When Is It Time To Replace An Irrigation System?

There is never a good time to replace an irrigation system, but when the cost of not replacing it becomes high enough . . . it's time.

BY PATRICK J. GROSS

hat is the one thing on a golf course that costs an exorbitant amount of money, most golfers never see, and most modern golf courses can't survive without? An irrigation system. The efficient application of water is playing an increasingly important role as golf courses are focused more than ever on conserving water resources and protecting water quality. In the western U.S., water shortages and the rising cost of water have put more emphasis than ever on irrigation system efficiency. In the eastern U.S. and other parts of the country with plentiful rainfall, an efficient irrigation system helps golf facilities comply with strict water-use regulations and contributes to better course conditioning. Like all mechanical systems, sprinklers, pipes, fittings, controllers and other components experience wear and tear and will need to be replaced at some point. However, when budgets are tight and replacement costs are on the rise, the question becomes "When is it time to replace an irrigation system?" This article will examine the many issues and pertinent questions to answer when determining the need to replace a golf course irrigation system.

EVALUATE THE STATUS OF THE CURRENT IRRIGATION SYSTEM

Age of system components: A good starting point is to review the age of various irrigation system components, including sprinklers, pipes, valves, fittings, and controllers. In general, as irrigation systems age beyond 25 years they tend to experience more frequent breakdowns, components become obsolete, and finding replacement parts may be more difficult. How-



Valve failure and frequent pipe breaks are signs that parts of an irrigation system are worn out and need to be replaced.

ever, just because parts of an irrigation system are old in no way implies they are past their usefulness; age is just a relatively easy way to anticipate general fatigue and wear on irrigation systems. The American Society of Golf Course Architects published guidelines regarding the expected life span of various items that can be used as part of this exercise (Figure 1). The guidelines are a general estimate of how long each item should last under normal circumstances. Areas of the country with a 12-month irrigation season can expect accelerated wear compared to golf courses in seasonal climates where irrigation systems are only used for a few months. Although

Figure 1 Expected Life Cycle of Irrigation System Components*

Item	Years
Irrigation system	10-30 years
Irrigation control system	10-15 years
PVC pipe (under pressure)	10-30 years
Pump station	15-20 years
*Adapted from Golf Course Items	

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Expected Life Cycle, American
Society of Golf Course Architects

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The capability of an irrigation system to apply a large amount of water in a short time allows superintendents to withhold irrigation if rain is expected, knowing they can catch up on watering the next day if the rain doesn't materialize.

golf courses in colder climates may only use an irrigation system for six to eight months, freeze/thaw cycles and winterization processes can weaken pipes and fittings, thus reducing the expected life span of those components.

Reliability of irrigation systems and the frequency of breaks and repairs: The reliability of irrigation systems is crucial since breakdowns tend to occur when irrigation is most needed and maximum stress is being put on the irrigation system. Many a superintendent has performed overnight baby-sitting duties during the summer to monitor old irrigation systems that are prone to failure. A reliable and efficient irrigation system

is a key component of producing high-quality turf conditions. Consider the following scenario: a superintendent just completed a fertilizer application and plans on immediately watering-in the material, only to find that the irrigation system has broken down, leaving no option but to watch the turf experience widespread fertilizer burn. Despite the best intentions and preventive maintenance, similar situations often plague golf course superintendents with old irrigation systems. Frequent pipe breaks and failure of system components are possible signs that parts of an irrigation system are worn out and need to be replaced. A review of maintenance records will provide helpful information

regarding the number of repairs each year, how much downtime is experienced, and annual costs associated with irrigation system repairs. Frequent breakdowns also can be a sign of incorrect installation, inferior products, or worn-out components. As a guideline, if pipe leaks are experienced more than one time per week and mainline pipe breaks occur more than two times per month, it is likely that the piping system and fittings need to be replaced.

Suitability of the irrigation system for the location and design of the course: It is important to evaluate whether the irrigation system design is suitable for the climate and location of the golf course. Parts of the country

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with limited rainfall depend almost entirely on irrigation systems to support turf growth throughout most of the year, whereas courses that receive frequent precipitation may only use irrigation systems as a supplement to natural rainfall. It is counter intuitive, but even golf courses in high-rainfall areas benefit from an efficient, highcapacity irrigation system. What would you do in the following situation? The forecast calls for a 50-percent chance of rain; however, the golf course needs a full irrigation cycle or the turf is going to suffer significant stress the next day. Does the superintendent irrigate and take the chance that the golf course will be excessively wet if it rains, or should the superintendent abstain from irrigating for one more night and hope that the irrigation system is capable of watering the course ahead of play the next day if it does not rain? The answer is completely dependent on the ability of the irrigation system to apply a large amount of water in a short period of time. This situation forces courses with low-capacity irrigation systems to irrigate because it would take several days to apply the amount of irrigation required by the turf in the event that no rain occurs, while in the meantime the turf will suffer significant drought stress and decline. Conversely, a course with a well-designed, high-capacity irrigation system can withhold watering knowing that a full irrigation cycle can be completed in a short time frame with no

disruption to play and without overwatering.

Also, the architecture of a golf course must be considered with respect to irrigation system design. Was the golf course designed to be a rustic layout with non-irrigated native grasses in the rough, or was the course designed to be highly manicured from wall to wall? Are there mounds, bunkers, or other architectural features that require specialized irrigation? Have renovation projects or architectural improvements been undertaken without making the necessary adjustments to the irrigation system? Good examples include the addition of new tees, the removal of turf in out-of-play areas, or establishment of native grass plantings that



Problems with irrigation uniformity are easy to spot due the number and size of wet spots and dry areas. But what is the exact cause of the problem? An audit of the irrigation system will help pinpoint which components are causing problems and what needs to be done to fix the situation.



have a significantly different irrigation requirement than adjoining fairways and managed roughs. The ability to isolate and control irrigation in sections of the golf course with different water requirements has a direct impact on overall course quality and water-use efficiency. If significant architectural changes have been made or are being considered, modifications or complete replacement of the irrigation system should be included in the plan.

EFFICIENCY AND UNIFORMITY OF THE IRRIGATION SYSTEM

There are several factors that influence the efficiency of an irrigation system and the uniformity of water distribution:

- Uniform sprinkler spacing based on manufacturer recommendations and performance data
- Sprinkler and sprinkler nozzle performance
- The ability to control individual sprinklers
- A pump station capable of delivering adequate water volume and consistent operating pressure
- Proper hydraulic design of the piping system and pumps
- System maintenance sprinklers level and at proper grade, pressureregulating valves properly set

Problems with irrigation uniformity are often easy to spot due to the number and size of wet and dry areas throughout the course. Determining which of the previous factors are contributing to the problem and to what degree takes more expertise and is best done by hiring a golf course irrigation design engineer to analyze the system. The analysis should include an evaluation of hydraulics and pipe sizing, the condition of pumps and controls, pressure checks at various points throughout the property, the time necessary to apply water during peak demand, and a check of distribution uniformity (DU) in various sections of the course by performing a catchcan test. Recognizing that natural rainfall is not completely uniform, the following rating scale from the Irrigation Association® is most often used when evaluating the distribution uniformity of golf course irrigation systems:



Performing a catch-can test in various sections of the golf course is one part of a comprehensive analysis of the irrigation system. Once completed, the analysis provides objective information on the status of the irrigation system so plans can be made for future improvements or replacement. (Photo courtesy of Jim Moore.)

80% = excellent/ achievable

70% = good/ expected

55% = poor

These values are a good benchmark to determine if an irrigation system improvement is needed. Once completed, the analysis will provide objective information on irrigation system status, which components need to be replaced, and a plan for making recommended improvements. The irrigation system analysis can identify several shortcuts that may have taken place during the design or installation process and other serious problems that may require major renovation or



complete replacement of the irrigation system. The information gained from an irrigation system analysis will allow management to develop an operational and financial plan for irrigation system improvement or replacement.

EVALUATING THE COST TO MANAGE AND MAINTAIN THE CURRENT IRRIGATION SYSTEM

When irrigation systems break down, most golf courses find there is little

- staff managing and adjusting the irrigation system
- Labor and material costs for making repairs
- The amount of time and labor devoted to hand watering dry spots to compensate for irrigation system deficiencies

Granted, it is difficult to justify spending \$2 million on a new irrigation system when water is free and labor is cheap, but tracking expenditures over time creates a clear vision of how the

- years that have enhanced the ability of superintendents to more precisely manage water. The state-of-the-art irrigation system installed 40 years ago has been replaced with at least five generations of newer, more efficient irrigation system components and controls. Examples include:
- Valve-in-head sprinklers that allow each head to be operated independently for more precise irrigation control
- Adjustable sprinkler nozzles that perform better in windy conditions
- Variable-frequency-drive pumping systems that pump water more efficiently and consume less energy
- On-site weather stations linked to central control computers that provide site-specific weather data and information on how much water is used by turfgrasses
- Wired and wireless in-ground moisture-sensing devices
- System integration that establishes communication between the central controller, pumping system, soil moisture sensors, and other parts of the irrigation system

The added information and feedback provided by advancements in irrigation technology allow superintendents to make more informed and accurate water-management decisions while lowering overall costs to operate irrigation systems. Even golf courses in high-rainfall areas benefit from improvements in irrigation technology that provide the ability to fine-tune irrigation programs leading to an overall improvement in turf quality and playing conditions.

Frequent pipe breaks not only leak water; they leak money for the cost of repair couplings and the labor required to install them. These costs and others should be tracked by the superintendent to get a clear picture of the total cost to manage the irrigation system.

option but to patch repairs together as quickly as possible. But how much money is leaking out of the system, especially if frequent breaks occur? It is important for the superintendent to keep track of labor and repair expenditures in order to have a comprehensive overview of the amount of resources spent on the maintenance and management of the irrigation system. Maintenance records should include:

- Water cost
- Electricity costs for pumping the water
- Amount of time spent by the superintendent and maintenance

irrigation system is managed and where money is spent. In cases where sharp increases in the price of water are experienced, there may be clear justification for upgrading or replacing irrigation systems. In situations where water costs are low, the main justification for upgrading or replacing an irrigation system may be an overall improvement in course quality and consistency.

IRRIGATION SYSTEM TECHNOLOGY

There have been rapid advances in irrigation system technology in recent

FUTURE COST AND AVAILABILITY OF WATER

In some parts of the country, the cost of water is steadily rising and water availability is being restricted. Nowhere is this more evident than in California, where some water districts have increased water prices by 50 percent and enacted strict water budgets. In such cases, inefficient irrigation systems that are prone to frequent breakdowns not only waste water but also waste money and may put golf courses out of business. Upgrading or replacing the irrigation system can

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Many golf courses will attempt to nurse an old irrigation system and devote several employees to hand watering. While this can be an effective short-term strategy, at some point the irrigation system infrastructure needs to be upgraded before catastrophic failure occurs.

easily be justified such situations. It may be more difficult to justify irrigation system improvements in areas where water is plentiful and inexpensive, but this might not always be the case. Unexpected changes in water-storage capability or a switch to a different water source may impact budgets and golf course operations in the future. It is important to talk with the agency responsible for water delivery in your area to develop a long-term view of the future price and availability of water and how future changes may impact your golf course. Although some locations might not be experiencing a crisis at the moment, planning for the next 10, 15, or 20 years is always a prudent idea.

WHAT IS THE RETURN ON INVESTMENT OF A NEW IRRIGATION SYSTEM?

If a golf course is going to spend \$1-2 million on a new irrigation system, questions are often asked, such as "What is the return on investment?" or "When will the project pay for itself due to savings in labor, water, and energy costs?" Such calculations are difficult to make because each golf course situation is different with respect to total acreage, architecture, water source, desired level of maintenance, and many other variables. The fact is that an irrigation system is a key component of the golf course infrastructure, similar to the roof on a house. It is not an optional accessory. In some circumstances, a new irrigation system can produce significant savings where water costs are high, and some courses document savings of 20 percent or more compared to previous irrigation systems. In nearly all cases, a new irrigation system produces better water application efficiency and flexibility, reduces labor and repair costs, and translates into improved turf quality and better playing conditions.

MAKING THE DECISION ON IRRIGATION SYSTEM REPLACEMENT

Like many decisions related to golf course management, there is not a clear-cut date, time, or number of operating hours that triggers when an

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irrigation system should be replaced. Making the decision to replace an irrigation system depends on a number of factors. An audit and analysis of the irrigation system by an irrigation design engineer who specializes in golf courses will provide objective data on the status of the irrigation system. Another good exercise recommended in the USGA Green Section Record article Does Your Irrigation System Make the Grade? is to do a reportcard-style evaluation of the irrigation system. The next step is to develop plans to achieve the desired objective for your course. The following examples offer insight into some possible scenarios for irrigation system improvement:

Upgrading pumps and controls:

The pumping station is the heart of the irrigation system. Inefficient pumps can adversely affect irrigation coverage but also can waste a significant amount of money by consuming exorbitant amounts of electricity. Assuming that the pipe system is in good condition

and is adequately sized, upgrading irrigation pumps and controls to a variable-frequency-drive system can improve pump efficiency and help save money on electricity. In some cases, the cost savings can be substantial.

Replacement of sprinklers, satellite controllers, and central controller: If the piping system is hydraulically sound and in good condition, upgrading the sprinklers and controllers may be all that is necessary. Sprinklers receive the most wear of any irrigation system component and are the items that need to be replaced most frequently. Some courses decide to replace sprinklers in phases to spread the financial impact over two or more seasons. Note that partially replacing sprinklers results in a mix of older- and newer-model heads with different coverage patterns and water application rates, which contributes to a wide-scale lack of uniformity. Although it may not be economically feasible to replace all sprinklers and controllers at once, completing the

project in a reasonable time reduces inconsistencies in irrigation coverage and control. Replacing infield satellite controllers provides an opportunity to upgrade to the latest technology for better reliability and efficiency and to obtain additional programming features. Upgrading controllers also provides a chance to increase the number of stations on each control panel so that every sprinkler can be wired separately and operated individually.

Replacement of the piping and control-wire systems: The frequency of pipe and fitting breaks offers a good indication that the piping system and fittings could be fatigued and may need to be completely replaced. Keep in mind that wires for the control system are typically placed in irrigation trenches, and an irrigation system that experiences frequent pipe breaks also is likely to have a worn-out wiring system. Pipe and control-wire replacement is a significant endeavor and usually signals the replacement of the entire irrigation system. However, replacing



Variable-frequency-drive pumping stations and controls are examples of improved technologies available to golf courses. Provided the pipe system is well designed, upgrading the pumping system can make a substantial impact on irrigation uniformity and reduce energy consumption.



irrigation piping provides opportunities to improve the hydraulic design of the irrigation system so the entire course can be irrigated in a shorter time frame and to modify sprinkler spacing and configuration for better irrigation uniformity.

CONCLUSION

Most would agree that there is never a good time to replace an irrigation system and, as far as the golf business is concerned, replacing an irrigation system is one of the most difficult projects to get approved. It is typical for a golf course maintenance staff to nurse an old irrigation system along for many years and incur excessive expenditures for repairs and handwatering, only to hear golfers say, "I don't know why you need a new irrigation system. The place looks great." However, at some point it is important to consider the cost of doing nothing. Ongoing preventive maintenance and repair can extend the life of an irrigation system, but eventually mechanical components simply wear out and need to be replaced. If left too long, finding replacement parts for an irrigation system may become increasingly difficult. Worse yet, there could be a catastrophic failure of the irrigation system and water could be unavailable for several days or weeks. Detailed maintenance records regarding irrigation system repairs are very helpful in determining if money is being wasted on keeping an obsolete and inefficient irrigation system in operation and may help justify the need for a new irrigation system. The services of an independent irrigation design engineer with experience in golf course systems is equally valuable for objectively evaluating the irrigation system and recommending improvement options. Replacing an irrigation system or upgrading major irrigation system



Pipe replacement is a major endeavor but provides an ideal opportunity to improve the hydraulic design of the system, modify the spacing of sprinklers, and incorporate new technology that can improve irrigation uniformity.

components provides opportunities to refine irrigation system design to meet current and future needs while taking advantage of current technology that can make water applications more uniform and efficient. The ultimate goal is to have an efficient and dependable irrigation system that serves the needs of the golf course for many years into the future while conserving precious financial and water resources.

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