United States Department of the Interior
U.S. Geological Survey
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Tuesday, May 14th, 2019 11:00 a.m.

A flexible framework for process-based hydraulic and water quality modeling of Best Management Practices

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Models that allow for evaluation of the effects of design considerations on the performance of best management practices (BMPs) and green infrastructure (GI) to control urban and agricultural runoff and associated contaminants have received considerable attention in recent years. While popular, the GI models are relatively simplistic. However, GI model predictions are being relied upon by many municipalities and State/Local agencies to make decisions about gray vs. green infrastructure improvement planning. Adding complexity to GI modeling frameworks may preclude their use in simpler urban planning situations. Therefore, the goal here was to develop a sophisticated, yet flexible tool that could be used by design engineers and researchers to capture and explore the effect of design factors and properties of the media employed in the performance of GI systems at a relatively small scale. We deemed it essential to have a flexible GI modeling tool that is capable of simulating GI system components and specific biophysical processes affecting contaminants such as reactions, and particle-associated transport accurately while maintaining a high degree of flexibility to account for the myriad of GI alternatives. The mathematical framework for a stand-alone GI performance assessment tool has been developed and will be demonstrated. The process-based model framework developed here can be used to model a diverse range of GI practices such as green roof, retention pond, bioretention, infiltration trench, permeable pavement and other custom-designed combinatory systems. The tool is also equipped with a wizard feature to allow creating models of various types of GIs using pre-designed templates as well as scripting to automate model creation. We will demonstrate the utility of this GI modeling framework to simulate flow and transport in a stream, bioretention, infiltration basin and permeable pavement GI systems.

Dr. Massoudieh's research interests include (1) Reactive contaminant fate and transport in aquatic systems; (2) Individual based modeling of ecological systems and fish population dynamics; (3) Storm-water quality, management and BMP optimization; (4) Evolutionary and soft computing methods in inverse modeling of contaminant fate and transport in natural systems (5) Contaminant sediment water interactions in streams and wetlands and (5) Bacterial horizontal gene transfer in porous media. Prior to joining Catholic University in 2008, he held research appointments at the University of California, Davis.

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