



UNIVERSITY
OF WYOMING

DUAL SAND CAPILLARY BARRIERS INCREASE PLANT AVAILABLE WATER WITH IMPLICATIONS FOR ARID LANDS RECLAMATION

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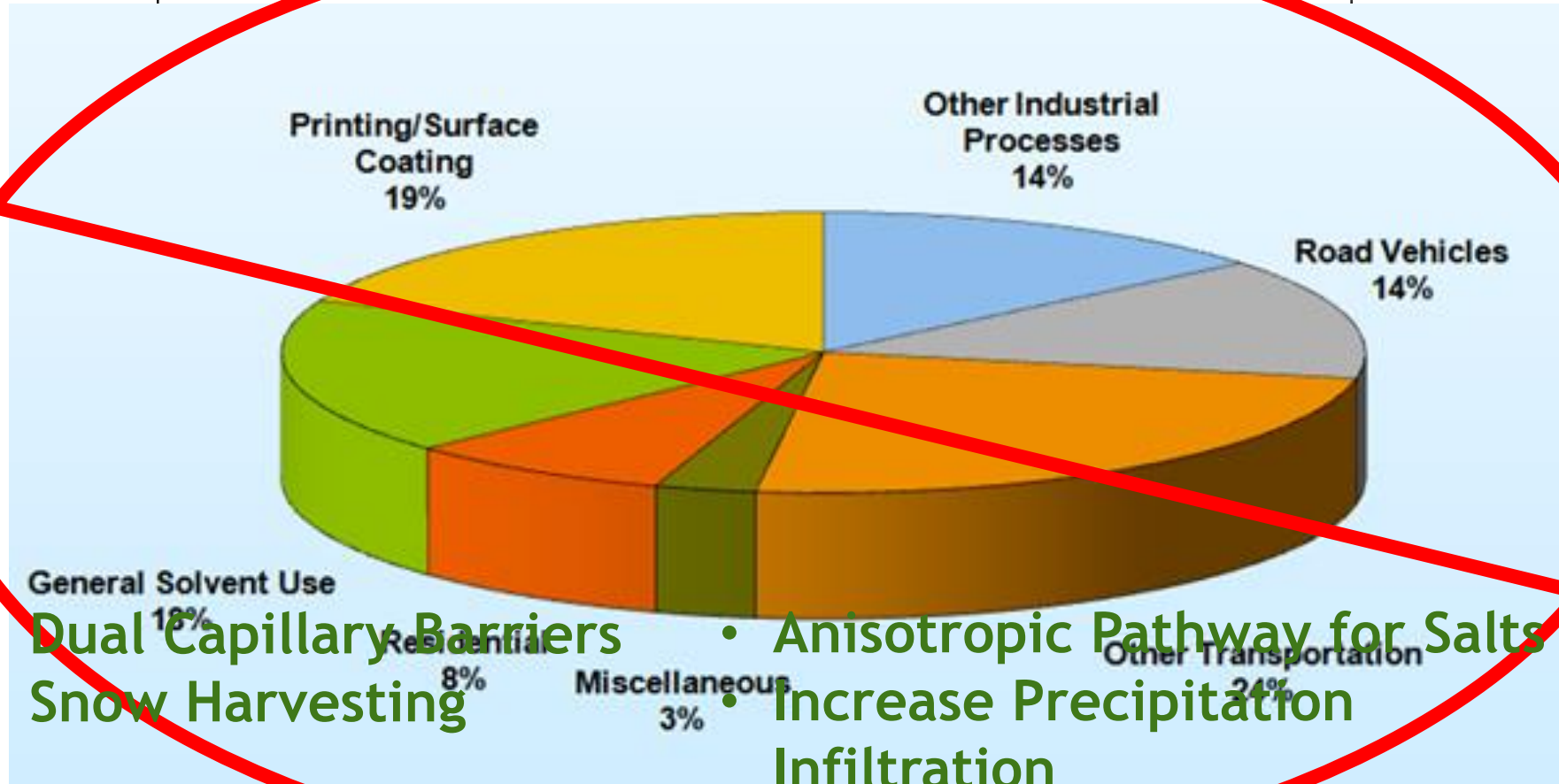


Today's Topics:
Seth Cude Thesis Work

1. Reclamation Pie

2. Column Experiments

What is a Reclamation Pie?



- Dual Capillary Barriers
- Anisotropic Pathway for Salts
- Snow Harvesting
- Increase Precipitation Infiltration

How Does a Capillary Barrier Work?

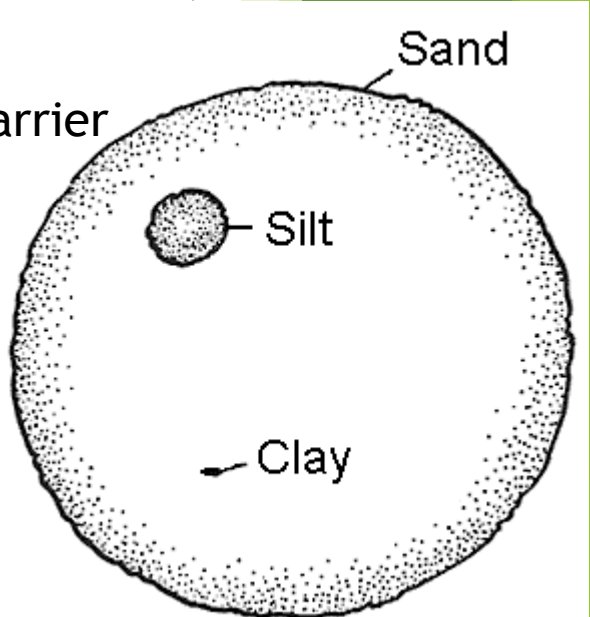
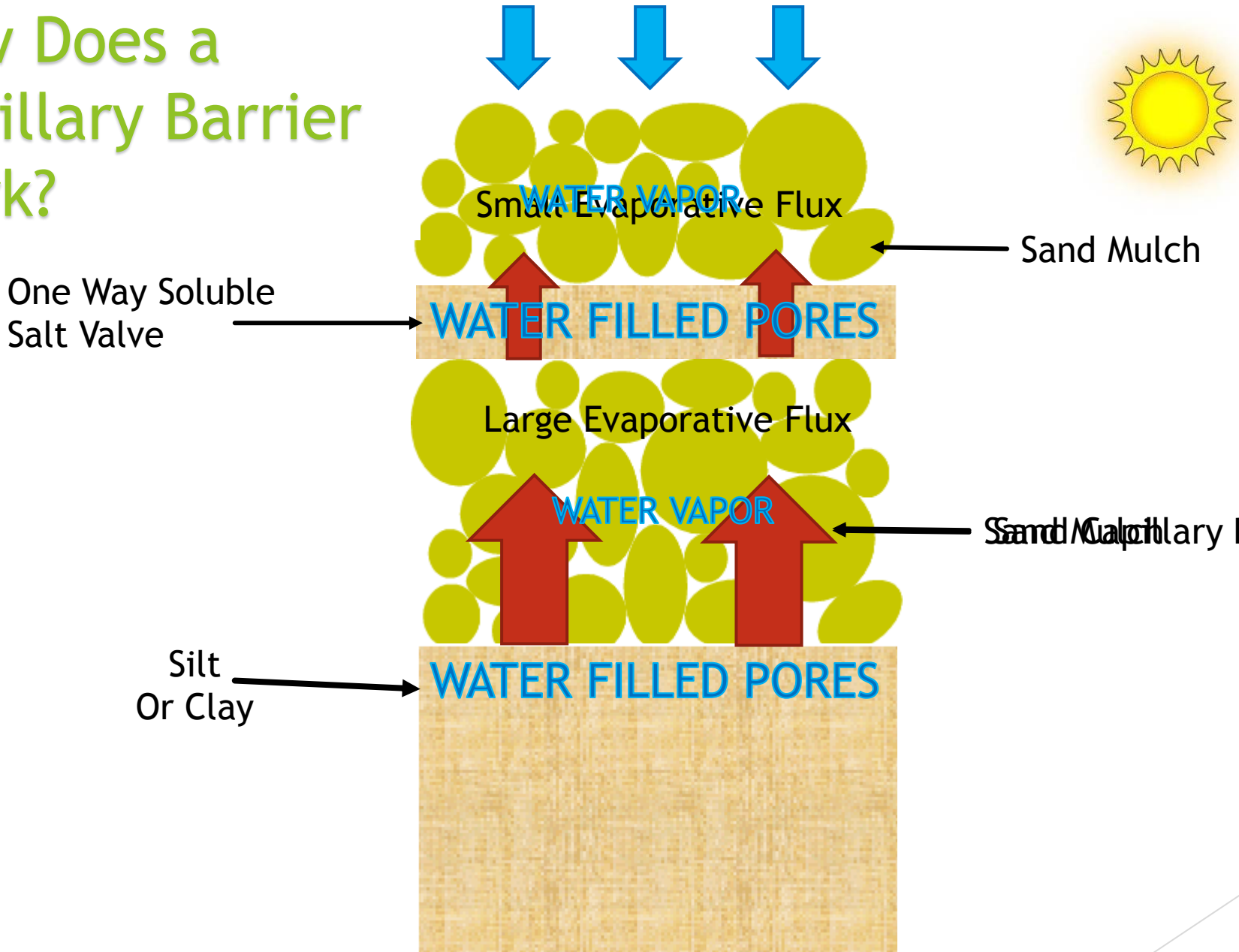
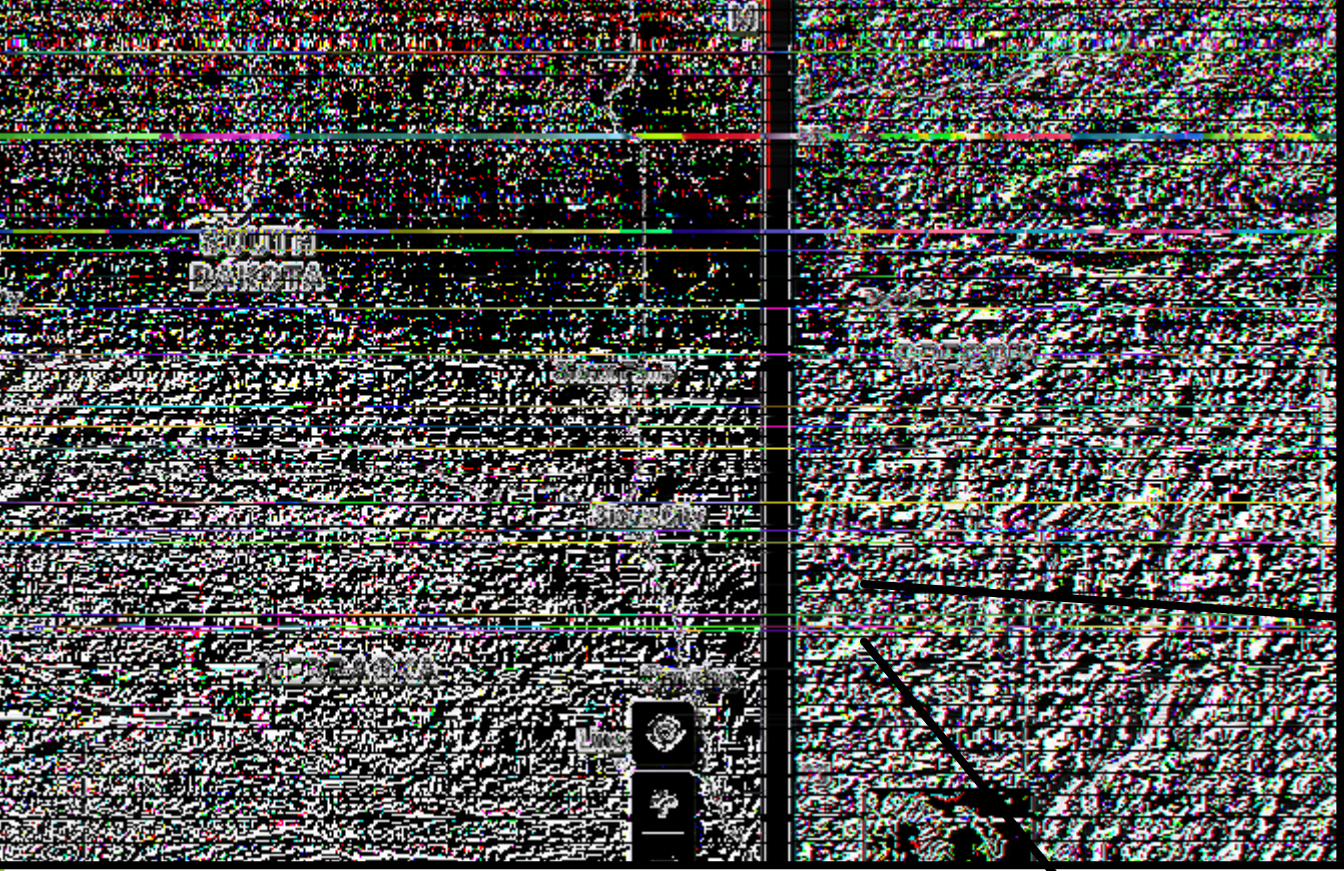


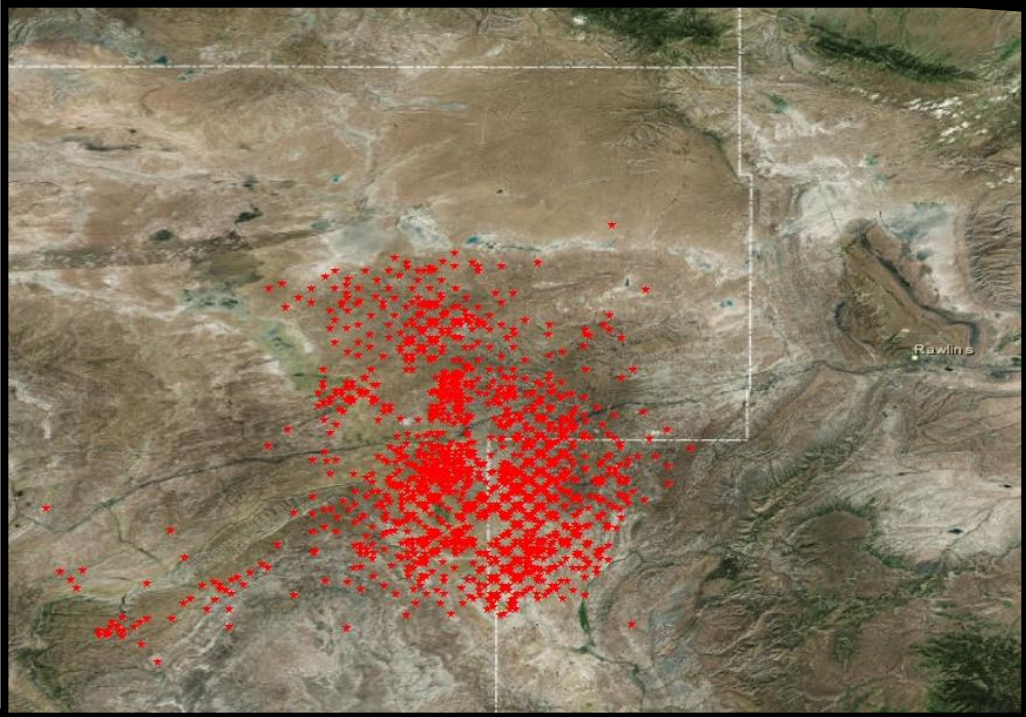
Image from: www.outsidepride.com



Where are we?

High Desert Basin

- ▶ > 4,000 WELLS
- ▶ > 60,000 ACRES OF DISTURBANCE





Native Vegetation



Beautiful
Wamsutter



It's so salty!

Where is the
rain???

I hate
cheatgrass!!!

There is too much
Sodium

Rain, why don't
you infiltrate?

Reclamation in Arid Lands is Difficult

BUT WE HAVE TO DO IT

THE QUESTION IS ... HOW

THE ANSWER:

A Reclamation Pie

Field Study

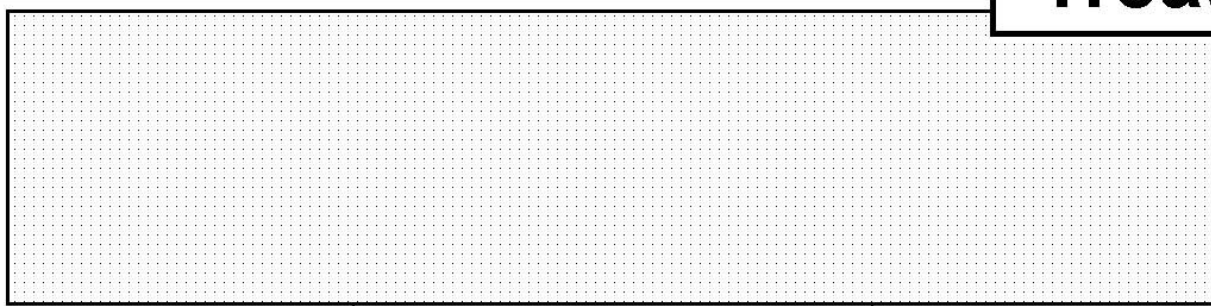
TWO PLUGGED AND ABANDONED GAS PADS

6 TREATMENTS IN CRBD

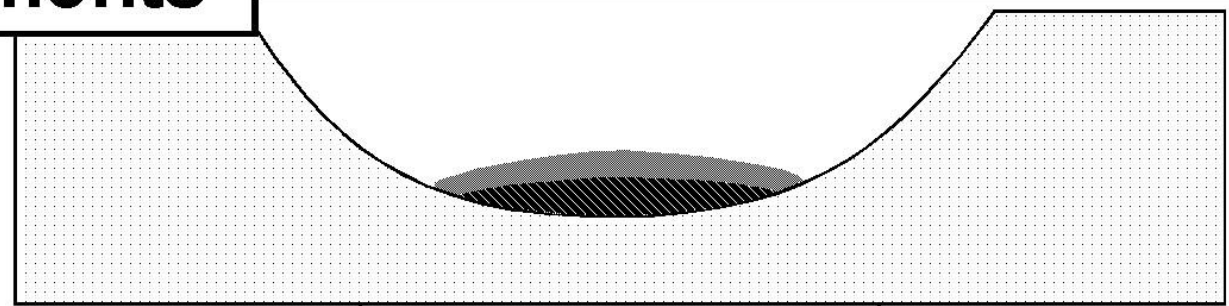
GRASSES SEEDED

CLAY SALINE SITES

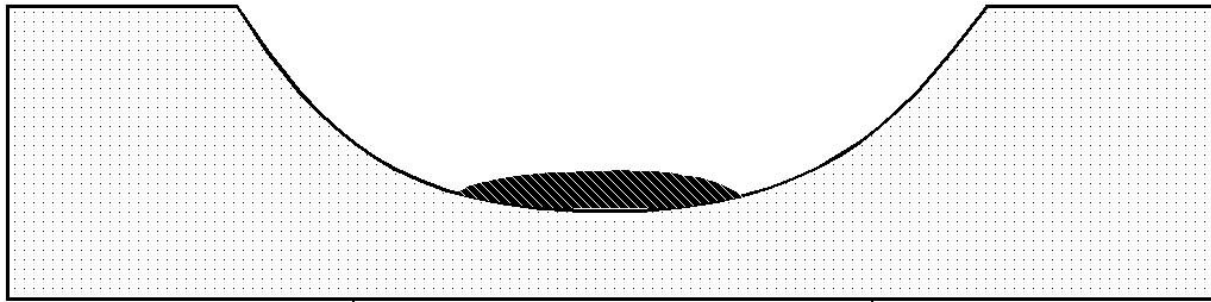
Treatments



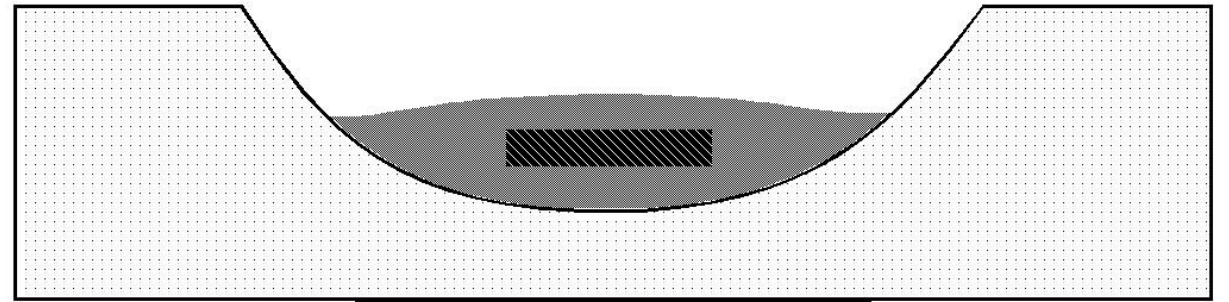
Control



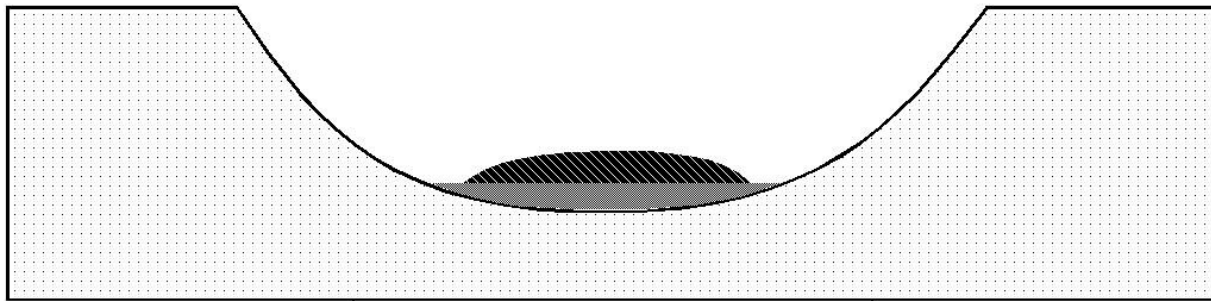
Mulch



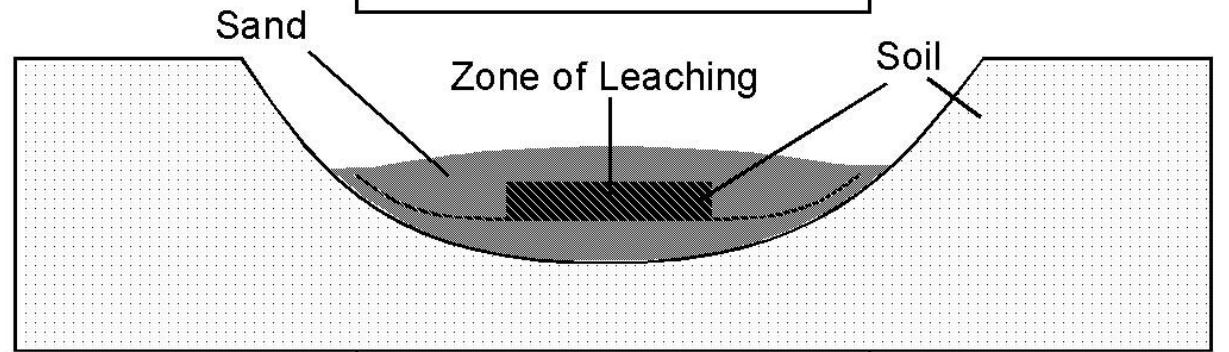
Depression



Reclamation Pie

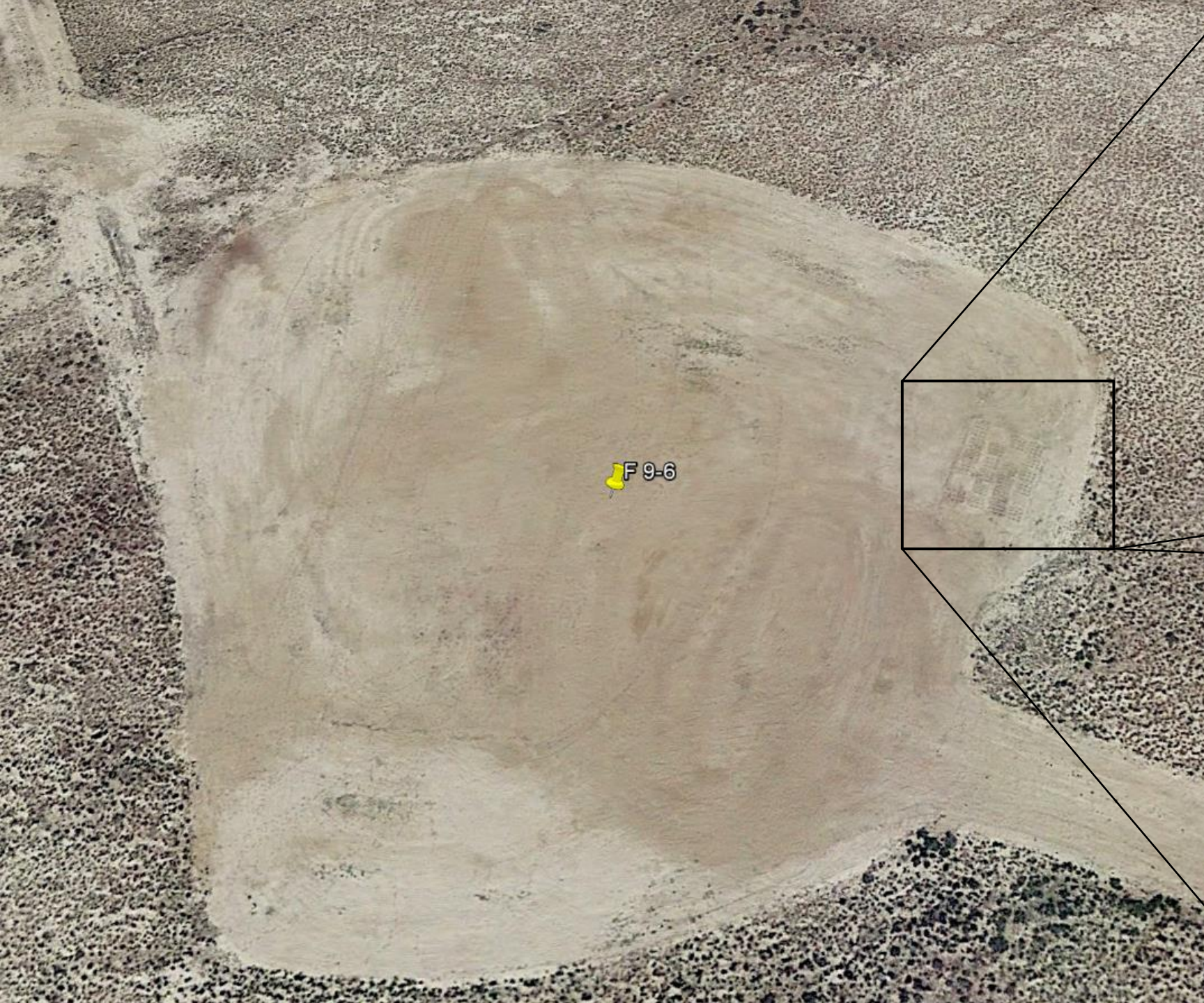


Capillary Barrier



Reclamation Pie with Wings

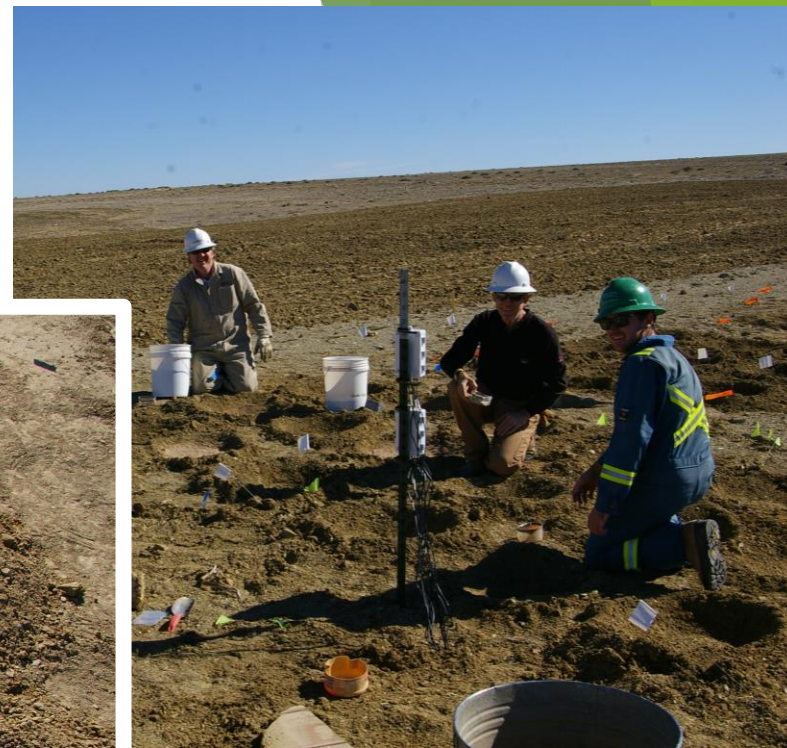
0 Centimeters 25

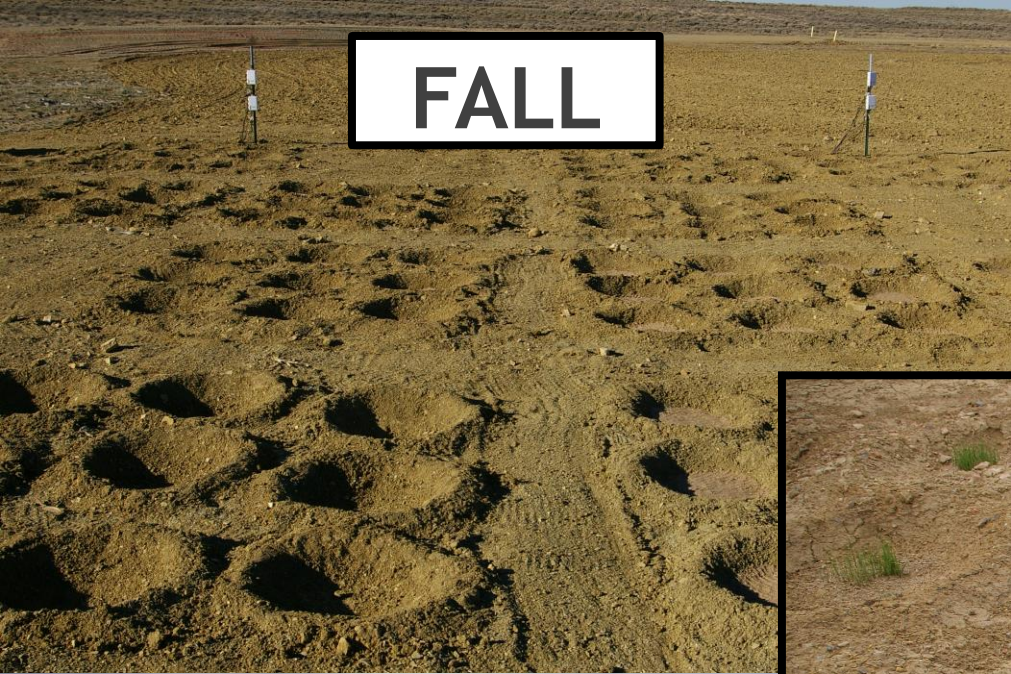


Tools for the Job



Construction Commences





FALL



WINTER

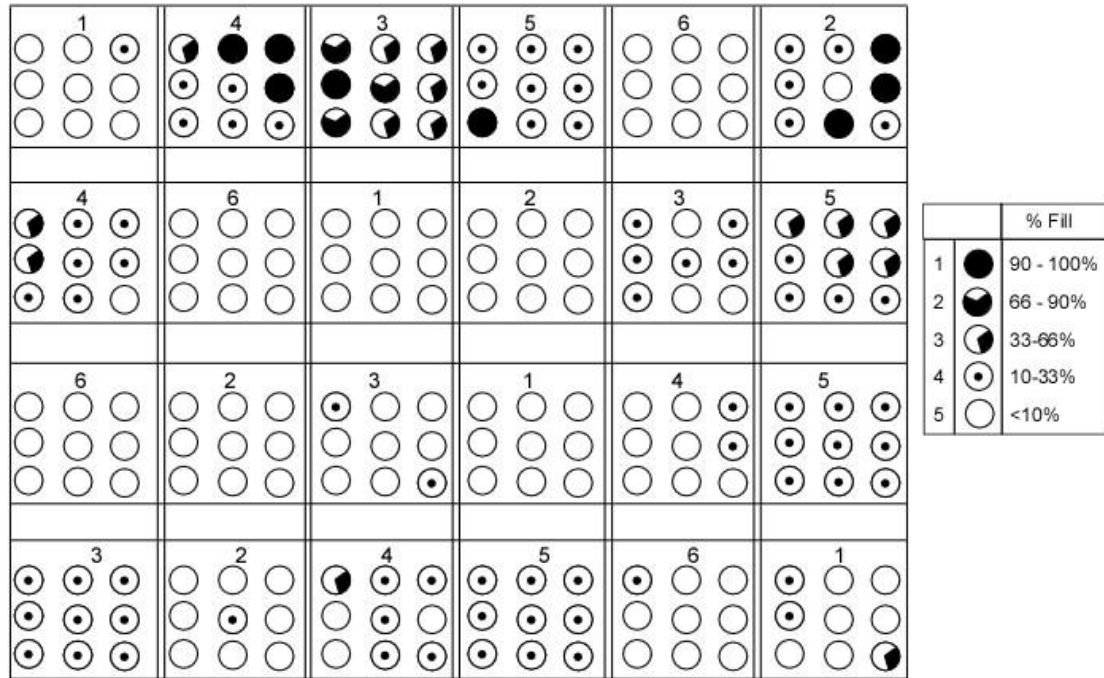


SPRING



Assessing Snow Collection on Both Sites

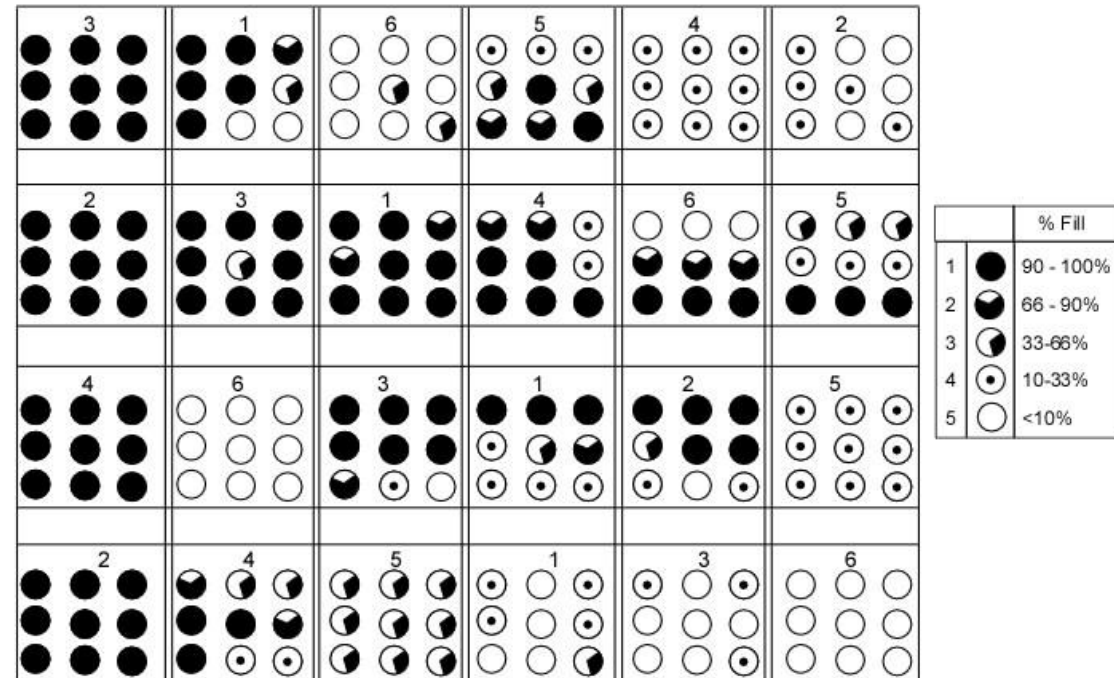
FREWEN 9-6 Snow Cover Measurements



LEGEND	
1. Mulch and Capillary Barrier	4. Capillary Barrier
2. Mulch, Capillary Barrier and wings	5. Depression
3. Mulch	6. No pit

10'

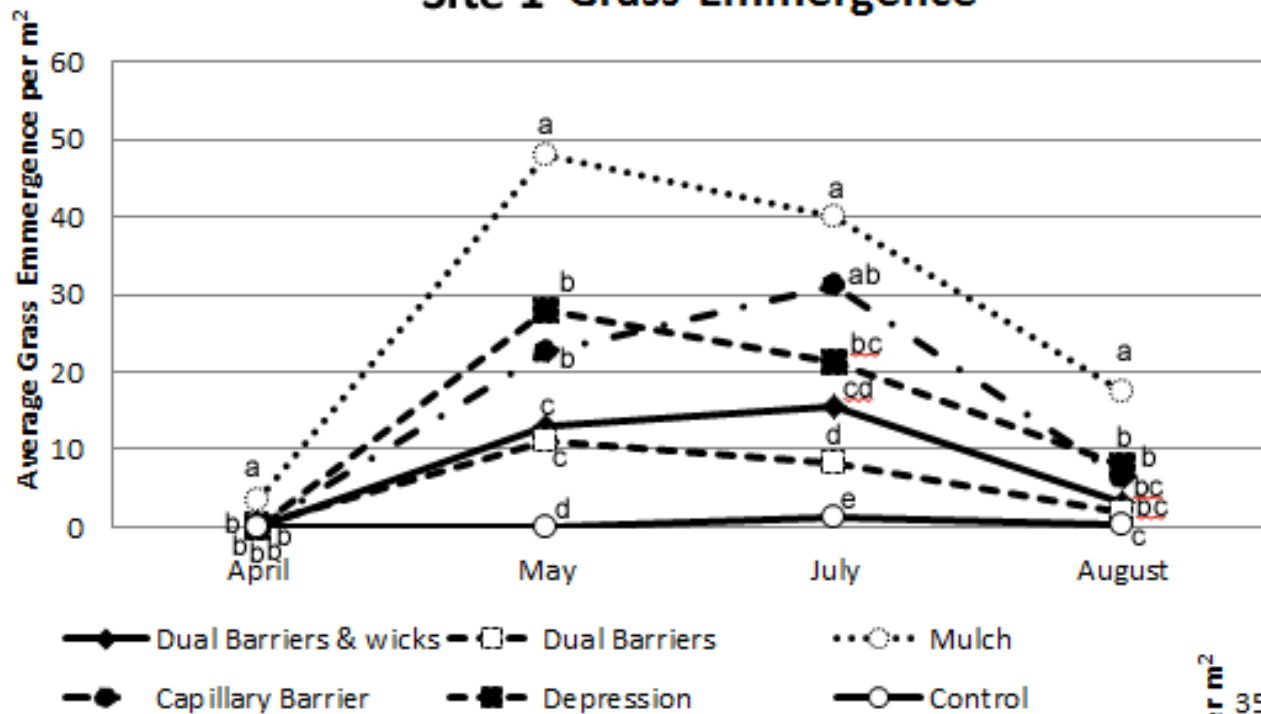
FREWEN 17-2 Snow Cover Measurements



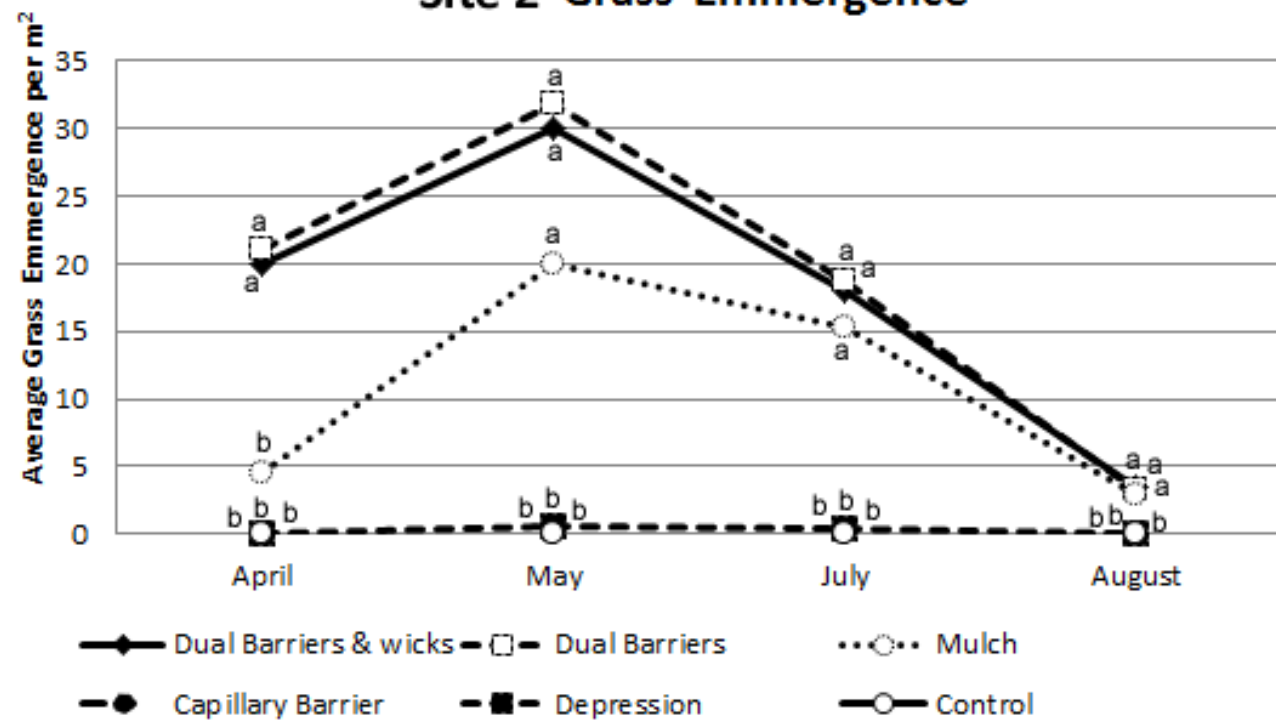
LEGEND	
1. Mulch and Capillary Barrier	4. Capillary Barrier
2. Mulch, Capillary Barrier and wings	5. Depression
3. Mulch	6. No pit

10'

Site 1 Grass Emergence



Site 2 Grass Emergence



Site 2 May



EFFECT OF LOWER CAPILLARY BARRIER



Site 2

Site 1



Change in Electrical Conductivity (dS/m) after 18 months (Salt)

Treatment	Site 1 (5.2 Initial)	Site 2 (4.3 Initial)
Dual Barrier	-0.19 ± 0.84a	1.142 ± 2.99a
Dual w/ Wicks	-0.40 ± 0.54a	2.188 ± 3.07a
Mulch	3.16 ± 1.47b	1.55 ± 4.14a
Low Barrier	-1.57 ± 0.43a	-0.86 ± 2.55a
Pit	-2.87 ± 1.13a	2.15 ± 1.14a
Bare Soil	6.69 ± 0.84c	1.47 ± 2.50a

Column Studies

Measuring Evaporation

SIX TREATMENTS IN CRBD

EQUILIBRIUM WETTING AND DRYING CONDITIONS

SAND THICKNESSES AND TEXTURES

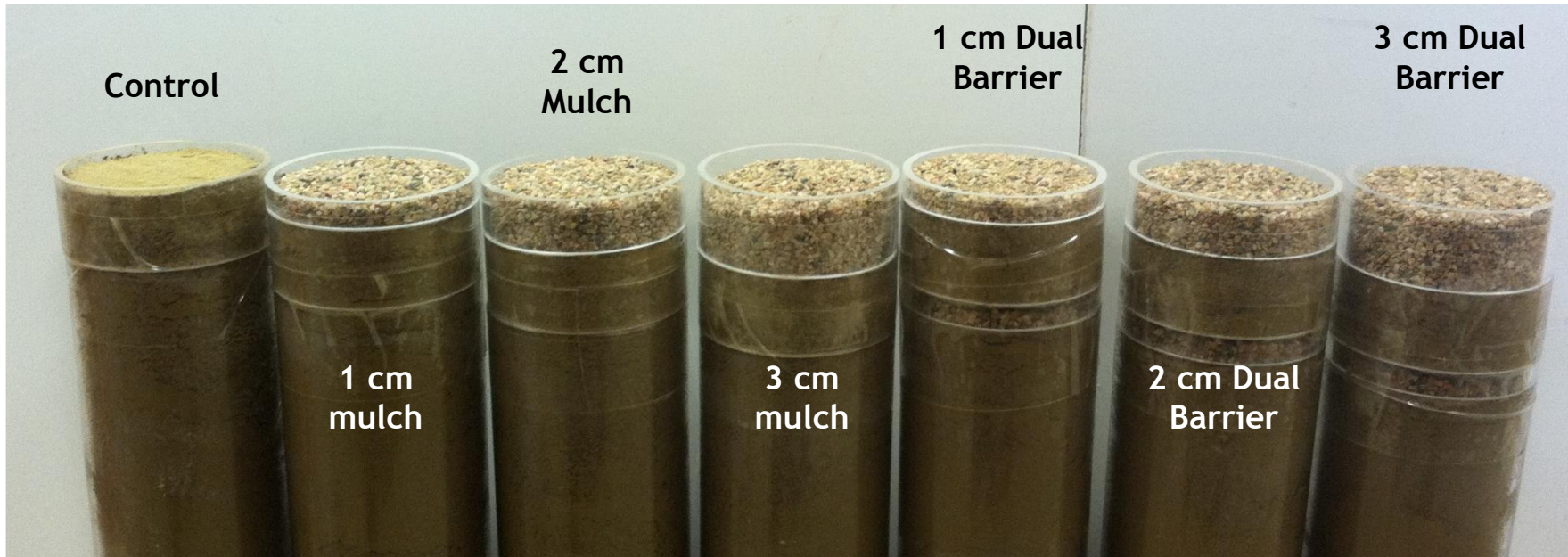
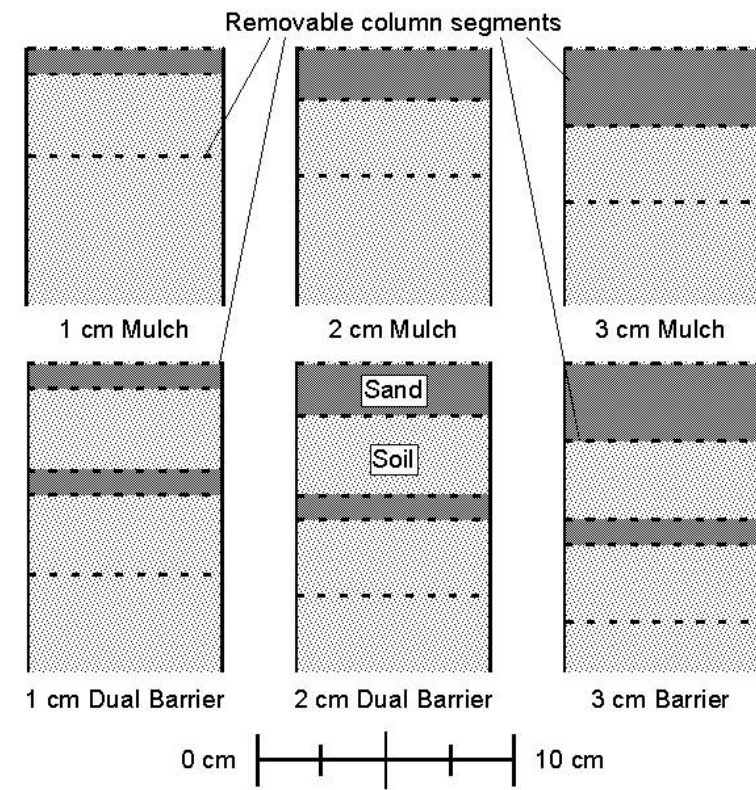
30 DAYS OF EVAPORATION



Treatments

SIX TREATMENTS

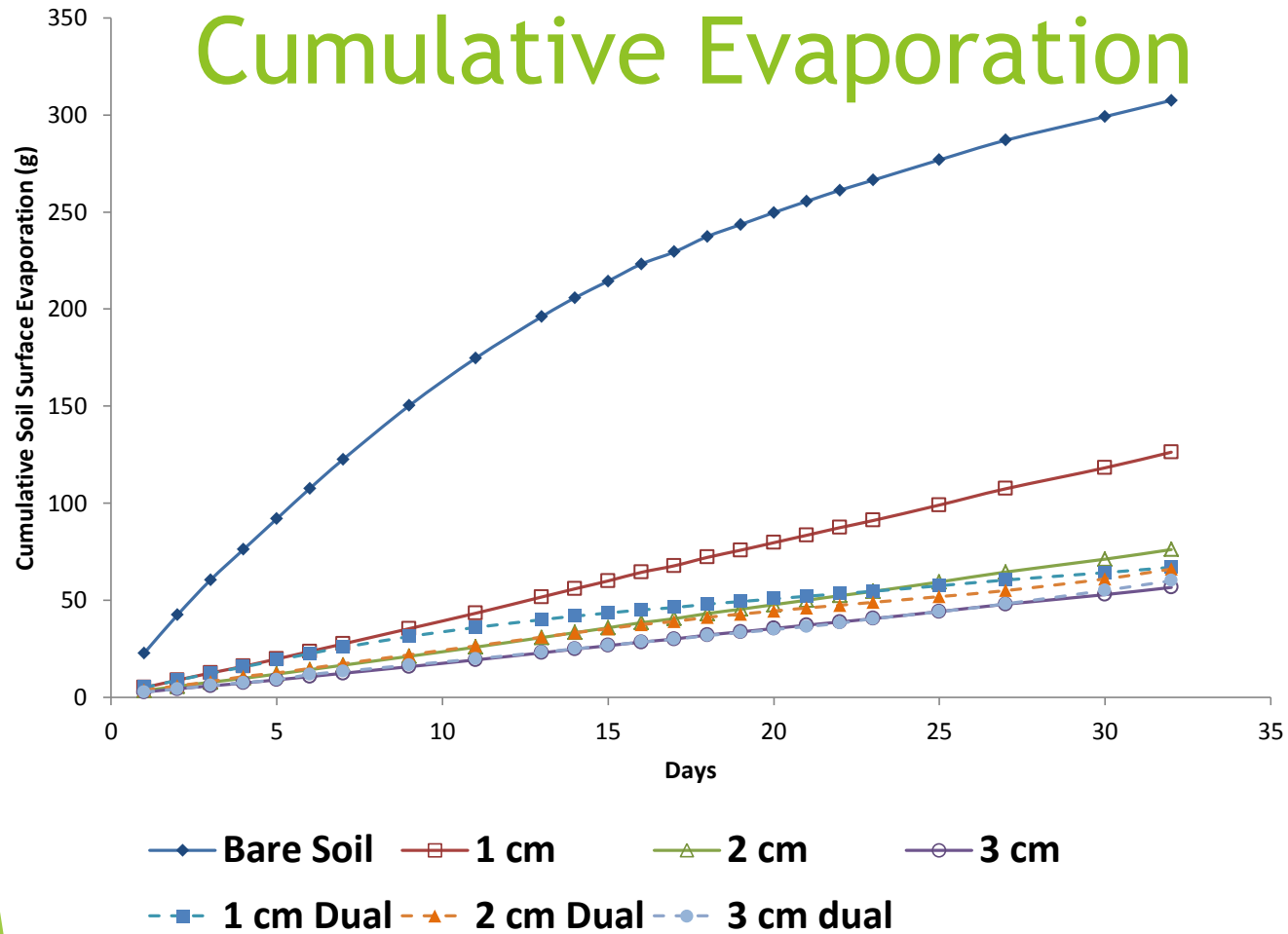
3 MULCHES



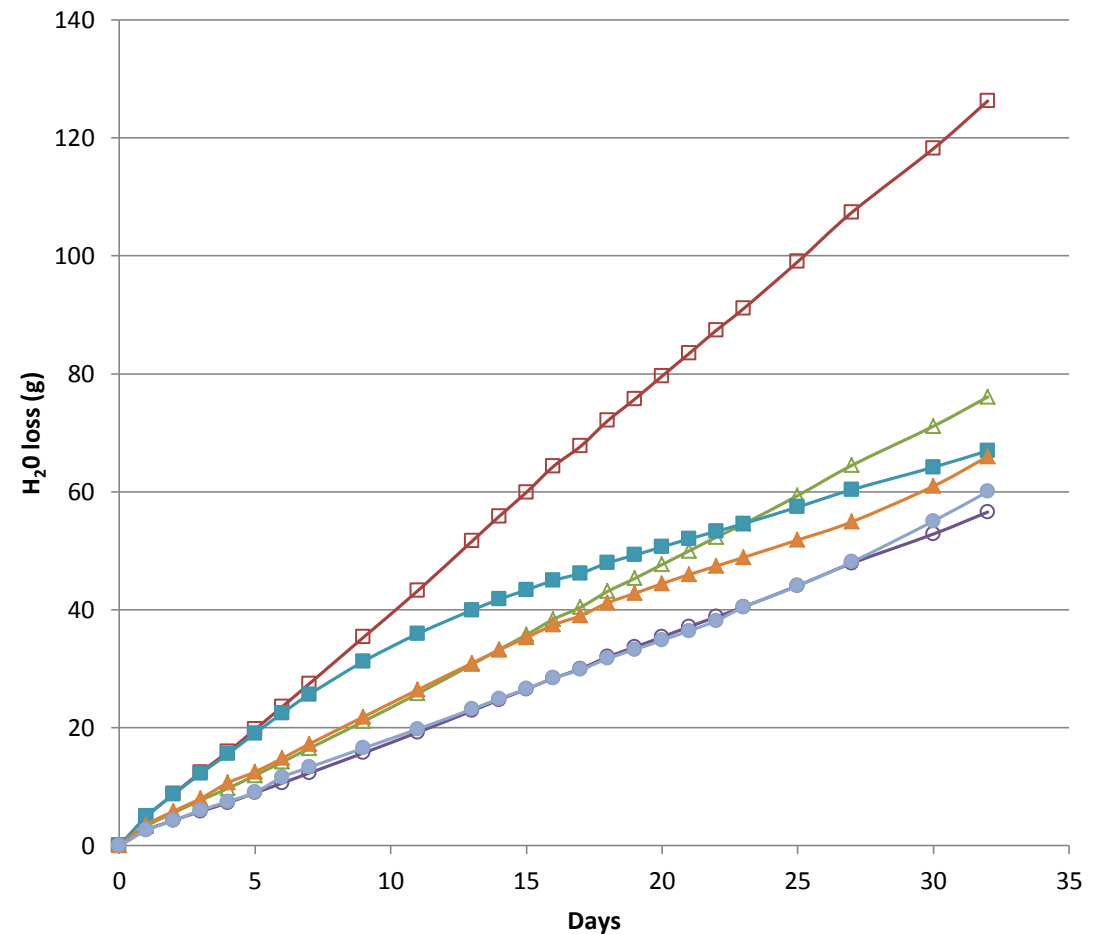
Wetting and Drying of Columns



Cumulative Evaporation



Cumulative Evaporation Without Control



A closer look at the data

MULCH AND DUAL BARRIERS

Average Evaporation Rates (mm/d)

Treatment	Week 1	Week 2	Week 3	Week 4	30 day avg
1 cm Mulch	0.93	0.96	0.92	0.93	0.93
2 cm Mulch	0.56	0.57	0.56	0.56	0.56
3 cm Mulch	0.42	0.42	0.41	0.42	0.42
1 cm Dual Barrier	0.87	0.57	0.34	0.32	0.51
2 cm Dual Barrier	0.58	0.55	0.43	0.36	0.48
3 cm Dual Barrier	0.45	0.40	0.38	0.47	0.43
Bare Soil	4.15	2.92	1.66	1.21	2.39

SAND TEXTURES

Average Evaporation Rates (mm/d)

Treatment	Week 1	Week 2	Week 3	Week 4	30 day avg
2.0 - 3.0 mm	0.56	0.55	0.54	0.54	0.55
2.0 - 1.7mm	0.56	0.53	0.53	0.54	0.54
0.5 - 2 mm	0.56	0.54	0.52	0.54	0.54
0.25 - 0.5 mm	0.68	0.60	0.58	0.58	0.61
0.1 - 0.25 mm	0.60	0.53	0.51	0.52	0.54
0.1 - 2.0 mm	0.59	0.55	0.53	0.55	0.56
Bare Soil	3.68	3.01	2.19	1.11	2.38

Conclusions:

MULCH WINS!!!

- Sand is an effective mulch - texture is irrelevant - thickness is not
- Pits catch snow in windy Wamsutter
- Water is the primary driver of vegetation growth AND salt leaching
- Combining pits with sand mulches increases growth
- Dual Barrier treatments need additional time to leach salts

Acknowledgements - Thanks!!



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