BMPs approach to water conservation on golf courses

To establish credibility and to maintain economic viability, the golf industry needs to adopt a best management practices approach to water conservation and encourage its adoption by regulatory agencies.

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EDITOR'S note:

This is the second in a series of three articles highlighting the importance of best management practices in relation to the golf industry and environmental issues concerning water. In the September 2005 issue of *GCM,* the third and final installment in this series will explore the experiences of two states that are in the process of adopting a BMPs approach to water conservation for the golf industry.

Photo by Terry Ostmeyer

Figure 1. Before they begin implementing BMPs, many golf courses have already instituted water conservation measures. For example, in warm-season areas, many courses, such as Pecan Valley GC in San Antonio, use bermudagrass, which is one of the most drought-resistant turfgrass species.

Water conservation on golf courses is no longer a matter of "if" or "when" but of "how." "How" to implement and achieve water conservation has profound implications for the golf course industry.

In the June 2005 issue of *GCM,* the first article in this series discussed two philosophies or approaches to addressing regulatory and site-specific environmental issues, namely, *rigid regulations* and *best management practices* (BMPs) (4). This month's article provides some background information that explains why the BMPs approach is critical to the golf industry's success in addressing water conservation and in maintaining its economic viability.

Importance of the BMPs approach

BMPs first evolved from a 1977 amendment to the Clean Water Act to protect water quality. With respect to water quality, BMPs have been defined as: "A practice or combination of practices that are . . . the most effective and practicable (including technological, economic and institutional considerations) means of controlling point and nonpoint source pollutants at levels compatible with environmental quality goals" (10).

More recently, the BMPs approach has been applied to water conservation (3,5,8,9). We strongly encourage the golf course industry to actively adopt BMPs terminology and concepts for water conservation, which have been widely accepted and adopted "within ordinances, regulations and guidance manuals" by governmental agencies and environmental groups for other environmental problems (8). The BMPs approach is favored for addressing environmental problems because it has certain inherent characteristics (a BMPs approach is science-based; it is holistic, that is, it incorporates all possible strategies to address an issue; it considers economic and environmental implications; values education; and requires entrepreneurship for continued improvement) (4). When an industry supports BMPs for water conservation, its approach is based on these characteristics, and it is difficult for critics to argue against such a stance. Other terms used to discuss the quantity of water for turfgrass irrigation are more vague and do not imply the same whole-systems approach as "best management practices." Examples of other terms or phrases include: water

conservation, water-use efficiency, Xeriscape concept, using native plants for water conservation and conservation of water resources.

Conserving water *and* turf

Controlled turfgrass research studies confirm that water conservation can be achieved to a point before turfgrass quality starts to decline; after this point, decreasing water availability reduces turf quality and/or performance (2). The resulting decline in turf quality or density implies a potential for reductions in recreational use, in environmental and functional capabilities, and in economic use and value of the site, which in turn affect direct stakeholders (users, owners) as well as a much broader set of indirect stakeholders through adverse economic and environmental changes (1,2,7). The real issue then becomes how to maximize water conservation on turfgrass areas while maintaining economic, environmental and recreational viability and aesthetic benefits.

According to the Environmental Literacy Council (6), the environmental literacy (knowledge and practice) necessary to positively address environmental problems "requires a fundamental understanding of the systems of the natural world, the relationships and interactions between living and the nonliving environments and the ability to deal sensibly with problems that involve scientific evidence, uncertainty, and economic, aesthetic, and ethical considerations." A holistic BMPs approach to water conservation on turfgrass sites conforms to the attributes noted in this definition. In the remainder of this article, we discuss the primary practices or strategies of an effective BMPs approach to water conservation.

Components of a BMPs water conservation program

The golf course industry cannot assume that environmental and water regulatory personnel understand the full scope of BMPs for water conservation. For example, it is not unusual to view turfgrass water conservation as only one or two strategies: change the grass species, use only native grasses, reduce the area of irrigated turf, improve irrigation design or use weather-based means of irrigation scheduling. BMPs for turfgrass water conservation, however, must include the widest set of potential strategies. Therefore, it is important to develop a consistent definition of BMPs related to turfgrass water conservation so that confusion does not arise as it has with the Xeriscape concept (see the related article on the Web at www.gcsaa.org in this month's *GCM*).

Implementation of BMPs for turfgrass water conservation involve three primary activities (3):

1. Site assessment and planning (information gathering and planning)
2. Identification, evaluation and selection of water conservation options from the 10 core water-conservation strategies
3. Assessment of benefits and costs of water conservation measures to all stakeholders

1. Site assessment and planning

Developing an effective water conservation BMPs program for a complex turfgrass area such as a golf course is very complicated, time-consuming and often costly. A site assessment provides the information necessary to determine the best options (that is, BMPs) for the specific course.

Identifying current conservation measures

First, determine the current water-use profile, conduct an extensive irrigation/water audit and identify the water conservation measures that already have been implemented. Estimate how much it has cost to implement these measures and estimate how much water-use efficiency has improved as a result of these practices, both individually and as a whole. This information helps clarify for the golf course management team and golfers exactly what is entailed in BMPs water conservation measures, and, when the final program is presented to regulatory agencies, it shows that golf courses have already been implementing BMPs for many years at considerable cost and effort. This information should be at the beginning of the BMPs document developed for a facility.

The following water conservation strategies are used on many courses.

- Bermudagrass, one of the most drought-resistant species, is the most widely used grass in many warm-season turfgrass areas.
- Water sources may include water harvesting and collection into irrigation ponds or using reclaimed water as an alternative irrigation water source.
- Greens are modified to improve water infiltration and/or percolation and deeper rooting; for USGA greens, a perched water table may aid water conservation.
- Cultivation programs and equipment improve water infiltration or percolation and enhance rooting.
- In certain areas, mowing heights are higher and irrigation is limited or nonexistent.
- Zones are used to improve efficiency of irrigation systems.
- Irrigation scheduling is based on plant water requirements as estimated by superintendent experience and site-specific weather data.
- Educational efforts contribute to an educated superintendent and crew.

Infrastructure assessment

The next step is to obtain additional site infrastructure assessment information: evaluation of alternative irrigation water sources; golf

Photo courtesy of Grady Miller

Figure 2. Evaluating the efficiency of the current irrigation system is one of the first steps in using BMPs for water conservation on a golf course.

course design modifications; irrigation system design changes; microclimate, soil, atmospheric and plant conditions affecting irrigation system design, zoning and scheduling; drainage needs for leaching of salts or any hydrological considerations that may arise from using any particular irrigation water source. Gathering information related to infrastructure changes often involves considerable time and cost. Thus, developing a BMPs water conservation plan may require more than a year, especially when alternative irrigation water sources must be found, when the irrigation water is of poor or changing quality, when the irrigation system is not efficient or when major landscape design changes must be made.

Future needs

The final step in planning is to determine future water needs and identify an initial realistic water conservation goal. As implied by the process of site assessment, plans may require adjustment as new information arises, but it is good to set an initial water conservation goal based on projected water needs.

2. Identification, evaluation and selection of water conservation options

At this stage, hard decisions must be made within the 10 core water-conservation strategies. Within each strategy, numerous options or possibilities are available. The choices are site-specific, based on water-quantity requirements and conservation goals, expectations of the golf course owners, and resource requirements and availability. Essentially all major water conservation options can be classified under one of the following 10 core water conservation strategies.

- *Nonpotable water sources for irrigation.* Many of the choices involved in using alternative water sources, water harvesting or water reuse can become costly or difficult; for example, water-quantity issues (multiple water sources, reliability over time, permitting, blending, etc.) and water-quality issues (water treatment, soil amendments, changes in nutritional programs, leaching ability, salt disposal, effects on subsurface hydrology, etc.).
- *Efficient irrigation system design and monitoring devices.* Possible changes include low-flow sprinklers in critical areas, adjustable heads, proper spacing of heads and nozzles, strategic placement of soil moisture and salinity sensors, etc.
- *Efficient irrigation system scheduling and operation.* In the future, sensor technology integrated into a GPS/GIS approach will assist in developing and interpreting site-specific information to improve irrigation systems and scheduling.
- *Selecting turfgrasses and other landscape plants.* Criteria for plant selection include the amount of water the plants require and the quality of water they can tolerate.
- *Golf course and landscape design for water conservation.* Designs will allow water harvesting; reduce unnecessary acreage of highly maintained, closely mowed, irrigated turf area; and avoid excessive mounds or slopes.
- *Altering management practices to enhance water-use efficiency.* Water-friendly management practices incorporate soil amendments, cultivation programs and their equipment needs, mowing, fertilization, chemigation, etc.
- *Indoor water conservation and conservation strategies for landscape areas other than the golf course.* If water conservation is confined to the golf course area, it will be viewed as the responsibility of the superintendent and not as a club policy. Applying water conservation practices on a clubwide basis involves all club members, the subdivision and the neighborhood.
- *Education.* Complex issues require educated decision making. Plan for continuing education on water conservation and management for the superintendent, crew, club officials, etc. (See the sidebar, "Learning about BMPs.")
- *Development of formal conservation and contingency plans.* A formal BMPs document should be developed and agreed on by all club officials and members so that the superintendent has support for all reasonable science-based measures to be undertaken. A written plan also may be required by regulatory agencies. This should be an ongoing, adaptable plan.
- *Monitor and revise plans.* Monitoring may involve sensor technology. Regular scheduled monitoring of the effectiveness of specific conservation strategies and the overall BMPs plan is essential for achieving goals and making effective adjustments. Flexibility is essential because climatic changes are an uncontrolled variable in implementing conservation strategies.

3. Assessment of benefits and costs of water conservation

It is necessary to assess the costs and bene-

LEARNING ABOUT BMPs

The GCSAA BMP program was designed as a cooperative program, in which:

- GCSAA provides the educational, media, organizational framework to develop and foster the BMP philosophy
- University scientists develop the comprehensive educational material in multimedia formats
- State or regional turf associations, with guidance from individuals within their region who are involved in water conservation issues, then take the basic template material and implement BMP adoption within their region with adjustments suitable to the specific location

As part of the benefit of taking the formal BMPs course, participants have been given permission to use the copyrighted material, including a CD-ROM of the document as well as a hard copy for development of site-specific BMPs and regulatory BMPs. Associations that wish to adopt this approach can obtain the copyrighted BMP workbook by having a lead individual from the organization sign up for the GCSAA program, which includes the online course and the workshop at the GIS in New Orleans in February 2006. For more details about the online course, see www.gcsaa.org/learn/online/water.asp. To assist the golf industry in understanding and adopting the BMPs approach, the workbook has been posted online at www.georgiaturf.com.

fits associated with developing and implementing a long-term BMPs water conservation plan in order to plan for the facility and to demonstrate to regulatory agencies and golf course critics that the facility has incurred substantial effort and costs in water conservation. Readers should review the pertinent articles in the "literature cited" section of this paper (1,2,7) for information about the economic, recreational, environmental and other social benefits of turfgrasses to direct and indirect stakeholders.

Benefits

- Direct and indirect to the owner/manager and customers using the site
- Direct and indirect to other stakeholders: water savings and other economic, environmental and recreational benefits. For the environmental category, list first the golf course's water conservation goal, and then list the other environmental benefits of turf.

Costs

The costs are associated with changes required to plan, initiate and implement the BMPs program; these are not the costs associated with past water conservation improvements.

- Facility costs (including future costs) for implementation of water conservation strategies such as irrigation system changes, water storage, pumping, new maintenance equipment, water and soil treatments, course design alterations, water harvesting, etc.
- Labor
- Costs associated with changes in maintenance practices, different irrigation water sources (water treatment, soil treatment, storage, posting, etc.)
- Costs that may affect the community if stricter (especially mandated) water conservation strategies are implemented, such as revenue loss, job loss, reduced turf performance, etc.

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Figure 3. The complex decisions demanded to successfully use BMPs require continuing education on water conservation and management for the superintendent, crew and club officials.

Conclusions

The BMPs approach successfully used to address other environmental issues on golf courses is also the best means to address water conservation on a long-term, sustainable basis. If this approach is not adopted by regulatory agencies, the alternative is rigid, mandated regulations. The most effective means of ensuring the adoption of the BMPs approach by regulatory agencies is for golf course associations and individuals to actively foster its adoption on their courses and to work with legislators and regulatory groups.

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THE RESEARCH says . . .

- **By using a** BMPs approach to water conservation on turfgrass, the golf industry will be able to successfully address water conservation issues, clearly articulate its goals, insulate itself against critics of its environmental stance and maintain the economic viability of the industry.
- **BMPs for turfgrass** water conservation involve: site assessment and planning; selection of water conservation options from the 10 core strategies; and assessment of the benefits and cost of water conservation to everyone involved.
- **The BMPs approach** is the alternative to rigid and mandated regulations governing water conservation on golf courses. To ensure adoption of the BMPs approach by regulatory agencies, golf course associations and their individual members need to adopt the approach on their courses and work actively with legislators and regulatory groups.

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