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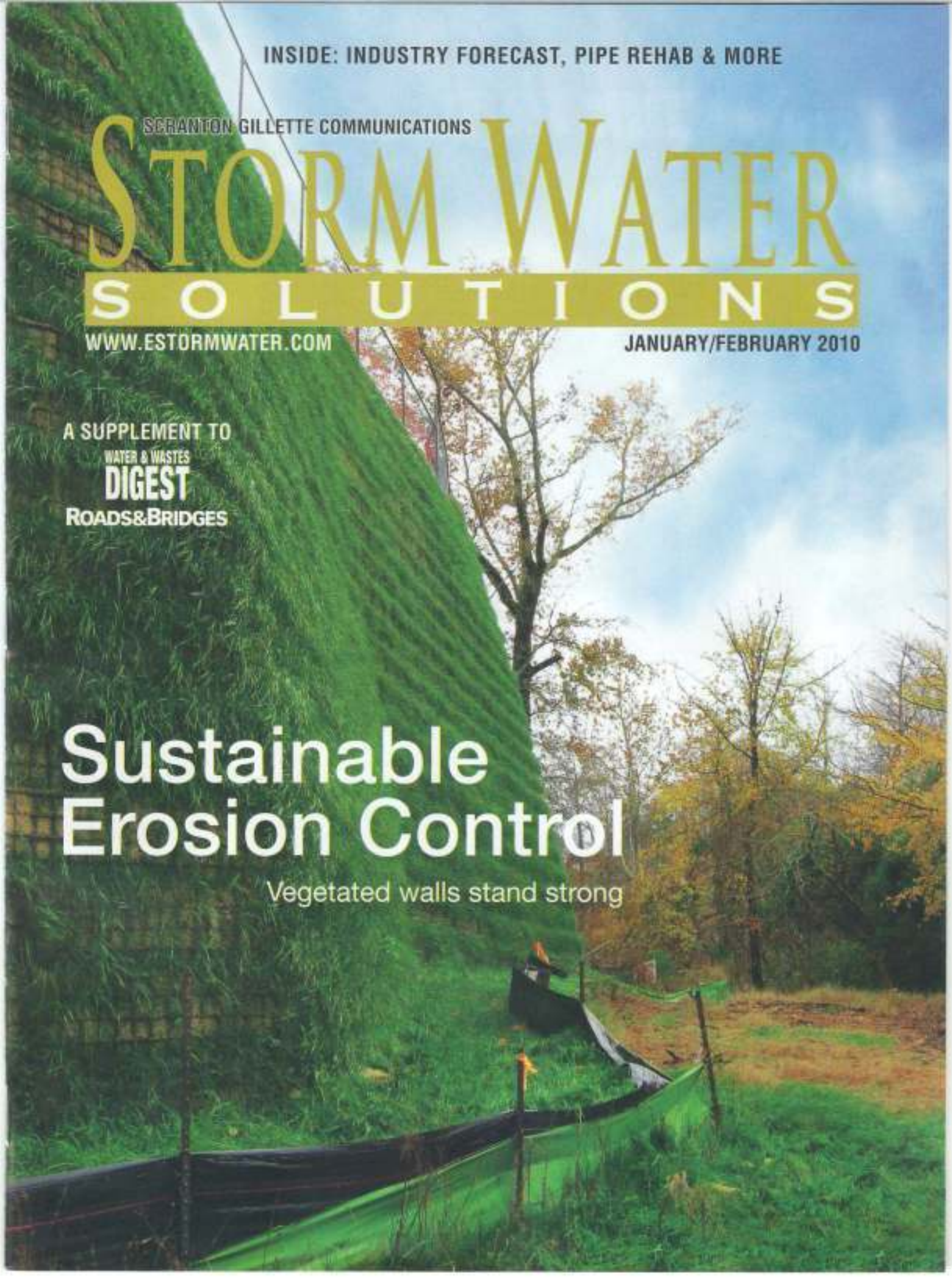

Sustainable Erosion Control

Vegetated walls stand strong

Making the Most of Rain

A Virginia school harvests and treats storm water for indoor/outdoor reuse

By Sarah Lawson

Rainy days are days to celebrate at Oscar Smith Middle School in Chesapeake, Va. When coastal storms pour on the school's roof, the community knows that nearby Chesapeake Bay tributaries are being protected. Instead of rainwater running off the roof, landing on the ground and carrying fertilizers, sediment and other contaminants to nearby waterways, it is directed to four 65,000-gal cisterns.

These cisterns provide enough storage for almost 2 in. of rain from the 220,000-sq-ft roof collection area. Although storing the water prevents the contaminants from entering local waterways, the contaminants can pose aesthetic and health issues when the water is reused. Sediment, organic matter and chemicals must be managed when a rainwater harvesting system is utilized, just as they would be if traditional storm water management processes were employed.

At Oscar Smith, contaminants are kept from waterways and reuse water is supplied through a combination of filtration and settling. Harvested rainwater is used both indoors (for toilet and urinal flushing) and outdoors. Because indoor water use typically requires a higher-quality water supply than outdoor use, the school's rainwater harvesting system is really two systems: a "cleaner" system with two tanks for indoor use and the two irrigation tanks into which they overflow.

Irrigation Tanks

Rainwater from the roof is directed through nine large-capacity vortex filters. These filters act as both first-flush diverters and mechanical filters. When the vertical mesh screen is dry, water drops through the center of the filter and to the storm water pipe, diverting the first flush—about 0.02 to 0.04 in., much smaller than the first flush traditionally considered in storm water management—from the indoor-use storage tank. As the mesh screen gets wet, water is pulled through the screen by surface tension and capillary action. Water only can get into the indoor-use storage tank by going through the filter. The first flush is directed to the irrigation storage tanks.

In many systems, harvested rainwater is used for irrigation with no filtration, but the irrigation system at Oscar Smith uses simple design tools to improve the quality of the water delivered to it. Water enters the first irrigation tank through a pipe that extends to just above the bottom of the tank and then turns upward. This "calmed" inlet prevents disturbance and resuspension of any settled sediment in the tank, and its design introduces oxygen into the bottom of

the tank and prevents development of a stagnant water layer. At the other end of the tank, 140 ft away, floating filters take water from just below the water surface and direct it to the second tank. Harvested rainwater must then travel the length of the second tank to reach the floating filters on the intakes of the irrigation pumps.

The calmed inlet, floating filters and extensive settling distance combine to provide clear, high-quality harvested rainwater to the irrigation system. While the first irrigation storage tank will need to be cleaned every few years, the only additional maintenance is rinsing the vortex filters approximately twice a year.

Indoor-Use Tanks

The higher water quality necessary for indoor use requires some additional treatment for the cleaner rainwater harvesting system. Because water entering these tanks has been filtered by the vortex filters, only a very small quantity of particulate (particles smaller than 380 microns) will enter this tank. Considering this system collects off an exposed surface, some bacteria will enter the tank and form a biofilm on its bottom.

This biofilm, a relatively stable community of bacteria attached to a solid surface, can help immobilize metals and may remove bacteria from the water column, according to 2006 research findings. The same calmed inlet, floating filters and settling distance are used in the indoor use system; they help protect this biofilm and encourage sediment settling.

The water is treated further with a 5-micron sediment filter and an ozone system to ensure that the water delivered to the toilets and urinals is clear and free of bacteria and odor. The initial filtration and the system

Top & Center: Nine large-capacity vortex filters prevent the first flush and debris from entering the indoor-use system's storage tanks. Bottom: Harvested rainwater passes through a 5-micron bag filter and ozone treatment system prior to use indoors.

Designed to support 1,500 students, the school anticipates its rainwater harvesting system will provide 3 to 4 million gal of water annually.

design improve the quality of the water delivered to these additional treatment units, leading to longer life and reduced maintenance.

Reason to Celebrate

The rainwater harvesting system at Oscar Smith is expected to provide 3 to 4 million gal of harvested rainwater per year; that is 3 to 4 million gal of water that does not have to come from the city's reservoir or wells and 3 to 4 million gal of water not running off into the Chesapeake Bay. With a well-designed, energy-efficient and sustainable filtration system, rainy days at the school are definitely worth a celebration. SWS

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