemical properties, compaction, and existing nitrate leaching data	July 31, 2028
Integrate satellite and ground sensed data.	July 31, 2028

Activity 2: Field research and lifecycle analysis

Activity Budget: $298,795

Activity Description:
Task 1. Implementation of agronomic regimens: We will apply the five specific management regimens including interseeding deep-rooted tall fescue as a component of a grass polyculture with Kentucky bluegrass to reduce irrigation demand, and aggressive aerification to relieve compaction, maximize stormwater infiltration, and prevent nutrient runoff.

Task 2. Environmental data analysis: We will analyze continuous data streaming from the sensors, alongside frequent water samples from the subsurface lysimeters to quantify nitrate leaching. These data will pinpoint the conditions that lead to negative groundwater outcomes. We will concurrently measure surface hardness during active soccer tournaments, as a proxy for field safety.

Task 3. Comparative economic data tracking: We will track all maintenance inputs for the natural grass plots, capturing exact water volume, labor hours, seed, and fertilizer usage. We have already collected preliminary records on

maintenance activities and costs, providing an initial benchmark that will be expanded into a complete, standardized dataset. We will compare these figures against the tracked maintenance costs of the artificial turf fields at the facility. By capturing the often-hidden costs of these synthetic surfaces, including specialized grooming labor, infill replacement, and chemical treatments, we will generate the objective data required for the lifecycle cost calculator.

Activity Milestones:

Description	Approximate Completion Date
Implement treatments on NSC fields.	September 30, 2028
Use sensor and field performance data to model solutions for municipal green spaces.	February 28, 2029
Develop a draft budget comparison tool for user feedback.	February 28, 2030

Activity 3: Statewide geospatial mapping and targeted community engagement

Activity Budget: $499,548

Activity Description:

Task 1: Remote sensing and environmental risk modeling

We will utilize satellite imagery, OpenStreetMaps, and Google Places API combined with other geospatial datasets to create a comprehensive, statewide inventory of municipal sports fields. By cross-referencing this with localized soil permeability and aquifer data, we will build models to identify specific community fields at the highest risk for nitrate leaching and poor water quality outcomes. Field performance models for estimating risk will be ground-truthed using NSC data.

Task 2: Stakeholder needs assessment

To ensure the resources developed in Activity 4 are highly practical, we will conduct semi-structured interviews with representatives from our three target audiences (policy makers, parks directors, grounds managers). Interviews will identify the specific operational and policy related barriers these groups face when trying to adopt sustainable practices, allowing us to tailor the toolkits to their real-world needs. We will also include stakeholders from regions where water quality concerns are at the forefront of public policy (White Bear Lake, Anoka Sand Plain, etc.)

Task 3: Targeted outreach:

We will prioritize in-person outreach and workshops specifically in those communities identified as having the highest concentration of high-risk fields, ensuring efforts are directed toward protecting the most vulnerable local water resources.

Activity Milestones:

Description	Approximate Completion Date
Data scientist/GIS specialist creates statewide municipal sports fields inventory.	July 31, 2028
Identify and invite interview participants	September 30, 2028
Hold in-person field day at NSC	July 31, 2029
Outreach and Extension efforts will be delivered in locations identified by modeling work.	December 31, 2029

Activity 4: Decision support toolkits for preserving public green assets

Activity Budget: $36,366

Activity Description:
We will translate agronomic and environmental data into actionable, audience-specific resources.

Toolkit 1. Asset preservation guide (for policy makers): Designed for city councils, park boards, and school boards, this resource details the environmental and economic return on investment of natural grass approaches (multi-species, monoculture, high input, low input) versus the capital costs and environmental liabilities (e.g., microplastics, PFAS) of artificial turf. It outlines groundwater protection metrics across the management scenarios tested in Activity 2. This guide will be printed and mailed directly to every public school district in Minnesota, and include quick response codes to link decision makers to ongoing university expertise.

Toolkit 2. Resource allocation matrix (for decision makers): Targeting parks directors and facility managers, this resource will provide protocols for allocating limited maintenance funds and communication templates to educate the public on sustainable aesthetics. The cornerstone of this toolkit is an online lifecycle cost calculator, a web-based tool for directors to objectively evaluate the long-term financial and environmental costs of various natural and synthetic field investments.

Toolkit 3. BMP manual (for grounds managers). This manual will equip turf and grounds managers with data-driven, low-budget strategies to maintain heavy-use fields and public green spaces while protecting water resources.

Activity Milestones:

Description	Approximate Completion Date
Outline toolkit content and approach based on research results and needs assessment	July 31, 2029
Draft versions of all toolkits for review by key stakeholders	December 31, 2029
Final publication and distribution of all 3 toolkits	March 31, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Bryan Runck	University of Minnesota	Bryan Runck, Geocomputing Scientist with the GEMS Agroinformatics Initiative, is trained broadly in the field of geocomputing, artificial intelligence, and machine learning, with specific emphasis on applications in agriculture. He understands both the computational and agricultural aspects of this project and will lead environmental sensing work in Activity 1&3.	Yes
Chengyan Yue	University of Minnesota	Yue holds the Todd and Barbara Bachman Endowed Chair in Horticultural Marketing, Professor at the Department of Horticultural Science and Department of Applied Economics at the University of Minnesota. She will lead the natural vs artificial budget tool work described in Activity 3.	Yes
Jon Trappe	University of Minnesota	Jon Trappe is the statewide UMN Extension Educator for turfgrass. In this role he communicates sustainable turfgrass and green space management information to professionals and the general public. He sits on the MN Parks and Sports Field Managers Association board. Dr. Trappe will help coordinate outreach in Activity 3.	Yes
Michael Barnes	University of Mineesota	Dr. Barnes is an assistant research professor in the Department of Horticultural Science where he specializes in utilizing interdisciplinary approaches to understand complex socio-ecological-technological systems and works at the intersection of social science, sustainability, and health. He will lead focus groups and assist in toolkit development in Activity 3.	Yes
Dominic Petrella	University of Minnesota	Dr. Petrella is an assistant professor studying managed turfgrass systems in the Department of Horticultural Science. His work focuses on the physiology of perennial grasses and how to manage turfgrass surfaces with minimal inputs while still providing functional surfaces that protect natural resources.	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.
All three project toolkits will be permanently hosted for public use on the university turfgrass science website (turf.umn.edu) in a fully accessible format that meets current federal accessibility guidelines. The lifecycle cost calculator will also be maintained on this platform (similar to z.umn.edu/roadsidecosttool). Additionally, demonstration of these toolkits and findings from this project will be presented at professional conferences for relevant stakeholder groups, including Minnesota Association of School Managers and Superintendents, Minnesota Recreation and Park Association, and the Minnesota Park and Sports Field Management Association. Finally, we will publish at least three new educational web resources through UMN Extension to translate these findings into practical groundwater protection guidance for Minnesota residents. All products, along with other outreach and education materials and presentations will acknowledge ENRTF funding and follow published guidelines.

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?
Results will be communicated to stakeholders through outreach efforts described in dissemination plan. Results will form the basis of future research on community sports fields and municipal green spaces conducted at UMN through other funding sources (state and federal grants, professional green industry groups, etc.). All research will be submitted for publication in peer reviewed journals and published for open access so that all Minnesotans can access. Funding for publication will come from internal program funds used for this purpose.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Phytoremediation for Extracting Deicing Salt	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 08g	$451,000
Promoting Pollinators on Corporate Campuses	M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 08n	$547,000

Project Manager and Organization Qualifications

Project Manager Name: Eric Watkins

Job Title: Professor

Provide description of the project manager's qualifications to manage the proposed project.
Eric Watkins leads the turfgrass science program where his research interests are focused on the development and utilization of low-input turfgrasses for cold climates. His group conducts wide-ranging research that includes plant adaptation to shade, plant-microbe interactions, germplasm improvement, plant genomics, lawn water conservation education, and species recommendations for Minnesota roadsides. He has worked with the Met Council for several years on strategies to reduce lawn water use in the Twin Cities Metropolitan Area, with strategies ranging from irrigation controller technologies to low-water-use turfgrass species. He has led multiple successful multidisciplinary grant proposals, and is active in outreach to Minnesota stakeholders through blog posts, professional trade magazine articles, in-person seminars, and site visits.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:
As part of the state's land-grant university, CFANS possesses the advanced analytical laboratories and administrative capacity required to execute rigorous environmental monitoring. The turfgrass science program and UMN Extension have an established, statewide network for disseminating research to decision makers and managers, ensuring the final products reach the decision makers who dictate local water and land use policies.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
PI Faculty salary (Watkins)		Lead project			36.6%	0.06		$15,113
CoPI salary (Petrella)		Lead research on turfgrass best management practices			36.6%	0.12		$21,394
CoPI salary (Barnes)		Social science/stakeholder outreach needs lead			36.6%	0.3		$40,908
CoPI salary (Yue)		Budget tool development lead			36.6%	0.09		$25,224
CoPI salary (Trappe)		Extension/outreach to stakeholders lead			36.6%	0.3		$36,517
CoPI salary (Runck)		Data science/sensing lead			36.6%	0.15		$30,188
Data Scientist		Lead mapping of community sports fields and modeling to determine best practices			36.6%	2.25		$270,498
Postdoctoral Associate		Budget tool development			26.1%	1.5		$125,342
Researcher		Sensor deployment and fleet management			32.3%	0.3		$31,499
Researcher / Sensor development		Sensor innovation and development for testing turfgrass fields			32.3%	0.3		$33,238
Researcher 2		Field research at NSC sports fields			32.3%	1.8		$147,941
Research Professional 3		Assist with focus groups and analyze/report results for optimizing stakeholder outreach			32.3%	2.25		$59,535
							Sub Total	**$837,397**
Contracts and Services								
UMN USpatial	Internal services or fees (uncommon)	USpatial will be used to develop a public facing, easy to use web app for decision makers to compare costs of municipal green space type (natural vs artificial) choices.				0.5		$30,000
							Sub Total	**$30,000**

Equipment, Tools, and Supplies								
	Tools and Supplies	supplies for mailing brochures to approximately 350 school districts	postage, envelopes and related items					$500
	Tools and Supplies	Supplies for 15 lysimeters to be installed at National Sports Center for installation in year 1.	Needed to quantify water quality differences between treatments					$11,500
	Tools and Supplies	$1000/yr for seed, fertilizer, plant growth regulators, etc.	Needed for executing research plan at National Sports Center					$3,000
	Equipment	15 environmental sensing nodes at $4,000	Monitor environmental conditions for modeling and understanding differences in treatments					$60,000
							Sub Total	**$75,000**
Capital Equipment								
		Clegg Impact Hammer	Research equipment needed for testing field safety (surface hardness)	X				$9,000
							Sub Total	**$9,000**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel to and from National Sports Center (Blaine) from St. Paul campus. .725/mile. 50 trips per year, 28 miles/trip	Researchers need to be on site in Blaine for research to occur. Outreach events also at Blaine.					$3,045
							Sub Total	**$3,045**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	Document printing (approximately 350 items printed)	Publication costs for toolkits that will be mailed to all MN school districts (Activity 4)					$3,683

							Sub Total	**$3,683**
Other Expenses								
		Annual operating cost for sensor nodes (15) at $175/yr for three years	Cellular data connection for upload of data					$7,875
		lab analysis of lysimeter samples (5500 per year in years 2 and 3)	Analysis needed to quantify water quality effects of treatments					$11,000
		participant incentives ($100 x 30 participants).	focus groups for optimizing utility of toolkits					$3,000
							Sub Total	**$21,875**
							Grand Total	**$980,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Equipment		Clegg Impact Hammer	This is a critical piece of equipment to measure safety of urban green infrastructure. **Additional Explanation :** Safety testing of community sports fields and similar surfaces will continue to be ongoing effort in the UMN turfgrass program.

Non ENRTF Funds

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

Total Project Cost: $980,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: b8683b80-fd2.pdf

Alternate Text for Visual Component

One-page diagram titled “Protecting Groundwater Through Optimized Municipal Green Infrastructure,” showing 2027–2030 activities: establishing a living laboratory to compare natural and artificial turf, identifying hidden costs of artificial turf, and creating toolkits to share knowledge with target audiences....

Supplemental Attachments

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

Title	File
UMN letter of endorsement	6e7c9449-044.pdf
Letter of Support form Paul Griffin City of Woodbury	d90adb56-967.pdf
Letter of Support from National Sports Center	6f0d17ea-de0.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:

Dominic Petrella, Michael Barnes, Jon Trappe, Chengyan Yue, Bryan Runck (all from 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

N/A