WE&T
water environment and technology

Solids thickening
Phosphorus supply
Aquifer storage
Watershed management

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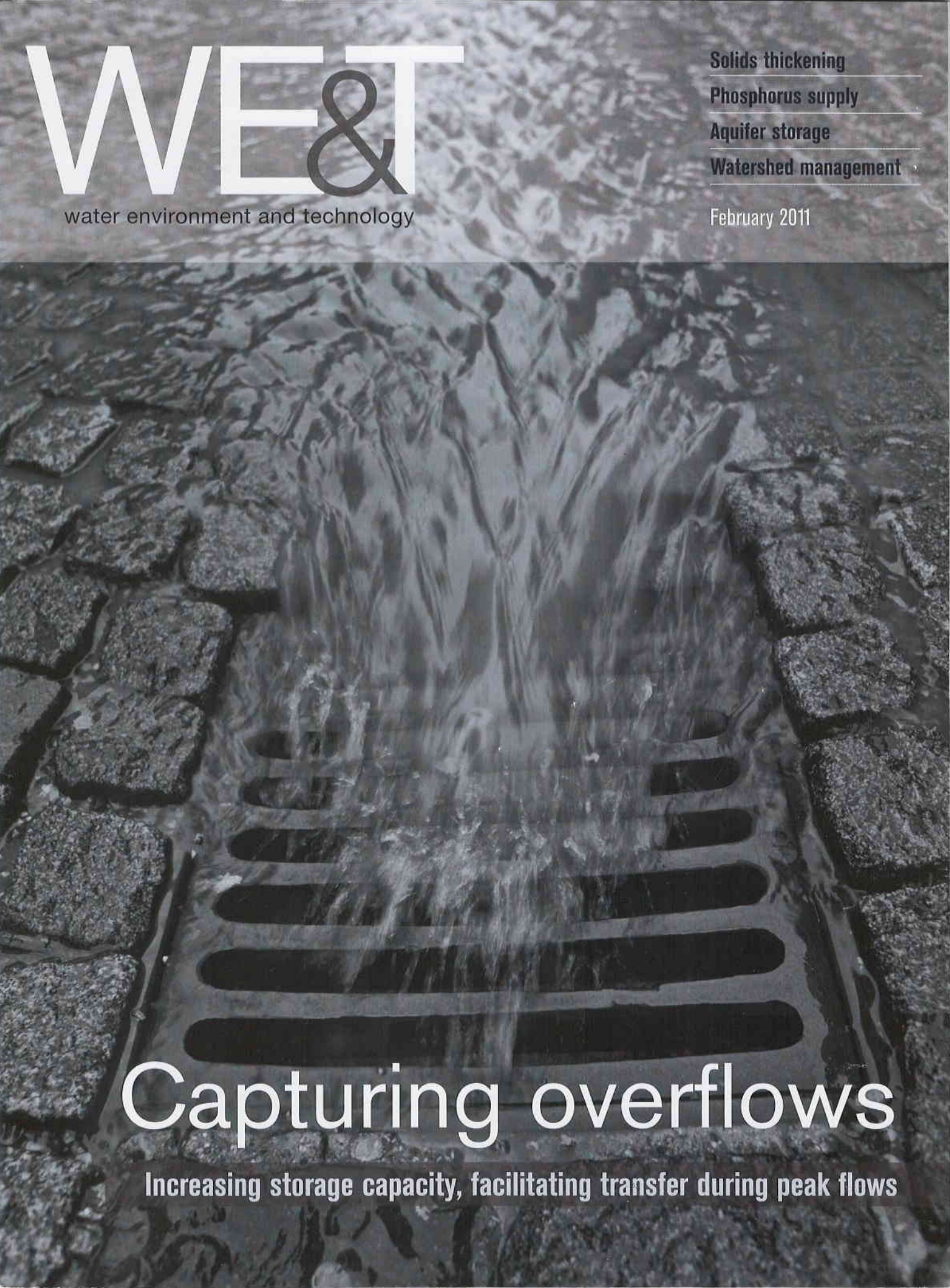

Capturing overflows

Increasing storage capacity, facilitating transfer during peak flows

Boosting a combined heat and power system

Problem: Difficulty maximizing energy efficiency in a combined heat and power system.
Solution: Use of an organic liquid booster to maximize amount of biogas for increased renewable energy.

The Landis Sewerage Authority Wastewater Treatment Plant in Vineland, N.J., used a liquid booster to increase its methane production. The authority uses the methane to run this 185-kW Schmitt-Enertec (Mendig, Germany) generator as part of its combined heat and power system.
Landis Sewerage Authority

The Landis Sewerage Authority Wastewater Treatment Plant in Vineland, N.J., uses byproducts of its operation as renewable energy sources and nutrients for the 162-ha (400-ac) farm operated onsite. The 22,700-m³/d (6-mgd) plant is one of the largest in-ground water-discharge plants in the state.

For many years, the authority used the methane gas produced by its digester to fuel a boiler to heat part of its plant. Excess gas was flared off with a gas burner. In 2008, the authority decided to install a new system to harness this unused energy.

In February 2008, the authority brought on-line a combined heat and power (CHP) system to harness the unused gas. But after operating for several months, the authority recognized two main challenges.

First, the CHP and boiler's combined demand for methane exceeded the digester's daily production capabilities. To overcome this, the authority decided to first fuel the CHP unit with methane from the digesters. Any additional methane then went to the boiler, with the rest of its energy needs being supplied by oil.

The second challenge was that methane gas production was limited on weekends, meaning the the CHP unit only operated partially. This reduction was due to the reduced weekend work force adding only primary sludge into the digester.

Under these circumstances, the maximum system performance attainable was 85% efficiency. While this is a relatively significant level, it did not reach the energy system's full design potential, and the authority was unable to maximize the return on its investment. Additionally, this perpetuated the authority's dependence on costly energy resources with large environmental footprints.

During the first 10 months of the CHP system's operation, the authority looked at the possibility of augmenting digestion by adding fats, oils, and grease (FOG) to the digester. The FOG would act as a food source to the existing bacteria in the digester and boost their activity and gas production. This would allow further breakdown of organic matter in the digester, resulting in greater levels of methane gas production. However, this option would require daily labor to maintain proper operation and additional equipment to feed the digester with the material.

Instead, the authority decided to add Biological Activity Enhancer (BAE™) to its anaerobic digester following the activated sludge dewatering process. BAE, produced by Prodex™ (Mount Laurel, N.J.), is an organic formula designed to improve plant operational efficiency and boost renewable energy production. Designed to improve performance of activated and nonactivated sludge systems, BAE can be used in a variety of anaerobic environments, including industrial digesters, agricultural digesters, and public or private wastewater treatment plants.

Derived from a peat extraction process, the liquid booster provides an alternative to system upgrades and helps maximize biogas production. Within 2 months of adding BAE, the average daily methane production increased by more than 481,440 L (17,000 ft³), about 28%, compared to the prior year.

The increase in gas production enabled the entire system to operate more efficiently. Prior to the addition of the booster, the CHP unit operated at 32% electrical efficiency and 53% thermal efficiency, totaling 85%. After the addition, the combined overall operating efficiency reached design criteria of 100%.

The payback time for the CHP project's construction loan was estimated at 6.3 years at the current electricity rate of $0.12 per kWh, with no increase to the rate during the life of the loan. Since addition of the booster, the authority has found that monthly electricity production has risen by 17,472 kWh, fuel-oil consumption has dropped by 5488 L/mo (1450 gal/mo), and the payback period of the loan for installation has shortened by 5.3 months.

In addition to these benefits, the authority received the 2010 Energy Star CHP Award from the U.S. Environmental Protection Agency for increasing biogas production and reducing its carbon footprint. ■