RAIN BIRD®

The Intelligent Use of Water™ Summit VIII
A Look at Global Conservation Initiatives and Strategies: Leading By Example

Monday, December 31, 2007 — 2:30 p.m. to 4:30 p.m. • Hilton Hotel, San Gabriel Ballroom — Pasadena, CA

SUMMIT VIII
PANELISTS' PAPERS

Mike Binns

Regional Landscape Director, Camden Living
Houston, Texas

Roger Cook

Owner, K&R Tree and Landscape Co. Inc.
Landscape Contractor for Emmy Award-winning Television Series, *This Old House*
Burlington, Massachusetts

Marty Eberhardt

Executive Director, The Water Conservation Garden
2007 Recipient of The Intelligent Use of Water™ Award
El Cajon, California

Steve Windhager

Director, Landscape Restoration
Lady Bird Johnson Wildflower Center; Sustainable Sites Initiative
Austin, Texas

David Zoldoske

Director, Center for Irrigation Technology
Fresno, California

MODERATOR

Dan Stark

Executive Director of the American Public Gardens Assoc. (APGA)
Wilmington, Delaware

MIKE BINNS

Michael T. Binns received an A.S. degree of Horticulture Science from Ricks College in Rexburg, Idaho, and a B.S. of Horticulture Science from Brigham Young University in Provo, Utah. He was employed in Phoenix with TruGreen LandCare from 1997 to 1999. He started with Camden in February 1999 as an Assistant Landscape Director managing Camden's landscapes in Las Vegas. In October 1999, he moved to Houston as a Regional Landscape Director to manage Camden's landscapes in Phoenix and Tucson as well as Houston, Austin, and Corpus Christi. He is married to Brita and has five children: AliEmme, Johnny, Hannah, Billy, and Rebecca.

I. Camden Property Trust (CPT)
   a. A publicly traded Real Estate Investment Trust (REIT) which owns and operates almost two hundred multifamily communities worth four billion dollars throughout the country and are located in the following key areas of the United States:
      i. Texas
      ii. Southern California
      iii. Nevada
      iv. Colorado
      v. Georgia
      vi. Florida
      vii. North Carolina
      vii. Washington D.C. and Virginia

II. Green Industry and Water Conservation
   a. Reduced water consumption has yet to become an absolute in the world of conservation; however, society is aware of the need to reduce water consumption as seasonal droughts across regions of the United States become more severe; the poster child of course for '07 is Georgia and areas of the Southeast. In the recent past, the Midwest and Intermountain west states have experienced what they have not before. Obstacles or perceived obstacles of water customers slow migration to technologies or tools of Rain Bird to conserve water are:
      i. Meeting with the decision maker – someone other than the person meeting with the water manager is the one who makes the decision.
      ii. Capital and operating funds – efforts made by the green industry and especially water managers need to incorporate terms such as Return on Investment (ROI) and Cap Rates into the conversation. Water conservation is not only a question of how much water and money was saved but what was the value added to the property. Financial benefit encourages environmental quality. An example from a Camden property will be communicated below.

III. Water Management
   a. Camden Greenway
      i. In January 2003, Camden Greenway and Camden Midtown in Houston, TX were selected as sites to install what quickly became the Rain Bird ET Manager. The ET Manager is a simple yet versatile technical tool to conserve irrigation water at the Camden properties. WaterLogic, a Houston-based water manager, partnered with Camden to install and manage the ET Manager and provided periodical reporting which was the catalyst in achieving results more than hoped for. As of this year, the ET Manager is on every irrigation controller (97) for Camden in Houston, Austin, and Corpus Christi, TX.

ii. The accompanying reports or graphs regarding results[1] for Camden Greenway illustrate two points to review for the balance of the discussion:

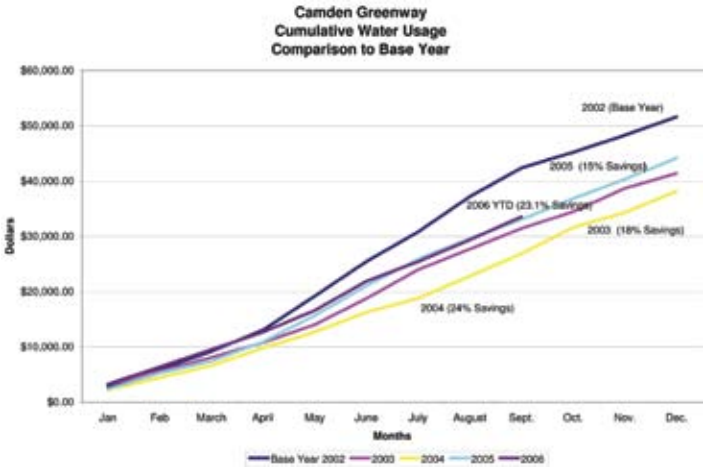
1. Reconciling what the water bill indicates to what the actual meter shows. Although the results at Greenway were more than hoped for, it became apparent over time that something else was influencing the irregular results at Greenway. Reviewing the situation with WaterLogic, a decision was reached to review or compare the actual meter readings to the water bill. At the end of '06, a lost meter was found and the reading showed the municipality had over-estimated water usage by eighteen million gallons over seven years. The graph from '06 has a meter Camden paid two thousand dollars a month for water that was not used. When the error was discovered, the meter was removed from the comparison and look at the difference! A refund is being processed and Camden anxiously awaits the proceeds. In addition to the eighteen million gallon refund, Camden has received three refunds totaling $60k from local municipalities in Houston and Austin, TX. When all is said and done, quantities of water conserved have to be measured and reported, not left to the assumption.

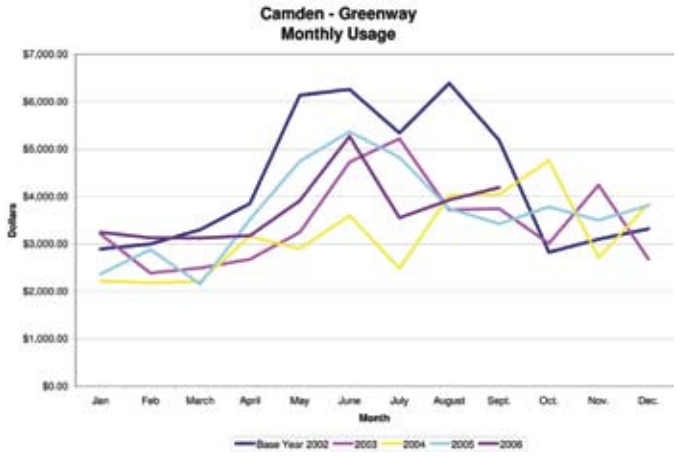
2. Financial results – ROI and value added to the property.

   a. The water savings over five years have paid for the initial installation and management fee almost five times! Not a bad investment at all, a 500% ROI.

   b. Through October '07, 4.2 million gallons have been saved compared to the baseline year of '02 which resulted in a savings of just over twenty thousand dollars. Twenty thousand dollars at a six percent cap rate increases the value of the property over three hundred and thirty three thousand dollars. Not bad at all! I am a Raving Fan and a more than satisfied client of WaterLogic and Rain Bird!

1. Values listed are computed by gallons of water saved multiplied by the current water rates of the local municipality.





Savings Analysis

Project Name: Camden - Greenway
Location: 3800 Audley
Contact: Mike Binns
Phone: 713-354-2500
Water Purveyor: City of Houston
Customer Service: 713-371-1400

Date Prepared: 9/22/2006
WL Rep: Jill Hedgpeth
Office: 713-983-9555
Cell: 832-250-8286

Acct. No.	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	Nov-02	Dec-02
Gallons	69,000	60,000	74,000	115,000	274,000	291,000	121,000	250,000	157,000	17,000	42,000	57,000
4327-7479-8016 2" Meter	$269.60	$269.60	$329.80	$500.00	$1,189.80	$1,262.90	$531.90	$1,095.20	$686.70	$84.70	$192.20	$256.70
Projected $ Amount With Rate Increase	$294.95	$294.95	$360.05	$550.70	$1,334.58	$1,416.35	$598.65	$1,219.14	$771.81	$96.41	$218.86	$290.81
Gallons	40,000	64,000	89,000	115,000	383,000	355,000	251,000	326,000	209,000	55,000	75,000	86,000
4327-7066-5017 2" Meter	$183.60	$266.80	$394.30	$500.00	$1,667.10	$1,538.10	$1,090.90	$1,422.00	$871.60	$246.10	$334.10	$381.40
Projected $ Amount With Rate Increase	$201.95	$313.55	$429.80	$550.70	$1,858.87	$1,724.19	$1,223.95	$1,584.70	$978.64	$289.19	$377.39	$439.30
Gallons	441,000	433,000	438,000	462,000	432,000	469,000	454,000	411,000	497,000	409,000	439,000	453,000
4327-7066-4010 2" Meter	$1,907.90	$1,873.50	$1,895.00	$1,955.20	$1,869.20	$2,028.30	$1,963.80	$1,774.60	$2,148.70	$1,770.30	$1,899.30	$1,959.50
Projected $ Amount With Rate Increase	$2,066.60	$2,029.40	$2,052.65	$2,117.75	$2,094.58	$2,272.53	$2,200.38	$1,993.55	$2,407.21	$1,983.93	$2,128.23	$2,195.57
Gallons	89,000	96,000	119,000	161,000	217,000	218,000	309,000	374,000	248,000	113,000	98,000	104,000
4327-7066-6015 2" Meter	$394.30	$424.40	$523.30	$700.00	$944.70	$949.00	$1,340.30	$1,628.40	$1,078.00	$497.50	$433.00	$458.80
Projected $ Amount With Rate Increase	$429.80	$462.35	$569.30	$555.35	$1,060.41	$1,065.22	$1,502.93	$1,815.58	$1,209.52	$560.17	$488.02	$516.88
Total Gallons	630,000	653,000	720,000	843,000	1,306,000	1,333,000	1,135,000	1,361,000	1,102,000	594,000	654,000	700,000
Total Dollars	$2,755.40	$2,854.30	$3,142.40	$3,655.20	$5,670.80	$5,778.30	$4,926.90	$5,920.20	$4,785.00	$2,660.60	$2,858.60	$3,056.40
Total With Rate Increase	$2,993.30	$3,100.25	$3,411.80	$3,774.50	$6,348.42	$6,478.29	$5,525.91	$6,612.97	$5,367.18	$2,923.70	$3,212.30	$3,433.56
Total 2002 Gallons	11,031,000											
Total 2002 Dollars	$48,004.10											
Total With Rate Increase	$53,182.18											

Jan. 2002 through May 2002 Base Total Adjusted

Acct. No.	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06
Gallons	82,000	54,000	57,000	67,000	117,000	152,000	64,000	99,000	85,000			
4327-7479-8016 2" Meter	$397.25	$267.05	$281.00	$327.50	$579.41	$747.76	$324.48	$492.83	$425.49			
Gallons	65,000	99,000	73,000	33,000	132,000	173,000	76,000	142,000	148,000			
4327-7066-5017 2" Meter	$318.20	$476.30	$355.40	$169.40	$651.56	$848.77	$382.20	$699.66	$728.52			
Gallons	464,000	450,000	421,000	464,000	435,000	522,000	464,000	435,000	478,000			
4327-7066-4010 2" Meter	$2,173.55	$2,108.45	$1,973.60	$2,173.55	$2,108.99	$2,527.46	$2,248.48	$2,108.99	$2,315.82			
Gallons	74,000	57,000	108,000	105,000	116,000	235,000	121,000	127,000	147,000			
4327-7066-6015 2" Meter	$360.05	$281.00	$518.15	$504.20	$574.60	$1,146.99	$598.65	$627.51	$723.71			
Total Gallons	685,000	660,000	659,000	669,000	800,000	1,082,000	725,000	803,000	858,000	0	0	0
Total Dollars	$3,249.05	$3,132.80	$3,128.15	$3,174.65	$3,914.56	$5,270.98	$3,553.81	$3,928.99	$4,193.54	$0.00	$0.00	$0.00
Total Gallons YTD	6,941,000											
Total Dollars YTD	$33,546.53											

Savings of $10,066.09 which is 23.1% in 9 months

ROGER COOK

Roger Cook and his wife, Kathleen, have owned and operated K&R Tree and Landscape Co. Inc. since founding the business in 1982. Cook also has served as the landscape contractor for the Emmy Award-winning television series "This Old House" for almost 20 years.

Roger's submission is in video form — a highlight from an episode of "This Old House." Please see DVD that accompanied the invitation to this event.

MARTY EBERHARDT

Marty Eberhardt is the Executive Director of the Water Conservation Garden. She has been in the botanical garden field since 1986, when she started as Education Director of the Tucson Botanical Gardens, where she became Executive Director for twelve years. Marty has also been a program officer for an environmental foundation, and a nonprofit management consultant. She has been on the boards of directors of numerous nonprofits, including the Arizona Native Plant Society, the Anza Borrego Foundation, and the Citizen Diplomacy Council of San Diego. She has an M.Ed. in Biology with an emphasis in environmental education, and has always been concerned with increasing awareness about natural resources. She is proud to further the Water Conservation Garden's mission of promoting water conservation in the landscape at this critical time in our history.

THE WATER CONSERVATION GARDEN: A GOOD IDEA THAT HAS BECOME A NECESSITY

A Little Background

San Diegans, blessed with a Mediterranean climate, have been able to grow almost anything as long as it is watered sufficiently. But consider this: San Diego, with 10 inches of annual rainfall, imports 90% of its water. The sources are the Sierra Nevada Mountains and the Rockies, via the Colorado River. And consider this: San Diegans use 50-70% of their water outdoors.

While all of this has been known for some time, recent headlines are starting to change the context. Consider the following news items, all of which have been reported in the last month:

Southwestern states have based their water sharing arrangements on estimates of Colorado River flow from the early part of the century, which tree ring data now show to have been an unusually wet period. Tree ring data and climate change predictions suggest that "extended droughts will recur and may be more severe than recent droughts" (*Water Science and Technology Board*, 2007).

Climate change models also posit highly reduced snow packs in the Sierras (San Diego Union Tribune 3/11/07).

At this time, much of the Southwest is currently under severe drought status (**www.ispe.arizona.edu/climas/forecasts/swoutlook.html**).

The Intergovernmental Panel on Climate Change is reporting that by 2080, water shortages could threaten between 1.1 and 3.2 billion people (Trenbeth, Kevin, 2007).

Early History of the Water Conservation Garden

Back in the early 1990s when officials from the Helix and Otway Water Districts were discussing building a public garden, most people were unaware of some of the long term issues mentioned above. What they did know was that there was a drought at the time and that people in San Diego used a lot of water on lawns and tropical landscapes.

It seemed to them that a major educational effort needed to be made to get people to change their behavior.

The two water districts got together with Cuyamaca College, which had a noted Ornamental Horticulture Department.

They committed to a 4.5 acre garden (which is quite a bit of land in southern California). The firm Deneen Powell Atelier was hired to design the Garden that opened in 1999. Eight years later, four other water districts have joined. The six districts provide about 75% of the Garden's operating funding, while the rest, and all the Garden's capital funding, is raised in the usual nonprofit ways.

The cactus garden brings winter color.

The premise that motivated the Garden's founders remains with us and proves truer each year: Inspire people with a beautiful garden, and give them the tools to make changes in their landscapes, and change will come. The mission statement gives us this mandate: "To promote water conservation in the southern California landscape through excellent programs and exhibits that educate and inspire the public."

Water Conservation through Exhibits

The Garden is an interesting combination of how-to exhibits demonstrating traditional xeriscape principles and lovely gardens. The mulch exhibit displays 21 kinds of mulches; the turf exhibit seven kinds of turf. The ground cover display features both hardscape and living alternatives to turf. The compost area features several kinds of bins (although the worm bin is the hands-down favorite with children). A new irrigation exhibit will take people through the key issues in installing an irrigation system. Our most popular how-to display shows a grimacing "Lawnmower Man" pushing a mower in a typical San Diego unkempt grassy backyard. The wall below points out that the landscape uses 28,000 gallon each year. The xeriscape next to it is unquestionably more appealing and uses a scant 6,000 gallons a year. Most people are sold immediately. These numbers are quite

The turf exhibit is a good example of the Garden's "how-to" comparison exhibits

The White Garden is a traditional botanical garden display with low water use plants

startling, but we know that the techniques we demonstrate can easily cut water use in half for many San Diegans.

The Garden also has attractive themed areas that would fit in most botanical gardens except that the plant material is nearly all drought tolerant and mostly from Mediterranean regions. There is a White Garden, a Cactus and Succulent Garden, a Bird and Butterfly Garden, a Container Garden, and our mini-oasis--a gazebo with a few roses and a bit of turf. A new fire-wise landscaping exhibit, with a scale model house and landscape, will teach the principles of saving water in the landscape while protecting your home from fire.

Recently, we have been working to encourage a broader audience. We've added child- and family-friendly signage and some hands-on exhibits (grinding acorns in a metate, for instance). We're starting to design a children's garden with our neighbors, Cuyamaca College's Child Development Center. We're thinking this will be one of a kind: a garden that trains teachers and has daily preschool visitors, as well as our own Garden visitors. Children will engage in fun activities that will, we hope, predispose them to caring about nature and conserving water when they're older.

Water Conservation Through Programs

Our programs range from a "Secrets of the Garden" preschool summer camp to "Design your Own Landscape" for homeowners to a certification class for professional landscape maintenance people. The goal is to reach as many audiences as possible with our message in as many ways as we can.

Our festivals are becoming one of our trademarks. People can sign up for free, 20-minute landscape consultations, buy water-wise plants, hear lectures about native plant care, and at the same time, send their kids on a scavenger hunt and buy compost bins to the sounds of live salsa music. It's part of the same philosophy driving our exhibits: learn and enjoy yourself mightily in the process.

Children love to learn about worm composting.

The certification classes are just a year old. They are a response to the question that we get quite often, "I can't find anyone to take care of my yard that knows a thing about saving water." Rather than recommend individuals, we post class graduates on our Web site and refer the public to them. We hear reports that business is good.

We also have about 60 adult classes a year. There is a quarterly Xeriscape Series and classes that help you design an irrigation system, a curbside strip, a butterfly garden,

or a salvia garden. Our school tours focus on plant adaptations to drought and where our water comes from.

What we do is not terrifically different from what most public gardens do, except that everything conforms to our laser-like focus on water conservation. The good news is that we do seem to have an effect. A recent survey by a local water district showed that of those who visited the Garden, nearly half made a change in their landscapes as a result of their visit. Visitation has been growing from 8% to 30% a year in the last three years. We have a long way to go before most San Diegans visit, but the headlines in the newspaper are waking people up in new ways.

We look forward to a day when San Diego looks less like Honolulu or Michigan, and more like the Mediterranean region that it is. We hope and expect that the Water Conservation Garden will have a role in that change.

References

Water Science and Technology Board. 2007. Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability. Washington, DC: The National Academies Press.

Trenbeth, Kevin E. 2007. "On Thin Ice: It's Unequivocal. It's Already Here," San Diego Union Tribune, 3/11/07.

San Diego Union Tribune, 3/11/07, "Q and A: Tony Haymet and Richard C. J. Somerville, Scripps Institution of Oceanography."

STEVE WINDHAGER

Steve joined the Lady Bird Johnson Wildflower Center staff in August 1999 to renew the Center's commitment to research by creating and serving as director for the Landscape Restoration Program. This program conducts research in applied ecology, and offers fee-based consulting on a wide variety of ecological issues. Steve has a B.A. in Philosophy from Texas A&M as well as a Masters in Environmental Ethics and a Ph.D. in Environmental Science from the University of North Texas.

THE SUSTAINABLE SITES INITIATIVE™

Green building standards are driving environmentally superior building design and construction in the public and private sectors. The widespread adoption of green building standards has shown that the necessary tools and information combined with recognition can produce environmental, economic and quality of life benefits.

It is easy to assume that because a landscape looks "green," its environmental function is purely positive. Unfortunately, this is not always the case. Planned landscapes across the country often use too much water, contribute to water pollution, and accelerate the spread of invasive species and increase resource consumption. By extending green building standards to landscapes, we can create attractive, useful landscapes without compromising ecological health.

Only limited green building standards currently exist for landscapes, yet landscapes are often a large expense item and a major consumer of scarce resources. A significant part of most construction projects is landscape, not structures. Examples are large campuses, public parks, conservation areas, private resorts, recreation areas and transportation and utility corridors.

The Lady Bird Johnson Wildflower Center, the American Society of Landscape Architects (ASLA), the U.S. Botanic gardens and a diverse group of stakeholder organizations are leading an effort to evaluate the ecological and social performance of planned landscapes. The Sustainable Sites Initiative will create voluntary, market-based incentives to aid in climate protection, increase biodiversity, reduce pollution and other types of resource stewardship. Ultimately, the standards developed through Sustainable Sites will be integrated with existing building rating and credit systems.

The initiative is in the process of developing the Standards and Guidelines for Sustainable Sites -- a compilation of current research, technology, and practices to provide technical guidance and performance benchmarks. The Preliminary Report on the Standards and Guidelines (**www.sustainablesites.org/report**) is now available for comment. The purpose of this report is to provide a snapshot of the first findings of the initiative with the intention of collecting feedback from professionals and stakeholders. It is critical to receive knowledge and input from other professionals and stakeholders to ensure that the products of the Sustainable Sites Initiative are relevant to those who influence land practices. An online feedback form is available to submit comments on the preliminary report. The public comment period will be open until January 11, 2008.

Other participating organizations include the U.S. Botanic Garden, the Environmental Protection Agency's GreenScapes Program, the National Recreation and Parks Association, the American Society of Civil Engineers Environment and Water Resources Institute, the National Association of County and City Health Officials, The Nature Conservancy's Global Invasive Species Initiative, and the Center for Sustainable Development at the University of Texas. Partial funding has been provided by the US Botanic Garden, the US EPA, the Meadows Foundation, and the Texas Commission on Environmental Quality.

For more information or to download a copy of the Preliminary Report on the Standards and Guidelines for Sustainable Sites,™ go to our website at **www.sustainablesites.org** or email **info@sustainablesites.org**.

DAVID ZOLDOSKE

Dr. David Zoldoske serves as the Director for the Center for Irrigation Technology and related water programs at California State University, Fresno. As the Director, David is responsible for a comprehensive university based program designed to engage regional community concerns regarding water, energy, and economic development. The core mission of the CIT is to conduct "good science" which forms the basis for policy development, technical innovation, and the management of finite resources.

David was recognized nationally as one of 18 Environmental Stewards and Innovators in the Golf Industry by the Golfweek's Superintendent NEWS, October 26th, 2001. He has an honorary Life Membership in the American Society of Irrigation Consultants, a member of the American Society of Agricultural and Biological Engineers and is an advisory Board Member for the American Vineyard magazine

AN OVERVIEW OF SMART WATER APPLICATION TECHNOLOGIES™ (SWAT™)

Introduction

The development of Smart Water Application Technologies™ or SWAT™ was initiated by water purveyors who wanted to improve residential irrigation water scheduling. It is estimated that typical residential landscapes apply 30 to 40% more water than is required by the plants. The hope is that the widespread adoption of "smart" controllers and soil moisture sensors would conserve a significant portion of the excess water applied. Most in-ground irrigation systems are operated by a controller. The basic design of these controllers requires frequent input from the operator (homeowner) to adjust irrigation run times during the year. It has been noted that much of the over-irrigation occurs during the fall of the year when plant/water demand is dropping off and the corresponding irrigation run times are not reduced accordingly.

SWAT™ is a national initiative designed to achieve exceptional landscape water use efficiency through the use of irrigation technology. SWAT™ identifies, researches, and promotes technological innovations and related management practices that advance the principles of efficient water use.

"Smart" Controllers

The evolution of the "Smart" irrigation controller has ushered in a new era of technology that promises to "take" the homeowner out of the irrigation scheduling equation. The premise of the "Smart" controller is to continually monitor changing plant/water demand and apply water when it is required. "Smart" controllers must also recognize rainfall in the irrigation schedule. Further, these

controllers are designed to minimize runoff and deep percolation.

A testing protocol was developed by the Irrigation Association (IA) to evaluate the performance of "smart" controllers. All versions are available at the IA website www.irrigation.org. The protocol is in its 6th draft and is currently being used to test and evaluate controllers by The Center for Irrigation Technology at California State University, Fresno.

The protocol defines a procedure for characterizing the efficacy of irrigation system controllers that utilize climatological, soil, or plant data as a basis for scheduling irrigation events. Controllers may also use on-site temperature or rainfall sensors. This evaluation concept requires the use of accepted formulas for calculating crop evapotranspiration (ETc). Commercial examples of this type of controller include the following:

- Controllers that store historical ETc data characteristics
- Controllers that utilize an on-site sensor as the basis for calculating real time ETc
- Controllers that utilize a central weather station as a basis for ETc calculations and transmit the data to individual home owners from remote sites
- Controllers that utilize rainfall and temperature sensors
- Control technology that is added on to existing time-based controllers

The art and science of applying irrigation water to turf and landscape areas is a practice developed over time. While general procedures based in science give an appropriate framework for determining irrigation amounts and frequency, the "fine tuning" of the irrigation schedule is often developed as a site-specific practice.

The protocol was developed to mimic typical and problem irrigation landscapes found anywhere in North America. It is recognized that the *virtual* yard utilized in the IA's testing protocol cannot represent every conceivable irrigated landscape. However, it is also recognized that many irrigated landscape areas can be categorized as "typical" and that others can be identified as "problematic."

While the landscapes and irrigation systems used in the evaluation are virtual, the weather conditions used to monitor the controller's ability to track changes in the plant water demand are real-time. Specific weather stations are identified to provide the baseline demand for the irrigated landscape. The controller must take this information into account, along with other onsite information, to maximize the efficiency of applied water.

The art and science of applying irrigation water to turf and landscape areas is a practice developed over time.

The idea of evaluating six irrigated zones which represent both the typical and problematic landscapes attempts to evaluate the controller's ability to adapt to a variety of conditions found in the field. The evaluation also emphasizes those conditions that use the most water (turf grass) as well as those conditions that cause irrigation water to run off (tight soil/high application rate).

The *virtual* landscape uses a mix of turf grasses, ground cover, shrubs and trees, combined with four types of irrigation methods, to represent a variety of conditions found in the field. Additionally, six types of soils and slopes are also presented in the evaluation. The irrigated zones are limited by root zone depth, percentage of full sun, and estimated irrigation application efficiency.

It is noted that the exact landscaped area and conditions used in the IA protocol may not exist anywhere in the world. It is also recognized that elements of this landscape are likely to exist everywhere landscapes are irrigated. The protocol was designed to represent a set of field conditions that controllers should be expected to effectively manage.

The IA protocol does not have a pass/fail rating. The procedure is designed to evaluate the controller's performance against an established "ideal" standard. The protocol utilizes the Environmental and Water Resource Institute (EWRI) of the American Society of Civil Engineers (ASCE) study on the standardization of reference evapotranspiration (ETo) formulas for the baseline. Other widely recognized standards are also cited in the protocol.

Efforts are underway to identify the appropriate agency (state or Federal) that can set the expected performance bar for controllers. Once a pass/fail limit is set, incentives designed to accelerate the adoption of "smart" controllers can be implemented by water purveyors.

The promise of significant water savings offered by the widespread adoption of "smart" controllers has led to the recommendation that beginning in 2010 all new irrigation controllers sold in California will have to meet the requirements of the IA Controller Testing protocol. This recommendation comes from a State Task Force created by Assembly Bill 2717 which was charged with developing new landscape irrigation guidelines and policy recommendations for the legislature. It was also recognized that a minimum performance level for "smart" controllers must be set, and the expectation is that

this would be established by the California Department of Water Resources.

Soil Moisture Sensors

Soil moisture sensors are another promising technology for irrigation scheduling. Sensors can provide closed-loop feedback to time-based system controllers. This allows controllers to recognize soil moisture levels and terminate irrigation events when soil moisture reaches predetermined levels. More sophisticated controllers can have the ability to interpret soil moisture readings to determine frequency and duration of irrigation events.

The Irrigation Association has developed a Soil Moisture Sensor protocol to evaluate sensors under laboratory conditions. This extensive evaluation looks at the sensor's responses under varying levels of moisture, soil type, and salinity. The test is designed to expose the sensor to a wide range of conditions that exist in the field.

There are a number of fundamental principles used in the design of soil moisture sensors. These principles include electrical conductivity (EC), time domain reflectometry (TDR), and heat dissipation, to name just a few. Each of these principles has inherent strengths and limitations. Calibration requirements, repeatability, wand accuracy over the range of test conditions represent some areas of potential variability. The cost of soil moisture sensors, while not directly identified in the testing protocol, will also influence the rate of adoption.

Future of SWAT™

A committee on the future of SWAT™ has been established through the Irrigation Association. Members of the committee represent water purveyors, industry, and government agencies. The committee's role is to expand the list of product categories that can demonstrate high water use efficiency. Currently a list of five product categories has been identified. Beyond the initial *scheduling technologies (e.g. controllers, sensors)*, four additional product categories have been identified which include:

- Overhead irrigation technologies (e.g. sprinklers, sprayers, nozzles)
- Low volume irrigation technologies (e.g. emitters, distribution systems)
- Hydraulic management devices (e.g. pressure management, check valves)
- Malfunction abatement technologies (e.g. high-flow shut offs, self-cleaning filters)

Nearly every irrigation product can be assigned to one of these five categories. It has been proposed that the categories will be ranked high to low, with the number one ranking having the greatest water-efficiency potential. Each succeeding lower ranking will signify a diminished potential in water-efficiency savings.

Initial funding has been identified for the review of the proposed product categories. After completion of the review, protocols will be developed for each category, starting with those products found in the number one category. The process will continue until protocols have been developed for all water-efficient products.

It is anticipated that eventually the SWAT™ process will include approved design, installation, and maintenance requirements. The long term goal is that a "SWAT™ designated irrigation system" will include a SWAT™ approved design, use SWAT™ products, and be installed and maintained according to SWAT™ guidelines. The end result will be an irrigation system that achieves the highest possible water use efficiency under commercial conditions. This goal fully recognizes the importance of water as a finite resource.

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Finally, the Federal Environmental Protection Agency (EPA) has taken the lead in developing what is referred to as the "WaterSense" program. It is looking to adopt irrigation equipment performance standards that will merit the "WaterSense" label. This program is in its infancy, but it is envisioned to mimic the highly successful "Energy Star" program. Current planning calls for the first "WaterSense" products to be so designated in late 2008. More information on this program can be found at **www.epa.gov/watersense/**.

The Intelligent Use of Water™ Summit VIII

Global Conservation Initiatives and Strategies: Leading By Example