Root zone water management

Maximizing irrigation efficiency for large landscapes

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The Problem

Large landscapes in both the private and public domain can be some of the biggest users of landscape irrigation water. Much of this is due to their size, but other factors such as hardscape features which can restrict system design and efficiency, public awareness of landscape appearance, and irrigation scheduling practices that are common to large properties play a role in water waste. Because these properties are often prominently visible there is sometimes great pressure on the individuals that control the irrigation scheduling to keep the landscape "clean and green". Design deficiencies and malfunctioning components will reveal uniformity issues in some areas which can lead to over irrigation in order to avoid criticism. It is also very common to see boilerplate irrigation schedules set at large properties regardless of plant/soil type or irrigation system design. New water efficient technologies certainly can help, but the scheduler must be properly trained to program these sophisticated controllers. Often they are simply too busy to spend the time customizing a schedule to the individual needs of a particular site. So the challenge becomes: how can we simply and effectively use the least amount of water possible to maintain healthy, attractive plant materials?

Typical irrigated streetscape

Timing is Everything

Conventional irrigation controllers are calendar driven and typically programmed with standard run times based on emitter type (spray, rotor, drip, etc.) and the scheduler's previous experience. Weather data or "ET" (*evapotranspiration*) based controllers offer a more scientific method of applying water but require an accurate data source and a trained operator to program in the site particulars. In some cases the weather data is provided via a fee based signal which has the potential for interruption due to financial issues. We wanted to know if calendar based programming or sophisticated ET controllers would apply the appropriate amount of water needed or should the schedule be determined at the root zone of the plant material?

Minding our business

How can we determine how much water a landscape really needs? For several years we have conducted many experiments with a testing device called the Water Savings Monitoring Kit (WSMK).

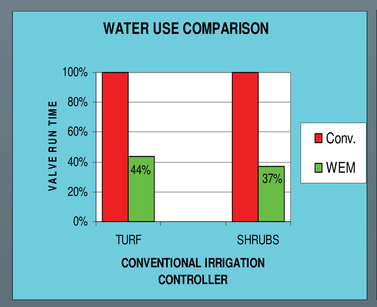
Water Savings Monitoring Kit

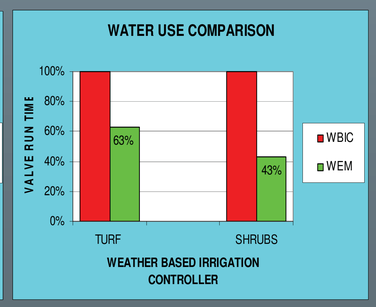
The purpose of the kit is to compare the total run time of irrigation valves that are controlled with either conventional or ET based controllers, to valves managed by plant demand. This is accomplished by selecting landscape properties that have a common area serviced by two separate irrigation valves. Both areas must have very similar plant materials, sun exposure, irrigation system components, etc. We then introduce an hour meter into each valve's wiring which records total run time on each valve independently. The controller is set for the same amount of run time on both valves. One valve will operate based on the controller's program, and on the other valve we install a WATERMARK Electronic Module (WEM) soil moisture management device to eliminate unnecessary applications.

The WEM consists of two soil moisture sensors and an electronic module that prevents unnecessary irrigation when the soil is wetter than the threshold setting. The module checks sensor status before allowing subsequent irrigation cycles. The moisture set point can be adjusted for soil/plant types, appearance, and irrigation system efficiencies. For these case studies the threshold on the WEM is adjusted to keep the plant material healthy and attractive while using the least amount of water possible.

Smart plants?

Actually we found that plants are pretty smart! They don't know what day of the week it is or what crop coefficient they've been assigned, but they do know when they need water and when they don't. In our case studies the hour meters consistently recorded less water applied to the WEM managed valves than the conventional or ET managed valves. **In turf we found average savings of 56% over conventional and 37% saving over ET controllers. In shrubs we saved 63% over conventional and 57% over ET controllers.** The charts below show the results graphically.

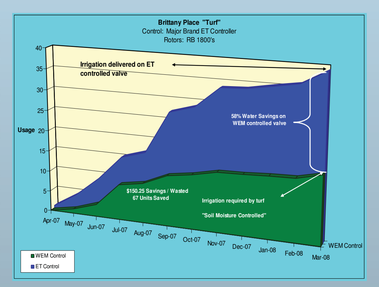




Real results

We are not suggesting that conventional or weather based controllers can't be programmed to apply water efficiently. But we did find that in the real world of landscape management, schedulers tend to default to what they are comfortable with. No manager wants scrutiny from the public or a Home Owners Association so they play it safe and tend to over irrigate in order to maintain the desired results. However, just like many people, plants don't understand politics very much; all they want is the correct amount of soil moisture, not too much and not too little. **Root zone water management is a very cost effective and efficient method of applying the correct amount of irrigation water.**

Britney Place HOA



Fact or fiction?

The photo and graph above are actual examples of a WSMK study. We have seen similar results from many case studies. The turf looks good and is healthy yet we saved 58% over a Weather Based Irrigation Controller (WBIC) controller. Numerous third party studies have discovered similar savings to our experience.

Two good sources of validation are a study done in Boulder CO by Aquacraft (see Qualls R.J., Scott, J.M., DeOreo, W.B. 2001. *Soil Moisture Sensors for Urban Landscape Irrigation: Effectiveness and Reliability*. American Water Resources Association Journal, June 2001.) and a UC Davis study showing substantial water savings with soil moisture technology. While the primary intent of this report was to study pesticide runoff in landscapes, it also shows results similar to our case studies when comparing conventional, soil moisture managed and ET based controllers (see Darren L. Haver, Ph.D., March 2008 *Mitigating Pesticide Runoff in Urbanized Environments Final Report*).

Further Information

IRROMETER Company has been a world leader for soil moisture measurement, monitoring, sampling and management since 1951. We serve the landscape, agricultural, environmental, and research markets. Our soil moisture management product offering includes basic residential devices up through sophisticated multiple hydrozone systems for commercial applications. Please contact us for more details on these case studies or other irrigation water efficiency studies.

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