Drip Irrigation Conversion

Scott Eden, Conservation Specialist

Site: J. Frank Schmidt Crystal Springs Seedling Nursery

Clackamas Soil and Water Conservation District
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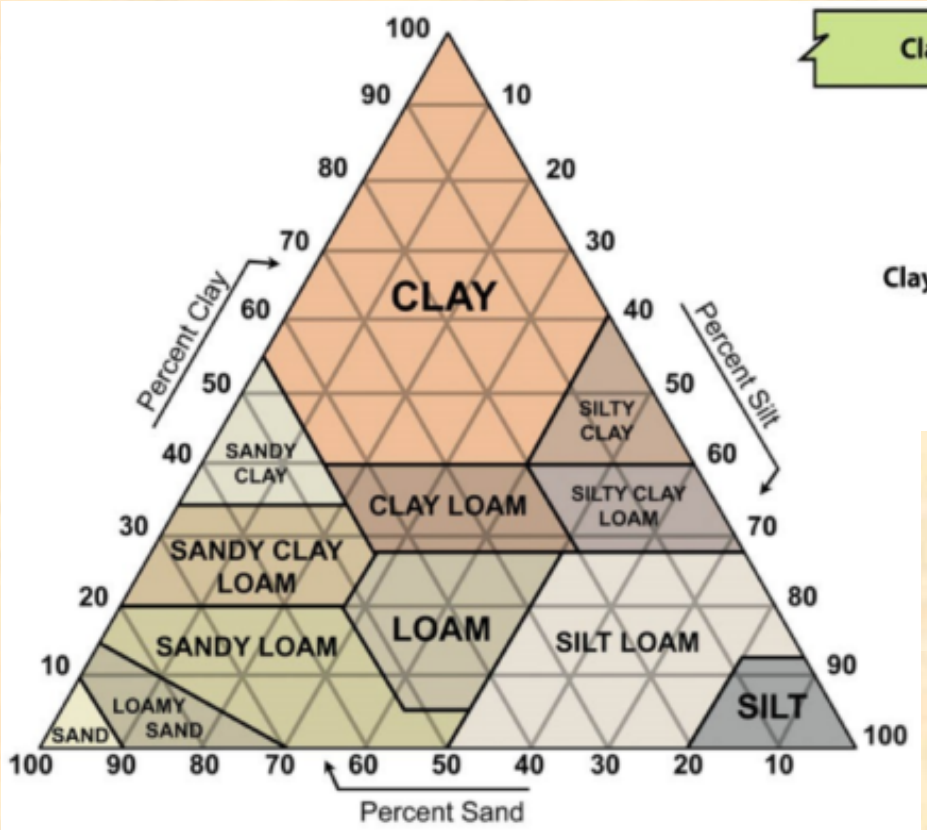
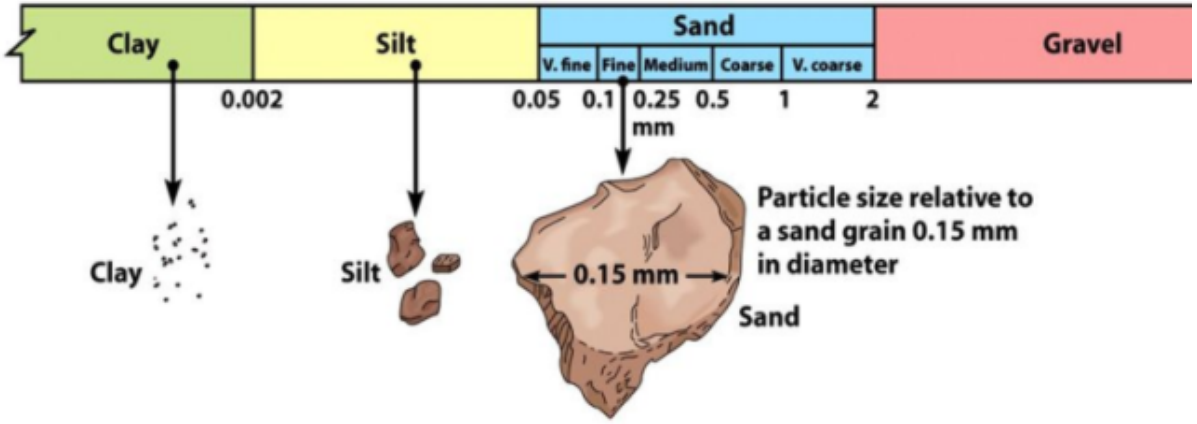
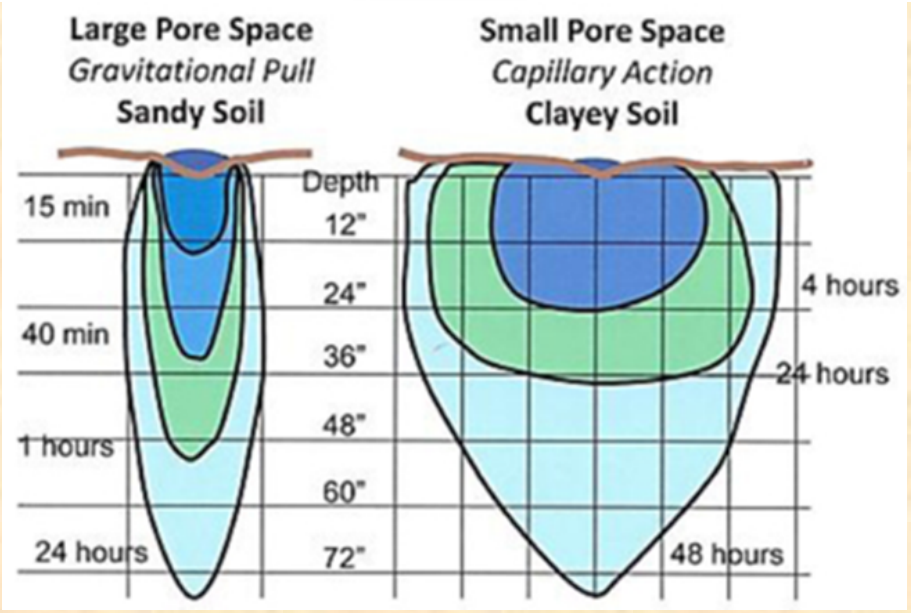
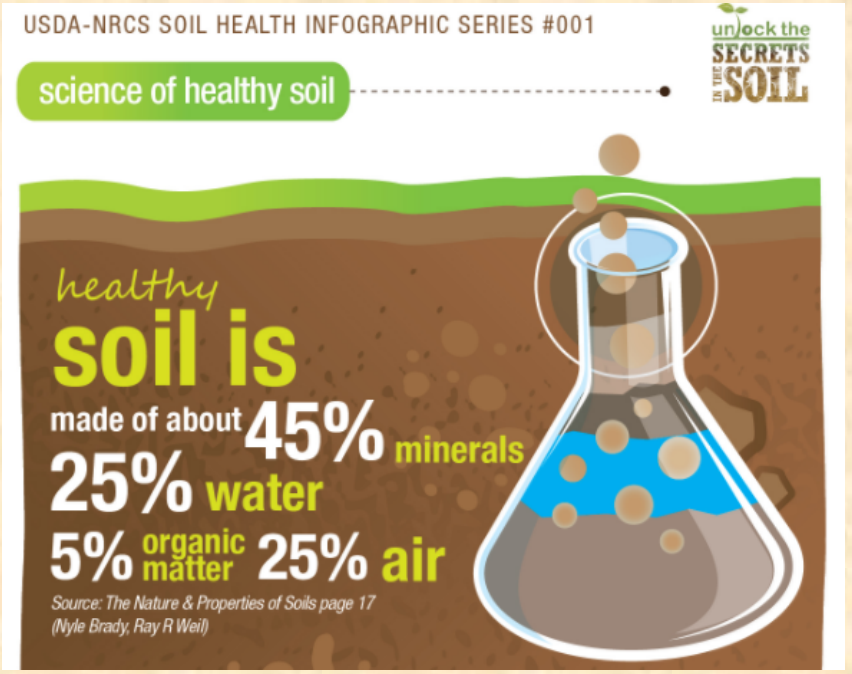








<u>Existing Soil Properties must be considered:</u>

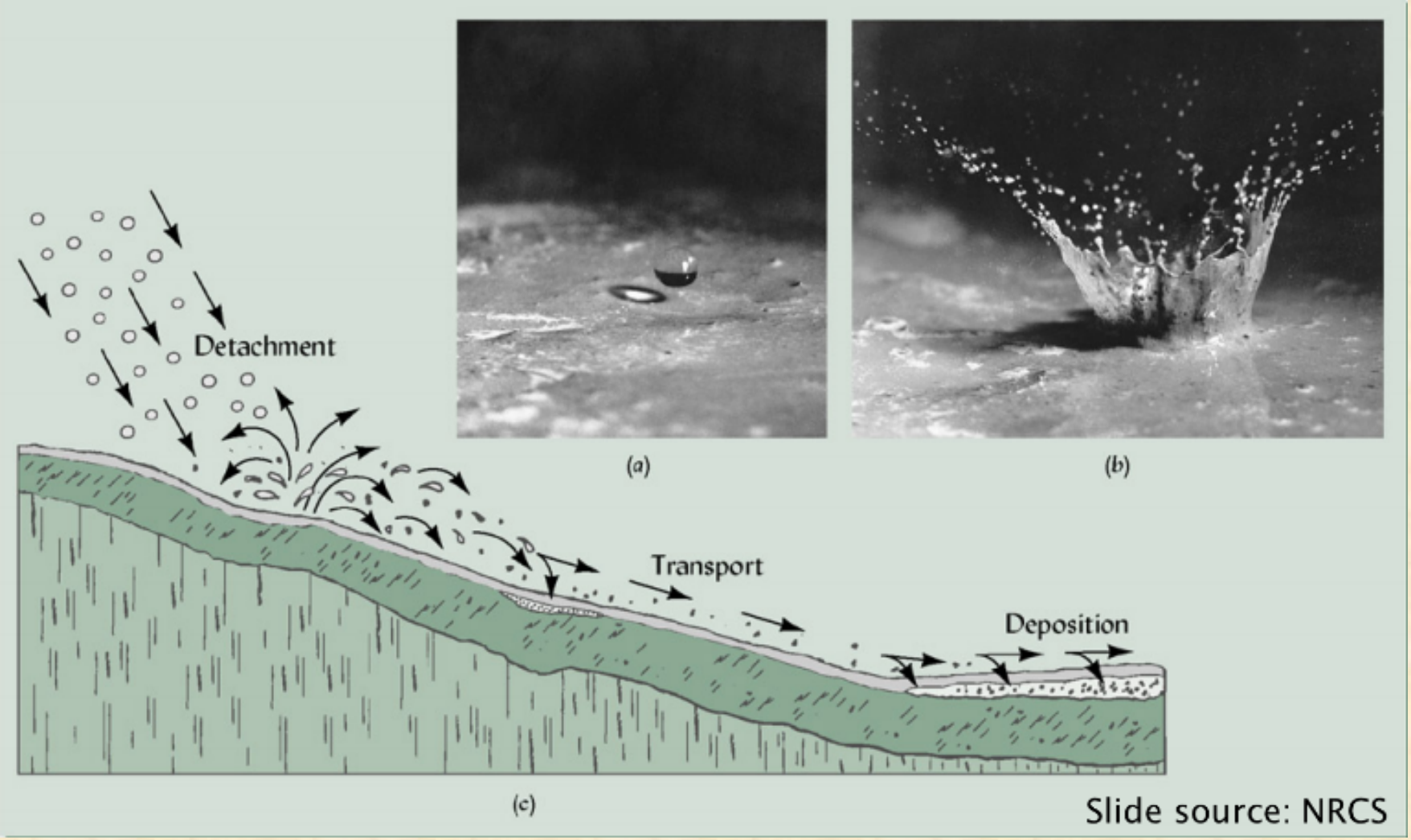
Soil = Air, Water & Minerals

Minerals = Sand, Silt, Clay

loam= equal parts sand, silt & clay

OM = glue

Reduced Infiltration



Bare soil exposed to rainfall or overhead irrigation can develop surface crusting, erosion & compaction = reduced infiltration

Runoff & Erosion:

RUSLE equation:

A = R * K * LS * C * P

= est. Soil loss (tons/ac/yr)

= Rainfall -runoff erosivity

= soil erodibility

= slope length

= slope steepness

= cover -management

= support practice

+ STIR: soil tillage intensity rating

Soil Loss /Soil Health

[Old J. Frank Schmidt irrigation]:High pressure, high impact sprinklers mimicked rainfall, contributing to compaction, soil sealing & soil loss

Old system estimated Water Use = 170 ac-ft

Soil loss leads to reduced productivity -the top few inches is the richest layer with the highest organic matter content.

Sediment in runoff negatively effects downstream waterways, #1 pollutant in most waters, & carries nutrients, pesticides, & chemicals.

Conversion: Estimated Water Savings

Old System: 30 acre-in/acre =2.5 ac/ft x 68 ac = **170 ac-ft**

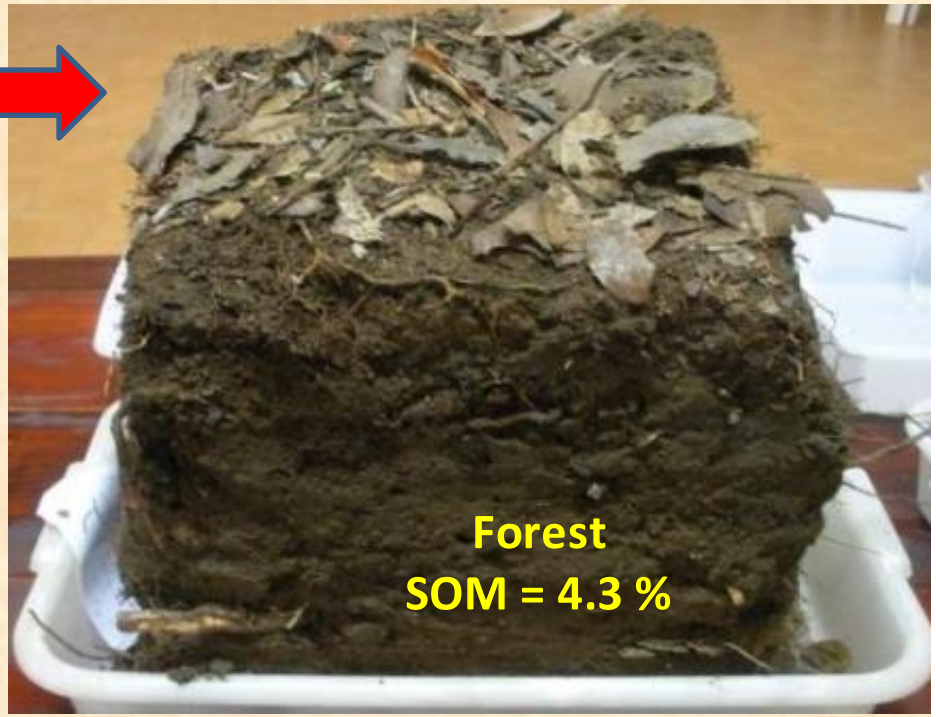
New system: 21 acre-in/acre =1.75 ac-ft x 68 ac x 25% (strip irrigated) = **30 ac-ft**

~ 18% of Water Right

Figured another way using a very conservative ET (0.25): If the system applied 0.55 inches daily for 4.5 hours of run time for 90 days during the irrigation season = 49.5 acre-in x wetted area (~17 acres) = **70 ac-ft.**

The system design predicts 1.5 ac-in applied for each irrigation, so over the season it would take 20 to 47 irrigation events to deliver the estimated 30 to 70 ac-ft.

Management Changes Soil Properties & Capacity of Soil to Function



Slide source: NRCS

62.8% loss of SOM after 17 yr intensive tillage

Soil Water Retention

- Soil with high Organic Matter (OM) holds more water; OM can absorb up to 90% of its weight in water
- OM water is plant available, unlike with clay
- a 1-3% increase in OM can reduce erosion 20-33%
- A 1% increase in soil OM can add 16,500 gallons of plant-available water per acre
- Every acre-inch of applied irrigation water = 27,154 gallons

Organic Matter Article Excerpts: Funderburg, Eddie, 2011
www.cattlenetwork.com

Cover Crops

Tips to keep soil healthy & prevent soil loss:

Birdseye view of an agricultural landscape with grass filter strips and other types of conservation buffers. Photo courtesy USDA NRCS.

- Irrigation Water Management
- Cover bare Soil
- Keep a living root all year
- Reduced tillage
- Use cover crops & rotations to feed soil microorganisms
- Conservation BMPs (RUSLE support practices): Slope breaks, buffers, filter strips, etc.
- Contour farming
- Reduced traffic

Irrigation Water Management (IWM)

- Reduced Energy use
- Water Savings
- Less runoff (sediment, nutrients, chemicals)

How? Assess site conditions (system, soils, weather, slopes & crops). IWM scheduling predicts water losses (crop water use, evaporation, deep percolation) & gains (rainfall) to schedule irrigation to replace lost soil moisture.

Start with basics and develop IWM schedule over time.

Goal: Uniform application of water to the crop root zone at the rate required by the crop using tools such as soil moisture meters, weather data, & soil moisture feel.

Soil Moisture Factors

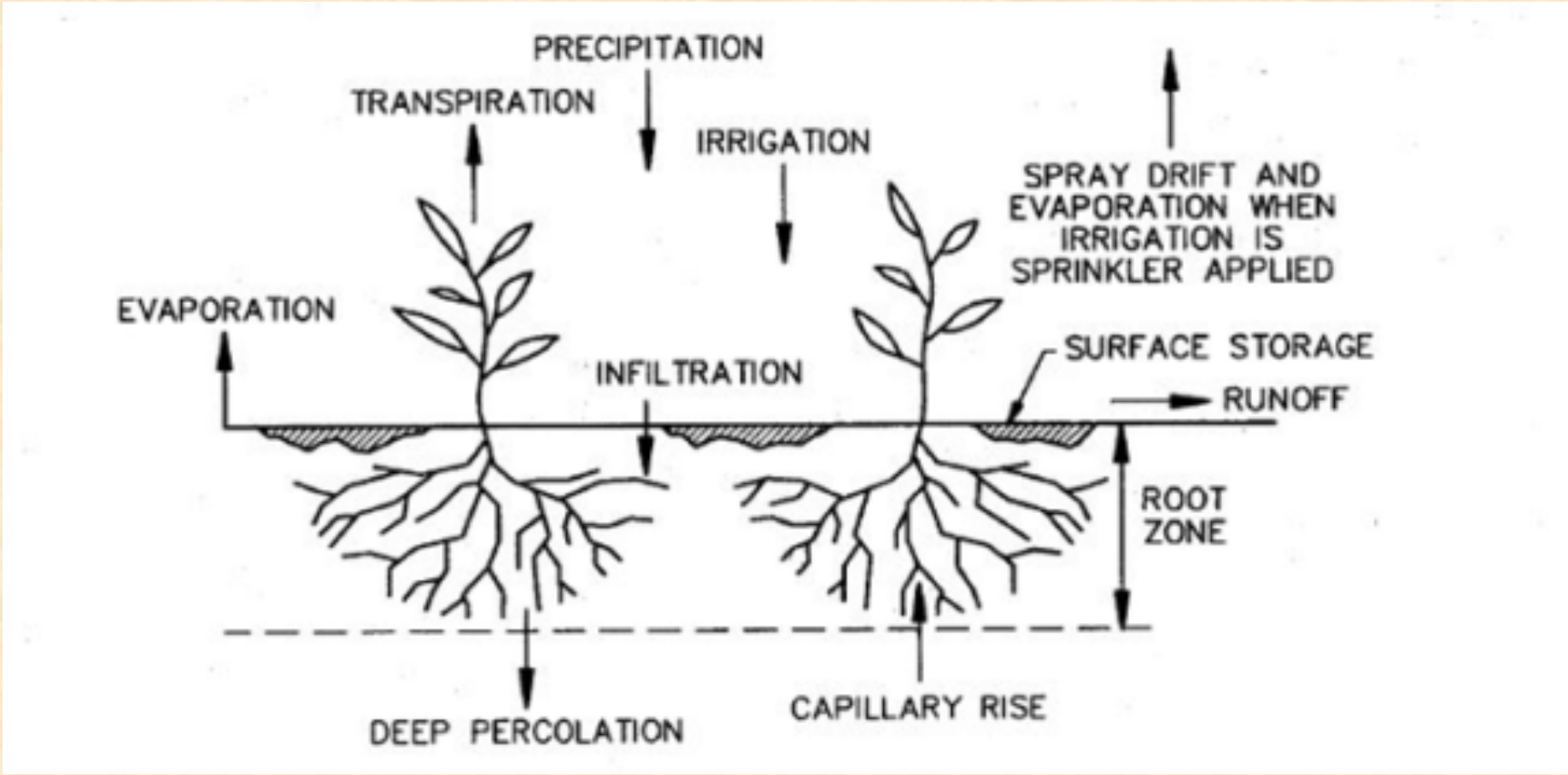


Image: Texas A & M

Irrigation Scheduling

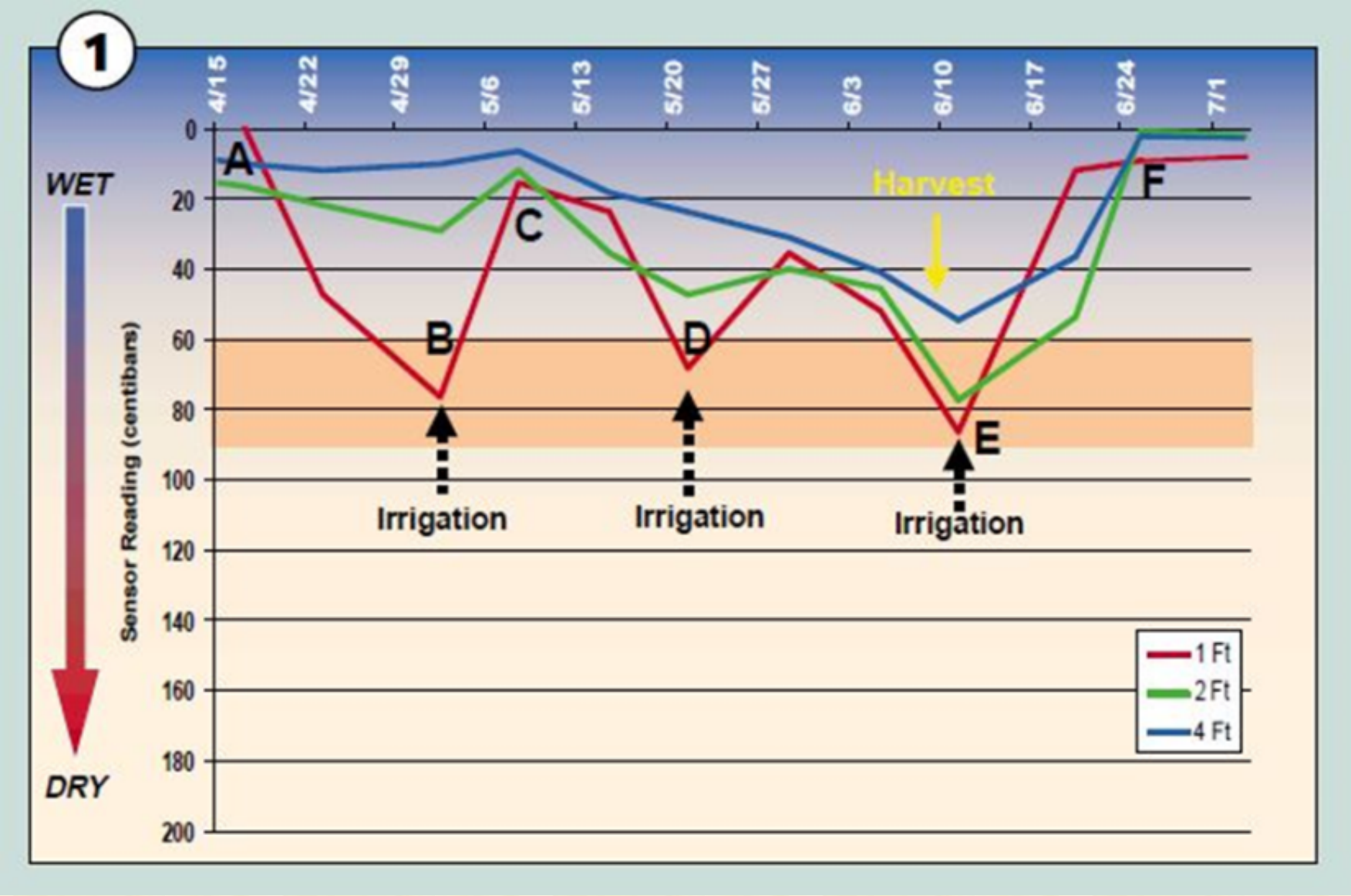
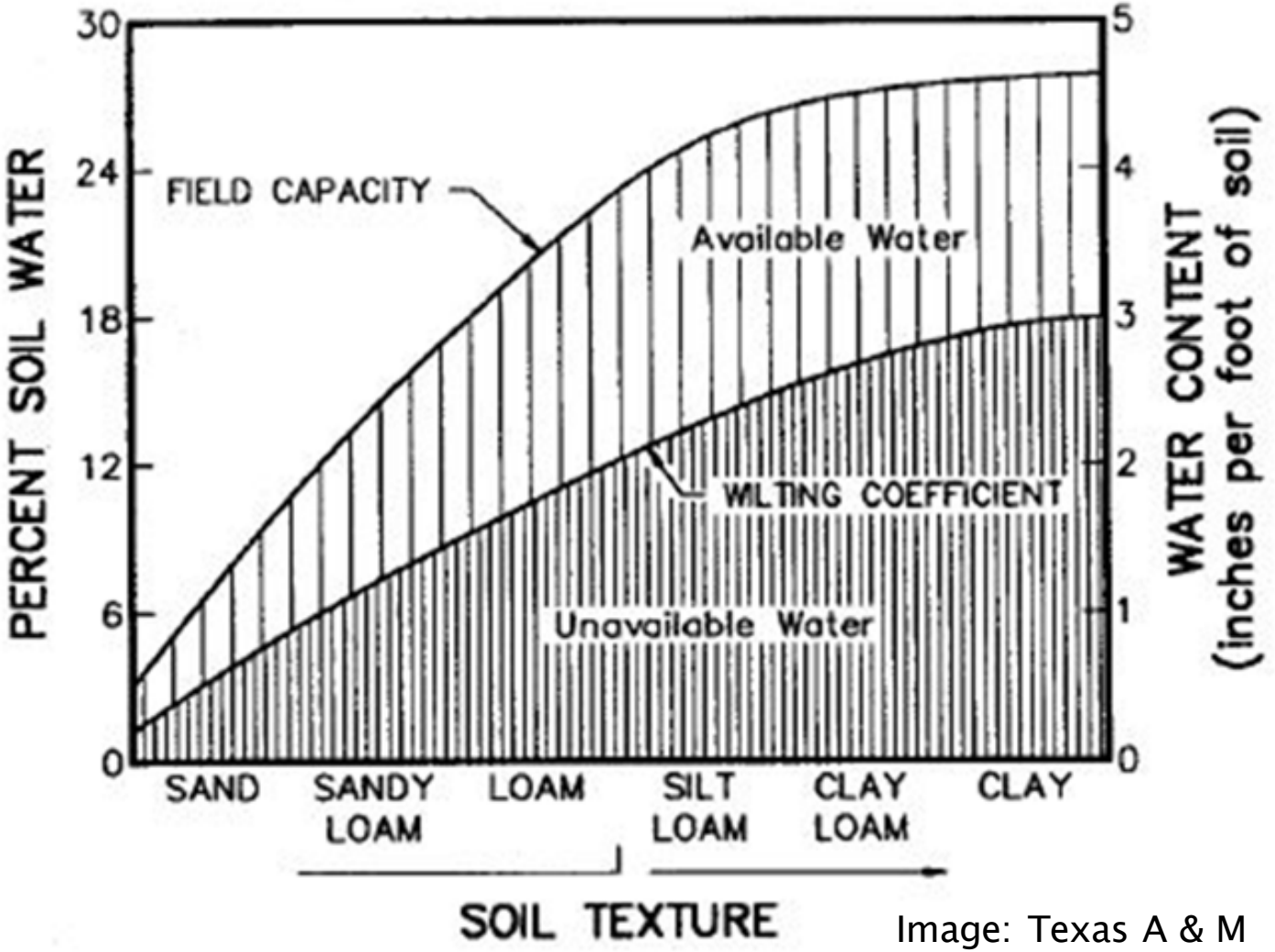


Image: UC Cooperative Education



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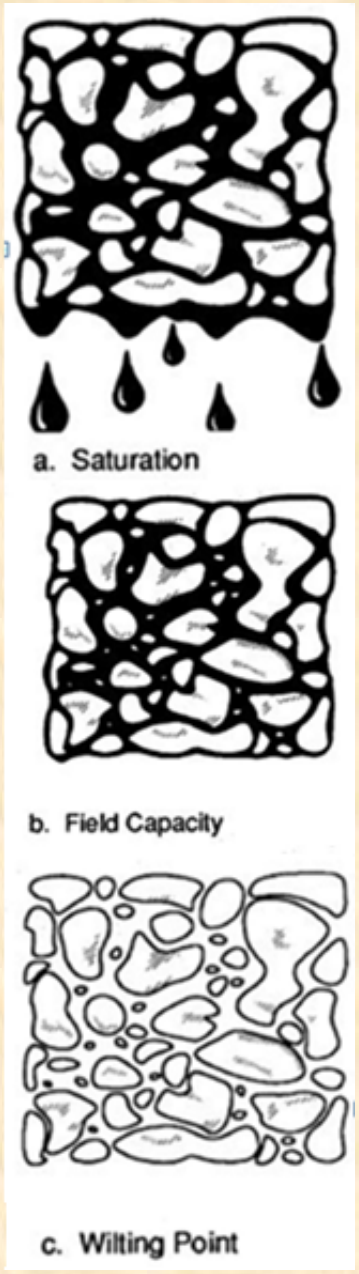
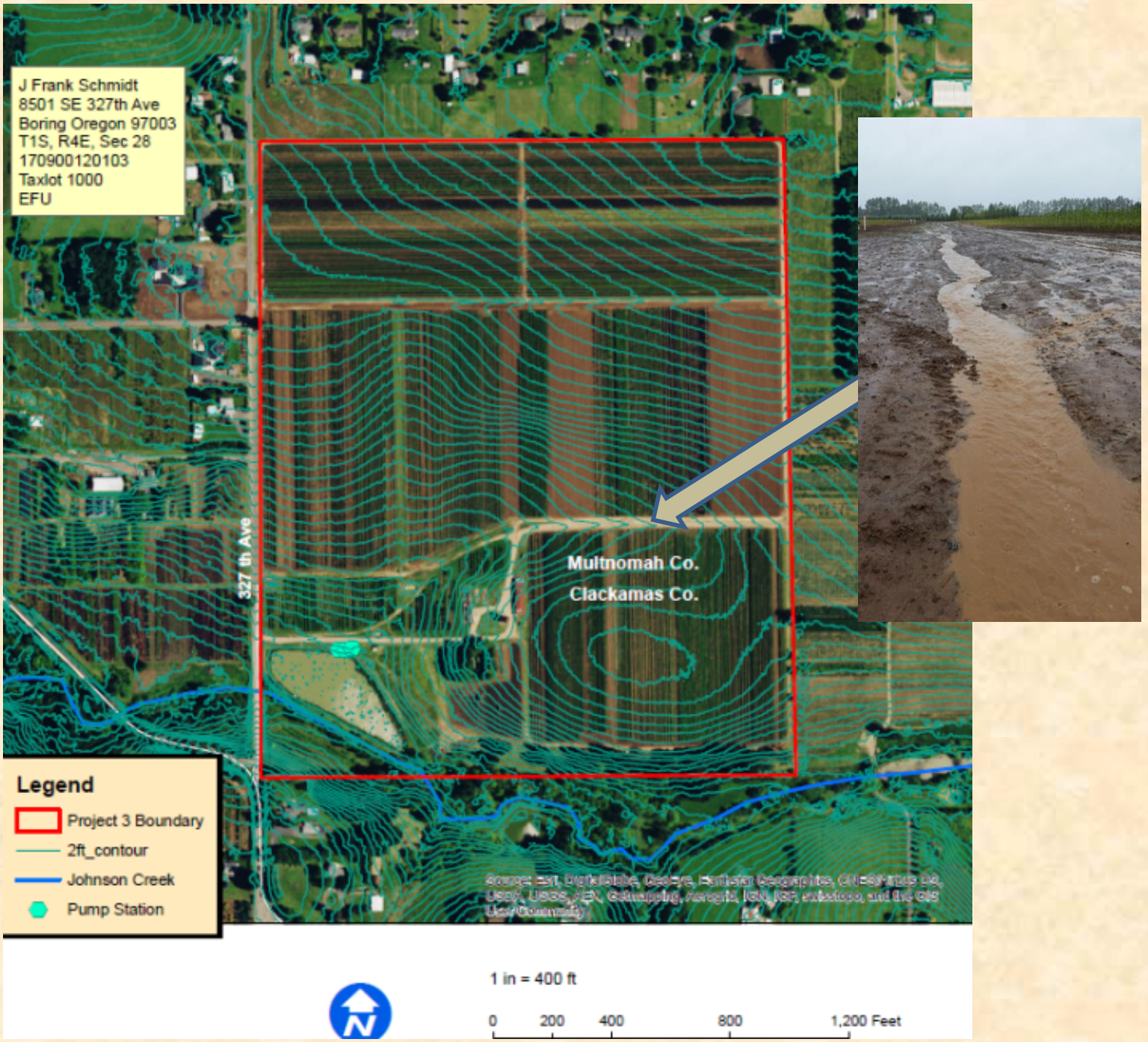
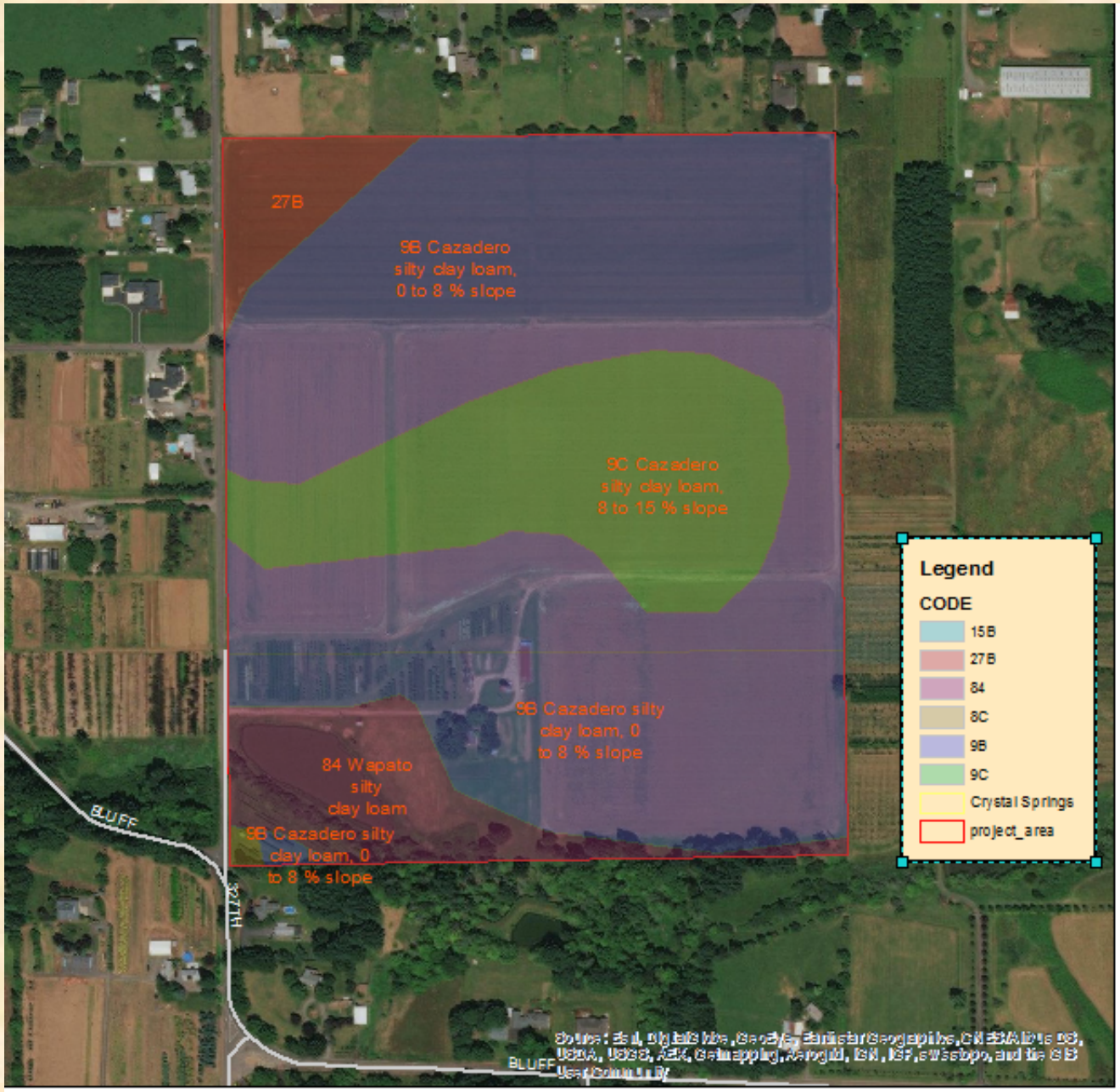


Idea is to irrigate when soil moisture levels are at (MAD), the Management Allowed Depletion level (~50%), before the crop wilting point, to bring soil moisture back to near field capacity


J Frank Schmidt
8501 SE 327th Ave
Boring Oregon 97003
T1S, R4E, Sec 28
170900120103
Taxlot 1000
EFU
327th Ave
Multnomah Co.
Clackamas Co.
Legend
Project 3 Boundary
2ft_contour
Johnson Creek
Pump Station
1 in = 400 ft
0
200
400
800
1,200 Feet

Project Area Soil Map



Web soil survey example

https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Physical Soil Properties–Multnomah County Area, Oregon														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
9B—Cazadero silty clay loam, 0 to 8 percent slopes														
Cazadero	0-16	-19-	-48-	27-34- 40	1.20-1.30-1.40	4.00-9.00-14.00	0.15-0.16-0.17	0.0- 1.5- 2.9	3.0- 3.5- 4.0	.24	.24	5	6	48
	16-60	- 3-	-45-	45-53- 60	1.30-1.40-1.50	1.40-3.00-4.00	0.11-0.12-0.13	3.0- 4.5- 5.9	0.5- 1.8- 3.0	.24	.24			
9C—Cazadero silty clay loam, 8 to 15 percent slopes														
Cazadero	0-16	-19-	-48-	27-34- 40	1.20-1.30-1.40	4.00-9.00-14.00	0.15-0.16-0.17	0.0- 1.5- 2.9	3.0- 3.5- 4.0	.24	.24	5	6	48
	16-60	- 3-	-45-	45-53- 60	1.30-1.40-1.50	1.40-3.00-4.00	0.11-0.12-0.13	3.0- 4.5- 5.9	0.5- 1.8- 3.0	.24	.24			

System Design

Peak Water Use ~ .25 in/day

Seasonal crop water use estimated = 21 ac-inches/acre

Drip tape w/ 0.53 gal/hr emitters spaced every 1 ft = 0.34 gpm/100 ft

Pressure is 15 to 50 psi

VFD pump can operate several blocks simultaneously up to 750 gpm

Mainline Installation

Construction

Pumphouse, Flow Meter, sand filtration system is installed

Soil Moisture Sensors

Bluetooth enabled remote sensing soil moisture probes.

Irrigation events are scheduled & programmed with controller

Installed!

Tree planting

irrigation

Benefits

Water Conservation: IWM is well suited for microirrigation, & can also improve existing, less efficient systems (e.g. sprinklers, hose reel).

Nutrient Management: Fertigation & chemigation can easily be added to a drip system – allows the injection of chemicals or fertilizers directly to the crop root zone, reducing nutrient loading & pollution

Profit: Instead of over-irrigating crops as insurance: irrigation scheduling can result in reduced costs, more retained water in rivers & aquifers, & better crop yield.

Questions?

http://irrigation.wsu.edu/ free app to track crop water use and predict irrigation sets.

OSU Ex. Crop Water Use spreadsheets for estimating a basic irrigation setup. https://catalog.extension.oregonstate.edu/em8713

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