

“Get a Grip on Drip”

Jim Borneman – Ewing Irrigation Products



The One Thing

Drip Irrigation systems are popular for their low pressure requirements and slow precise application of water. Many drip systems do not have this capability due to poor scheduling. This is largely the case because their rates of application are not known

The Situation

Irrigation runoff with drip irrigation systems into the waterways of the state and within the drip zones shifting water away from the intended target. A significant loss of plant material due to poor scheduling. Much of this occurs because drip application rates are not known!

This area is under drip (point source) irrigation. How many minutes per week should it be watered in Sacramento in July



This area is under line source (brown tubing) irrigation.
How long should this station water?



The Answer!

Who could know with such limited information?

Irrigation runoff in a common area in north Chico, CA



This water in the gutter pan the morning after an irrigation event



The soil appears dry, but water is seeping out under the curb



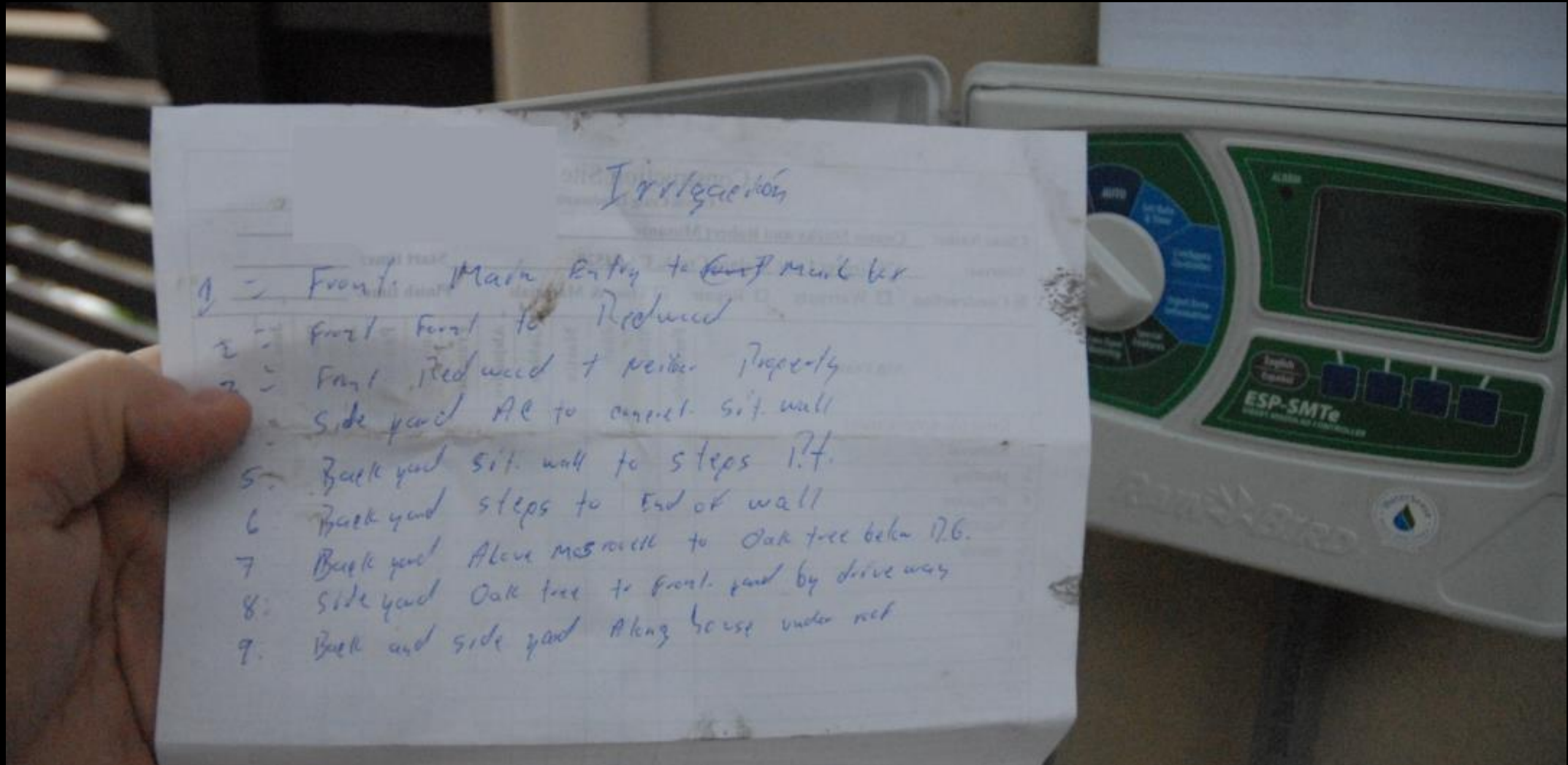


Valve boxes are all flooded!





Look to the Irrigation Controller for site information –
area irrigated, plant material, and application rate!



RAIN

RAIN BIRD.

PROGRAMMING CHART for ESP LX+ Controllers

Clear all pro
Borra la info



Set current
Ajuste la fe

8

5c Set Cycli
Fije Cale



Watering
Days



Program
Start Times

Water Budget

Station Delay

Technical Assistance: 800-247-3782

Station	Description	MV/Pump Relay	Run Time ⌚	Run Time ⌚	Run Time ⌚	Run Time ⌚
✓ 1.	South East Rotors	<input type="checkbox"/> on	12			
✓ 2.	South East - Pores	<input type="checkbox"/> on	15			
✓ 3.	SE Rotor Porey	<input type="checkbox"/> on	10			
X 4.	?	<input type="checkbox"/> on				
✓ 5.	Front R.	<input type="checkbox"/> on				
6.	Front R. side	<input type="checkbox"/> on				
✓ 7.	Front side	<input type="checkbox"/> on				
✓ 8.	Pop up Extra	<input type="checkbox"/> on				
X 9.	*	<input type="checkbox"/> on				
X 10.	Rotors by clock	<input type="checkbox"/> on	1 Hr 0			
✓ 11.	By clock	<input type="checkbox"/> on	15			
✓ 12.	12 Rotors by clock	<input type="checkbox"/> on	30			
✓ 13.		<input type="checkbox"/> on				
✓ 14.		<input type="checkbox"/> on				
✓ 15.	Rotors South Side Bldg	<input type="checkbox"/> on				
✓ 16.	Mail Box and North Side	<input type="checkbox"/> on				
✓ 17.		<input type="checkbox"/> on				
✓ 18.	North Side Bldg	<input type="checkbox"/> on				
✓ 19.		<input type="checkbox"/> on				
✓ 20.		<input type="checkbox"/> on				

Program A	Program B	Program C	Program D
MTWTFSS <input type="radio"/> Day cycle <input type="radio"/> even <input type="radio"/> odd	MTWTFSS <input type="radio"/> Day cycle <input type="radio"/> even <input type="radio"/> odd	MTWTFSS <input type="radio"/> Day cycle <input type="radio"/> even <input type="radio"/> odd	MTWTFSS <input type="radio"/> Day cycle <input type="radio"/> even <input type="radio"/> odd
1 am / pm	1 am / pm	1 am / pm	1 am / pm
2 am / pm	2 am / pm	2 am / pm	2 am / pm
3 am / pm	3 am / pm	3 am / pm	3 am / pm
4 am / pm	4 am / pm	4 am / pm	4 am / pm
5 am / pm	5 am / pm	5 am / pm	5 am / pm
6 am / pm	6 am / pm	6 am / pm	6 am / pm



PROGRAMS		A							B							C						
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WATER DAYS		M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
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Interval or Odd/Even Days																						
---------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--


Event Day(s) Off																						
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START TIME(S) Set the time(s) to start the program's watering cycle(s).	1																					
---	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

	2																					
--	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

	3																					
--	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

	4																					
--	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

 Only one program start time
is needed to run the cycle.

STATION	Location	Station Run Time	Station Run Time	Station Run Time
1	Lawn Strip - at mesa ave street			
2	Plants R side Front			
3	Plants L & R Lower area Front			
4	Lawn back yard Lower			
5	Plants at the back yard			
6	Plants at the back yard by shed			
7	Plants drip L. and Lower area			
8	Plants drip R. and circle			
9	Plants drip upper area			
10				
11				
12				
13				
14				
15				

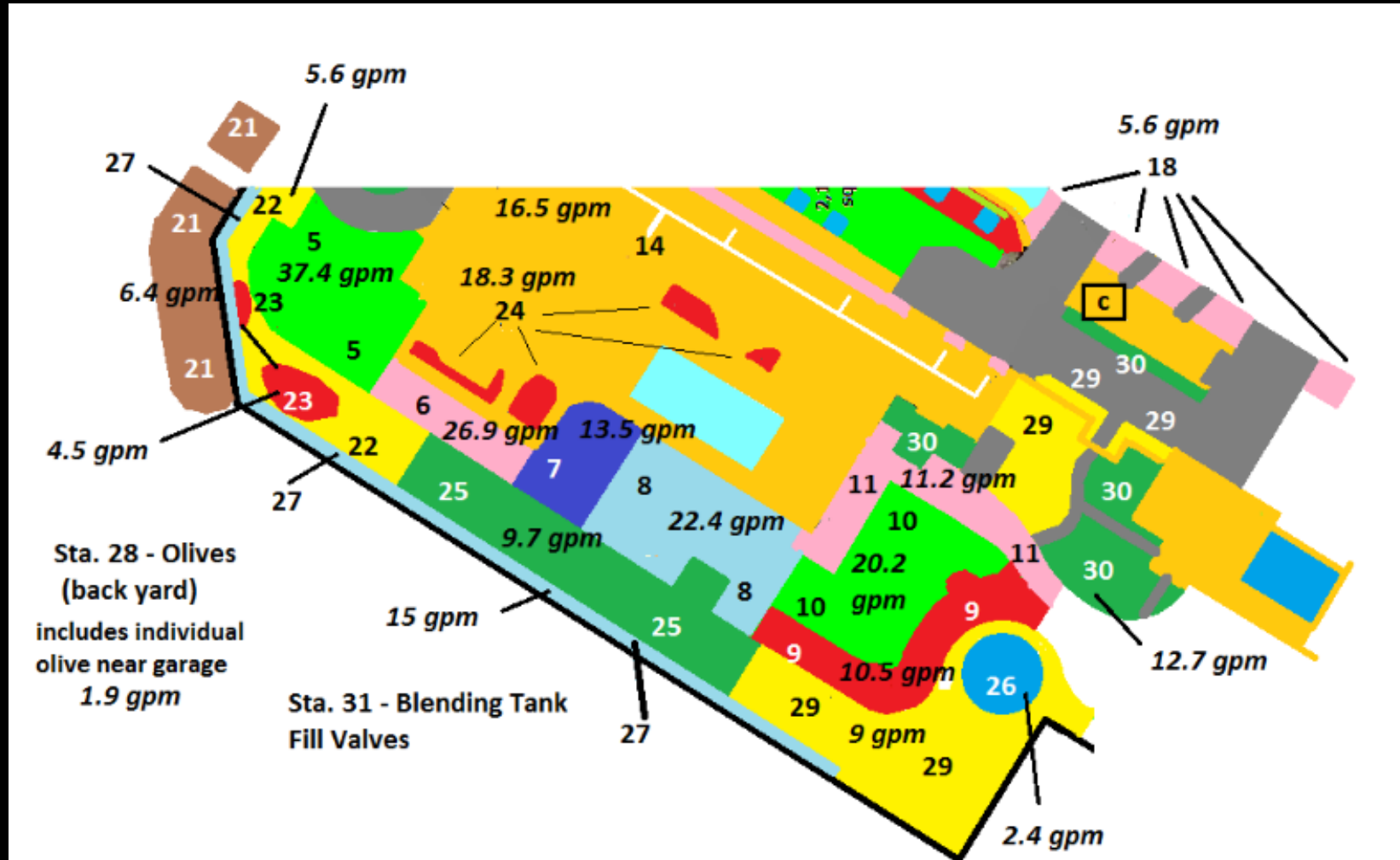


No information on sprinkler type or application rates,
limited info on plant material

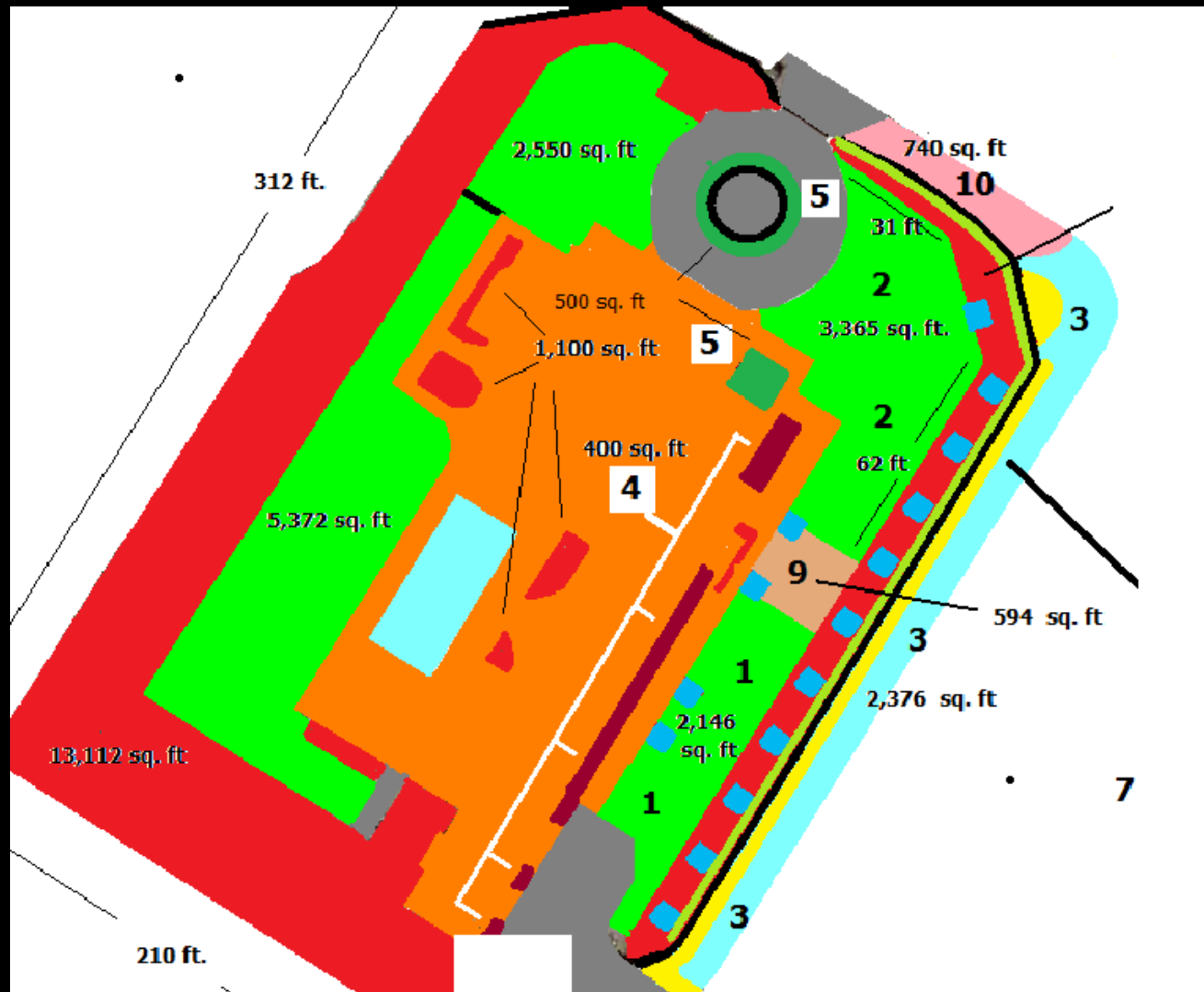
Program	Days	Times
A	2/1	12 AM 3:30 AM
B	2/1	12 PM 3:30 PM
C	2/1	12 AM 3:30 PM
D	2/0	12 PM 3:30 PM

	Program	Times	Pump
1 LAWN BY FAIRVIEW	A	20	✓
2 ATHERTON LAWN	A	20	✓
3 FRONT STEP LAWN	A	20	✓
4 FRONT STEP LAWN	A	20	✓
5 FEATHER GRASS	A	7	✓
6 AGAPANTHUS & HYDRANGEAS	A	10	✓
7 FRONT DRIVEWAY SPRAY	A	7	✓
8 BACK DRIVEWAY SPRAY	A	10	✓
9 FRONT DRIP @ BEDWARD	B	10	✓
10 PARKING AREA & SMOKE TREE	B	10	
11 ZEBRA & FEATHER GRASS	B	7	
12 LAUREL HEDGE ON ATHERTON	B	20	
13 WEST SIDE DRIVEWAY FRONT	B	20	
14 BACK LAWN LOW STEP	C	5	
15 BACK LAWN UPPER STEP	C	5	
16 " " MAIN	C	25	✓
17 " " PLAYGROUND	C	15	

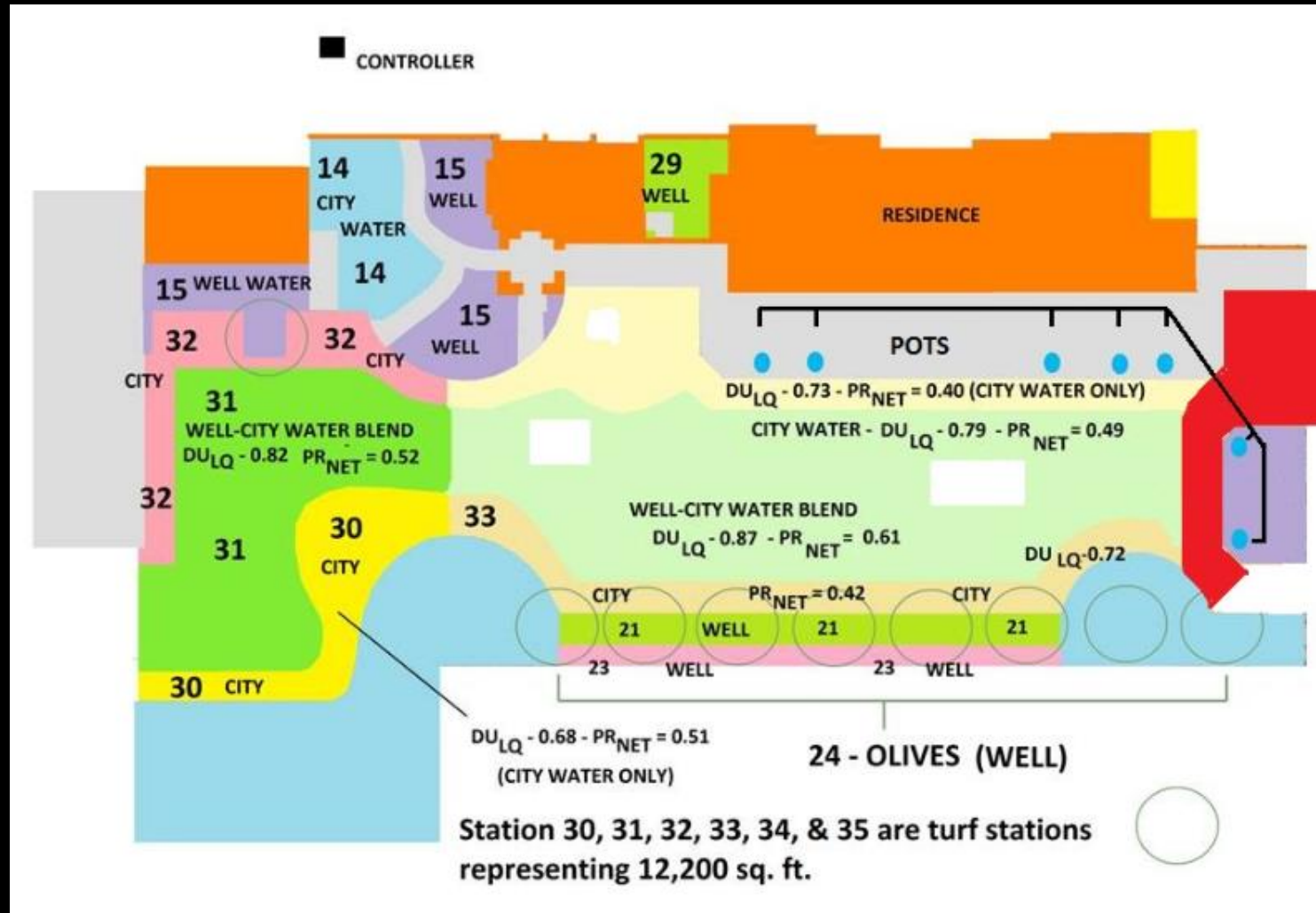
This residential landscape has flow information for all stations



The area in square feet of each valve circuit (hydrozone) is known so application rates can be calculated



The map makes scheduling easier. A separate sheet shows plant material by circuit. Note precipitation/application rates



Learning Objectives

- Demonstrate an understanding of the resources available to determine plant water requirement – CIMIS and WUCOLS
- Demonstrate an understanding of site data that must be collected to determine a drip system application rate. Process this information manually with the formula or the “APP” to develop an application rate.
- Develop an irrigation run time for a 3 day interval in July for low water use shrubs irrigated with a drip system

Learning Objectives

- Demonstrate an understanding of key design and installation criteria necessary to insure a viable drip system

Where we're trying to go today!

Match the Plant Water Requirement to the
Irrigation Application Rate and develop a run
time in minutes (without runoff)

Run Time Formula – Point Source Irrigation



divided by!

(a constant)

$$RT = \frac{\text{Plant Water Requirement (in inches)}}{\text{Application rate of emitters (inches/hr.)}} \times 60$$

RT = $\frac{0.50''}{0.25'' / \text{hr}}$ x 60 = 120 min (2 hrs)

Run Time Formula – Line Source Drip Irrigation



divided by!

(a constant)

$$RT = \frac{\text{Plant Water Requirement (in inches)}}{\text{Application rate of emitters (inches/hr.)}} \times 60$$
$$RT = \frac{0.50''}{1.44'' / \text{hr}} \times 60 = 21 \text{ min}$$

Determining Plant Water Requirements

CIMIS – (California Irrigation Management Information System)-
Plant Water Requirement in Inches / Month
ET_o – evapotranspiration – transpiration and evaporation are
indicators of plant water use and this is expressed in inches

California Irrigation Management Information System (CIMIS)

CIMIS Monthly Average ETo Report


Rendered in ENGLISH Units.

Printed on Wednesday, October 11, 2017

Average ETo Values by Station

Stn Id	Stn Name	CIMIS Region	Jan (in)	Feb (in)	Mar (in)	Apr (in)	May (in)	Jun (in)	Jul (in)	Aug (in)	Sep (in)	Oct (in)	Nov (in)	Dec (in)	Total (in)
170	Concord	SFB	1.31	1.96	3.41	4.71	6.34	7.20	7.45	6.66	4.99	3.27	1.72	1.08	50.10

What if your landscape is outside the area served by a CIMIS weather station – SPATIAL CIMIS



California Irrigation Management Information System
California Department of Water Resources

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CIMIS Station Reports

[CIMIS Station Reports](#) | [FTP Reports](#) | [My Reports](#) | [Preferences](#)

1. Select report style and date range [More Info?](#)

Create in from to

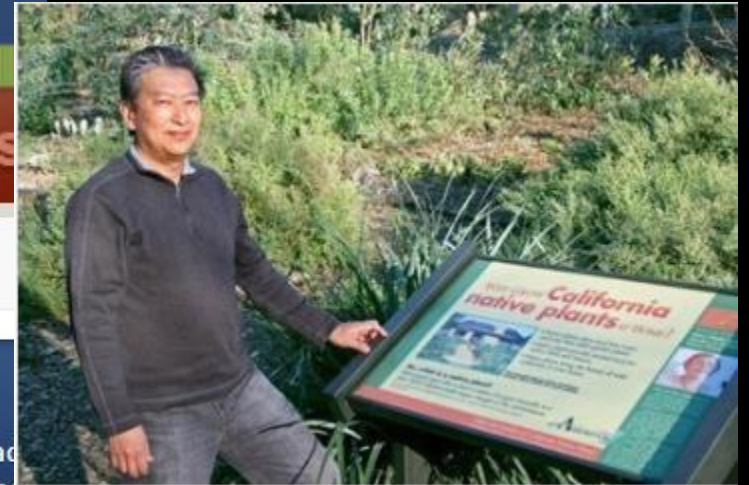
2. Select one-to-[many](#) stations. Click on Column headers to sort

Id	Name	Region	County	Status	Connect	Disconnect
124	Panoche	San Joaquin Valley	Fresno	Active	7/27/1995	---
125	Arvin-Edison	San Joaquin Valley	Kern	Active	3/22/1995	---
126	San Benito	Monterey Bay	San Benito	Active	6/9/1994	---
129	Pajaro	Monterey Bay	Monterey	Active	9/13/1995	---
131	Fair Oaks	Sacramento Valley	Sacramento	Active	4/18/1997	---
135	Blythe NE	Imperial/Coachella Valley	Riverside	Active	1/16/1997	---
136	Oasis	Imperial/Coachella Valley	Riverside	Active	1/7/1997	---

So we know to a certainty how much water
plants generally need in inches of water
per month or per day from CIMIS - ET_0

How much water do specific ornamental
shrubs trees and groundcovers need
relative to the ET_0 ?

The Answer is WUCOLS! (water use classification of landscape species) a key resource for WELO



WUCOLS categorizes over 3,700 landscape plants as to their plant water use.

Categories of Water Needs

Category	Abbreviation	Percentage of ET _o
High	H	70-90
Moderate/Medium	M	40-60
Low	L	10-30
Very Low	VL	< 10

Species were evaluated as needing high (H), moderate/medium (M), low (L), and very low (VL) amounts of irrigation water. Expressed as a percentage of reference evapotranspiration (ET_o)[\[1\]](#), these categories were quantitatively defined as follows.



A High water use plant in an 7.45 inch (ET_o) month at 80% would require 5.96" of water. (7.45" x 0.80 = 5.96")

A daily requirement is 0.192" (5.96"/31)

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A Low water use plant in an 7.45 inch (ET_o) month at 10% would require 0.745" of water. (7.45" x 0.10 = 0.745")

A daily requirement is 0.024" (0.745/31)

The state is broken down into six geographical regions that define use

Regions

Since substantially different climate zones exist in California, species were evaluated for regions that represent six different climatic conditions. These are not the only climate zones that exist in California, but they include much of the state where irrigated landscapes occur. For locations outside of the six regions, it is best to use species evaluations from a region that is most similar climatically to the location of interest.

Number	WUCOLS Region	Sunset climate zones*	CIMIS ET ₀ zones**	Representative Cities
1	North-Central Coastal	14, 15, 16, 17	1, 2, 3, 4, 6, 8	Healdsburg, Napa, San Jose, Salinas, San Francisco, San Luis Obispo
2	Central Valley	8, 9, 14	12, 14, 15, 16	Auburn, Bakersfield, Chico, Fresno, Modesto, Sacramento
3	South Coastal	22, 23, 24	1, 2, 4, 6	Irvine, Los Angeles, Santa Barbara, Ventura, Vista
4	South Inland	18, 19, 20, 21	9	Corona, Escondido, Pasadena, Riverside, San Bernardino, Santa Paula
5	High and Intermediate Desert	11	14, 17	Apple Valley, Barstow, Bishop, Lancaster, Lone Pine, Tehachapi
6	Low Desert	13	18	Borrego Springs, Blythe, Death Valley, El Centro, Needles, Palm Springs



We can research plant material on-line or export a database

WUCOLS IV						
Water Use Classification of Landscape Species						
Plant Search Database						
Plant List for all Regions						
3769 results						
Type	Botanical Name	Common Name	North Central Coastal	Central Valley	South Coastal	South In Valley
Water Use						
S N	Rhododendron spp. (CA native and non-native spp.)	azalea	Moderate/Medium	Moderate/Medium	High	High
S N	Rhododendron spp. (CA native and non-native spp.)	rhododendron	Moderate/Medium	Moderate/Medium	High	High

Two Resources on-line – Links are in your handout

- CIMIS – local weather station or spatial CIMIS provides information based on ET_0 as to how many inches of water plants generally need
- WUCOLS – indicates % of ET_0 that should be replaced on a regional basis

How much water do sprinklers apply?

Why is this important?

An Award Wining Landscape in Northern CA
(They did not wand drip so they used PC bubblers)

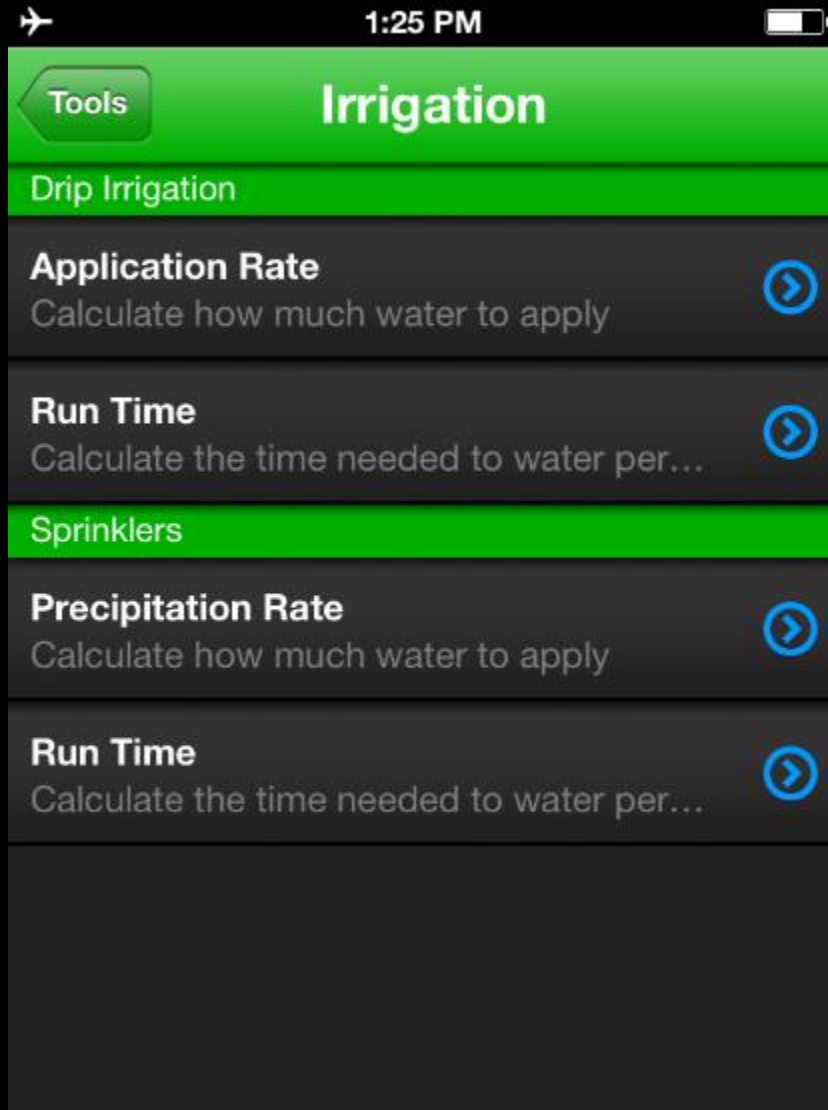


2 foot
diameter shrub
3.14 sq ft of
canopy

There were two of these on a 2 foot shrub – $\frac{1}{2}$ gpm
which is 30 gallons per hour



Use the Ewing “APP” to calculate application rate





Runoff because the clay soils with an intake rate of 0.10" per hour are overwhelmed with an application rate of 15 inches /hr.



Determining application rate of any drip irrigation zone (data to collect)

- Area that is served by the drip zone in square feet
- Circuit flow in cubic feet, or gallons per hour


Steps in calculating canopy area

- Activate the zone and operate until wet margins of the zone appear
- Measure the canopy area using the 16 point Ewing method

Sixteen Point Method – Determining the Average Perimeter
(Radius) measure from the center to the canopy edge 16 times
at 22.5 degree increments




Add the measurements together



A photograph of a pile of dark, irregularly shaped stones on the left side of the image. To the right of the stones is a sheet of lined paper with handwritten measurements in blue ink. The measurements are listed vertically, corresponding to the rows of the table on the right. The measurements are: A 5' 6", B 7' 0", C 8' 7", D 10' 4", E 11' 11", F 12' 1", G 10' 4", H 9' 2", I 9' 4", J 7' 0", K 8' 5", L 7' 1", M 13' 1", N 12' 0", O 13' 10", and P 8' 5".

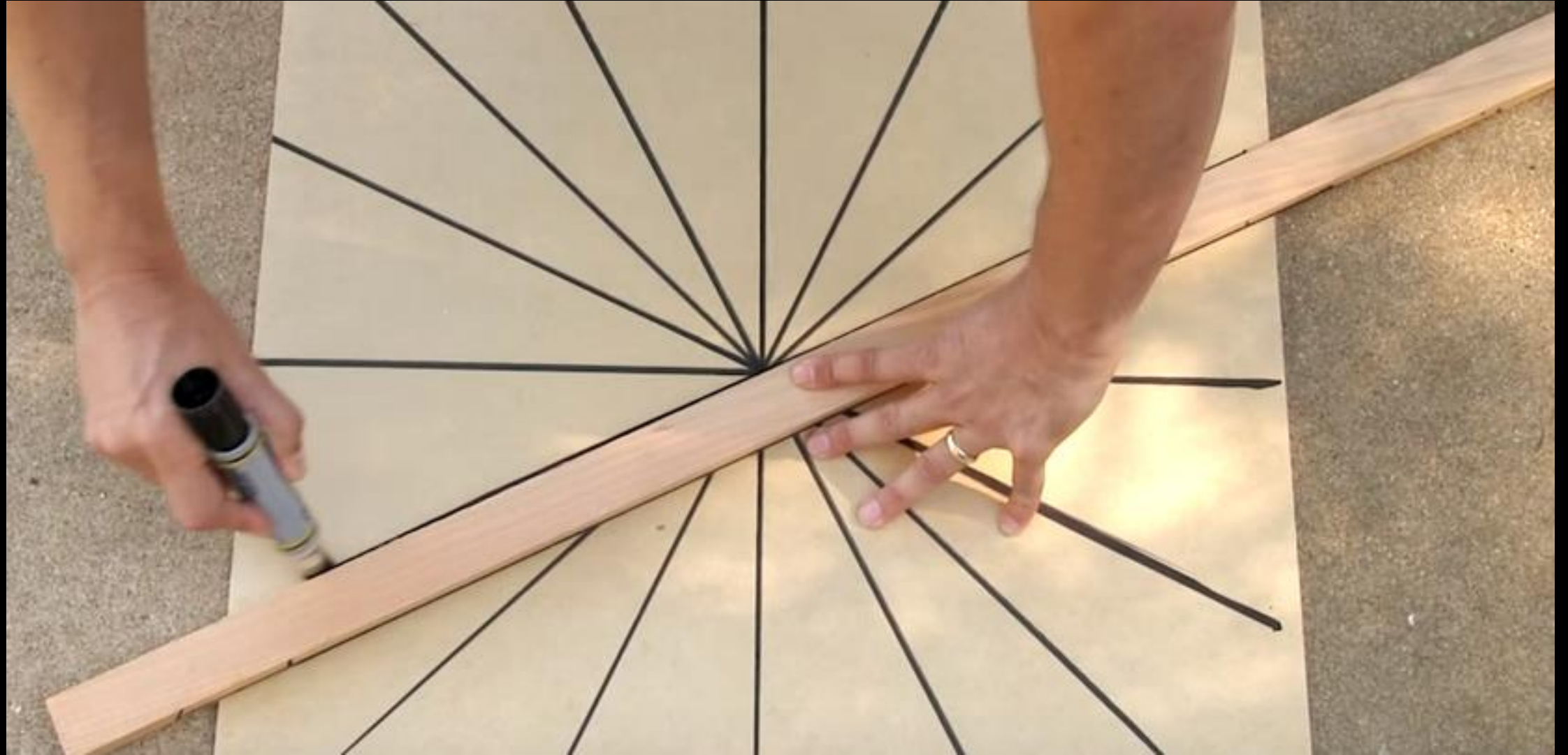
	FEET	INCHES
A	5	6
B	7	
C	8	7
D	10	4
E	11	11
F	12	1
G	10	4
H	9	2
I	9	4
J	7	
K	8	5
L	7	1
M	13	1
N	12	
O	13	10
P	8	5
	154	1



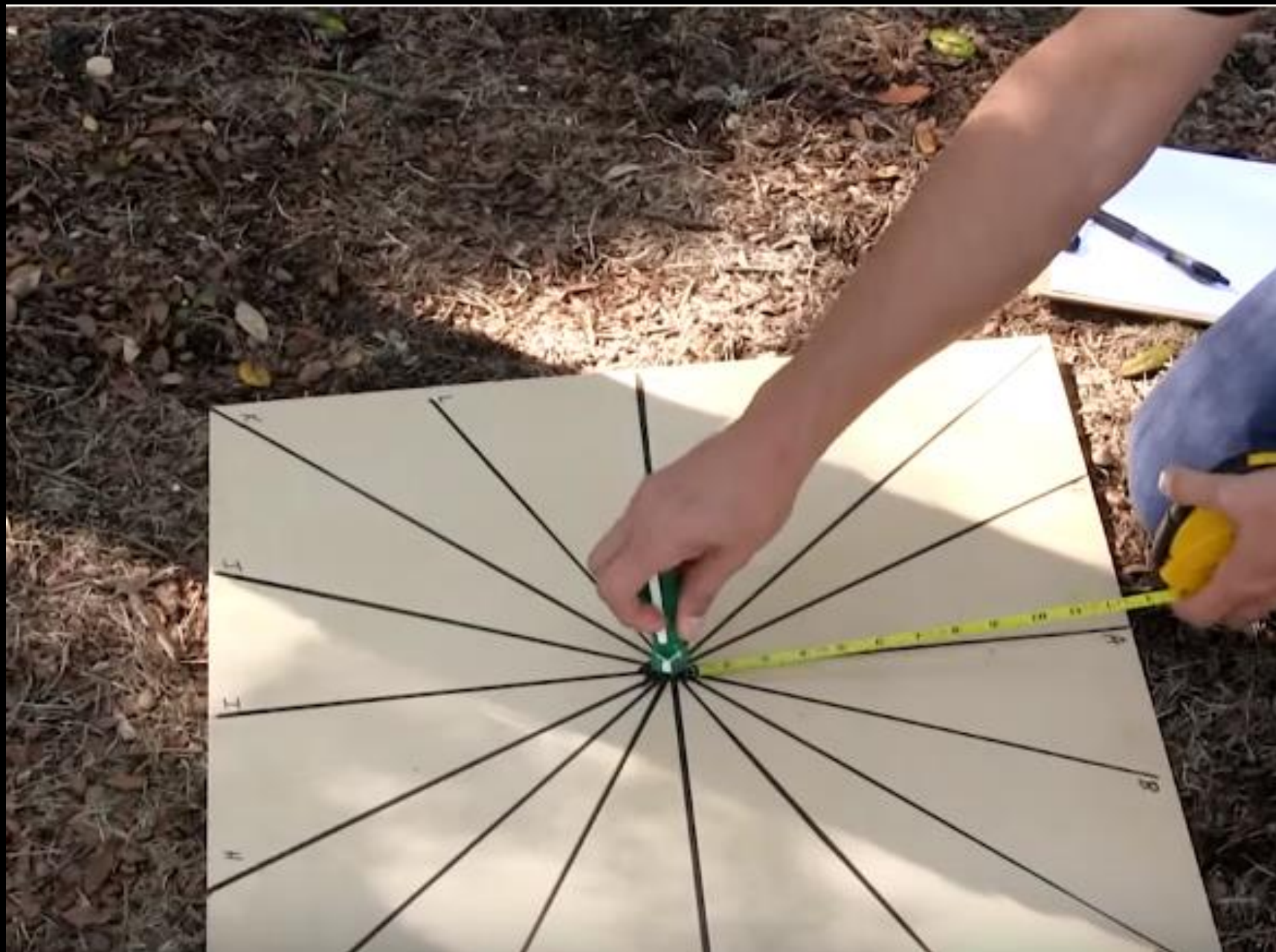
Access the tables to determine area in square feet!

Area (square feet)	Sum of 16 perimeter measurements		Area (square feet)	Sum of 16 perimeter measurements		Area (square feet)
295	155					
314	160		1,142	305		2,48
334	165		1,179	310		2,54
355	170		1,218	315		2,59
376	175		1,257	320		2,65
398	180		1,296	325		2,71

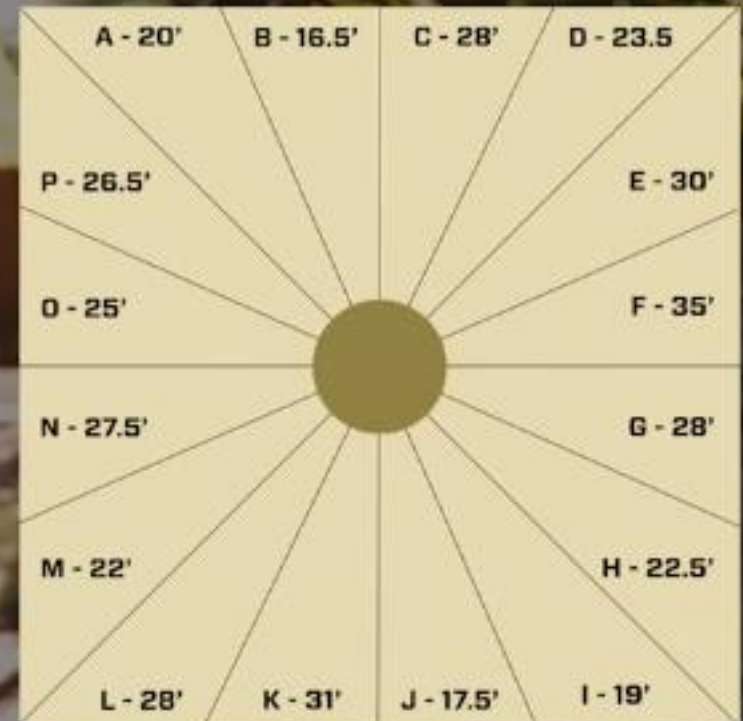
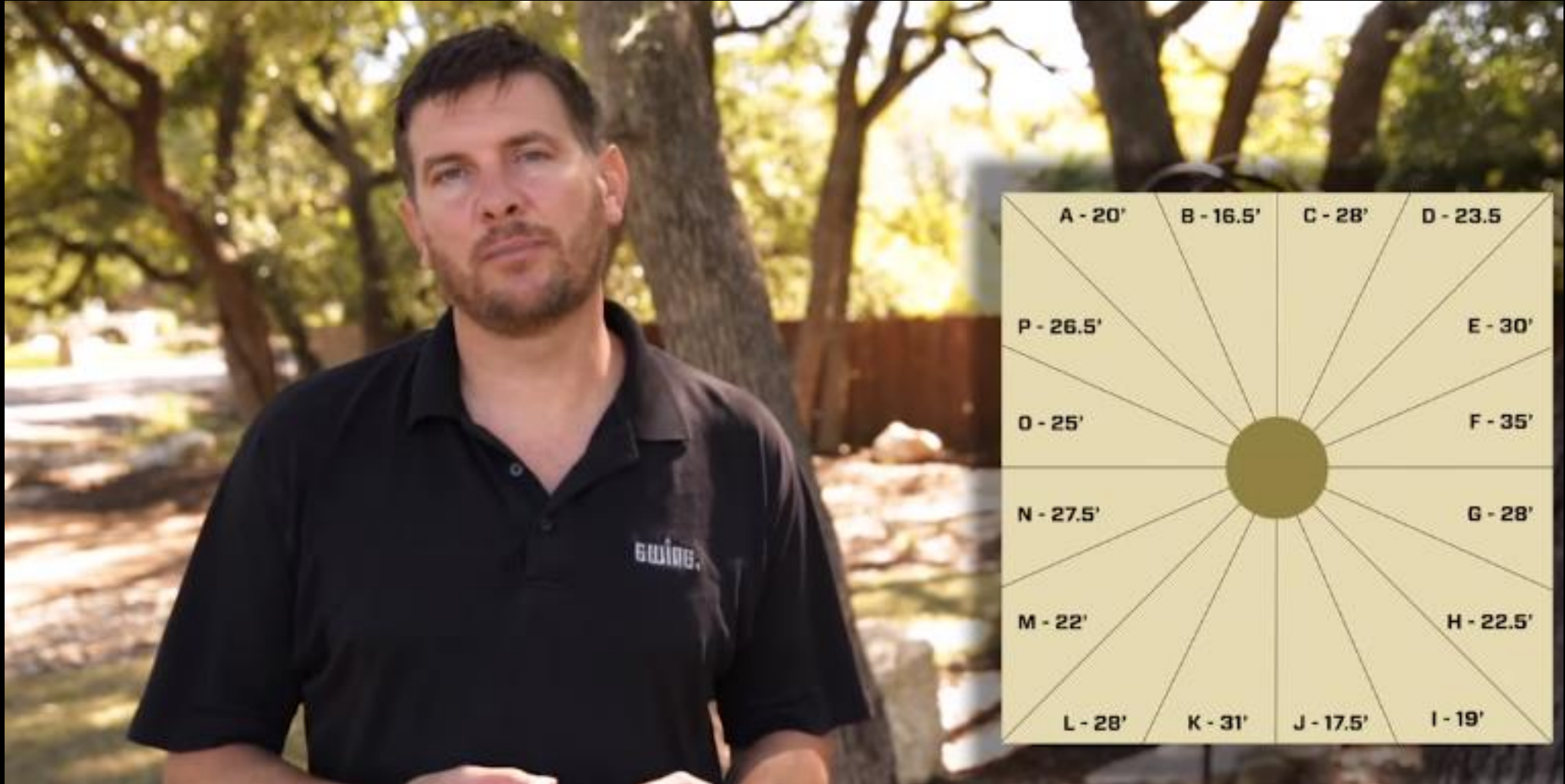












Area (square feet)	Sum of 16 perimeter measurements		Area (square feet)	Sum of 16 perimeter measurements
295	155			
314	160		1,142	305
334	165		1,179	310
355	170		1,218	315
376	175		1,257	320
398	180		1,296	325
420	185		1,336	330
443	190		1,377	335
467	195		1,419	340
491	200		1,461	345
516	205		1,503	350
541	210		1,547	355
567	215		1,590	360
594	220		1,635	365
621	225		1,680	370
649	230		1,726	375
678	235		1,772	380
707	240		1,819	385
737	245		1,867	390
767	250		1,915	395
798	255		1,964	400



Measure the flow to the zone in cubic feet in 1 minute



Commercial meters – 1 ½" and larger – each revolution 10 cubic feet or 74.8 gallons – each 1/10th is 7.48 gal



Residential meters – 1" and smaller – each revolution 1 cubic foot or 7.48 gallons – each 1/10th is 0.748 gal

Let's calculate a drip zone application rate given the following area and flow

- Flow on the residential meter – 2/10ths of a revolution in 1 minute
- Area is 612 square feet

Just remember - 721



Application Rate Formula and Calculation

$$\text{Application Rate (inches/hr)} = \frac{\text{cubic feet / min} \times 721}{\text{area in square feet}}$$

$$\frac{0.2 \times 721}{612 \text{ sq. ft}}$$

$$\frac{144}{612} = 0.235 \text{ " / hr}$$

Check it out with the “APP”

- 0.2 cubic feet per minute must be converted to GPH (gallons per hour) ($0.2 \times 7.48 = 1.496$ gpm) $\times 60 = 90$ gph
- Area is 612 sq. ft

●●●●○ AT&T 3G

12:53 PM



Irrigation

Irrigation

Drip Irrigation - 

Application Rate



Send

Gallons per Hour

90

Area in Square Feet:

612

Solution:

0.236 in. per hour

Calculate

Use solution to calculate run time

What about application rates for linear drip

- Since it is a grid, you'll need to know the flow and the spacing!

Dripline Selection Guidelines			
	Clay	Loam	Sand
Nominal Emitter Flow Rate	0.4 gph	0.6 gph	1.0 gph
EZ-ID Color Code	Orange	Blue	White
Emitter Spacing	18"	12"	12"
Dripline Row Spacing	18"	18"	12"
Application Rate (Inches/Hour)	0.29	0.64	1.60
Time to Apply 1/4" of Water	53 mins.	23 mins.	10 mins.

TECHLINE CV	TURF												SHRUB & GROUNDCOVER											
	CLAY SOIL			LOAM SOIL			SANDY SOIL			COARSE SOIL			CLAY SOIL			LOAM SOIL			SANDY SOIL			COARSE SOIL		
EMITTER FLOW	0.26 GPH			0.4 GPH			0.6 GPH			0.9 GPH			0.26 GPH			0.4 GPH			0.6 GPH			0.9 GPH		
EMITTER SPACING	18"			12"			12"			12"			18"			18"			12"			12"		
LATERAL (ROW) SPACING	18"	20"	22"	12"	14"	18"	12"	14"	18"	12"	14"	16"	18"	21"	24"	18"	21"	24"	16"	18"	20"	16"	18"	20"
BURIAL DEPTH	Bury evenly throughout the zone from 4" to 6"												On-surface or bury evenly throughout the zone to a maximum of 6"											
APPLICATION RATE (INCHES/HOUR)	0.19	0.17	0.15	0.64	0.55	0.43	0.98	0.84	0.65	1.48	1.27	1.11	0.19	0.16	0.14	0.30	0.26	0.23	0.73	0.65	0.59	1.11	0.99	0.89
TIME TO APPLY ¼" OF WATER (MINUTES)	80	89	97	23	27	35	15	18	23	10	12	13	80	93	106	50	58	66	20	23	26	13	15	17
Following these maximum spacing guidelines, emitter flow selection can be increased if desired by the designer. 0.9 GPH flow rate available for areas requiring higher infiltration rates, such as coarse sandy soils.																								

Note: 0.4, 0.6 and 0.9 GPH are nominal flow rates. Actual flow rates used in the calculations are 0.42, 0.61 and 0.92 GPH.

You can measure the emitter spacing at 12
or 24" in the tube and measure the parallel
row spacing

But what is the emitter flow in GPH?






EMITTER FLOW (TIME TO FILL 2" CAP)				
EMITTER TYPE		GPH	FILL TIME	
POINT SOURCE		2.00	56 SECONDS	
POINT SOURCE		1.00	1 MIN 52 SECONDS	
LINE SOURCE		0.92	2 MIN 2 SECONDS	
LINE SOURCE		0.61	3 MIN 4 SECONDS	
POINT SOURCE		0.50	3 MIN 45 SECONDS	
LINE SOURCE		0.42	4 MIN 26 SECONDS	

So let's calculate with the "APP" a 12" x 12" spacing with a 1.0 gph emitter!

●●●○ AT&T 3G 7:38 PM

Irrigation

Drip Irrigation - ⓘ  Send

Application Rate

Gallons per Hour

Area in Square Feet:

Solution: **Calculate**

[Use solution to calculate run time](#)

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Time to Apply 1/4" of Water	53 mins.	23 mins.	10 mins.

So calculating “APP” rates for linear drip
can be easier as tables are available

Let' complete our final objective

The criteria for scheduling

- Given – a calculated application rate of 0.25” per hour
- A low water use hydrozone in Concord in July
- Watering every 4 days

WUCOLS IV - Low Water Use

Drip / Point Source - random

Ornamental Shrubs with a species factor K

DU _{LQ}	0.9	
PR Rate	0.25	inches / hr.
RTM	1.06	20% of ET _o

	Concord	Concord	Concord
	ET _o	ET _o	Orn. Shrub
	Avg	Avg.	Req't
	Monthly	daily	daily
31 Mar	3.41	0.1100	0.0220
30 Apr	4.71	0.1570	0.0314
31 May	6.34	0.2045	0.0409
30 Jun	7.2	0.2403	0.0481
31 Jul	7.45	0.2403	0.0481

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$$4 \text{ days} \times 0.2408 = 0.9632 \text{ ET}_o$$

$$0.963 \text{ ET}_o \times 0.20 = 0.193'' \text{ plant water requirement after 4 days}$$

Run Time Calculation – Point Source

divided by!

(a constant)

$$RT = \frac{\text{Plant Water Requirement (in inches)}}{\text{Application rate of emitters (inches/hr.)}} \times 60$$

$$RT = \frac{0.193''}{0.25'' / \text{hr}} \times 60 = 46 \text{ min.}$$

What about runoff???

Application Rate - in/hr	Time to runoff in minutes (flat clay)	Application Rate - in/hr	Time to runoff in minutes (flat clay)	Application Rate - in/hr	Time to runoff in minutes (flat clay)	Application Rate - in/hr	Time to runoff in minutes (flat clay)
0.10	60	0.60	10	1.05	6	1.50	4
0.15	40	0.65	9	1.10	5	1.55	4
0.20	30	0.70	9	1.15	5	1.60	4
0.25	24	0.75	8	1.20	5	1.65	4
0.30	20	0.80	8	1.25	5	1.70	4
0.35	17	0.85	7	1.30	5	1.75	3
0.40	15	0.90	7	1.35	4	1.80	3
0.45	13	0.95	6	1.40	4	1.85	3
0.50	12	1.00	6	1.45	4	1.90	3

Minutes of run time before run off occurs at varying application rates on flat clay

All bets are off if installation is poor or pressure is low

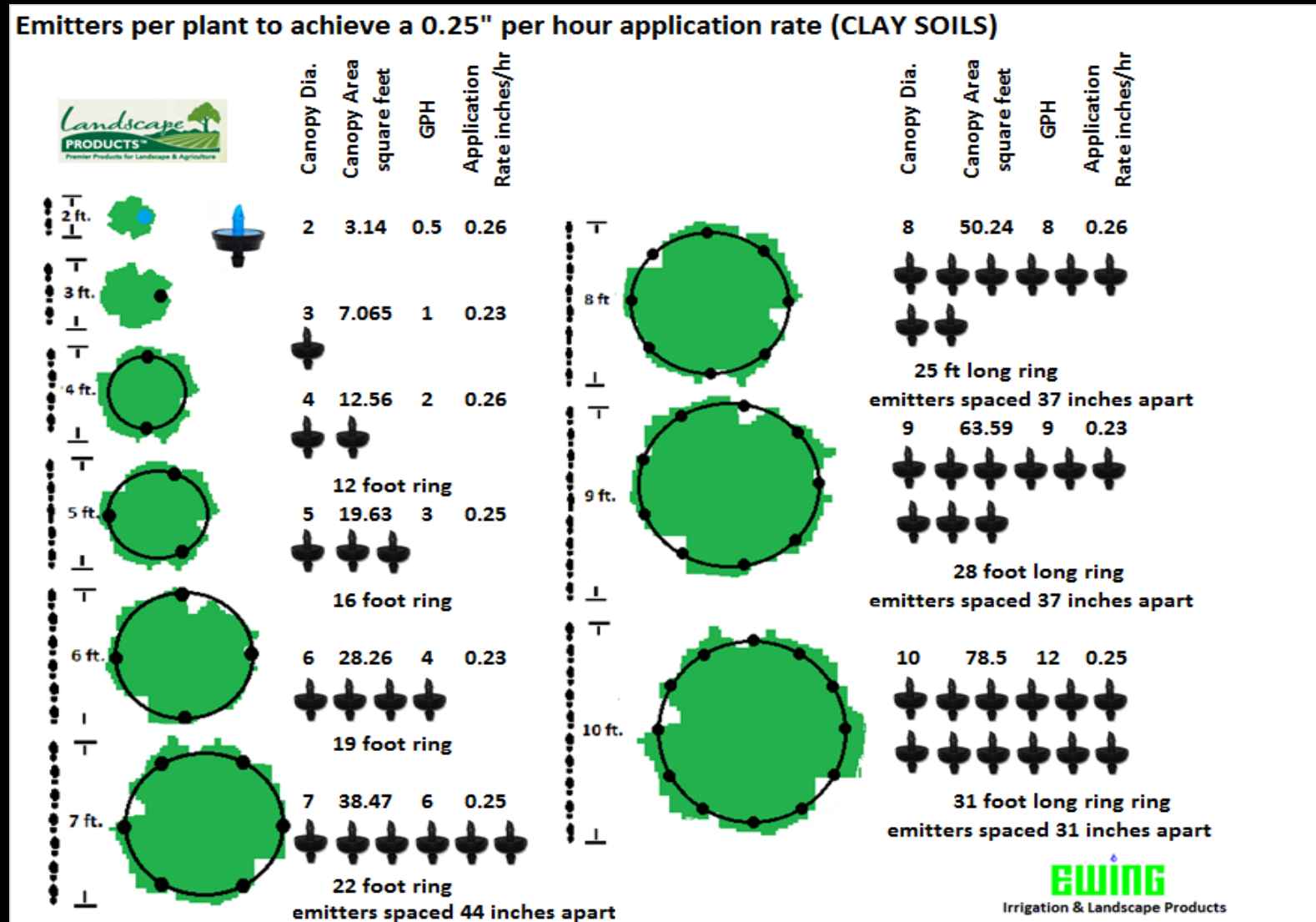
- 10 psi minimum for point source systems
- 15 psi for line source or emitters will not open
- Arrange point source emitters so all plant material on the hydrozone has the same application rate (see attached sheet)
- Do not use 0.9 gph or 1 gph linear tubing
- Keep line source tubing parallel

The Pressure Test

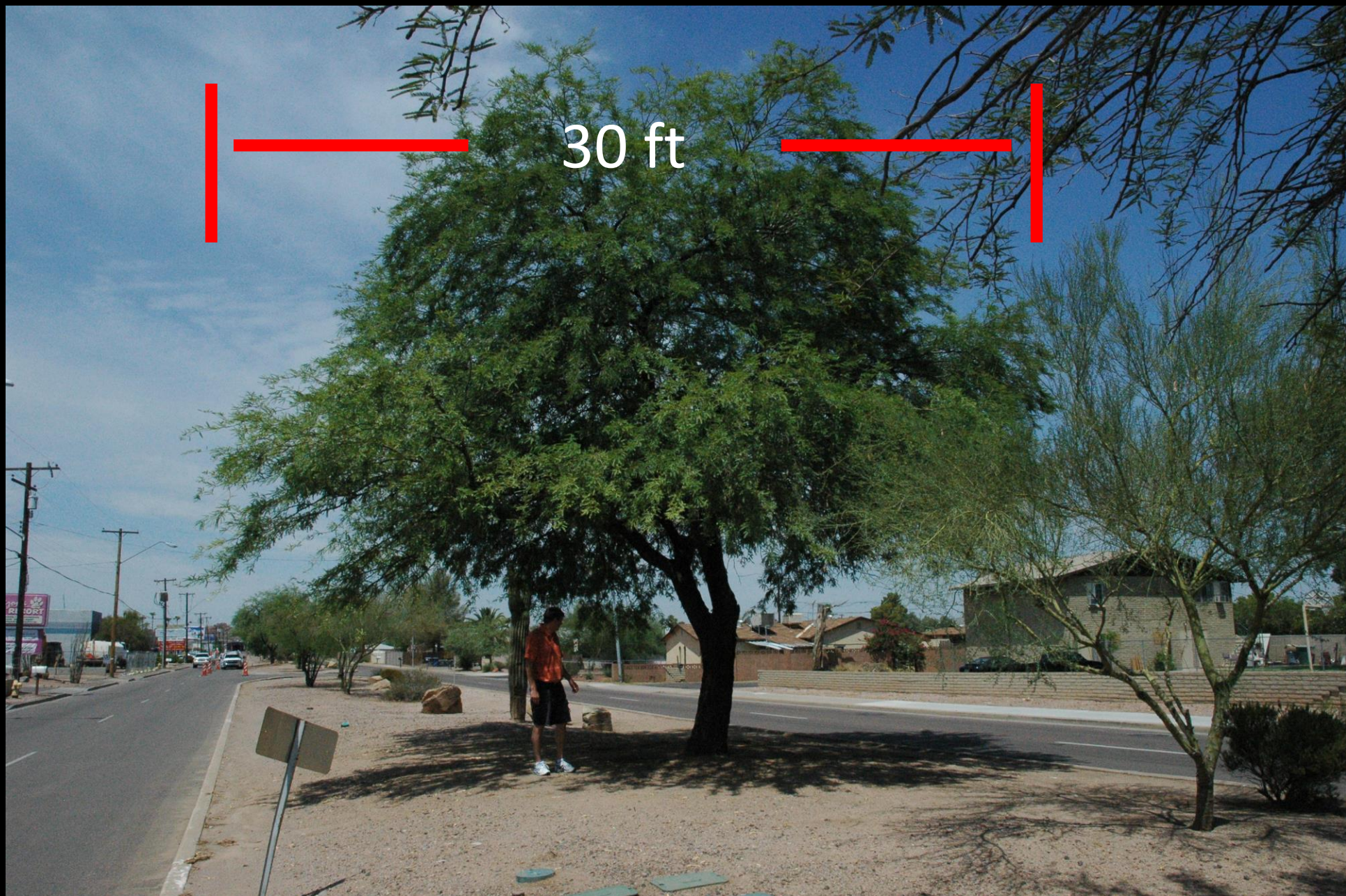


Plant material must be organized in valve groupings by water requirement – This is known as a “Hydrozone”

Since all plant material on a zone has the same water requirement, it must have the same application rate



canopy diameter in feet	canopy area - square feet	canopy diameter in feet	canopy area - square feet	canopy diameter in feet	canopy area - square feet
1	1	11	95	21	346
2	3	12	113	22	380
3	7	13	133	23	415
4	13	14	154	24	452
5	20	15	177	25	491
6	28	16	201	26	531
7	38	17	227	27	572
8	50	18	254	28	615
9	64	19	283	29	660
10	79	20	314	30	707
Canopy area in square feet at various diameters					



Ten – 2 gallon per hour emitters – good placement
(calculate application rate)









Rendered in ENGLISH Units.

Printed on Wednesday, April 08, 2015

Average ETo Values by Station

Stn Id	Stn Name	CIMIS Region	Jan (in)	Feb (in)	Mar (in)	Apr (in)	May (in)	Jun (in)	Jul (in)	Aug (in)	Sep (in)	Oct (in)	Nov (in)	Dec (in)	Total (in)
200	Indio 2	ICV	2.98	3.53	6.28	8.39	10.55	10.95	10.78	9.66	8.25	5.85	3.63	2.62	83.47

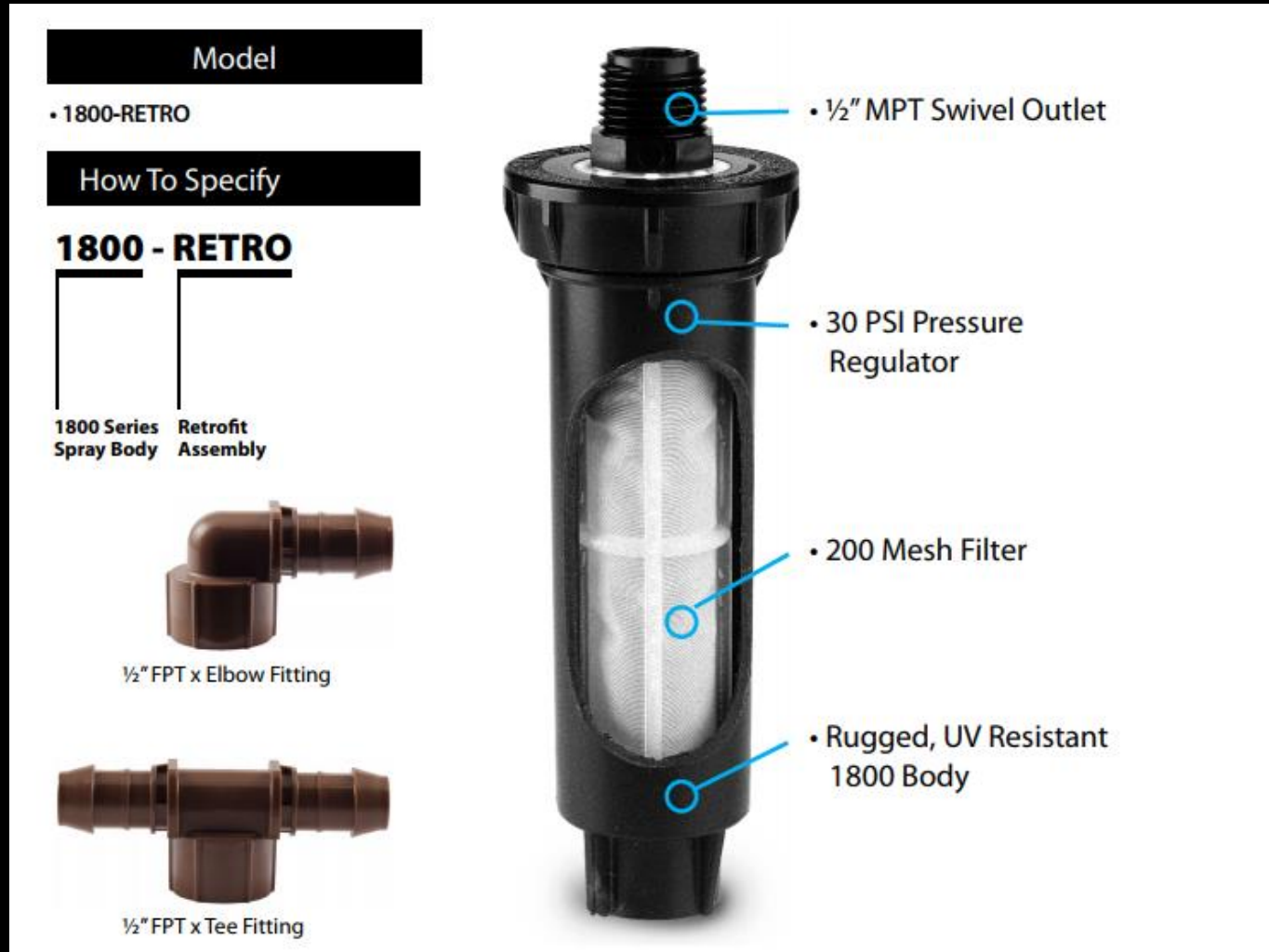
Converting existing spray zones to drip



Spray to Drip adapter feature a filter and 30 psi pressure regulator



This product allows retrofit into an existing spray body











Flow Requirements

Minimum flow is $\frac{1}{2}$ gpm or 30 gph

Maximum flow around 6 gpm or 360 gph

Caps are provided to cap existing spray bodies























Learning Objectives

- Demonstrate an understanding of the resources available to determine plant water requirement – CIMIS and WUCOLS
- Demonstrate an understanding of site data that must be collected to determine a drip system application rate.
Process this information manually with the formula or the “APP” to develop an application rate.
- Develop an irrigation run time for a 3 day interval in July for low water use shrubs irrigated with a drip system

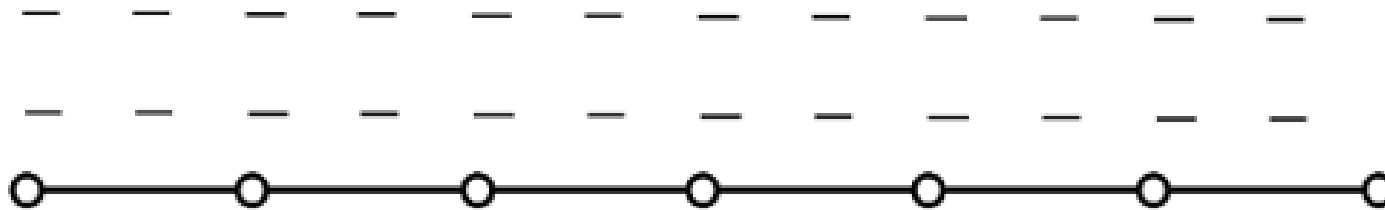
Learning Objectives

- Demonstrate an understanding of key design and installation criteria necessary to insure a viable drip system

Exercises – “A” Group – Micro Spray Audit

Micro Spray Audit

Run time - 5 min



Check driest six - Add them together and divide by 6 to obtain average _____ total _____ average

Add all catches together and divide by 24 to get their average _____ total _____ average

Exercises – B Group – Area Measurement and Application Calculation

Determining Application Rates with cap

	A	B	C	D	E
Time to fill	—	—	—	—	—
Flow	—	—	—	—	—
Canopy Diameter	2 ft	5 ft	12" x 12" sp	12" x 24" sp	10 ft
Area					
Application Rate					

Estimating Irregularly shaped Areas

Measurement

A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	

TOTAL	
AVG/16	
SQ. FT	

METER	
FLOW	
CFM	

PR Rate	
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EMITTER FLOW (TIME TO FILL 2" CAP)		
EMITTER TYPE	GPH	FILL TIME
POINT SOURCE	2.00	56 SECONDS
POINT SOURCE	1.00	1 MIN 52 SECONDS
LINE SOURCE	0.92	2 MIN 2 SECONDS
LINE SOURCE	0.61	3 MIN 4 SECONDS
POINT SOURCE	0.50	3 MIN 45 SECONDS
LINE SOURCE	0.42	4 MIN 26 SECONDS