

**Environment and Natural Resources Trust Fund**

# M.L. 2025 Final Work Plan

## **General Information**

**ID Number:** 2025-112

**Staff Lead:** Noah Fribley

**Date this document submitted to LCCMR:** June 6, 2025

**Project Title:** Documentation and Toxicity of Microplastics in Urban Ecosystems

**Project Budget:** $300,000

## **Project Manager Information**

**Name:** Lea Pollack

**Organization:** U of MN - College of Biological Sciences

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## **Project Reporting**

**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. 04j

**Appropriation Language:** $300,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to research how land use and toxicity affect the accumulation of microplastics and associated contaminants of concern in stormwater ponds and the wildlife that use stormwater ponds.

**Appropriation End Date:** June 30, 2028

## **Narrative**

**Project Summary:** Researching how land use drives differences in the suites of microplastics and associated contaminants of concern found in ponds and the subsequent transfer of those pollutants into wildlife.

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

Millions of tons of plastic accumulate in the environment every year. Extensive research has documented the ingestion of plastic by hundreds of species and its associated negative health impacts. This is an especially important issue because plastics adsorb other toxicants (e.g., heavy metals, organic contaminants), making them up to six times more contaminated than the surrounding environment. Contaminants adsorbed to plastics are then consumed by wildlife, where they can bioaccumulate within food webs and create health risks for local ecosystems.

Stormwater systems are a key part of the freshwater ecosystems across Minnesota. Stormwater ponds retain storm runoff and ease downstream flooding during storm events. Importantly, these ponds reduce the negative impacts of runoff by allowing polluted sediment to settle to the bottom, where it can later be collected and properly disposed. This makes stormwater ponds a hotspot for plastic accumulation and potential wildlife transfer. However, how local land use impacts plastic accumulation and how this varies with contaminants of concern is wholly unknown. Moreover, how these factors affect consumption by local wildlife is poorly understood. Understanding of these key questions would guide efforts to reduce plastic mediated transfer of pollutants toward identification of effective control.

**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.**

In collaboration with established monitoring programs, we propose to survey stormwater ponds to measure microplastic concentrations and associated contaminants of concern. Stormwater ponds allow us to measure the impact of landscape features on a detailed scale, making it possible to pinpoint sources of plastic pollution and where plastics serve as vectors for other contaminants.

To identify avenues by which plastics move within food webs, we will also survey local snail populations for microplastic accumulation. We will pair field-based surveys with lab experiments that directly test how variation in the levels of contaminants associated with microplastics alters consumption rates. Freshwater snails are an ideal model for this study because they are ecologically important (i.e., in the diet of many species critical to Minnesota, including many ducks) and can bioaccumulate many types of microplastics. These snails are found across a broad range of stormwater ponds and, given their limited ability to move between ponds, provide a snapshot of a single pond’s water quality.

We will share our data directly with stormwater managers (e.g., cities of Bloomington and Roseville) and the Minnesota Pollution Control Agency, with whom we have ongoing collaborations (via Co-PI Finlay). We will also publish two scientific papers.

**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?**

Identifying habitats where plastics are accumulating is important for targeted remediation efforts throughout the state (e.g., by updating source control and pond management practices). Moreover, this study will help fill the large gap in freshwater ecotoxicology research, since so little is currently known about how terrestrial and aquatic plastic cycles are connected. Therefore, the proposed study has the chance to impact both stormwater management practices and basic knowledge of the movements of plastic pollution within local freshwater ecosystems.

## **Project Location**

**What is the best scale for describing where your work will take place?** Region(s): Metro

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

**When will the work impact occur?** During the Project and In the Future

## **Activities and Milestones**

### **Activity 1: Survey the spatial distribution of plastics and associated contaminants of concern in stormwater ponds**

**Activity Budget:** $120,000

**Activity Description:**The goals of activity 1 is to document how urban landscape features drives differences in plastic accumulation within stormwater ponds and the associated chemicals of concern. Forty stormwater ponds across the greater Metro Area with known differences in landscape features (i.e., traffic volume, green space, population density, commercial area use) will be surveyed for microplastics and contaminants of concern. Microplastic levels in the water column and pond sediment will be measured using previously established methods. After filtering and processing, microplastic particles will be identified and quantified using FTIR imaging (Fourier-transform infrared spectroscopy). Geographic Information Systems (GIS) will be used to derive land use cover and traffic volume surrounding ponds.

First, this activity will allow us to identify how landscape features can drive differences in the amount of microplastics within a pond and the chemicals that come together in association with these microplastic particles. Second, this will allow us to identify how pond features (i.e., size, oxygen availability, salt levels) drive differences in plastic particles in the water column compared to particles collected within the sediment.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Approximate Completion Date** |
| Identify 40 MN ponds with variation in important landscape features using GIS | August 31, 2025 |
| Conduct field collections of water and sediment from 40 ponds | February 28, 2026 |
| Identify and quantify microplastic particles within water and sediment using FTIR | June 30, 2026 |
| Measure associated contaminants of concern with water and sediment | June 30, 2026 |
| Share data with city partners and MPCA via first Whitepaper | December 31, 2026 |

### **Activity 2: Document how plastic moves into a common prey species within local food webs**

**Activity Budget:** $100,000

**Activity Description:**The goal of activity 2 is to document how variation in landscape features drives the movement of microplastics into food webs using aquatic snails as a model system. Ten snails per pond will be collected from the same forty ponds as activity 1 (n = 400). Using previously established methods, snail bodies will be analyzed for accumulated plastics and contaminants of concern. To quantify plastic load, snails will be digested in a strong acid, which dissolves organic material but leaves plastic remaining for identification and quantification using FTIR imaging. Microplastics retrieved from snail bodies will be characterized by size, type, shape and color to determine if they match those found in water and/or sediments of the ponds they were collected from. To quantify other contaminants of concern, snail bodies will be homogenized and dried before preparing them for mass spectrometry.

This activity will allow us to compare how concentrations of plastics and associated contaminants in the sediment and water column correlate with snail uptake. In particular, we will be able to examine at what levels of background concentration snail accumulation of microplastics might increase or plateau.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Approximate Completion Date** |
| Conduct field collections of snails from 40 MN ponds with variation in important landscape features | November 30, 2025 |
| Process snails for chemical analysis using strong acid digestion | February 28, 2026 |
| Measure associated contaminants of concern within snail bodies | June 30, 2026 |
| Identify and quantify microplastic particles within snail bodies using FTIR | March 31, 2027 |
| Share data with city partners and MPCA via second Whitepaper | June 30, 2027 |
| Draft manuscript generated for publication | June 30, 2027 |

### **Activity 3: Lab-based experiments to test animal consumption and toxicity of plastics and associated contaminants of concern**

**Activity Budget:** $80,000

**Activity Description:**The goal of activity 3 is to test how differences in the level of associated contaminants of concern with microplastics influences animal consumption and toxicity. Snails will be fed diets with 15% polystyrene particles (i.e., a common microplastic that sinks in water) with increasing ecologically relevant concentrations of PFAS (i.e., a common and contaminant of concern that sorbs to plastic). Using previously established UV light methods, levels of microplastics and PFAS bioaccumulation will be quantified across different ecologically relevant treatments. Fluorescent polystyrene fragments <200 um will be treated with varying amounts of PFAS within an aqueous solution and then mixed with food substrate. First, we will determine how variation in PFAS within solution translates to its sorption on plastic particles. Second, we will assess the relationship between plastic consumption and snail health (i.e., body condition and stress).

This activity will allow us to determine how variation in the suite of associated contaminants of concern influences animal consumption of microplastics. In particular, we will be able to examine whether snails modulate their intake of potentially harmful particles based on the level of toxicity and whether that translates into direct physical effects.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Approximate Completion Date** |
| Experiments that test how much plastics sorb PFAS within an aqueous solution with different concentrations | December 31, 2026 |
| Experiments that test how variation in PFAS associated with microplastics influence snail consumption and health | March 31, 2027 |
| For both experiments above, assess snail body condition and oxidative stress markers | June 30, 2027 |
| Draft manuscript generated for publication. | June 30, 2027 |

## **Project Partners and Collaborators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organization** | **Role** | **Receiving Funds** |
| Emilie Snell-Rood | University of Minnesota (Ecology, Evolution & Behavior) | Professor collaborating on project with strong expertise on ecotoxicology, microplastic pollution, and animal behavior. Will provide guidance on experimental design, field protocols, and snail behavior experiments. | No |
| Jacques Finlay | University of Minnesota (Ecology, Evolution & Behavior) | Professor collaborating on project with strong expertise on stormwater pond pollution and ecology. Will provide guidance on experimental design, field protocols, and chemical analysis. | Yes |
| Cara Santelli | University of Minnesota (Earth and Environmental Sciences) | Professor collaborating on project with strong expertise on water and sediment chemistry. Will provide guidance on experimental design and chemical analysis. | Yes |
| Matt Simcik | University of Minnesota (Public Health) | Professor collaborating on project with strong expertise on PFAS pollution and microplastic chemistry. Will provide guidance on experimental design and chemical analysis. | Yes |
| Ben Janke | University of Minnesota (St. Anthony Falls Laboratory) | Researcher collaborating on project with strong expertise on stormwater hydrology, stormwater pond structural components, and ecology. Will provide guidance on experimental design, field work protocols, and statistical analysis. | 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.**Dissemination and presentation: In addition to sharing our work with the greater scientific community through two publications in peer reviewed journals, we will share our findings with our city and watershed partners. Continuing our relationships through the National Science Foundation Long Term Ecological Research Program (NSF LTER), we will provide the agencies who manage stormwater ponds in the Metro area with yearly written reports, putting the data from their ponds in context. We also plan to present our results to the greater freshwater management community of Minnesota at the Minnesota Water Resources Conference in 2027. The Environment and Natural Resources Trust Fund will be acknowledged through use of the trust fund logo or attribution language on all publications, presentations, and reports.

Documentation: Field data collected as part of this project will be integrated within and managed with the larger long term data set being amassed by the NSF LTER team monitoring stormwater ponds in the great Metro area. This data set consists of over 500 ponds, with over 100 actively studied in the last 10 years. By integrating our data in with the NSF LTER team’s larger data archives, it will ensure that researchers will have access to the information long after the study has been completed. In addition, raw data will be stored and shared publicly online in conjunction with the publication of academic papers.

## **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?**This data has the potential to update stormwater management practices, which is disseminated by the MPCA via the Minnesota Stormwater Manual. Co-PI Finlay currently collaborates with the MPCA on updating the manual. Moreover, the PIs on this project are part of a broader collaboration across universities, state and federal agencies, and non-profits within Minnesota through the NSF Long Term Ecological Research Program. This work will add to the larger data collection efforts to document pollution across the urban metro region, where researchers can continue to access this information for future work, including via two white papers and two scientific publications.

## **Budget Summary**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category / Name** | **Subcategory or Type** | **Description** | **Purpose** | **Gen. Ineli gible** | **% Bene fits** | **# FTE** | **Class ified Staff?** | **$ Amount** |
| **Personnel** |  |  |  |  |  |  |  |  |
| Academic Research Associate - Lea Pollack |  | Project manager responsible for leading the project full time for the 2 years proposed. |  |  | 37.1% | 2 |  | $182,000 |
| Academic Faculty - Matt Simcik |  | Collaborate on on microplastics and PFAS sampling, analysis, and interpretation (Activities 1-3). Dr. Simcik is an expert on microplastics and PFAS pollution. |  |  | 37.1% | 0.04 |  | $10,000 |
| Academic Faculty - Cara Santelli |  | Collaborate on field sampling and processing of water and sediment (Activity 1). Dr. Santelli is an expert on inorganic pollutants in water and sediment. |  |  | 37.1% | 0.04 |  | $10,000 |
| Academic Faculty - Jacques Finlay |  | Collaborate on field sampling and processing of water (Activities 1 & 2). Dr. Finlay is an expert on stormwater, freshwater ecology, and urban watershed pollution. |  |  | 37.1% | 0.04 |  | $10,000 |
| Academic Research Associate - Ben Janke |  | Collaborate on field sampling and analysis of water and sediment (Activity 1 & 2). Dr. Janke is an expert on stormwater ecology and hydrology. |  |  | 37.1% | 0.2 |  | $11,000 |
| Undergraduate Research Assistant - Academic Year |  | Student will assist in field work and lab processing of samples collected. Student will work 5 hours per week during the academic school year. |  |  | 0% | 0.38 |  | $6,000 |
| Undergraduate Research Assistant - 2 Students for Summer |  | Students will assist in field work and behavioral studies with snails. One student will work full time and one student will work part time. |  |  | 0% | 1.5 |  | $24,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$253,000** |
| **Contracts and Services** |  |  |  |  |  |  |  |  |
| Simcik Laboratory | Internal services or fees (uncommon) | Liquid chromatography–tandem mass spectrometry (LC-MS/MS) to determine PFAS in samples will be performed at the Simcik Laboratory. |  |  |  | 0.02 |  | $15,000 |
| University of Minnesota Characterization Facility | Internal services or fees (uncommon) | Fourier-Transform Infrared Spectrometer (FTIR) analysis to analyze plastic particles from samples will be performed at the College of Science and Engineering Characterization Facility. |  |  |  | 0.02 |  | $13,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$28,000** |
| **Equipment, Tools, and Supplies** |  |  |  |  |  |  |  |  |
|  | Tools and Supplies | Field Supplies - Inflatable Kayak | An inflatable kayak is needed to float on top of pond surfaces so that the bottom water and sediment are not disturbed before collection. An inflatable kayak allows the researchers to easily move between multiple ponds in a day. |  |  |  |  | $1,500 |
|  | Tools and Supplies | Laboratory Supplies - Chemical Reagents | Chemical reagents are needed to store and process samples appropriately. |  |  |  |  | $3,000 |
|  | Tools and Supplies | Field Supplies - Gravity Corers | Gravity corers for both sediment and water allow us to collect water and sediment from the bottom of the ponds from the floating kayak without mixing. |  |  |  |  | $3,500 |
|  | Tools and Supplies | Plasticware (1000 vials and 500 bottles) | Plastic vials and bottles will be used to collect samples in the field and transport them into the lab. Once in the lab, plastic vials will be used to process and store samples. |  |  |  |  | $1,000 |
|  | Tools and Supplies | Laboratory Supplies - Tanks (40) | Tanks, tubing, and bubblers to house snails collected for behavioral experiments |  |  |  |  | $1,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$10,000** |
| **Capital Expenditures** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Acquisitions and Stewardship** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Travel In Minnesota** |  |  |  |  |  |  |  |  |
|  | Miles/ Meals/ Lodging | Travel between approximately 40 different ponds and laboratory. Approximately 3000 miles over the course of the 2 year project at a rate of $0.67/mile. | Driving is needed to collect and transport samples between stormwater ponds across the Metro Area and the University of Minnesota. |  |  |  |  | $2,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$2,000** |
| **Travel Outside Minnesota** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Printing and Publication** |  |  |  |  |  |  |  |  |
|  | Publication | Open Access Fees | Fees paid to academic journals to make sure publications are available to the public free of charge. |  |  |  |  | $6,900 |
|  | Printing | Protocols, data sheets, reports (1000 pages). | Printing to share information between researchers and between researchers and community partners |  |  |  |  | $100 |
|  |  |  |  |  |  |  | **Sub Total** | **$7,000** |
| **Other Expenses** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
|  |  |  |  |  |  |  | **Grand Total** | **$300,000** |

### **Classified Staff or Generally Ineligible Expenses**

|  |  |  |  |
| --- | --- | --- | --- |
| **Category/Name** | **Subcategory or Type** | **Description** | **Justification Ineligible Expense or Classified Staff Request** |

### **Non ENRTF Funds**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Specific Source** | **Use** | **Status** | **$ Amount** |
| **State** |  |  |  |  |
|  |  |  | **State Sub Total** | **-** |
| **Non-State** |  |  |  |  |
| In-Kind | University of Minnesota | In-kind overhead for administrative and operational expenses that willsupport the proposed research | Potential | $164,000 |
|  |  |  | **Non State Sub Total** | **$164,000** |
|  |  |  | **Funds Total** | **$164,000** |

**Total Project Cost: $464,000**

**This amount accurately reflects total project cost?**
 Yes

## **Attachments**

### **Required Attachments**

#### ***Visual Component***

File: [703e18a5-9c6.pdf](https://lccmrprojectmgmt.leg.mn/media/map/703e18a5-9c6.pdf)

#### ***Alternate Text for Visual Component***

Microplastics can transport contaminants of concern in local freshwater food webs. Pollution into stormwater ponds includes microplastics and PFAS, which can attach to each other chemically. When local wildlife consumes plastic, they might also be ingesting high concentrations of PFAS, which then can bioaccumulate up the food chain....

### **Supplemental Attachments**

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

|  |  |
| --- | --- |
| **Title** | **File** |
| SPA Letter of Approval | [effcd25a-090.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/effcd25a-090.pdf) |
| 2025-112 Research Addendum revised\_final | [dc8c6d7d-aba.docx](https://lccmrprojectmgmt.leg.mn/media/attachments/dc8c6d7d-aba.docx) |

## **Difference between Proposal and Work Plan**

#### ***Describe changes from Proposal to Work Plan Stage***

I have changed the completion date to match the appropriation end date. I have updated the title of activities 1 and 2 to match the updated research addendum. I have also updated the methods description of activity 2 to better match the updated research addendum. In addition, I have updated the timeline dates for the objectives for activities 2 and 3 to reflect the updated research addendum. Thank you for your suggested edits.

## **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?**
 N/A

**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 project:**

 Emilie Snell-Rood, Jacques Finlay, Cara Santelli, Matt Simcik, Ben Janke (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