

Banking on Natural Fibers

by Greg Northcutt

WHEN White Creek Mitigation, LLC, embarked on a large scale stream restoration project, their environmental consulting firm, Register-Nelson, Inc. of McDonough, GA, designed an approach involving natural stream restoration techniques. The design to restore and stabilize the degraded rural stream featured dimensions similar to a nearby existing stable stream. After construction it was overlaid with natural fiber stabilization materials.

The project combined stream stabilization principles developed by noted hydrologist Dave Rosgen with erosion control products made from environmentally-friendly coir and jute fibers. The jute fiber product used on portions of this project is designed for short-term applications on moderate slopes with lower stormwater runoff velocities. Coir fibers, derived from coconut husks, provide strength and durability for moderate-term (< 3 years) applications, and were used to control erosion on steeper slopes and higher flow velocity areas.

The banking process

The solution was approved by the U.S. Army Corps of Engineers as a commercial stream mitigation bank before the restoration work began in May, 2006. One purpose of this project is to generate stream mitigation bank credits, which are available for sale. These stream mitigation credits can be used as compensatory mitigation to satisfy mitigation needs under the requirements of Section 404 of the Clean Water Act.

The three-month long restoration project was completed in August, 2006. This winter, while planting conditions are more favorable, native trees and shrubs are being installed. They are being planted along the streambanks and in the riparian corridors paralleling the restored streams to establish a native bottomland hardwood community and stream habitat typical of streams found in undeveloped portions of this Piedmont region.

Completion of the stream restoration work marked the beginning of a monitoring term to earn final acceptance of the



Restoration of White Creek meant re-creating the rural streams natural meandering type of channel (above) and adding pools, boulders and other features for fish habitat while installing natural fiber products, like coir erosion control blankets, to stabilize the streambanks (below).

restored stream by the U.S. Army Corps of Engineers. Register-Nelson will monitor the stability and ecological benefits of the site and will report to the Corps annually over the next seven years.

Rebuilding the stream

The restored stream, located on a former dairy farm, drains a 1.8 square mile watershed in a rural area southwest

of Atlanta. "Livestock activity in and near the stream over the years had left it highly degraded," says Mark Nelson, a partner in the consulting firm. "Given that the streams and riparian corridors were highly degraded, and that the site was in close proximity to fast-growing Atlanta, the site is in a prime place to establish a stream mitigation bank."

The project involved the restoration



of about one-half mile of White Creek and more than 1,000 ft. of three other smaller tributaries. The original meandering stream was channelized and straightened as part of previous farming operations. Over time, the channel became even more degraded and unstable. Nelson's crew relocated the stream into a meandering channel. Heavy machinery, including excavators and front-end loaders, were used to produce a "C"-type stream based on the Rosgen stream classification system. Characteristics of a "C"-type stream include a meandering channel, with a slope of two percent or less and a series of riffles and pools.

After creating the new, stable channel for White Creek, Nelson and his crew installed riffles, log vanes, and other habitat and stabilization structures at various locations along the stream and the tributaries. These habitat and stabilization structures, made of cedar logs and boulders, are designed to reduce scour energies on the outside bends of the meandering stream. Along with strategically placed boulders, they provide habitat for native warm-water fishes.

Reinforcing the slope toes

To further protect the newly-formed stream channels and banks from erosive base and flood flows, the company installed woven coir erosion control blankets, coir logs and coir wattles made by RoLanka International, Inc. These durable, natural and biodegradable products can be used in a variety of bio-engineered stream bank restoration projects. When installed properly, they provide the initial soil protection needed to control erosion until mature vegetation becomes established to hold soil in place.

Log-like rolls of coir were anchored along the outer bends of the stream to assist in protecting the structural stability of the earthen banks from the expected erosive stream flow velocities. This product, BioD-Roll, is made from coir fiber that is densely packed into a tubular outer netting, with 2-in. x 2-in. openings, made of coir twine.

The 12-in diameter, 10-ft. long coir rolls used on this project have a density of 9 lb./cu. ft. They are designed to resist erosion and support establishment of vegetation for about five years or longer.



One type of woven coir erosion control blanket, designed to protect soil from higher flow velocities, was installed in the stream channel. A coir blanket with a more open weave was placed higher up the stream banks where stream flows are likely to be slower.

"The coir rolls help absorb and deflect the flow energies, especially on the outside meander bends, and assist in protecting the stream banks from eroding," Nelson says.

In time, sediment will be deposited around these rolls, to support growth of riparian vegetation.

Protecting the channel and side slopes

Two types of degradable erosion control blankets were used to control erosion of the restored stream bed and banks. The blankets are woven from machine-twisted bristle coir twine and have a functional life of about four to six years. The open-weave construction allows vegetation to grow up through the openings in the blankets. It also allows trees and shrubs to be planted through the mat without cutting it and reducing its strength.

The BioD-Mat 70 blanket was installed in the stream channel where erosive forces typically are higher than on the streambanks. This blanket is recommended for slopes as steep as 1:1 and for short-term flow velocities as high as 12 ft./sec. "The mat also collects sand, silt and pebbles that the stream carries naturally," Nelson said. "The sediments cling to or are trapped in the voids in the mat and assist in creating habitat for macro-invertebrates."

The lighter weight, less-densely woven BioD-Mat 40 product was used to protect the area of the streambanks and flood prone areas above the active channel. It is recommended for slopes of 2:1 or less and flow velocities up to 8 ft./sec. "Because of the expected lower flow velocities in these higher areas compared to the active channel, these higher areas can be stabilized with a lighter-weave mat," Nelson says.

The disturbed areas above the active channel and flood prone areas were covered with Jute Mat. Woven from biodegradable spun jute yarns, it is designed to provide protection for about six months.

Earthwork activities

The earthwork included construction of the new active channel where higher velocities would generally be contained. Flood prone areas were created and tapered upgradient to natural ground. Earthwork was done in this taper area between flood prone and natural ground. "The jute fabric was used to protect the disturbed "non-flow" areas from rainfall and surficial runoff erosion and to assist in establishing herbaceous ground cover," Nelson says.

The project also involved the installation of 12-in diameter, 10-ft. long

BioD-Watt coir wattles. They were laid horizontally on the longer stream bank slopes to slow runoff velocities and collect suspended sediment before it washes into the stream. The wattles are made from cleaned mattress coir fiber that is uniformly and lightly packed into a high-strength bristle coir fiber netting which has 2-in. x 2-in. openings. Wattles allow runoff to pass through while trapping any sediment.

After protecting all disturbed areas with the blankets, they were seeded with millet to help temporarily control erosion. "The millet germinated well and produced a nice, uniform stand," Nelson notes. This winter, bare root native mast trees, including oak and hickory, and fruiting shrubs, like elderberry and dogwood, are being planted through the coir and jute blankets to assist in providing permanent stabilization, erosion control, and shading.

Monitoring-Maintenance Process

"Initial performance of the White Creek project has met expectations", Nelson reports.



Not long after construction was completed, this stand of grass is helping to control erosion.

In the month directly after completion of the restoration and installation of the jute and coir products, the local watershed experienced a series of significant storm events, including some with up to about 2.5-in. of rainfall. "The stream remains stable and there has been no erosion," he says.

Register-Nelson will continue to monitor the project over the next seven years following Corps of Engineers' procedures. This will include comparing the longitudinal and cross sectional profiles of the streams at selected points with the original measurements to detect any change in stability. "This information will

be compared to a nearby reference stream to determine how other factors, such as drought or unusually heavy storms, might be affecting the stream's stability. The monitoring will also include annual checks of growth and establishment of vegetation and the fish and macro invertebrate populations and habitats.

"We anticipate that we will need some follow-up maintenance through at least the first year after construction and applying flowing water to the newly restored channel," Nelson says. "If there are any problems, we'll fix them right away." **L&W**

Assuming all goes as planned, this reach of White Creek will improve in ecological function and value and provide suitable habitat for a diversity of species for years to come. More information about mitigation banking, stream restoration, and use of the coir and jute products is available at www.RegisterNelson.com and www.WhiteCreekMitBank.com.

For more information, visit www.rolanka.com.



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