Calculations Showing Reductions of SO_2 Treatment of Salton Sea Waters

New/Neutralized Water Calculations:

1 mole Diprotic H2SO3 reduces 2 moles Bicarbonate netting 1 mole new water:
Direct Drain (Agricultural) water: 300 mg/L, or .3 gram/L x 3.785gal/L = 1.1355 gr/gal. Converting to moles 1,1355 gr. bicarbonate/61gr/mole bicarbonate = .018615 moles bicarbonate/gal**.** Direct Drain 93,000,000 gal flow/day x 365 days/year x .01865 moles bicarbonate/gal = 631,880 M moles bicarbonate/yr**.** Dividing by 210.04 moles water/gallon = 6,016,738 gallons total water generated by bicarbonate reduction**.** Subtracting the 1 mole water sulfurous acid reduced, leaves 3,008,369 gal/year new water produced by Direct Drain water reduction.
New water for Alamo = 259mg/L /300 mg/L x 551 MGPD/93MGPD x 6,016,738 gal/year = 30,775,723 gallons/year.
New water for New River = 300 mg/L/300 mg/L x 436.0 MGPD/93MGPD x 6,016,738 gal/year = 28,207,503 gallons.
New water for Whitewater = 245 mg/L/300 mg/L x 47 MGD/93MGD x 209,990.35 gal/year = 2,483,252 gallons/year new water for Whitewater.
Total New Water: 61,466,478 gallons/year

Bicarbonate Salt Reduction:

1.1355 gr/gal x 93,000,000 gpd x 365 day/yr /453.59 gr/lb = 84,976,625 lbs/yr or 42,488 tns/yr Direct Drain (Ag Water)
259 mg/L x 551,000,000 gpd x 365 day/yr/453.59 gr/lb = 1.148×10^{11} lbs/yr or 57,418,356 tns/yr Alamo
300 mg/L x 436,000,000 gpd x 365 day/yr/453.59 gr/lb = 1.053×10^{11} lbs/yr or 52,626,821 tns/yr New River
245 mg/L x 47,000,000 gpd x 365 day/yr/453.59 gr/lb = 9266022179 lbs/yr or 46,330,011 tns/yr Whitewater
Total Bicarbonate Removal: 156,417,676 tns/yr Bicarbonate Removal

Direct Salton Sea Treatment

Assuming 1 AH Lundberg molten sulfur burner at 110 tons Sulfur/day x 2000 lbs/ton = 220,000 lbs Sulfur/day/32 lbs Sulfur/lb mole S = 6,875 lb mole S/day x 365 days/yr = 2,509,375 lb moles S/yr.

2,509,375 lb moles S/yr produces net 2,509,375 lb moles water/yr x 18 lbs/mole H20 = 45,168,750 lbs (22,584.4 tns) new water/yr x 0.119826427 gal/lb mole water = 5,412,409 gallons new water/yr/100 tons Sulfur/yr.
Direct Salton Sea application also neutralizes/removes 2 bicarbonates or 2,509,375 lb moles S/yr x 2 moles $HCO3^-$/lb mole S x 61 lb bicarb/mole bicarb. = 3.0614 x 10^8 lbs/yr (1.53 x 10^5 tns) of .3 mg/L Salton Sea bicarbonates. Solving for x gallons neutralized Salton Sea water assuming .3 gr/L;
x gallons times 2.504 x 10^{-6} lb bicarb/gal = 3.0614 x 10^8 lbs bicarb/yr bicarbonate. Solving for x = 3.0614 x 10^8 lbs/2.504 x 10^{-6} lbs/gal = 122,260 x 10^8 MG neutralized water of the Salton Sea. This is a net increase of 1.52006 x 10^8 MG gal bicarbonate neutralized Salton Sea water + 671,600 gal new water = **1.52007 x 10^8** MG bicarbonate free water/year.

TSS Removal

Excess acid at >pH 6.5 will agglomerate the total suspended solids, which are negatively charged colloids. This reduces the TSS as follows:

Alamo River TSS of 357mg/l to < 10 mg/l or 551 MGPD x 365 days/yr x 3.785 l/gal x 347 mg/l = 2.6414 x 10^{14} mg TSS/year reduction or 264,143/453592 mg/lb = 582.34 M lb/yr
New River TSS of 217 mg/l to < 10 mg/l or 436 MGPD x 365 days/yr x 3.785 l/gal x 207 mg/l = 1.2469 x 10^{14} mg TSS/year reduction or 274.88 M lb/yr
Whitewater River TSS of 95.7 mg/l to < 10 mg/l or 47 MGPD x 365 days/yr x 3.785 l/gal x 235 mg/l = 1.5259 x 10^{13} mg TSS/year reduction or 33.640 M lb/yr
Expected TSS Reduction: 890 M lb/yr

Colliforms

New River Fecal coliform concentrations at the international boundary- Calexico, California typically average >16,000 MPN/l00 ml. At pH 3.5 for 30 minutes sulfites reduce fecal coliform to ~ 2 MPN. If UV sulfite excitation is employed for nitrate reduction, fecal coliforms are reduced to 0 MPN

Nitrogen

UV energized sulfites remove Nitrates without bioremediation.