Watershed and stormwater managers need modeling tools to evaluate how best to address environmental quality restoration and protection needs in urban and developing areas. Significant investments are needed to protect and restore water quality, address total maximum daily loads (TMDLs), and evaluate and design sustainable stormwater management systems. A number of stormwater control strategies, commonly known as best management practices (BMPs), are used to mitigate stormwater runoff volumes and associated nonpoint source pollution. BMP types include ponds, bioretention facilities, infiltration trenches, grass swales, and filter strips. Another control option is "low-impact development" (LID) – or hydrologic source control – which strives to retain a site's pre-development hydrologic regime by combining impervious area controls with small scale BMPs. Retaining and treating the stormwater runoff at or near its source is the prime objective of the LID concept. This source control helps create more sustainable development that manages stormwater while minimizing downstream effects.

To assist stormwater management professionals in planning for BMP/LID implementation, efforts have been under way by USEPA since 2003 to develop a decision-support system for placement of BMPs at strategic locations in urban watersheds. This tool will help develop, evaluate, select, and place BMP options based on cost and effectiveness. The system is called the System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN). SUSTAIN has seven key components: framework manager, ArcGIS interface, watershed model, BMP model, optimization model, post-processor, and Microsoft Access database. They are integrated under a common ArcGIS platform. The completed Phase 1 work included a framework design with all major components in place. The ongoing Phase 2 work will expand the capabilities and functionalities of the system. Key enhancements include a pre-processor to facilitate selection of placement sites, more tightly integrated and flexible post-processors, expanded cost estimating functions, and additional BMP types and improved BMP simulation processes. The optimization module will include additional solution techniques (currently uses scatter search algorithm) and provide a means to perform a multi-tier evaluation of individual watersheds and of multiple nested watersheds. In addition, the work will include case studies at several sites to demonstrate applications of a diversity of BMP types, soil/climate, and watershed development conditions.

By the time of this conference, most of the framework's development and enhancement will be completed to allow a comprehensive and in-depth presentation of SUSTAIN. The paper will present:

(1) Pre-processing tools to facilitate BMP selection and configuration, and preparation of watershed model input date files.
(2) Watershed processes of runoff, and pollutant production and wash-off.
(3) Implemented flow and pollutant (including sediment) routing methods through ponds, wetlands, infiltration trench, swales, buffer strips, and other BMPs (e.g., green roof, porous pavement).
(4) How to define aggregate hydrologic parameters to represent distributed BMPs for larger scale simulations.
(5) Methods to consider interaction of BMPs with groundwater.

(6) Optimization methods for meeting dual objectives of pollution control and flood control.

(7) How to perform multi-tier or cascading optimizations to develop large watershed scale solutions from information developed in small scale watersheds, e.g., residential parcels.

(8) The approach taken to balance the computational efficiency and the process simulation details to produce meaningful outputs for decision making.