John A. Johnson
Bureau of Reclamation
Lower Colorado Region Office

In response to Letter to Interested Parties

Pre-proposal - October 9, 2005

We at Solar Power&Water offer a system or tool which can be used in several applications to deal with problems of interest to the Bureau of Reclamation**:**
   1. recovery or replacement of agricultural return flows from the Wellton-Mohawk Irrigation and Drainage District
   2. support operation of the Yuma Desalting Plant (YDP) by supplying the electricity and consolidating the YDP waste
   3. lower the groundwater elevations in the Yuma area to stop water flowing underground from the United States into Mexico that is not counted as part of Mexico's treaty deliveries
   4., supply Yuma with power and fresh water derived from brackish groundwater
   5., treaty deliveries to Mexico

Our system is based on a salt gradient solar pond and a low pressure expander. The pond is supplied with water containing dissolved solids such as agricultural return flows, YDP wastes, groundwater, etc. Hot brine from the pond bottom flows to the expander in which some of the brine flashes to steam as the expander turns to drive an electrical generator. The un-flashed concentrated brine is returned to the pond bottom. Our system is unitized with a pond normally 60 acres and an expander sized to drive a 1 MW generator. The products are electricity and steam condensate fresh water. For illustration, we represent our system as a Water and Power "Farm" as shown in the figure, and herein called a pond/plant.

Proposals:
Regarding 1., drainage recovery or replacement: pond/plants receive the drainage and produce fresh water and power. The fresh water can be blended as appropriate and sent to Mexico as part of the treaty delivery or returned to the Colorado River.
Regarding 2., pond/plants can be located near the YDP to receive the waste and produce the power necessary to run the plant. The fresh water can be used for best purpose.
Regarding 3., pond/plants can be located near Yuma to remove groundwater for the purpose indicated and produce more fresh water and power.
Regarding 4., with pond/plants,Yuma can be supplied with fresh water and power.
and Regarding 5., by arrangement with Mexico, pond/plants can be installed in Mexico to provide fresh water there in sufficient amounts to meet our treaty obligations. Mexico benefits because it gets pure water instead of water of Colorado River average salinity plus 150 +/- 30 PPM. The installations can be owned or structured so that Mexico uses the power or contracts to deliver it to a US utility. And we keep all the Colorado River water. (Separately, all the needs of the Cienega de Santa Clara can be supplied totally from within Mexico.)

Our system produces a pond bottom brine layer of about 250,000 PPM. This represents a roughly 100-fold reduction in volume of the inlet wastes. The ponds can be sized to accumulate 20 years of brine, holding it for convenient disposal, such as via the drain to Mexico during heavy rains, or routinely by injection wells, or sending to the existing sludge waste ponds.

For examples of proposed uses of our system, please read our Lake Cahuilla proposal for restoring the Salton Sea to any desired elevation and salinity. This proposal reaches outside of the Imperial Valley to locations in the Lower Colorado River Region. This proposal presents considerable detail about our system. The proposal is attached and is available on CD with references.

In considering this response to your invitation to interested parties to submit potential methods to recover or replace the bypass flow, it can be seen that we offer a versatile means, or tool, which can be applied to many of the Bureau of Reclamation matters of concern. We would be pleased to work with you to focus our proposed support where it serves you best.

One more thing. We wish to point out that ours is a low cost producer of electricity. This can be seen on our System Comparison table. A consequence of this is that in our Salton Sea restoration application, our plan becomes not only free but produces a net income from power sales.

Acknowledging that our unit system might be considered small, and perhaps larger sizes can be built, it will be recognized that a grower of, say oranges, who wants to grow many oranges, does not look for a giant tree but plants as many as are needed.
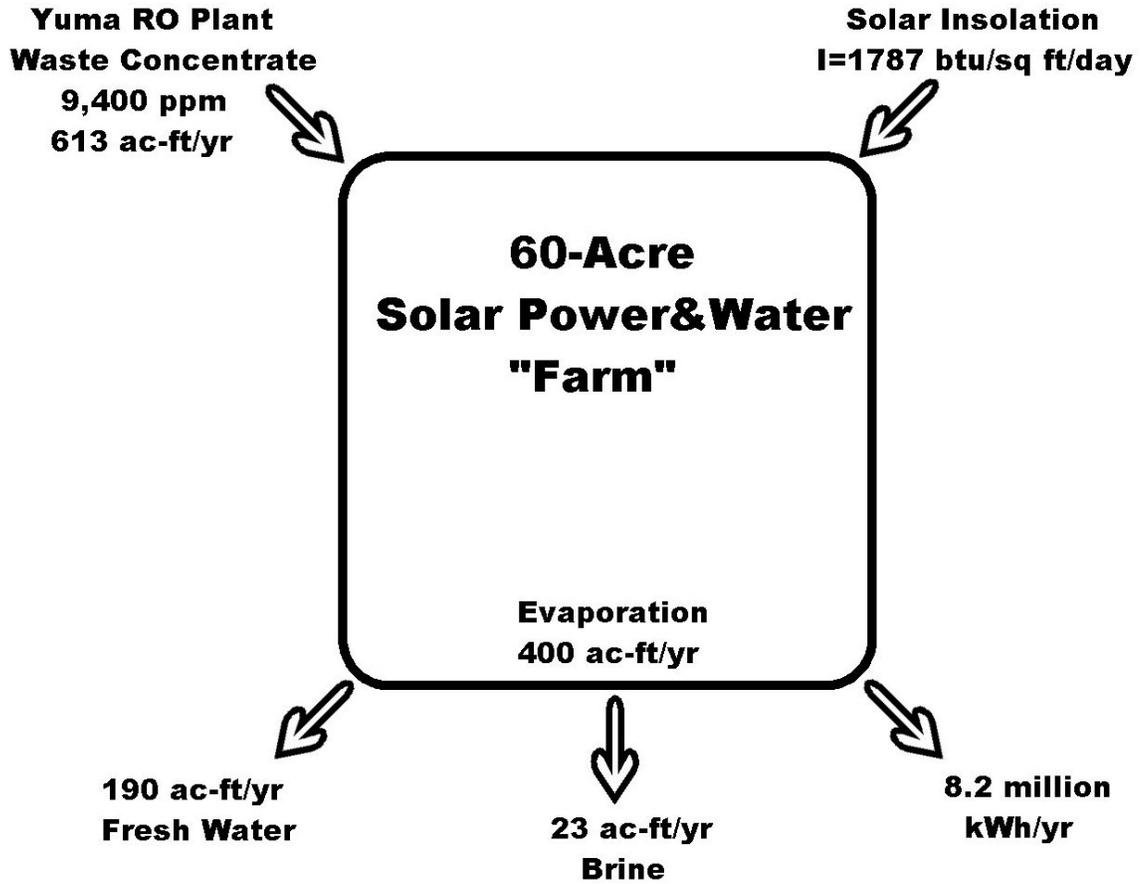
Pond/plant Quantities est.
For 1., 176 pond/plants will be needed to receive the drain water. 2/3 of the water will be lost to evaporation. The pond/plants will produce 1.44 billion kWh/yr and 33,000 ac-ft/yr fresh water.
For 2., 46 pond/plants will be needed to accept the YDP waste, with the power from 20 of these needed to operate the YDP. Pond/plants adjacent to the YDP can heat the RO input water to increase the throughput.
For 3. and 4., the amount of groundwater to be removed and processed will determine how many pond/plants will be required.
For 5., Many pond/plants will be required if Gulf water is processed to fulfill the obligations to Mexico, with or without RO. The power production would be large (~8,500 MW).

Notes**:** The literature reports that salt gradient solar ponds cannot support power generation; they can if operated properly. The power generated is green power, suitable for use in meeting RPS goals**;** funding support should be available.

Yuma RO Plant
Waste Concentrate
9,400 ppm
613 ac-ft/yr

Solar Insolation
I=1787 btu/sq ft/day

60-Acre
Solar Power&Water
"Farm"

Evaporation
400 ac-ft/yr

190 ac-ft/yr
Fresh Water

23 ac-ft/yr
Brine

8.2 million
kWh/yr

System Comparison

	Desert Water Agency Solar PV System	Semitropic Water Storage District Solar PV System	Solar Power&Water Solar Pond System
Annual Electrical Energy Production	662 MWh	1,700 MWh	8,200 MWh
Cost	$2.4 million	$6 million	$2.5 million
Cost (After Rebate)	$1.2 million	$3 million	$1.25 million
Pure Water Production	None	None	190 ac-ft/yr
Energy Storage, Peaking	None	None	Yes
Income @ $150/Mw-hr and $250/ac-ft	$99,300	$255,000	$1.275 million
Operating Cost	$20,000	$40,000	$324,000
Net Income	$79,000	$215,000	$951,000
Return on Investment	15 Years	14 Years	1.32 Years

Richard McKay, richard@solarpandw.com
Roger Sprankle, rogers@solarpandw.com
Solar Power&Water