# A WATER PURVEYORS VIEW OF SMART WATER APPLICATION TECHNOLOGY

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## SILENT SERVER NO MORE

Water is necessary for life. In the 1800s North American communities pulled together to assure water supply, establish water management strategies and build infrastructure with an eye toward building to serve future generations. Their strategic planning and build-out has allowed water utilities to assume the roll of “silent server”. The business goal of most utilities is to be so reliable and serve such an excellent product that the customer could assume our product was pure and plentiful at the lowest price possible. North American water utilities have succeeded so well that many people take the water supply for granted. The average citizen has not had to think very much about water supply, water resource management and water utility infrastructure. In the past twenty or thirty years this comfortable situation has changed dramatically. Drought pressures, population pressures and the increasing cost of continued infrastructure build-out have conspired to make it everyone’s business to assure a reliable water supply. Municipal water management is especially important to businesses that rely on a ready supply of water, such as the landscape industry.

## WATER USE PATTERNS

Municipal water use is generally divided into two sectors, residential and industrial/commercial/institutional (ICI). Water uses are generally divided into two categories, indoor and outdoor. ICI water use is characterized by a fairly consistent and large indoor water

use year-round. Conditioned space cooling contributes a slight increase in ICI demand as weather warms. Parks are an exception to this pattern; they have very low domestic water use and large amount of outdoor water use for the landscaped park area. Residential water use is characterized by fairly low indoor water use and a large amount of outdoor water use. This huge increase in demand is a primary concern for water utility engineers and operators and is called "peak water use," the "seasonal peak", "peaking factor" or more often just "peak." A secondary concern to water operators is daily peak water use. "Peak hourly use" refers to the hours of the day of greatest demand, typically morning and evening. Morning hourly peaks are much greater during the watering season due to the common recommendation to "water early in the morning" causing a predictable and considerable spike in water distribution pumping. Peak management is a challenge in the water business. The water infrastructure must be built to meet the demand of the peak season, more specifically the demand of the hourly peak during the peak season. The remainder of the year peak capacity infrastructure sits idle and does not generate revenue. For many western utilities peak capacity is only utilized for about three months of the year.

Statistically, in North America outdoor water use is an average of 60% of all residential water use. During the watering season the utility infrastructure must serve up more than double the amount of water used at other times of the year. Some utilities in the arid west experience a three to five fold increase in water demand in the summer watering season. When you consider that a fraction of the residential customers actually water outdoors, it becomes clear that the landscape watering of the few has a huge impact on how water utilities must build and manage the entire water distribution system on a seasonal basis.

## WATER MANAGEMENT STRATEGIES

As populations grow and water supplies must be stretched to meet demand, water management becomes more important than ever. Assuming current demand trends, the looming funding gap for infrastructure build-out is expected to be $45 - $102 billion dollars in the United States alone by 2022 (EPA-816-R-02-0, September 2002). Many utilities have built oversized infrastructure to meet predicted summer peak demands and have come to view this oversized capacity as a resource, hence the phrase “conservation as a source of supply”. Effective use of current irrigation technology as well as introduction of new irrigation technology can manage irrigation demands such that capacity formerly allocated to meeting peak can reliably be allocated to new growth in the service area.

In the past, utilities noted demand trends then simply planned for future building based on those trends. Increasingly limited water sources, availability of land for reservoirs and other infrastructure have conspired to make this a prohibitively expensive way to do business, so many utilities are looking for demand management solutions that can assure capacity just as building new infrastructure had in the past. Several demand management solutions are available, including indoor hardware retrofits, landscape conversions from high water use turf to native plant materials, and innovative irrigation controller technology – all combined with aggressive customer educational programs.

While indoor hardware retrofit is well developed as an offset for demand trends for more than 20 years, outdoor technology solutions are just beginning to become a viable demand management

strategy. Since irrigation is often the largest contributor to the peaking factor, it is the greatest opportunity for peak reduction.

In an attempt to offset the need for emergency drought response, many water utilities have enacted voluntary and mandatory watering restrictions, hoping to manage water treatment plant peaking. They have created water conservation educational programs, hoping to change the behavior of ratepayers. Some water utilities have offered irrigation audits, hoping that homeowners or commercial properties would repair or upgrade their irrigation systems to improve water use efficiency. Unfortunately, even if incentives are offered very few customers make the necessary repairs or upgrades and quantifying water savings from educational conservation programs is extremely difficult. All strategies outlined above have an expectation of changing human behavior rather than a reliable technology solution that provides sustained water savings.

## A SENSE OF TIMING: CASE STUDY UPPER LEVEL PUMP SYSTEM

### CASE STUDY: THE PROBLEM

In Eugene Water & Electric Board (EWEB), several upper level areas of the system are operated by continuous running pumps and are therefore particularly sensitive to large demands. One upper level area was experiencing peak demands and was nearing pump station capacity on Monday, Wednesday and Fridays between 5 a.m. and 7 a.m. This pumping pattern would require expensive upgrades much sooner than originally planned unless customers could manage water use to change demand patterns. When conservation staff took a closer look they determined that predicted building patterns had changed so that new homes had much more irrigated landscape

than previously built homes in the area. Most of these irrigation controllers set on the same schedule were threatening to exceed pumping capacity about 10 years earlier than expected for pumping demands, totaling about 48 hours a year.

## CASE STUDY: AVAILABLE OPTIONS

The available courses of action included expanding the pump station within two years and accelerate plans for building a future reservoir, or to somehow persuade customers to manage demand in this upper level pump system. EWEB engineers began drawing up plans for expansion while the conservation staff began the work of crafting a message for these customers.

## CASE STUDY: SOLID RESEARCH

Emergency door hangers during the summer watering season had no affect. EWEB contacted local landscape contractors at association meetings. Contractors noticed that the water use peaks were on the same days that many of them set controllers throughout the city, however they let us know that most of their customers manage the controllers after spring start up. Further research was required on how to reach these customers. EWEB conservation staff conducted focus groups with customers from this neighborhood, explaining the problem and inviting them to help craft a cost-effective solution. The focus group participants told EWEB that they and their neighbors just needed solid information about the distribution system and their impact on it in order to make informed decisions about their water use patterns. These customers were adamant that they did not want prescriptive programs or water use restrictions. They were confident that given proper information they could manage the peaking problem and avoid costly emergency upgrades.

CASE STUDY: NEWSLETTER AND WEEKLY POSTCARD UPDATES

By mid-summer the next year, the same peak pumping pattern emerged and the pump station was again nearing capacity. Conservation staff had been hard at work crafting an information campaign called the “700-gallon per minute (GPM) Challenge”. At 700 GPM, only one of the pumps in the station would be needed. For this reason, the EWEB conservation staff targeted the 700 GPM benchmark as the goal for minimizing peaks that had begun to consistently exceed 1100 GPM and peak as high as 1350 GPM during the previous summer.

A newsletter explained the situation and the potential to avoid costs if customers changed behavior. This was followed by weekly pump station “GPM report cards”. The response was immediate and marked. After the first weekly report card the pump station GPM did not exceed the requested goal of 700 GPM for the rest of the summer. And after the second summer information campaign, only two pumping days exceeded the goal, 720GPM and 733GPM respectively.

The “700-gallon per minute Challenge” has enabled customers to help EWEB manage the distribution system, along with the associated operations and upgrade costs. Even as some new construction continues in this area, EWEB staff believes this reduced peak pumping pattern can be sustained and will decrease pump maintenance costs, possibly manage electric costs, as well as avoid emergency upgrades. As of now, the future reservoir will likely be built according to the original timetable.

## CURRENT TECHNOLOGY VERSUS NEW TECHNOLOGY

It is important to note that the change in irrigation demand on this upper level pump system was achieved using current technology. Only timing of irrigation was changed while pumping volumes remained virtually the same. The new smart controllers will be able to continue to manage timing to minimize peaking impacts on the distribution system, and they will provide better tools for managing the total volume used as well.

New irrigation technologies available today have solid demand management potential, though they will not assure captured capacity alone. Technology must be used in combination with Best Management Practices (BMP) for the design, installation and management of irrigation systems. The Irrigation Association®, as well as other professional organizations, has developed BMP guidelines. Many water utility resource managers have realized that it is time to partner with the landscape and irrigation industries, to help manage our distribution systems with mutual benefits.

Over the last decade, utilities have scrambled to find technologies to reduce the impact of irrigation. Many products have come to the marketplace that shows promise. For example, there are more than 20 companies alone that offer climate-based irrigation controller technologies. Even more products are available in sensor technology, including soil, rain, solar radiation and more. However, many landscape professionals have been slow to accept these new products because they view them as unproven in the field. Given the high expense of some of the new technologies, landscape professionals are sticking with proven methods for keeping it green.

Many water agencies and universities have conducted testing of some of the new weather-based irrigation technologies. However, since different testing methodologies have been used in each of the studies, water agencies have voiced skepticism that similar water savings and quality landscape appearance could be duplicated in their service area.

## SMART CONTROLLER TECHNOLOGY ATTRIBUTES

Current controller products on the market do not apply water efficiently; because they do not automatically adjust run times to changes in plant water need or create watering schedules based on industry standards. They require people to calculate and set irrigation schedules in minutes of run time. To keep up with weather changes, people must repeat the action of inputting the correct scheduling information over and over again.

Smart controllers on the market alleviate the guesswork that comes with traditional irrigation scheduling. Several have built-in irrigation scheduling engines that create baseline schedules for every zone on the system, with daily updates to the watering schedule as the weather changes. For those products with scheduling engines, the installer simply inputs specific site information (i.e. soil type, plant type, sprinkler type, solar exposure, precipitation rate, system efficiency and degree of slope). Depending on the manufacturer, weather updates are received through wireless pager technology, on-site sensors, Internet, phone lines or cellular service. Other smart controller products update watering schedules based upon historical weather information, using a temperature gauge and a rain sensor or soil moisture sensor to modify irrigation run times. For water utilities concerned about maintaining strict watering days, most of these clocks have features that allow for interval watering and odd/even watering day restrictions.

Although the irrigation industry uses smart controllers as a generic term, water managers should not assume the same water savings levels between products, across homes and commercial landscapes. Some products use real-time weather data, while others rely on historical weather information. Of those that use real-time weather data, some receive their data from on-site sensors, while others receive them from a comprehensive network of National Weather Service stations. Additionally, moisture sensor-based products rely on sensors installed in the ground to delay irrigation.

## IS THE TECHNOLOGY SMART

In 2002 the Irrigation Association initiated a partnership with water utilities that has come to be known as Smart Water Application Technology (SWAT.) The Association recognized that irrigation manufacturers, designers, distributors, contractors, consumers – as well as water utility managers, conservation staff and operators – need to be informed about the water management potential for efficiency-tested technology. In the past, irrigation manufacturers have been required to safety test their products according to Underwriter Laboratories Inc., International Association of Plumbing and Mechanical Officials and American Society of Agricultural Engineering (ASAE) test protocols. Now they also have the opportunity to pursue third party testing to be tested against water efficiency criteria. When conservation performance is assured, water utilities and landscape professionals will have reliable technology to promote to their customers that will assure captured water resource.

SWAT testing protocol have been peer reviewed by all interested parties using an Internet comment tool, then updated by the Center for Irrigation Technology (CIT) staff. All comments were answered, but not all were incorporated into the protocol. The committee was lucky to have Ed Norum, from the Center for Irrigation Technology in Fresno, as lead for the protocol writing effort. His more than 50 years of experience have included lab and field testing of all types of irrigation products using ASAE and other protocol, as well as participation in development of the International Organization for Standardization (ISO) Irrigation Standards. Norum's balance of technical knowledge, field experience and a firm grounding in irrigation science has proven to be of great service in this effort. CIT is the only SWAT testing facility to date, though the testing protocol are available to any public or private institution.

Several generous donations from water utilities made it possible to purchase the necessary equipment for CIT to begin beta testing for weather-based controllers during spring 2004, with regular testing offered to manufacturers for a fee since August 2004. Manufacturers submitting a product for testing will receive confidential test results, and may choose to release results to the public or go back to further develop their product. While ET Water Systems is the only controller manufacturer to release results at this time, three other controller products are currently undergoing testing with results expected during fall 2005. The protocol for soil moisture sensors was published in November 2004. The SWAT website was launched in 2004 and has postings of SWAT protocol, test results and more information about weather-based and sensor adjusted irrigation controllers (www.irrigation.org).

In California, Assembly Bill 2717 requested that a stakeholder working group develop, evaluate and recommend proposals for improving the efficiency of water use in new and existing urban landscapes in the state (Chapter 682, Section 1.a). According to Marsha Prillwitz, Project Manager, the AB2717 Task Force has recommended that all irrigation controllers sold in California after 2010 should be performance tested according to IA SWAT protocol. These recommendations must go through a public comment period before presentation to the governor for approval in December 2005. However, the consensus of the task force indicates a keen interest in testing of products claiming to irrigate efficiently and confidence in the SWAT controller protocol in particular.

## FOCUS ON THE CUSTOMER

For all parties concerned, homebuilders, irrigation product manufacturers, distributors, contractors, irrigation consultants, designers, architects and water utilities—the customer is the focus. While most of these parties collect their payment from the customer and then go on to the next customer, the maintenance contractor and the water utility have an ongoing relationship with the customer. The customer can initially pay for efficient design and installation to a vendor with short-term interests, or will pay later in higher irrigation maintenance and water bills than necessary to a vendor with long-term interests. Landscape professionals are encouraged to educate builders and consumers to motivate them to pay the extra initial cost so operation costs can be managed better for the life of the irrigation system. The hidden cost incurred by an inefficient irrigation system is the impact to the utility's infrastructure. You are invited to partner with the water utility to manage infrastructure build-out costs that will ultimately impact ratepayers. As a partner you can be at the table when water management decisions are under

consideration. You will be able to offer your expertise to the efforts to keep the water flowing in your municipality. You will have opportunities to understand the constraints of your local utility regarding water resource and water infrastructure management and offer irrigation efficiency recommendations and possibly services. Educating our mutual consumers and fostering a dynamic, innovative partnership with your local water utility are proactive ways to manage your customers' access to the water needed to keep it green and ultimately the health of your business.

REFERENCES

EPA-816-R-02-0, September 2002. The Clean Water and Drinking Water Infrastructure Gap Analysis, 43

California Assembly Bill 2771, Chapter 682, Section 1.a

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