Get a Grip on Your Irrigation Program

Precipitation rate is measured through catch cans placed near the sprinkler and halfway to the next one. The testing run time should be enough to collect 25 ml of water.

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Good water management on sports fields results in irrigation efficiency, which is achieved when most of the water applied is used by turfgrass. Water savings from the irrigation system can be accomplished by using irrigation schedules based on a knowledge of the performance of the irrigation system and the plant's need for water. The results of good water management include:

- reduced water usage and fewer dollars spent on water;
- improved field appearance and fewer wet or dry spots;
- reduction of water loss below the rootzone; and
- reduced fertilizer and chemical requirements.

Good performance generally means applying the irrigation water as uniformly as possible without runoff. Good-performing systems are the result of an appropriate design, followed by maintenance to keep the design intact. Continuing good performance depends on adequate maintenance, financial support for the proper replacement commitment and the human resources required to make repairs and adjustments.

To determine the system performance characteristics of *distribution uniformity* and system *precipitation rates*, a landscape audit should be performed. An audit consists of a series of field procedures for collecting irrigation system data, then the use of computer software to evaluate system performance characteristics.

During the irrigation-audit phase, sites that demonstrate potential water savings are identified, and information about each site's technical characteristics and controller capabilities is obtained. Data, such as site maps, irrigation plans and water-usage records, is analyzed to determine which sites are using more water than necessary. Areas are then identified that will benefit most from improved water management.

The two phases of landscape water management, *irrigation audits* and *irrigation management*, can be broken down into a series of steps. They are:

Irrigation Audits	Irrigation Management
1. Select Sites	1. Implement Base Schedule
2. Tune System	2. Schedule Adjustment
3. System Tests	3. Track Water Use
4. Calculate Base Schedule	4. System Maintenance

Site Selection

When analyzing multiple-site water-management programs, the first step is to identify sites having maximum potential to save money. Reference evapotranspiration (ET) and rainfall data are essential. In California, the Department of Water Resources California Irrigation Management Information System (CIMIS) can be used as a source for ET. In other states, local water districts or government agencies, such as the Natural Resources Conservation Service (formerly known as the Soil Conservation Service) may be a source for rainfall and ET data.

Another factor in site selection is determining the maximum water allowance based on the area's reference evapotranspiration, the ET adjustment factor and size of the field. The amount of water recommended annually in the irrigation schedule should not exceed the maximum water allowance.

The water meter or billing records can be used to determine water usage at a particular site. Include all water meters at the site in the total. Determine any non-irrigation water usage and subtract this amount from total water usage. One way to estimate non-irrigation water usage is to use water records from months when there is little or no irrigation.

Water usage for each site in a group can be used to decide the order in which sites should be audited based on the

amount of water the site used compared to the amount needed or to the existing water allowance. The table in Figure 1 shows how a site group was ranked. The average annual ET of 48 inches used in this example is for a specific location in California.

Site Selection Ranking Table

A	B	C	D	E	F
Site Name $ET_0 = 48"$	**Irrigated Area** (sq ft)	**Allowance** (100 ft^3) $ET_0 \times 0.8 \times LA \times 0.00083$	**Water Use** (100 ft^3) Water Bill	**Water Use minus Allowance D-C**	**Priority**
Central Park	233,500	7,442	8,272	8,272	1
East Park	195,300	6,225	5,660	5,660	3
Kid's Park	13,211	421	450	450	2

Figure 1

The larger the difference between the water usage and the allowance, the greater the potential for savings. Even the site where the amount of water being used is less than the allowance still holds some potential for savings, depending on the type of landscape plant material and the distribution uniformity of the irrigation system. One site, East Park, is using less than the allowance, while the other sites, including Kid's Park, are using more than the allowance. Use the total amount in excess of the allowance to decide which site should be audited first. In this example, Central Park should be audited first, followed by Kid's Park and East Park.

Prior to actual tests, a system inspection will identify obvious problems, such as broken sprinkler heads, sprinkler alignment and pressure problems. All obvious sprinkler system problems should be noted at this time. Look for valve malfunctions, sunken sprinklers, plugged equipment, lateral line drainage, slow drainage or ponding, and runoff. Check each sprinkler head to make sure the head is rotating. Leaks around seals and gaskets should be repaired.

Pressure Adjustment — Pressure always varies throughout a system; therefore, each station should be checked for the proper pressure setting. Standard pressure gauges, along with pitot tubes (for large sprinklers) or adapters (for spray or stream rotor equipment), are used to check the pressures at the sprinkler heads while the system is operating.

To obtain an estimate of the lateral pressure variation, take three readings in each zone — beginning, middle and end. If the pressure varies by more than 20 percent (highest to lowest pressure), the system should be evaluated by an irrigation expert who has a background in system hydraulics.

Pressure adjustments can be made easily on most electric control valves with "flow-control" stems. With the main line at "normal" pressure, open or close the flow-control stem until the expected pressure at the nozzle is achieved. Pressures can be reduced with this method (although excessive wear

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Sprinkler Auditing

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problems may arise if the valve is almost closed at the desired pressure). If the required pressure cannot be reached even with the valve fully open, a booster pump or system design change may be needed.

The procedures for system tune-up include:

1) Confirming availability of the sports field for audit. Make sure the field will not be used for a game or practice.

2) Obtaining and reviewing site plans for general orientation, plus location of important components, such as water meters, controllers and valves;

3) Locating the irrigation equipment, such as finding the point of connection (water meter) and first controller. Leave a person with a walkie-talkie at the controller;

4) Observing station operation by using a site inspection worksheet. Run each station and record observations; and

5) If possible, making the necessary adjustments and repairs to the system. This involves pressure adjustments, sprinkler repair and replacements, plus sprinkler alignment and adjustments.

Sprinkler System Tests

Once the inspection and system tune-ups are complete, system tests are conducted to determine irrigation system performance. Several methods have been developed to obtain the information required to analyze system performance.

With sprinkler systems, catch cans are used for measuring precipitation. Catch cans are placed near each sprinkler being tested and then halfway to the next sprinkler.

The next step is to start each station and flag the sprinkler heads, so they will be easier to locate. When testing multivalve groups, use different-colored flags for adjacent stations.

Each catch can should be horizontal and as low as possible. The catch can should be far enough away from the sprinkler to prevent the main spray from hitting the side of the can.

After the catch devices are laid out, each station is turned on for its testing run time until the entire test group has run. The testing run time should be long enough to collect 25 ml of water. When testing large rotary sprinkler heads, measure at least five rotations, then read whatever volume is in the cans. Two factors are recorded: the volume of water collected and the time in which it was accumulated (test time).

The volume captured in each device is estimated to the nearest milliliter. Hold the water at eye level and make sure that the catch can is horizontal. Read the "darker" lower line on the side of the can and estimate to the nearest milliliter.

Hydrozone Information

At the time of the system test, hydrozone information such as turfgrass species, planting density and station microclimate are recorded. This permits estimation of water demand in the station. Rootzone depth and soil type are recorded so an accurate irrigation frequency can be determined.

Soil Type — It is necessary to know the soil type for the landscape water maintenance (LWM) software to correctly determine the holding capacity and irrigation frequency. Use a soil probe at the site and define the soil type, then record the data in the appropriate worksheet location.

The texture (sand vs. loam vs. clay) of soil determines how much water can be stored within the rootzone of a plant. The structure (organic content, compaction) of soil influences the infiltration rate (how fast water can be returned to the rootzone). Compacted soils and thick thatch create low infiltration rates.

Rootzone Depth — Rootzone depth is another factor in determining irrigation frequency. To determine the rootzone depth, use a soil probe to take soil cores. If it is impossible to get a hand coring, an adequate depth can be estimated based upon plant type and stage of growth.

Lateral Pressure — Make sure test pressures are the same as normal operating pressures. Daytime demands may differ from nighttime demands, resulting in differences between daytime and nighttime pressure. Proper test pressure plays a large role in determining the success or failure of the catch-can test. Also look for variation, which is a potential source of poor distribution uniformity.

Pressure Checks on Different Sprinkler Types

The correct method for testing the pressure on *large rotor-type* sprinkler systems is to use a pitot tube. Stick the pitot tube directly into the nozzle. The key is to check for pressure differences between the heads. Each pressure reading will have about the same amount of error if each reading is taken the same way.

Spray and stream rotor sprinklers have adapters designed to fit under the sprinkler head. A pressure gauge is then attached to the adapter, and the pressure is read directly from the gauge. Pressure readings should be taken on each lateral being tested to provide a picture of the pressure uniformity on spray and stream rotor systems.

Schedule Calculation

Use the LWM software to calculate irrigation schedules for each station at the site. Stations are grouped by LWM into "programs" to facilitate controller programming. Implementation of these schedules can reduce water usage.

Once base schedules are created, they should be reviewed for practicality. Starting times should be arranged so that multiple programs are not running at the same time.

After the auditing process, you'll have a clear assessment of your irrigation system. With the increased distribution uniformity, you'll notice lower water costs and heightened turfgrass appearance. Periodic audits will ensure the irrigation system is working at its peak performance. ❑

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