

Innovative Channel Protection Systems

City of Tucson

The deserts and arid mountains of the Southwestern United States display rainfall patterns characteristic of such deserts around the world. Rains are infrequent, but, when they occur, they are often very intense. Of course, these sudden deluges of water do a great deal more erosion damage than the same quantity of water would do if spread over a longer period of time.

Cities located in these “flash flood” regions must invest considerable time and resources in developing networks of storm water channels which can handle these high velocity floods. Though completely dry most of the time, a heavy seasonal rain can create flood water flows of 10 to 15 feet per second (fps) in the space of an hour.

Traditional methods of armoring these channels range from poured concrete liners or rock filled gabion baskets, to loose rock or riprap - options not considered aesthetically pleasing additions to most residential communities or downtown developments. City of Tucson engineers found a superior solution.

Rose Hill Wash

City Engineers were tasked with upgrading a channel which serviced an established residential neighborhood to enable it to handle occasional 10 to 15 fps velocity flows after their seasonal brief storms. The existing channel was under capacity and had eroded badly. Sensitive to the community desire for a more natural and attractive solution than riprap or gabions, engineers began to review vegetated systems and discovered the GEOWEB® Cellular Confinement System, manufactured by Presto Products Company.

The GEOWEB product is a honeycomb-like structure made of HDPE plastic which is expanded, staked in place and the cells infilled with specified materials. The possibilities were clear: using GEOWEB, a large rock infill could be used to provide resistance to high velocity flows, and that same rock could then be covered with a layer of topsoil or “dressed” and hydroseeded with native grasses.

Since the City Engineers had no previous experience with this technology, they decided on a staged implementation. They developed a design using gabion baskets to line the “pilot” channel (a large part of which was below grade) and used the GEOWEB Cellular Confinement System to both line and vegetate the more visible slopes above the central channel.

The design was an unqualified success. High velocity water erosion was controlled, and the slopes vegetated completely. In fact, all signs of the GEOWEB installation disappeared under the vegetation just as the designers had hoped they would. The natural look achieved at Rose Hill Wash encouraged City of Tucson engineering staff to evaluate the possibility of employing the GEOWEB product more aggressively and at larger scale on another project with similar design criteria. A second project, this one at 22nd St and Osborne Ave, presented them with exactly that opportunity.



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22 Street and Osborne Ave

When the City of Tucson found it necessary to increase the capacity of a downtown storm water drainage channel between 22nd Street and Osborne Avenue, they contracted with Cella-Barr Associates, a prominent local engineering firm, to evaluate the hydraulics and develop a design which would be able to handle 100-Year storm events. The channel was to be trapezoidal with side slopes as steep as 1.5 :1 and base varying from 17' to 40' wide. At water depths of up to 8', the channel could be expected to see serious hydraulic challenges. In addition, the channel liner was to be permeable (i.e., the water must be able to percolate through the sides and bottom of the channel naturally).

Cella-Barr determined that a vegetated channel meeting those specifications could be constructed using the GEOWEB[®] Cellular Confinement System, manufactured by Presto Products Company, with large rock infill. The design would be similar to that of the Rose Hill Wash project, in that a soil dressing would be used, but it would differ in that heavier rock, stronger tendons and a higher density of anchors would be used to meet design requirements. The fact that various sizes and depths of GEOWEB sections are available make the system versatile - equally able to meet the City's light duty bank protection requirements at Rose Hill Wash and the more extreme challenges at 22nd and Osborne where the GEOWEB System was used to protect the channel as well as the banks.



With preliminary design assistance provided by Presto Products Company, Cella-Barr developed a design incorporating drop structures which minimized channel slope and reduced velocities, enabling the use of a flexible lining system for a 100-Year design and anticipated peak flows of 12 fps. The design featured GEOWEB sections with 16" diameter cells, perforated cell walls, a geotextile underlayer, special UV resistant tendons and heavy angular rock infill with maximum diameter of 8".



The GEOWEB channel liner was crest anchored at the top of the side slopes and a tendon/ATRA[®] stake system anchored it securely to the sides. Tendons were threaded through the factory drilled sections prior to expanding them down the slopes. Once the rock infill was placed, the liner was covered with a topsoil layer and hydroseeded with native grasses.



After 5 years of service without maintenance problems, City of Tucson engineers are pleased with their decision to switch from stark concrete and wire systems to GEOWEB channel liners. The GEOWEB technology is not only a better looking solution, it is less expensive to maintain. Unlike the old systems which crack and spall or rust and break, requiring ongoing maintenance expenses, the GEOWEB system is chemically inert and unaffected by damaging environmental factors that tend to rapidly age the older and less durable technologies. Switching to GEOWEB was a smart move for the City and a much more appropriate way to handle flash flooding requirements for these neighborhoods.



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