A Storm Water Management Treatment Train

A SIMPLE, UNIFIED SOLUTION TO A COMPLEX CHALLENGE

By Tom Gable

Without question, the passage of the Environmental Protection Agency's (EPA) Clean Water Act (CWA) in 1972 and the development of the National Pollution Discharge Elimination System (NPDES) in 1990 have greatly improved the quality of our waters. The cleanup, however, has only just begun. Urban and suburban polluted storm water runoff continues to plague our rivers, lakes and estuaries.

Phase I of the EPA's storm water program, NPDES, covered medium and large municipalities, or municipal separate storm sewer systems (MS4s) with populations of 100,000 or more. Also covered by Phase I were construction activities disturbing five or more acres and 10 categories of industrial activities.

Phase II requires MS4s with a population of 10,000 or more and construction activities disturbing more than one acre to implement programs and practices to control storm water runoff. By regulating storm water discharge, implementation of Phase II is intended to further reduce the impacts that urbanization and construction projects are having on water quality.

CONQUERING THE CHALLENGE

Meeting the requirements of Phase II was one of the primary civil engineering concerns regarding Cedar Shopping Center's Cedar Kingston 4 project in Kingston, N.Y. While conducting site assessments of the four-pad retail/commercial development lot, the civil engineers of Medenbach and Eggers, Stone Ridge, N.Y., discovered a number of storm water challenges they would need to address. The post-development site is mostly impervious surface, so the engineers commissioned to develop the shopping center's storm water program had their work cut out for them.

Nick Sadler of Medenbach and Eggers found the project's greatest challenge to be adhering to state storm

Contractors install water quality units to pretreat retention beds.

water design criteria while preserving valuable onsite real estate. "It was determined early on in the project," said Sadler, "that storm water treatment and detention would have to be achieved using a subsurface system."

A high groundwater table kept engineers hard at work. Despite some filling on site, engineers tried keeping it to a minimum to reduce costs. "We needed a system that could maintain a 3-ft separation from the groundwater," Sadler said.

Advanced Drainage Systems Inc. (ADS) StormTech chambers were chosen for the shopping center plan because of their ability to fit into this limited zone. Workers used the larger SC-740 chamber for much of the project and the smaller SC-310 in areas with the highest groundwater.

Pretreating runoff before it entered the chambers soon became yet another major storm water challenge. The high infiltration rates of the soils on site required 100 percent of the water quality volume to be pretreated. Sadler said he selected ADS water quality units because of their ability to work off line, handle smaller first-flush storms and meet New York state's Department of Environmental Conservation required particle removal rates.

Ultimately, the engineers at Medenbach and Eggers specified three subsurface storm water retention systems using storage chambers and six water quality units. Nyloplast drainage structures and high-density polyethylene pipe also were specified for storm water collection and conveyance purposes.

"This is really the future in storm water collection and treatment," said Steve Wolk, project manager for the excavating contractor, Leo Boice and Sons of Kingston, N.Y., in reference to the various drainage solutions he installed in this undertaking.

UNDERSTANDING THE TRAIN SYSTEM

Water quality units pretreat storm water before it enters underground retention ponds by removing the concentrations of sediment and hydrocarbons typically found in parking lots.

The ADS water quality unit is designed based on the fundamental principles of Stoke's Law and a standard outlet control device. The settling velocity of a particle is calculated based on the smallest particle to be removed. Standard units offer a choice of No. 140 or No. 200 sieve size. The

StormTech chambers fit the site's limited zone.

outlet orifice is sized to release a typical first-flush discharge and to redirect any excess flow to an external bypass piping system installed with the unit.

In lieu of traditional drainage structures, Nyloplast catch basins inlet the water quality units. "Unlike concrete structures, there is no brick and mortaring of joints necessary with these structures," said project worker Steve Wolk. "The Nyloplast structures came with watertight bells already installed. We just slipped on the gaskets and pushed home the pipe."

Retention systems, which allow accumulated storm water to gradually seep into surrounding soil, and detention systems, which temporarily hold accumulated storm water and release it into a designated receiving area through an outlet pipe, are needed for downstream treatment.

The soils on site allowed engineers to design a combined retention/detention system. For the one-year-or-less storm events, storm water is infiltrated into the ground via the chambers. For heavier rain events, peak flows are released into adjacent wetlands through an outlet control device downstream from the chamber beds.

In order to store storm water in a cost-effective manner, the shopping center development team opted to use subsurface storage chambers. Workers installed three separate beds under the various parking lots positioned around the site's four buildings. In order to maintain a constant elevation in storage beds, the chambers convey storm water laterally through sidewall openings, as well as through angular stone foundation and backfill. **SWS**

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