Water-Efficient Irrigation Techniques
Portola Valley Sept. 23, 2010

Lori Palmquist, CID, CIC, CLIA, CLWM

You can achieve optimum efficiency with any existing sprinkler or drip system. From simple adjustments and repairs, to full renovations, any level of action that you take to make your system more efficient will pay large dividends in the long run.

A. What factors define irrigation efficiency?

1. The most efficient landscape irrigation systems:
   a. Deliver the exact amount of water any given plant requires in any given climatic condition
   b. Have controller schedules that correspond to current weather conditions
   c. Have little or no water waste, as in deep percolation or runoff
   d. Utilize the proper pressure rating for each delivery system
   e. Deliver the water at a rate that matches the infiltration rate of the soil
   f. Have high uniformity (good coverage)and functionality of sprinklers
   g. Provide for optimum health and vitality of plants
   h. Comply easily with drought rules, mandates, and water budgets
   i. Use sprinklers for turf and drip systems in planted areas

B. Is your landscape water efficient? How to obtain your report card:

How to determine how well your system is performing

1. Determine water budget for your landscape
   a. Acquire square footage measurements of the whole irrigated landscape (including pool and water features)
   b. Apply the following formula to determine your yearly water budget
   18.6 x Area (square footage of landscape) = # of gallons per year
2. Determine your historical water use
   a. Acquire water bill history from water company for the past two years. Water company can email you the billing history if you ask. You want to see the water use numbers in spreadsheet form to make comparisons
   c. Add the consumption totals for 2009, then 2008.
   d. If water consumption is measured in hundreds of cubic feet, multiply the result for each year by 748. This will convert the result to gallons. There are 748 gallons in one hundred cubic feet of water.
   e. For each person living in the house, subtract 27,375 gallons from the result for each year. This will give the approximate irrigation water use for each year.
   f. Compare the actual water use numbers with the yearly water budget for the landscape.

C. Three main options for reducing landscape water use

1. *Reduce site water requirement*
   a. Make sure hydrozones are properly formed
   b. Cycle in drought tolerant plants when replacements are necessary
   c. Reduce density of plantings
   d. Reduce or eliminate unneeded turf areas
   e. Increase hardscaping and garden features
   f. Reduce evaporation with mulch
   g. Increase tilth of the soil by adding organic material frequently
   h. Convert all non-turf areas to drip
2. *Improve irrigation scheduling (see "scheduling solutions" below)*

3. *Improve system efficiency*
   a. Perform system evaluation to identify equipment that needs to be repaired or updated
   b. Improve design and placement of sprinkler heads (costly option)
   c. Upgrade to system components with focus on higher efficiency
   d. Assure each zone has proper pressure. For every 5 psi the pressure goes down, there is a water savings of 6-8% water. Not only is there water waste due to excessive flow, but the droplets become a mist that flies away in the slightest breeze.
   e. Assure that all zones have equal flow rates
   f. Assure that the delivery rate of the sprinklers or drip emitters does not exceed the infiltration rate of the soil

D. Drip systems

1. **Matched application** rate (do not mix drip emitters and microsprays in the same zone)
2. **Pressure regulation -** Drip systems require no more than 30 psi.
3. Rule of thumb for emitter placement: New plants minimum of 2 emitters. Established plants circle 75% of plant dripline, emitters spacing 18" to 24".
4. Drip systems need to grow with the plants.

E. Sprinklers

1. Matched precipitation nozzles (no mixing of nozzle types)
2. Pressure regulation to 30 (or 40 psi for MP Rotators) at valve or built into sprinkler head eg. Rain Bird 1806 SAMPRS
3. High efficiency nozzles **Rotary nozzles** (Hunter and Rain Bird) **or Precision nozzles** (Toro)
4. **Check valves** at sprinkler heads (or built in)
5. Low angle nozzles for windy areas
6. Match the application rate to soil and slope?
7. Mounted on **swing joints** so they won't break if run over or kicked?
8. Assure that spray from the sprinklers is not being blocked by plants

F. Strategies for achieving optimum efficiency for water conservation

1. Utilize a **remote control** to assist in irrigation maintenance and repair.
2. Design **hydrozones** properly:
   a. Group plants together with similar water needs
   b. Turf and shrubs in separate zones
   c. Separate zones for sun and shade
   d. Separate zones for flat and sloped areas
   e. Separate zones for plants in pots
   f. Established trees on separate zone if possible
   g. Use **WUCOLS** or established drought tolerant demonstration gardens as a guide for plants.
   h. Santa Clara Valley Water District approved plant list http://www.valleywater.org/Programs/Landscaping.aspx

G. Scheduling solutions

1. Develop detailed, accurate watering schedules that reflect changes in climate
   a. Use handout called "Peninsula Watering Runtimes"
   b. Utilize WUCOLS online to determine water use value for plants
2. Install self-adjusting (Smart) controller
3. Install rain, wind, and freeze sensors to shut down irrigation in adverse conditions
4. Utilize multiple programs for cycle and soak
5. Utilize the percent adjust feature to adjust schedule monthly or weekly
6. Controller feature of non-volatile memory for power outages
7. Run sprinklers at night or early morning

H. *Convert sprinkler zones to drip* *(or fine-tune existing drip system). The efficiency rating on drip systems is much higher, and there is less evaporation, runoff, fewer weeds, and the water is applied directly to the root zone of the plants. This also allows the individual needs each plant to be addressed, as opposed to spray systems that broadcast water at the same rate to all plants.*

1. Drip is often not included in drought restrictions
2. Match precipitation rate with soil and slope
3. Make sure emitters and microsprays are not on same zone
4. Use drip tubing with pressure compensation and check valves
5. Remove any bubblers that are not contained, and replace with drip emitters

I. Sprinkler fine-tuning and upgrades

1. Walk Through Site Evaluation (handout)
2. Install MP Rotators or Precision nozzles nozzles to improve coverage and assure matched precipitation
3. Make sure pressure matches sprinkler specifications:
   50 psi for long distance rotors; 40 psi for MP Rotators; 30 psi for normal sprinklers and drip system
4. Change sprinkler bodies to those with pressure regulation and check valves, i.e., Rain Bird 1800 SAM PRS
5. Raise blocked sprinklers, or change to longer pop-ups
6. Make sure nozzles are matched-precipitation rate nozzles (do not mix fixed arc with variable arc in 5 ft., 8 ft., and 10 ft. radii)
7. Install swing joints for better durability and mobility of sprinklers
8. Assure integrity of built structures (houses, garages, fences, etc.) by not pointing sprinklers at them.

Application rates of different types of irrigation:

1. Rotary nozzles (high efficiency nozzles)	.39-.45 inches/hour
2. Drip (plant-to-plant sparse plantings)	.35 inches/hour (approx.)
3. Toro Precision nozzles (high efficiency nozzles)	1.0 inches/hour
4. Standard fixed spray nozzles	1.7 inches/hour
5. Microspray and variable arc nozzles	2.0 inches/hour

Infiltration rate of various soil types:

Soil Texture Class	AW *(in./in.)*	**Basic Intake Rate** *(in./hr.)*	Mgt. Allowed Depletion *(MAD)*
Clay (C)	0.17	**0.10**	30%
Silty Clay (SC)	0.17	**0.15**	40%
Clay Loam (CL)	0.18	**0.20**	40%
Loam (L)	0.17	**0.35**	50%
Sandy Loam (SL)	0.12	**0.40**	50%
Loamy Sand (LS)	0.08	**0.50**	50%
Sand (S)	0.06	**0.60**	60%