**PROJECT TITLE: Trace organic contaminants in groundwater from stormwater infiltration**

**I. PROJECT STATEMENT**

**Trace organic contaminants (TrOCs) are present in stormwater runoff at concentrations that rival wastewater treatment plant effluent.** When stormwater is infiltrated, it may transport TrOCs to groundwaters that serve as drinking water sources orthat discharge to surface waters. **We will measure the mass inputs and associated toxicity of 400 TrOCs to groundwaters receiving infiltrated stormwater using passive samplers.** This data will provide planners and water resource managers with knowledge for informed decision-making regarding stormwater management.

**Stormwater is increasingly recognized as a substantial TrOC source and/or pathway in the environment.** Recent research in the Twin Cities Metropolitan area documented the presence of more than 100 TrOCs in stormwater runoff, including pharmaceuticals, industrial compounds, pesticides, and personal care products. Results also show that untreated stormwater can affect vertebrate biological functions related to hormones, tissue repair, and fat metabolism.

Recent efforts to reduce stormwater discharges to surface water promote infiltration of stormwater runoff using green infrastructure practices such as bioinfiltration basins, tree trenches, and permeable pavements. The amount of stormwater currently infiltrated by green infrastructure is relatively small but is expected to increase because new developments must consider infiltration for stormwater management. **Groundwater contamination may affect human health through drinking water and ecological/biological health in connected surface waters.**

**This work will help establish a reasonable level of concern for stormwater infiltration to groundwater in Minnesota municipalities and address how site design may influence TrOC transport in the environment.** We will focus on different types of infiltration practices, site designs, and landscape settings to optimize the project’s value toward informing management decisions regarding infiltration BMP design and installation.

**II. PROJECT ACTIVITIES AND OUTCOMES**

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| **Activity 1 Title: Measure TrOCs and toxicity in groundwater and untreated stormwater**  **Description:**Groundwater and untreated stormwater at up to five stormwater infiltration sites and groundwater at up to two wastewater rapid infiltration sites will be sampled. Passive samplers will be used to characterize the chemical and toxicological profile of: (1) groundwater up- and downstream of stormwater infiltration sites four times over two years, (2) untreated stormwater two times over two years, and (3) groundwater downstream of wastewater facilities four times over two years. Samples will be analyzed for approximately 400 TrOCs including pharmaceuticals, pesticides, and organic wastewater chemicals. A subset of samples will be analyzed using a suite of established biological assays that can quantify biological activity/toxicity associated with poor health outcomes.  **ENRTF BUDGET: $727,800** | |
| **Outcome** | **Completion Date** |
| 1. Select BMP and wastewater rapid infiltration sites | January 2021 |
| 2. Collect (passive) water-quality samples (58 environmental and 12 QA/QC sample) | November 2022 |
| 3. Chemical and toxicological analyses of water-quality samples | February 2023 |

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| **Activity 2 Title: Measure groundwater levels upstream and downstream of infiltration sites to estimate water flows**  **Description:**Pressure transducers installed at all sites will continuously record water level upstream and downstream of infiltration sites to monitor flow rates and effects on local groundwater levels. Computer-based hydrogeological data modeling will estimate infiltration rates and input or removal rates of individual TrOCs.  **ENRTF BUDGET: $65,600** | |
| **Outcome** | **Completion Date** |
| 1. Install pressure transducers at all sites | May 2021 |
| 2. Download, process, and analyze data | January 2023 |

**Activity 3 Title: Calculate contaminant loading to groundwater, screen chemical data against toxicity data, compare chemical data and biological activity across site types**

**Description:**Data will be thoroughly quality assured and made publicly available upon completion of USGS review. Contaminant loads will be calculated to determine TrOC mass inputs to groundwater and compare different infiltration practices. To understand potential ecological and human-health impacts, TrOC data will be compared against publicly available toxicity databases to identify biological targets of measured TrOCs. Results will be disseminated to the scientific community, water resource managers, and public through scientific report(s), local and/or national conferences, and communication with relevant agencies/groups (e.g. MPCA, MDH, MDA, UMN, MN Stormwater Research Council)

**ENRTF BUDGET: $116,600**

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| **Outcome** | **Completion Date** |
| 1. Quality assured data | April 2023 |
| 2. Data analysis & interpretation | August 2023 |
| 3. Report preparation | May 2024 |

**III. PROJECT PARTNERS AND COLLABORATORS:**

The project team has considerable experience investigating TrOCs and potential biological effects in the environment, wastewater, and the environment. The Principal Investigator, Elliott (USGS), has studied the occurrence of TrOCs in Minnesota’s water resources for 10 years and is an expert in data management and analysis. Richard Kiesling (USGS) is an expert in water-quality sampling and statistical analysis. David Fairbairn (MPCA) has expertise in TrOCs, stormwater, water resources, and analysis. Dalma Martinović-Weigelt (UST) has expertise in toxicology and analysis of complex biomolecular datasets. All project partners will contribute to study design, site selection, data analysis and interpretation, and dissemination. Data management, quality assurance, and reporting will be completed by USGS to meet rigorous Federal standards and ensure that the final data are publicly available.

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

This project will enhance and support ongoing research on the occurrence of TrOCs and biological effects of TrOCs in stormwater and groundwater, and the ability of stormwater infiltration to remove these harmful contaminants and their toxicity. Most existing stormwater TrOC research has focused on surface water impacts, with groundwater impacts rarely considered, let alone quantified. This study will provide valuable information to urban planners and water resource management decisions on application of infiltration practices to manage Minnesota stormwater and wastewater streams, which will provide great returns for health and water resource protection throughout Minnesota.

**V. SEE ADDITIONAL PROPOSAL COMPONENTS:** A, B, F