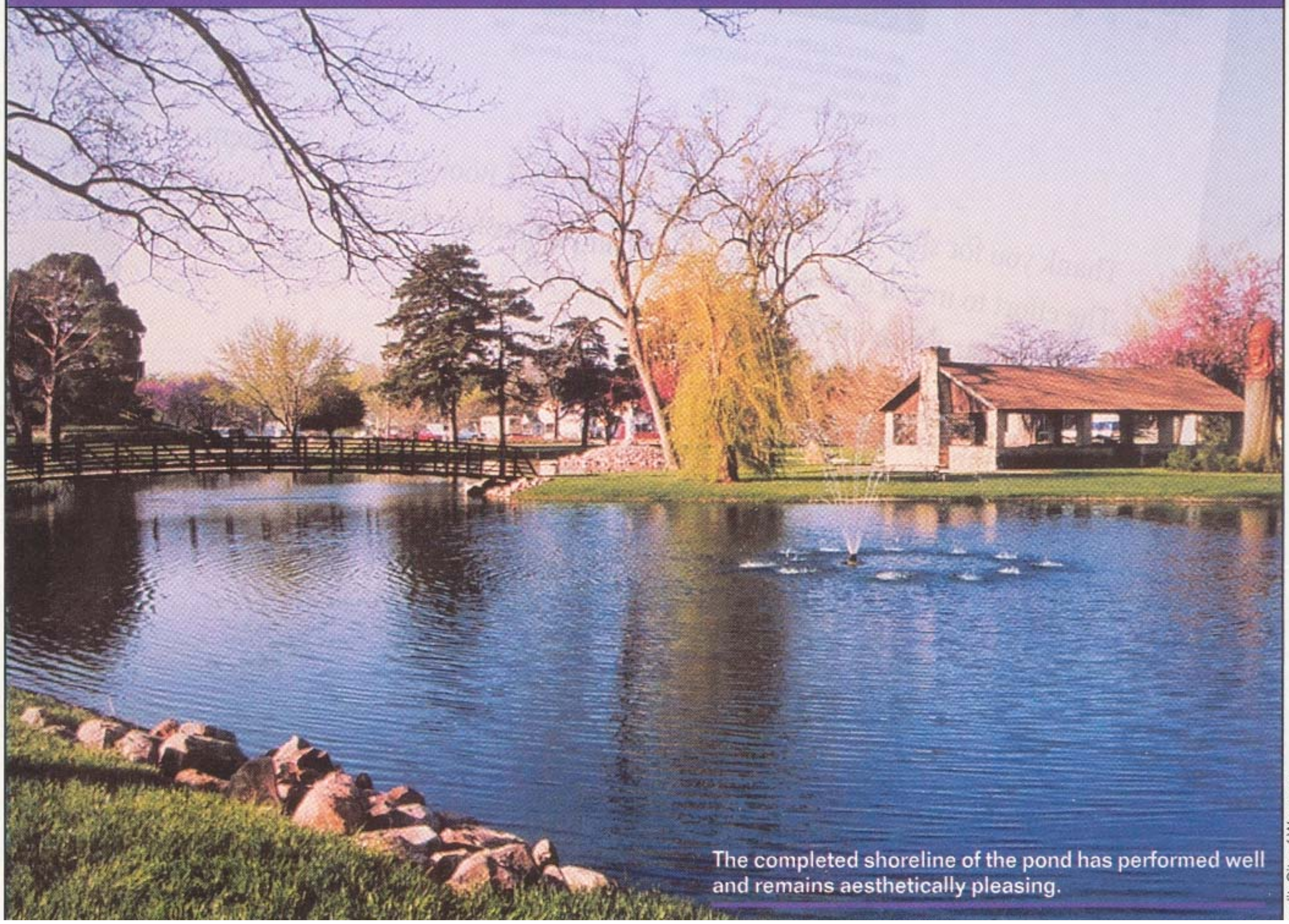
CONFINEMENT SYSTEM OFFERS STABILIZING OPTIONS FOR

Shoreline Restoration



The completed shoreline of the pond has performed well and remains aesthetically pleasing.

Credit: City of Wamego

Wamego, a community in Northeast Kansas, is a self-proclaimed "friendly town where trees are taller than buildings." Wamego's 4,000 residents are proud of their small town look. The city's focal point, the City Park, includes several historic buildings, a rebuilt Dutch windmill, and a one-acre fish-shaped pond complete with an island strategically placed as the fish's eye.

Morris Crisler, John Warren, CPESC, and Patricia Stelter

Mr. Crisler is City Park Supervisor, Wamego, Kansas; Mr. Warren is Erosion & Sediment Control Specialist, ASP Enterprises, Inc., Lee's Summit, Missouri; and Ms. Stelter is Media Manager, Presto Products Company, A Business of Alcoa, Appleton, Wisconsin.

Years of sediment buildup from shoreline erosion, however, had caused the once beautiful focal point to become an eyesore of muddy, stagnant water. The town was challenged with having to restore the pond to its original state while including measures to protect against recurring erosion and sediment problems.

City Park Supervisor Morris Crisler points out that warm winters had attracted several hundred migrating geese to the pond, also contributing to erosion problems. Historically, abundant red, glaciated quartzite rock had been used throughout the park and generously around the shoreline.

Ultimately, the pond had deteriorated to the point where a large portion of the shoreline rock had eroded into the pond, causing an invasion of grasses and weeds requiring weekly weed trimming along the entire shoreline.

After meeting with geosynthetics' supplier John Warren of ASP Enterprises, Inc. (Lee's Summit, Missouri), the city was convinced the pond would be even more aesthetically pleasing after the restoration and was ready to move ahead with a plan.

"The shoreline was so degraded that once this natural solution was presented, other considerations were eliminated", says Crisler.

THE SOLUTION

The plan to restore and protect the 1,350 ft of shoreline from erosion involved a combination of geosynthetic materials: Presto Products' (Appleton, Wisconsin) perforated Geoweb® (geocell) cellular confinement system and a non-woven geotextile. Warren and Crisler collaborated on a design that included both vegetation and concrete protection.

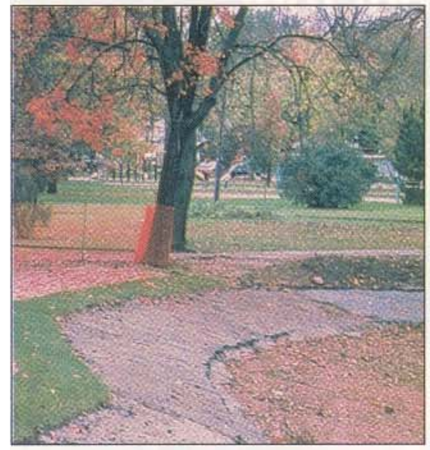
"Concrete was designated for the Geoweb system's lower half exposed to water contact to provide a hard-armored lining system and to prevent infill washout. Topsoil and turf were planned for the upper half to maintain the green aesthetics of the shore-line," explains Warren.

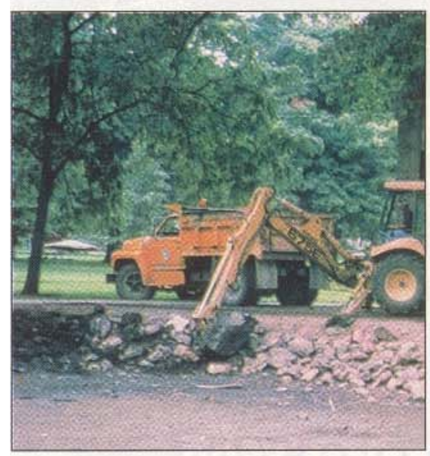
Confining the two infill types in the perforated cellular structure had distinct benefits. Concrete infill within the cells produces a durable lining system of uniform thickness, resistant to infill washout and the erosive effects from water contact. The geocell sections act as lightweight, flexible forms with built-in expansion joints. When filled with concrete, the system retains flexibility and conforms to potential subgrade movement without loss of integrity. The cell wall perforations in this case allowed concrete to flow from cell to cell, creating greater infill lock-up in the system's cells. The geotextile underlayment provided a separation layer between the subsoil and concrete infill.

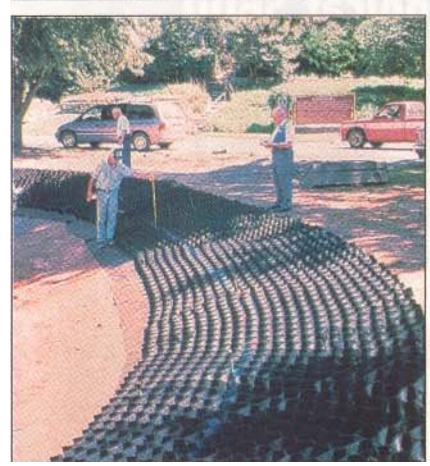
The cellular system confines, rein-forces, and restrains the vegetated layer. It also controls downslope movement due to hydrodynamic and gravitational forces and prevents the formation of rills and gullies. Cell wall perforations also provide better lock-up of the root masses for a more stable vegetated system.

Photos top to bottom:

1) **The stabilized shoreline is infilled with vegetation in the upper portion and concrete in the lower portion exposed to water contact.**
2) **Years of sediment buildup and erosion had made the city pond an eyesore.**
3) **The pond was drained and dredged, removing sediment and large amounts of accumulated rock.**
4) **The Geoweb shoreline protection system was expanded and positioned longitudinally on the perimeter slopes.**







SYSTEM BENEFITS

• The system stabilizes topsoil, reducing suspended solids and improving water quality.

• The system reduces maintenance, allowing workers to mow up to the water's edge without the additional use of weed trimmers.

• The concrete's uniform, rough surface increases safety for the maintenance crew.

• The concrete-filled system minimizes shoreline damage by geese, muskrats, and other destructive wildlife.

• The system allows aquatic plant control.

INSTALLATION PROCESS

Installation began with dredging the pond with a backhoe, removing large amounts of red quartzite rock. The bottom and side slopes of the pond were graded and readied for placement of the shoreline protection materials.

Twelve-ft wide, four-ounce non-woven geotextile sections were cut in half to form six-ft wide sections and placed around the shoreline perimeter. Two wooden, notched two-by-fours were used as templates to mark the placement of geocell anchor stakes in both the horizontal and vertical direction on the slope.

Geocell sections, eight ft by 20 ft by four in. were expanded and laid lon-gitudinally on the slope. The geocell material was positioned such that only the lower half planned for concrete infill was

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placed over the geotextile. This geotextile underlayer would act as a separation layer, keeping the cells free from the base materials during the concrete infill process.

"A geotextile underlayer is not typically required beneath the vege-tated area," explains Warren. "How-ever, it can provide a more secure system with steep slopes or in areas with higher flows."

The geocell sections were secured with the anchors and connected with a pneumatic stapler. Once the high and low water levels were determined, a string line was used to delineate the separation between the concrete and topsoil fills.

The infill process began with placing concrete in the lower section and raking the concrete flush with the top of the cell walls.

"The concrete infill was placed to six in. above the high water line and six in. below the expected low water line," explains Warren. "It's important to get the elevations and proper grade correct."

The majority of the concrete infill was obtained from excess concrete that was donated locally. "To save money on this project, 90 percent of the concrete came from a local cement contractor's left over residue-and in a variety of mixes. It was a challenge to have the area pre-pared for whatever mix was to come in that day. Over the course of eight to 10 weeks, concrete was delivered in varying quantities-from a yard-and-a-half to as much as seven yards at a time," explains Crisler.

After the concrete was cured, topsoil was added in the upper portion and raked in the same manner as the concrete and then seeded. An in-house irrigation system was also installed around the vegetated areas.

Selected quartzite boulders were salvaged, cleaned, and placed back within the system's concrete fill, in specific locations, creating an attractive rock shoreline effect.

"Preserving and incorporating a portion of the red quartzite rock was historically important," says Crisler, "but this involved a bit of labor-intensive effort." Portions of the geocell sections were cut out to accommodate the boulders that were mortared in by hand.

Other geocell sections were left void of concrete in lower, underwater areas, allowing cattails and other natural water plants to be established in desired areas. Various algae are growing over the concrete sections and have added a more natural color to the concrete.

THE RESULTS

With the use of the geocell shoreline stabilization system, local park labor, and concrete donations by Midwest Concrete Materials, the local concrete plant, Wamego was able to cost-effectively restore its city pond to a condition that was both functional and more attractive than the original shoreline.

Crisler comments on the project since its completion: "We have no regrets that we invested in the materials and the labor. We have had no other erosion problems since we stabilized the shoreline. If I could add a `lessons learned,' I would note that if we were to do it again, we would be more careful with shooting grade. Because of equipment limitations and undulations in the shoreline causing variations in the water level around the perimeter, some of the concrete is exposed above the high water level. This actually works to an advantage on windy days, however, when the water laps against the concrete instead of the grass, helping to control any shoreline erosion. in all, it's been a very successful project. **PW**