Achieving Efficient Irrigation Systems
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"Whether you are a homeowner looking to upgrade your own system, or a landscape professional, you can achieve optimum efficiency with any existing sprinkler or drip system. From simple adjustments and repairs, to full renovations, you'll come away with the knowledge and ability to take any level of action."

The best landscape irrigation management requires well-designed, finely-tuned irrigation systems, a watering schedule that reacts to changing weather conditions, and continuous monitoring.

A. What is efficiency?

1. The ratio of the effective or useful output to the total input of the system
2. The most efficient landscape irrigation systems:
   a. Deliver the exact amount of water any given plant requires in any given climatic condition.
   b. Water the plants, not the garden
   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. Allow the soil at the root zones of the plants to dry out between watering enough so that the roots get the oxygen they need.
   h. Provide for optimum health and vitality of plants
   i. Comply easily with drought rules and mandates

B. 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. Aerate turf areas once per year for better infiltration
   e. Reduce or eliminate unneeded turf areas
   f. Increase hardscaping and garden features
   g. Reduce evaporation with mulch
   h. Reduce or eliminate use of fertilizers (incorporate organic material into the soil as desired)
   i. 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. Perform simple audit of turf sprinklers to determine uniformity and precipitation rate (see handout)
    c. Improve design and placement of sprinkler heads
    d. Upgrade to system components with focus on higher efficiency
    e. 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.
    f. Assure that all zones have matched precipitation
    g. Assure that the delivery rate of the sprinklers or drip emitters does not exceed the infiltration rate of the soil

C. Drip systems

1. Matched precipitation (do not mix emitters and microsprays in the same zone)
2. Make sure valve used will support zone flow. Some drip zones have a very low flow rate, and require low flow valves.
3. Pressure regulation
4. Pressure compensation: assure that there is the same amount of pressure at all parts of the system.
5. Check valves in inline emitters and individual emitters
6. Rule of thumb for emitter placement: New plants minimum of 2 emitters. Established plants circle 75% of plant dripline, emitters spacing 18" to 24".

D. Sprinklers

1. Matched precipitation nozzles
2. Pressure regulation in sprinkler head or somewhere in line
3. Rotary nozzles
4. Check valves at sprinkler heads
5. Low angle nozzles for windy areas
6. Match precipitation rate to soil and slope?
7. Mounted on swing joints so they won't break if run over or kicked?

E. 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 (see brochure for ACWD Drought Tolerant Demonstration Garden)

3. Scheduling solutions

a. Know your soil's properties
   i. The soil is a reservoir (sponge demonstration)
   ii. Water leaves the soil through evaporation and transporation, and weather conditions affect the rate at which it leaves
   iii. The rate of evaporation and transporation can be predicted (or measured) based on weather conditions
b. Develop detailed, accurate watering schedules that reflect changes in climate
   i. Use handout called "East Bay Watering Runtimes"
   ii. Utilize WUCOLS online to determine water use value for plants
   iii. Utilize CIMIS online to determine ET value for any given time period
c. Factors that affect the rate of evapotransporation
   i. Solar radiation
   ii. Air temperature
   iii. Wind speed
   iv. Relative humidity
   v. Rainfall
d. Know the output rate (precipitation rate)of sprinklers
   i. Perform catch-can test on lawn sprinklers
   ii. Use published PR rates from manufacturers' catalogs
   iii. Use default data for PR rates (handout on PR rates)
e. Install self-adjusting (ET) controller
   i. ET controllers with on-site weather sensors and/or historical weather data by zip code: Weathermatic SL1600, Hunter ET System, Hunter Solar Sync, Rainbird ESP-SMT, AquaConserve ET
   ii. ET controllers that utilize off-site weather station and pager technology for data transmission: Irritrol SmartDial, Toro Intellisense, HydroPoint WeatherTRAK (subscription service)
   iii. ET controllers that utilize the internet, Weather.com forecast: Cyber-Rain XCI
   iv. ET controllers that utilize the internet and pager technology to provide weather data and offsite user interface: ET Water, Rainmaster RME Eagle-I,

f. Develop detailed, accurate watering schedules that reflect changes in climate. See handout
g. Install rain, wind, and freeze sensors to shut down irrigation in adverse conditions
h. Utilize multiple programs for cycle and soak
i. Utilize the percent adjust feature to adjust schedule monthly or weekly
j. Controller feature of non-volatile memory for power outages

4. **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.*
   a. Drip is often not included in drought restrictions
   b. Match precipitation rate with soil and slope
   c. Make sure emitters and microsprays are not on same zone
   d. Use drip tubing with pressure compensation and check valves (Netafim brand)
   e. Make sure runtime matches soil type and slope
   f. Remove any bubblers that are not contained, and replace with drip emitters
5. **Sprinkler fine tuning and upgrades**
   a. Walk Through Site Evaluation (handout)
   b. Install MP Rotator nozzles to improve coverage and assure matched precipitation
   c. Make sure pressure matches sprinkler specifications:
      50 psi for long distance rotors; 40psi for MP Rotators; 30psi for normal sprinklers and drip system
   d. Change sprinkler bodies to ones with pressure regulation and check valves, eg. Rainbird 1800 SAM PRS
   e. Raise blocked sprinklers, or change to longer pop-ups
   f. 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)
   g. Install swing joints for better durability and mobility of sprinklers
   h. Assure integrity of built structures (houses, garages, fences, etc.) by not pointing sprinklers at them.