

Dispatches From World Water Day in Nairobi: Water By the Numbers

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If you're looking for ways to invest your money in 2010, you'll get a return on companies building wastewater treatment plants, according to United Nations (UN) experts speaking to journalists gathered today at UN offices in Nairobi, Kenya.

Satinder Bindra, director of communications for the UN Environment Program (UNEP), said his financial advisor told him this week that "one of the best investments this year is water quality improvement."

The theme of the 17th annual World Water Day, on Monday, is "Water Quality" with an emphasis on water pollution caused by human sewage, often dumped directly into rivers, lakes, and the ocean in the developing world, where treatment plants can be few and far between.

According to the UN Environment Program (UNEP), more people die every year from exposure to polluted water than in all wars and conflicts around the globe. And most of that pollution is in the form of pathogens from human and animal waste.

As populations and economic development climb, and water resource are spread even more thin, we are reaching a tipping point at which wastewater issues can no longer be ignored, according to the experts. One of the results: wastewater-treatment and sanitation projects becomes a entry point for larger-scale, and often well-funded, development projects. Engineering, and water treatment and supply companies that will be contracted for these projects stand to make profit.

While the corporate world and investors capitalize on cleaning water, taxpayers and governments could also find financial reward. For every dollar invested in wastewater treatment, it is estimated that society gets a \$3-34 return when you consider medical and environmental costs, according to Nancy Ross, communications director at the California-based Pacific Institute, which specializes in global water issues.

The Value of Water, Wetlands, and Forests

If you're personally not looking for insider trading tips, there is another angle on water economics that may be of interest--the value of green infrastructure, including wetlands that provide natural filtration, fisheries support, and flood control, and forests that protect water quality.

Wetlands alone are valued at \$400 billion globally, according to the Pacific Institute.

A paper issued yesterday by the Convention on Biological Diversity, cites an analysis of Chinese forests that puts a \$1-billion pricetag on the water storage and filtration functions of these trees. Soil and vegetation

store, and to some degree keep clean, nearly 60 percent of the world's renewable freshwater. That water, when returned to the atmosphere through evapotranspiration, or water vapor, eventually falls back to the ground through precipitation, providing a generally reliable water source for drinking, agriculture, and business.

Intact forests also help reduce the amount of sediment--considered a pollutant--that ends up in the water supply through erosion, a common result of deforestation. The Convention on Biological Diversity values the water storage capacity of the trees in China at nearly three times what they are worth as lumber.

On the other side of the world, the Amazon rain forest, according to Pavan Sukdev of UNEP, is a similar water pump that sends nearly 20 billion tons of water daily into the atmosphere and generates rain for a nearly \$1-trillion, primarily agricultural-based economy in the region.

Yet, deforestation continues.

In an attempt to curb the cutting and protect freshwater sources, the World Bank and environmental nonprofits are funding forest protection projects in Costa Rica, Nicaragua, South Africa, and elsewhere. But the challenge remains putting a pricetag on some of these ecosystem services in a market where they have traditionally been unaccounted for, according to the Convention report.

Business Constraints

Companies, especially beverage companies, are feeling the immediate effects of water pollution. According to UNEP's Sukdev, bottled water producers Evian and Vittel are now paying upstream farmers \$280 a hectare (2.5 acres) to protect forests, reduce sediment loads to the river, as well as the use of chemical herbicides and gross amounts of nitrogen-rich fertilizers--in essence to keep the water cleaner.

Scarcity sounds alarm bells too, for business. A 2009 Citigroup report said that unsustainable water usage has caused water scarcity to become a limiting factor in the growth of China, India, Indonesia, Australia, and the western U.S. A sister survey of Fortune 1000 companies found that 40 percent said water shortages would have a severe, if not catastrophic, impact on their business.

Citi concluded that we are on the verge of water bankruptcy.

For more on clean water and water conservation, visit National Geographic's freshwater website.

--*Tasha Eichenseher*

Photograph by UNICEF/Giacomo Pirozzi

California's Pipe Dream

A heroic system of dams, pumps, and canals can't stave off a water crisis.

By Joel Bourne

On a blistering day in the megalopolis that is southern California, Shivaji Deshmukh of the Orange County Water District offers me a cup of cool, clear water that just yesterday was swirling around in an Anaheim toilet bowl. We're standing outside the second largest water-reclamation facility in the world, a high-tech assemblage of micro-filters, membranes, and UV lights that every day recycles 70 million gallons of Orange County sewage into water so clean it's almost distilled. "It's OK," Deshmukh reassures me, casually taking a slug from his own cup. "It's the same technology they use on the space station."

After spending the past century building one of the most elaborate water-delivery systems on the planet, replete with giant pumps and thousands of miles of pipes and canals, California has come to this—akin to the last desperate act of lifeboat-bound sailors drinking their own bodily fluids. The reasons are multiple and complex, but the bottom line is that the state's world-renowned plumbing is now perilously stressed. A three-year drought has drained most of the state's major reservoirs to their lowest levels in nearly two decades, forcing mandatory water restrictions for many residents. And warming temperatures have been shrinking the all-important snowpack in the Sierra Nevada, the largest storehouse of surface water in the state.

The biggest and weakest link in the system is the Sacramento-San Joaquin Delta, a former 700,000-acre marsh that has been drained, diked into islands, and farmed for more than a century. Much of the land has subsided, and many islands now sit more than 20 feet below sea level, creating California's own little slice of Holland in the middle of the Central Valley.

The delta is also the state's hydraulic heart. Water flows in through two great arteries: the Sacramento and San Joaquin Rivers. Much of it is then pumped south via two massive, man-made rivers—the Central Valley Project and the California Aqueduct—and therein lies the problem. Sea level rise combined with more severe storms now threaten to topple the weaker levees and flood the lowest islands, inundating farmland and poisoning the big delta pumps with salt water from San Francisco Bay. A major earthquake—already overdue in the area—could take out hundreds of miles of levees in seconds, slashing water supplies for two-thirds of Californians. Experts say it could take years to put California's Humpty Dumpty hydraulics back together again.

More immediately, water exports from the delta have been partly to blame for crashing populations of protected chinook salmon and tiny delta smelt, forcing court-ordered cutbacks on water deliveries and leaving some Central Valley farms high and dry. In large protests and in lawsuits, farmers are demanding that they be given precedence over the fish. All the while the population of southern California continues to increase by more than 200,000 each year.

"The way the system works now is a disaster," says Lester Snow, California's secretary of natural resources. "The majority of water for the state's economy is coming out of critical habitat for endangered species. Every year there are more restrictions on that water."

The Sacramento-San Joaquin Delta has become such a bottleneck that last fall Governor Arnold Schwarzenegger and the California legislature hammered out the most sweeping overhaul of the state's aging water infrastructure in nearly half a century. The suite of new laws mandates water conservation and attempts to restore the delta ecosystem and secure reliable water supplies for the state's growing population. It also resurrects a proposal that's been controversial for 30 years—a giant, ten-billion-dollar ditch known as

the Peripheral Canal that would bypass the delta altogether. For decades, northern Californians have seen the mammoth project as just one more water grab by the state's crowded, parched south. Southern Californians see it as, by and large, the key to their continued prosperity and survival.

If built, the Peripheral Canal would be the latest link in a Rube Goldberg system of pumps, pipes, dams, tunnels, and canals constructed over the past century that now slake the thirst of more than two-thirds of the state's population. The system also waters nearly all the state's eight million acres of irrigated cropland as well as the tenth largest economy on Earth—in a climate that varies from temperate rain forest in the northwest to true desert in the south. It's probably no coincidence that Goldberg, a cartoonist famous for drawing absurdly complex machines, began his career as a water and sewer engineer for the city of San Francisco.

The reason behind the convoluted system is simple math. Roughly 70 percent of California's available water falls as rain or snow in the less populated north. Meanwhile, 80 percent of the demand lies in the southern two-thirds of the state, much of which gets just a few inches of rain a year. Former governor Pat Brown, who some 40 years ago built the California Aqueduct to connect the delta to southern California's cities, said he did so to "correct an accident of people and geography."

But as anyone familiar with the state's fractious water history will tell you, southern California's ever swelling population was no accident. Rather, it was the result of numerous audacious water projects designed to keep people coming. "The value of our homes, businesses, and the security of our jobs all depend upon an ample water supply," shouts a 1928 government film made to whip up support for an aqueduct from the Colorado River. "If we are to survive and to grow, we must have the water that will enable us to maintain our mastery of the desert!"

That mastery began in the early 1900s, after shallow aquifers and seasonal rivers could no longer sustain Los Angeles. Out of desperation, city engineers began buying up land and water rights in the Owens Valley, east of the Sierra Nevada. In 1913 they completed the 223-mile-long Los Angeles Aqueduct, which sent the entire flow of the Owens River south to the growing city. Within a decade Owens Lake became a dust bowl, and the desert scrubland of the San Fernando Valley was worth millions. The infamous water grab—fictionalized in the 1974 film *Chinatown*—addicted Los Angeles to water imports and inspired in the rest of the state a deep-seated mistrust of the city that lingers to this day.

The heyday of California water development began in the late 1930s with construction of the colossal Central Valley Project, or CVP. To get water from the wet north to the dry south, the federal Bureau of Reclamation took advantage of the fact that the state's two largest rivers, the Sacramento and San Joaquin, funnel vast amounts of runoff from the High Sierra into a shared delta the size of Rhode Island. By building a big pumping station in the delta at Tracy and connecting it to nearly 500 miles of canals south of the delta, the CVP became a lifeline for the Central Valley. Today it waters more than 10 percent of the entire country's irrigated farmland and enables California to produce fully half the nation's fruits, nuts, and vegetables.

The 1960s brought the State Water Project (SWP), which includes the Oroville Dam, another pumping plant near Tracy, and the 444-mile-long California Aqueduct. The SWP now serves 23 million Californians, from north of the Bay Area to the Mexican border, and irrigates 755,000 acres of farmland.

The Peripheral Canal was supposed to be the system's final link, a liquid superhighway around the delta's slow-moving twists and turns. But the state ran out of money, the federal government wanted no part of it, and the growing environmental toll of the previous big water projects sapped political support. In 1982 northern Californians defeated a referendum on the project in a landslide. It was a dead issue—until a three-year drought and a sardine-size fish brought the state to its knees.

Not since the endangered snail darter briefly held up the Tellico Dam in Tennessee during the 1970s has there been such a monumental mismatch. In one corner: the delta's two mighty pumping stations, marshaling a total of nearly half a million horsepower. In the other corner: a silvery fish that lives a year or two at best, requires plenty of cold, clean water, and exists nowhere else on Earth. A 2009 trawl survey netted the fewest smelts ever recorded—less than 2 percent of the number counted in 1993, when the fish was first declared endangered. Chinook salmon had plummeted as well. Invoking the powers of the Endangered Species Act, a federal court placed limits on the pumps at Tracy in an attempt to save the fish.

The cutbacks may have helped the salmon and smelt, but they've been disastrous for farmers such as Joe Del Bosque, whose spread lies in the hard-hit Westlands Water District, west of Fresno. Del Bosque and other Westlands farmers received notice at the start of the 2009 growing season that they would get no water from the Central Valley Project. As a result, nearly half the district—some quarter million acres—is now growing tumbleweeds and dust devils instead of cantaloupes, canning tomatoes, onions, or any of the 50 other crops usually raised in the district. Officials in the farm town of Mendota, the "Cantaloupe Center of the World," organized food drives to help the hungry as the jobless rate hit 40 percent.

The drama has fomented large protests and rants against the Endangered Species Act. But local economist Jeffrey Michael, who studies Central Valley employment at the University of the Pacific in Stockton, says the smelts aren't a major cause of the misery. A dependence on seasonal farmwork and the shuttering of several large packing plants has caused Westlands to suffer a high jobless rate for years. "Even when they had full water allotments, unemployment was at 30 percent," Michael says.

Del Bosque, for his part, says farmers can "roll with the punches. We can roll with weather, decreasing prices, government red tape. But without water—we can't roll with that punch. It's a knockout punch for us."

The Peripheral Canal, he believes, would disentangle his water supply from the delta—and from the endangered fish. Others say it could also protect the state from another knockout punch, this time from Mother Nature, that could paralyze its vast plumbing in an instant.

The Sacramento-San Joaquin Delta sits just east of the Hayward Fault, one of the most dangerous earthquake zones in the country. Geologists now say that the area has a two-out-of-three chance of being hit by a major quake in the next 30 years. Many of the islands in the central and western delta are protected by levees with foundations shoveled up by Chinese laborers in the late 1800s. A catastrophic earthquake could liquefy hundreds of miles of levees in a matter of seconds, allowing seawater to flood a huge swath of the delta and shutting off the pipes for months until a patch could be built.

Even without an earthquake the levees are increasingly vulnerable because of the continued subsidence and sea level rise. A run-of-the-mill winter storm in 2006 nearly flooded several islands, requiring heroic efforts to save them. In two recent reports, researchers from the Center for Watershed Sciences at the University of California, Davis, and the Public Policy Institute of California documented the extreme vulnerability of the delta, warning that the average island now has a 90 percent chance of flooding in the next 50 years.

"This is the dead meat of the delta," says Jeff Mount, an author of the reports, as he sweeps a finger across a map of some 60,000 acres of farmland. "This is going to be aquatic habitat at some point in time, I'm 99 percent certain."

Some fisheries biologists now believe building the Peripheral Canal could also improve the delta's ecosystem—as long as the fish were guaranteed adequate water. Some of the lowest islands could be allowed to flood, providing habitat and food for smelt, salmon, and other native species. But the Peripheral Canal is still such a hot topic that it wasn't mentioned explicitly in any of the water

legislation passed last fall—even as those bills opened the door for its construction. The canal's future now lies with the delta's water exporters, who must develop a plan for restoring smelt and salmon habitat before they can legally increase pumping. If their plan is approved, water agencies in the Central Valley and southern California have pledged to foot the bill for construction.

"A new canal could take the pressure off the delta, but it could also be the kiss of death—because you'd have the capacity to take all the water," says Leo Winternitz, a water-policy expert with the Nature Conservancy. "But there's an old Chinese proverb: 'Unless you change direction, you're apt to end up where you're headed.' And where we're headed in the delta is not a place we want to be."

To get a firsthand look at the fish that started all the fuss, I dropped by the University of California, Davis, smelt lab, which sits within a few hundred yards of the pumps that are partly responsible for the species' predicament. There, biologist Joan Lindberg is raising thousands of delta smelts in a captive-breeding program as a possible safety net against extinction. A graduate student pulled an adult smelt from a tank and held it in the palm of his hand—a frisky, wide-eyed, bullet-nosed fish that quickly leaped back into the tank.

After the brief tour I thanked Lindberg and got back in the car, but before I could drive away she ran up to my window with a concerned look on her face. "If you think about how we settled the West, it was all limitless, limitless resources," she said, rather out of the blue. "But now we're running up against limits, and people don't want to think about that."

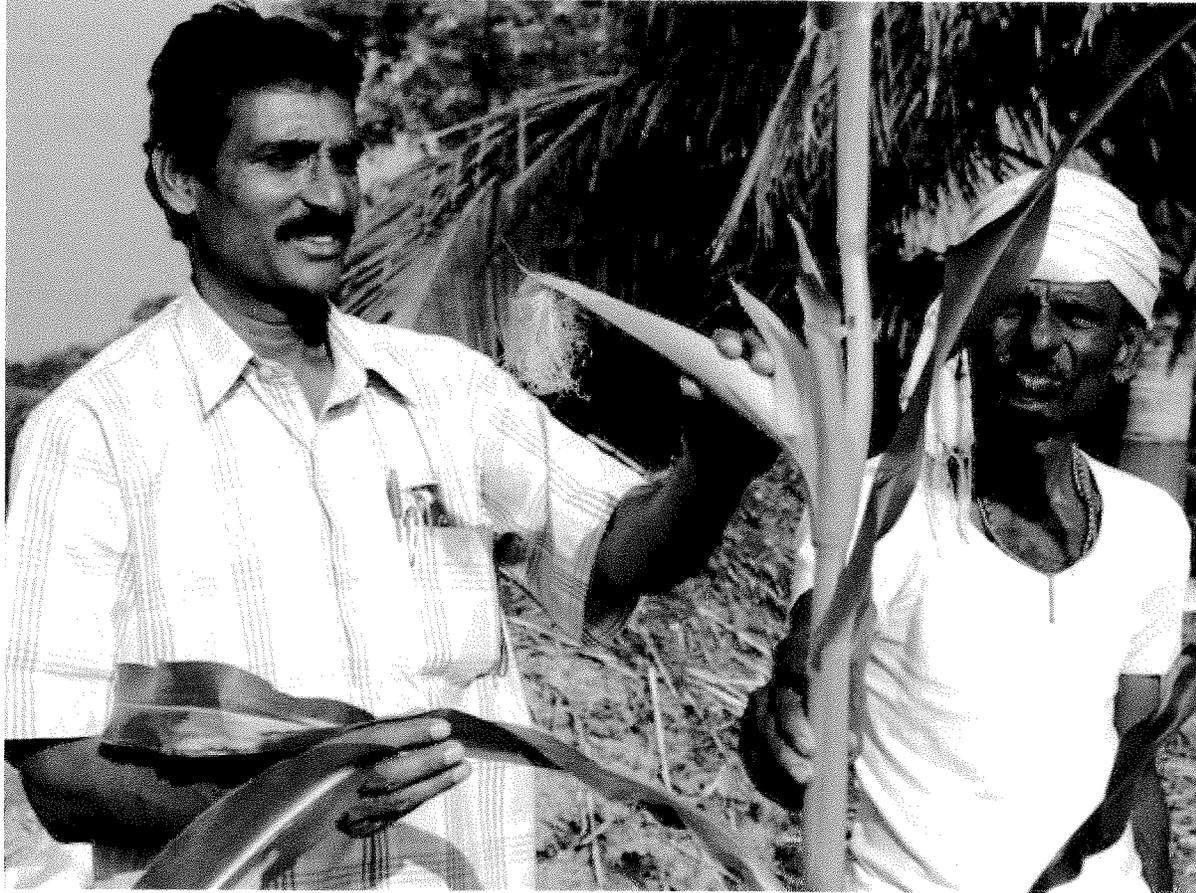
Therein lies a crucial part of the solution, water experts say, one much simpler and closer to home than a massive plumbing patch: learning to live within the water resources of an arid landscape. Fully 70 percent of residential water in southern California is used outside the home for lawns, pools, and other niceties. Reducing that demand by using drought-resistant plants and recycling wastewater offers the fastest and cheapest potential water savings in the state.

To that end, the raft of new laws passed last fall calls for cities to cut water use 20 percent by 2020. Water agencies that supply farms must develop water conservation plans and monitor groundwater usage. And in November, California voters will decide whether their state—already crippled by a \$20-billion budget deficit—should take on another \$11 billion in debt to fund new water-storage projects, conservation efforts, wastewater recycling, and desalination plants.

Even without the bond, southern Californians are focused on increasing efficiency and developing new drought-proof sources. San Diego, which pipes in 90 percent of its water, is considering following Orange County's example and opening its own wastewater-recycling facility. And the largest desalination project in the country broke ground late last year in Carlsbad, which will daily produce 50 million gallons of potable water from 100 million gallons of seawater. Despite their high cost and energy use, some 19 more plants are on the drawing board in the state.

Back in Orange County, the proffered cup of purified sewage is still in Shivaji Deshmukh's hand. The thrum of the big pumps forcing all that wastewater through the micromembranes nearby ripples the surface of the clear liquid. I take a gulp. It's bold, bright, and refreshing. It tastes like California's future.

Lessons From the Field—Rainwater Harvesting in India



Popat Rao Pawar, *sarpanch*, or assemblyman, of Hiware Bazaar village in India, examines corn. His village has successfully used rainwater harvesting to secure water supplies.

National Geographic Published 4/10

From rainwater harvesting in one Indian village to an aggressive conservation program in an American city, communities around the world are finding ways to manage the water demands of growing populations and expanding economies.

We're inviting scientists, community leaders, water managers, conservationists and activists to share the lessons they've earned from the field—and the innovative solutions they've found.

We hope their stories will build a shared sense of community and motivate the public across the world to conserve freshwater and the diversity of life it sustains.

How will vast regions of India, where highly unreliable rainfall makes the difference between famine and sustenance, cope with climate change? Over 85 percent of the cultivated area in this country is either directly dependent on rain or depends on rain to recharge its groundwater. Seasonal rain provides water for irrigation, drinking, and household needs. It provides water to livestock and is necessary to grow fodder for animals. The question of how these areas will adapt as rainfall becomes even more variable with climate change is especially important now, as groundwater is being pumped from deeper and deeper wells to grow water-guzzling crops like sugarcane, rice, wheat and even flowers.

I ask these questions once again, because for once I have some answers. I traveled to Hiware Bazaar village in Ahmednagar district to find an amazing example of environmental regeneration. This village of a thousand-odd families in the rain shadow, drought-prone region of Maharashtra was reportedly destitute and lawless some 15 years ago. Today, it is an incredible example

of how rainwater harvesting can create prosperity.

In 1972, when water scarcity had hit the state, a dam to encourage water to sink into the ground was built under a new employment guarantee scheme. But like most dams this structure leaked. Water scarcity increased. The next water harvesting structure led to a murder in the village, as people fought over the water it provided. Villagers took to making, drinking, and selling country liquor (country liquor is made from a potent mix of chemicals and plants in different regions), instead of water. The surrounding forests were hacked down. Villagers recall how a forest guard was beaten and tied up as he tried to stop people from felling trees. By the early 1990s, migration was the only alternative to poverty in this village.

As I heard all of this, I realized I was standing on the same hill where trees had once been cut. All I could see now was thick forest, vast expanses of grass, and lush green fields in the village below. Last year, the village's own rain gauge showed rainfall had been good—some 21 inches (541 millimeters). But this year it was below average—some 12 inches (300 millimeters). This rain had come after three years of crippling scarcity and drought. So, small rainfall gains had given huge returns. How?

The turnaround began in the early 1990s, after Papat Rao Pawar took over as village *sarpanch*, or elected leader of the village assembly. This postgraduate was persuaded to return to the village, but his initial water harvesting bore little fruit. The first tree plantation built under his leadership was eaten up by village cattle after the fencing had been taken away for firewood. People saw no value in conserving forests or water.

Pawar recalls that the dire situation began to turn around when the state government started the Adarsh Gaon Yojana or model village plan. This program was based on five principles: bans on cutting trees, free grazing, and liquor; family planning; and contributions of village labor for development works. Hiware Bazaar opted to be part of this scheme. The first work it took up was to plant trees on forestland, where people were persuaded to stop their cattle from grazing.

Between 1995 and 1998, the state's employment guarantee scheme was used to provide money to village workers to dig trenches and embankments along the contours in the forestland to hold water. Then it built small earthen dams in the drains and dug village tanks. People invested in leveling their fields to hold water. It is estimated that this contribution alone cost them over 70 lakh (U.S. \$ 1.50) in labor and equipment, but the gains were big. For a start, grass productivity increased, and this in turn boosted milk yields from cows that were better fed. By 2007, the village sold 790 gallons (3,000 liters) of milk daily.

As water became available, new wells were dug: There was one well for each household. Pawar says he soon realized that when water is not at a premium, people lose sight of community concerns. The attitude is "This is my water and I will use it for growing high-value crops, even if it depletes the water table." What could persuade Hiware Bazaar residents to do things differently?

The village started keeping records of its wells: Each month's data from six observation wells was matched with data from four rain gauges and related to its watersheds. This started a system for water audits: The village worked with local groundwater agencies to assess water availability and to match it with crop-planting patterns. Each year the area under each crop was calculated in terms of its water need. This year, for instance, the *gram sabha*, or village council, decided that there was not enough rainfall to support wheat. When I asked villagers tending their fields why they agreed to not grow wheat, their reply was simple: They could see their well had less water. Science and practice had built bridges.

Today the village has a simple rule: if there are 4 inches (100 millimeters) of rainfall, then there is drinking water for all and enough for one crop; 8 inches (200 millimeters) of rainfall gets the village drinking water, one full crop, and two half crops (crops planted on half a field); and if the rainfall is 12 inches (300 millimeters) or more then the village is assured drinking water and irrigation for three full crops.

In other words, little rain but assured gains. The question is whether this model can be replicated. Can this laboratory of development teach others? Let's continue to discuss this.



SAHUARITA SUN > NEWS

Council backs QC project; sewer hampers growth

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By Philip Franchine, The Sahuarita Sun

Published: Tuesday, April 27, 2010 9:30 PM MST

The Town Council Monday took steps toward expanding commercial opportunities west of Quail Creek and in the planned Rancho Sahuarita Power Center west of Interstate 19.

The council unanimously approved a 50-acre rezoning for a commercial area west of Quail Creek despite reservations about the likelihood that developer Robson Communities would put a storage business there.

The council in executive session discussed a contract with Rancho Sahuarita to extend sewer service west of the freeway to the area where Home Depot has been discussed. In the open session the council voted to direct staff to keep working on the sewer extension effort and did not vote to terminate the contract.

The sewer system that is owned and operated by the town serves Rancho Sahuarita, and extending its service west of I-19 is crucial to attracting business to the planned Power Center along La Canada Drive south of Sahuarita Road. Home Depot has said its requirement to move to Sahuarita is to have a site served by roads and utilities.

The problem is that the funding source that the town was counting on to finance the project, the state Water Infrastructure Financing Authority, cannot do it for technical reasons, Town Attorney Dan Hochuli said, so the Town Council could have terminated the contract. Instead, the town will continue to search for financing mechanisms. The council discussion of freeway signs in Rancho Sahuarita months ago revolved in part around the developer's idea that such signs were needed to attract Home Depot, but the revelation that there is no immediate prospect of infrastructure for the Power Center means it is highly unlikely that Home Depot will open any time soon.

Quail Creek vote

The Quail Creek rezoning was approved by a 7-0 vote and will turn the 50.68 acres on the southwestern corner of Old Nogales Highway and Quail Creek Boulevard into a commercial zone.

A concept put forth by Robson Communities shows a convenience store and gas station on the north end, more retail space in the middle and a combination self-storage and RV-storage facility to the south.

Mayor Lynne Skelton said this would be the third storage facility developed in the town since she joined the council about a decade ago, and questioned whether it fits into the town's economic development strategy, though she voted for the rezoning.

Quail Creek resident Cecilia Axton said she was opposed because she chose Quail Creek as an all-residential community, unlike Green Valley. Also, because having managed a self-storage facility in California for three years, Axton said such facilities require 24-hour security to deter criminals and said the convenience store would attract crime.

Skelton scolded engineer Lance Hanson, representing Robson, for not bringing any officials of Robson, saying she was "a little insulted" by the developer's absence.

Town Manager Jim Stahle reminded council members that the rezoning would authorize a long list of commercial uses and that a self-storage facility or an RV storage facility would be among the many uses.

In other news:

- Two Pima County officials described efforts to help homeowners threatened with foreclosure and warned against scams.
- Town Economic Development Manager Kathy Ward said the town lacks land suitable for light industrial uses and for that reason was not considered by a company that plans to move to Southern Arizona with several hundred jobs paying an average of \$75,000. That company was not named and has narrowed its choices to four locations.

Skelton asked whether the town should engage in land banking in an effort to guide the real estate market and make sure land is devoted to high-wage employers, but acknowledged the town now cannot afford such a venture.

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PRESS RELEASE

April 28, 2010, 11:22 a.m. EDT · [Recommend](#) · [Post](#)

American Water Supports Senate Action on Sustainable Water Infrastructure Investment Act of 2010



AMERICAN WATER

VOORHEES, N.J., Apr 28, 2010 (BUSINESS WIRE) -- American Water, the largest investor-owned U.S. water and wastewater company, supports S. 3262, the bipartisan Sustainable Water Infrastructure Investment Act of 2010 introduced by Senator Robert Menendez (D-NJ) and cosponsors Senator Kit Bond (R-MO) Senator Mike Crapo (R-ID) and Senator John Kerry (D-MA). The bill will remove state volume caps on private activity bonds (PABs) for water and wastewater projects, freeing up billions of private capital dollars for investment in the nation's water infrastructure. A similar bill introduced in the U.S. House of Representatives last year by Congressman Bill Pascrell (D-NJ) was passed by the House as part of the Small Business and Infrastructure Tax Act last month.

According to the U.S. Environmental Protection Agency (EPA) and the Government Accountability Office, there is an investment gap of more than \$500 billion for necessary infrastructure upgrades over the next 20 years to ensure safe drinking water and wastewater treatment. This bill would create up to 57,000 jobs by converting a modest investment by the federal government into billions of dollars of necessary economic investment into our nation's aging water and sewage infrastructure. Standard and Poor's cites approximately \$180 billion in new money available for infrastructure investment.

"This legislation will not only address the nation's deteriorating water and wastewater infrastructure, estimated to be a trillion dollar challenge by the EPA, it will also generate thousands of jobs and help stimulate the economy," said Don Correll, President and CEO of American Water Works Company, Inc. (AWK 21.55, -0.15, -0.68%). "Exemption for bond caps exists for other infrastructure but not for water. Removing these caps will free up crucial investment dollars and create needed jobs."

Other major infrastructure components already exempt from existing caps include airports, high-speed rail and solid waste disposal. PAB issuance is one of the fastest forms of federal assistance when applied to water and wastewater projects, with only 90-120 days needed to complete the process, from approval to sale to get Americans to work. Many small and local engineering and construction businesses will benefit from project opportunities that will arise from an increased availability of resources.

Providing opportunities for public water providers to leverage private sector investment in water and wastewater infrastructure, the bill will also generate significant tax revenue for states and communities across the country. According to the Clean Water Council, each \$1 billion invested in water infrastructure yields an increase of \$82.4 million in state and local tax revenue.

Founded in 1886, American Water is the largest investor-owned U.S. water and wastewater utility company. With headquarters in Voorhees, N.J., the company employs more than 7,000 dedicated professionals who provide drinking water, wastewater and other related services to approximately 16 million people in 35 states, as well as Ontario and Manitoba, Canada. More information can be found by visiting www.amwater.com.

SOURCE: American Water

American Water

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 Arizona Daily Star

Yuma desalination plant to start flowing

Tony Davis Arizona Daily Star | Posted: Saturday, May 1, 2010 12:00 am

Thirty-six years and \$150 million after it was authorized by Congress, the Yuma desalination plant cranks up Monday for a test run.

The plant will capture very salty irrigation runoff and convert it to potable water to send to Mexico to meet U.S. treaty obligations. Without it, the U.S. has to send more Colorado River water to Mexico from Lake Mead, an important but drought-plagued source of drinking water for Tucson and Phoenix.

Southwestern states have been pushing the U.S. for years to start up the long-shut desalination plant.

However, because it costs so much to run - \$23 million for the 12-month test - it's still far from clear the plant will ever operate full bore.

The U.S. Bureau of Reclamation thinks it might even be cheaper and smarter to pay farmers in the Yuma area not to grow crops. The Colorado River water they now use could then go to Mexico, reducing the need for the expensive desalination.

It's the latest chapter in the long, tangled history of the Yuma Desalting Plant, whose backers call it part of the solution for the drought in the Colorado River basin.

But as a plant that has sat idle most of its 18 years and will cost four times as much to operate as the Central Arizona Project, it's also been called a white elephant.

Starting Monday, the plant will operate at 30 percent of capacity during 12 of the next 18 months.

The test will let officials clearly understand the plant's operating costs and how much additional investment they'll have to make in the plant. It will operate with a lot of aging equipment.

Arizona water officials believe that the federal government should operate the plant permanently and that the time for evaluating other alternatives is over, said Chuck Cullum, a senior policy analyst for the Central Arizona Project, which brings drinking water to Phoenix and Tucson from the river.

"We're in a drought. Let's conserve water" in Lake Mead, Cullum said. The lake is on the Arizona-Nevada border; the water is brought to Southern Arizona by the CAP canal system.

But he added, "We need to start making the difficult decisions about how we are going to move forward if the plant is not going to operate."

In what officials call unprecedented state-federal cooperation, the governments of Arizona, California and Nevada are combining to pay \$14 million of the \$23 million. In return, they'll get rights to a proportionate share of the water that will be stored in Lake Mead and not be released downriver to Mexico.

At full blast, the plant could produce 78,000 acre feet of water annually. That's enough to supply nearly 250,000 families for a year.

Arizona officials say the plant is needed in part because the Colorado River will run short someday.

The decade ending in 2009 was the hottest and driest decade on record in the seven-state Colorado River Basin. Runoff into the Colorado is expected to peak this spring at only 66 percent of normal flow into Lake Powell.

The plant's estimated operating cost is \$484 per acre-foot, compared to about \$120 an acre-foot to deliver CAP water. The plant's acre-foot cost could drop if it runs full blast because of the savings of running it on a larger scale.

Cullum acknowledged that the bureau has been very cooperative in exploring alternatives and has been caught in the middle of conflicting pressures.

Karl Flessa, a University of Arizona researcher who will work on a study monitoring the desalination plant's environmental effects, said his hunch is that officials could save the amount of water the plant would produce with conservation measures in farms and cities. Water is also needed to supply the region's few remaining wetlands, he said.

"In Western water, the focus until recently has been on increasing our supply," said Flessa, head of UA's Geosciences Department. "Now, we need to take a look at the demand side."

One problem the bureau may have in permanently running the plant is that it doesn't usually receive the kind of large budget increases that would be needed plus sizable investments to replace aging equipment, said Jennifer McCloskey, manager of the bureau's Yuma office.

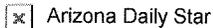
A few years ago, before the economic bust started, "I would have been a little bit more optimistic" about the plant's long-term future, McCloskey said.

If authorities go the route of taking farmland out of production, however, the experience to date suggests that it won't be the whole solution.

In four years, the bureau has saved 20,000 acre-feet of water by paying \$90 to \$170 an acre-foot to farmers near Yuma and in Southern California.

After sending letters to all major farmers in that area, "We've gotten some takers, but not a lot ... not as much as I would have anticipated at the start of the program," said Steve Hvinden, an operations director for the bureau.

Contact reporter Tony Davis at 806-7746 or tdavis@azstarnet.com; follow him on Twitter at [tonydavis987](https://twitter.com/tonydavis987)

 Arizona Daily Star

TEP's solar projects plan gets initial ACC support

David Wichner Arizona Daily Star | Posted: Tuesday, May 4, 2010 12:00 am

State regulators are recommending approval of \$14 million worth of new solar-energy projects proposed by Tucson Electric Power Co., including expansion of the company's massive photovoltaic array at Springerville.

If the plan wins final approval later this month, it could result in increases starting next year in surcharges customers pay monthly to pay for renewable-energy projects.

But longer term, the plan represents a shift to long-term funding of such renewable-energy projects through basic electric rates.

The utilities staff of the Arizona Corporation Commission has recommended that the panel approve construction of two company-owned solar projects - 1.8 megawatts of additions to TEP's photovoltaic plant near the coal-fired Springerville Generating Station, and a new, 1.6-megawatt solar array at Tucson International Airport.

The Springerville project would cost \$7.3 million and add to the existing 4.6-megawatt photovoltaic array, already one of the nation's biggest utility-owned solar plants. The airport project, with solar panels that track the sun, will cost \$6.7 million.

Like other renewable-energy projects, the Springerville solar array was funded through surcharges on customers' electric bills.

That funding mechanism, called the Renewable Energy Standard and Tariff, is based on usage and is currently capped at \$3.20 monthly for residential ratepayers.

The plan proposed by TEP and recommended by the commission staff would fund the projects initially through the surcharge.

When TEP files its next rate case, after its currently capped rates expire at the end of 2012, the plan would shift funding to the company's rate base - costs for the array of generating assets, including coal- and gas-fueled power plants, on which rates are based.

The plan would spread the costs over 20 years, while the surcharge is adjusted annually to pay for pending projects or programs like customer rebates.

"It represents a transition of sorts in the way utilities handle renewables now," TEP spokesman Joe Salkowski said.

Figures on the effect TEP's latest plan would have on monthly bills were not immediately available, but funding major projects through the surcharge alone can be costly.

TEP originally proposed a combination of company-owned and third-party renewables projects and asked to boost the cap on the usage-based renewables surcharge to \$9 from \$4.50 monthly for residential customers, along with increases in surcharges for business customers.

In January, the commission delayed consideration of TEP's company-owned projects. To pay for other renewable-energy efforts, the panel raised the surcharge rate and cap on commercial customers substantially - to \$160 from \$75 monthly for small businesses - but cut the residential cap to \$3.20 from \$4.50.

When spread over three years through the renewable surcharge alone, the \$14 million in proposed TEP-owned projects would cost ratepayers more than \$5 million per year, including financing costs, according to documents filed in the case. Spread over five years, the cost would top \$3 million annually.

In contrast, initial funding through the surcharge would cost about \$1.8 million next year, \$1.7 million in 2012 and \$1.6 million in 2013. Added to base rates over the next 17 years, the increase in rates would likely amount to fractions of cents per kilowatt-hour.

Corporation Commission Chairman Kris Mayes said that while she couldn't comment specifically on the pending TEP case, she generally supports the move to include renewables in utilities' rate bases.

"It's important to mainstream renewable energy into the utilities' portfolios," Mayes said. "It's important for the utilities to have that mindset that this is a form of generation like the others."

She noted that the commission has allowed Arizona Public Service Co., the state's largest regulated power utility, to include 50 megawatts of renewable-energy generating capacity in its rate base.

But Mayes also plans to propose an amendment to TEP's plan that would require the company to buy additional power from independent owners of renewable-energy plants.

"We need a good mix of independent solar-energy producers and company-owned projects," she said.

The commission plans to take up the issue May 13.

DID YOU KNOW

The push for renewable-energy projects is being driven by a state mandate that regulated utilities boost their use of renewables, from 2.5 percent of their retail power needs this year to 15 percent by 2025.

Contact Assistant Business Editor David Wichner at 573-4181 or dwichner@azstarnet.com

 Arizona Daily Star

County opposes city water for project by Tucson Mts.

Andrea Kelly Arizona Daily Star | Posted: Tuesday, May 4, 2010 12:00 am

Pima County may urge Tucson to avoid annexing and providing water service to a proposed development in the Tucson Mountains foothills.

Though the county approved zoning for 260 homes on 287 scenic acres in the Painted Hills, the developer cannot begin work until it establishes a water source. Tucson Water has no obligation to provide water outside the city limits and outside its existing non-city service area.

The landowner, the Dallas city firefighters' pension fund, is seeking city annexation, said Keri Silvyn, the fund's Tucson attorney.

Development plans situate the homes away from the peaks and would preserve 200 acres as open space, Silvyn said. The county would like to buy the property for open space using funds set aside in the 1997 and 2004 bond programs, said Richard Elias, the county supervisor who represents the area.

Pima County can't buy the land unless the owner is interested in selling, but the owner is obligated to make money for the retirement fund, and plans to develop to do so, Silvyn said.

The Tucson Mountains Association and the Gates Pass Area Neighborhood Association have opposed development on the site, between Anklam Road and Speedway, adjacent to the western city limits.

"We are very concerned about sensitive environmental areas on the Painted Hills property, including wildlife corridors, mature saguaros, important riparian areas, and peaks and ridges," said Ed Verburg, Tucson Mountains Association president.

Meanwhile, the owner has filed a claim against the city for \$46.25 million, said City Attorney Mike Rankin. The claim seeks the money to make up for lost value in undeveloped land and associated development expenses, Rankin said.

"We haven't agreed to provide water, but if it's in the city we'd have to give them water, so annexation is part of the discussion," though the formal process hasn't begun, Rankin said.

Elias plans to ask the Board of Supervisors during its regular meeting today to oppose any annexation efforts.

"We would love to buy Painted Hills," he said.

Contact reporter Andrea Kelly at 807-7790 or akelly@azstarnet.com

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May 4, 2010

Fears That a Lush Land May Lose a Foul Fertilizer

By ELISABETH MALKIN

MIXQUIAHUALA, Mexico — Night and day, Marcelo Mera Bárcenas slops the fetid water that has coursed 60 miles downhill from the sewers of Mexico City and spreads it over the corn and alfalfa fields of this once arid land.

From the roads here in the Mezquital Valley, fields stretch to the hills in a panoply of green, graced by willow trees. But up close, where Mr. Mera is paid for every acre of field he irrigates, the smell and look of the water that feeds this lushness chokes the senses.

With only rubber boots for protection, he does not buy into the general belief here that the water does no harm, that a scrub with detergent each night will cure whatever ills it brings. Itchy boils break out on his hands, he said. He is often sick with colds and the flu.

“Of course it affects us because the water is so dirty,” said Mr. Mera, a laborer who has worked in the muck of these fields for 38 years, since he was 15. “But there’s nothing else to do.”

For 100 years, Mexico City has flushed its wastewater north to irrigate the farmland of Hidalgo State. This foul cascade, which the farmers call “the black waters,” flows through a latticework of canals and then trickles over the fields.

So when word got out that the government was finally going to build a giant wastewater treatment plant, one might have expected the farmers around here to be excited. Instead, they were suspicious.

“Without that water, there is no life, “ said Gregorio Cruz Alamilla, 60, who has worked his family’s 12-acre farm since he was a boy.

Mr. Cruz knows the water is loaded with toxic substances, including chemicals dumped by factories, and he tires of clearing his field of plastic bottles and wrappings every time he irrigates.

But like many others here, he worries that treating the water, though it may remove harmful contaminants, will also strip away some of the natural fertilizers that even the authorities here say have helped make this valley so productive. And despite the government’s assurances, the farmers here suspect the worst: that once the water is treated, it will be pumped back to Mexico City, leaving the farms dry.

“If they take away the black waters we will die of hunger,” Mr. Cruz said. “We don’t know how to do anything else.”

Farmers irrigate crops with wastewater across the developing world, but nowhere else on the scale of Mezquital Valley, researchers say. The 350 square miles of the valley’s irrigated fields lie at the end of a crisscross of tunnels, rivers, lakes, dams and reservoirs that date from the 14th century, when the Aztecs settled on an island amid lakes and engineered the first network of dikes and dams to control the floodwaters.

Mexico City has never managed to keep those waters at bay. When they break loose, as they do most every year during the rainy season, the wastewater gushes into the streets and swamps the patios of working-class neighborhoods in the city’s low-lying eastern suburbs.

It has been almost 40 years since Mexico City has built a new tunnel to drain the city’s wastewater, and it now needs constant maintenance. Since then, the population of the metropolitan area has doubled to almost 20 million people.

“It was a predictable problem, but we never paid enough attention to it,” said Ernesto E. Espino de la O, who manages the treatment and water supply project for the National Water Commission. A collapse of the crumbling system, warned one study from Mexico’s National Autonomous University of Mexico, would be catastrophic, flooding large parts of the city.

To stop the flooding, the federal government is building a 38.5-mile tunnel to drain all the wastewater north at a rate of 40,000 gallons a second. "In July, August and September, we need the whole system to work well," said Rafael Carmona Paredes, who is in charge of the tunnel project for the commission, known as Conagua.

Engineers have begun to drill a series of giant shafts going down as far as almost 500 feet. Below, enormous circular boring machines cut through the rock and lay down the tunnel's concrete casing. At the tunnel's end, near the town of Atotonilco, is the site of the planned water treatment plant, now just a sloping hillside and a sign with a promise.

"It is a disgrace that Mexico City doesn't treat its wastewater," said José Ramón Ardavín, the deputy director of Conagua.

The plant, which is budgeted to cost \$1 billion and will begin operating in 2012, will clean 60 percent of the city's wastewater. The water commission's measurements show that the water is laced with heavy metals like lead and arsenic, filled with high levels of pathogens and parasites, and weighed down by grease.

But the farmers "are worried that the treatment plant will take out the nutrients, that the water will go back to Mexico City and that it will be privatized," said Filemón Rodríguez Castillo, the director of the main irrigation district here. "The water is very much appreciated here, independent of the fact that it smells so ugly, that it stinks."

One of his jobs is to persuade local residents that even though the residents of Mexico City will have to pay to have their water treated, they will not get it back.

The main benefit of irrigating with clean water, he has told them, is that they will be able to grow many kinds of vegetables, which are now restricted to protect consumers from illness.

Officials here now direct farmers not to grow crops in which the edible part comes into contact with the irrigation water and is eaten raw, ruling out vegetables like lettuce, carrots or beets. Alfalfa is permitted because it is used as animal feed. But enforcement is spotty and the farmers abide by an elastic interpretation of the regulations, planting broccoli and cauliflower, for example.

To the farmers here, whose sturdy opinions match their surprisingly good health, the proof that their water is good is in what they see around them. “Plants won’t absorb poison; they would die,” said Jesús Aldana Ángeles, a 75-year-old fifth-generation farmer, who was watching his small flock of sheep munch on the remains of his harvested alfalfa field. “There is no better laboratory than the ground. The earth absorbs everything. It purifies it, it treats it.”

As the sun set, he brought the sheep in, crossing a footpath over an irrigation ditch that curls around his house like a black moat. “Bad water would never make anything green,” he said. “But here the black waters turn everything green.”

The Washington Post

New EPA water infrastructure policy seeks to encourage smart growth

By Alec MacGillis
Washington Post Staff Writer
Wednesday, May 5, 2010; A19

If you build it, they will come. And, if you don't, they won't.

Such is the thinking behind a policy released late last month by the Environmental Protection Agency that instructs states to adopt smart-growth principles in allocating the \$3.3 billion in water infrastructure funding that the federal government doles out each year. States, it asserts, should prioritize projects that upgrade the drinking water and wastewater infrastructure in cities over projects intended to serve new developments on the suburban fringe.

The new guidance arguably arrives five years too late -- after a home building boom that swallowed up vast swaths of land. But building will eventually resume, and EPA officials say the leverage of the federal funding -- the Clean Water and Drinking Water State Revolving Fund -- could coax states toward a more sustainable form of development. With so many cities contending with aging water pipes and sewer lines, officials say, it makes most sense to address those needs first.

"What you have now that we're trying to change is that some of the money goes into new [water] collection systems or new treatment plants where there are very few people and that can fuel growth," said Nancy Stoner, the deputy assistant administrator of the EPA's Office of Water. "We're interested in supporting the infrastructure where people already live. It's a focus on making infrastructure sustainable and reviving those communities, reviving cities as attractive places."

The policy is meeting with criticism. Not surprisingly, the National Association of Home Builders has "serious concerns," said its senior vice president, Susan Asmus. "While we recognize the need to repair, replace and upgrade existing infrastructure, this should not be done at the expense of new growth," she said.

The associations in Washington that represent state infrastructure officials say smart growth is commendable but question using the federal funds as a lever. As it is, they note, the EPA requires that states use 20 percent of their federal funds toward "green" projects such as restoring riparian buffers or reducing impermeable blacktop cover. Although sprawl is hardly ideal, they say, failing to expand sewer lines to outer-rim communities could result in overloaded septic systems that pollute groundwater.

"While we want to incorporate these ideas . . . we're concerned about a prescriptive approach that says so much of the money goes here, so much goes there," said Rick Farrell, director of the Council of Infrastructure Financing Authorities. "We'd prefer they say, 'These are things you can do that are good approaches,' and let the states work it out."

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Linda Eichmiller, director of the Association of State and Interstate Water Pollution Control Administrators, was more blunt. The federal funds are "not a mechanism to accomplish social goals," she said. "It is not going to be able to manage growth."

Jag Khuman, director of the Maryland Water Quality Financing Administration, said the guidance would have little effect on his state, which, he noted, emphasizes smart growth. But he said it could present challenges in states with less of the aging infrastructure that the EPA wants the funds to go toward. And there are often gray areas, he said: If a town is repairing a sewage plant that handles 5 million gallons, should it also expand it so it can handle 7 million gallons, or would that only encourage sprawl?

"That's where you're going to get variable answers," he said.

Kevin Ward, executive administrator of the Texas Water Development Board, said that in many towns, the authorities that decide how to use water funds have no say in planning and zoning decisions and are simply obligated to provide service to a given district. But the EPA seemed "sensitive to these matters," he said.

Paul Marchetti, director of Pennsylvania's water infrastructure agency, bristled slightly at the guidance, saying that his state has long allocated funds with the input of local governments to discourage sprawl.

"To the extent we have dictums coming down from on high, it makes it potentially difficult for each of the programs to run things in ways that make sense for each state," he said. But the guidance's vague wording reassured him that the judgment would be left at the state and local level.

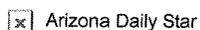
This is why Geoff Anderson, the president of Smart Growth America, wishes the new guidance were more specific, to really goad states where sprawl predominates. "The EPA ought to be thinking about how to go further," he said.

But he praised the guidance, rejecting the concern about its preventing sewer lines from reaching septic-reliant new development. Septic-based developments should be approved, he said, only if they can guarantee that their septic systems will function over the long term. "The ultimate performance of those septic systems can't rely on the endless extensions of a wastewater system that we can't even afford now," he said.

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Accord will test new water flows to Colorado delta

US-Mexico deal aims to protect wetland

Tony Davis Arizona Daily Star | Posted: Sunday, May 9, 2010 12:00 am

Cattails, clapper rails and honey mesquites living in the Sonoran Desert's biologically richest wetland are being watched closely by University of Arizona scientists during the trial run of the Yuma Desalting Plant.

The wetland, Ciénega de Santa Clara, will be in better shape than it would have been had the desalting plant in Arizona opened two or three years ago.

The flow of water to the wetland in northern Sonora appeared for years to be threatened by the plant's operations, but it has been preserved for now. That's thanks to an unprecedented agreement to bring replacement water. The deal was signed last year by U.S. and Mexican government officials and environmentalists from both countries.

But just as finding money to permanently run the \$150 million plant is a big question mark, how to provide and pay for enough water to keep the wetland going forever remains a mystery.

The ciénega is 15,000 acres of open water and marsh grasses, lying about a half-hour drive south of the Arizona-Mexico border. It has lived mostly on saline runoff from farmers in the Yuma area. But the desal plant, which started a one-year test run on Monday, is taking that water from the marsh by treating it and putting it into the Colorado River, bound for farmers in Mexico.

To keep the ciénega whole, the parties to the binational agreement found another 30,000 acre feet of water -enough to serve 90,000 families for a year - to send to the marsh during the test run. That water is from Arizona's Lake Mead and from Mexico.

"This agreement marks a new way forward," said Jennifer Pitt, a resource analyst for the Environmental Defense Fund that was a party to it. "It's the first time the two governments have cooperated on something like this, and the first time that either federal government has deliberately sent water to the delta."

UA and Mexican researchers checking out the ciénega's health are operating on about \$280,000 from Arizona, Nevada and Southern California water agencies and from Mexican environmental agencies.

The three states benefit from the desalting plant because it keeps water in Lake Mead, for states' future use - the Colorado River water that otherwise would flow to Mexico.

Researchers have placed instruments to record water quality and water levels all over the ciénega: in open water, along the marsh's edges and deep cattail thickets. Since 2006, researchers have taken small boats to visit the instruments and download information stored in them. This will continue monthly throughout plant operations.

The ciénega's salinity levels will be a key thing to watch, said Karl Flessa, a UA geosciences professor who heads the monitoring. Besides the 30,000 acre-feet of fresh water, the ciénega will also get about 8,000 acre feet of highly salty wastewater from the desalting plant that's left over from treatment of irrigation water. If salinity rises a lot, that will start to kill off cattail and other plants, and decrease habitat for endangered species living there, he said.

Even with that risk, Flessa praised the three states' attitude of "Let's try and collaborate."

But if the desal plant ever starts running at full blast as the states want to happen, it would treat three times as much water. The ciénega would need 100,000-acre feet annually to keep going.

In the future, the research will determine the wetland's most important environmental values, determine how big the ciénega needs to be to meet those values and figure out where that water could come from, said Chuck Cullom, a senior policy analyst for the Central Arizona Project, one of the agencies paying for the monitoring.

DID YOU KNOW

The Ciénega de Santa Clara, an accidental wetland, has thrived since the late 1970s, when the U.S. government started diverting salty runoff from the Wellton-Mohawk Irrigation District east of Yuma into a 70-mile-long canal bound for the wetland area.

Previously, the runoff went into the Colorado River and was so salty it was drawing complaints from the Mexican government that its quality violated treaty obligations. At the ciénega, the same water unexpectedly nourished a marsh habitat.

Today, the wetland holds 24 plant species and 225 bird species, including the largest population of the endangered Yuma clapper rail. Another endangered species at the ciénega is one of the last remaining populations of desert pupfish in the Colorado River basin.

OtherS involved

In addition to the University of Arizona, others involved in monitoring the ciénega are Mexico's National Institute of Ecology, the University of Baja California-Mexicali and two nongovernmental organizations, ProNatura and the Sonoran Institute.

Contact reporter Tony Davis at 806-7746 or tdavis@azstarnet.com

Cocaine, Spices, Hormones Found in Drinking Water



The water flowing from your tap might be spiked with some unusual ingredients, according to scientists who are investigating what lurks in our freshwater supplies.

Around the world, researchers are finding trace amounts of substances—from heroine and cardamon to rocket fuel and birth control—that might be having unintended consequences for humans and wildlife alike.

for [National Geographic News](#)

Published February 26, 2010

This story is part of a special series that explores the global water crisis. For more clean water news, photos, and information, visit National Geographic's [Freshwater Web site](#).

How's this for a sweet surprise? A team of researchers in Washington State has found traces of cooking spices and flavorings in the waters of Puget Sound. (See [map](#).)

University of Washington associate professor Richard Keil heads the Sound Citizen program, which investigates how what we do on land affects our waters.

Keil and his team have tracked "pulses" of food ingredients that enter the sound during certain holidays.

For instance, thyme and sage spike during Thanksgiving, cinnamon surges all winter, chocolate and vanilla show up during weekends (presumably from party-related goodies), and waffle-cone and caramel-corn remnants skyrocket around the Fourth of July.

The Puget Sound study is one of several ongoing efforts to investigate the unexpected ingredients that find their way into the global water supply.

Around the world, scientists are finding trace amounts of substances—from sugar and spice to heroin, rocket fuel, and birth control—that might be having unintended consequences for humans and wildlife alike.

Vanilla Seas?

When spices and flavorings are flushed out of a U.S. home, they travel to a sewage-treatment facility, where most of them are removed.

In the area around Puget Sound, the University of Washington team found, the spicy residues that remain in wastewater end up flowing into the sound's inland waterways.

Of all the flavors trickling downstream, artificial vanilla dominates the sound, Keil said. For instance, the team found an average of about six milligrams of artificial vanilla per liter of water sampled.

The region's sewage runoff contains more than 14 milligrams of vanilla per liter. This would be like spiking an Olympic-size swimming pool with approximately ten 4-ounce (113.4-gram) bottles of artificial vanilla.

For now, there's no evidence that a sweeter and spicier sound is a bad thing—salmon, which can smell such flavors, could be enjoying their vanilla-enhanced habitat, Keil said. In an attempt to understand some of the consequences of spice in the water, Keil and colleagues plan to study whether cooking ingredients harm the reproduction of octopuses in Puget Sound.

Overall, he added, the spice project has become a successful recipe for educating people, especially schoolkids, "that everything you do is connected to the watershed."

Illegal Drugs

The link from kitchen or bathroom to coast can also grease the path for some rather unsavory substances, such as illegal drugs, experts have discovered.

After a person has taken drugs such as cocaine, heroin, marijuana, and ecstasy, active byproducts of these substances are released into the sewage stream through that person's urine and feces.

These byproducts, or metabolites, are often not completely removed during the sewage-treatment process, at least in Europe, said Sara Castiglioni of the Mario Negri Institute for Pharmacological Research in Milan, [Italy](#).

That means the drug-tainted wastewater can enter groundwater and surface water, which are collectively the major sources of drinking water for most people.

(Related: ["Cocaine on Money: Drug Found on 90% of U.S. Bills."](#))

In a new review study, Castiglioni and colleague Ettore Zuccato found that illegal drugs have become "widespread" in surface water in some of Europe's populated areas.

For instance, in a 2008 study scientists discovered a byproduct of cocaine in 22 of 24 samples of drinking water at a Spanish water-treatment plant—despite a rigorous filtering and treatment process.

Likewise, in 2005, Zuccato found that a daily influx of cocaine travels down the [Po River](#), Italy's longest river.

Though these drug traces are still tiny, it's possible that the potent residues could be toxic to freshwater animals, according to the study, which will be published in an upcoming issue of the journal *Philosophical Transactions of the Royal Society A*.

For this reason, the "risks for human health and the environment cannot be excluded," the study warns.

Pharmaceuticals

Scientists are also developing a clearer picture of how legal pharmaceuticals and personal-care products—from antibiotics and morphine to fragrances and sunscreen—are flooding our waterways.

For example, previous research had revealed that up to 44.1 pounds (20 kilograms) of pharmaceuticals flow down Italy's Po River each day.

Much like illegal drugs, traces of pharmaceuticals often filter through traditional sewage-treatment processes.

These products are also found in many U.S. waterways, and studies have shown that certain drugs may cause harm to the environment—though no evidence to date has shown effects in people, according to the U.S. Environmental Protection Agency.

Some of the drugs that mimic hormones, such as birth control, may also throw off an animal's endocrine, or hormone-regulating, system. Some male fish in the U.S., for example, have been growing female parts due to exposure to estrogen in the water.

Researching these substances is important, Castiglioni said, "because [these] are quite unknown contaminants, and they are present in the environment in huge amounts, especially for pharmaceuticals."

To control the flow of these substances, some experts have suggested creating "green pharmacies," which would allow a consumer to send back their drugs to a pharmacist or manufacturer instead of flushing them down the toilet and into the wild.

Contaminants

Current EPA regulations say that more than 90 contaminants must be filtered out of drinking-water systems, said Cynthia Dougherty, director of EPA's Office of Groundwater and Drinking Water.

Viruses and other microorganisms are kept at bay, as are inorganic substances such as lead, cyanide, copper, and mercury. Pollutants from fertilizer runoff, such as nitrate and nitrite, are also removed.

In addition, the agency regularly studies new chemicals that may need regulation. Of particular interest right now is perchlorate, a natural and human-made chemical used in fireworks and rocket fuel, Dougherty said.

At sufficiently high doses, the chemical—found in at least 4 percent of U.S. drinking water—can reduce iodine uptake into a person's thyroid gland. If continued long-term, reduced iodine can lead to hypothyroidism, according to the agency, which is now seeking input on whether to regulate perchlorate.

Ultimately, "what you really want is to not ever have things you're concerned about in drinking water in the first place," Dougherty said.

That's why it's crucial for local communities to keep a close eye on what runs into their waterways, she said.

"If you have an understanding of what your source of drinking water is and what can happen to it," Dougherty said, "you can be a more educated citizen in engaging in those issues."

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Human Waste Used by 200 Million Farmers, Study Says

Tasha Eichenseher in Stockholm, Sweden
for National Geographic News

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Facing water shortages and escalating fertilizer costs, farmers in developing countries are using raw sewage to irrigate and fertilize nearly 49 million acres (20 million hectares) of cropland, according to a new report—and it may not be a bad thing.

While the practice carries serious health risks for many, those dangers are eclipsed by the social and economic gains for poor urban farmers and consumers who need affordable food, the study authors say.

Nearly 200 million farmers in China, India, Vietnam, sub-Saharan Africa, and Latin America harvest grains and vegetables from fields that use untreated human waste.

Ten percent of the world's population relies on such foods, according to the World Health Organization (WHO).

"There is a large potential for wastewater agriculture to both help and hurt great numbers of urban consumers," said Liqa Raschid-Sally, who led the study published by the Sri Lanka-based International Water Management Institute (IWMI) and released this week at the World Water Week conference in Stockholm, Sweden.

Health Risks

The report focused on poor urban areas, where farms in or near cities supply relatively inexpensive food. Most of these operations draw irrigation water from local rivers or lakes. Unlike developed cities, however, these areas lack advanced water-treatment facilities, and rivers effectively become sewers.

When this water is used for agricultural irrigation, farmers risk absorbing disease-causing bacteria, as do consumers who eat the produce raw and unwashed. Nearly 2.2 million people die each year because of diarrhea-related diseases, including cholera, according to WHO statistics. More than 80 percent of those cases can be attributed to contact with contaminated water and a lack of proper sanitation. But Pay Drechsel, an IWMI environmental scientist, argues that the social and economic benefits of using untreated human waste to grow food outweigh the health risks.

Those dangers can be addressed with farmer and consumer education, he said, while the free water and nutrients from human wastewater and feces can help urban farmers in developing countries to escape poverty.

Waste Into Water

Agriculture is a water-intensive business, accounting for nearly 70 percent of global fresh water consumption.

In poor, parched regions, untreated wastewater is the only viable irrigation source to keep farmers in business, according to Drechsel. Mark Redwood, a senior program officer with the Canadian International Development Research Centre, said that in some cases, water is so scarce that farmers break open sewage pipes transporting waste to local rivers.

Irrigation is the primary agricultural use of human waste in the developing world. But frequently untreated human feces harvested from latrines is delivered to farms and spread as fertilizer.

In most cases, the excrement is used on cereal or grain crops, which are eventually cooked, minimizing the risk of transmitting water-borne pathogens and diseases, IWMI's Drechsel noted.

With fertilizer prices jumping nearly 50 percent per metric ton over the last year in some places, human waste is an attractive, and often necessary, alternative, Redwood said.

In cases where sewage sludge is used, expensive chemical fertilizer use can be avoided, he said. The sludge contains the same critical nutrients—nitrogen, phosphorous, and potassium.

Wastewater Recycling

It is generally unheard of for untreated wastewater to be used for agriculture in developed countries, simply because farmers there have access to treated water, said Margaret Catley-Carlson of the Global Water Partnership.

Instead, farmers in developed countries use recycled wastewater that often meets drinking-water standards.

To address health risks associated with wastewater agriculture in developing countries, IWMI recommends education programs for both consumers and farmers.

The nonprofit also recommends that such operations adhere to World Health Organization (WHO) standards for safe wastewater usage. WHO, in turn, has made their own standards less stringent.

"Overly strict standards often fail," James Bartram, a WHO water-health expert, said. "We need to accept that across much of the planet, waste with little or no treatment will be applied to agriculture for good reason." According to IWMI's report, few developing countries have

official guidelines for the use of wastewater for farming. But the fact that authorities are even acknowledging that wastewater agriculture exists is progress, the report says.

In the city of Kumasi, Ghana, home to 1.6 million people, IWMI estimates that there are about 12,000 families growing food on 27,000 acres (12,000 hectares) using mostly polluted surface water.

Just this year the Ghanaian government began to recognize this type of informal irrigation in its new irrigation policy, according to IWMI's Drechsel, who views the move as a giant breakthrough for addressing related health issues.

There are also low-tech solutions for "treating" human waste. IWMI suggests employing appropriate and time-tested indigenous practices.

The report cites examples in Indonesia, Nepal, and Vietnam. There, farmers store wastewater in ponds to allow solid feces and worm eggs to settle, possibly reducing bacterial content in the residual water.

Composting, in which heat kills much of the bacteria, is another option, according to the report.

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