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(continued from page 50)

strategies and timelines for implementation.

We all know Texas is going through severe drought and Las Vegas is a dry city, so drought restrictions are to be expected. Let's look at water use restrictions for a wetter climate. In Massachusetts, as the drought worsens (advisory, watch, warning, emergency) the amount of water used is restricted by percentage as shown in the table on page 50.

So what are the major components that might go into a drought management plan? Well, if you are in a state with very specific reduction points like Massachusetts, then the water-use reductions in your plan would mimic their requirements. Pennsylvania has similar percent reductions, as do other states. These type reductions can be ambiguous, though. What if you have sprinklers that throw both on the fairway and in the rough, such as on a double row system? Can you operate any of these sprinklers if you are not allowed to water the rough?

Best management practices are the best place to start for any water management or drought plan. You should also list all of your water-conservation practices. Here is a partial list of items that may be required or should be included in the plan:

- Metering your use – if you don't know how much you're using how can you manage it?
- A calibration schedule for your meters
- Lining ponds

- Irrigation system maintenance and inspection schedule
- Installation of moisture sensors and weather stations
- Central control systems
- Aeration schedule
- Use of non-irrigated area (natural areas?)
- Alternative water sources
- Raising turf height
- Drought tolerant turf species
- Employee training

The plan should also outline your procedures and process that you will undertake when there is little or no rainfall even before there is a drought declaration. If your plan doesn't start until there is a drought, then it may be too late. Keep in mind also that a drought management plan doesn't just entail water and irrigation systems. It includes an overall approach to reducing the use of water on the golf course. To accomplish this, you may need to train your members/customers. They will need to understand that in a drought the amount of water you have to work with is less than ideal. This can be accomplished with informational sheets, email, blogs, newsletter articles and social media.

With a little thought and some staff input a drought management plan can be developed. It is much better to develop the plan when you are not in a drought and have it on the shelf then be forced to quickly come up with a drought plan when you're already in one. **GCI**

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# A STREAM runs through it

A suburban Philadelphia course looks to stream restoration to solve flooding and erosion problems and enhance course value.

Many golf courses have small streams running through them. These water features have the potential to either wreak havoc with course operations or become key course assets that enhance play and course value.

At Whitford Country Club in suburban Philadelphia, course managers had long been dealing with recurrent flooding problems and increasingly severe erosion from a small stream, Colebrook Run, which bisects the course. Over the years, portions of the stream had filled in with sediment and, as a result, flooding began to occur more frequently. In one location, flood waters would frequently run over the stream banks and flow down the 6th fairway. The 6th and 11th greens were also frequently inundated, causing significant down time, frequent course closures, and diverting staff away from other critical course maintenance activities. Accrued sediment was also frequently clogging the intake structure that Whitford uses to fill its irrigation ponds. In other locations, including the signature 4th green, worsening stream erosion threatened key course assets.

Through the years, course managers had implemented small bank-stabilization projects, but the stream seemed

to eventually migrate around these measures and continued to erode. After years of escalating costs, reduced revenues from course closures, and failed stream stabilization projects, Whitford decided to take a radically different approach. Ron Rottman, the club's general manager, says the club had reached a breaking point. "The creek was eroding into the 4th green. The left side of the 4th green was going into the creek. The creek was at ground level on 6. Something needed to be done. If you keep putting Band-Aids on something you never fix the problem. It made sense to fix the problem once instead of fixing it 10 times."

The new approach involved a comprehensive redesign of the entire channel system, about 4,000 feet in total, rather than the piecemeal approach that had typified previous attempts. After several years of design development by another firm, Whitford retained AKRF, an environmental design firm specializing in natural channel design. AKRF worked with Whitford throughout the design, regulatory approval and construction process.

**LEVERAGING ENVIRONMENTAL BENEFIT.** During the design process, Whitford managers also uncovered the potential to secure state funding to partially offset

project costs. Since the project would take an environmentally friendly approach to fixing the stream, it was eligible for funding through a grant program administered by the Pennsylvania Department of Environmental Protection (PADEP) called Growing Greener. Whitford applied for the Growing Greener grant and was awarded \$400,000 to support project implementation. According to Chotty Sprenkle, watershed specialist with the Chester County Conservation District (CCCD), the organization that sponsored and administered the Growing Greener Grant, the reduction in bank erosion, which contributes harmful nutrients to local streams, combined with the club's willingness to install tree and shrub plantings along the creek banks, made the project an attractive investment.

**FLUVIO-WHAT?** Prior to design work, the project design team first sought to understand the behavior of the stream as an entire system, by applying the principles of fluvial geomorphology, a branch of science that focuses on the behavior of river systems. By looking at historical aerial photographs, designers discovered Colebrook Run once flowed through agricultural lands and appeared to have been straightened along the margin between

two fields. Since most streams naturally meander, many of the erosion problems experienced by the club were probably due to the natural processes of a straight stream returning to a meandering form over time. Additionally, the turf grasses lining the stream edge offered little erosion resistance to slow the rate of erosion.

In some areas, undersized bridge or culvert crossings contributed to the erosion problems by accelerating stream flow through the bridge opening. During high flows, the bridges also slowed upstream flows, causing sediment to pile up.

Project designers also discovered the flooding and erosion problems were closely linked. As banks eroded in the upstream areas of the course, sediment from the eroding banks would be carried by the flow to lower portions of the course. Since the gradient of the stream flattened toward the lower end of the course, much of the eroded bank sediment was deposited in these areas. Over time, sediment buildup reduced the size and depth of the channel, causing the stream to flood with increasing frequency.

**DESIGNING FOR MULTIPLE OBJECTIVES.** The design strategy evolved from a solid initial understanding of the stream and its behavior over time. The design



team worked with the club to set final design goals for the project, which included reducing erosion and flooding in key areas, improving course aesthetics, maintaining playability and improving in-stream and stream-side habitats.

To address the design goals, the design approach included several interwoven design elements. First, the project team designed continuous bank stabilization measures using stacked

boulders within the upper areas of the stream. These features would eliminate bank erosion and thus reduce the potential for additional sedimentation within the lower areas of the course.

Next, the team redesigned the channel system in the lower two thirds of the course. Most critically, the stream bed was lowered by several feet and a floodplain was added at a lower elevation, creating flood storage

throughout once flood-prone areas. Within the lower areas of the course, the team designed the new stream channel with natural meanders, pools and riffles, and step/pool structures to mimic the natural pattern exhibited by healthy streams. Where possible, native grasses, shrubs and trees were planted along the banks to improve erosion resistance.

In the far downstream end of the project, the team rerouted

Boulder toe stabilization was implemented around the 4th green to prevent additional erosion, while enhancing the aesthetics of the hole.



Prior to project implementation, frequent flooding caused frequent course closures, diverted maintenance resources, and damaged key course assets. This image depicts stream side flooding of the 6th green bunker and approach after a rain event in 2005.

about 1,000 feet of the stream through an unused open field. This allowed for the creation of a broad forested floodplain to reduce

course flooding and improve in-stream habitat for aquatic life.

The team also redesigned several bridge

and culvert crossings, including a vehicular crossing near the club's maintenance facility. This structure was replaced with a bottomless, modular arch culvert to promote fish passage. The new structure also reduced downstream flow velocity, reducing the potential for bank erosion, while matching the course aesthetics using a concrete form liner. Elsewhere, cart and footbridges were replaced to account for the new stream elevation and floodplain.

The team also redesigned the club's irrigation intake structure. The new structure provided an adjustable weir and was located within a designed pool structure. The pool structure was designed to provide sufficient flow to move sediment, thus eliminating the potential for clogging. Finally, the team designed two pocket wetlands to treat and detain runoff from the club's maintenance facility.

**NAVIGATING REGULATORY CHALLENGES.** The project required numerous local, state and federal approvals. At the local level, the team secured a floodplain consistency letter from

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the township. The letter required mapping of the floodplain boundaries before and after the project to demonstrate the project would not increase downstream flooding. The project also required a tree-mitigation plan from the township and a review of the stormwater management design. An approved erosion-and-sediment-control plan was required from CCCD. At the state level, the project required an National Pollution Elimination Discharge (NPDES) program permit for Stormwater Discharges Association with Construction Activities an a Water Obstruction and Encroachment Permit, both issued by PADEP. Finally, the project required a Nationwide permit from the US Army Corps of Engineers.

**BUILDING A NEW STREAM.** Project construction occurred during fall/winter 2009 and spring 2010 and was carried out by Frontier Golf (Jones Mills, Pa.). The project was implemented during cold weather months to minimize conflict with course operations.

During construction, Frontier also worked with Whitford to develop a plan to reuse the excavated sediment generated by lowering the creek to rebuild the course's aging driving range. This reduced project costs by eliminating the need to haul material off site.

**PROJECT OUTCOMES.** Since the project was installed in 2009, club management and members have been very pleased with the investment. As the plantings have grown in, the project has become an indistinguishable part of the course. "You wouldn't know if the project was installed three years ago or thirty years ago" says head golf pro Mike Ladden. "I can say that not one of our members would question the \$1 million investment we made now that the project is completed."

The club has reduced down time due to flooding problems. "If we hadn't done the project, we would probably have lost 14 days of operation due to flooding this year alone" says Ladden. "Now we can do the things that need to be done instead of shoveling silt off of the 6th green."

In addition to reducing flooding and erosion, the redesigned stream channel has also added interest and challenge to several holes, for instance bringing water into play on the approach to the 6th green and enhancing the 4th green with boulder walls. "The project has enhanced the overall feel of the golf course," says general manager Ron Rottman

The project is also an environmental suc-

cess story CCCD's Sprenkle is eager to tout as an example project. "We're hoping it's a trend, because the golf course community is easy to work with."

**KEYS TO SUCCESS AND THE NEXT STEPS.** Three years after project implementation, the Whitford staff is focused on protecting its invest-

ment through vegetation maintenance and project monitoring. The club is conducting a 5-year monitoring effort designed to evaluate the performance of the project and so far the monitoring results are very favorable. GCI

*Contributor Shandor Szalay was the AKRF project manager on this project.*

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## MEMBERS SAY THE DARNEDEST THINGS

**A**s folks engaged in the business of keeping golf courses healthy and looking good, we have control over everything except two factors: the weather and other people.

Weather we understand and are trained to deal with. But people? Every turf-education program should include a few classes in human psychology. How else to deal with the club committees, boards and membership? Most of them, in my experience, are nice and mean well, but they've also been known to check their brains at the clubhouse door.

Knowing that most of the country's clubs are getting ready to open again and we can all use a good laugh, what follows are honest-to-goodness, real-life questions and statements to superintendents. I called a few friends for these and they had no problems responding.

I swear all of these are true. I hope they provide a chuckle and make you realize you are not alone.

**NEW YORK STATE OF MIND.** I understand replacing club flags with American flags on the Fourth of July. But at one club the superintendent was asked to convert the bridge across a par-three pond into the Brooklyn Bridge, complete with ferries and tug boats in the water. He also was asked to paint one golf cart yellow like a New York City taxicab to shuttle members across the bridge while Frank Sinatra blared from speakers.

**ON THE ROCKS.** Experiencing the worst drought in West Coast history, one superintendent was preparing for a major event when an ingenious member – who happened to own a shipping company – offered to take a couple of his tug boats up to Alaska and tow back several icebergs that could be melted for the necessary water.

**TRUE GRIT.** During a particularly rainy spell, one course member asked the superintendent, “Do you think your staff could bring the sand from the bunkers inside at night so it could dry out?”

**110 ON THE STIMPMETER.** A superintendent in the Midwest told me that while enduring relentless 100-degree days, his club president approached him concerned about membership safety. Seems he had been told that in times of excessively high heat it wasn't unusual for greens to blow up. Yes, actually explode when the earth overheated.

**HIGH-SALT DIET.** Having lost a saltwater marsh to fresh water, the president of one coastal club asked the superintendent if there was any way to return the feature to its previous state. Told it was impossible, the president came back a few days later with his own

Seems he had been told that in times of excessively high heat **it wasn't unusual for greens to blow up.** Yes, actually explode when the earth overheated.

suggestion: The super should go to the hardware store, buy large blocks of salt (the kind used for attracting deer), grind them in the big wood chipper, and spread the ground substance to “re-salt” the marsh.

**YOU CAN'T MAKE THIS STUFF UP.** How many of these have you heard?

“What time is the 9 o'clock shotgun tomorrow?”

“My member-guest partner packed in a hurry but forgot to bring any underwear. Could you go to the mall and pick up some for him? He's a size 40.”

“We know there's a no-cell-phone policy at the club, but we also know the club provides you one. Can we use it to order lunch and call our offices?”

You are standing in an 8-foot-deep hole filled with water, covered with mud and soaking wet: “Hey Bill, you fixing a leak?”

“I read somewhere there is a statistical relationship between agricultural chemicals and breast cancer. So please don't spray on ladies day. Spray only when the men are playing and on outing days.”

“Can you get some of those softer flagpoles so when our balls strike the pin they don't ricochet so far from the hole?”

“I have a great idea for our holiday tournaments and closest-to-the-hole contests. On the greens you should paint a red heart for Valentine's Day, a colored egg for Easter, a shamrock for St. Patrick's Day, and a wreath for the Christmas tournament!”

What's is the most ridiculous request you've heard? Send your best MMMMs – most memorable member misstatements – to my blog, [www.aspire-golf.com/buzz.html](http://www.aspire-golf.com/buzz.html).

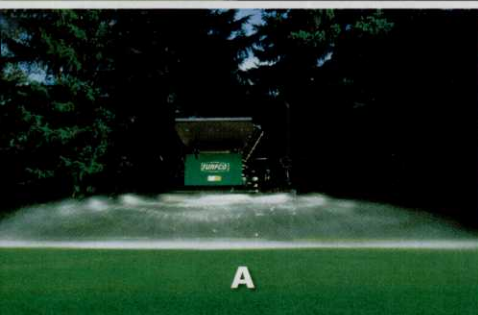
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# A GAME CHANGER

The turf industry faces off against the possible emergence of bacterial wilt, a bizarre, complex, indiscriminate killer. By David McPherson

**T**he snow has yet to melt in the Midwestern and the Southeastern United States and superintendents are already losing sleep over what surprises Mother Nature has in store for them come opening day. What diseases are lurking below the surface – just waiting for the right conditions to make the turf bosses' job that much more difficult? For golf clubs with creeping bentgrass greens in certain parts of the country, one of the biggest fears is a pathogen called "bacterial wilt."

"It's a game changer and an indiscriminate killer," says Jeff Kent, superintendent, Quail Hollow Club in Charlotte, N.C., home of The PGA Tour's Wells Fargo Championship each May. "It begins as a minor nuisance but spreads rapidly and builds over time like rolling a snowball down a hill that eventually ends in an avalanche."

Bacterial wilt has caused some confusion in the turf pathology field. Not all academics, who were initially working cooperatively doing research, partly

funded by the United States Golf Association (USGA), are on the same page. Currently, the USGA is supporting research on the bacteria question with Joe Vargas at Michigan State University, Nathaniel Mitkowski at the University of Rhode Island, and Bruce Martin at Clemson. In the past, they also funded Lane Tredway – part of the not-yet-convinced camp – at North Carolina State University. Tredway is currently working for Syngenta.

"It is an interesting, complex story," says Stan Zontek, director

of the USGA Green Section's Mid-Atlantic region. "Most pathologists in our industry have discounted bacteria as being much of a turf problem. I don't think we quite know whether it is a primary pathogen, but I can tell you this does have the industry concerned with ample justification. That's why the USGA is supporting research on a fairly wide scale."

As Zontek alludes to, most are in agreement, but some dispute that what superintendents such as Kent at Quail Hollow have