Who needs an ocean? San Joaquin Valley projects give new life to salty water

By Mark Grossi
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A glistening spectacle on the west Fresno County prairie could be a rock star in California's next drought.

It's a mirrored solar array longer than a football field, collecting heat to boil salt and other impurities out of irrigation drainage. The cutting-edge experiment — capable of producing heat up to 600 degrees — is only one of three desalination projects going at this site.

Betty Hurley Lindeman of the Panoche Water and Drainage District looks over the engineering that went into the WaterFX Desalination solar array's 377-foot-long SkyTrough parabolic mirror | JOHN WALKER jwalker@fresnobee.com

Unlike more than a dozen well-publicized projects planned to desalt seawater, these San Joaquin Valley projects were not a reaction to the drought. But this irrigation drainage cleanup campaign could easily wind up creating a useful new source of water.

"We're looking at recovering a lot of water that can be used again," says Dennis Falaschi, general manager of the Panoche Water and Drainage District, which spearheads the desalination efforts. "It could become a huge benefit."

Desalination is not strictly a coastal concept. In the west Valley, it dates back a half century to a desalination project in Coalinga.

The technology is among Valley water stories that The Bee will tell this month in a weekly series. These stories will go beyond the crisis to give a fuller picture of water in the country's highest-earning farm belt — an industry worth $37 billion annually.

After today's story, The Bee will take a deeper look at three other water topics, developing a fuller explanation of water use among individual crops, a broader view of groundwater in the Valley and the cutting edge of farm irrigation technology.

Underground sea of farm water

Desalination may seem the most unlikely of the topics. There hasn't been an ocean in the Valley for millions of years, but there is a sea of brackish irrigation drain water trapped below the ground on the west side. And it's no secret.

In 1965, UCLA built the world's first reverse-osmosis desalination project in Coalinga. Using high-pressure flows, brackish groundwater was forced through a membrane with microscopic openings.

It successfully trapped contaminants, but it eventually clogged and bogged down with elements in the water — selenium, boron, molybdenum, mercury and arsenic.

The same thing happened in the next UCLA experiment in the 1970s when the university built another reverse-osmosis project in Firebaugh. The buildup of contaminants on the membrane eventually forced it to shut down the

effort.

“The problem is well-known,” says UCLA Professor Yoram Cohen, who has researched desalination for the last 35 years. “Reverse-osmosis works in the lab, but you need to be in the real world to find out how to really make it work.”

That’s why UCLA is running an experiment now at a site on Russell Avenue, right next to the monster solar array. But in terms of approach, UCLA is miles apart from the solar project.

Researchers refined and automated reverse-osmosis to the point that nobody needs to actually be on-site to monitor the process. A 40-foot cargo container at the Russell Avenue experimental site in west Fresno County contains a mini version of large-scale reverse-osmosis, along with layers of pre-filtering and sophisticated monitoring technology.

From the Southern California campus, Cohen and colleague Anditya Rahardianto can see real-time data on water flow and contamination levels.

The system also produces frequent and easily accessed digital photographs of the reverse-osmosis membrane itself. The computer at the research container can quickly detect a problem. It makes changes to slow the amount of brackish water entering the process, sends in rinse water and clears away the problem.

Catching a problem fast enough to correct it will save time and money.

“Technology is bringing down the cost,” Cohen says. “I can see this technology being used for isolated rural areas in the San Joaquin Valley to clean up contaminants in the drinking water.”

There’s no shortage of brackish water on the Valley’s west side. It is trapped on lenses of clay beneath the ground — remnants of past streams and lakes, according to the U.S. Geological Survey.

The bad water rises as it accumulates after irrigation. Eventually, it poisons the ground above, and nothing will grow. The same phenomenon has happened to irrigated agriculture in many places all over the globe.

The federal government, which knew about the issue before west-side agriculture expanded in the 1960s, has been trying to solve the drainage problem for decades.

Compelled by a federal court order over a farm drainage lawsuit, the U.S. Bureau of Reclamation works with the Panoche Water and Drainage District to construct a pilot plant along Russell Avenue to desalt the water, removing naturally occurring elements such as selenium and boron. Officials hope to expand the cleanup process to hundreds of thousands of west-side acres.

Drainage water to irrigate

Falaschi represents farmers who need to stop discharging selenium into the San Joaquin River. In high concentrations, selenium is toxic to wildlife. Falaschi’s group wants to protect the river and save a 97,000-acre piece of farming worth nearly $500 million a year.

Farmers in this area use efficient drip irrigation on their crops, then capture any runoff below the roots of the plants and funnel it to 6,000 acres of once-barren land.

To collect the drainage, perforated pipe is buried beneath the crops, and the water moves into the pipes after it passes through the root zone. The collected drainage water then is used on the 6,000 acres to irrigate salt-tolerant crops, such as pistachios and Jose tall wheatgrass. The wheatgrass is used as feed at dairies.

After irrigating the 6,000 acres, a much smaller amount of highly concentrated drainage is again captured and sent to the desalination plant for cleanup.

A mashed lump of concentrated selenium sludge is left over. It is classified as hazardous waste, meaning it must be taken to a special landfill, such as Kettleman Hills in Kings County.

“The brackish water is not as salty as seawater,” Falaschi says. “But the brackish water is complex because of the mineral content. We’ve been reducing our discharges to the river for many years. We’re not discharging anything this year.”

Boiling out impurities

The pilot plant is not nearly as eye-catching as the visuals at the 377-foot-long, mirrored solar array out front. It’s called SkyTrough, an immense water distillation process, boiling salts out of the water.

The trough shape magnifies the sun’s heat up to temperatures up to 660 degrees. But the distillation project doesn’t need that much heat. Less than half as much will do the job, says Aaron Mandell, co-founder of WaterFX, the company involved in the experiment.

The heat is focused on a long tube carrying a mineral oil from one end of the solar array to the other, collecting the heat. This heat boils saltwater in several stages, producing steam that is cooled and becomes pure water. The salts are left behind in a solid form.

“It’s very important to remember you need a lot of energy for desalination,” Mandell says. “That’s a big cost. Solar makes it far more cost-efficient without the air quality issues related to fossil fuel production.”

The next step in this project is to expand. If the project stays on schedule, there will be 35 more of these troughs spread over 75 acres in this area, Mandell says. The complex would run for 30 years, he says.

The project will could deliver up to 2,200 acre-feet of water per year. Each acre-foot equates to 326,000 gallons of water. The distilled water from the solar process is so pure that it would need to be blended with other water to replace some of the natural ingredients that boiling removes, Mandell says.

“Climate-driven drought is going to continue,” Mandell says. “This alternative gives you the chance to adapt by using the power of the sun.”

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Water: Beyond the drought crisis

The Bee presents a four-part series on the most vital resource for the San Joaquin Valley’s No. 1 farm economy in the country. The series will address some of the big questions left unanswered in drought coverage.

Today: New supplies from salty water

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