

Designing Golf Courses for Water Conservation

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How can golf courses be more sustainably designed to use less water? This article includes an examination of the issues impacting golf course design and the management of water resources. Water conservation on golf courses begins by addressing the issues of resource management and conservation throughout the design process for new golf courses and the renovation of existing facilities.

The first golf courses appeared along the coastlines of the British Isles in Scotland and Ireland. At certain points on these coastlines, where the confluence of rivers and the sea occurred, a very unique landscape called “linksland” was formed over time by the forces of nature. This physical characteristics of linksland provided an ideal setting for playing golf and the first golf courses were simply discovered by local people as they explored these landscapes. Golf, as then played in the linksland, represents the fundamental relationship between the game and the environment, that of playing over and against the existing landscape with the elements as your companion.

The discovery of golf holes in the linksland was a selection process and represented the earliest form of golf course design.

Through this selection process, from the larger scale of the landscape to a smaller scale of individual golf holes to yet a smaller scale of tee and green areas, the first “course designers” were completely reliant upon the features and other existing conditions of the landscape. In this design process, the environment dictated to the discovery and creation of these golf courses. There was no thought to try and ma-

nipulate the landscape, nor was there a reason to. You played the course as you found it.

As golf continued to spread to new areas and courses were created on a greater variety of landscapes, the environment continued to serve as the foundation for design. Landscapes with an abundance of natural features still provided the best opportunity to create a golf course that would fit seamlessly into its surroundings and stimulate the imagination. These landscapes produced appealing golf courses because they had a natural advantage. In choosing these landscapes, the early designers recognized the incomparable work done before them. After all, Mother Nature is and always will be the ultimate “designer.” Her landscapes are perfectly orchestrated works of art that have an intrinsic beauty

Figure 1. Ballybunion Golf Club, Ireland – Early linksland golf course



Figure 2. Prairie Dunes Country Club, Kansas – Early American golf course



and appeal. They always function properly because their very existence is wonderful design in which many smaller ecosystems evolve into one larger compatible, efficiently functioning environment.

Designers explored these landscapes in order to understand how climate, topography, soils and vegetation functioned together a system. They recognized that by working compatibly the existing landscape, not against it, designers could lay a course lightly on the land and create an engaging golf experience that was indicative of the region and inseparable from its environment. While conservation of natural resources was not always an overriding concern in the past, today the protection and conservation of our natural resources are more important issues than ever. It is not simply about “going green” anymore, but rather about sustainability, the creation of sustainable solutions for quality development and resource management that are sound economically, improve social conditions and enhance en-

vironmental stewardship. The most important resource for a golf course is water. Typically one of the first design issues is source and availability of water for irrigation. This issue has become even more important with the emphasis and regulation placed on water resources. Regardless of water supply, the design process should still establish the conservation of water and other resources as a primary design objective, along with creating an attractive golf course that is fun to play.

Today, designers must return to the old playbook and perform a thorough site reconnaissance and analysis to completely understand the existing conditions of a proposed site. The various physical aspects of a site, along with climatic conditions will drive decision making from the onset of the design process. Regional context must also be investigated to fully understand a site and determine how it functions within this larger system. Issues such as watershed impacts, habitat connectivity for wildlife migration and infrastructure needs will have to

be addressed as a part of the design and permitting process. In addition to the broader contextual issues, the following characteristics of a site must be thoroughly investigated in order to create a sustainable design solution:

Climatic information, such as orientation of the sun, temperature ranges, prevailing winds and annual rainfall have be considered in the design and maintenance of the golf course. Golf holes and their features, such as tee and green complexes are strategically located to take advantage of wind direction and not be adversely affected by the orientation of the sun. The amount of annual rainfall will determine the adequacy of the water supply, design of the irrigation system and opportunities for water resource conservation.

Water availability and quality must be determined at the onset of the design process. Even with conservation, an adequate water supply of good quality will need to be available for irrigation. Sources such as groundwater, existing ponds or streams can often be regulated or restricted resulting in the need for supplemental sources of water. On-site impoundments, or alternative sources of water such as effluent often must be utilized to avoid reliance upon any type of public water supply.

The topography and natural features of the site have to be thoroughly studied in order to locate the golf course in the most advantageous areas. By properly utilizing the topography, the golf course can be designed to derive an inherent character and strategy of play from the existing landscape. Golf holes can be located to allow for water conservation by working in concert with surface drainage patterns and avoiding excessive or poorly oriented slopes. Also, by working compatibly with existing site conditions, the course can be constructed more economically.

Drainage patterns and water features, such as existing streams and ponds, have to be studied in conjunction with the topography. Designing a golf course with respect to existing drainage patterns is fundamental to water retention, conservation and efficient maintenance. By analyzing where and how surface runoff will move on a site, features and sub-surface drainage systems can be designed into the golf course to collect and impound stormwater in order to serve as a primary source for irrigation water or supplemental supply to reduce the demand on a primary source. To achieve high quality playability and efficient maintenance, a golf course must have the proper drainage. Ideally, water features can be incorporated into the design of the golf course to provide collection, but also to provide strategy and aesthetics for individual holes.

The composition of soils is an important component of the site analysis. The porosity of the soils, organic content, chemical content and amount of topsoil will all affect how the site can support plant material, specifically turf grass. The physical make-up of the soil, even depth to bedrock on some sites will have an impact on irrigation requirements and must be given consideration.

Vegetation consisting of trees, understory, shrubs and grasses are reviewed to identify the indigenous plant communities and wildlife habitat contained on a site. Areas of existing vegetation can be preserved and incorporated into the design of a course. They require no irrigation and contribute to water conservation, but also serve as the foundation for the aesthetics of a course and contribute to the design strategy.

Sensitive environmental areas, such as wetlands, fragile vegetation and protected wildlife habitat are carefully studied to determine their effect on or utilization in the design of the golf course. Sensitive areas typically require no irrigation or other maintenance and can often provide some of the most distinctive features on a site when incorporated as a part of the golf course in a compatible manner.

Based on the analysis of these basic issues, along with regional context and any specific issues, the constraints and opportunities for sustainable design and water conservation can be identified. Further enhancement of water conservation can then be considered in each of the following aspects of the detailed golf course design.

The routing or layout of the golf holes will not only impact water conservation, but is critical to the playability, maintenance and successful operation of a golf course. The location of golf holes determined by the routing should take advantage of the topography and existing characteristics of the site to create a unique but natural character for the golf course. Routing based on the constraints and opportunities analysis, as well as more field reconnaissance will respect the lay of the land, so the golf course can be compatibly integrated into its setting and result in more efficient maintenance, as well as reduce irrigation requirements. The routing must also ensure that the desired playability and aesthetics can be achieved for the golf course to be operated sustainably.

The availability and amount of water supply will be a significant determination in the design of the golf course and impact irrigation practices. On sites where a natural water supply is limited, restricted or practically non-existent, alternative sources of water, such as effluent or recycled water can be used as a supply for irrigation when available and economically feasible. In

Figure 3. Laurel Hill Golf Club, Virginia – Resource conservation and water quality



areas where there are sufficient amounts, rainfall can be collected and retained in ponds designed as a part of the golf course to serve as reservoirs and supply water for irrigation. To reduce the use of groundwater or off-site water supplies these ponds can be located to capture as much storm water runoff from the site and drainage from the golf course, as possible.

The golf course features, such as teeing areas, green complexes, sand bunkers and water features are designed to create the desired strategy, challenge and aesthetics for each golf hole. Whether the features are severe or subtle in nature, they must be designed to function compatibly with the existing conditions of the site in order to reduce development costs, the amount of required maintenance and provide the opportunity for water conservation.

Reducing high maintenance areas on a golf course is a significant way to provide water conservation. Designing to reduce high maintenance turf areas must be done with consideration for the playability and pace of play for the golf course. At a minimum, tees, fairways, greens and a small primary rough are typically irrigated to provide the necessary playing conditions for a course to operate successfully. These areas can often be further reduced once the patterns of play for high handicap and senior players have been identified. Secondary roughs of accessible turf grasses can be limited to the areas of heavy play.

Turf grass selection and use of indigenous plant materials will also contribute reducing water use, as well as maintenance costs for the course. Design consideration must be given to the types of turf grasses to be used on a course and their ability to produce the necessary playing conditions. Selecting turf grasses which are most suitable for the micro-climatic conditions of a site, as well as being specifically drought and stress resistant, will allow the best use of an efficient irrigation system and reduce irrigation requirements on the course during both typical and exaggerated weather conditions. Properly selected turf grasses can also result in less management requirements for chemical use without sacrificing the playing conditions of the course. Indigenous grasses can be utilized in the secondary roughs and out of play areas to reduce, if not eliminate, the need for irrigation. However, these grasses can go off color under the stress of heat and drought or winter dormancy and must be properly designed to be compatible with the existing native landscape and provide intriguing aesthetics in addition to environmental enhancement. Often an educational effort is necessary to overcome misconceptions about off color grasses and provide information of their environmental benefits.

Conservation areas or other out of play areas consisting of native grasses, adapted grasses or other existing indigenous vegetation that has been left undisturbed on the site are incorporated into the golf course to reduce irrigation and maintenance requirements, but

also as environmental enhancement for the promotion and diversity of wildlife habitat. Many golf courses use natural areas to enhance their character by establishing a particular appearance and visual quality. In addition to further reducing irrigation requirements, the use or preservation of native grasses and other indigenous plant materials will reflect the existing environment and provide consistency for wildlife habitat.

The irrigation system can reduce water usage and provide conservation through highly efficient control and application. These systems are capable of being programmed for the application of water precisely where and in what amount it is required. Different irrigation heads are used to apply water only to the intended areas and soil moisture sensors, as well as weather monitoring stations built into the systems allow adjustments in the rate or frequency of application in response to soil moisture, temperature, wind and rainfall. In addition, irrigation systems can be designed in coverage zones for the maintained areas of each golf hole which allows the irrigation coverage to be reduced for the roughs, tees and portions of the fairways during periods of drought. Entering the dryer times of the year, when recharge to the water supply is minimal, zone coverage can allow irrigation application to be reduced by 50% and up to 70% under drought conditions to prolong the water supply.

Conclusion

All of the aforementioned design practices can contribute to reducing water use on a golf course when employed individually. However, the most successful designs will utilize all these practices in a holistic approach to water resource conservation. In addition, the golf course superintendent can often further reduce the use of water on the course through management practices that enhance what has been designed into the golf course.

In a way, the golf course design process and its relationship to the environment has come full circle since discovering course in the linkland. Today, innovative and sustainable golf course design combines art, science, engineering and common sense. In order to understand the environment involved in a landscape, we explore it in terms of opportunities to create great golf and constraints for environmental stewardship. By concentrating on the opportunities, designers can “discover” golf courses that will lay lightly on the landscape and possess the unique, inherent character found in every great test of golf. At the same time, by respecting the environmental constraints we create sustainable golf courses that compliment the existing natural systems of a site and provide resource conservation into the future.

Figure 4. Hunting Hawk Golf Club, Virginia – Water Conservation

