HOW TO CREATE AN IRRIGATION SCHEDULE FOR DRIP SYSTEMS

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DRIP VS. SPRAY AND ROTOR

Differences

- Drip typically applies water to an individual plant
- The application rate on a zone can vary according to plant needs by changing emitter number and size (up to a certain point)
- Landscape coefficients are less well documented than for turf

Similarities

- Still need to know the species factor, density factor, micro-climate factor, soil type, irrigation efficiency, and ET rate

Additional factors

- Plant size (diameter or leaf area)
- Plant maturity
- Multi-story landscapes

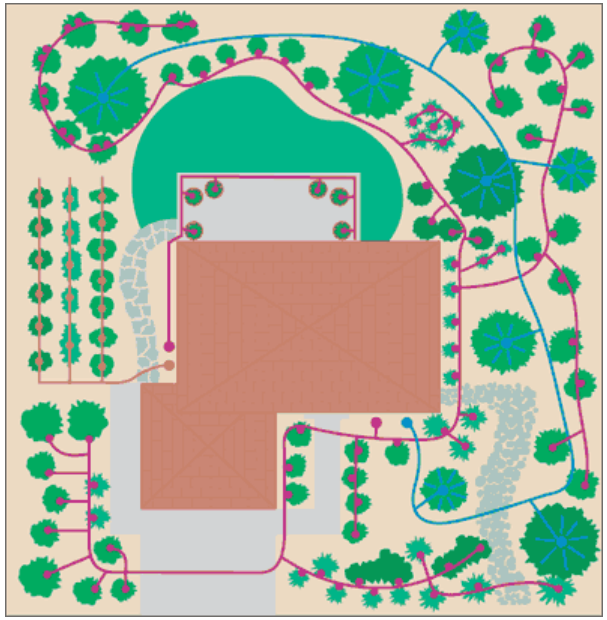
PLANNING DRIP ZONES

It's best to group plants with similar water needs on a zone

- Zone A – trees
- Zone B – shrubs
- Zone C – small plants
- If possible, put high water use plants on a separate zone from low water use plants, shrubs, or trees.

Consider how much water each species will need

- Select an appropriate number of emitters and application rate
- Consider needs of young plants versus mature plants
  - **Will need to adjust emitters over the life of the plant**



JUDGEMENT AND OBSERVATION ARE CRUCIAL

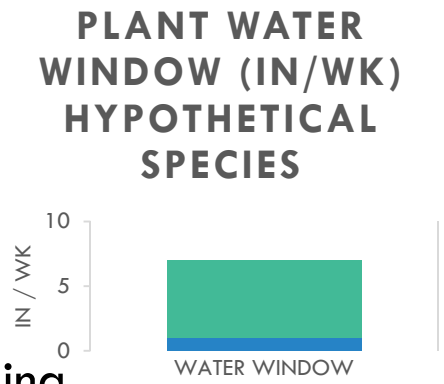
Because of

- Complexity of designing water application for different species
- More judgement calls in drip irrigation system design
- System efficiency changes over time, example, emitters r
- Plant water needs change as they mature

Regular observation and adjustment are neede

- Test soil moisture and depth
- Observe how healthy plants appear to be
- Adjust watering frequency, length, and emitters

PLANT WATER NEEDS



Most species have a water need window

Minimum is minimum needed to survive

Maximum is most the plant can tolerate before drowning

Applying the least amount within the window of tolerance will conserve water

System inefficiency is unavoidable due to

- Water applied deeper than root zone
- Water applied beyond reach of roots (horizontally)
- Extra water applied because of varying plant needs on a zone

Drought-tolerant plants will reduce their water use as water becomes scarce; other plants will simply die.

GUIDELINES FOR WATERING DEPTH

Root depths vary by species and type of plant

Mature trees – 24”-36”

Young trees – 6” - 24”

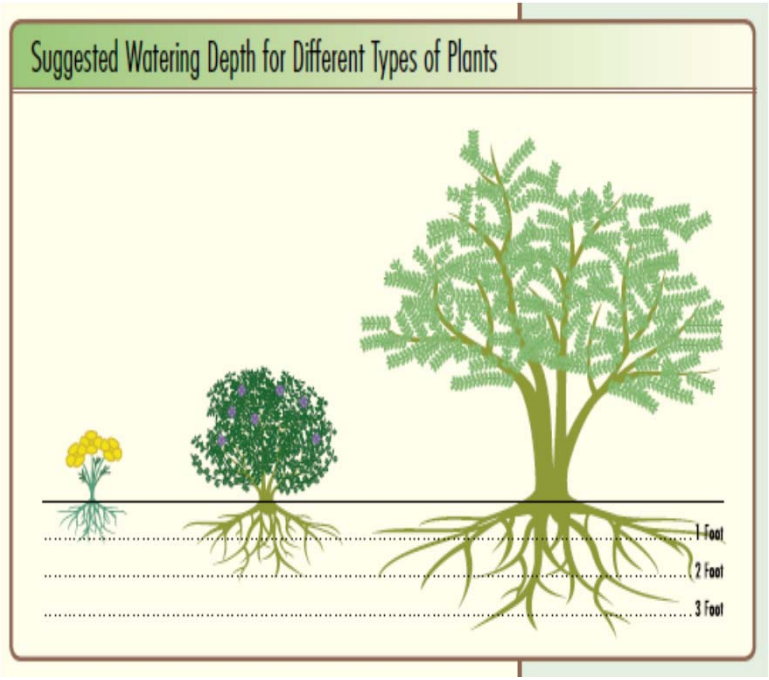
Shrubs – 18” - 24”

Small plants – 6” -12”

Groundcover – 6” – 10”

You want to irrigate to the bottom of the root zone, but no further.

Use soil probe an hour after irrigation.



Landscape Watering by the Numbers, A Guide for the Arizona Desert

USE THIS INFORMATION TO CREATE A SCHEDULE

1. Determine each plant's water needs
2. Estimate size or leaf area
3. Use formulas to estimate water needs of your plants
4. Figure out how much water is needed per week
5. Adjust emitters or bubblers to relative needs in the zone
6. Develop a schedule based on ET and Zone needs
7. Regularly test soil moisture and observe plants; adjust irrigation

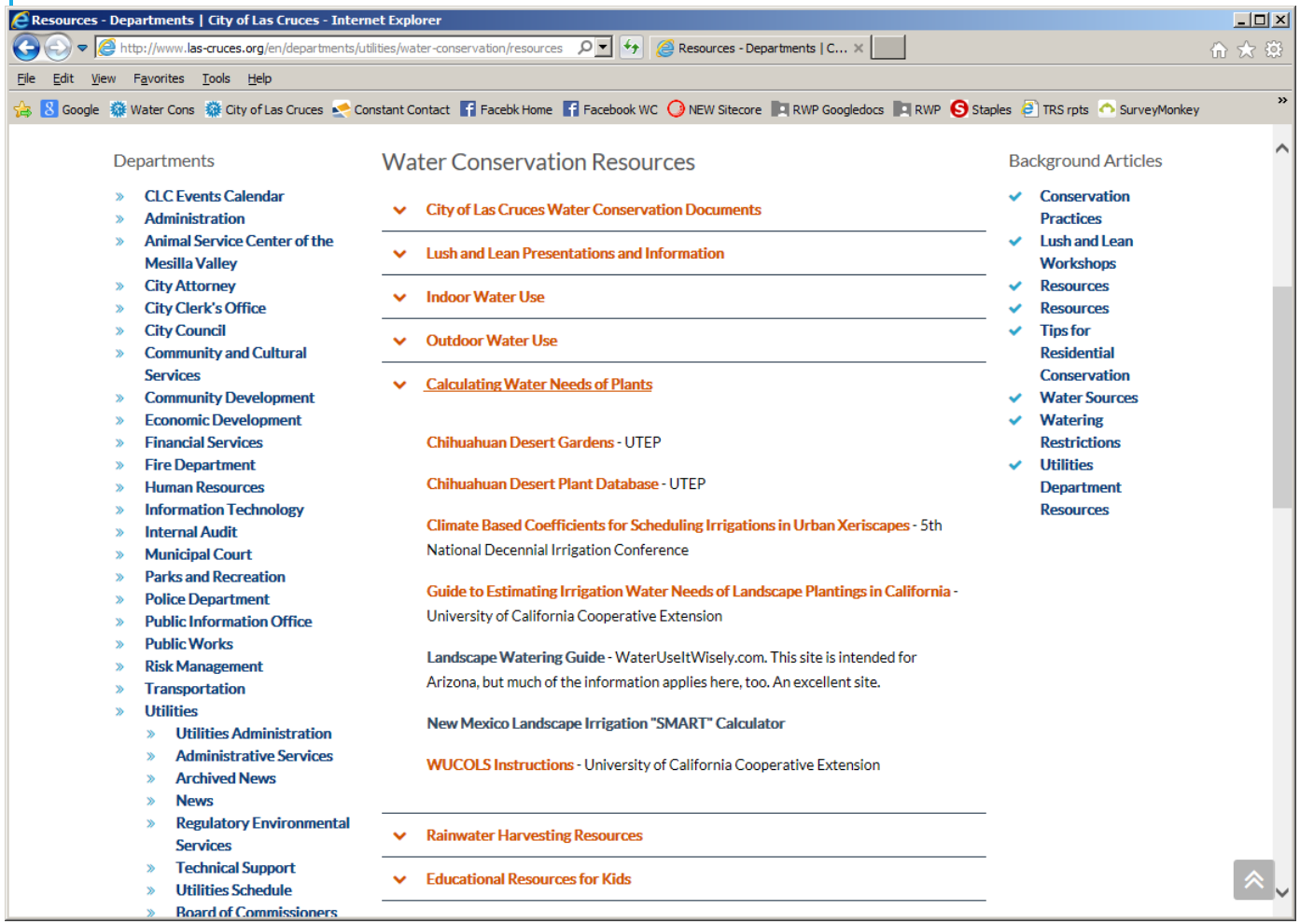
1. DETERMINE EACH PLANT'S WATER NEEDS

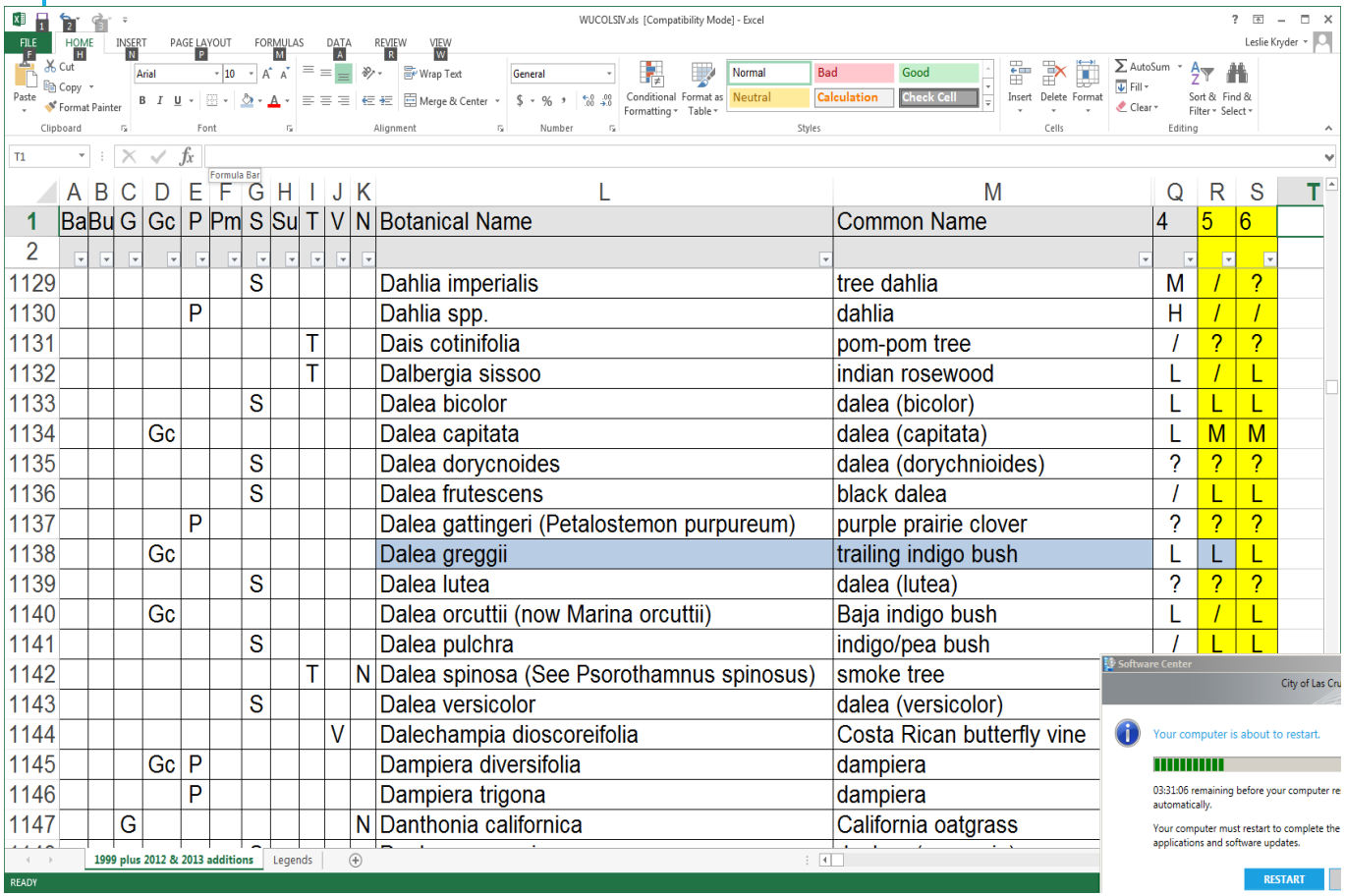
Look up water requirements

- Try www.mswn.com and look for information sheets
- Or other sites; make sure you get info for **desert** climate

Species Factor (Ks)	
Very low	< 0.1
Low	0.1 – 0.3
Medium	0.4 – 0.6
High	0.7 – 0.9


http://www.mswn.com/media/info_sheets/dalea_greggii.pdf - Internet Explorer
http://www.mswn.com/media/info_sheets/dalea_greggii.pdf
mswn.com
File Edit Go to Favorites Help
Google Water Cons City of Las Cruces Constant Contact Facebk Home Facebook WC NEW Sitecore RWP Googledocs RWP Staples TRS rpts SurveyMonkey
MOUNTAIN STATES WHOLESALE NURSERY
DALEA GREGGII
TRAILING INDIGO BUSH
GROUND
This long-lived, durable ground cover requires almost no maintenance. Dalea greggii is a ground cover that thrives in full sun and reflected heat locations, forming a dense silvery mound to only one to two feet tall. The fuzzy purple flower balls produced in the spring and early summer are not overly showy, although the bees seem to like them. Trailing indigo bush is a great choice for steep banks, or other areas where erosion control is needed. It is notorious for looking scraggly in nursery containers, but don't let that discourage you from trying it. Once established, it's one of the hardiest ground covers available! Just be careful not to mix this ground cover with water-loving plants, as it is susceptible to rotting out if over-watered.
AT A GLANCE SUMMARY
SIZE (H X W) 2 feet x 6-8 feet
FLOWER COLOR Rose-Purple
FLOWER SEASON Summer
EXPOSURE Full Sun, Reflected Heat
WATER Low
GROWTH RATE Fast
HARDINESS 10° F, USDA Zone 7
PRUNING Minimal


Resources - Departments | City of Las Cruces - Internet Explorer
http://www.las-cruces.org/en/departments/utilities/water-conservation/resources
Resources - Departments | C...
File Edit View Favorites Tools Help
Google Water Cons City of Las Cruces Constant Contact Facebk Home Facebook WC NEW Sitecore RWP Googledocs RWP Staples TRS rpts SurveyMonkey
Departments
CLC Events Calendar
Administration
Animal Service Center of the Mesilla Valley
City Attorney
City Clerk's Office
City Council
Community and Cultural Services
Community Development
Economic Development
Financial Services
Fire Department
Human Resources
Information Technology
Internal Audit
Municipal Court
Parks and Recreation
Police Department
Public Information Office
Public Works
Risk Management
Transportation
Utilities
Utilities Administration
Administrative Services
Archived News
News
Regulatory Environmental Services
Technical Support
Utilities Schedule
Board of Commissioners
Water Conservation Resources
City of Las Cruces Water Conservation Documents
Lush and Lean Presentations and Information
Indoor Water Use
Outdoor Water Use
Calculating Water Needs of Plants
Chihuahuan Desert Gardens - UTEP
Chihuahuan Desert Plant Database - UTEP
Climate Based Coefficients for Scheduling Irrigations in Urban Xeriscapes - 5th National Decennial Irrigation Conference
Guide to Estimating Irrigation Water Needs of Landscape Plantings in California - University of California Cooperative Extension
Landscape Watering Guide - WaterUseItWisely.com. This site is intended for Arizona, but much of the information applies here, too. An excellent site.
New Mexico Landscape Irrigation "SMART" Calculator
WUCOLS Instructions - University of California Cooperative Extension
Rainwater Harvesting Resources
Educational Resources for Kids
Background Articles
Conservation Practices
Lush and Lean Workshops
Resources
Resources
Tips for Residential Conservation
Water Sources
Watering Restrictions
Utilities Department Resources



	A	B	C	D	E	F	G	H	I	J	K	L	M	Q	R	S	T
1	Ba	Bu	G	Gc	P	Pm	S	Su	T	V	N	Botanical Name	Common Name	4	5	6	
2																	
1129							S					Dahlia imperialis	tree dahlia	M	/	?	
1130					P							Dahlia spp.	dahlia	H	/	/	
1131									T			Dais cotinifolia	pom-pom tree	/	?	?	
1132									T			Dalbergia sissoo	indian rosewood	L	/	L	
1133							S					Dalea bicolor	dalea (bicolor)	L	L	L	
1134				Gc								Dalea capitata	dalea (capitata)	L	M	M	
1135							S					Dalea dorycnoides	dalea (dorychnioides)	?	?	?	
1136							S					Dalea frutescens	black dalea	/	L	L	
1137					P							Dalea gattingeri (Petalostemon purpureum)	purple prairie clover	?	?	?	
1138				Gc								Dalea greggii	trailing indigo bush	L	L	L	
1139							S					Dalea lutea	dalea (lutea)	?	?	?	
1140				Gc								Dalea orcuttii (now Marina orcuttii)	Baja indigo bush	L	/	L	
1141							S					Dalea pulchra	indigo/pea bush	/	L	L	
1142									T		N	Dalea spinosa (See Psorothamnus spinosus)	smoke tree				
1143							S					Dalea versicolor	dalea (versicolor)				
1144										V		Dalechampia dioscoreifolia	Costa Rican butterfly vine				
1145				Gc	P							Dampiera diversifolia	dampiera				
1146					P							Dampiera trigona	dampiera				
1147			G								N	Danthonia californica	California oatgrass				

Use Column 5 for high desert or 6 for low desert

1. DETERMINE EACH PLANT'S WATER NEEDS

Density Factor (Kd)

- Low 0.5 – 0.9
- Average 1.0
- High 1.1 – 1.3

With drip, most of the time you will use Average or 1.0 for individual plants

Use low and high values where you are irrigating an entire area rather than individual plants

1. DETERMINE EACH PLANT'S WATER NEEDS

Microclimate (Kmc)

- Low 0.5 – 0.9
- Average 1.0
- High 1.1 – 1.4

- **Low** – sites shaded or protected from winds, often on north or northeast side of buildings
- **Average** – open areas without extraordinary wind or heat from nearby buildings, parking lots, etc.
- **High** – ATYPICAL direct winds, e.g. wind tunnels; heat from walls or parking lots; southern and western exposures, full sun

1. DETERMINE EACH PLANT'S WATER NEEDS

Landscape Coefficient (corresponds to crop coefficient for turf) (KL)

KL = Ks * Kd * Kmc

Example:
Species: Dalea greggii (groundcover)
Ks = low = 0.2
Kd = average = 1.0
Kmc = high = 1.2southwest exposure next to rock wall

KL = 0.2 * 1.0 * 1.2 = 0.24

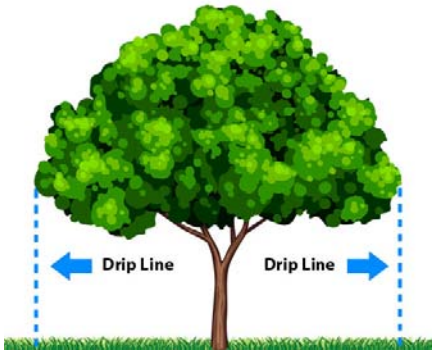
2. ESTIMATE SIZE OR LEAF AREA

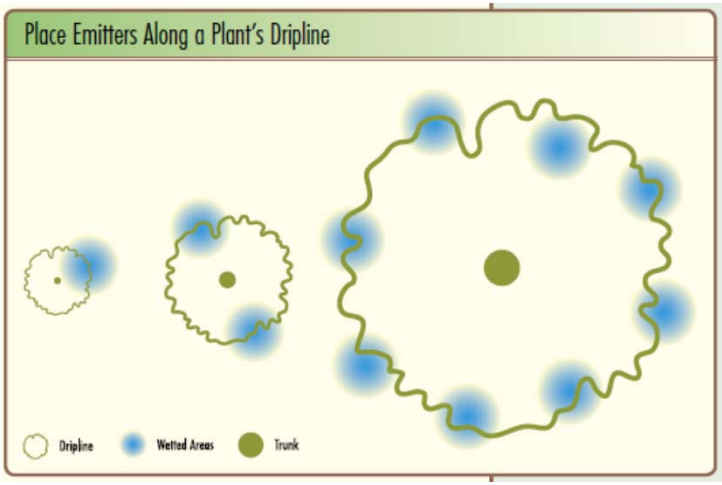
Use plant diameter to calculate area covered

- Ac (sqft) = D[2](ft) * .785
- Note: [2] means squared.

Dalea greggii mature width 6'-8'; let's use 6'

- Ac = (6ft)[2] * .785 = 28 sqft





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3. USE FORMULAS TO ESTIMATE WATER NEEDS OF YOUR PLANTS

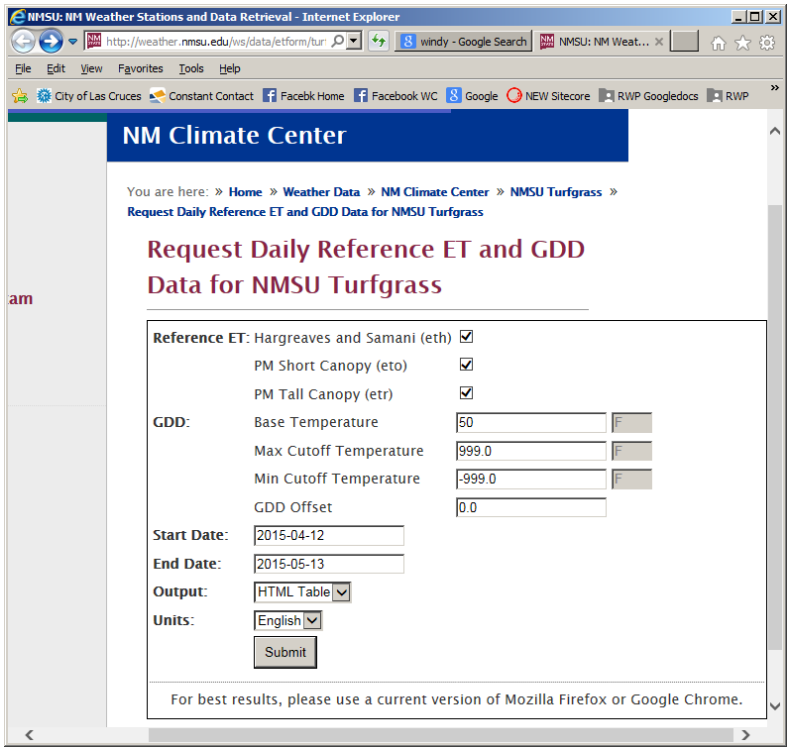
Calculate gallons needed

- Irr (gal) = ET[o](in) * KL * Ac (sqft) *.623

- Look up ET[o] on NMSU website at

  http://weather.nmsu.edu/ws/data/etform/turf-da-1/

- Use June numbers : 9.8” in June
- Daily: 9.8”/30 days = 0.33in/day
- Weekly: 0.33 in/day * 7 days = 2. 3 in/week



4.FIGURE OUT HOW MUCH WATER IS NEEDED PER WEEK

Calculate gallons needed

- Irr (gal) = ET[o](in) * KL * Ac (sqft) *.623

Dalea greggii information so far:

KL = 0.24

Area = 28 sqft

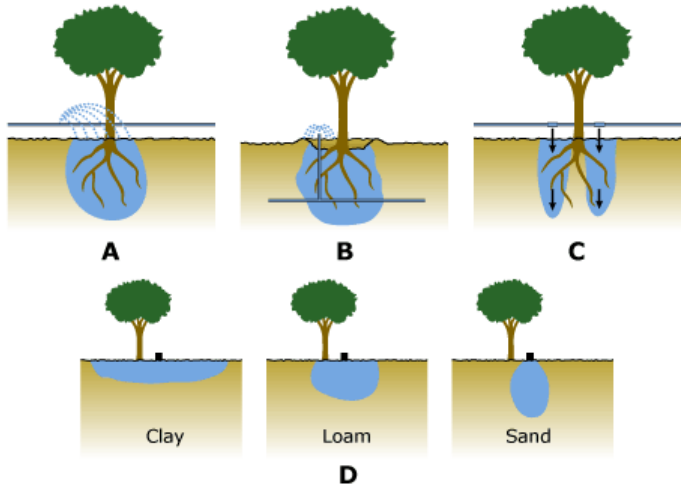
ET = 2.31 in/week

- Irr (gal) = 2.31 in/week * 0.24 * 28 sqft *.623 = 9.7 gal / week

4.FIGURE OUT HOW MUCH WATER IS NEEDED PER WEEK

System inefficiency is unavoidable due to

- Water applied deeper than root zone
- Water applied beyond reach of roots (horizontally)
- Varying plant needs on a zone



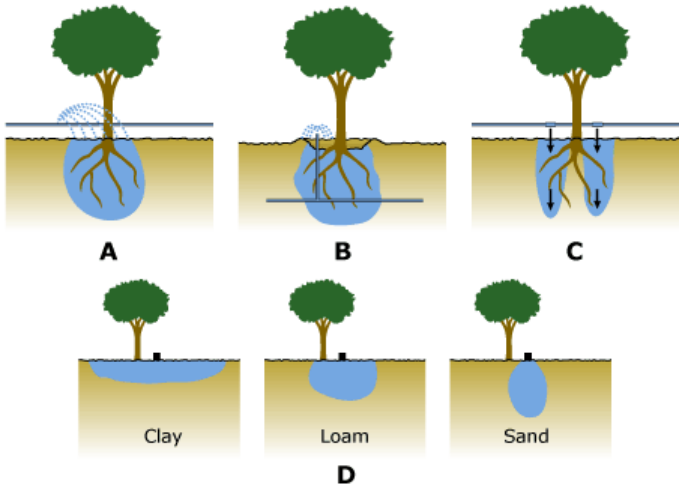
Conduct a formal irrigation audit if possible

4.FIGURE OUT HOW MUCH WATER IS NEEDED PER WEEK

In the absence of better information, start with 78% efficiency (.78)

To find the **Total Water to Apply (TWA)** divide water needed by system efficiency

- TWA (gal) = Irr (gal) / Eff
- TWA = 9.7 gal / .78 = 12.4 gal



4. ADJUST EMITTERS OR BUBBLERS TO RELATIVE NEEDS IN THE ZONE

Make a table showing each plant's water needs

Refer to Excel spreadsheet for example calculations (IrrigationScheduleWorksheet.xlsx)

- Plant name
- Scientific name
- Water need (very low, low, medium, high)
- Species factor (Ks)
- Density factor (Kd)
- Microclimate factor (Kmc)
- Diameter of plant (ft)

System inefficiency	78%												
ET[rs] per mo		in											
ET[rs] per day	0.00	in											
											Emitters	**Emitter**	**Time to run**
Plant Name	**Scientific Name**	**Water Need**	**Ks**	**Kd**	**Kmc**	**Ks**	**Diameter (ft)**	**Ac (sqft)**	**Irr (gal)**	**TWA (gal)**	**flow rate (GPH)**	**#**	**(min)**
						0		0.0	0.00	0.00			#DIV/0!
						0		0.0	0.00	0.00			#DIV/0!
						0		0.0	0.00	0.00			#DIV/0!

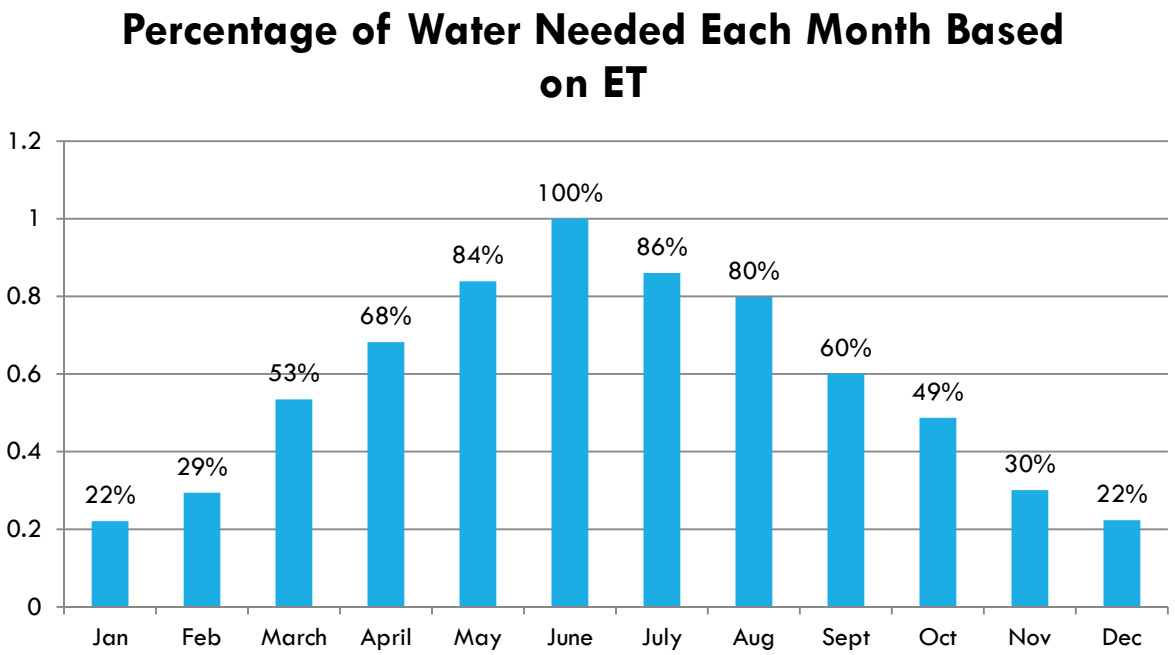
IRRIGATION SCHEDULE WORKSHEET

System inefficiency	78%												
ET[o] per mo	4	in											
ET[o] per day	0.13	in											
											Emitters	**Emitter**	**Time to run**
Plant Name	**Scientific Name**	**Water Need**	**Ks**	**Kd**	**Kmc**	**Ks**	**Diameter (ft)**	**Ac (sqft)**	**Irr (gal)**	**TWA (gal)**	**flow rate (GPH)**	**#**	**(min)**
Yellow Bells	Tecoma stans	Medium	0.5	1	1.4	0.7	3	7.1	0.41	0.53			#DIV/0!
Trailing Indigo Bush	Dalea greggii	Low	0.2	1	1.4	0.3	5	19.6	0.46	0.59			#DIV/0!
Mulberry	Morus rubra	Medium	0.5	1	1	0.5	25	490.6	20.38	26.12			#DIV/0!

4. ADJUST EMITTERS OR BUBBLERS TO RELATIVE NEEDS IN THE ZONE

System inefficiency	78%												
ET[rs] per mo	4	in											
ET[rs] per day	0.13	in											
											Emitters	**Emitter**	**Time to run**
Plant Name	**Scientific Name**	**Water Need**	**Ks**	**Kd**	**Km c**	**Ks**	**Diameter (ft)**	**Ac (sqft)**	**Irr (gal)**	**TWA (gal)**	**flow rate (GPH)**	**#**	**(min)**
Yellow Bells	Tecoma stans	Medium	0.5	1	1.4	0.7	3	7.1	0.41	0.53	1	2	15.8
Trailing Indigo Bush	Dalea greggii	Low	0.2	1	1.4	0.3	5	19.6	0.46	0.59	0.5	5	14.0
Mulberry	Morus rubra	Medium	0.5	1	1	0.5	25	490.6	20.38	26.12	4	25	15.7

6. DEVELOP A SCHEDULE BASED ON ET AND ZONE NEEDS



Step 1 Calculate the amount of water you need to apply in June (on average).

Step 2 Program the irrigation timer schedule for the month of June.

Step 3 On the first of each month, adjust the percentage based on the chart below. For example, if it's April, you need 68% of June water.

2013 was a particularly dry year. You may find that some years you will need less water.

In cooler months you may need to scale back the frequency of watering as well as time.

6. DEVELOP A SCHEDULE BASED ON ET AND ZONE NEEDS

Step 1 Calculate the amount of water you need to apply in June (of any year).

Step 2 Program the irrigation timer schedule for the month of June.

Step 3 On the first of each month, adjust the percentage based on the chart below. For example, if it's April, you need 68% of June water.

2013 was a particularly dry year. You may find that some years you will need less water.

In cooler months you may need to scale back the frequency of watering as well as time.

If you need to run for 30 minutes a week in June, how often should you irrigate?

A. Apply enough water during each irrigation to wet the root zone of the plants.

Ex: If Dalea greggii can be irrigated to 1' depth in 15 minutes, then irrigate 2x per week for 15 minutes for a total of 30 minutes per week.

In April, reduce watering to 68% of June, or about 10 minutes twice a week. However, if soil is not moist at 10"-12", consider watering once per week for 20 minutes.

6. DEVELOP A SCHEDULE BASED ON ET AND ZONE NEEDS

Other things to consider when putting together a schedule:

- Sandy soil will require more frequent, shorter irrigation cycles.
- Sloping terrain will often require several very short cycles to avoid runoff.
- Be aware of allowable watering days and times.
  - Even a SMART controller must be programmed to conform to the schedule.
- Water needs of plants will change as they mature.
  - Newly planted plants need a lot of water and more frequent watering until their roots are established.
- Long-term, it's better to water less frequently in greater quantities to encourage roots to grow deep.

7. REGULARLY TEST SOIL MOISTURE AND OBSERVE PLANTS; ADJUST IRRIGATION

Signs of underwatering

- Older leaves turn yellow or brown and drop
- Leaves are dull, wilted, or dropping
- Leaves curl
- Stems or branches die back

Signs of overwatering

- Leaves turn a lighter shade of green or yellow
- Young shoots are wilted
- Growth is excessive
- Algae and or mushrooms are on or around plants

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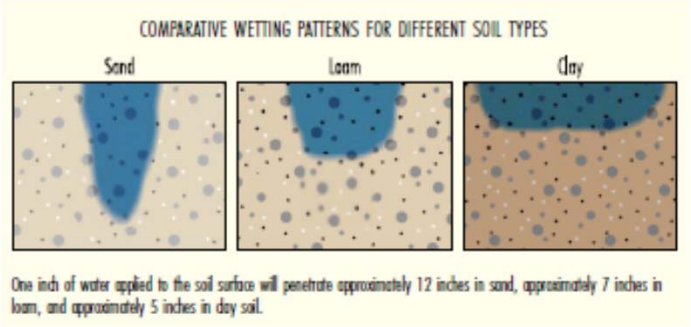

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- Sandy soil will require more frequent, short watering cycles.
- Sometimes you will need to run several short cycles with resting time in between.

7. REGULARLY TEST SOIL MOISTURE AND OBSERVE PLANTS; ADJUST IRRIGATION

- In cooler months you should scale back the frequency of watering as well as time.
- Calculate total water needed per week; then determine frequency so that you apply enough water to wet the root zone.
- Check soil moisture an hour after irrigation.

MORE RESEARCH

More research is needed to determine actual ET on a plant by plant basis.

Available information will put you in the right ballpark, but observation and adjustment will be needed.