Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

General Information

ID Number: 2025-257

Staff Lead: Lisa Bigaouette

Date this document submitted to LCCMR: June 17, 2025

Project Title: Facilitated Transport Hybrid Membranes for CO2 Separation

Project Budget: $1,050,000

Project Manager Information

Name: Jun Li

Organization: U of MN - College of Science and Engineering

Office Telephone: (612) 626-0153

Email: junli1@umn.edu

Web Address: https://cse.umn.edu/

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. 07d

Appropriation Language: $1,050,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to develop and test advanced polymeric membranes for capture and reuse of carbon dioxide at industrial sources.

Appropriation End Date: June 30, 2028

Narrative

Project Summary: To capture CO_2, we will develop advanced polymeric membranes infused with metal-organic framework nanoparticles. These membranes facilitate the passage and collection of CO_2 while blocking the permeation of other gases.

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

CO_2 emissions have a huge impact on the global carbon cycle. It is well-documented that CO_2 is a greenhouse gas and one of the main contributors to global warming. Also, the accumulation of CO_2 in the atmosphere results in a reduction in the pH of the upper ocean. Reducing CO_2 emissions remains a major challenge to mankind. A solution that sequesters atmospheric CO_2 will bring enormous environmental benefits. Various CO_2 capture technologies include absorption, adsorption, membrane, biological capture, and cryogenic capture. Compared to other separation methods, membrane separation is generally more energy efficient and environmentally benign, thus has been intensively studied for CO_2 capture.

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 design and develop highly permeable and highly selective membranes, termed facilitated transport hybrid membranes (FTHMs), by integrating functionalized metal-organic framework (MOF) particles into a polymer matrix. These tailored membranes aim to facilitate the transport of CO_2 molecules while effectively blocking other gases typically found in emission sources. FTHM would enable the capture and collection of CO_2 for subsequent utilization.

By harnessing the unique properties of functionalized MOFs, our membranes are expected to outperform conventional polymeric and hybrid membranes (HMs), which rely on inorganic nanoparticles. This superiority stems from (i) the chemical affinity and compatibility of MOFs with the polymer, and (ii) the incorporation of specific functional groups onto the MOFs to enable reversible reactions with CO_2, thereby boosting the efficiency of CO_2 transport across the membrane.

Our specific objectives are:

1. Develop MOFs for optimal facilitated transport and incorporation into FTHM.
2. Design a robust fabrication method that can uniformly distribute the MOF particles within the polymer matrix.
3. Deliver an FTHM and compare its CO_2 permeability and selectivity with that of state-of-the-art HMs for CO_2 capture.
4. Deliver a membrane module for CO_2 separation and compare its performance with that of state-of-the-art membrane contactors.

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?

The proposed membranes help reduce CO_2 emission in Minnesota, specifically to localized emission sources in industrial facilities that continue to use oil and natural gas to heat and operate. Emissions from these sources have risen 14% between 2005 and 2020. As key outcomes, we will demonstrate both FTHMs and prototype membrane modules and evaluate their performance with respect to the state-of-the-art performance. Milestones include synthesis, testing, modeling, and validation of these technologies. We will also submit all required LCCMR project reports and disseminate findings through peer-reviewed journal articles corresponding to each major research activity, ensuring broad scientific and stakeholder impact.

Project Location

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

City(s): Minneapolis

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

In the Future

Activities and Milestones

Activity 1: High performance molecular dynamics computational simulation studies of gas separation in a MOF-based FTHM (Dumitrică)

Activity Budget: $229,868

Activity Description:
Simulations will fill key knowledge gaps in our understanding of the factors that limit the separation performances of the FTHMs. Specifically, concentration gradient-driven molecular dynamics simulations will quantify and characterize the gas dynamics through MOF, polymer, and the MOF/polymer systems. We hypothesize that interface processes exert a key role on the FTHM's performance and that the gained understanding will influence the FTHM in terms of its structure and material combination. Atomistic models of FTHM portions will be used to investigate the role of the interface compatibility between the polymer (Pebax and Matrimid) and MOF (UiO-66 and Zif-8), both with and without added functionalizations. We will identify the detrimental effects of defects, like voids, identify the benefits of functional groups added to MOF, and ultimately establish a connection between simulated compatibility and the measured performance of FTHM. In addition to delivering a microscopic picture of CO2 transport and other gases (N2, CH4, H2), and formulating predictions of the separation performance based on the individual constituents of a FTHM, the constituent screening afforded by these simulations will play a guiding role in the FTHM materials selection, interface design through MOF functionalization and MOF architecture, for the next-generation HMs for CO2 separation.

Activity Milestones:

Description	Approximate Completion Date
1.1 Simulation of CO2 transport in pristine membranes (Pebax and Matrimid)	September 30, 2025
1.2 Simulation of CO2 transport in FTHM with and without interfacial defects	December 31, 2025
1.3 Deliverables: atomistic models for pristine membranes and FTHMs	March 31, 2026
1.4 Computational optimization of membranes of Pebax/MOF (functionalized) with and without interfacial defects	September 30, 2026
1.5 Computational optimization of membranes of Matrimid/MOF (functionalized) with and without interfacial defects	September 30, 2027
1.6 Simulation of N2, CH4, H2 transport in optimized FTHM	March 31, 2028
1.7 Deliverable: submission of manuscripts for modeling Pebax+MOF and Matrimid+MOF membranes	March 31, 2028

Activity 2: Fabrication and characterization of MOF-based FTHMs (Stein, Li)

Activity Budget: $499,803

Activity Description:
In Budget Period 1, we plan to optimize the design of the UiO-66-based FTHM based on a previous 3M-funded seed project and the computational guidance in Activity 1. Then, we will fabricate the optimized UiO-66-based FTHM. Following that, we will characterize the FTHM, focusing on the dispersion of the functionalized UiO-66 in the polymer matrix and the durability of the FTHM.

In Budget Period 2, we plan to fabricate FTHMs of polymer/other functionalized MOFs based on information from Activity 1. Specifically, we are interested in using 2D MOFs. Besides having reversible reactions with CO2, the 2D MOFs could also possibly act as diffusion barriers for other gases, assuming only weak interactions with those gases, to achieve high selectivities. We will use characterization to verify dramatically improved dispersion of the functionalized MOF throughout the membrane and extraordinary durability for the optimized FTHM. We anticipate seeing improvements in the facilitate transport mechanism for it, too, which will be reflected by a higher CO2 sorption coefficient of the FTHM.

In Budget Period 3, we plan to scale up the optimized MOF-based FTHM, in order to make our FTHM more ready technically and practically.

Activity Milestones:

Description	Approximate Completion Date
2.1 Fabrication of optimized FTHM of polymer/UiO-66 (functionalized) based on 1.2	March 31, 2026
2.2 Characterization of FTHM from 2.1. Verify dispersion of functionalized UiO-66 and durability	June 30, 2026
2.3 Synthesis and characterization of MOF particles	December 31, 2026
2.4 Fabricate FTHMs of polymer/other MOFs based on 1.4-1.6	June 30, 2027
2.5 Characterization of FTHMs from 2.4. Verify dispersion of functionalized MOFs and durability	September 30, 2027
2.6 Deliverable: write manuscript sections on fabrication and characterization of FTHMs	September 30, 2027
2.7 Scale-up of optimized MOF-based FTHM	December 31, 2027

Activity 3: Testing of CO2 permeation and sorption performance of MOF-based FTHMs (Li)

Activity Budget: $139,183

Activity Description:
In Budget Period 1, we will build a high-fidelity gas sorption test facility that can accurately quantify the facilitated transport performance for membranes. We will use an existing gas permeation test facility from a previous 3M-funded seed project to measure CO2 permeation performance for our membranes.

We will measure the CO2 permeability and selectivity of the FTHM developed in Activity 2.1 using the gas permeation test facility. We will verify that there is improved performance compared to previously developed UiO-66-based FTHMs from the previous 3M-funded seed project.

We will measure the CO2 solubility of the FTHM developed in Activity 2.1 using the gas sorption test facility. The CO2 sorption coefficient will be derived based on the results. We will use that to verify the improvements in the facilitate transport mechanism and the advantages of our design.

In Budget Period 2, we plan to perform the same tests described above to the FTHMs developed in Activity 2.4 (using other MOFs), which are supposed to have even higher performance than those from Activity 2.1. We will verify that both the CO2 permeability and selectivity of the optimized FTHM are dramatically higher than the state-of-the-art HMs.

Activity Milestones:

Description	Approximate Completion Date
3.1 Build-up of gas sorption test facility for membranes	March 31, 2026
3.2 Testing of the FTHM developed in Activity 2.2	June 30, 2026
3.3 Testing of FTHMs developed in Activity 2.4	June 30, 2027
3.4 Deliverable: submission of manuscript on the FTHMs studied in Activities 2 and 3	September 30, 2027

Activity 4: Testing of CO2 separation performance of membrane modules using MOF-based FTHMs (Li)

Activity Budget: $181,146

Activity Description:
To make our technology more ready for applications, starting from Budge Period 2, we will build a test facility for membrane modules for CO2 separation.

Using the scaled-up, optimized MOF-based FTHM from Activity 2.7, we will also design and fabricate novel membrane modules for CO_2 separation. Finally, we will test these membrane modules on our test facility.

We will compared the effectiveness of our best membrane module for CO_2 separation to that of state-of-the-art membrane modules.

Activity Milestones:

Description	**Approximate Completion Date**
4.1 Build-up of the test facility for membrane modules for CO_2 separation	September 30, 2027
4.2 Novel design of membrane modules for CO_2 separation	September 30, 2027
4.3 Deliverable: test facility for membrane modules	September 30, 2027
4.4 Fabrication of CO_2 separation membrane modules using FTHMs developed in Activity 2.6	March 31, 2028
4.5 Testing of the membrane modules developed in Activity 4.4	June 30, 2028
4.6 Deliverable: modules with optimized FTHMs	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Andreas Stein	U of MN - College of Science and Engineering	Professor Stein's expertise includes zeolite and MOF syntheses, zeolite membranes, and functionalization of delaminated clay or graphene oxide materials for polymer nanocomposite fabrication with improved structural and barrier properties. He will lead the synthesis, functionalization, and characterization of the MOF particles, as well as the characterization of FTHMs.	Yes
Traian Dumitricã	U of MN - College of Science and Engineering	Professor Dumitrică's expertise includes molecular dynamics computations for describing the fundamental mechanical deformations of nano-materials, determining optimal equilibrium nano-structures, and investigating the transport properties of nano-system. He will lead the molecular dynamics computational effort to provide design guidance for the component materials of our FTHMs.	Yes
Michael Kesti	3M Company	3M will work with us as an industrial partner. They will provide perspectives from the industry. They are also considering providing us with their proprietary MOFs. They will look into opportunities to commercialize our research outcomes (i.e. membranes and membrane modules) after the project provided the results are promising.	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.

1. Dissemination and Presentation

All team members are active members of their scientific and engineering communities. The findings and results will be disseminated to federal and state agencies, industries, and other interested parties, through open-access/closed-access publications and conference presentations.

In our dissemination and presentation efforts, we will acknowledge the Environment and Natural Resources Trust Fund through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications and outreach. We will adhere to the attribution language and social media tags for the ENRTF.

The data will be published to the greater scientific community through peer-reviewed publications. In addition, as needed, raw and/or processed datasets will be provided as online supplemental material to the published manuscripts. After publication, all raw and analyzed data will be available from the PI upon email requests. Access to the data will be free, with no embargo periods involved in the proposed project. To our knowledge, there are no ethical or privacy issues with the sharing of data from this work. The datasets will neither be covered by copyright nor licensed.

We will particularly focus on in-state conferences on membrane technologies and decarbonization, including the meetings of ACS (American Chemical Society) Minnesota Section and SME Minnesota Conference. Founded in 1876, the ACS currently has more than 155,000 members at all degree levels and in all fields of chemistry, chemical engineering, and related fields. It is one of the world's largest scientific societies by membership. The Minnesota Local Section (#513) of the American Chemical society serves chemists, chemical engineers, educators, and the general public in Minnesota and Western Wisconsin. The SME Minnesota conference is a great venue to disseminate our research results to the Minnesota mining industry, which is one of the major sources of greenhouse gas emissions in the industry sector of the State of Minnesota.

All team members are engaged in outreach activities to the general public and will report results of this project and its benefits to the State of Minnesota to a large set of stakeholders.

2. Documentation

Raw data for the material syntheses and membrane fabrication protocols will be manually recorded into a laboratory notebook by the researcher, as well as entered into a computer file via Excel or Word and digitally stored as an .xls or .docx file. Raw sensor data and calibrated data from MOF and membrane characterizations will be obtained using proprietary software and exported as .csv or .txt file for further analysis. For the gas permeation and gas adsorption experiments, pressure data, along with the data of temperature and/or humidity, will be collected by a datalogger. The pressure data will be saved in a .tdms file, which is a native LabVIEW file format that includes metadata embedded in the file. Further analysis may be performed using Microsoft Excel, which would import LabVIEW data and save it as a .xls file. For all experiments, a laboratory notebook specific to this project will keep detailed notes on the experimental setup and location of the digital data.

Hardcopy data will be stored in laboratory notebooks. Electronic data will be generated and stored in a proprietary format depending on the instrument manufacturers, but in most cases it will be converted to ASCII, jpeg, and other common formats for manipulation, display, and archival storage. It will be stored in cataloged collections of micrographs, images, spectra, and simulations.

Digital data will be routinely backed up on local hard drives or remote storage devices. Output from analysis programs, spreadsheets, and data files used for any figure in a given publication will be cataloged by the publication name and archived on external hard drives or remote storage devices.

Hardcopies for experimental data (e.g., laboratory notebooks) will be stored indefinitely in the laboratory space in a safeguard against fire or water damage. Raw and analyzed data (e.g., photos, spreadsheets), along with uncertainty and error deduction results, will be backed-up on external hard drives as well as on a laboratory server and will be stored indefinitely.

Both experimental and modeling data will be organized in a logical manner with all relevant metadata attached to each file, and column labels that clearly explain the meaning of the data. These data back-ups will be moved to new media as new technology is developed. Archival publications will also be stored with data to provide information on the methods by which the data were obtained.

3. Sharing

Re-use, re-distribution, and production of the derivatives of the data will be allowed based on requests. When the PI or the journal where the data is originally published issues permission to a request for re-use, re-distribution, or production of the derivatives of the data, the PI will provide all the metadata needed to reproduce the data. Then, the requestor will be required to write a disclaimer stating the reproducing right has been permitted alongside the produced data in their products for the protection of intellectual property. The requestor should not re-distribute the data. All requests for re-use, re-distribution, or production of the derivatives must be made directly to the PI or the journal. For any data from the PI’s website, the website will contain this policy regarding the use of the data. For the data from published journals, the PI will communicate with the journal to make sure the same policy applies.

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 findings and results will be disseminated to federal and state agencies, industries, and other interested parties, through open-access publications and conference presentations.

3M, as our industrial partner, will scale up our technology and commercialize our technology provided that the results for membranes and contactors in this project are promising.

If new avenues for research emerge from this combined experimental-computational research effort, we will apply for funding from federal sources such as the U.S. Environmental Protection Agency (EPA), the National Science Foundation (NSF), the Department of Energy (DOE), etc.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Jun Li		PI			27.06%	0.27		$37,818
Traian Dumitrica		Co-PI			27.06%	0.27		$46,713
Andreas Stein		Co-PI			27.06%	0.27		$58,747
ME Research Assistants		Research Assistants			43.64%	4.5		$549,465
Chem Research Assistants		Research Assistants			51.32%	1.5		$179,294
							Sub Total	**$872,037**
Contracts and Services								
Scientific Services	Internal services or fees (uncommon)	Characterization of materials synthesized in this project (MOFs and membranes) at the UMN Characterization Facility and UMN Polymer Characterization and Processing Facility.				3		$36,000
							Sub Total	**$36,000**
Equipment, Tools, and Supplies								
	Equipment	1) Maxwell Robotics UB-C-1106-004 thermoelectric heater/chiller module. Quantity: 1. $4,500. 2) Maxwell Robotics UB-C-1106-003 Dual-pressure range pressurization system. Quantity: 1. $4,500. 3) Maxwell Robotics UB-C-1106-002 gas injection valve. Quantity: 5. $7,495. 4) Swagelok Diaphragm Valves 6LVV-DPHFR4-P-C. Quantity: 4. $2,000. 5) Thermo-Fisher temperature controller. Quantity: 1. $1,505.	Build-up of gas sorption test facility for membranes					$20,000
	Equipment	1) Thermo-Fisher SC-150 temperature controller. Quantity: 2. $5,660. 2) MKS Baratron 622D11TBE capacitance manometer. Quantity: 4. $4,200. 3) Feed solution pump. Quantity: 1. $2,500. 4)	Build-up of the test facility for membrane modules for CO2 separation					$42,963

		Absorption solution pump. Quantity: 1. $2,500. 5) ATO variable frequency drive (VFD) + Dayton general purpose motor. Quantity: 2. $4,000. 6) Customized stainless steel feed tank. Quantity: 1. $4,000. 7) Customized absorption tank. Quantity: 1. $4,000. 8) Customized gas mixer. Quantity: 1. $900. 9) Customized gas-liquid separator. Quantity: 1. $950. 10) Danfoss condenser. Quantity: 2. $1,600. 11) Fisherbrand Maxima rotary vane vacuum pump. Quantity: 1. $1,930. 12) OMEGA HX85BA hygrometer. Quantity: 2. $1,900. 13) Swagelok diaphragm valves. Quantity: 5. $1,930. 14) Membrane modules for CO2 separation. Quantity: 5. $6,000. 15) Omega absolute pressure transducer. Quantity: 1. $893.						
	Tools and Supplies	Chemicals and general laboratory supplies and consumables. Quantity: N/A	Synthesis of MOFs and polymers needed for FTHM fabrication					$25,000
							Sub Total	**$87,963**
Capital Expenditures								
		Maxwell Robotics UB-201-X control system. Quantity: 1.	Build-up of gas sorption test facility for membranes	X				$15,000
		ThermoFisher TRACE gas chromatography (GC) analyzer. Quantity: 1	Build-up of the test facility for membrane modules for CO2 separation	X				$15,000
		Micro Motion ELITE mass flow meter and transmitter. Quantity: 1	Build-up of the test facility for membrane modules for CO2 separation	X				$15,000
							Sub Total	**$45,000**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	3 trips. 1 person.	Jun Li's trips to two meetings of ACS Minnesota Section and one SME Minnesota Conference.					$1,668

	Conference Registration Miles/ Meals/ Lodging	3 trips. 1 person.	Andreas Stein's trips to two meetings of ACS Minnesota Section and one SME Minnesota Conference.					$1,666
	Conference Registration Miles/ Meals/ Lodging	3 trips. 1 person.	Traian Dumitricã's trips to two meetings of ACS Minnesota Section and one SME Minnesota Conference.					$1,666
							Sub Total	**$5,000**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Open access publication fee. Quantity: N/A	Disseminating the work and make our results publicly available.					$4,000
							Sub Total	**$4,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,050,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Expenditures		Maxwell Robotics UB-201-X control system. Quantity: 1.	The Maxwell Robotics UB-201-X control system, as the system controller, is an indispensable for the gas sorption test facility. The UB-201-X is an embedded Linux computer system with a touch screen interface. It coordinates all system functions, such as gas flow sequencing, pressure control, temperature control, etc. **Additional Explanation :** The Maxwell Robotics UB-201-X control system is an indispensable part of the gas sorption test facility. It will be used as long as the gas sorption test facility is used for testing CO2 sorption.
Capital Expenditures		ThermoFisher TRACE gas chromatography (GC) analyzer. Quantity: 1	Gas chromatography (GC) analyzer is used to separate and quantify each compound in a gas mixture. We will use it to analyze the downstream flow after the membrane module. It is a necessary piece of instrument for the test facility. **Additional Explanation :** The GC analyzer will stay with the test facility for membrane modules. The test facility will be used continuously for measuring the performance of various membrane modules for CO2 separation.
Capital Expenditures		Micro Motion ELITE mass flow meter and transmitter. Quantity: 1	The mass flow meter is necessary for measuring the mass flow rate of separated CO2 flow in the test facility for membrane modules for CO2 separation. We will need this quantity to derive the effectiveness of CO2 separation by the membrane module. **Additional Explanation :** The mass flow meter is an indispensable part of the test facility for membrane modules for CO2 separation. It will be continuously used for the same kind of research.

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	unrecovered F&A calculated at 55% MTDC	Support of ME facilities where research will be conducted.	Secured	$433,888
			Non State Sub Total	**$433,888**
			Funds Total	**$433,888**

Total Project Cost: $1,483,888

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 6b3dc326-236.pdf

Alternate Text for Visual Component

Summary chart to demonstrate the Work Plan...

Supplemental Attachments

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

Title	File
3M Letter of Support	74ce1e2d-fde.pdf
University of Minnesota Authorization Letter	03e435fd-20a.pdf
Follow up letter	167db8ce-9c9.pdf
2025-257 Research addendum_revised final	6bcea29f-686.docx

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

The recommended funding for our project is $100,000 less than the funding that we originally requested. Therefore, we have deleted Activity 5: Field testing of CO2 separation membrane contactors using MOF-based FTHMs in our Work Plan. The corresponding item deleted in the Budget Summary was the Professional or Technical Service Contract, which was budgeted at $100,000.

All the scientific findings and technology development should not be affected.

We also want to point out that although there will be no immediate field test for our membrane modules, 3M as our industrial partner plans to perform field tests and scale up our technology provided that the results for this research are promising.

Clear milestones have been added in the "Outcomes" session in the Narrative page (Tab 4).

In the Budget page, the "Scientific Services" item has been moved to the "Service and Subawards" session and has been selected as "Internal services or fees" for Agreement Type.

In the Budget page, the equipment, tools, and supplies that are in the same 'Category' and have the same 'Purpose' have been combined into a single line.

Deliverables have been added to each Activity to clearly demonstrate the anticipated outcomes of each Activity.

We have included the budget for three trips to in-state conferences.

We believe we have budgeted adequately for the publications. Most of the journals to which we plan to submit do not require a publication fee.

There will not be a fee for data management and hosting. We will use the data storage resources provided by our University at no charge.

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 UMN Policy on travel applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

Yes

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

Yes

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

No

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 project:

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