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WAKE UP AND SMELL THE WATER

The mantra all golf superintendents now have to live by is "water is the new oil." Our profession is scrutinized, criticized, and demonized for using too much of this valuable natural resource. We are taken to task for over watering our lush, green fields of well fertilized turf grass for the pleasure of the rich and famous and to the detriment of the sensitive environment that surrounds us.

All that might sound good and smart but it just isn't true. The golf industry shows more initiative than most to conserve water on all types of golf courses. And it might surprise people to know that one of the best examples of sound water management practices one of our most famous golf playgrounds, Pebble Beach Resort on California's Monterey Peninsula. Because besides all its cachet and beauty, Pebble Beach is one of the most pristine and diverse costal environments on the planet, and the people responsible for keeping it playable are committed to keeping the area safe.

Pebble Beach has been investigating, implementing, and utilizing water saving technology, water reduction, and precise water distribution on the peninsula for many years. They use a significant amount of potable water, which was a huge concern to the community. So beginning back in 1994, the Pebble Beach Company developed a permanent, sustainable solution. While their actions required substantial financial commitment and in many instances cannot be duplicated, they stand as smart and caring examples of how different parties can work together to find a solution.

Pebble Beach Company (PBC) began this process by:

•Irrigating with tertiary–treated, recycled water.

•Upon discovering that the salt content of this water was too high for use on its courses, PBC funded a second phase to rehabilitate a 320-acre feet reservoir for recycled water storage.

• Upgrading with a state-of-the-art microfiltration/reverse osmosis system.

• Completing the above enabled PBC and the other courses in Del Monte Forest to exclusively use recycled water to irrigate seven golf courses, athletic fields, and selected landscaping.

The golf industry shows more initiative than most to conserve water on all types of golf courses.

•As a result, PBC's water needs were satisfied, and just as important, the local environment and community concerns were handled properly and wisely.

However, using effluent or recycled water from waste containment sites with high sodium concentration is always a concern. It's necessary to routinely "flush" with quality water to avoid potential negative impact to turf grass and landscaping. This created another local concern. So PBC launched a second phase, designed to improve the reservoir by allowing for storage and distribution of recycled water:

•The size of the reservoir was expanded from 320 to 350-acre feet.

•Sophisticated leak detection and monitoring equipment was installed, along with micro-strainers for algae control.

•Modern and efficient pumping systems were installed.

•The reservoir was seismically fitted and sealed with a vinyl liner.

With storage and transport concerns rectified, in 2006 PBC moved to further enhance the water quality within the reservoir by:

•Installing a microfiltration system and reverse osmosis (RO) as treatment technologies.

•The RO process was added to remove significant amounts of sodium and total dissolved salts.

•Only a small portion of the microfiltration treated water is treated by the RO system to minimize post-treatment chemical additions.

These actions show how golf courses can keep the future in mind while protecting those around them. And PBC is not done. Today, they are implementing the next step in water saving technology and distribution.

Since 2008, Pebble Beach Company, in conjunction with Rain Bird, has been implementing the new Integrated Control System www.rainbird.com/golf/products/field/ICsystem.htm As a result, less water is used, while being distributed more uniformly with the ability to isolate to one irrigation head to a designated location on the golf course.

• The IC system is a single-station satellite located at the sprinkler or valve.

• With up to 750 sprinklers per wire path, there are no electrical limitations. Heads can be added anywhere on the course and have direct computer communication with the head.

• The amount of copper wire in the ground is reduced up to 90 percent compared to a traditional satellite system. This makes the IC system easier to install, quicker to troubleshoot, and less expensive.

• There are no unattractive field satellite boxes and no maintenance costs for their upkeep.

I recently toured Pebble Beach with Golf Course Superintendent Chris Dalhamer, CGCS, who is very please

(continued on page 81)

innovative IRRIGATION

by Shawn Emerson

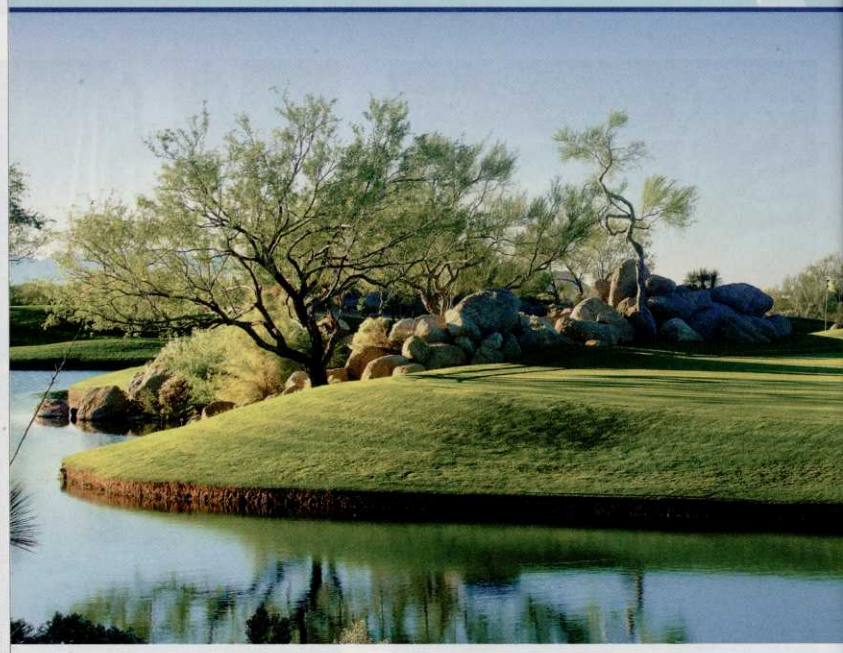
Data, collected from on-site telemetry systems, including water flow, electricity usage and lake levels is captured, analyzed and displayed by the system in a single, unified view of usage across the property.

DESERT MOUNTAIN

Desert Mount Club turns to technology to halt costs and conserve water.

It was six years ago that the agronomy team at the Desert Mountain Club in Scottsdale, Ariz., realized that the pricing on our commodities – reclaimed water, fertilizer, seed – was on the rise. That's always cause for concern for any club but especially so at Desert Mountain with six Jack Nicklaus Signature courses on 550 acres of turf. Comprised of six turf types, the courses accommodate 150,000 rounds of golf annually.

Typically we use 400,000 pounds of seed and 600,000 pounds of fertilizer in a year. In addition, we're located in the Sonoran desert where water is one of our most precious, and expensive, resources. Desert Mountain partnered with the city of Scottsdale and the state to utilize treated effluent, or reclaimed water, to reduce our water footprint. Using 1 billion gallons annually makes us the largest user of reclaimed water in the metro



Dessert Mountain employed a comprehensive records system to track how much water they were using and just how much we really needed.

Phoenix-Scottsdale area. We move that water through 11 on-site pump stations and eight reclaimed water lakes.

Dealing with the sheer volume of running an operation of this size and the cost it entails, I recognized the need for a comprehensive records system to keep track of just how much water we were using and just how much we really needed. Reducing energy and operating costs while continuing to maintain the greens in championship condition to provide a golf experience the members have come to expect on these award-winning courses also became a goal. In addition, reaching these goals would reduce our footprint on the land as no decision is made here without considering the indigenous plants and the wildlife that make this property home.

One of the areas I thought we could reduce our use of reclaimed water as well as fertilizer was in our leaching schedule. We had been flushing the salts and alkali out of the soil 20 times per year, requiring a significant output of water and power. It was at that time that I enlisted the help of Walt Norley at UgMo, a leader in advanced soil moisture monitoring, to create a wireless ground sensor that would tell me the TDS (total dissolved salts) in the soil which I could compare to the industry standard. Sensors installed, we monitored and waited for the TDS level to rise. It didn't, and we were able to eliminate the guess work and reduce the flushing to six times per year for a savings of 3-4 million gallons of water and a 10-15 percent reduction in our greens fertilization.

The sensors also captured moisture level, soil temperature and other variables. But what good was all this disparate data if we couldn't integrate it into our existing software that would help us monitor our peak water and energy usage, our storage lake levels and, most importantly, pinpoint how much water (and the energy to pump it to the courses) and fertilizer were actually needed in order to become better stewards of the land and save money?

TWEAKING THE TECHNOLOGY. In my two decades in the agronomy industry, the best words of wisdom I can give are these: It's okay to have problems but it's even better to ask for help. The agronomy department utilizes four separate softwares: Rainbird, Microcom, Arizona Public

DESERT MOUNTAIN

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Service and UgMo. But together they're incompatible and we needed them to communicate in real time so that if our weather station tells us the courses received rain the night before, we could adjust the irrigation to water less that day, among other situations that require fine tuning on a daily basis. The agronomy budget could not withstand the purchase of all new software so once again I turned to experts in the business.

Through UgMo's partnership with IBM, I learned that IBM's Intelligent Operations Center (IOC) and Water Information Hub (WIH) systems could unite the four softwares into one platform to help us gather analytics while continuing to utilize our existing software. This became IBM's first application of analytics software on a golf course.

A key partner in this effort is Element Blue, an IBM Premier business partner responsible for the installation and management of the IOC and WIH systems. The IOC is an expandable platform designed to provide operational insight across one or multiple domains. The WIH allows users to have a system-wide view of operational and infrastructure performance. Together they create a common platform for information flow across the entire property. The software solution is hosted on the IBM Smart Cloud and managed by Element Blue.

With a customized dashboard and mobile notification capability, we can capture and visualize measurement data from monitors and the wireless ground sensors with which to base our decisions. Data, collected from onsite telemetry systems, including water flow, electricity usage and lake levels is captured, analyzed and displayed by the system in a single unified view of usage across the property. In addition soil moisture, salinity and temperature data is gathered from sensors across the course and combined with the telemetry data to provide an integrated view of course conditions and direct feedback on water and power usage.

In other words, instead of taking 30 days to gather and verify data, we can gather information up to six times per hour, 24 hours per day, allowing us to make decisions within 15 minutes. We can maximize response times to changing course conditions, and to minimize water usage, power consumption, personnel time and other direct costs. Course supervisors can adjust the system to respond to preset thresholds for every measurement collected and can be alerted in real time when thresholds are exceeded. We no longer need to rely on "sneaker net," meaning that we're running back and forth to gather updates on course and soil conditions.

THE PAYBACK. The software installation on the Cochise course will be completed by the end of July and we are projecting a 5-10 percent energy savings, a 20 percent reallocation of reclaimed water to other areas of the property and a 50 percent time savings for the irrigation manager. Eventually, we plan to install the technology on the remaining five courses in the next 1-3 years which will require only the cost to integrate the software into the main platform. I also anticipate that the purchase and integration cost of the software will pay for itself in three years.

With today's continually rising costs, coupled with increased player expectation of the quality of course conditions and overall golf experience, it is important for superintendents to know the business of running their course on a daily basis and to recognize trends in order to maintain quality and to control costs. As innovative as the Desert Mountain Club is, we did not invent anything new to help us achieve these goals. We simply identified the issues and engaged our partners in helping us find the answers in an inexpensive way. And in the process, we'll become better stewards of the land and educators in protecting our natural resources. **GCI**

Shawn Emerson is director of agronomy at Desert Mountain Club.

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HOW GOLF COURSE ARCHITECTS CONSERVE WATER

Water conservation is one of the most talked about topics these days in golf circles. And it seems that every meeting I go to concerning this topic makes me even more aware of future ramifications to the golf industry.

Conservation is a joint task that involves the cooperative efforts of golf course architects, irrigation designers, superintendents, and manufacturers. Golfers can also help in this effort by curbing – or flat out eliminating – their insatiable demands for consistent and lush conditions.

Golf course architects select turf types for drought tolerance, design tree areas in clumps for easier drip irrigation, and logically size the irrigation storage pond to balance evaporation loss against storage needs. However, some would argue that the biggest contribution is in reducing turf acreage.

However, turf reduction isn't simple, and to do it correctly, we consider many things:

SPRAY PATTERNS -SPRINKLERS. In most cases, we retrofit turf edges to existing sprinklers.

Luckily, the typical 65-foot to 75-foot spacing works well to set up some nicely flowing curves. However, picking the right ones balancing all the factors below requires in field study.

If the project calls for a completely new irrigation system or revisions, we coordinate with the irrigation designer. The irrigation designer provides an initial "wall-to-wall layout", and we prepare our preliminary turf reduction plan.

For the next step, we compare them and adjust both sprinklers and turf edges to perfect the plan work, considering using full- or part-circle sprinklers on the edges, wind and traffic patterns, etc.

SPRAY PATTERNS – GOLFERS!

The average golfer's "golf shots gone wild" require balance between reducing turf and providing comfortable playing areas for enjoyment and pace of play, knowing that virtually any spot on the course may be an unintended landing zone.

For example, about 90 percent of shots land within 15 degrees of either side of the intended line of play with the slice side seeing more misses than the hook side. I strive – but often fall short – to attain turf about 30 degrees wide in main landing zones from 180 yards to 240 yards. I narrow it near the tee and for the 1 percent of long hitters to save turf and encourage less wild play. That translates to about width of 70-90 yards for most players.

Keep in mind that, statistically, almost one tee shot per foursome per hole is "duffed" in some fashion, suggesting limited forced carries for average golfers. It's usually advisable to avoid/limit forced carries from forward tees, which often leads to new, shorter tees being built at the same time.

However, carry limits should be reasonable for all golfers.

In headwinds, even some Tour Pros have trouble carrying 200 yards. And, knowing that most top amateur and local pro events set the course up to NOT embarrass the shortest hitting competitors, I generally set average maximum carries at about two-thirds of total driving distance expected from typical players on the gold, blue, white and red – or any others – or:

- 178 yards for 270-plus-yard drivers
- 158 yards for 240-yard drivers
- 138 yards for 210-yard drivers
- 118 yards for 180-yard drivers
- 100 yards for 150-yard drivers
- 80 yards for 120-yard drivers

We reduced irrigated turf by 30 percent, substituting as appropriate, native wildflower mixes, bark mulch and drought tolerant salt grass in those areas. We did introduce some forced carries and members and guests do notice a few more lost golf balls, but play remains reasonably paced.

CART PATH ACCESS. It's easy to use natives just outside the path. However, it should be noted that natives can hide paths and fit landforms better if they intertwine with it, as long as wide access points to the fairway and tees are in logical locations.

AESTHETICS. Turf lines can look naturalistic on plan, but jagged viewed on the ground. I always field review the proposed native lines to make sure it works aesthetically.

While renovating La Costa Champions Course last year, our design team implemented a turf plan as part of the renovation.

We reduced irrigated turf by 30 percent, substituting as appropriate, native wildflower mixes, bark mulch and drought tolerant salt grass in those areas. We did introduce some forced carries and members and guests do notice a few more lost golf balls, but play remains reasonably paced.

This is the golf course of the future, but it requires some new thinking to achieve great results. **GCI**

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Not too dry, not too wet

As we enter the dog days of summer, manage soil moisture to ensure cooler, healthier turf.

by Carmen Magro

Much of the industry faced a nearly non-existent winter with a quick, non-transitional period into warm summer-like weather far earlier than normal this year. While the weather variable alone will add to the complexity of seasonal challenges, one variable, soil moisture, will be a key indicator for many ailments or rewards you will encounter as the season progresses.

Some of you are witnessing the effects of poor and good soil moisture management from earlier this year. Those not able to dry out their turf early saw the development of early season disease pressures and slow uptake of nutrients in saturated conditions. On the other hand, those who had minimal soil moisture but started operations later due to calendar or labor restraints missed a golden opportunity to jump start the growing season and build early energy reserves in the turf, which will help in the summer months.

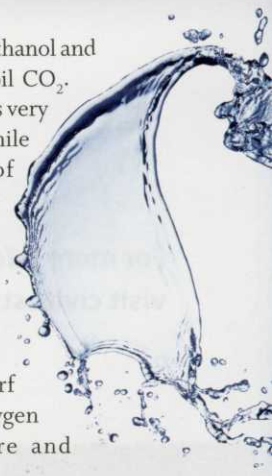
Temperature excluded, soil moisture is the single most important factor that affects the physiology of your turf and its growth habit as the season progresses. Ironically, moisture has a tremendous impact on temperature in the soil and the turf canopy.

WHY WE MONITOR. Early turf educational lectures taught us that a perfect soil is one where there is an optimal balance of soil moisture, air and gas that leads to strong turf growth. This is particularly true for growth under the typical stresses of golf course management. It is the reason why USGA specifications call for a high sand content mix to develop high quality putting greens, tees and other areas where compaction leads to loss of turf.

Even under packed conditions, these mixes maintain a quality level of soil moisture, air and gas. As a soil gets heavier...that is, less sand with a higher amount of smaller particles and therefore more compaction...we typically find less air and more water which leads to more compaction as we put traffic on these soils.

Those with "runway" type cart paths know exactly what I am talking about. The concentrated traffic of carts in these areas causes excessive compaction, especially under higher than optimal moisture conditions. This unfortunately was noticed much earlier this year due to the extended season with the early onset of traffic.

Soil moisture triggers many physiological responses in the turf plant. For one, turf cannot chew its food. It depends on dissolved nutrients in solution, including dissolved oxygen, to function properly. Even the fundamental process of respiration where the roots utilize soil oxygen is greatly affected when soil moisture levels are too high. The byproduct of respiring in low oxygen conditions is the production of ethanol and a buildup of soil CO_2. Ethanol alone is very toxic to turf while the buildup of soil CO_2, particularly when it cannot escape from the soil leads to exponential declines in turf activity as oxygen becomes more and more limiting.



As the ambient temperature rises and a condition of photorespiration kicks in – a process where oxygen replaces the desired carbon dioxide in photosynthesis – a much less efficient plant growth process produces a net loss of carbon and nitrogen with ammonia as the by-product of the latter. Both slow plant growth processes including those that we depend on to survive the stresses of play conditioning. While C4 or warm season grasses have a storage mechanism for basically storing CO_2 so that the plant can remain efficient even in hot temperatures, having excess moisture in the soil leads