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PHOTO 3

The aeroponics system consists of several 20-gallon containers with submersible pumps that work on 110-volt alternating current.

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grass year round and conduct herbicide efficacy and other trials. We even grow weeds and mow them just like a typical turfgrass system. We have a large experiment underway that will evaluate hundreds of herbicide combinations on mature dallisgrass.

The dallisgrass plants were established in pots from rhizomes collected from Chatmoss Country Club near Martinsville, Va. The new system has allowed us to acclimate these dallisgrass plants for the past six months in the greenhouse. By starting from mature rhizomes and culturing the plants for an entire season in the greenhouse, we are able to better simulate what would happen in the field. Without the mower track system, we could not afford the manpower necessary to manage all those dallisgrass plants for such duration.

If you want to ramp your greenhouse technology to the next level, try growing turfgrass without soil. That has been one of our goals for the past several years. By growing turfgrasses in nutrient solution, one can produce clean roots and monitor the effects of various chemicals on roots in an efficient manner.

But we continue to have problems when growing turfgrass hydroponically for our laboratory studies. We just could not get enough oxygen to the roots in the aqueous nutrient solutions. Repeated attempts with aquarium pumps and other oxygenating devices met with only limited success.

The problem of oxygen delivery was solved by utilizing a method of plant culture called aeroponics. Turfgrass plants are transplanted into foam discs, and the roots are sprayed with a nutrient solution inside an empty container. The roots are always wet but are simply hanging inside an empty container full of oxygen. It's really not much different than what is happening in the soil. The gravity water drains off, and the roots are left with air-filled cavities. This has been the best method of producing clean roots for our experiments that we've seen.

The aeroponics system consists of several 20-gallon containers with submersible pumps that work on 110-volt alternating current. The pumps are linked with flexible tubing to a rack of PVC pipe containing sprinkler nozzles. When the pump is activated, the nozzles spray nutrient solution from the container below onto the roots of plants growing through the lid of the container above. It is a bit high-tech for the average superintendent, but it helps produce research results that shape the way we use turf protection chemicals.

In some experiments, students are spiking the nutrient solution with various herbicides to gauge the effects of herbicides on turfgrass roots. In the same way, products reported to promote rooting can be closely evaluated for effects on roots. Just simply lift the lid and inspect your roots as easily as you inspect the foliage.

Dr. Shawn Askew is associate professor of turfgrass weed science in the department of plant pathology, physiology and weed science at Virginia Tech. He is also Virginia's extension specialist for turfgrass weeds. For more information, visit his web site at www.turfweeds.net.

the straight scoop on bentgrass

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Preserving Stream Corridors Mitigates Erosion, Pollution

By Alan D. Wood

Golf courses, like most outdoor recreation facilities, can be highly compatible with restoring and maintaining natural stream corridors. Riparian corridors, normally including most of the floodplain, are complex ecosystems that require a balance among several factors: hydrology, geomorphology and biology. In layman's terms, that's water, ground and plant and animal life.

If we remove all these components from a stream, by building a concrete channel, for example, we are left with a lifeless waterway, which is not aesthetically appealing, nor environmentally friendly. Unfortunately, a typical natural stream corridor, which in most climate zones includes trees and shrubs, is not always compatible with outdoor recreation, such as golf, which requires some open spaces.

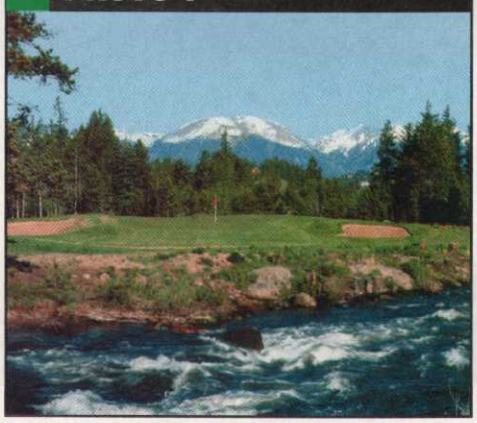
In Photo 1, we see a course with a beautiful vista of snow-capped mountains. However, to have that vista and allow for low drives across the stream in the foreground, all the trees and shrubs were removed from the stream corridor. Not only does this destroy the riparian ecosystem and detract from the visual appeal, but it also opens the door for severe erosion of the streambank soils. Other courses want an English garden look with grass mowed down to the water's edge (Photo 2), again removing the protection that deep-rooted vegetation provides from erosion.

However, streambanks can be maintained with vegetation and/or "hard" materials which simultaneously promote a natural ecosystem and allow for the activities on a golf course. In Photo 3, wildflowers and shrubs have been planted among some large rocks to be both aesthetically pleasing and erosion-resistant. Where needed for visibility or ball flight, the shrub varieties can be selected from among those with a naturally low-growing height (e.g., chokeberry, silky dogwood, dwarf willow and spirea) or can be pruned to maintain a specific height. (For a complete list with applications, see NRCS's Streambank and Shoreline Protection at www.info.usda.gov/CED/ftp/CED/EFH-Ch16.pdf)

In areas where rock is difficult to obtain, large woody material, such as rootwads, can be installed in streambanks to resist erosion along with grasses or until live woody vegetation can be established. Photo 4 shows rootwads, constructed of two logs (one with the rootball still attached) and buried into the streambank (to prevent floating away). Low shrubs have been planted between the rootwads to re-establish woody vegetation.

Although shrubs can be planted from rooted cuttings or nursery stock, soil-bioengineering uses "unrooted" cuttings of species, such as willows and red-osier dogwood, to establish woody shrubs along the streambank. During dormancy, livestakes or whips of the plant stems can be

PHOTO 1



Streambanks are part of a complex riparian ecosystem.

QUICK TIP

Now that the holiday season is over, a new year is upon us, bringing with it new challenges. What to do with the old tube television and where to hang the flat-panel LCD or plasma TV might be high on your to-do list. However, learning new ways to better manage your course should also be near the top. Many companies are currently finalizing new products they plan to introduce at the Golf Industry Show in Orlando. These innovations can help turf managers do their job more efficiently and more economically, with less environmental impact. So, use the rest of the month to educate yourself on these new products. Get to it — and don't forget to come see us at the show!

PHOTO 2

Grass mowed to the streambank often begins unsightly erosion.

PHOTO 3

Streambank rocks and plantings can prevent erosion, stop unnecessary mowing and provide aesthetic appeal.

PHOTO 4

Rootwads stabilize the streambank while letting riparian shrubs to establish.

inserted into the streambank at very low per-unit costs. Within a couple of years, as seen in Photo 5 (page 62), lush vegetation will provide good riparian cover, and even hide rocks, among which cuttings can be planted.

Although "hard materials" such as rocks and rootwads are needed on high-velocity streams, vegetation alone can be utilized on slow-moving waterways. However, it is best to use nongrass species, if for no other reason than to remind the mowing staff NOT to mow right up to the stream edge. In areas with year-round growing seasons, wildflower mixtures can serve this purpose as well as being aesthetically pleasing. In colder climates, obligate (wetland) plants, such as cattails, can be visually pleasing and provide erosion resistance, even during dormant periods, as seen in Photo 6 (page 62).

Obviously, the best vegetation to maintain along the stream corridor is that which naturally occurred prior to human activities, such as large trees and shrubs. Even where a course layout requires a fairway to cross a stream, a window can be created through the tree line where only low shrubs are still maintained, as seen in Photo 7 (page 62).

By keeping the plants and wildlife necessary for a healthy riparian ecosystem, other important factors such as shade and nutrient uptake are provided. The former is important to prevent heating of the stream water (which is not good for most fish species); not to mention the appreciation of golfers on a hot afternoon. The latter can be important on a golf course where high amounts of fertilizer are needed to maintain durable, attractive grass. The stream-edge buffer plants can intercept any excess nutrients and utilize them for growth, instead of allowing them to enter the stream as pollution.

Many landscape architects are knowledgeable with riparian corridor plantings that can compliment a golf course. Additional information can be obtained from state and federal agencies, such as USDA's Natural Resources Conservation Service, which has several helpful references (page 62), as well as conservationists and engineers that can assist with plantings and streambank structures. As we all try to improve the quality of our natural envi-

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Stream-edge buffer plants can intercept any excess nutrients and use them for growth, instead of allowing them to enter the stream as pollution.

PHOTO 5

Soil-bioengineering after three years provides riparian cover and hides a rock toe.

PHOTO 6

Even dormant cattails can stabilize the banks of a slow-moving stream.

PHOTO 7

A fairway window through a treed riparian corridor provides a challenge for drives across a stream.

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ronment, outdoor recreational facilities such as parks and golf courses, can easily be a partner by restoring and maintaining good stream corridors.

Alan Wood's current emphasis is on stream restoration activities. He completed a Ph.D. in agriculture and biological engineering at Penn State University in 2004. Wood started his career with the Soil Conservation Service in 1970 in Maryland, and from 1978 to 1985 was a design engineer for SCS in Albuquerque, N.M. Since 1985, he has been the state project engineer for NRCS in Pennsylvania, where he has worked on numerous flood control, mine reclamation and pollution-control projects.

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Extreme

The practice range at Traverse City Golf & Country Club was made near perfect thanks to an extensive renovation

BY RAYMOND HEARN AND STEVEN J. HAMMON

Traverse City Golf & Country Club (TCG) was established in 1915 and sits on 143 acres just a few minutes from Traverse City's vibrant downtown.

The Michigan course is a classic Tom Bendelow design. The club has an enthusiastic membership and loads of social activities and golf events, a solid food and beverage program, a recently remodeled clubhouse and numerous amenities, including a new fitness facility — all to keep the membership active throughout the year. In that context, the club's outdated practice facility seemed out of character.

The range was improved in 1984 when the club relocated four holes to bring it from the middle of the course nearer to the clubhouse, but it was still ill-suited to real game improvement. Smaller and inefficient in its use of space, the range was essentially a place to warm up: two target flags on an uphill slope. It seemed more a liability than an asset to attract and retain members.

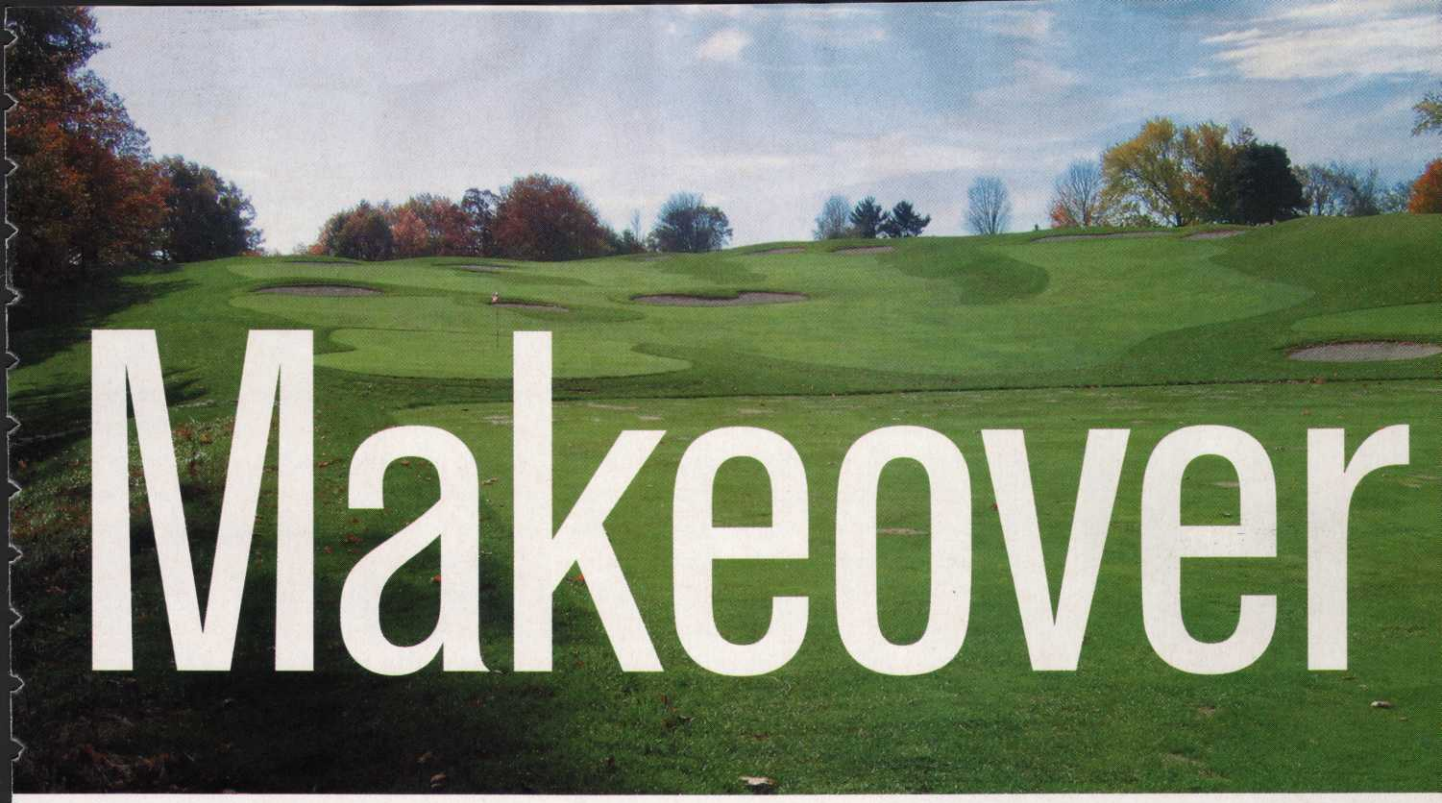
The authors, Steven Hammon (left) and Raymond Hearn, discuss an aspect of the project.

An extensive survey of the membership in 2001 ultimately confirmed many members' dissatisfaction with the range, and the green committee decided to address the problem. We collaborated until our vision — as designer, superintendent and membership — was clear for what the redesigned range should be. We began construction on the range in August 2006. The range re-opened last June.

Game improvement

The first golf courses in Scotland had no practice facilities, so why are they necessary today? Although their importance to a golf course's overall operation often remains neglected, the game's changing nature has made them as rigorous as oversized drivers and other improvements in equipment. Crucial to our oft-stated goal of "growing the game," a quality practice facility also constitutes a huge competitive advantage among existing golfers.

Resort owners typically seem more attuned to the benefits of an upscale practice facility. Unfortunately, many golf course owners and private clubs have not grasped all these advantages. (Some have, though. We know of one upscale semi-private course that turned its practice facility into a profit center by selling unlimited-use memberships.) As in all such redesign projects, TCG's progressive approach relied heavily on cooperation and frequent communication between all interested parties, including Country Golf, the contractor that executed the design specifications on time and within budget.



Makeover

TCG's priorities in updating its practice facility included the following:

- main tee,
- green,
- bunker practice area,
- chipping areas,
- target greens,
- target fairways,
- target bunkers and
- sides and end of the range.

Plenty of room on the practice tee

The initial focus of most ranges is the practice tee, and the most common shortcoming is insufficient square footage, leading to overuse and accompanying difficulty in maintaining healthy, lush grass.

Ideally, 20,000 square feet to 30,000 square feet of surface area is allocated for the practice tees, but that's not plausible at many layouts.

Some 10 percent to 20 percent more square footage can be attained by simply adjusting grades, maximizing surrounds and other strategies. Other typical problems plaguing practice tees are misalignment, uneven surfaces, poor drainage, lack of proper soils, improper turfgrass, and tree and root encroachment.

Everyone was pleasantly surprised by the amount of space we were able to recapture for the TCG practice tee, which was initially 11,200 square feet. By removing a space-wasting tier and pushing surrounds to the limit, we gained 2,605 square feet. In addition, the single-level tee was seeded using topsoil from the site, mixed on-site with sand, which produced an easily maintained turfgrass surface.

About the green

Check out the practice green at a place like Pinehurst and it's clear what a huge amenity, and even an identity element, it represents. Sure, that's a rather grand example, but more modest practice greens can be just as appealing. (That was, and is, the case at TCG, where, thanks to its ample size and pleasing proportions, the practice green was left untouched in the redesign.) Again, practice greens we've visited elsewhere often suffer from the "logistical" problems cited above, as well as one other. Their surfaces often fail to provide the desired sense of contour and speed of those on the course, meaning that practice might actually hurt one's performance in play.

To give golfers a representative sample of the putting surfaces they can expect to find over the next 18 holes generally requires 8,000 square feet to 15,000 square feet. Needless to say, it also ought to be built using the same design and construction techniques used on the holes themselves. Regrettably, this is frequently not the case when practice greens are installed as an afterthought.

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After a survey of members revealed dissatisfaction with the range, the Traverse City Golf & Country Club decided on a detailed upgrade. The result is above.

PHOTOS COURTESY: STEVEN J. HAMMON

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A good rule of thumb is to build bunkers at least 75 feet long and 30 feet wide, allowing 10- to 15-foot spacing between practicing players.

Practice bunkers: The real thing

Considering the need for most players to work on their bunker shots — we speak from experience here — practice bunkers are in especially short supply. The correlation is probably that skulled shots from bunkers, a standard hacker's miscue, require a buffer zone between them and other practice areas. Thus, the ideal complement of two bunkers — one emulating greenside play and the other fairway bunker shots — is sometimes prohibitive.

As with the practice green, the sand and depth of the bunkers should simulate their on-course cousins. A good rule of thumb is to build bunkers at least 75 feet long and 30 feet wide, allowing 10- to 15-foot spacing between practicing players. Again, like the bunkers on the course, they need to be built for proper drainage and maintenance.

Spatial considerations limited the absolute size of TCG's practice bunker, but repositioning it directly in front of the chipping green made bunker practice much more targeted and also allowed for increased simultaneous usage by members in adjacent areas.

Wanted: Space for chipping areas

Like practice bunkers, chipping areas are in short supply, in some measure because a good one requires at least 20,000 square feet. A standard space-condensing approach, which we used at TCG, is to devote a portion of the practice green to chipping, although this may require segregated cupping areas and other traffic-control tactics to minimize competing uses.

At the other extreme, facilities with 3 acres to 15 acres at their disposal can create a chipping course, with up to nine holes testing various short-game skills — a great place to get the kids started.

With the repositioning of the practice bunker at TCG, we saw an opportunity to create a new bentgrass chipping area that can be mowed to collar height around the practice bunker and part of the chipping green. We thereby increased the chipping green's size by more than a third and created new angles — over the bunker, for instance — for shots to it.

Golfers love target greens

While the absence of practice bunkers and chipping greens may be due purely to land-availability constraints, the absence of target greens, even at exclusive private clubs, is a bit more baffling to us. Target greens are comparatively inexpensive and golfers, who consistently tell us they visualize hitting their practice shots to greens, love them. Why should golfers spend their practice time hitting into a flat field?

Unlike your practice green, of course, target greens need not be built like the real thing — you can use regular topsoil. Keys to their visual appeal are to make them 4,000 square feet or larger and to cant them back to front at roughly 10 percent, that is, tilted to face the practice tee.

Before-and-after photos at TCG were an instant hit with members and their guests. The images show how the new target greens, which replaced the usual series of colored poles, add definition and pizzazz to the range.

The new targets were even built with fill generated from grading the surface of the range to remove "blind spots" that had existed about 185 yards from the tees. Target greens now allow players to practice shots from as little as 40 yards and as much as 270 yards, and the "on-course" feel is enhanced by bunkers also built with recycled fill.

Target fairways and bunkers

You can further recreate the playing experience with features like target fairways lined with bunkers, as we did to great effect and universal approval at TCG.

Bunkers can be built using a permeable liner and filled with limestone rock approximating the color of the sand on the course, again configured with an exaggerated slope (10 percent to 15 percent) for utmost visibility from the tee. The coarse surface allows ball-retrieval equipment to be driven through the bunkers.

The fairway in the center of the range at TCG simulates a par 4 with bunkers, a fairway and a green. The range's other fairways, bunkers and target greens are laid out as par 3s of various length — a lot of bang for the construction buck.