

bunker location, and certain players did not feel enough sand was visible from the tee. The bunker caught most well-placed drives, and the ball would be buried. Needless to say, the Superintendent's next project was to investigate possible sands for eliminating this problem. We knew coarse sands would be the solution, and many mixes were tested, including a special 1 mm mix. (This was not an acceptable sand for play.) Finally, a mix was chosen, and in the last 3 years we have utilized it in 6 new fairway bunkers. The mix contains #1 mason sand, spec. between .25mm and .84mm.

Bunker consistency varies with moisture content, and the membership desired the fairway bunkers to be firm. In fact, the feeling was that fairway bunker maintenance should be totally different from that of green bunkers in terms of frequency of raking and depth of raking. We experimented with the mechanical rake using 2 rows of teeth, 1 row of teeth, and no teeth at all. Also, we looked at shallow raking vs. deep raking. This relationship between raking and firmness sparked the idea of smoothing rather than raking with teeth or combs. We have investigated dragging rubber mats, nylon nets, rubber hoses (different sizes and shapes) filled with sand, and replacing the combs on the mechanical rake with smooth steel of different weights and at different angles. All of these attempts turned out to have drawbacks. We have not tried replacing the combs with soft rubber rollers. Hand raking has its positive and negative aspects also, and perhaps a combination of mechanical and hand raking is the answer. Raking, then watering a bunker, leaves a very desirable playing surface for a period of time.

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When one discusses bunker maintenance procedures, it is assumed that the sand is uniform and clean. Consistency cannot be maintained if soil/silt contamination has occurred, and simply adding sand does not solve the problem. Complete removal of old sand, checking and repairing/replacing drain tiles and replenishing the bunker with fresh

sand is the only answer. Unique equipment is at our disposal whether hired or rented. Machines called **Grade-all** or **Cruz-Aire** are 4-wheel drive hoes which can be very productive during the winter months. Frost in the ground prevents turf damage, and snow does not hinder performance. The bucket reach of 30' allows most bunkers to be cleaned from one location outside the bunker. This reach also facilitates loading of trucks, an important part of the operation. This is definitely a winter project, which flows well with hauling fresh sand into the bunker. The key is to grade the sand as soon as possible so it will not freeze. At Blue Mound, this has become the primary method of

bunker reconstruction. We can remain within the original architectural design, while reshaping where necessary and updating sand texture and drainage.

To sum up, quality bunker construction involves many aspects, and requires first hand inspection during all phases of the project. The membership can only be pleased if the bunker is neat, with defined edges and is noticeable. Since this is just one more hazard, praise and thanks cannot be expected. Most golfers will never land in a bunker that they like, so our satisfaction must be in the proper design, construction, and maintenance of a hazard which is always a controversial topic.

SAND BUNKER RENOVATION

By Larry Lennert

Maintaining high quality playing conditions in a hazard seems more than a little bit ironic to me, but it is an irony all of us must face with sand bunker maintenance. The high level of playability we all seek cannot be maintained indefinitely with just the standard maintenance techniques of raking and edging. Sooner or later, sand bunkers need to be renovated.

Sand bunker renovation is a continuous process at North Shore Golf Club at Menasha and we renovate several of our 34 bunkers each year.

The first step in the renovation process is deciding which bunkers, if any, need renovation. Bunkers that hold water after a rain or have low quality playing conditions are good candidates. Once you have decided which bunkers need renovation, work can begin.

First, remove **all** of the old sand from the bunker. This is often the most important step in sand bunker renovation. Just adding new sand to a bunker filled with contaminated sand will not improve drainage and may actually reduce playability by building up excessive sand depths over time. This practice is nothing but a temporary fix and a waste of new sand. In the long run it has the same ef-

fect as throwing a pair of clean socks into a washer full of dirty clothes. The presence of only 5 percent silt and 3 percent clay in a sand can reduce drainage.

To remove the old sand we use a front-end loader and load the sand into one ton, dual wheel dump trucks. Most of the old sand can be removed this way. The rest of the sand is shoveled by hand into Cushman's. We have often found that just removing the old sand and replacing it with new, clean sand eliminates many of our drainage problems.

Next, check the drainage system. Replace or repair it if necessary or install one if none was there before. We use plastic drain tile and cover it with a nylon "sock" to keep sand from filling the tile. After the tile is in place we cover it with ¾ inch gravel to keep the drainage channel open and the drain tile in place. Surface drainage is also examined to make sure large amounts of water are not flowing through the bunker during heavy rains. If this is the case, we use surface contouring, where possible, to divert water away from the bunker.

After the drainage work is completed, the bottom of the bunker is shaped using a box scraper, a power rake and hand labor. The edges of the bunker are hand dug

to a depth of about one foot.

When shaping and edging are finished, the bunker is ready to be filled with new, clean sand. We use sand that meets USGA particle size guidelines (0.25 to 1 millimeter). The playability of sand is determined, to a large extent, by its particle size. Sand that is on average larger or smaller than the USGA guidelines will have a lower quality of playability and is harder to maintain.

We haul the new, clean sand to the bunker using the same one ton, dual wheel dump trucks we hauled the old sand away with. Pieces of plywood are laid on the edge of the bunker so the trucks can back into the bunker and dump the sand without crushing the lip. This minimizes hand labor and saves time. The sand is spread out and leveled in the bunker using a power sand rake with a metal pushing blade attached to the front. Little hand shoveling is needed. Cushman's are used to dump sand on the green side of the bunker, where the trucks cannot go. We wet the sand before we put it in the bunker because wet sand is easier to control. Dry sand tends to pour like sugar, making it hard to handle. We continue to fill the bunker with sand until it reaches a depth of nine inches.

The sand in the newly renovated bunker is soft and loose for about 90 to 120 days. Frequent raking with a power rake can reduce this settling period. I have read that using a gunite machine eliminates this settling period. This machine blows sand under high pressure through a hose up to several hundred feet into the bunker. The sand is compacted by the force of impact as it enters the bunker and eliminates the soft sand problem. This method may be worth trying.

We renovate bunkers one at a time and a six man crew can usually complete renovation of an average sized bunker in one working day.

The March/April 1980 issue of the USGA Green Section Record has an article on installing sand in bunkers using the gunite machine and the November/December 1983 issue contains an excellent article on selecting and handling sand. They would be well worth reviewing if you plan on doing any sand bunker renovation this year.

COOPERATORS REQUESTED FOR GYPSY MOTH TRAPPING

We've heard from Julie Nara and learned that the Wisconsin Department of Agriculture, Trade and Consumer Protection is seeking cooperators to conduct local trapping for gypsy moths again this year. Julie, a Plant Industry Specialist in the Bureau of Plant Industry, Agricultural Resource Management Division of the Department, has appreciated the help and cooperation of Wisconsin's Golf Course Managers in recent years and would like to see similar or even increased participation in this program for 1986.

The gypsy moth, which was introduced and accidentally released in the state of Massachusetts in 1869, has now attained outbreak populations in the northeastern United States. In Wisconsin, isolated infestations in Oconomowoc, Monona, Hubertus and a possible infestation in Sheboygan were treated in 1985. No moths were caught in these treated areas during 1985, and while 13 gypsy moths were captured last year, no new infestations were identified in the state. In neighboring states, moths have been caught near the Wisconsin border in Minnesota, Michigan and Illinois.

While the gypsy moth situation in Wisconsin has been stable during the last few years, there is a possibility of an upswing in the future, and continued vigilance is necessary.

Gypsy moth trapping requires adherence to the following timetable in the southern part of the state.

- July 14 — All traps should be in place.
- July 20 — First moths expect to emerge.
- Last week of July — First check of traps. If possible, check at weekly intervals afterwards.
- End of August — Remove and check traps again.
- September — Send us a map or sketch with trap locations indicated and trapping results.

Gypsy moth trap density is 1 — 4 traps per square mile. Location of traps, placement date, dates and results of checks should be recorded.

If you are a golf course superintendent interested in cooperating, please fill out the following form and send to: Wisconsin Department of Agriculture, Trade and Consumer Protection, Agricultural Resource Management Division, P.O. Box 7883, 4702 University Avenue, Madison, WI 53707.

1986 Gypsy Moth Trapping Cooperator

Name: _____

Address: _____

Telephone number: _____

I would like to cooperate in gypsy moth trapping in:

_____ County _____ Township,

Section _____

The trapping area measures approximately _____ square miles and is: residential, parkland, golf course, nursery, cemetery, other _____

The number of traps I can take care of is: _____