

Modeling of Urban Watersheds and Stormwater Best Management Practices



Background

Austin and its sub-urban areas are divided into 66 creek watersheds, most of which enter the Colorado River at Lake Austin or Town Lake before flowing to the Gulf of Mexico. Austin's location in Central Texas means that the city is in the path of highly unpredictable weather from the Gulf Of Mexico and the Pacific coast of Mexico. When Austin has heavy rainstorms, creeks often flood which is hazardous for people and property.

Study Area

Austin is one of the few cities that monitors its creeks for flooding, soil erosion, and water quality. Most of the downtown and the surrounding watersheds consist of highly developed land. When it rains, water quickly runs off these developed surfaces to a storm drain and then to creeks. This sort of quick response has to be controlled to avoid flooding, high erosion and the associated transport of pollutants to nearby rivers or lakes. Structural storm water best management practice can be helpful under these circumstances.



Addressing the Problem

Structural storm water best management practices are required to capture some of the runoff, attenuate the flood peaks, and remove a portion of the pollutants before they reach the creek. Some of the commonly followed storm water best management practices are:

- Detention Basin
- Retention Irrigation
- Wet Pond
- Sedimentation Filtration Pond
- Porous Pavement
- Green Roof
- Rain Garden
- Cistern

The Hydrologic Modeling Team at the Blackland Research Center are using the Soil and Water Assessment Tool (SWAT) model to simulate the hydrology of urban watersheds in Austin, TX. As a part of this project, tools are being developed for: (a) rainfall-runoff modeling at sub-hourly time steps, and (b) representing the storm water best management practices and analyzing their effects on downstream water quantity and quality.



Using SWAT (Soil and Water Assessment Tool) for urban modeling:

- SWAT is a fully supported open source model
- 30+ years expertise in hydrologic and water quality modeling (>1,600 journal papers published)
- SWAT simulates landscape management practices
- Works for small scale (~50 acres) and large scale (>300,000 acres) scenarios
- GIS Interface



Urban Modeling and LID (Low Impact Development) are used in tandem to determine Stormwater Best Management Practices (BMPs). LID practices include implementation of green infrastructure such as a green roof (often connected with a cistern), a rain garden, porous pavement, or other similar designs. LIDs allow for on-site micro-scale controls and data collection. Modeling current LID practices with SWAT can evaluate the fastest, most cost effective LID solutions and provide consistent, accurate data for improving the SWAT model for use in similar watersheds in the future.



Green Roof



Rain Cistern

Subdaily model

- ✓ **SWAT modules for sub-hourly simulation**
- ✓ **Overland flow, stream flow, ponds, reservoirs, and point sources**
- ✓ **Soil erosion and sediment transport**

Urban BMPs

- ✓ **Sedimentation-Filtration basin**
- ✓ **Retention-Irrigation basin**
- ✓ **Detention pond**
- ✓ **Wet pond**

Green Infrastructure

- ✓ **Green roof**
- ✓ **Rain garden**
- ✓ **Cistern**
- ✓ **Porous pavement**