3/8/2024: Blake Sanden and Louise Ferguson

SALT TANK OPTION TO RESTORE SEMI-SALINE IRRIGATION WATER TO MARICOPA SALINITY DRIP TRIAL

We propose to install salt tanks and injection equipment at the test plot site to increase the canal water salinity (~0.5 dS/m EC) to the level of the original well water salinity (~2.5 dS/m EC).

The calculations below are for the added/injected salt load necessary to make this possible. A concentrated NaCl solution would only require a 2.5 gpm injection rate into the 3 manifolds (0.84 gpm/manifold) that service the test plot area. As there is no power to the trial area, this could be achieved with a water flow operated Dosatron or solar/battery powered injection pumps and 3, 3000-gallon poly tanks placed at each manifold. Salt mixing would be achieved with a gas-powered sump pump, adding bags of salt by hand. We need to dig down to each manifold line on the first trial row (Row 139), install injection ports and a riser topped with a 3" valve for the purpose of filling the tanks with water. The Excel sheet with the below calculations is attached. To keep up with the mid-summer irrigation demand this requires loading and mixing each tank with 2.25 tons of salt by hand every 7 days; this would be done by the postdoc, Mukesh Mehata and CSU summer student assistant . There is a little calcium in the well water (about 1 part Ca to 5 parts Na). This will be supplied by a 2-foot banded application of Lima pit gypsum (~85% purity) @ 1 ton/applied acre on top of the berm over the hose (using a Ranchero side deliver spreader) every 2 – 3 weeks. Details for the summarized calculations below are attached: Att_I_Test plot Area and Rqd Flow GPM.xlsx.

Density dry NaCl: 2.16 g/cm^3

The solubility of sodium chloride is 35.7 g/100 mL water at 20°C. | 1 US gallon = 3785 ml (cm3) water | @ 35% solubility = 1324.8 (grm NaCl/gal) = 613.310185 (cm3 NaCl/gal)

NaCl: for field temps assume 35 g/100 g water = 15.6% brine = 1.51 lb/gal | **Final solution density =** (613 cm3 salt + 3785 cm3 water)/3785 cm3/gal) = 1.16 gals

= 4397 (grms/gal) = **9.69 (lb/gal)**

= **1.51 (lb salt/gal)**

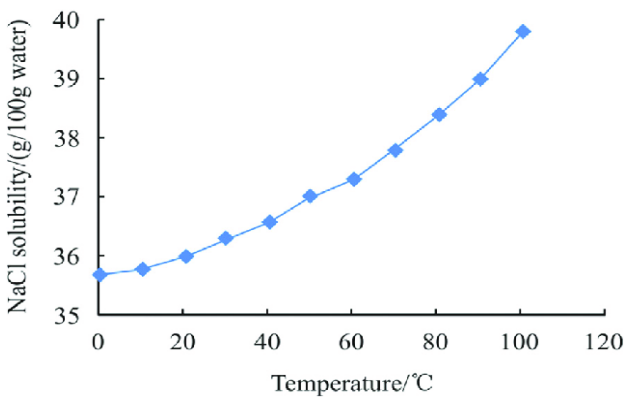
FLOW REQUIRED TO TESTPLOT + EXTRA TREES ON 3 MANIFOLDS

= 243 (trial area) + 41.4 (rows to W) + 75.8 (trees to S) = 360 gpm

Irrigation flow to each manifold = 120 gpm

WELL WATER QUALITY: Calculated

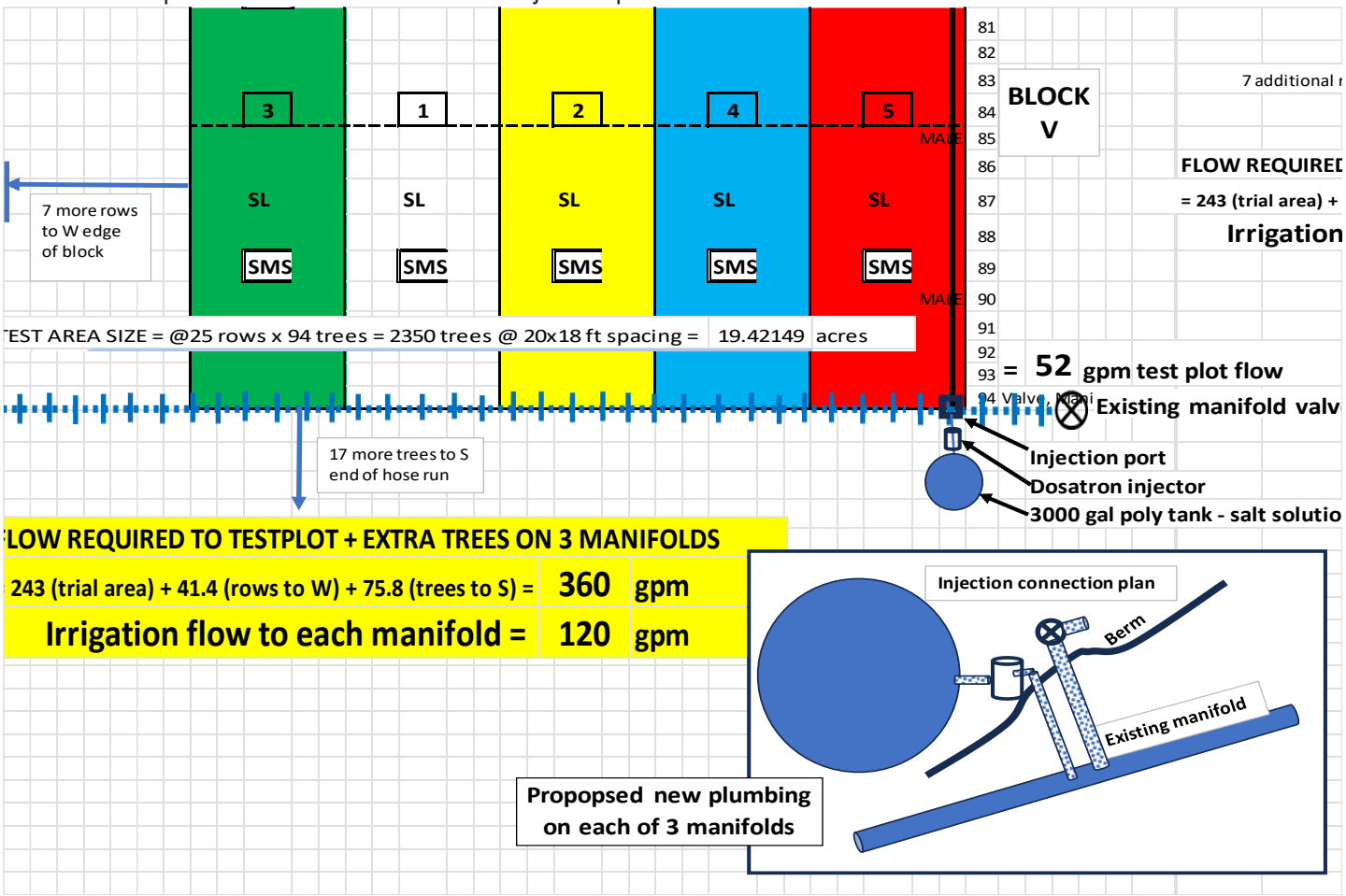
Description	Date Sampled	Time Sampled	at 25°C unit	EC dS/m	Ca meq/L	Mg meq/L	K meq/L	Na meq/L	SAR calc	SAR calc	Cl meq/L	B mg/L	CO_3 meq/L	HCO_3 meq/L	Fe mg/L	Mn mg/L	SO_4 meq/L	---------NO_3-N--------- mg/L	lbs N/ac-ft	L.I. calc	TDS mg/L	TDS @ 640*EC mg/L
WELL WATER																						
Coehlo Well	10/5/20	11:00	7.8	2.08	3.87	0.76		15.2	10.0	14.6	11.4	1.5	6.9	0.9	<0.10	0.0	6.90	<0.1		-0.1	1220	1331.2
Irrigation Well	10/28/22	12:51	8.1	2.54	3.2	0.2	0.06	**15.90**	**12.30**	**16.60**	9.7	1.68	ND	1.36	ND	0.05	8.4	0.3	0.8	0.1	1220	1625.6
CANAL WATER																						
Westlands TO	4/29/22			0.57	3.0			2.48			2.34	0.17					0.52	0.6			340	367.36
						(Actual number not available from Westlands. Estimated by making the additional ions to reach EC of 0.57)																
Post Filter Rep 3	7/19/23	11:00	7.6	0.19	0.6	0.5	0.03	0.81	1.13	0.95	0.6	0.07	ND	0.80	ND	ND	0.3	0.3	0.8	-1.3	125	121.6
						(Much lower canal water salinity than usual due to the record runoff year for 2023. 2022 EC is more typical.)																



ADDED SALT (using NaCl for increasing CANAL TDS to equal WELL water TDS):							
Assume average WELL WATER TDS = 1600 ppm (EC = 2.5 dS/m)							
Assume average CANAL WATER TDS = 350 ppm (EC = 0.55 dS/m)							
NaCl only per 3,000 gal tank serving 1 manifold @ 120 gpm:							
Mass of added salt to make up difference =	1250	ppm, mg/l =					
0.0104	(lb/gal irrigation) =	1.25	(lb/120 gpm) =	75.06	(lb salt/hr)		
Injected volume of NaCl solution to be injected @ 1.51 lb/gal:							
=	49.8	(gals solution	597	(gal/12 hr set)			
=	0.83	(gpm solution injection flow)					
=	4,523	lb salt per 3000 gal tank @ 1.51 lb/gal					
=	3,615	minutes irrigation/3000 gal =	5.02	12 hr sets			
=	1.58	inch applied water @ 0.63 in/day in 5.02, 12 hr sets					
=	7.53	days in July @ 0.21 in/day ET					
=	42.9	tons NaCl per tank for season @ 30" ET/Irrigation					

Added Solubor needed (@ 21% B)							
Need to add 1.5 ppm B to canal water = 7.2 ppm Solubor							
=	0.007	lb injection of Solubor per minute					
=	5.2	lb Solubor per 12 hr set					
=	26.1	lb per 3000 gal tank					
=	494.1	lb Solubor/tank for season @ 30" ET/Irrigation					

Here's the simple schematic for each of the 3 injection points.



Blake has remaining UCCE Farm Advisor funds to cover the cost of the plumbing modifications, pumps, Dosatron and power supply. Joe Coehlo of Valley Orchard tentatively can provide the three poly tanks and logistical support.

We would need to increase the budget to cover the cost of the salt and Solubor:
Quoted delivered cost : salt: $46,648 and Solubor: $3,144 = $52,092 total. I (Louise Ferguson) can cover ~50% of this with the CDFA funds I have been using to supplement this experiment. We are requesting an additional $26,046 to our proposal budget; our original proposal with a revised budget is attached: Att. II. Proposal HA-2024_23 Modifications_2024_03_08.