

# Discussion Topics

## Soil Web Survey

- Define an AOI
- Retrieve soil information
  - Texture, EC, AWHC
- Generate a soil report

## CIMIS

- Different uses for  $ET_0$  values
  - Irrigation scheduling
  - Water budget
- CIMIS-based resources
  - WaterRight
  - Water Destination Graph

## Water Destination Graph

- NRCS Irrigation Visualizer

### Web Soil Survey - Home

[websoilsurvey.nrcs.usda.gov/](http://websoilsurvey.nrcs.usda.gov/) ▾ Natural Resour  
Web Soil Survey (WSS) provides soil data and information from the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service. You've visited this page many times. Last visit: 3/1

### CIMIS - State of California

[www.cimis.water.ca.gov/](http://www.cimis.water.ca.gov/) ▾ California Department of Water Resources  
A description for this result is not available because the content is too large to display. You've visited this page many times. Last visit: 4

### Waterright Irrigation Scheduling

[www.waterright.org/](http://www.waterright.org/) ▾  
About the Site. The WATERRIGHT site was developed by the Center for Water Technology at California State University, Fresno with funding from the California State Water Resources Control Board.





# Soil Web Survey

- Define an AOI

## Step 3

View ?

Address 3380 Somis Road Somis CA 93066

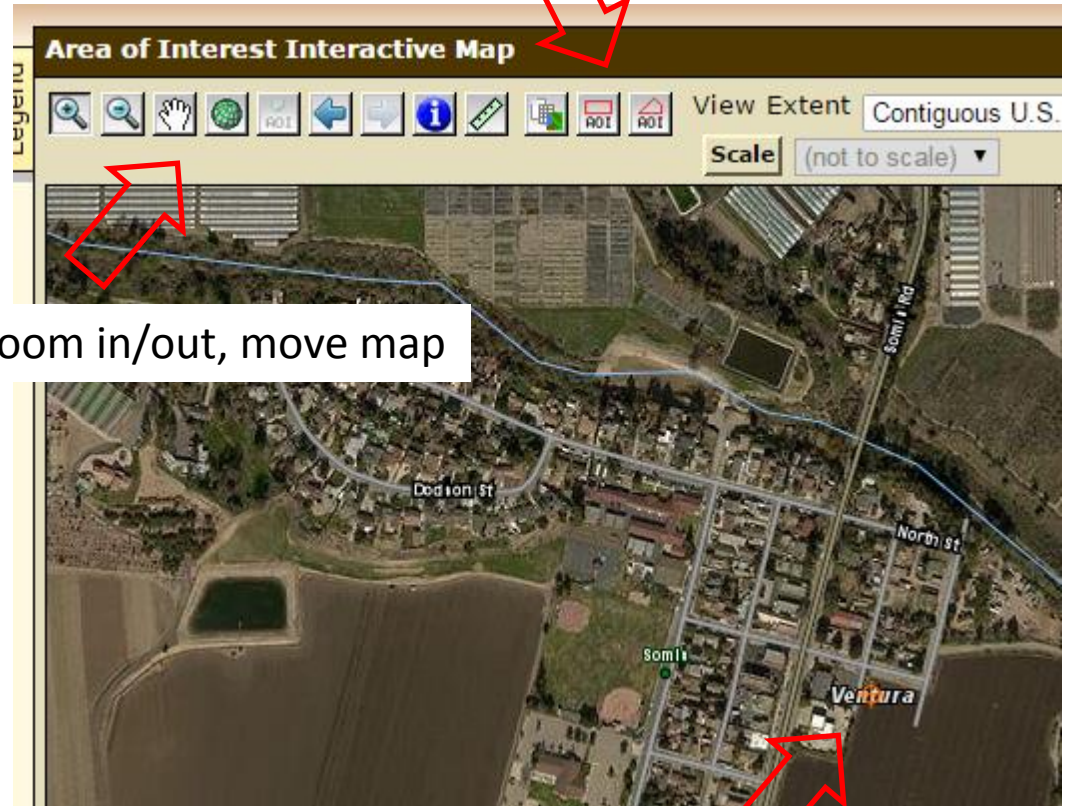
Location marker

View

Type in address & click view

## Step 4

Rectangular or irregular shape AOI



Zoom in/out, move map

AOI marker



# Soil Web Survey

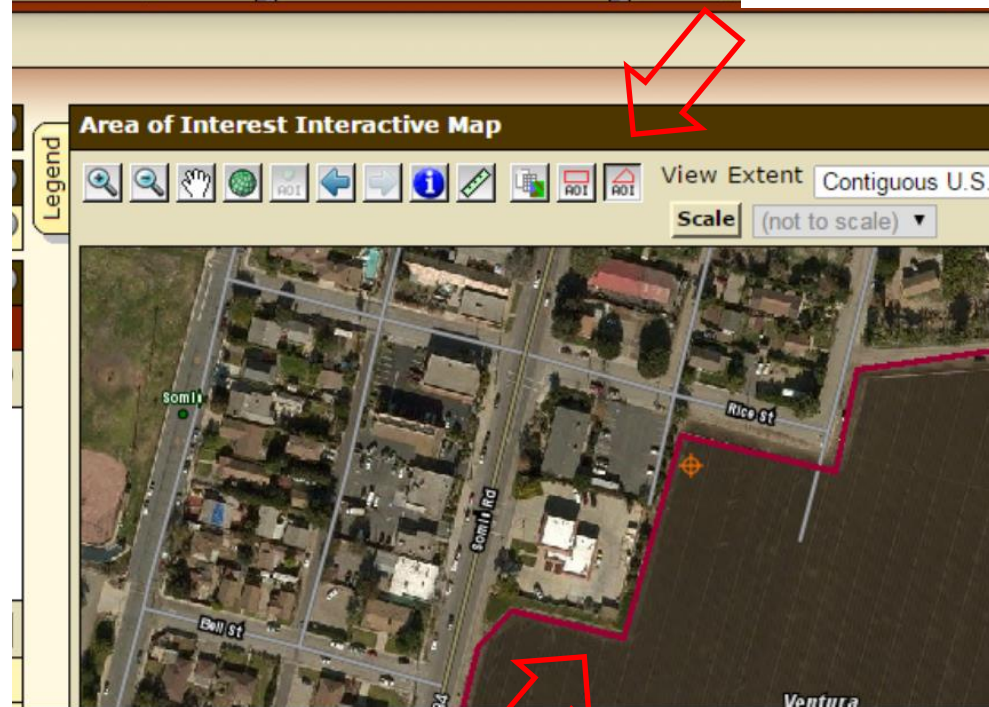
- Define an AOI

## Step 5

Tab still greyed out



Note AOI type selected



Edge of AOI boundary;  
Single click sets point; double click closes polygon

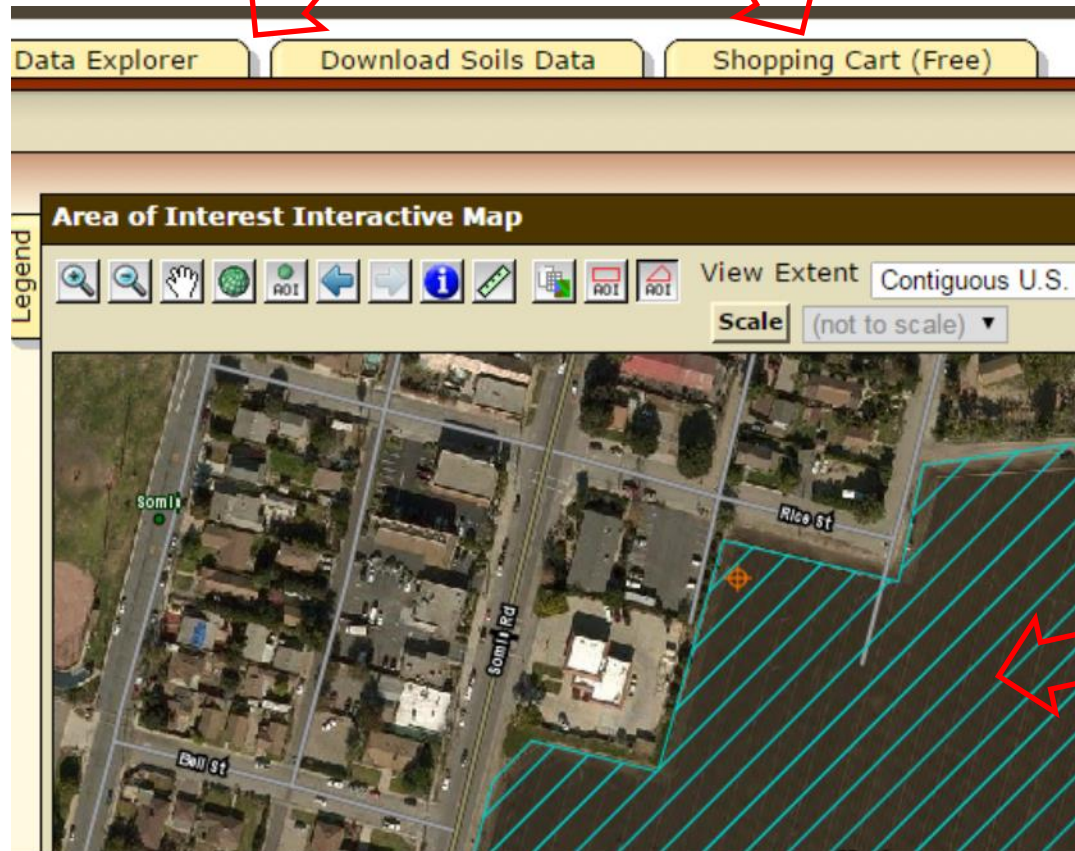


# Soil Web Survey

- Define an AOI

Tabs now active

## Step 6



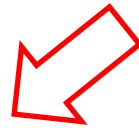
Once AOI is set, NRCS server loads data for area.



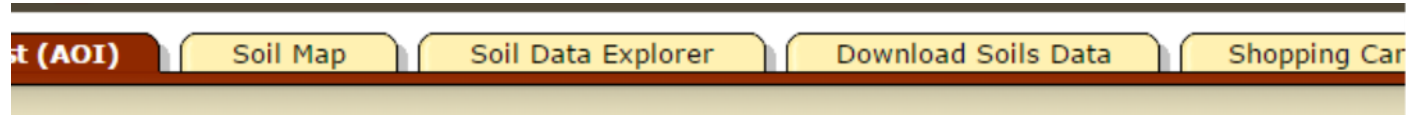
# Soil Web Survey

- Retrieve soil information
  - Texture, EC, AWHC

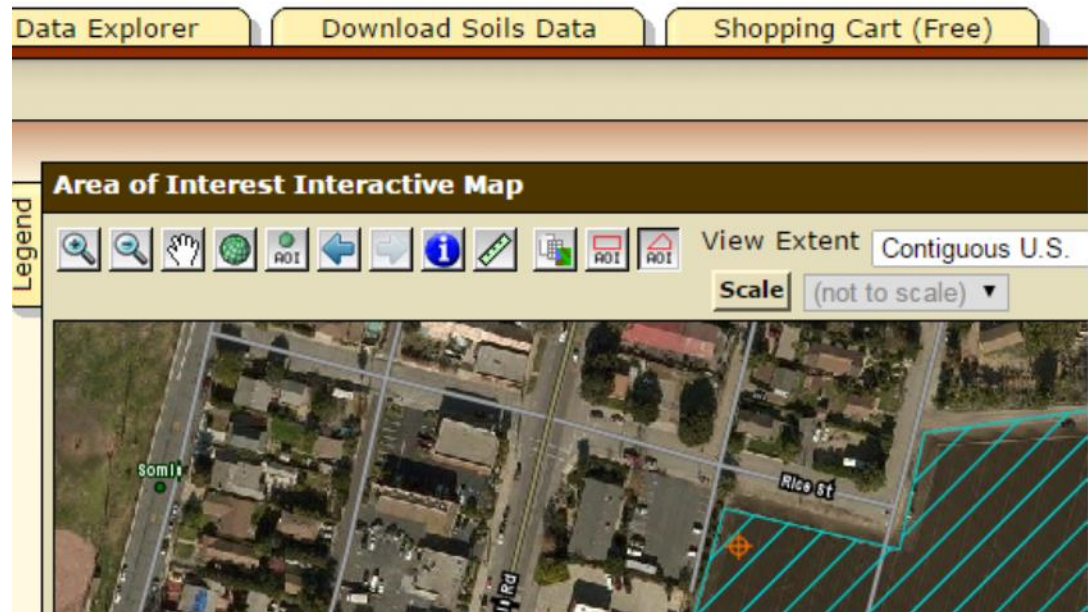
Variety of tabs now available;  
Note single tier



## Step 1



Click on tab



# Soil Web Survey

- Retrieve soil information
  - Texture, EC, AWHC

Note that a second tier is available

## Step 2

Soil Data Explorer

Download Soils Data

Shopping Cart (Free)

Filteration By Use: All Uses

Printable Vers

Suitabilities and Limitations for Use

Soil Properties and Qualities

Ecological Site Assessment

Soil Map

Legend

Scale (not to scale)

Texture, EC, AWHC

Soil map



# Soil Web Survey

- Retrieve soil information
  - Texture, EC, AWHC

We've switched to a new tab in the second tier; nothing has changed in the first tier

## Step 3

The screenshot shows the 'Soil Data Explorer' tab selected in the second tier. Below it, the 'Soil Properties and Qualities' sub-tab is active. On the left, a search menu is expanded, showing categories like 'Soil Chemical Properties', 'Soil Erosion Factors', 'Soil Physical Properties', 'Soil Qualities and Features', and 'Water Features'. A text box 'We want these two' with red arrows points to the 'Soil Physical Properties' and 'Soil Qualities and Features' items. Another red arrow points to the 'Soil Properties and Qualities' sub-tab. A third red arrow points to the 'Soil Data Explorer' tab. The interface includes a top navigation bar with links like 'Contact Us', 'Subscribe', 'Archived Soil Surveys', 'Soil Survey Status', 'Glossary', 'Preferences', 'Link', and 'Logout'. Below the navigation bar are tabs for 'Area of Interest (AOI)', 'Soil Map', 'Soil Data Explorer', 'Download Soils Data', and 'Show'. A dropdown menu for 'View Soil Information By Use:' is set to 'All Uses'. Below the sub-tabs are 'Intro to Soils', 'Suitabilities and Limitations for Use', and 'Soil Properties and Qualities'. The 'Soil Map' section on the right shows a map with a legend and various tool icons.

Information classes and menu expand/collapse





# Soil Web Survey

- Retrieve soil information
  - Texture, EC, AWHC

## Step 4

Intro to Soils | Suitabilities and Limitations fo

**Search**

**Properties and Qualities Ratings**

Open All | Close All

**Soil Chemical Properties**

- Calcium Carbonate (CaCO<sub>3</sub>)
- Cation-Exchange Capacity (CEC-7)
- Effective Cation-Exchange Capacity (ECEC)
- Electrical Conductivity (EC)
- Gypsum
- pH (1 to 1 Water)
- Sodium Adsorption Ratio (SAR)

**Soil Erosion Factors**

**Soil Physical Properties**

- Available Water Capacity
- Available Water Storage
- Available Water Supply, 0 to 100 cm
- Available Water Supply, 0 to 150 cm
- Available Water Supply, 0 to 25 cm
- Available Water Supply, 0 to 50 cm

**Electrical Conductivity (EC)**

View Description | View Rating

**View Options**

- Map
- Table
- Description of Rating
- Rating Options
- Detailed Description

**Advanced Options**

Aggregation Method: Dominant Component

Component Percent Cutoff: [ ]

Tie-break Rule:  Lower  Higher

Interpret Nulls as Zero:  Yes  No

Layer Options (Horizon Aggregation Method):  Surface Layer (Not applicable)  Depth Range (Weighted Average)

Top Depth: [ 0 ]

Bottom Depth: [ 24 ]

Inches  Centimeters

All Layers (Weighted Average)

View Description | View Rating

- Click EC
- Data Visuals
- Cutoffs
- Get Data

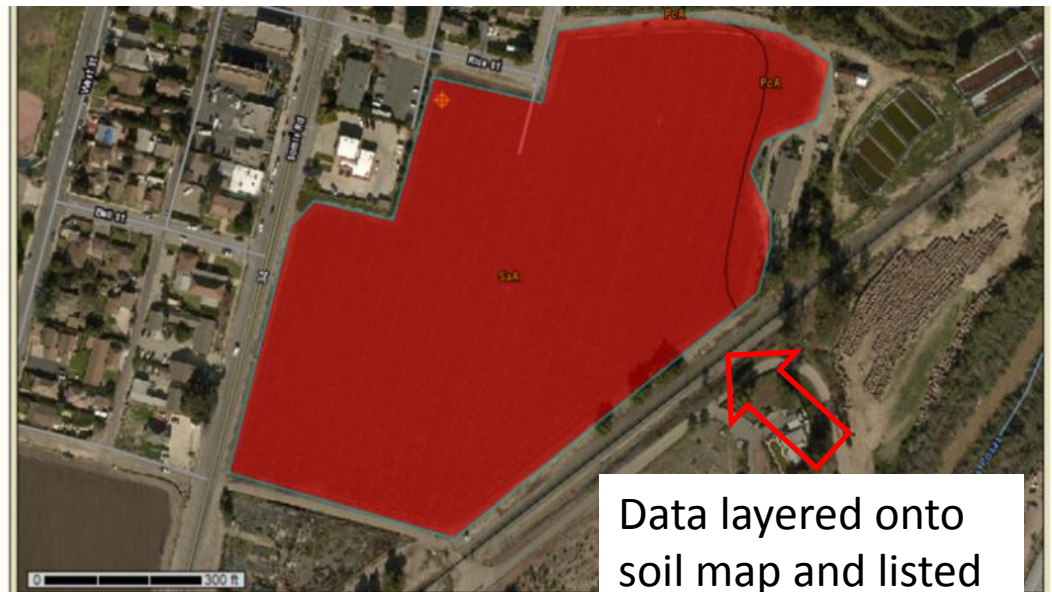


# Soil Web Survey

- Retrieve soil information
  - Texture, EC, AWHC

## Step 5

Processing request; note Greyed-out background



Data layered onto soil map and listed in table as per prior selection

**Warning: Soil Ratings Map may not be valid at this scale.**  
 You have zoomed in beyond the scale at which the soil map for the area was created. The resulting soil map may not be accurate. The level of detail shown in the resulting soil map may not be accurate. The level of detail shown in the resulting soil map may not be accurate.

Mostly clay loam

Running "Electrical Conductivity (EC)"...

**Warning: Soil Ratings Map may not be valid at this scale.**  
 You have zoomed in beyond the scale at which the soil map for the area was created. The resulting soil map may not be accurate. The level of detail shown in the resulting soil map may not be accurate.

Tables — Electrical Conductivity (EC) — Summary by Map Unit

Summary by Map Unit — Ventura Area, California (CA674)

Map unit symbol	Map unit name	Rating (decisiemens per meter)	Acres in AOI	Percent of AOI
PcA	Pico sandy loam, 0 to 2 percent slopes	1.0	0.9	5.7%
SaA	Salinas clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	1.0	14.5	94.3%
<b>Totals for Area of Interest</b>			<b>15.4</b>	<b>100.0%</b>

Printable Version   Add to Shopping Cart

Soil Reports

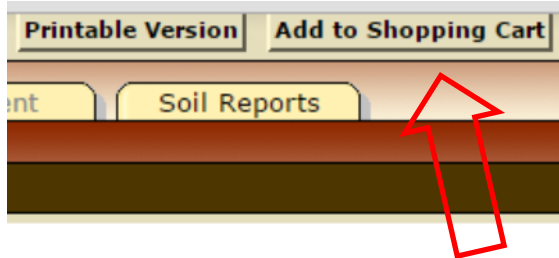
Look at top of page



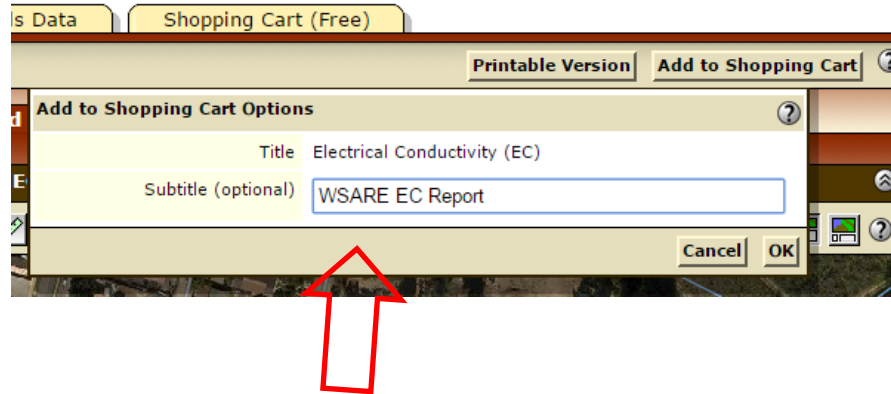
# Soil Web Survey

- Retrieve soil information
  - Texture, EC, AWHC

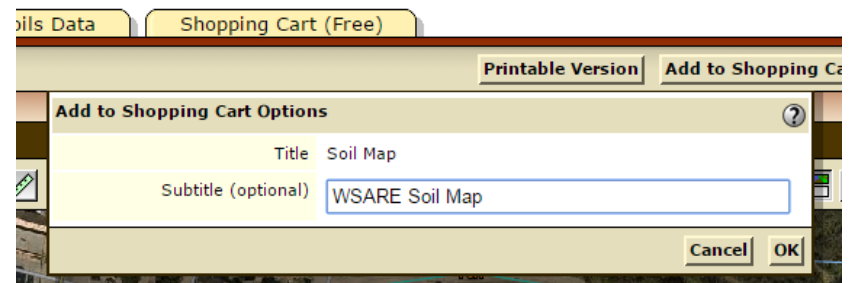
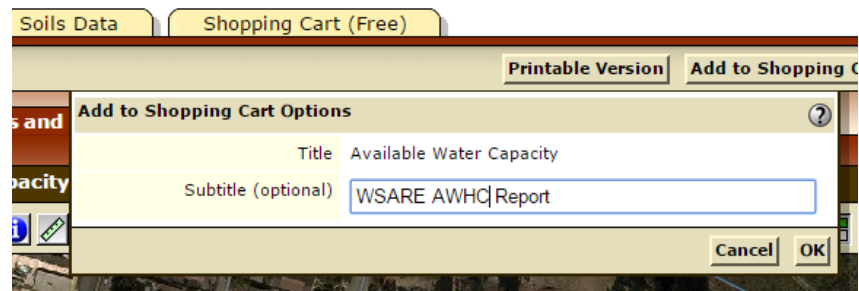
## Step 6



Tells server what data set to queue



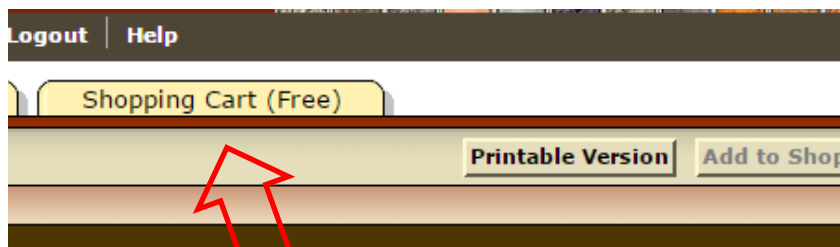
Can personalize it a bit



# Soil Web Survey

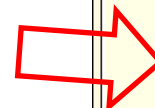
- Generate a soil report

## Step 1



We're going here

Can add more personalized information



**Report Properties**

**Title**

Title	Custom Soil Resource Report for Ventura Area, California
Subtitle	<input type="radio"/> Area of Interest Name: (none defined) <input checked="" type="radio"/> Custom Subtitle: <input type="text" value="WSARE Demo Report"/> <input type="radio"/> None

**Map Options**

Map Scale	Fit to page
Printed Sheet Size	A landscape (11" × 8.5") — 1 sheet
Show UTM Coordinate Ticks	<input checked="" type="checkbox"/>

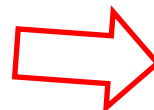
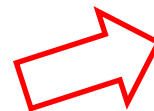
**Table of Contents**

- Custom Soil Resource Report for Ventura Area, California: WSARE Demo Report
  - Cover
  - Preface
  - Contents
  - How Soil Surveys Are Made
  - Soil Map
    - Soil Map: WSARE Soil Map
    - Map Unit Legend: WSARE Soil Map
    - Map Unit Description
  - Soil Data Explorer
    - All Uses
      - Soil Properties and Qualities
        - Soil Chemical Properties
          - Electrical Conductivity (EC): WSARE EC Report
        - Soil Physical Properties
          - Available Water Capacity: WSARE AWHC Report
  - References
  - Glossary

Can't remove greyed selections



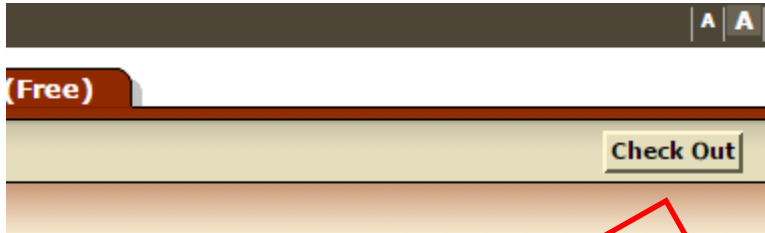
Our previous selections add automatically



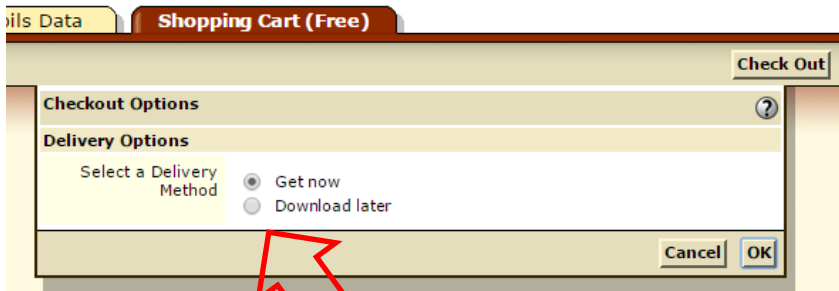
# Soil Web Survey

- Generate a soil report

## Step 2 +



Top of page

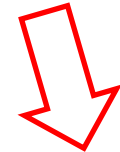


Get now opens tab with pdf

pdf is being generated



Here it is!



A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

## Custom Soil Resource Report for Ventura Area, California

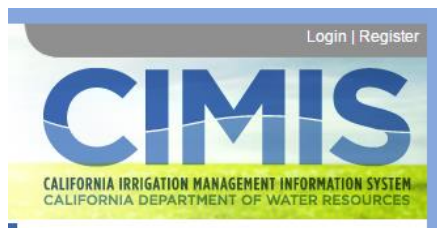
WSARE Demo Report



# Discussion Topics

Soil Web Survey

CIMIS



Dispersed, so easy for growers to question relevance...

Monthly Average Reference

Zone	Jan	Feb	Mar	Apr
1	0.93	1.40	2.48	3.10
2	1.24	1.68	3.10	3.72
3	1.86	2.24	3.72	4.34
4	1.86	2.24	3.41	4.03
5	0.93	1.68	2.79	3.41
6	1.86	2.24	3.41	4.03
7	0.62	1.40	2.48	3.10
8	1.24	1.68	3.41	4.03
9	2.17	2.80	4.03	4.65
10	0.93	1.68	3.10	3.72
11	1.55	2.24	3.10	3.72
12	1.24	1.96	3.41	4.03
13	1.24	1.96	3.10	3.72
14	1.55	2.24	3.72	4.34
15	1.24	2.24	3.72	4.34
16	1.55	2.52	4.03	4.65
17	1.86	2.80	4.65	5.27
18	2.48	3.36	5.27	5.89

Variability between stations zone 1 and during winter months. ETo between estimation sites.

Geographic zones... doesn't address microclimates, transitional areas...



On-site instruments ideal but do the growers know how to use the data?

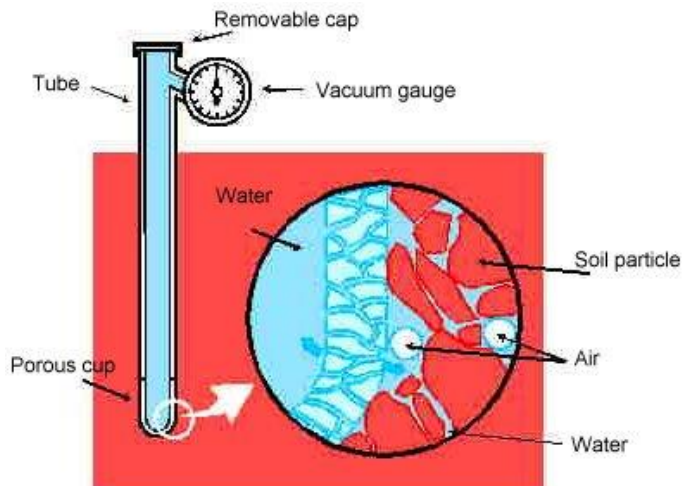


# Discussion Topics

## Soil Web Survey

### CIMIS - GROUND TRUTH! Approach isn't simple or foolproof....

- Different uses for  $ET_0$  and system variability makes it complicated and tough to dial in....
  - Irrigation scheduling = sensitive to emission deviations and crop coefficients
  - Water budget = sensitive to placement and wetted area values
  - So to help mitigate disaster...take it Slooow and Ground Truth!



Soil sensors measure how “thirsty” soil is - this correlates with plant water stress.

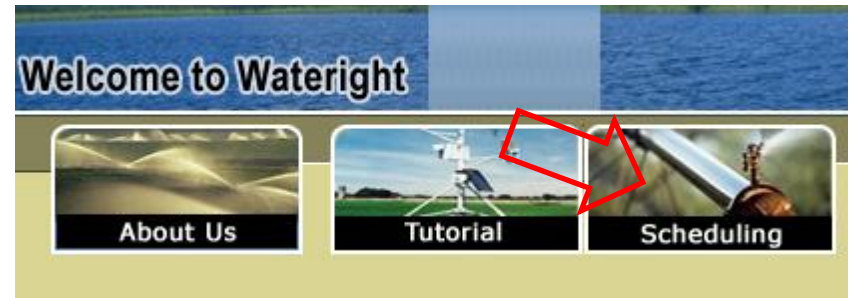


Sensors above & below the root zone help monitor soil moisture & limit plant water stress and leaching.



# CIMIS

- CIMIS-based resources
  - WaterRight



Helpful Links

Please note that CIMIS is not responsible for the content of these sites.

Water Use and Efficiency Branch (WUE)

California Department of Water Resources(DWR)

**WATERRIGHT**

California Data Exchange Center(CDEC)

California Land & Water Use

Web Link

**Agricultural Irrigation Scheduling**

**Field List**

Click Edit to modify an existing field or New to enter a new field.  
Click Schedule to see the irrigation schedule for that field.

Field Name	Crop	Weather Station	Soil Type	Irr. System		
	Avocado	CIMIS 107	Fine Sandy Loam	Microsprinkler	<b>Edit</b>	<b>Schedule</b>
Avocado	Avocado	CIMIS 107	Fine Sandy Loam	Drip Emmitter	<b>Edit</b>	<b>Schedule</b>
					<b>New</b>	<b>Schedule</b>
					<b>New</b>	<b>Schedule</b>

Edit existing or add new

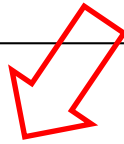




# CIMIS

- CIMIS-based resources
  - WaterRight

Need to populate, some are self generated



## ■ Agricultural Irrigation Scheduling

### Field Data Summary

Field Name:	<input type="text"/>
<b>Choose Station</b>	CIMIS Station - 107 City - Santa Barbara County - Santa Barbara
Scheduling Basis and Criteria (choose one):	
<input checked="" type="radio"/> Management Allowed Depletion	<input type="text" value="50"/> %
<input type="radio"/> Set Time/Irrigation Set	<input type="text"/> hrs
<input type="radio"/> Set Days in Rotation	<input type="text"/> days
<b>Choose Crop</b>	None selected
<b>Choose Soil &gt;&gt;&gt;</b>	Avail H2O (in/ft) - Soil .45 - Coarse Sand/Gravel ▼
<b>Choose System &gt;&gt;&gt;</b>	Drip Tape ▼
<b>System Parameters</b>	Irrigation Efficiency - % Gross Application Rate - 0.000 in/hr

**Schedule this Field**

**Back to Field List**

**Save this Field**

#### Instructions (detailed):

1. Enter a Field Name.
2. Click the 'Choose Station' button to select a weather station. (You MUST do this first if using the AgriMet system!)
3. Choose a Scheduling Basis and enter the Criteria.
4. Click the 'Choose Crop' button to choose a Crop

5. Select the soil type from the drop-down list.
6. Select the irrigation system from the drop-down list and then click the 'System parameters' button.
7. Then click one of the action buttons above.

### Crop Selection/Data Entry

Crop Name	<input type="text" value="Alfalfa (cycle)"/>
Start Month	<input type="text" value="6"/> End Month <input type="text" value="7"/>
Start Day	<input type="text" value="20"/> End Day <input type="text" value="20"/>
Maximum Rooting Depth (feet)	<input type="text"/>
ETc Adjustment (%) (This factor can be used to increase or account for individual management factors)	<input type="text"/>
<b>Next</b>	

**Instructions:**

1. Use the pull-down list to choose a crop.
2. Defaults will appear in the other entry boxes as necessary.
3. You may want to come back and change the resulting irrigation schedule does not appear.

Output!



Maximum RootZone (ft)	2
Irrigation System	Drip Emitter
Irrigation Efficiency	85%
Gross Application Rate (in/hr)	0.401
Scheduling Basis	Set Rotation
Days Between Irrigations	2

#### Seasonal Irrigation Schedule

For Week Ending	Average Year		This Year		Averages for Week			Change This Yr vs Avg Yr	Total ETc to Date	
	ETo	Rain	ETo	Rain	Kc	ETc	Root Zone			
	In/Day	In/Wk	In/Day	In/Wk		In/Dy	Ft	HH:mm	%	In
1/8/2015	0.07	0.19	0.07	0.00	0.52	0.04	2.00	0:44	0	0.25
1/15/2015	0.07	0.29	0.05	1.26	0.53	0.04	2.00	0:45	-28	0.51
1/22/2015	0.07	0.69	0.06	0.00	0.54	0.04	2.00	0:47	-16	0.78
1/29/2015	0.07	0.46	0.07	0.14	0.55	0.04	2.00	0:50	-6	1.06
2/5/2015	0.08	0.31	0.07	0.00	0.56	0.04	2.00	0:54	-11	1.37
2/12/2015	0.08	0.19	0.07	0.49	0.57	0.05	2.00	0:57	-15	1.70
2/19/2015	0.09	0.52	N/A	N/A	0.58	0.05	2.00	1:01	N/A	2.04
2/26/2015	0.09	0.55	N/A	N/A	0.59	0.05	2.00	1:04	N/A	2.40
3/5/2015	0.09	0.91	N/A	N/A	0.60	0.05	2.00	1:07	N/A	2.78



# Discussion Topics

Soil Web Survey

CIMIS

## Water Destination Graph

- NRCS Irrigation Schedule Visualizer

Irrigation scheduling is based on concrete principles but just talking about those principles makes them abstract.

WDG may help put things into relative perspective....

ALL CREDIT TO MARK BARNETT  
ET AL. & NRCS



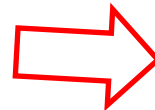
# Water Destination Graph

- NRCS Irrigation Schedule Visualizer

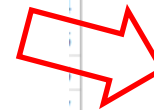
Standard input field;  
edit yellow cells



Calculation Field



ET water loss (Grey)



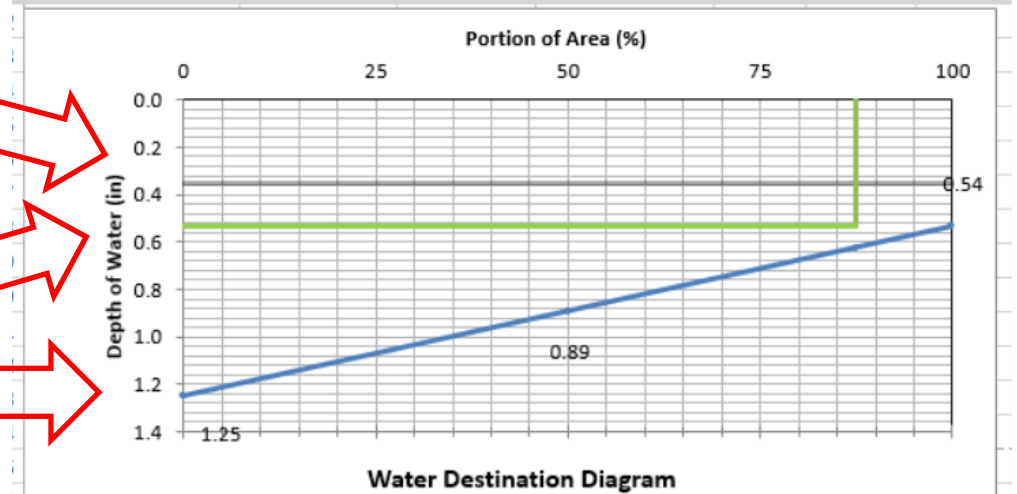
Applied water depth (Green)



Irrigation management curve (Blue)



Water Destination Diagram			
Current Scheduling			
<b>Given:</b>	<b>Crop Data:</b>	Crop =	Avocados
		Peak ET =	0.05 in/day
	<b>Scheduling:</b>	Calculated DU =	0.7
		Typical Set Time =	10 hrs
		Days Between Irrigation =	7 days
	<b>Emitter Data :</b>	Calculated Emitter Flow Rate =	12.5 gph
		Emitter per plant =	1
	<b>Field Spacing:</b>	Plant spacing =	15 ft
		Row Spacing =	15 ft
<b>Equations:</b>		y =	Mx + b
		Inches applied (in) =	$\frac{96.3 \times \text{Flow Rate (gpm)} \times \text{Set Time (hrs)}}{\text{Row Spacing (ft)} \times \text{Plant Spacing (ft)}}$
<b>Solution:</b>		Inches Applied =	0.892 inches
		Average of the Low Quarter =	0.624 inches
		SMD =	0.350 inches
		Slope, M =	-0.0071
		b =	1.25



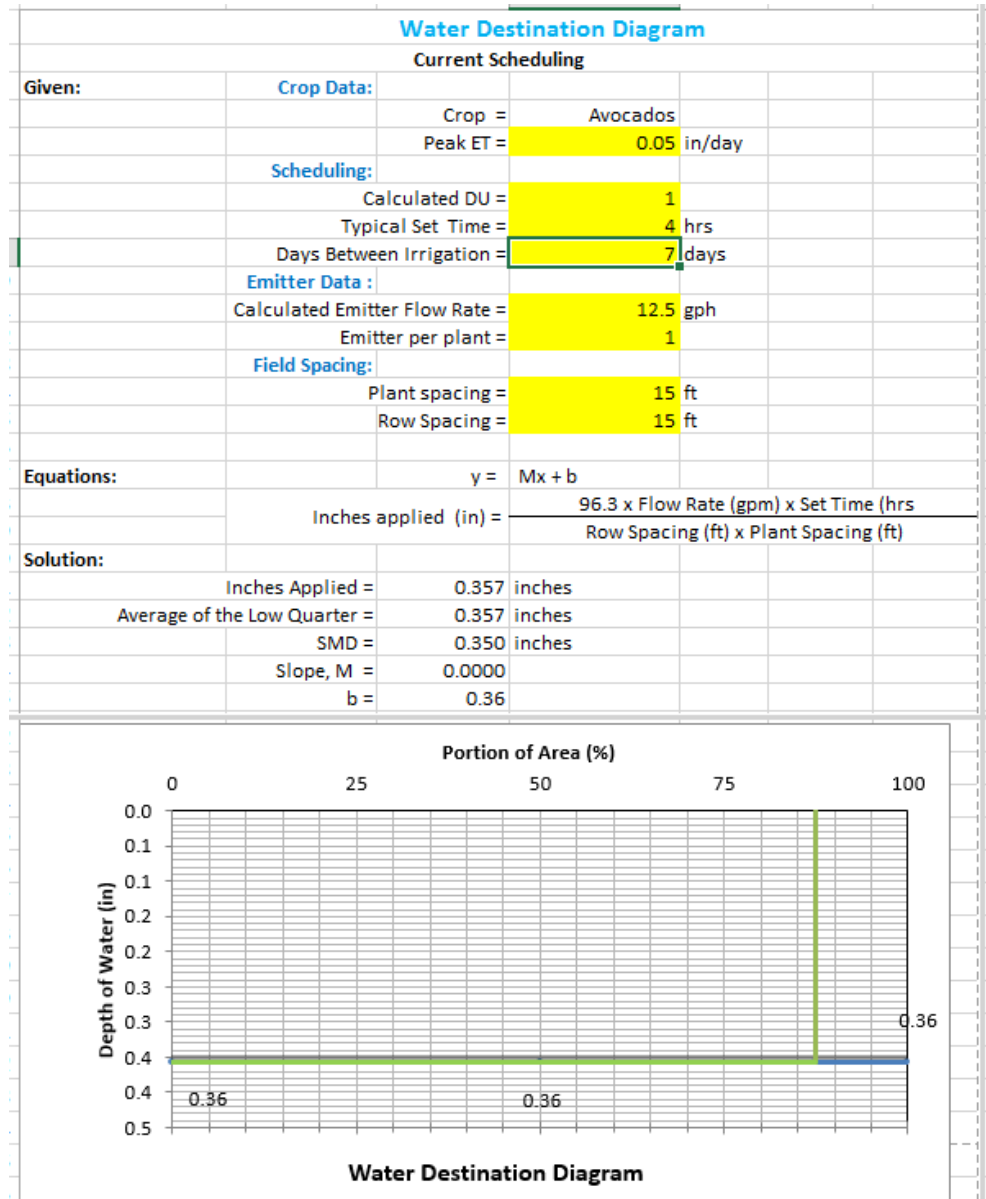
# Water Destination Graph

- NRCS Irrigation Schedule Visualizer

“In Your Dreams” scenario...

ET = applied water & perfect DU

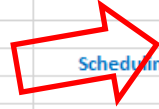
All curves are now lined up;  
water budget is balanced



# Water Destination Graph

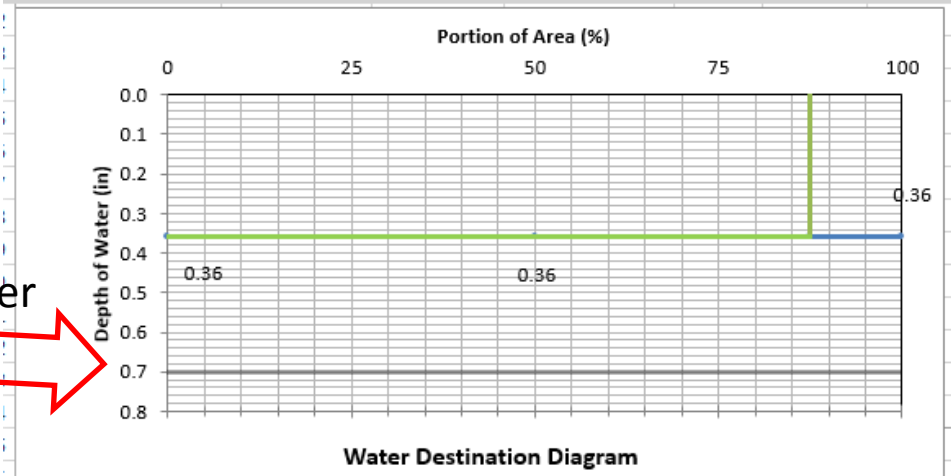
- NRCS Irrigation Schedule Visualizer

An ET increase...



Water Destination Diagram			
Current Scheduling			
Given:	<b>Crop Data:</b>	Crop =	Avocados
		Peak ET =	0.1 in/day
	<b>Scheduling:</b>	Calculated DU =	1
		Typical Set Time =	4 hrs
		Days Between Irrigation =	7 days
	<b>Emitter Data :</b>	Calculated Emitter Flow Rate =	12.5 gph
		Emitter per plant =	1
	<b>Field Spacing:</b>	Plant spacing =	15 ft
		Row Spacing =	15 ft
<b>Equations:</b>		y =	Mx + b
		Inches applied (in) =	$\frac{96.3 \times \text{Flow Rate (gpm)} \times \text{Set Time (hrs)}}{\text{Row Spacing (ft)} \times \text{Plant Spacing (ft)}}$
<b>Solution:</b>		Inches Applied =	0.357 inches
		Average of the Low Quarter =	0.357 inches
		SMD =	0.700 inches
		Slope, M =	0.0000
		b =	0.36

NOTE: There's been no "water" or "management" change; crop is now being under-irrigated



... shows as deeper water loss

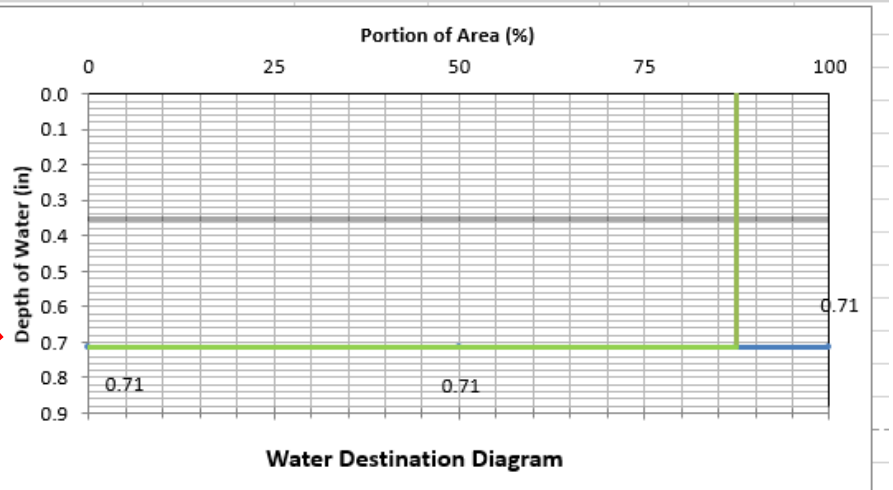


# Water Destination Graph

- NRCS Irrigation Schedule Visualizer

What about a return to 0.05 ET but an increase in applied water?

Water Destination Diagram			
Current Scheduling			
Given:	<b>Crop Data:</b>	Crop =	Avocados
		Peak ET =	0.05 in/day
	<b>Scheduling:</b>	Calculated DU =	1
		Typical Set Time =	8 hrs
		Days Between Irrigation =	7 days
	<b>Emitter Data:</b>	Calculated Emitter Flow Rate =	12.5 gph
		Emitter per plant =	1
	<b>Field Spacing:</b>	Plant spacing =	15 ft
		Row Spacing =	15 ft
Equations:		y =	Mx + b
		Inches applied (in) =	$\frac{96.3 \times \text{Flow Rate (gpm)} \times \text{Set Time (hrs)}}{\text{Row Spacing (ft)} \times \text{Plant Spacing (ft)}}$
Solution:			
	Inches Applied =	0.713	inches
	Average of the Low Quarter =	0.713	inches
	SMD =	0.350	inches
	Slope, M =	0.0000	
	b =	0.71	



Depth of water loss is shallow...

... applied water depth is deeper.



# Water Destination Graph

- NRCS Irrigation Schedule Visualizer

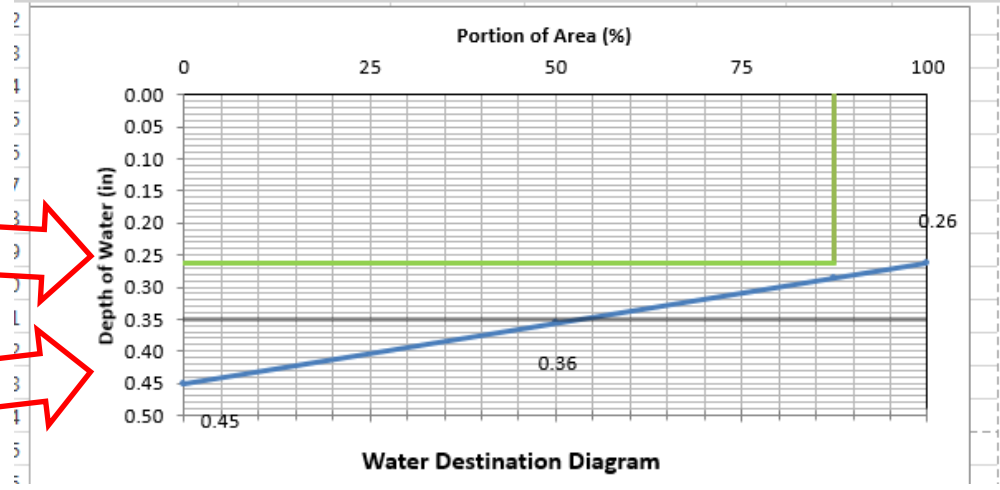
What about a return to 0.05 ET and 4 hour set, but a poor DU?



All low quarter trees under-irrigated

Only half of entire population getting adequate irrigation.

Water Destination Diagram			
Current Scheduling			
Given:	<b>Crop Data:</b>	Crop =	Avocados
		Peak ET =	0.05 in/day
	<b>Scheduling:</b>	Calculated DU =	0.8
		Typical Set Time =	4 hrs
		Days Between Irrigation =	7 days
	<b>Emitter Data :</b>	Calculated Emitter Flow Rate =	12.5 gph
		Emitter per plant =	1
	<b>Field Spacing:</b>	Plant spacing =	15 ft
		Row Spacing =	15 ft
<b>Equations:</b>		y =	Mx + b
		Inches applied (in) =	$\frac{96.3 \times \text{Flow Rate (gpm)} \times \text{Set Time (hrs)}}{\text{Row Spacing (ft)} \times \text{Plant Spacing (ft)}}$
<b>Solution:</b>		Inches Applied =	0.357 inches
		Average of the Low Quarter =	0.285 inches
		SMD =	0.350 inches
		Slope, M =	-0.0019
		b =	0.45

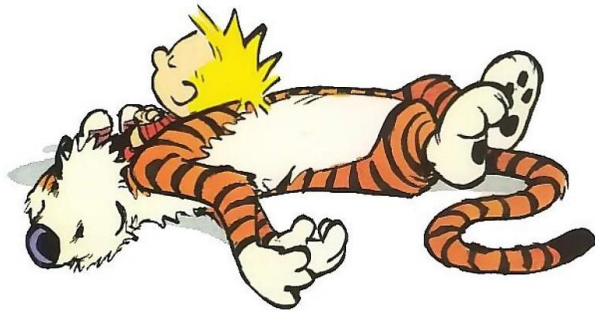


# Water Destination Graph

- NRCS Irrigation Schedule Visualizer

No worries...

- Correct the DU
- Adjust the set time
- ...and...
- GROUND TRUTH!



“Real-world” water use, in balance with a minimal amount of leaching.



Water Destination Diagram			
Current Scheduling			
Given:	Crop Data:	Crop =	Avocados
		Peak ET =	0.05 in/day
	Scheduling:	Calculated DU =	0.9
		Typical Set Time =	4.5 hrs
		Days Between Irrigation =	7 days
	Emitter Data :	Calculated Emitter Flow Rate =	12.5 gph
		Emitter per plant =	1
	Field Spacing:	Plant spacing =	15 ft
		Row Spacing =	15 ft
Equations:		y =	Mx + b
		Inches applied (in) =	$\frac{96.3 \times \text{Flow Rate (gpm)} \times \text{Set Time (hrs)}}{\text{Row Spacing (ft)} \times \text{Plant Spacing (ft)}}$
Solution:		Inches Applied =	0.401 inches
		Average of the Low Quarter =	0.361 inches
		SMD =	0.350 inches
		Slope, M =	-0.0011
		b =	0.45

