



Water-Efficient Irrigation Techniques

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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. Use 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 for 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 -
 $18.6 \times \text{Area (square footage of landscape)} = \# \text{ of gallons per year}$
2. Determine your yearly 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 tilling 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 that 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; emitter 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 psi (or 40 psi for MP Rotators) at valve or built into sprinkler head. e.g., Rain Bird 1806 SAM PRS
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. Use a **remote control** to assist in more efficient irrigation maintenance and repair
2. Design **hydrozones** properly:
 - a. Group plants together with similar water needs
 - b. Turf and shrubs and/or other plantings 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. See *Irrigation Resources* handout.
 - 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 Schedule"
 - b. Utilize WUCOLS online to determine water use value for plants. See *Irrigation Resources* handout.
2. Install self-adjusting, weather-based (Smart) controller
3. Install rain, wind, and freeze sensors to shut down irrigation in adverse conditions
4. Use multiple programs for cycle and soak
5. Use the percent-adjust feature to adjust schedule monthly or weekly
6. Have controller with the feature of non-volatile memory to ensure programming is saved during 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 than sprinkler systems, 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 of each plant to be addressed, as opposed to spray systems that broadcast water at the same rate to all plants.*

1. Drip is often allowed during 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, and evaluate sprinkler positioning and nozzles
2. Replace inefficient nozzles with rotary or Toro Precision 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.
9. Assure there is no overspray or runoff produced by the sprinklers. This is now illegal in California.

Application rates of different types of irrigation:

- | | |
|---|---------------------------|
| 1. Rotary nozzles (high-efficiency nozzles) | .39 - .45 inches/hour |
| 2. Mid- to long-range gear rotors, i.e., Hunter PGP | .51 - .99 inches/hour |
| 3. Drip (plant-to-plant sparse plantings) | .35 inches/hour (approx.) |
| 4. Toro Precision nozzles (high-efficiency nozzles) | 1.0 inches/hour |
| 5. Standard fixed-spray nozzles | 1.7 inches/hour |
| 6. 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%

Irrigation Resources, Information Sources, Stores

Irrigation Resources

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California Irrigation Management Information System (CIMIS)

Current daily, weekly, monthly ET values
www.cimis.water.ca.gov

Canopy, nonprofit tree group in Palo Alto
(650) 964-6110

www.canopy.org

City of Mountain View Public Works, Water Conservation Program

231 N. Whisman Road
(650) 903-6311
www.conservewater.mountainview.gov

Water-Wise House Calls -Free

- a. Santa Clara County residents, call (800) 548-1882.
- b. San Jose Water Company customers, call (408) 279-7900.

A water surveyor visits your home or apartment complex, reviewing your water use, providing low-flow showerheads and aerators (if needed), and suggesting water-wise recommendations - including an annual irrigation schedule.

Santa Clara Valley Water District

1. Landscape Rebate Program
Pre-inspection Survey REQUIRED, before starting any work.

Call Water Conservation Hotline (408) 265-2607, ext 2554 or see details at:
www.valleywater.org/Programs/LandscapeRebateProgram.aspx

2. Irrigation Equipment Upgrade Rebates

Santa Clara County single-family, multi-family properties (any size) and business properties with 5,000 sq. ft. or more of irrigated landscape can receive rebates for installation of high-efficiency irrigation equipment. Same contact information as for Item 1, for **Landscape Rebates**. **Pre-approval required.**

Department of Water Resources

Office of Water Use Efficiency
Julie Saare-Edmonds (916) 651-9676
Water Use Classifications of Landscape Species – **WUCOLS** list available free online (Alert: 160-page document. Plant classifications on pages 63-99.):
www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf

EPA WaterSense Program (Environmental Protection Agency)

Toll-free 1-866-WTR-SENS
www.epa.gov/watersense

Scheduling & Design Guides, Tools

Jess Stryker's Irrigation Tutorials Online (*free*)

www.irrigationtutorials.com

Rain Bird Corporation

www.rainbird.com
Irrigation Manufacturer
Free design publications, tutorials,
Technical assistance
Design guides: www.rainbird.com/drip/literature/dripline.htm

UC Guide to Healthy Lawns www.ipm.ucdavis.edu/TOOLS/TURF/MAINTAIN/irrsched.html

Irrigation Manufacturers

www.hunterindustries.com

Hunter Industries - Full array of professional irrigation products (MP Rotators 10'-30' radius)

www.irritrolsystems.com

Irritrol Systems - Full array of professional irrigation products

www.netafimusa.com

Netafim - Drip tubing and other products

www.rainbird.com

Rain Bird - Full array of professional irrigation products

www.toro.com

Toro - Full array of professional irrigation products (Precision nozzles 5'-15' radius)

Local Irrigation Houses (retail and wholesale)

The Urban Farmer Store

Professional irrigation and landscaping materials

Free classes, consultations, and **free** design of irrigation systems

Richmond, Mill Valley, San Francisco

www.urbanfarmerstore.com

San Carlos

Ewing

900 Industrial Rd., Ste. C (650) 591-2618

John Deere

815 American St. (650) 591-5163

Campbell

Lane Irrigation Equipment Company

70 Cristich Lane (408) 377-5600

San Jose

Ewing

1735 Rogers Ave. (408) 436-8848

Horizon

1990 Stone Ave. (408) 287-7882

John Deere

1145 N. 13th St. (408) 295-3376

Los Altos

Los Altos Supply & Garden Center

4730 El Camino Real (650) 948-2218

Menlo Park

Horizon

4060 Campbell Ave. (650) 323-5161

Palo Alto

Peninsula Hardware (in business 50 years)

2676 Middlefield Rd. (650) 325-3491

Redwood City

Alfred Joseph Garden Service

1011 Taft St. (650) 366-3833

R & B Co.

939 Broadway St. (650) 366-3833

