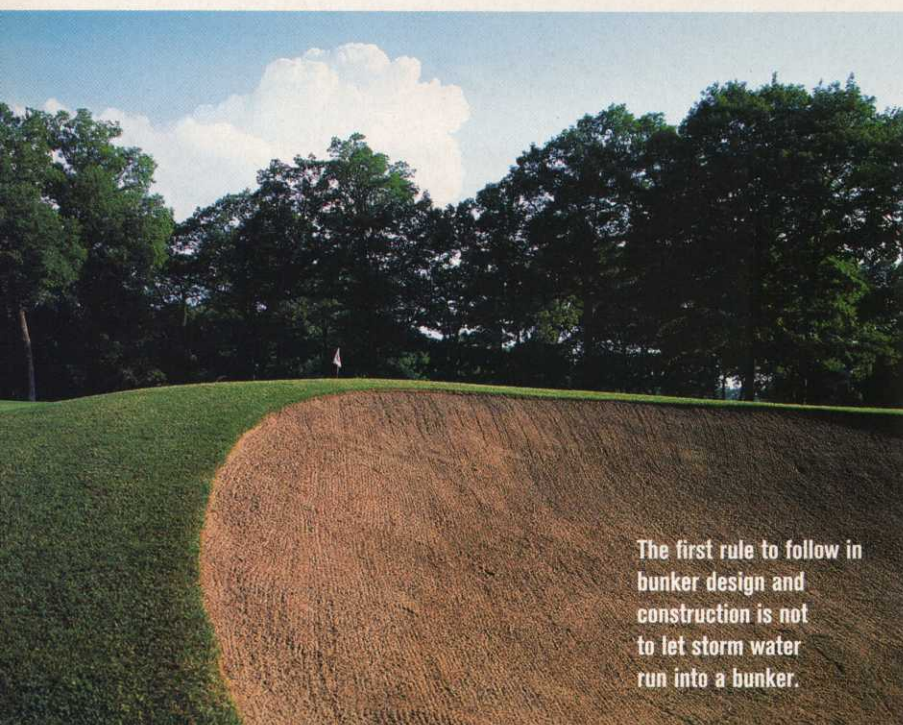


# The Book on Bunkers

These hazards need to be moved up the maintenance priority list



The first rule to follow in bunker design and construction is not to let storm water run into a bunker.

MIKE KLEMM

BY JON SCOTT

**B**unkers are supposed to be bad, right? If golfers don't like them, they should stay out of them. After all, they are hazards. Who says they have to be fair?

Well, for starters, the USGA implies that bunkers should be fair by differentiating them from water hazards. According to the 2003 edition of the USGA Rules of Golf, "A bunker is a hazard consisting of a prepared area of ground, often a hollow, from which turf or soil has been removed or replaced with sand or the like."

There you have it: Bunkers are not water hazards. Water hazards are *supposed* to be bad. Rarely

will a ball skip across the water and out. Landing in the water will cost you at least a full stroke and sometimes two before the ball finds the cup.

On the other hand, even with a partially buried ball in a sand bunker, the golfer has a decent chance to stave off bogey with a well-struck wedge. Ultimately, the degree to which this is possible depends on how well the bunker was constructed and maintained, and whether the person in charge has the right attitude and skills to do so.

There are two main problems that affect how a bunker will play on a golf course. The first is how fast water moves through and out of the sand, and the second is the bunker's degree of soil contamination. Since the first problem is directly related to the second, it makes sense to start with good drainage.

The first rule to follow in bunker design and construction is not to let storm water run into a bunker. All it takes is a little attention to water-flow patterns to shape the subgrade and surface contours so that water is diverted to catch basins instead of flowing down bunker faces carrying sand and soil into the bunker bottoms.

Ideally, no sand would extend vertically up a slope instead of grass. Unfortunately, this doesn't put much excitement into the framework of a golf hole. So whenever sand is flashed up a face, it's critical that water goes somewhere else. Failure to heed this rule will almost certainly lead to erosion and contamination problems.

The next goal is to make sure the subgrade cavity is shaped well for drainage. A common mistake is to construct a subgrade as if it is the

*Continued on page 74*



## The Book on Bunkers

*Continued from page 72*

finished surface, but that usually produces grade slopes that are too shallow for moving water to drains quickly. A good subgrade pitch inside a bunker cavity is around 5 percent.

Once the grade has been established, the proper installation of drain pipe is critical. Whether conventional round pipe or the newer, flat-type drain is used, correct size and spacing will insure that water flows quickly and smoothly out of the cavity. Placement and spacing should be dictated by the rule of not forcing water to flow more than 10 feet in any direction to reach a drain pipe. Just as with greens construction, a "smile" or exit drain at the low point where the drain leaves the cavity should be mandatory, extending as far in either direction as the end of the first laterals from the central mainline.

Four-inch diameter round tile bedded in gravel is most commonly used, but flat pipe is gaining in popularity because of



MIKE KLEMMIE

its efficiency and ease of installation. Flat pipe also requires a narrower trench and allows sand to substitute for gravel in the back-fill. If flat pipe is used, make sure it's at least 6 inches wide and installed according to the manufacturer's guidelines.

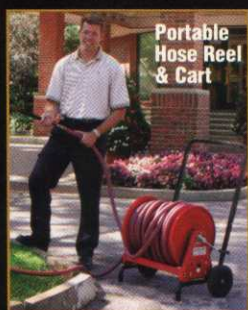
**Once the right sand has been selected, it must be installed at the proper depths and distributed uniformly.**

Round pipe can be a problem if no attention is paid to the sand and gravel particle-size relationship or bridging factor. When this is ignored, sand may migrate into the gravel, eventually clogging up the water flow channels. Any USGA-recommended laboratory can perform a test and issue an opinion on this potential.

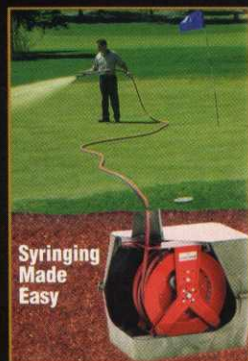
The next step is to decide whether any type of soil sealant or fabric liner is needed to prevent soil or rocks from contaminating the sand from below or on slopes where sand frequently washes down during rainfall. If the answer is yes, there are several types and brands on the market, and each should be investigated carefully to separate the marketing hype from the reality of experience.

Fabric and mesh-type liners are popular because they are self-installed, but the one big drawback is keeping them attached to the subgrade surface in one piece, especially with mechanical raking. Soil binders and coatings are more difficult to install, but have the advantage of not causing the golfer to strain a wrist muscle if the club snags in a fold of material.

Once the bunker cavities have been properly constructed and drained, it's time to look for the proper sand. In spite



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of what you hear from the sand and soil companies, the only way to find the right bunker sand is to start with a proper lab test of your own using a company that knows good bunker sand. While there's no specification for bunker sand in the USGA Green Section Handbook, there is a guideline which can be obtained from [www.usga.org](http://www.usga.org).

Essentially, the criteria for bunker sand is not all that different from greens construction sand, except it tends to favor the coarse-medium fractions instead of the medium-to-fine grades more commonly used for topdressing. In bunkers, finer sands usually do not drain as well, will rapidly contaminate and are easily eroded by wind.

An often-overlooked criterion for sand selection is particle shape, as opposed to color, which is one that gets far too much attention. Sharp, angular sands work well for drainage and firmness, but they also abrade turf when blasted up onto greens

and collars. It's better to look for subangular sands with a good bit of gradation in the coarse-medium zone and enough fines on the other end to remain stable.

On the other hand, color can be important to course designers, television and green committees, but it's not important to good play or long-term performance. While it often becomes the overriding factor in sand selection, selection by color alone almost always ends up being a big mistake.

Once the right sand has been selected, it must be installed at the proper depths and distributed uniformly according to the plan. Too much sand on the faces will almost always produce plugged balls in the slope and under the bunker edge. Remember, this is not supposed to be a water hazard. The golfer should be able to expect a reasonable chance of saving par or getting up and in the hole in two.

Once the bunker project is complete, a great deal of grief and cost can be

avoided with a solid commitment to proper maintenance. This commitment is more than periodic raking and edging. There will be anywhere from 2 to 5 acres of sand to protect.

Bunker sand has a one-way ticket to nowhere through the wind, water erosion, soil contamination and swinging golf clubs. The best that can be hoped for is to keep adequate levels of sand in place, uniformly distributed, and make sure it stays functional for as long as possible.

This takes a lot of work, and it takes a sufficient annual budget line. Unfortunately, the former tends to be affected by the latter when budget priorities are rearranged to meet short-term financial goals. Instead of placing bunkers at the bottom, they need to be moved up the priority list — ahead of roughs, and at least even with the fairways and tees. It could even be argued that bunkers should be placed on a par with greens. Fail to rake

*Continued on page 76*

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## The Book on Bunkers

*Continued from page 75*

a bunker every day, and it starts to get weedy and covered with algae and deteriorates rapidly. Skip regular cultivation and the sand gets compacted and waterlogged. Put off adding sand and the bunker starts to grow stones and dirt chunks, making the surface rough and thin. Stop edging and the bunker begins to shrink to the point of becoming all grass instead of sand. Fail to keep the drains clean and the bunker becomes a swamp.

Quite simply, after construction, the main reason that most bunkers fail to perform is because of poor maintenance. Once this occurs, bunkers become costly and time-consuming to renovate.

Here are some maintenance tips from the PGA TOUR that will help give bunkers a long life and good performance:

- Periodically probe bunker cavities for proper depth and uniformity and either shift or add sand as required to meet the established guidelines. As much as 2 inches of sand can be lost per year to various types of erosion. Remember, a bunker without sand is not a sand bunker anymore.

- Check and clean out drains when cavities begin holding water. This can be as simple as putting fresh sand over the pipe or as complicated as digging up the pipe and resetting or replacing it. It's a lot easier to fix a drain than it is to replace all the sand.

- Maintain good edge definition but don't overexcavate. It's important to delineate the hazard boundary, but it can be overdone.

Exposed dirt edges bleed soil and stones down into the sand, causing contamination and ultimately drainage failure. Trim the grass, not the sod. It has to be done more often this way, but the soil will stay where it is supposed to stay, supporting the turf above it.

- Cultivate the sand regularly, either by mechanical raking with spikes or by hand with steel rakes. In extreme cases, like with the coral sand of Hawaii, it might take a rototiller. Failure to include this in a maintenance program will usually produce concrete hardness in the bottoms and the consistency of sugar on the sides.

- When raking with a powered machine, make sure to use an experienced operator. Raking should be slow and methodical. Bad operators ruin more bunkers by raking too close to the edge. This activity picks up stones, brings in dirt, and wrecks edges. All edges should be raked by hand with lightweight rakes, preferably from the inside of the bunker.

Once again, remember that bunkers are not water hazards. Players who hit their balls in bunkers should have a reasonable opportunity to make par.

If bunkers are supposed to be more of a penalty to an errant shot, why not use water instead? Because golf would be boring without bunkers. Golfers like the anticipation and thrill that come with a well-struck sand shot. ■

*Scott is vice president of agronomy for the PGA Tour.*

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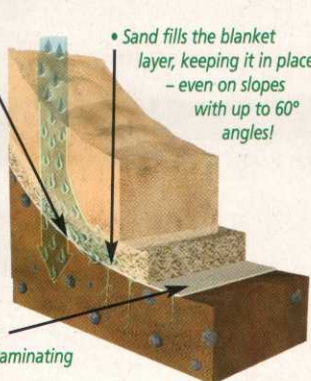
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"I have always been besieged by problems of retaining sand on bunker faces and soil particles being washed into the sand from a heavy rain during my over 30 years as a Golf Course Architect. In a recent bunker renovation project at Fox Run CC, we installed TrapMaster™ bunker erosion and contamination control fabric. I was quite skeptical that it would be of value, but after a recent 4" downpour, all of the old bunkers were completely washed out, and the renovated bunkers that were lined with TrapMaster™, were virtually unaffected! The owner, golf course superintendent, and myself could only say "amazing". I can assure you that TrapMaster™ will be included in all my future bunker constructions.

**Gary Kern**  
Golf Course Architect



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