By Robert G. Traver, Ph.D., P.E., D.WRE

Design Direction

Research progresses at Villanova University's storm water monitoring lab

The potential for urban storm water to deliver pollutants and increase flows to receiving waters over short intervals is a well-recognized environmental issue. These challenges, coupled with U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System Phase II regulations, have brought a new direction to storm water management.

Volume and quality have joined peak flow as design parameters, radically changing the design approach of storm water professionals. The design, performance and maintenance of best management practices (BMPs) are still emerging, as recognized by the 2002 EPA guidance manual on storm water monitoring.

Monitoring Research

To demonstrate and learn more about this emerging technology, Villanova created the Villanova University Stormwater Research and Demonstration Park. Current BMP study sites include a pervious concrete/porous asphalt comparison, a bioinfiltration traffic island, an infiltration trench and a storm water wetland.

The research focus is to determine BMPs' effectiveness in reducing storm water runoff volumes, peak flows and nonpoint source pollution to the surface water system and to determine the volume and quality of the infiltrated runoff. The storm water monitoring strategy focuses on assessing volumes, rates and pollutant loads for wet-weather flows both entering and exiting the BMPs.

The research requires water quality and water quantity analysis. Water quantity is addressed through site instrumentation. A watersheds laboratory has been constructed to support water quality studies.

Measurements of storm water flows into and out of a BMP provide data on its volumetric capacity and ability to retain, infiltrate or dampen flows. Water quality sampling, storm water, infiltration and overflow are analyzed for a host of parameters, including pH, temperature, conductivity, total suspended solids, dissolved solids, chlorides, nutrients and metals.

This work can be daunting. Rainfall is extremely variable, and the pollutant loadings change during a storm event; this requires multiple samples per site. The random nature of rain makes it difficult to forecast storm events, and the workload can be extreme.

Based on these factors, it was decided to create a dedicated storm water lab; here, following a storm event, a student workforce could process the samples within the required holding times. While the solids testing, pH and conductivity are typically straightforward processes, metals and nutrients are more complex operations.

Metals Analysis

Generally, the requirements for metals analysis are met through the use of a Perkin Elmer 5100ZL graphite furnace/flame atomic adsorption spectrophotometer. The versatility of this type of unit is due to the graphic furnace portion meeting the low detection limits for some metals and the flame for those with higher concentrations in the environment.

Cadmium, chromium, copper and lead in storm water samples are determined in the parts-per-billion range, and trace metals such as zinc are determined in the parts-per-million range (flame). Having one unit performing both analyses is critical to the success of the operation. With a six-month holding time, it is ideal to run the metals analysis between storm events.

Nutrient Analysis

Analysis of nutrients has been a more difficult process. Attempts using spectrophotometers resulted in a year of "nondetects." HPLC analysis worked during summer and fall rain events, but high chloride loadings in winter and spring raised detection limits to unacceptable levels.

After purchasing the EasyChem discrete analyzer, detection limits dropped an order of magnitude and tests are not subject to chloride interference. Current detection limits in use in the lab are 0.005 mg/L for nitrites, 0.01 mg/L for orthophosphates and total phosphorus, 0.1 mg/L for total Kjeldahl nitrogen and 0.5 mg/L for chloride.

It should be noted that lower detection limits are obtainable but not necessary for this particular application. Because the analyzer uses micro-quantities, chemical usage and waste generation have been reduced dramatically. The system is easy to use and offers flexibility to perform multiple test parameters on the same sample without operator intervention. SWS

Robert G. Traver, Ph.D., P.E., D.WRE, is professor and director of the Villanova Urban Stormwater Partnership. Traver can be reached at 610.519.7899 or by e-mail at robert.traver@villanova.edu.

For more information, write in 5005 on this issue's Reader Service Card.

WEBresources ➤➤➤

Related search terms from www.waterinfolink.com:
volume, water quality, monitoring, VUSP

For more information related to this article, visit www.estormwater.com/lm.cfm/st090905