



Gabions being used as a headwall.

Gabions - Their Applications on the Golf Course

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EROSION IS a basic part of nature, and indications are that the forces that tear down and build up are not tired yet. One of these forces that we in the golf course business have to deal with is that of water and resultant erosion. Creek, pond, stream, or wave erosion affect almost all of us at some time.

Erosion caused by running water can be extremely devastating. These problems become magnified in areas of increasing population. Water runoff increases each time houses, roads, and parking lots are built. Runoff causes quiet little brooks to become raging torrents and placid creeks to act like bulldozers as they tear away the soil.

We who are within the influence of streams and rivers tend to become concerned when the rain starts coming down hard.

Our golf course, like so many others, contains some land that is not suitable for housing or farming. Forty-eight of 180 acres are in a flood plain. Winters Run, a major stream, meanders through the course, giving it character, beauty, floods, erosion, and silt. The last named items caused us to look for protection from water damage early in the club's history. It is interesting to note that from 1972 through 1979 we experienced at least five "100-year floods." Floods of this magnitude, statistically speaking, are only supposed to happen once every

100 years. Unfortunately, Winters Run does not understand such definitions and will probably flood a few more times in our lives.

Many ideas have been proposed to prevent creek bank erosion. Vegetation, logs, rip-rap, railroad ties, concrete, and steel sheet piling have been used with varying degrees of success and/or failure. In our case, we decided that rip-rap would protect our eroding creek banks most effectively and at minimal cost. After finding local stone (at no cost), we spent \$5,000 to haul and place it along 300 feet of bank. The next "100-year storm" scattered most of our work down the stream, leaving just a few of the very largest rocks in place.



First gabions on the upper course (summer).

Re-evaluation showed us that our banks would best be protected through the use of gabions.

Gabions may be traced back to Roman times, when they were used primarily in warfare. The term gabion means "a large basket, sometimes wickerwork . . . or iron, filled with earth or stones to create a battlement or sunk in water to form a bar or dike . . ." Modern gabions fit this definition perfectly except that they are rarely used in war. Today's gabions come in a variety of sizes, and all are made of either heavily galvanized or PVC-coated wire. The basic size used in this country is 3 feet high by 3 feet wide by either 6, 9, or 12 feet long. Variations include baskets that are 1½ feet high, all other dimensions similar, and mattresses which are 1 foot thick by 6½ feet wide by either 8, 10, or 12 feet long. Galvanized wire is recommended for all applications except where the baskets will be exposed to salt water or water with a pH considerably different from 7.

THE GABION principle, where applied to water control and not warfare, embodies two things which make it unique and thus quite advantageous — flexibility and porosity. Because the gabion baskets are filled with 4" to 7" stone and laced shut, they are capable of bending, should the need arise. Also, since they are filled with rather large stone, the voids are numerous. These allow water to pass through, but not with great speed or force.

In the majority of cases, hydrostatic pressure is the downfall of stream bank protection systems. How many times have we seen walls made of rigid material, such as railroad ties or concrete, falling over into the very stream they were built to protect against? This is not a case of the force of the stream pushing the wall down, but rather that of water buildup behind the wall pushing it into the stream. It can be embarrassing to build a mighty defense against one force only to have it succumb to another.

Because of the voids between the stones, gabions do not allow any hydrostatic pressure buildup. In the case of our stream, it tends to flood quickly and then rapidly drop back to normal levels. This leaves the banks in a super-saturated condition. In other words, there is a lot of water left in the soil of the stream banks. It wants to hurry back to join the stream itself and will stop at nothing to get there. Gabions allow this drainage to occur rapidly and so prevent any pressure buildup. Additionally, the porosity of the structures keeps them from being subjected to heaving or other frost damage.

In protecting stream banks, two things should be considered. The slumping of earth from the sides of the banks into the water must be stopped. Also, the scouring action of the water along the base of the banks must be arrested. In many cases this scouring action does most of the damage.

Gabion mattresses, usually 12 to 18 inches thick, are used with great success

as both a base for upper courses and as a scouring protector. Because of their great flexibility, these mattresses bend if water erodes the underlying soil. When they do this they interrupt the erosion process. Mattresses may also be used on sloping banks and as linings for stream bottoms.

The 3 foot by 3 foot by 6, 9, or 12 foot long baskets are used on top of the previously mentioned mattress. They both protect the bank from water and the upper courses may be used as retaining walls.

GABIONS ARE shipped assembled but folded up. In the field they must be unfolded, and the corners and individual cells are laced together using wire provided. After being built, they are moved into position and wired to any adjacent baskets. This wiring creates a monolithic type of structure out of individual blocks. When this step is completed, the basket is filled with 4-inch to 7-inch stones. These may be placed by hand or carefully loaded by machine. The more hand work done in placing stone within the basket the neater the overall job will be. When the basket is filled, the lid is folded down and wired shut. Gabion construction progresses in a similar manner to concrete block work. The difference between the two is that, with gabions, the completed blocks are as large as four cubic yards and weigh as much as six tons apiece.

Because of the simplicity of assembly, these structures do not require the expertise of outside labor. Once the decision has been made to use gabions and the design work is finished, normal golf course crews should have no trouble doing a fine job. In many instances the work can be carried out in stages. The job can be started during a slack work time, then finished later on. In our case, we usually can do the mattress work in July and August when cool-season grasses are not growing much and when it is pleasant to be in the creek — then come back and complete the upper courses after the usual fall work is done.

Although in this article we have concentrated on stream bank protection, keep in mind that gabions may also be used as retaining walls, dams (weirs), channel linings, and on gradually sloping banks. They can be used to arrest wave erosion on seashores and to prevent bank deterioration in ponds due to burrowing animals or the like.

We have successfully used these structures as outfall basins for storm drains, abutments for bridges, and head

walls for culverts, as well as the normal applications. Currently we are thinking of putting a gabion retaining wall on a steep slope to create a terrace that will support a needed golf cart path. Before starting that, we have to get back in the creek and install some 600 feet of gabion mattress in order to protect a fairway that is eroding yearly, due to scouring at the base of the bank.

GABION COSTS will vary depending on distance from a manufacturing and distribution point and the price of large stone delivered to the job site. Our costs do not usually exceed \$100 per cubic yard for installed gabions. In most cases this includes any excavation and backfill. We normally use our own backhoe-loader for preparing, lodging baskets, and backfilling. Limited access, great distance from supplies, and lack of equipment will all tend to raise the cost.

In summary, if you have any of the problems outlined here, or anything approaching them, take the time to investigate gabions. Gabions are useful for river training, flood control, and earth control. Consider that they can be constructed with existing labor, can be worked on in stages (and added to years later if need be), cause no hydrostatic pressure problems, are yielding and will bend instead of break, are versatile, and they look quite handsome when finished.

John Drew is superintendent at Winters Run Golf Club, in Bel Air, Maryland. He has been associated with the club since construction began in 1971. After graduating from Salisbury State College with a Bachelor of Science Degree, Drew spent five years in the public education system.



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