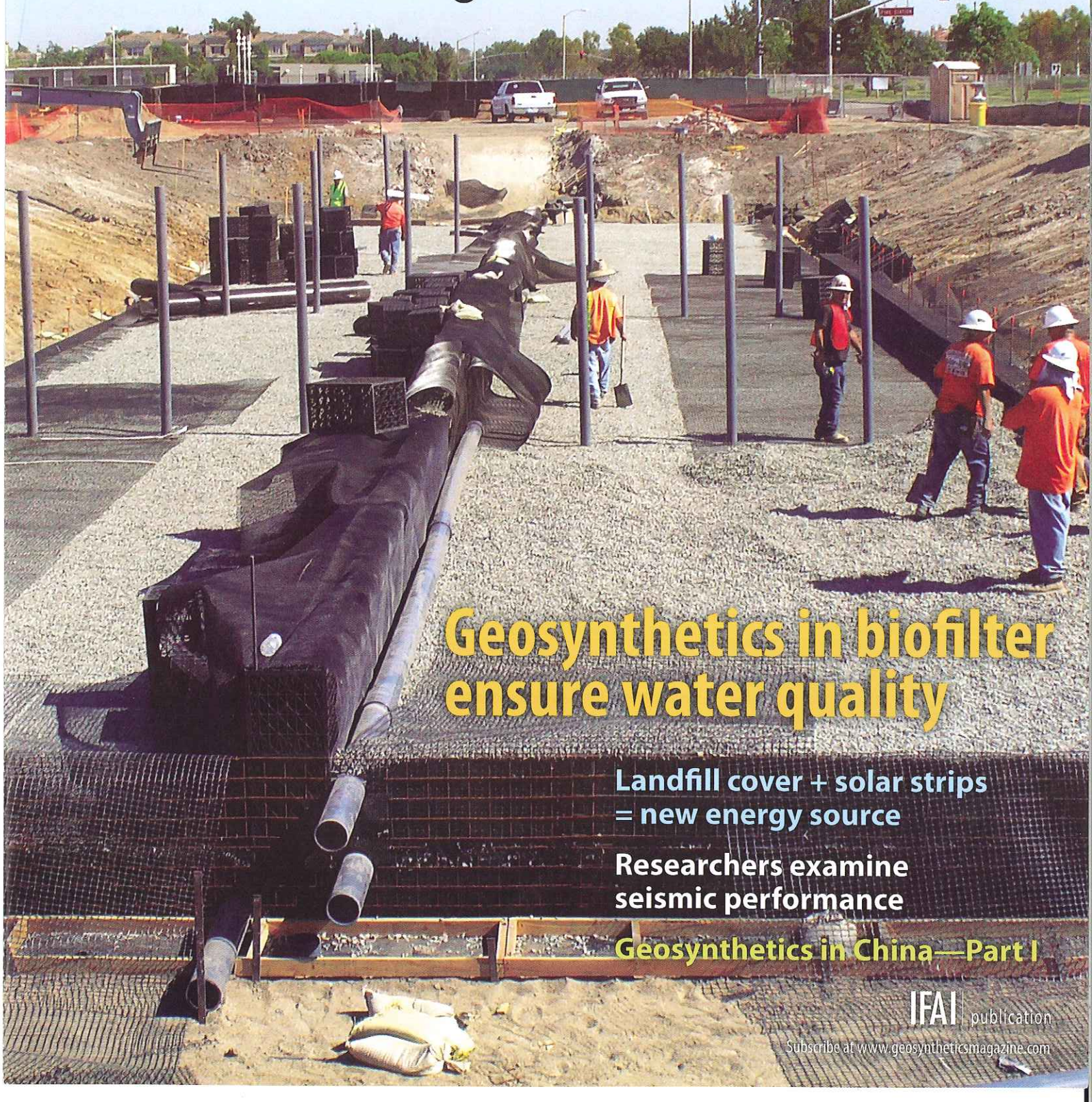
| August September 2009 |
Volume 27 Number 4

Geosynthetics



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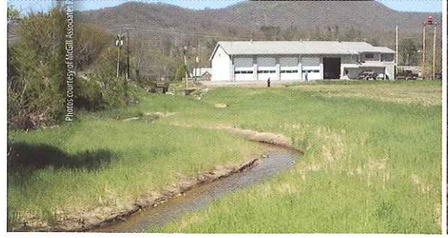

Photo 1 | This "after" photo shows the restored tributary winding through the small town of Clyde, N.C.

Photo 2 | This "before" photo shows the artificially straightened tributary with steep banks.

Photo 3 | Post-hurricane runoff accelerated creekbank erosion.

Photos 4 & 5 | The addition of an MSE retaining wall added strength to an unstable slope.

Project Showcase

Erosion-control mix rebuilds Clyde's creekbank

| A North Carolina town used a portfolio of geosynthetic erosion-control and reinforcement materials to restore a local streambank and relieve safety threats.

Introduction

During two weeks in September 2004, the town of Clyde, N.C., was pounded by hurricanes Ivan and Frances, both delivering destructive amounts of rainfall. The small town recovered, but four years later concerns were growing about a badly eroded tributary that skirted through the Haywood County community.

Located upstream of the Pigeon River, the narrow tributary **(see "before" Photos 2, 3 and "after" Photo 1)** flows behind the town's fire station, a local bank, and a Methodist church. Historic farming practices had straightened more than 500ft of the east and west banks of this creek, with streambank slopes steeper than 1:1 and vertical bank heights of 11ft **(Photo 2)**.

Destruction from the hurricanes allowed excessive amounts of runoff to rush through this channel at a high velocity, causing accelerated streambank erosion **(Photo 3)**. If further disturbed during other high-flow storm events, the exposed soil and steep vertical slopes could further erode, threatening the stability of its bordering buildings and pushing even more sediment into the French Broad River Basin.

By 2008, the stream bank restoration project was urgent and compelling work for the town of Clyde, located in far western North Carolina. The fire station, bank, and church, agreed to the project and the town was awarded a state grant appropriated from the Hurricane Recovery Act of 2005 (Senate Bill 7).

The proposed restoration plan called for constructing a meandering stream channel at the existing bed elevation and establishing a new flood plain. The addition of a mechanically stabilized earth (MSE) retaining wall would add strength to unstable slopes and native vegetation would create habitat, slow water flow, and beautify the site **(see Photos 4–8)**.

The plan

Determined to adopt a low-impact solution, the town of Clyde hired stormwater specialists, McGill Associates, from nearby Asheville, N.C.

"The goal was to enhance the environmental habitat of the existing site," said head project engineer J.P. Johns. "Town officials wanted to establish a natural stream corridor and cause minimal disturbance." This meant conservative soil displacement, avoiding chemical-heavy remedies, and using biodegradable materials to preserve the natural landscape.

The plan for the 2-acre site was designed to both restore and provide a natural stream setting to an urbanized watershed. "The new stream alignment and bank stabilization plans would enhance the area by providing access to the new floodplain and allow for natural stream functions consistent with riffle/pool/run sequence throughout the reach," said Johns.

Project Highlights
Project/Location: Streambank restoration in Clyde, N.C.
Timeline: Construction, December 2008–February 2009
Owner/Client: Town of Clyde, N.C.
Engineering/Landscaping: McGill Associates P.A., Asheville, N.C.
Geosynthetic Products: HydraCX2 Extreme Slope Matrix, C125BN, SC150BN, coconut wattles
Product Developer: Mulch and Seed Innovations LLC, Centre, Ala.; Cotton Incorporated; USDA
Distributor: North American Green, Poseyville, Ind.

Specifications and installation

In January 2009, Johns and his team completed the planned restoration of the site, including the relocation of the stream channel, decreasing the stream bank slopes and creating a stable, green retaining wall **(see Photos 4–8)**.

To leave the rejuvenation of the site up to Mother Nature, Johns and his team selected and applied a special mix of sustainable erosion-control solutions, each with its own complement to address challenges posed by this project.

To manage soil stabilization, Johns prescribed biodegradable/bionet erosion control blankets (ECBs), installed under the mulch to protect the soil from unwanted weeds, filter urban runoff, and reduce erosion of volatile soil during the stabilization process.

Both ECBs feature layers of coconut fiber stitched with biodegradable thread between biodegradable natural-fiber top and bottom nets; one is constructed with a straw and coconut fiber mix and provides a strong double-net structure.

In addition, coconut wattles were placed on the outer bends of the restored channel reach to intercept and absorb water flow and to collect sediment on-site. A classic degradable rolled erosion-control blanket containing 100% coconut fibers, the wattles would eventually decompose into the landscaping.

True to Johns' commitment to a sustainable restoration plan, biodegradable eco-stakes were used to hold both the blankets and wattles in place rather than traditional metal stakes that can remain present long after the blankets and wattles have returned to the earth.

Once erosion and sediment control were addressed, the issue of establishing vegetation on the streambank remained. With proposed new side slopes of 3:1, speedy vegetation was imperative because the stream would be quick to swell after the first spring rains and potentially wash away anything that was not snug to the earth.

For quick vegetation establishment, Johns selected a hydraulic erosion-control product that is made with mechanically processed straw fibers, reclaimed cotton plant material, and performance-enhancing tackifiers that form a protective layer that holds soil in place. Mixed with a range of seven different native grass seed varieties, as dictated by the North Carolina Department of Environment and Natural Resources, Division of Water Quality, it was applied at a rate of 2,000 to 2,500 pounds per acre to the streambanks and the MSE retaining wall—a "living wall" constructed near the fire station **(Photos 6 & 7)** to stabilize the bank and designed to eventually blend into the surrounding landscape.

"One of the most important goals of this project was to be sure the native grasses and plants successfully germinated," said Johns. "And even though we had taken additional precautions to prevent erosion, [this] was an added security blanket because it also prevents erosion."

Results

The new floodplain, adjacent to the stream channel, was graded as flat as possible to maximize flow dispersion during high rain-event, bankfull flows.

"The new stream channel was created taking into account the higher volumetric flow rates, velocities, and shear forces associated with an urban watershed, as compared to an undeveloped watershed," said Johns. "It now allows flood flows to reach the floodplain faster in order to reduce shear stress in the channel and slow velocities throughout the reach."

The restoration project, with a blend of native grasses and spot-on biodegradable erosion-control materials working on its behalf, was regularly watered by seasonal spring rainfall and began to germinate within two weeks. A month later, a healthy stand was apparent, and two months later, 18-24in. grasses covered the Clyde streambank **(Photos 1 & 8)**.

"In February, not even a week after it had been sprayed, we experienced significant snowfall," said Johns **(Photo 9)**. "We wondered what effect the freezing temperatures and snowmelt would have on the newly applied product, but there were no adverse effects, no loss of product, and the vegetation continued to grow healthy and strong."

Johns insisted that installing this mix of products, each with a specific purpose for this project, created a system that provided excellent erosion prevention while establishing a stand of native vegetation at the same time.

"Equally as important," he added, "is that none leaves a carbon footprint—only a stable, functional, and safe environment for the town of Clyde." G

Photos 6 & 7 | A geosynthetically-reinforced MSE slope stabilized the creekbank adjacent to the Clyde Fire Station.

Photo 8 | The stabilized creekbank was designed to eventually blend into the surrounding landscape.

Photo 9 | Even after a February snowfall, "there were no adverse effects, no loss of product, and the vegetation continued to grow healthy and strong".

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