Building Blocks for Resource-Wise Landscapes:

Knowledgable Management

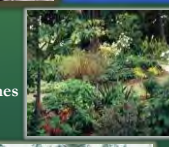
Efficient Watering

Proper Plants

Good Soil

Building Blocks:

Efficient Watering
- ✓Effective hydro-zones
- ✓Efficient equipment / layout
- ✓Appropriate schedules
- ✓Documentation

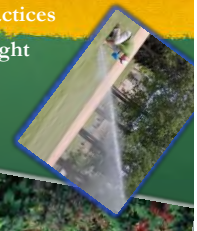


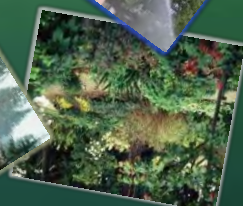
Proper Plants
- ✓Mostly drought-tolerant / low-maintenance
- ✓Group "thirsty" and "needy" plants in few zones
- ✓Appropriate size / spacing

Good Soil
- ✓Well-drained, compost-amended
- ✓Loose sub-grade
- ✓Adequate depth / planter size
- ✓Mulch

Stumbling Blocks

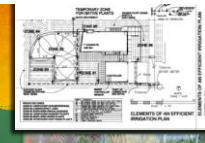
- ? Lack of information on good practices
- Poor communications and oversight
- $ Low bids = cut corners
- $ Landscapes don't get no re$pect





Management Makes the Difference Between…

Management



Watering
- ✓Install according to plans
- ✓Document system "as-built"
- ✓Schedule based on plants, conditions and equipment
- ✓Know when to stop (established plants)

Plants
- ✓ Install the right species / variety
- ✓ Water / fertilize / prune appropriately
- ✓ Replace stragglers and failures

Soil
- ✓Protect existing topsoil
- ✓Proper soil and amendment
- ✓Adequate depth / planter size
- ✓Maintain mulch on beds

Steps to Sustainability

- ✓ "Best Practices" in specifications, plans and bid documents = level playing field
- ✓ Clear communications and documentation
- ✓ Oversight / Enforcement
- ✓ Educate professionals and customers
- ✓ Ways to shift benefit$ to the development phase

Building Blocks:

Good Soil
- ✓Well-drained, compost-amended
- ✓Loose sub-grade
- ✓Adequate depth / planter size
- ✓Mulch

Healthy, Deep Soil Makes Up For A Lot of Other Mistakes and Short-Cuts

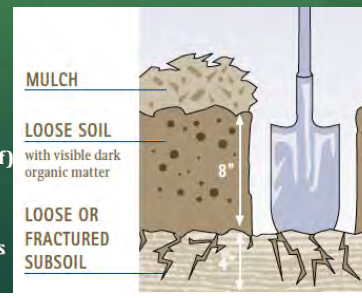
Healthy Soil
- ✓ Absorbs and stores water, reduces irrigation need and plant stress.
- ✓ Supplies and stores nutrients and minerals
- ✓ Feeds soil life that help plants resist pests & diseases

Healthy Plants
- ✓ Need little fertilizer or pesticides
- ✓ Make low-input management practical
- ✓ Protect soil from erosion and compaction

Sustainable Management
- ✓ Requires less inputs
- ✓ Protects soil and soil life

There Ought To Be a Law

- ✓ Protect undisturbed native soil and vegetation where possible
- ✓ Provide 8" depth topsoil with 10% organic matter content (5% for turf)
- ✓ Scarify compacted subsoil 4" deep
- ✓ Mulch planting beds 2" thick



"% Organic Matter" vs. % Compost

"% Organic Matter" is measured by weight, not volume:
- **Compost is just 40-60% organic matter by weight**
- **Mineral soil weighs 2-3X more per volume**

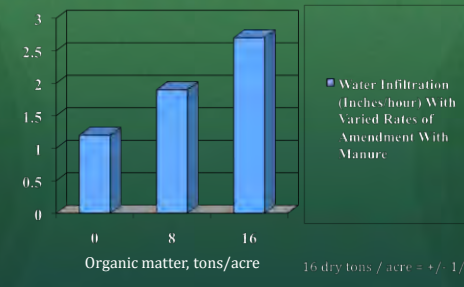
5% Organic Matter Content =

Topsoil mix: 25-30% compost + 70-75% sand/mineral soil
OR
Amend: 1.75" (+/-) compost mixed to 8" depth of soil

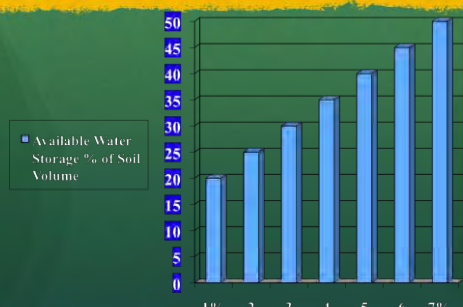
10% Organic Matter Content =

Topsoil mix: 40-45% compost + 55-60% sand/mineral soil
OR
Amend: 3" (+/-) compost mixed to 8" depth of soil

Effect of Organic Matter Additions on Water-Infiltration



Effect of Organic Matter Content on Plant-Available Soil Moisture Storage



UW Trials: Impact of Organic Matter on Stormwater Infiltration and Storage

Turf on glacial till soil

Turf on glacial till amended with 40% compost: Resulted in 50% reduction in storm water runoff.

Organic Matter and Soil Biology

Organic Matter: Decomposing plants and animals—absorb water and pollutants, feed plants and create soil structure

Soil Life: Improve soil structure, store nutrients, decompose pollutants, nourish healthy plant cover

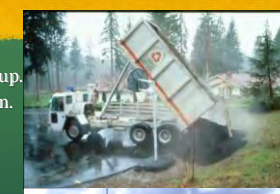
Plant Canopy: Protects soil from erosion and compaction, intercepts rainfall to evaporate without reaching soil surface

BMP Lets You Choose the Most Economical and Practical Method

Soil Depth:
- ✓Import soil or compost to build up.
- ✓Rip compacted layers to go down.

Organic Matter:
- ✓Add compost at default rates (1.75"/turf, 3"/beds).
- ✓Test soil organic % and density, and calculate reduced rates.

Protection:
- ✓Protect undisturbed areas, no amendment or tillage required.
- ✓Stockpile and reuse Soil

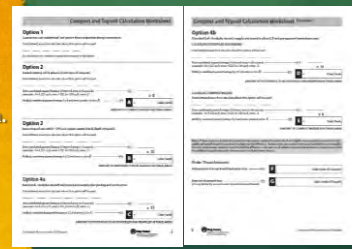


Calculates:
- ✓ Amendment rate (inches) needed based on inexpensive tests of soil and compost product.
- ✓Cubic yards of compost or topsoil needed for each area.

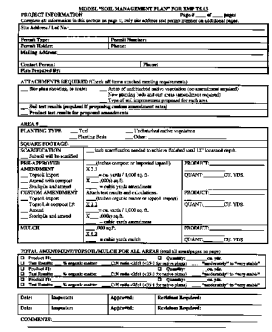
Allows different treatments for each area on a site.

King County Compost and Topsoil Calculator

http://your.kingcounty.gov/solidwaste/compost-calculator.htm



"Soil Management Plan"



- ✓Seattle, King Co., Snohomish Co. and other permitting agencies have version.
- ✓Provides worksheet to calculate amounts of amendment and topsoil needed.
- ✓Useful record.

Soil Protection:
Most Economical Option—By Far

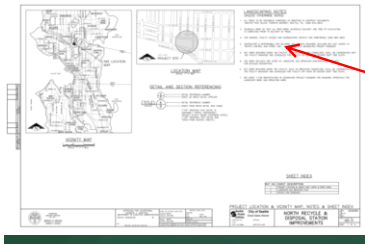
Requires:

- ✓ Advanced planning
- ✓ Education of owners, Civil Engineers, Architects, Landscape Architects, contractors
- ✓ Communication: Early and often
- ✓ Physical barriers and signage

Preserving Topsoil Through Grading and Stockpiling

- ✓Saves transport costs—export and import.
- ✓Stockpile topsoil separate from subsoil—reuse in order.
- ✓A good plan—and a skilled operator—make it easy!

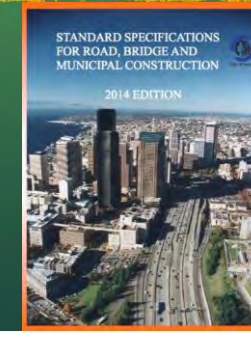
Specifications: Keep It Really Simple



- ✓ Put essential soil specs on plan NOTES sheet, details in specs.
- ✓ Put NOTES in front of plan set, to be sure.
- ✓USE REALLY BIG RED LETTERS (NEXT TIME)

Specifications: Use Standards—Don't Reinvent the Wheel

- ✓ Soil mixes using standard sand specifications that can be met by multiple local source.
- ✓ Fertilize based on lab tests—cut wa$te, nutrient runoff, excessive growth prone to disease and damage and damage to soil life.
- ✓ Don't add unnecessary provisions or test requirements that are costly to test, difficult to meet…



Specifications: Provisions to Ensure Soil Quality

- ✓ Specify STA-Certified Compost
- ✓ Submit soil mix sample to retain at job site: Project Manager can stop delivery and require testing if delivered mix doesn't match submittal.
- ✓ Project Manager can inspect delivery tickets for any load to confirm product comes from source approved on submittal. Prevent the old Swith-eroo.

US Composting Council Seal of Testing Assurance

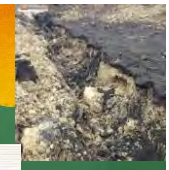
…instead of…

Speaking of Sustainability…Buy Compost Made from Local Recycling Programs

US Composting Council Seal of Testing Assurance

CEDAR GROVE

Don't Hesitate To Speak Up and Dig In



Step 1: Compare conditions to Soil Management Plan / drawings.

Step 2: Inspect delivery tickets to make sure topsoil and compost delivered match.

Step 3: Dig many test holes to check depth of amended soil & scarification.

Step 4: Use shovel to check uncompacted depth in multiple locations

Mulch Can Cover A Lot of Mistakes…Among Other Benefits

- ✓ **Protects soil from compaction during construction, planting and establishment.**
- ✓ **Reduces water use over 50% in new / sparse plantings.**
- ✓ **Keeps surface porous: Absorbs water and reduces runoff.**
- ✓ **Feeds plants and soil life as it decomposes.**
- ✓ **Easiest tool to renovate soil on established sites.**

Mulching Guidelines

Mulch whole beds, or 3'+ rings around trees in lawns

✓**Trees & shrubs:** 2-4" wood chips or "medium-fine" bark. Replenish when decomposed – don't apply too often.

✓**Annuals, perennials, berries, roses:** Composted bark or woody composted "overs", or mixes of bark and compost.

Bark and Wood Chip Mulch:

✓Don't tie up nitrogen

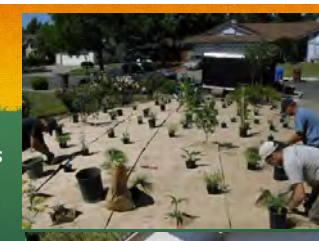
✓Longer-lasting and better weed barrier than compost or aged sawdust

✓Protect soil from compaction

✓Avoid fine bark, and over-applications.

Sheet Mulching

- ✓ Cardboard or paper layers suppress weeds until plant canopy can shade them out.
- ✓ Adds extra moisture retention and compaction protection.
- ✓ Decomposes 1-3 years.
- ✓ Secret to Success: Top with an attractive mulch.



Wood Chip Sheet Mulch Protects Soil During Construction and Planting

Pull Back to Plant. Leave In Place As Mulch

Recycle Organic Material: It's Not Yard "Waste"

Chipped woody debris as mulch:
✓ Supplies 100% nutrients needed by most ornamental shrubs and trees.
✓Cuts water need by 20-80% (depending on canopy density).
✓Builds soil organic content—water and nutrient holding capacity, porosity pest and disease resistance…

Grasscycling:
✓ Can supply >40% of WSU recommended nitrogen. (Or 100% of HMS recommended amount).
✓Decreases thatch over a few years.
✓Builds soil organic content—water and nutrient holding capacity, porosity, pest and disease reistance.

Building Blocks:



Efficient Watering
- ✓Effective hydro-zones
- ✓Efficient equipment / layout
- ✓Appropriate schedules
- ✓Documentation

Proper Plants
- ✓Mostly drought-tolerant / low-maintenance
- ✓Group "thirsty" and "needy" plants in few zones
- ✓Appropriate size / spacing

Efficient Irrigation Starts with Good Documentation

- ✓Plans and photos of installation
- ✓Creates template for inspections, repair punch-lists, staff and customer communications…
- ✓Enables management continuity when staff change

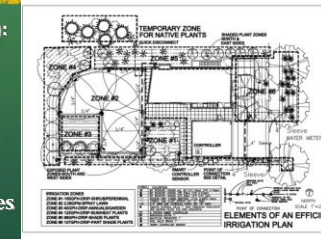
And Ends Without It


Typical Documentation At A Controller

I'm Thrilled To See Documentation Like This

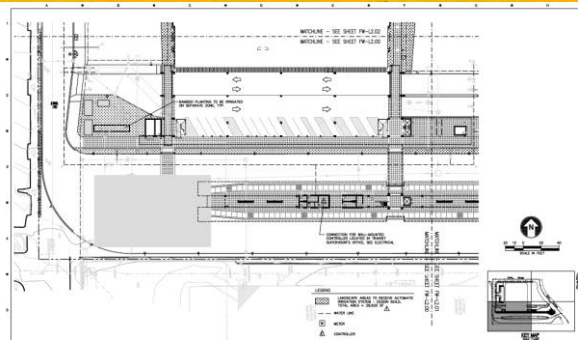
Plans Are More Useful For Most People

Include (at a minimum):
- ✓Zone locations and numbers.
- ✓Locations of valve boxes and point of connection.
- ✓Pipe and wire trenches
- ✓An electronic copy—sent to everyone involved.



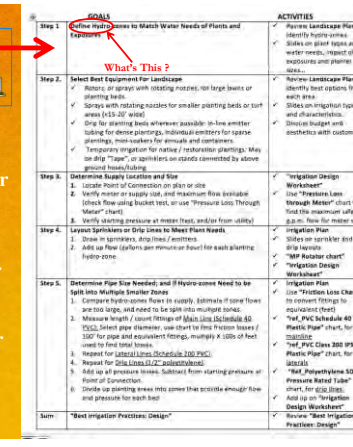
Most landscape people are visual thinkers…

This Is Not An Irrigation Plan !



Irrigation Design: Step 1

Define Hydro-zones:
- ✓Groupings of plants with similar water needs, which can be efficiently irrigated together.
- ✓Allows changing drought tolerant plants to irregular irrigation once they are established.



Consider Technical Irrigation *Audits*

- ✓ Measure equipment efficiency.
- ✓ Fine-tune scheduling.
- ✓ Calculate site irrigation needs.
- ✓ Estimate conservation potential and costs/benefits.

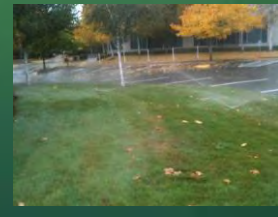
Efficient Hydro-Zones & Scheduling: 1. Based on Plants / Water Needs

	Turf	Annuals	Perennials, Shrubs and Trees
Where the Roots Are / Where to Water	Typically 4-6 inches deep, only under grass cover. Irrigation must be uniform to avoid brown areas.	Most in top 12 inches of soil, with similar spread. Have to moisten >50% of soil adjacent to plant crown.	Spread 2-5 times branch spread. Most in top 1-3 ft. Can scavenge water from lawn, broken water lines, neighbors…
Summer Water Need	2/3 to 1 inch / week, to stay green. Can recover from deficit.	2/3 to 1.5 inches / week. Deficit may stunt of kill plants.	Needs vary widely, typical ¼ to ½ inch per week. Can recover from deficit. Many need no irrigation a few years after planting

How Would You Meet the Needs of These Two Planting Areas if they Were In the Same irrigation Zone?

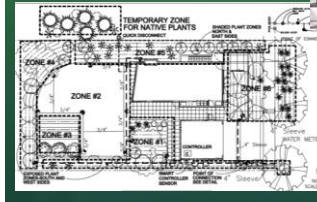
You Wouldn't

¼" Per Week



¾" to 1" Per Week X 150% for Uniform Coverage

Efficient Hydro-Zones & Scheduling: 2. Based on Plant Exposure

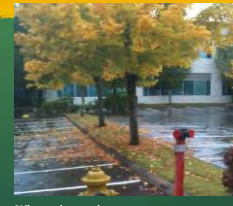


Reflected heat on south and west sides of this structure increases water need 50% or more.

Shade on the east and north sides reduce need by half.

Efficient Hydro-Zones & Scheduling: 2. Based on Plant Density

Dense plantings can increase water need 50% or more



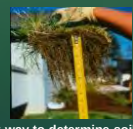
When a large plant canopy must get water from a small or shallow root zone, irrigation has to be increased proportionately.

Sparse plantings may require 50% less water

Which Suggests Another Way To Save Water

Efficient Hydro-Zones & Scheduling: 3. Soil Type and Depth Change the Equation

Soil Texture	Total Water Storage inches/foot depth	Plant-Available Water Storage inches/foot
Sand	1.2	0.9
Sandy loam	1.9	1.6
Loam	3.2	2.0
Clay loam	3.8	2.0
Clay	3.9	1.5

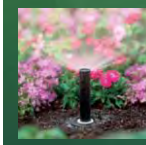


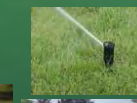
Digging in is the only way to determine soil depth. A core-sampler makes checking soil depth and moisture easy.

Less moisture storage requires smaller and more frequent watering.

Efficient Hydro-Zones & Scheduling: 4. Based on Irrigation Type

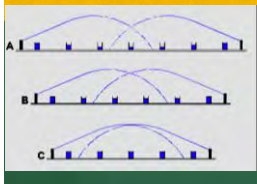
✓Non-uniform sprinklers require over-watering some areas just to keep others alive.





Sprays	Rotary Nozzles	Rotors	Drip
Areas <18' wide	Areas <30' wide	Areas >15' wide	Any size area
Turf / beds	Mostly turf	Mostly turf	Mostly beds
Less uniform	More uniform	More uniform	Super uniform
Typ. 1.2 – 2.0" hour	Typ. 0.4 – 0.6" hour	Typ. 0.4 – 0.6" hour	Typ. 0.5 – 1.0" hour

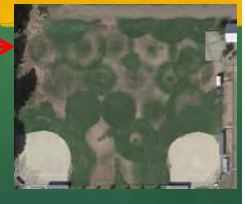
Sprinkler Uniformity:100% (+/-)Spray Overlap Needed for Efficient Coverage



←Ugly→

Bad

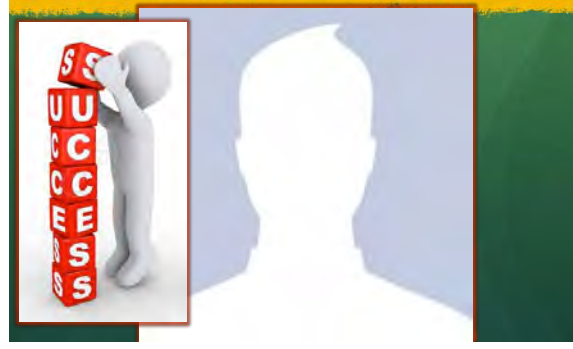
Good



Impact of irrigation uniformity on water use / co$ts

Water Need (inches per year	Irrigation Uniformity	Irrigation Need (inches per year)	Annual Irrigation Need (hundred cubic feet / 1,000 sq. ft.)	Cost (at $5 / hundred cubic ft)
14.5	0.4	36.3	30.3	$151
14.5	0.7	20.7	17.3	$87

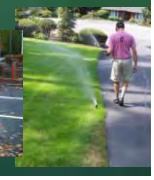
How Do We Get There?



Do A Basic Assessment of Problems and Opportunities

Run the irrigation system, and record:

- ✓ Zone locations, plant types, exposures, equipment.
- ✓ Identify basic irrigation system problems and maintenance needs.
- ✓ Zones with poor coverage, mixed planting types or exposures,
- ✓ Gather information needed to develop efficient schedules: Soil type and depth, sprinkler rates, uniformity



Confirm Controller Basics—Start Building Your Documentation

- ✓ Zone list and program posted? Don't trust it.
- ✓ Review and record the programs actually set for each zone.
- ✓ Rain / weather sensors connected and turned on?
- ✓ Each zone only set to run on one program? Multiple programs probably unintentional.

Consider Technical Irrigation *Audits*

- ✓ Measure equipment efficiency.
- ✓ Fine-tune scheduling.
- ✓ Calculate site irrigation needs.
- ✓ Estimate conservation potential and costs/benefits.

Planting Beds: Look for…

Unneeded sprinklers on unplanted areas. Turn off zones or nozzles; or cap heads.

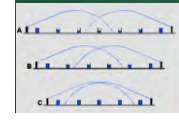
Dead / dying plants—often irrigation related. This plant is drowning.

Narrow zones (parking strips, etc.) best without irrigation or use drip.

Do New Irrigation Technologies Really Save Water?

High-Efficiency Spray Nozzles: (Should Be) The New "Standard" for Residential and Small Commercial Applications

- ✓ Can be retrofitted on sprays to meet plant needs better with 20-30% less water.
- ✓ Uniformity similar to rotors, at lower cost per head.
- ✓ Use less water, so can fix undersized or under-pressured zones.
- ✓ Less misting and overspray



"Precision" Oscillating-Stream Nozzle

Rotator Nozzle

When It Comes to Uniformity—Drip Irrigation Rules!

- ✓ Applies water directly to soil. No evaporative waste "in flight" or from soil.
- ✓ Highly uniform (99%) = no overwatering some spots to barely moisten dry spots.
- ✓ No foliage blockage = un-watered plants.
- ✓ No spray on pavement, buildings….
- ✓ Prevents foliage disease spread by splashing soil.
- ✓ Reduces summer weeds.
- ✓ **Grow healthier plants with 50% less water / $$$.**

Strategies for Successful Drip Irrigation

- ✓ Use only high- quality, standard sized parts

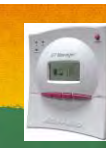
gridded so lines are easy to avoid or locate.

Keep It Simple and Straight(ish) KISS

- ½" tube to most plants. ¼" line costs more in long run.
- In-line emitters (Netafim, Rainbird Dripline) for most plantings.
- Low profile emitters (no outlet barb to 1/4" line) where needed
- Bury lines under mulch—not deep in soil.
- Use lots of staples to keep lines in place.

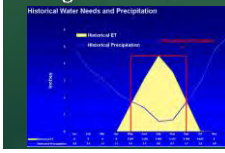


How About Smart Controllers ?



Automatically adjust run times based on weather data from on-site sensors or local weather station.

Seasonal adjustment of irrigation schedules has the potential to reduce irrigation 25% or more.

Smart Controller Retrofits

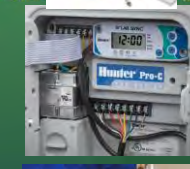
Many controllers can be retrofitted with sensors to create weather based scheduling:

- ✓Hunter Solar Sync Sensor Module
- ✓Rainbird ESP Modular Upgrade Kit
- ✓Irritrol Climate Logic System
- ✓Hermit Crab retrofits for most major brands

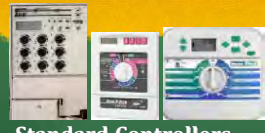



Smart Operators?

- ✓ **Proper programming is essential to success.**
- ✓ Some (Hunter, Irritrol,) adjust user-set peak summer program by %, based on weather data from on-site sensors or local weather station. Some savings guaranteed (almost).
- ✓ Some (Rainbird, Weathermatic) calculate program based on inputs of plant/soil/sprinkler type and exposure for each zone. Lots of work. Many assumptions that could be wrong. Sometimes use goes up!



Smart Managers Can Get Similar Conservation With "Dumb" Controllers



Standard Controllers

- ✓Multiple Programs & Start Times
- ✓Non-Volatile Memory
- ✓Sensor Overrides: Rain, Soil Moisture
- ✓Seasonal Adjust. Some allow monthly preset for entire year.

Smart Controllers

- ✓Multiple Programs & Start Times
- ✓Non-Volatile Memory
- ✓Sensor Overrides: Rain, Soil Moisture, Flow
- ✓*Automatic ET Adjust*

Conservation Success

Standard Controllers

Smart Controllers

- ✓ **Set programs based on plants, exposures, soil type /depth.**
- ✓ **Use** Multiple Programs & Start Times
- ✓ **Use** Sensor Overrides
- ✓ **Use** Seasonal Adjust or Automatic ET Adjust
- ✓ Document zones, schedules, problems
- ✓ Observe & Maintain

Flow Sensors

- ✓ Measure flow data and send to controller.
- ✓ Compatible controllers learn each zone's flows, and detect irregular flows caused by leaks, or stuck valves…
- ✓ Controllers shut down problem zones – or entire system if main line breaks. So if system is not networked, controller must be checked onsite frequently for warning light.
- ✓ Great potential. But can be expensive to install. A good wireless system if the Holy Grail…

Central / Networked Controllers

- ✓ Allow remote monitoring and program adjustment. Huge savings potential just from identifying leaks and out of season irrigation.
- ✓ Essential for effective use of flow sensors that isolate and shut off breaks—and send alarms.
- ✓ New technologies / lower prices every year.
- ✓ Still require dedicated, trained professional managers

Rain Shutoff Devices: Why Not Us?

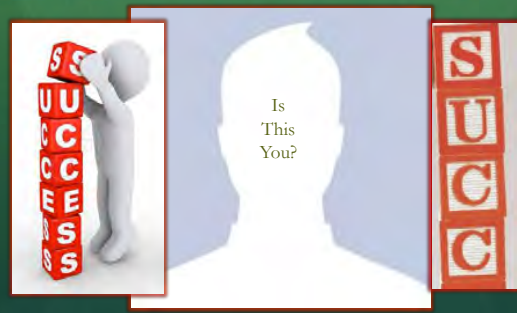
- ✓ Shut off irrigation after rain to save water—and avoid bad PR.
- ✓ Can save >20% of annual use on systems that are not regularly maintained and adjusted.
- ✓ Misunderstood and underutilized technology—great potential for a fraction of the cost of the high-tech solutions.

Why are we always bypassed?

Soil Moisture Sensors / Controllers

- ✓ New products improving soil moisture-sensing accuracy.
- ✓ Several available as add-on modules. Some only work with proprietary controllers.
- ✓ Most sites need controller equipped to use multiple sensors and assign each zone to a sensor in appropriate conditions (exposures, soils and irrigation uniformity). Need professional attention.

Today's Case Studies Will Show: Thoughtful, Committed Managers Make A Difference



Our Challenges

- ? Lack of information on good practices
- Poor communications and oversight
- $ Low bids = cut corners
- $ Landscapes don't get no re$pect