



The Environmental Control and Life Support System Mockup for the International Space Station includes a Water Recovery System that uses an extensive filtering process. Source: NASA Marshall Space Flight Center

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## Student Highlight

Nathaniel “Nate” Delano is a second-year master’s student in the School of Natural Resources and the Environment’s Water, Society, and Policy program.

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## Publications

The Water Resources Research Center produces research reports, outreach materials and regular publications, including the Weekly Wave e-news digest, the quarterly Arizona Water Resource newsletter and the Arroyo, an annual publication focusing on a single water topic of timely concern in Arizona. **Sign up online to receive WRRRC newsletters, event updates and more at: [wrrc.arizona.edu/subscribe](http://wrrc.arizona.edu/subscribe).**



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# Innovative Technologies Solve Spectrum of Water Problems

Water-related technologies developed in recent years are improving efficiency, treatment, utility operations and more. These technological advances have already had an impact on water use and point toward future innovations.

## NASA Water Recycling Technologies Have Earthbound Uses

by **Lucero Radonic, WRRRC Graduate Outreach Assistant**

A search for advanced filtration water bottles at any online retail store will come back with various product options, many of them made possible by NASA-derived technologies. “Spinoffs” is the term used to refer to technologies that were developed by NASA for its space explorations and later adapted and commercialized for everyday use on Earth. Since the 1960s, when NASA first began to develop water purification systems for the Gemini

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# Conference Panel Takes on How to Close Water Supply-Demand Gap

transcript by **Ann Posegate, WSP Graduate Outreach Assistant**

On April 8, 2014, a panel of water professionals and thought leaders discussed ideas for closing the water supply-demand gap in Arizona, during the final panel session of the WRRRC Annual Conference, “Closing the Gap Between Water Supply and Demand”.

Moderator Sharon B. Megdal, WRRRC Director, opened the panel with a charge to the panelists to begin a dialogue on the topic, “Closing the Gap: How can we do it?” She provided brief introductions for all the panelists, noting that the first speaker, Jennifer McCloskey, Deputy Regional Director of the U.S. Bureau of Reclamation Lower Colorado Region, would be providing

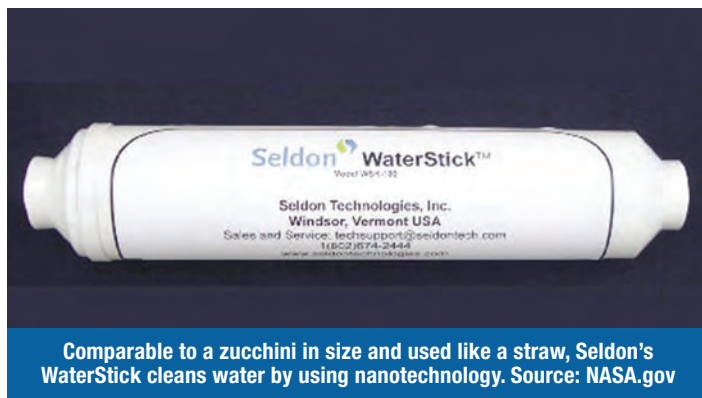
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program, technologies for water recycling and purification have taken off.

The first successful spinoffs came from Apollo-era technology. In preparation for lunar missions, in 1968 NASA developed a small lightweight water purifier the size of a cigarette pack that was designed for minimal power consumption and monitoring. This chlorine-free device dispensed silver ions into the water supply to kill off bacteria. A private company, Carefree Clearwater, Ltd. from Georgia, was later given permission by NASA to manufacture a modified version of the Electrolytic Silver Ion Cell for commercial and industrial applications. The commercial system passes a small electrical current through copper and silver electrodes, releasing ions into the water. The ions kill bacteria and algae in the water by breaking down their enzymes, and the ions and dead organisms are then filtered out. Independent studies show it to be effective against pathogens like *E. coli*, *Pseudomonas*, *Staphylococcus*, *Streptococcus* and *Salmonella*. This purification system is used today in swimming pools, hot water spas, cooling towers, decorative fountains, ponds, manufacturing processes, and evaporative water cooling towers. Less chlorine in the purification system means less eye irritation, less dry skin, and a reduced exposure to carcinogens.

NASA's Space Shuttle program, which requires a longer-lasting water purification system for its multi-week missions, has had more influence on the development of commercial technologies for drinking water purification. In the mid-1970s NASA developed a water purification system that used iodine, rather than chlorine, to kill bacteria. Since then, water for the Space Shuttle Orbiter has been disinfected by a unit that passes water through a bed of iodinated resin known as a Microbial Check Valve (MCV). The original MCV cartridge had limited life, requiring periodic replacements. Continued research led to the development of the Regenerable Biocide Delivery Unit, which regenerates cartridges in place without removing them from the unit. This improvement of space technology constitutes a significant advancement in water purification, and is useful for pressing needs on Earth. The use of iodine provides an effective disinfectant and eliminates the hazards associated with chlorine. In addition, regenerability reduced the cost, ultimately to perhaps less than one cent per gallon, compared with \$1 to 2 per gallon for bottled water, which makes it attractive as an emergency backup system for use during power outages, floods and other natural disasters.

In 2003, Seldon Laboratories LLC received a NASA Small Business Innovation Research (SBIR) award for a Nanomechanical Water Purification Device. Seldon patented Seldon Nanomesh, a lightweight, low-pressure water purifier that uses carbon nanotubes to remove waterborne viruses and bacteria quickly from large quantities of water. This system reduces the power requirements of closed-loop water treatment systems developed a decade earlier and successfully removes pollutants. The commercial version of the carbon Nanomesh designed under the NASA SBIR agreement was later released as WaterStick. This handheld, lightweight water purification system operates like a straw and is able to clean about 5 gallons (200 milliliters) of water per minute by using water pressure and gravity. Ease and portability makes this new line of spinoff water technology useful for accessing clean water in remote locations or disaster areas, where electricity might not be available.



A most recent innovation with great potential for future applications is the closed-loop water recycling system. In 2009, NASA gave the crew on the International Space Shuttle (ISS) authorization to drink the water purified by the station's new water recycling system. This was the first time water was recycled in a closed-loop system and made available for human consumption. Since that time, ISS has used distillation technology, an absorption bed, and a catalytic oxidation reactor to treat urine and condensate water to generate potable water. The equipment was developed to operate in microgravity, while being simple enough that it can be repaired by the astronauts and maintained in orbit.

As NASA gears up for a future mission to Mars, which would take about two years, it continues to explore new water-recycling and purifying technologies that could support such a mission and address some Earthly water concerns.

## Oro Valley Adopts Smart Metering

by Shirley Seng, Town of Oro Valley, AZ

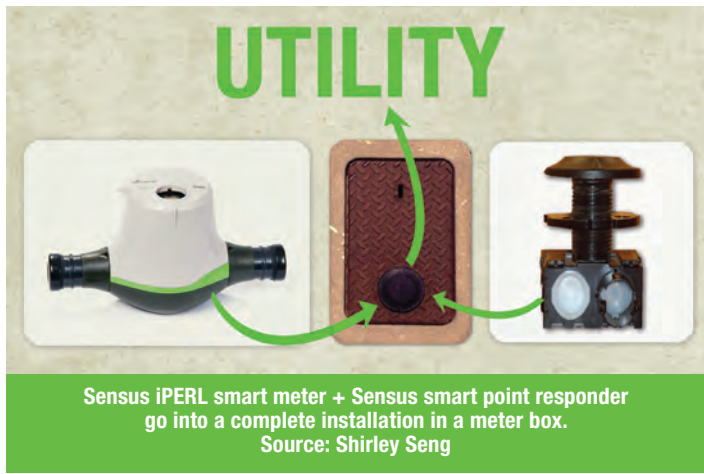
Smart metering is the wave of the future in improving the operating efficiency of water utilities, and the Town of Oro Valley, Arizona is catching the wave. Smart meters permit timely meter reading from remote locations, eliminating meter reading errors, increasing labor efficiencies, and providing early leak detection. Oro Valley began implementing Advanced Metering Infrastructure (AMI) along with a water meter replacement program in 2011. AMI equipment includes smart meters, smart point transponders, a computer server, antennas and base stations. Meter readings are transmitted from smart points to an antenna. The antenna then transmits that data to a base station and ultimately back to a dedicated computer server in the utility's office. The Town's AMI equipment allows Water Utility personnel to read meters from the office instead of manually reading them in the field.

The Town's initial project replaced 2,200 aging water meters in a satellite water service area about 10 miles from the Town's main service area. Personnel monitored and analyzed metering data for two years to evaluate the effectiveness of the technology. Results from the initial project showed a 4 percent reduction in unaccounted-for water and a 57 percent reduction in the volume of water credited for leak adjustments. The test installation also reduced the number of trips made by service personnel to the area by 56 percent, resulting in a gasoline savings of \$2,300 per year. In addition, the reduced traffic on residential streets provides a safety benefit.

The implementation of AMI has significantly improved

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customer service provided by the Town’s Water Utility. AMI water use data is transferred to a secure site that customers can access via a web portal known as AquaHawk. They are now able to view their water use on an hourly, daily, weekly, monthly or annual basis. Customers can set billing thresholds that, if exceeded, will trigger an alert sent via text, email or telephone, depending on their personal preference. The AquaHawk web portal can be viewed by customers anywhere they have internet access, making it a valuable tool for those who spend long periods of time out of town. The Town offers this web portal free of charge.

Early leak detection capability is a significant benefit of using AMI. The software associated with AMI allows Utility personnel to monitor for leaks on a daily basis. Customers are notified within 24 hours of a potential leak. This gives them an opportunity to repair the leak right away, resulting in savings of water and money. Conservation staff use this information to assist with water audits by educating customers about their specific water use.

With the elimination of manual meter reading, billing dates are no longer impacted by the day of week, holidays, weekends, or staffing. AMI allows the Water Utility to bill its customers on the same day every month, resulting in consistent water bills. This is important because the Utility uses increasing block rates to encourage conservation. Customers want to be certain that they have not tipped into a higher block rate because of a billing delay caused by a holiday.

The availability of AMI data facilitates the use of iPads by field personnel, which improve scheduling and customer relations. Daily work orders are emailed to Utility operators who then map a route for the most efficient travel plan. Through the use of Facetime on their iPads, supervisors can now support their staff without having to be at the same location. Field personnel also have access to the AMI data, as well as the billing and web portal software, allowing them to interact with customers on a new level. When responding to a customer inquiry in the field, personnel have the ability to show customers their water usage on a graph.

The Town is continuing with the AMI and meter replacement project throughout its entire water service area. The project is being completed in phases and is expected to be finished before July 2016.

In the future, the Town of Oro Valley will be incorporating water use data from AMI into its GIS mapping, hydraulic modeling and SCADA systems—the systems that handle the

automated operation of the Water Utility’s infrastructure. AMI will provide the actual water demand and location of that demand. In addition to improved modeling capability, this demand data will enable Utility personnel to make adjustments on SCADA equipment that will improve water system operational efficiency.

## Demand-Controlled Pumps: Saving water, time and money

by Dave Grieshop, Reality LLC, Sierra Vista, AZ

Hot water may come out of a faucet or showerhead, but it takes a plumbing system to get it to you. Regrettably, the vast majority of plumbing systems in the 75 million owner-occupied homes in the United States today are rather inefficient when it comes to delivering hot water.

This article reports on 11 of more than 130 homes in the Sierra Vista area that installed demand-controlled pumps (DCP) via a 2013 grant rebate program under the auspices of the Cochise Water Project, a not-for-profit 501(c)3 entity. These pumps meet IAPMO Material and Property Standard PS 115-2007, “Hot Water On-demand or Automatic Activated Hot Water Pumping Systems”.

DCPs have been around for two decades or so. They fundamentally do three things. First, they operate only when the homeowner activates the pump from any location in the home with an activation switch. Second, the DCP delivers hot water by priming the hot side from the water heater’s trunk line to the most distant fixture (sink) and uses the cold side of the trunk line to return ambient water back to the water heater – with no loss of water while the DCP is running. (Think of it as

Average daily waste	Without DCP	With DCP
Water, cups (16 cups = 1 gallon)	121.6	10.8
Time, seconds	252.4	25.2
<b>Average annual savings</b>		
Water, gallons	na	<b>2,567</b>
Time, hours	na	<b>23</b>
<b>Annual energy savings, dollars</b>		
Electricity	na	26 - 75
Natural Gas	na	12 - 35
Propane	na	27 - 77

Savings with Demand-controlled pumps. Source: Dave Grieshop

moving the water heater close to any fixture.) Third, the DCP automatically shuts off when it senses a 5 to 7 degree rise in temperature at the pump’s thermistor – about 2 to 5 feet from the hot water stub out. In other words, no hot water gets past the pump. The DCP is really a “fire and forget” pump activated by the homeowner when hot water is needed. Normally the DCP is installed under the sink at the most distant fixture from the water heater, using the existing hot and cold stub-outs under that sink. Once the DCP is installed and power is provided for the first time in the life of a home’s existing plumbing system,

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# Student Spotlight

## Nathaniel Delano, School of Natural Resources and the Environment



Nathaniel “Nate” Delano is a second-year master’s student in the School of Natural Resources and the Environments’ Water, Society, and Policy program. He is also pursuing a graduate certificate in Geographic Information Systems and working as a Graduate Assistant at the WRRRC, under the direction

of WRRRC Director Sharon B. Megdal.

Delano grew up in rural Virginia on the shores of the Chesapeake Bay. Growing up exploring and learning about centuries-old farms, forests and unique ecosystems, and the people who depend on them, gave him a lifelong interest in the interaction of humans with their environment. This interest was informed and sharpened at the Chesapeake Bay Governor’s School for Marine and Environmental Science, a regional magnet school that he attended for his final two years of high school. Delano then attended the University of Mary Washington in Fredericksburg, Virginia, where he majored in History and Geography, and completed a senior thesis on the economic and cultural influences of declining water levels in the High Plains Aquifer, sparking an interest in water management.

Upon completion of his undergraduate degree, he joined the Peace Corps as an agricultural extensionist and was sent to Paraguay. During his 27 months in Paraguay, Delano lived in a one-room house in Barrio San Pedro, a small, rural, predominately subsistence-based agricultural community. His role primarily focused on the development of a community needs assessment and the subsequent implementation of projects identified in that assessment. He constructed 55

wood-burning cooking stoves (known as fogonés), introduced green manures to the crop cycle for farmers, and kept bees with many members of the community. With one particularly engaged Paraguayan living in his site, Delano constructed a complete sustainable farming system, including gardens, bees, compost, a woodstove, an egg incubator and a biodigester.

This combination of theoretical interest and practical experience in natural resource management led him to enroll at the University of Arizona as a Paul Coverdell Peace Corps Fellow, and continue his study of water and natural resource management and GIS. While still developing, his master’s project will likely be centered around a partnership with local Tucson NGO, Native Seed/SEARCH, focusing on developing a water saving irrigation system for its conservation farm in Patagonia, Arizona.

As a graduate assistant at the WRRRC, Delano has worked on various projects with his advisor, Dr. Sharon B. Megdal. Their work on characterizing Tucson’s water service providers compared to other cities was recently published in *The Water Report*, a respected water newsletter. He has additionally created several maps that have been published in well-known journals, such as *Groundwater*. This summer he is working on WRRRC grant proposals, mapping projects, and coordination of a major meeting on antibiotic resistance, hosted by the UA in August.

## CALS Outstanding Senior

The College of Agriculture and Life Sciences awarded the Outstanding Senior award to Leah Edwards of the department of Agricultural and Resource Economics, who completed two degree programs, Environmental and Water Resource Economics and Political Science. Leah worked at the WRRRC between 2011 and 2014 for the Water RAPIDS (Research and Planning Innovations for Dryland Systems) program. She is pursuing a career integrating environmental economics into policy for Western cities in arid regions. 🏡

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a loop is formed from the water heater to the most distant fixture and back to the water heater. This newly formed loop, incorporating the DCP, is the key to avoiding waiting for hot water and wasting water that otherwise would go down the drain! (For more detailed information on how a DCP works, visit [www.gothotwater.com](http://www.gothotwater.com).)

To calculate the impact of the DCPs on the 11 homes in which they were installed, data on wasted water and wasted time were gathered. Four daily demands for hot water were posited: three at the kitchen sink and one at a master bathroom fixture. In reality this is a very low estimate of demand that makes the calculations conservative. Wasted water and wasted time data were collected by homeowners when using their DCP and not using their DCP. The data reported are behavioral, not scientific, yet are real. As expected, the data had notable variances. The table shows the daily and annual results plus annual inferred energy savings due to water saved via a DCP. While water, time and energy savings

were expected with a DCP installed, the magnitude of these savings was greater than anticipated. Energy costs used in the savings calculations were based on average Arizona costs for spring 2014 as calculated by the DOE’s Energy Information Agency.

In multiple surveys of homeowners who installed DCPs, 100 percent said they would do it again. When asked why, the universal answer was “the convenience” provided by the pumps. One homeowner made this comment about their pump: “It’s the best thing we have done in our home in 30 years.”

Homeowners might also want to consider this demand-controlled pump in their homes, given where we live in the Desert Southwest. Water is a precious commodity and should be used as efficiently as possible with convenience and reduced energy expenses as a bonus. Visit [www.thecochisewaterproject.com](http://www.thecochisewaterproject.com) for more information. 🏡

## UCLA Tests Cargo Container-Sized Desalination Plant

The Los Angeles Times reported on May 2, 2014 that UCLA was about to test a new mobile water treatment system for treating brackish groundwater and agricultural runoff. A 40-foot cargo container holds the test desalination plant, which uses membrane technology to produce fresh water. The unit can be controlled remotely to adjust operations to deal with changes in water quality and potential membrane fouling, eliminating the need for on-site maintenance personnel. Treating up to 25,000 gallons of brackish water per day, the mobile treatment plant is being tested on high-salinity drainage water in the San Joaquin Valley. Inventor-designer Yoram Cohen of UCLA said the technology is scalable from household size up to serving entire cities. The U.S. Bureau of Reclamation, the California Department of Water Resources and several water districts in the San Joaquin Valley are supporting the testing.

## Microbes Power Wastewater Treatment and Energy Production

A wastewater treatment system that produces electricity is being employed in the beer brewing and wine making industry, according to a Planet Forward report ([www.planetforward.org/tv-segments/beer-space-water-conservation](http://www.planetforward.org/tv-segments/beer-space-water-conservation)) and a story on the Guardian Water Hub. The production of beer uses five times the amount of water contained in the beer, and wine production uses considerably more. The rest of the water is waste in need of treatment. The company Cambrian Innovations has created a waste treatment system called Ecovolt, which uses microbes to turn the constituents of wastewater from these production processes into electricity and heat. The energy is used to reduce electricity costs. Although Cambrian is not the only group exploiting this technology, it has the advantage of an almost off-the-shelf product. Units are modular and operated remotely by Cambrian.

## Proposed Rule on Waters of the U.S. Encounters Opposition

The Waters of the U.S. (WOUS) Proposed Rule released on March 25, 2014, is intended to clarify the definitions of streams and wetlands regulated under the Clean Water Act (CWA) including those considered seasonal. According to the EPA, the rule does not propose to cover any new types of waterways, while others feel it will extend the reach of the CWA. At the request of agencies meeting with representatives of states, local governments, stakeholders and elected officials, the comment period for the proposed ruling has been extended an additional 91 days from July 21 until October 20, 2014. The Western Governors' Association says the rule-making will hinder state authority in water management, and outreach conducted by the EPA and Army Corps of Engineers does not satisfy Executive Order 13132 designed to include states, when possible, in designing federal regulation. Pushback has also come in the form of criticism from industrial and agricultural interests,

which say the ruling will greatly increase mandates for CWA permits that could paralyze the economy. Information about the proposed rule can be found at [www.epa.gov/uswaters](http://www.epa.gov/uswaters). Comments are being taken at <http://www.regulations.gov/#!submitComment;D=EPA-HQ-OW-2011-0880-0001>.

## Direct Potable Reuse Comes to Wichita Falls, Texas

The city of Wichita Falls, Texas announced plans for a direct potable reuse system that will create a blend of 50 percent treated wastewater and 50 percent lake water that regularly supplies the city. The ongoing drought in West Texas is pinching existing water supplies and new sources are needed. The waste water that would normally be treated and discharged into the Big Wichita River, a source for downstream water users, will be piped to the drinking water treatment plant and purified to drinking water standards. The plant will use chlorination, advanced filtration and reverse osmosis in the purification process. Although Big Springs, Texas has been drinking its treated wastewater since 2013, Wichita Falls is the first of several Texas cities to embrace direct potable reuse on a city-wide scale. The system is expected to come on line in July when water quality testing, required by the Texas Commission on Environmental Quality, is completed and results are analyzed to ensure that the water is safe to drink.

## Catch the Rain: 2014 WRRRC Summer Photo Contest




The theme of the 2014 WRRRC photo contest is “Catch the Rain”, which challenges photographers to capture Arizona-specific ways rain is captured—from water in our natural environment, to the ingenious ways we catch and use rainwater.

Each photograph submitted in the contest should place an emphasis on one of two categories:

*Water in Nature:* Including (but not limited to): rainfall; rivers, streams, washes and watersheds; rain-fed native landscapes and natural habitats; people and/or wildlife and rainfall, monsoons and storms; wetlands and waterways; etc.

*Catch and Reuse:* Including (but not limited to): natural and built water collection; low water use landscapes; rainwater harvesting; rainwater runoff/collection; rainscapes, xeriscapes, rain gardens, food gardens; cisterns, tanks and earthworks; etc.

The WRRRC will select three winning photos: Best of Show, and Best of Category for “Water in Nature” and “Catch and Reuse.” A \$100 cash prize will be awarded to the Best of Show winner and each Best of Category winner will receive \$75. Additional photos will be selected to round out a Top 20.

Readers can learn more and submit photos at: [wrrc.arizona.edu/photo-contest/catch-the-rain](http://wrrc.arizona.edu/photo-contest/catch-the-rain). 





WRRC Director Sharon B. Megdal moderates a panel discussion on Closing the Gap: How Can We Do It? Source: John Polle

background on the Colorado River water situation from the federal perspective.

The second speaker, Kathleen Ferris, spoke from over 36 years of experience with water issues. She co-wrote the 1980 Groundwater Management Act and worked with the Arizona Municipal Water Users Association for many years before being named its Executive Director in 2012. Rick C. Lavis has been the Executive Vice President of the Arizona Cotton Growers Association for the past 33 years. George Arthur was elected to the Navajo Nation Council in 1991 and served there for the next 20 years. He is a founding member of the Colorado River Ten Tribes Partnership and Immediate Past President of the Colorado River Water Users Association. Thomas W. McCann is the Assistant General Manager for Operations, Planning and Engineering for the Central Arizona Project. Sandra Fabritz-Whitney held several positions at the Arizona Department of Water Resources over her 20 years of service, most recently as Director. She is currently Water Strategy Director with Freeport-McMoRan. Speaking last on the panel, Rodney B. Lewis, of the Gila River Indian Community, is a consulting attorney, Akin Gump Strauss Hauer & Feld LLP, advising American Indian tribes on federal and state public policy issues.

## Panel Discussion

The following summary is an abbreviated transcript of the panel session.

**Jennifer McCloskey:** The Colorado River is a key component of Arizona's water supply, the allocation being 2.8 million acre-feet (maf) of water. On the Colorado River, we are in a significant drought. We have been in a drought for the last 14 years. This is very much driving the conversation about water around the Colorado River.

Through the course of this year, we're expecting a decline in our reservoirs, going down to 53 percent at Lake Powell and 40 percent at Lake Mead. The good news is because of the management of the water supply, we have had a little bit

of relief with the snowpack this year. The latest projection is that we'll be back up for water year 2015. However, we do have a slight risk, even with our 9 maf projection, of being in a shortage condition in 2015. We have a little greater than a 50 percent chance of being in a shortage condition in the 2016 time frame.

Regarding our water budget for Lake Mead in the Lower Colorado River, for our apportionments in the lower basin, we're on average expecting an inflow of around 9 maf. Our commitments, our outflows in the lower basin for Arizona, California, Nevada, and Mexico combined are 9.6 maf. That's further exacerbated by evaporative losses of 0.6 maf, giving us an annual gap of 1.2 maf. These projections and these kinds of conditions, not only the drought, are also driving the conversation and putting a strain on the gap.

Reclamation has been a part of the conversation with the water users on the Colorado River. Part of that conversation is making sure that we continue to protect what we call the interim guidelines, which dictate how our reservoirs are going to operate.

They also provide for reductions in use for shortage conditions and are an important part of protecting our water supply for sustainability purposes.

Several programs we have initiated contribute to closing the gap. We are re-engaging in a program called System Conservation. When we engaged in this program in the past, we entered into voluntary fallowing agreements. The water that we would be able to purchase as a result of this program would be put into system storage. We would keep that volume at Lake Mead to help stave off potential for shortage and help protect water supplies for the future.

Another program is intentionally created surplus. Today, we have stored about 1.5 maf of water in Lake Mead as a result. Finding ways to be flexible and expand this program into the future is going to be another key component.

Our agreement with Mexico in Minute 319 provides for Mexico to share in shortage with U.S. basin states. In the good times, they can also share in surplus. Mexico suffered a significant earthquake in the Mexicali Valley in 2010, and since then, it has been storing water in Lake Mead for future use as part of this agreement. We're looking at investments in conservation in Mexico. I think our work with Mexico is going to be significant.

Another component is water for environmental flow. We're looking to time the delivery of water for environmental commitments.

We're also working on operational efficiency, on our ordering procedures, on communicating about water that gets delivered to farms and the irrigation district and which gets released out of system storage, and seeing what we can do to further refine that process so the amount released more closely matches the amount taken.

**Kathleen Ferris:** Conservation will continue to be necessary. But conservation and reuse alone will never close the gap. They are the tools that municipalities and water providers use first to stretch their water supplies. They won't necessarily translate to reductions of diversions from the Colorado River. Municipal providers are on the front lines of conservation and

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I personally think that municipal providers have taken a bum rap in the last few years. We've had so much talk about how much we are not doing and so little education about what we are doing. While our population has increased by 152 percent since 1980, our water use has increased by only 87 percent. We do all this while providing clean, reliable supplies on a day in, day out basis.

Another point I want to make is that groundwater mining cannot be a way to stretch our water supplies in the West in general. We have spent decades protecting our groundwater supplies as a savings account for times like those we might be facing.

Another one of my truths is that I think we need smarter growth. Growth should occur where water supplies and infrastructure exist to serve that growth. We should discourage growth based on groundwater. We should prevent urban growth for which an adequate water supply is not acquired in advance. We should stop believing that every acre of land has a right to grow houses.

Finally, there are tradeoffs to everything that we do. We could in the future ban all swimming pools and water features and say we're not going to have a blade of grass. But is that what we really want to do? Do we want to make the desert so inhospitable that no one would ever want to move here? Maybe some would like that, I don't know.



Panelist Rick C. Lavis, Arizona Cotton Growers Association, speaks on Closing the Gap: How Can We Do It? Source: Lynn Ketchum

**Rick C. Lavis:** I'm getting concerned about how we're making water policy in this state. It isn't the old water policy paradigm that we understood in 1980. There were three interest groups at the table: mining, cities and agriculture. Who wasn't at the table? Developers, home builders, environmentalists, and others. We have fantastic representation in this room of people who are involved in water policy in this state. What's missing? Leadership.



The structure created in the 1980 Groundwater Management Act was first-rate. There needs to be a conviction and a commitment to working on a new structure of policy making when it comes to shaping contemporary water policy for Arizona.

You have to get in the room and do business with people. It has to be a consensus. My message here today is, don't walk out of this room thinking that various kinds of water solutions are supplies and demands issues. That's only one part of the picture. We've got to think about how we do this. I want to emphasize how important it is for this state to create and capture a new process which represents all entities.

**George Arthur:** There has certainly been a variety of concepts and ideas stated as to how to bring the gap closer. But this panel is stating why it's not going to work. In order for this to work, in order for the gap to come closer, the Tribes have to be at the table.

Also, is the next generation after us present here? No, they're not. How do we get that segment involved, and who's going to do it? The schools? The leadership? I think those elements are missing in closing the gap. It's not impossible to implement. This university, I think, just by observation the past few months, is doing a tremendous job of educating and reaching out. Earlier, someone said that water is life, and indeed it is. It's life to those generations that are yet to come. In Navajo terms, we speak about eight generations. In order for us to move forward, we have to be creative, we have to be conservative, but most often, we have to communicate. We have to cooperate. We have to listen, and we have to understand.

The Ten Tribes have asked the Bureau of Reclamation to do a two-year study that would involve them. It would be referred to as the Colorado River Basin Tribal Water Study. The partnership basically consists of Jicarilla Apache, Southern Ute, Ute Mountain Ute, Navajo, Northern Ute of Utah, Fort Mojave, Colorado River, Cocopah, Chemehuevi and Quechan.

Having been a party to both sides of the table, from a tribal perspective and through serving as the Colorado River Water Users Association President, I know that we can move forward and we can accomplish the task of bringing the gap closer in our time.

**Thomas W. McCann:** I want to start with a short quote, and see if this sounds familiar.

"... assuming a long-term average annual supply of 14.9





Panelists Kathleen Ferris, Arizona Municipal Water Users Association and Sandra Fabritz-Whitney, Freeport-McMoRan, on Closing the Gap: How Can We Do It? Source: John Polle

million acre-feet, sometime after the Central Arizona Project is fully operational the Colorado River will not yield enough water under normal circumstances to meet Upper and Lower Basin demands, Mexican Treaty obligations, and system losses. Thus the Colorado River Basin faces future water shortages unless its natural flows are augmented or Basin development is curtailed.” [“Westwide Study Report on Critical Water Problems Facing the Eleven Western States” U.S. Dept. of the Interior, 1975]

Today, it seems like we are just as far away, if not further, from where we were in 1968 [the Colorado Basin Project Act] as described in the 1975 Western U.S. Water Plan Study (see <http://babel.hathitrust.org/cgi/pt?id=uc1.b4515074;view=1up;seq=9>). If we are not willing to invest in, show an interest, have a willingness to pay, and have environmental willingness to do projects [to augment the water supply], then we need to look at the other side of the equation.

We’re in what amounts to an unsustainable condition. Kathy [Ferris] talked about groundwater mining; that’s not sustainable. Most of us know and accept that. But we’re doing the same thing on the Colorado River. We’re mining our storage in Lake Mead. For the last 14 years of drought, we’ve had normal releases from Lake Powell every year until this year and the elevation of Lake Mead has gone down. We got by in the 80s and 90s when the Central Arizona Project wasn’t fully on board yet, and we only started delivering [Arizona’s full 2.8 million acre-foot apportionment] around 2000, which happened to be when the drought began. Now we’re seeing the consequences of failure to take action, and we’re at the point where we have to do something. The choices that we have are not going to be pleasant for anybody. They’re going to involve money. They’re going to involve water. And they’re going to hurt.

**Sandra Fabritz-Whitney:** I came in here this morning looking for some very specific action items, specific words. I heard these words: cooperation, collaboration, coordination, working together, and augmentation. I’ve heard augmentation a total of 13 times and the others a total of 22 times.

Throughout the day, we have been given a lot of perspectives. There has been a lot of finger-

pointing as well. But this is about all of us, this is about Arizona, and every single one of us is part of this. What we need to figure out is how to work together. The 1980 Groundwater Management Act brought mines, cities and agriculture users together. They were the biggest water users in the state, and they were probably the ones who should be doing something about their water use in the state and conserving water. So, from that perspective, that worked. But you’ve got to make sure that everybody is in the room, everybody is talking with each other, not at each other. That’s how we’re going to find solutions and close this gap.

Director Lacey this morning presented the state’s plan. ADWR has taken the initiative to try to solve the situation. Key and paramount to that is getting leadership to support these solutions, as others said. It’s not just political leadership. It’s the business community, communities, cities, towns, local politicians, individuals—we all have a role in solving these issues. Now we’ve got something to rally around. We have a vision from the State of Arizona. But it’s nothing new. As Tom pointed out, we’ve been talking about these things forever. It’s time to stop talking. It’s time to start *doing* something.

**Rodney B. Lewis:** One thing George [Arthur] mentioned earlier is that many times tribal groups have been left out of discussions about water in Arizona. Prior to 2000, in my opinion, there was considerable tension between the Tribes, Indian interests, the state and even the federal government, and of course other interests. We talk about cooperation now. The concept simply did not exist. Things didn’t change until we were gathered together under strict supervision, guidance and oversight by Senator Kyle, Bruce Babbitt and Governor Hull, who called us into a room and said, “Look, we’ve got to work this out.”

Prior to that time, I think the general attitude of many people in Arizona was that you can’t work with Indian Tribes. Why not just litigate to try to get people to assert their rights? There’s certainly a changed attitude now. Things have gotten a lot better. In a sense, the State of Arizona has matured, has come to respect and acknowledge that Indian tribes are entitled



Panelists George Arthur, Ten Tribes Partnership, and Rodney B. Lewis, Akin Gump Strauss Hauer & Feld LLP, on Closing the Gap: How Can We Do It? Source: John Polle



to water, that there are ways in which water can be allocated that perhaps do not harm existing users. That was the basis of the Arizona Water Settlements Act of 2004. Since that time, the pace has picked up. We have a lot of water settlements coming through. I think that's important if we're talking about how we close the gap as we look forward.

One way in which supply and demand can be met is with tribal groups working together. This is something we haven't done very extensively. A lot of tribes have developed water policy and are working diligently toward not only protecting their rights, but actually using the water to which they're entitled. The Inter Tribal Council of Arizona has a water policy council which is beginning to put Tribes together to think in the big picture, to work together with their water and develop a water policy and work with other interest groups to address the need for closing that gap.

We can look toward water exchanges. Tribes at some point in the future will be working with water marketing, leasing and participating in conservation efforts. What about taking a look at the true cost of water as far as consumers are concerned? That's something to think about and something which water interests in Arizona should sit down and begin to work on with Tribal groups from this point on.

**Sharon B. Megdal:** What seems to ring through [these ideas] is the issue of process: How can we do it? I want to tell a story about an experience of my own as I was returning to the University in 2002. Having sat on the Governor's Water Management Commission that finished its recommendations in late 2001, there was talk about the need to educate legislators on water, especially with term limits and questions about the knowledge base. I thought the University should be helping educate anyone who wants to be educated. We held a dinner and invited legislators. Thirty-three showed up. That was good, but it was a real challenge to get something scheduled because legislators are either running for election or they've just had their election and they're very busy. How do we do the education?

**Kathleen Ferris:** Leadership is critical but elusive. There's an elected official who decides that this is a really important issue and he or she is going to make sure that the stakeholders get in a room and hammer out their disagreements. In my view, it's not enough to educate. We have to find somebody in the legislature or in the governor's office who cares deeply about this issue and who is smart enough to take it on.

**Rick C. Lavis:** The question is: Who is going to lead? The shortage issue looms very large, and agriculture's right smack dab in the middle of it. Also, we've all been living off the luxury of our successes. We're not sitting in the room here talking about a crisis. We're talking about how we make it better, how we take care of our water problems.

**Rodney B. Lewis:** You go to a lot of water conferences and a lot of the ideas are about how to work out negotiations. One way is to identify what's important to the other party or all the parties in the room, and then you work on those. In the Indian experience in Arizona, that's simply not how it works. It's really been about how one can take Indian water without paying for it. It's been a difficult kind of process. Leadership is absolutely essential. That requires the education of political leaders, and you in this room are the people who are able to provide that education for the respective political leaders in Arizona.

**Sandra Fabritz-Whitney:** The traditional model that worked very well in the Groundwater Management Act and

the Water Settlements Act worked in those situations. I'm not disparaging it, but maybe the old model is not exactly what we should be using. Maybe it's time to look for a new model as we think through these things, as we try to find solutions. Nobody can do this alone. We've got to work together. Maybe it's new, innovative, creative ways of finding these solutions and somebody to lead that charge, whether it's political leadership or business leadership.

## In Closing

As time ran out, Megdal closed the panel with a call to action from the panelists and the audience. She noted that the panel provided some good advice, but left some unanswered questions on how to put their advice into effect. Reiterating comments by the panel, she emphasized the importance of dialogue and identified the need for that key person who puts people around the table. Finally, she stated that non-water people—the business community and others—need to be engaged in water issues, but that broader engagement will be a challenge. “We need to get people excited about water without getting them alarmed,” she said. “We need to excite people into action before we do have a crisis.”



2014 Conference audience members hear perspectives on how to close the Arizona water supply-demand gap. Source: Lynn Ketchum



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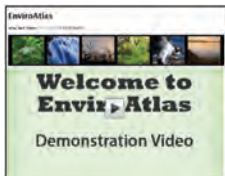
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## EnviroAtlas

U.S. Environmental Protection Agency, [enviroatlas.epa.gov/enviroatlas/atlas/html](http://enviroatlas.epa.gov/enviroatlas/atlas/html)



On May 6, 2014, the U.S. Environmental Protection Agency (EPA) released a web-based interactive tool, *EnviroAtlas*. The atlas is meant to help decision makers understand the implications of planning and policy decisions on ecosystems and the communities that depend on them for goods and services. Designed for everyone interested in the impacts of a decision, such as siting a new road or city park, *EnviroAtlas* is available to anybody with access to a computer and an internet connection. No special software is needed. *EnviroAtlas* integrates more than 300 separate layers of geospatial data from a variety of sources. Key components are an interactive map, a browser that shows linkages between ecosystems, the services they provide and human health, and resources including GIS and analysis tools. A video tutorial is available to guide people through the use of the interactive map. Developed through the collaboration of EPA; U.S. Geological Survey; U.S. Forest Service; other federal, state, and non-profit organizations; and several universities, this powerful web application lets users generate customized maps and images that show the condition of their local air, water and landscape; as well as population density and other demographic data. Not yet optimized for smartphone or tablet use, a mobile-friendly version is planned for the future.

## Water and Business

*Nature Climate Change*, May 2014

The journal *Nature Climate Change* published a special issue containing a series of opinion papers on water challenges facing businesses from the risks associated with climate change, extreme weather and population growth. These four papers feature case studies and solutions available to businesses to effectively plan for a sustainable future. Peter Simpson discusses the need to integrate the expertise of water companies in local water management decision making. He presents a case study of strong investment in both infrastructure and business planning by a water company in a region heavily impacted by extreme weather. Water expert Arjen Hoekstart analyzes the role of water in trade supply chains from a global perspective. She considers business participation in water stewardship and stresses the importance of the role of government, including oversight of water allocation and leadership in basin-level and international cooperation. Paul Kelly emphasizes the necessity of looking at adaptation measures that businesses can implement to ensure the sustainability of supply chains. Finally, in a case study drawn from India, Andy Wales recounts the story of making sustainable beer within a local supply chain in which the relationships between water, food, energy and local labor are seen as a nexus of resources. These articles in *Nature Climate Change* can be found at <http://www.nature.com/nclimate/focus/water-risks/index.html>.

## Water Harvesting Assessment Toolbox

UA Water Resources Research Center, [wrrc.arizona.edu/dwhi/toolbox](http://wrrc.arizona.edu/dwhi/toolbox)

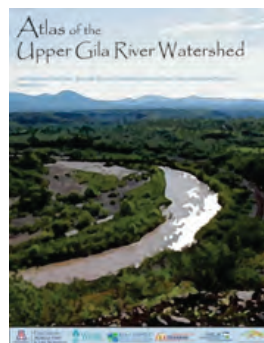


The Desert Water Harvesting Initiative (DWHI), a program of the WRRC, recently released its new Water Harvesting Assessment Toolbox. This decision-support guide aims to help communities in the arid and semi-arid Southwest evaluate water harvesting as a strategy for meeting water resource challenges and providing multiple additional benefits, such as mitigating urban heat island effects, reducing energy costs and meeting stormwater quality regulations.

This prototype water harvesting decision guide was developed as part of a two-year research grant from the U.S. Bureau of Reclamation WaterSMART program and the Desert Landscape Conservation Cooperative. The Toolbox includes a narrated video presentation orienting users to water harvesting, linked web resources with further information, and several worksheets designed to help users develop an appropriate roadmap for implementing water harvesting in their communities.

## Atlas of the Upper Gila River Watershed

Katie Banister, David Chan, Jessica M. Driscoll, Christopher Fullerton, Aaron Lien and Kelly Mott Lacroix, UA Water Resources Research Center, January 2014



This Atlas contains a baseline assessment of conditions in the Upper Gila River watershed. It includes information on the history, cultural and natural resources of the watershed, and how some of those resources have changed over the past few decades. The range of information it provides includes basic geography of the region: geology, soils, towns and roads, to changes in watershed conditions: land use, forest fires, population and groundwater levels. Organized as a comprehensive reference for quick access to available information, the Atlas can also be used as a starting point for watershed planning, because it provides a common base of data for stakeholders in the Upper Gila River watershed. The Atlas was assembled using a database with 62 unique geospatial datasets ranging from soil erodibility to instream flow right applications. It includes more than 20 original maps, as well as the first Automated Geospatial Watershed Assessment model for the Upper Gila River watershed. The Automated Geospatial Watershed Assessment model can be used to determine the impacts of changing land use characteristics on water resources, and maps showing key model outputs can be found in the last section of the Atlas. The Atlas can be accessed at [wrrc.arizona.edu/sites/wrrc.arizona.edu/files/programs/AzEWNA/pdf/Atlas\\_web\\_final.pdf](http://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/programs/AzEWNA/pdf/Atlas_web_final.pdf). 📄



## Complex Water Management Issues Require Thorough and Ongoing Dialogues



By Sharon B. Megdal

We in Arizona justifiably speak of our water management accomplishments. The Groundwater Management Act, the completion of the Central Arizona Project, the storage by the Arizona Water Banking Authority, and our recharge statutes have put the most populous parts of our state on a strong footing. We have prepared for anticipated Colorado River shortages by negotiating with the other Colorado

River Basin states for shortage declaration criteria that would result in more frequent shortages but more limited cutbacks to Municipal & Industrial (M&I) and Indian deliveries. The Water Banking Authority has stored millions of acre-feet of water for times when shortage would be deep enough to affect M&I and Indian CAP water subcontractors. However, challenges remain. The 2012 Bureau of Reclamation *Colorado River Basin Water Supply and Demand Study* was termed a “call to action”. More recent information on the condition of the Colorado River and the probability of a shortage declaration has been referred to as a “wake-up call”.

Notably, the term “structural deficit” was used in association with Colorado River allocations in a recent Central Arizona Project white paper, entitled “The State of the Colorado River”. The paper states: “The continued decline in Lake Mead is due in large measure to the structural deficit that exists in the Lower Basin. Simply put, the Lower Basin uses about 1.2 million acre-feet more each year than it receives from Lake Powell and from side inflows. If steps are not taken in the next few years to correct the structural deficit, there is increased likelihood of conflict among the Basin States, the United States and Mexico.” This is a most sobering acknowledgement. The briefing paper can be found at <http://www.cap-az.com/documents/meetings/05-01-2014/9.%20Colorado%20River%20Report%20May%201%20Board.pdf>.

The text continues: “It is the responsibility of all Lower Basin states and water users and the United States to take action to close the structural deficit. Augmentation may be an effective long-term solution, but immediate action is needed to avoid critical reservoir elevations. The only available near-term options are those that reduce system losses and reduce consumptive use in the Lower Basin.”

Regarding the state of our water resources and addressing Arizona’s water challenges, Kathleen Ferris, Executive Director of the Arizona Municipal Water Users Association, recently wrote in her blog: “We are desert dwellers who hope for the best and plan for the worst. Keeping the big picture in mind and having the foresight to make the bold choices and investments needed in these challenging times will ensure that we maintain our resilient water supplies.” CAP Board President Pam Pickard wrote in the *Arizona Daily Star*: “If the drought continues unabated, the previously agreed-upon shortage sharing measures may not be sufficient to compensate for the Lower Basin (Arizona, Nevada and California) continuing to use more water than it receives each year. Ultimately, the extended drought on the Colorado River can only be addressed by reducing demand, curbing system losses and adding new supplies.” Elsewhere in this newsletter, you can read additional perspectives on closing the gap between water supply and demand.

I often include a slide, shown here, in my many presentations that I formerly called my “Issues and Challenges” slide. More

recently I have changed its title, adding the word “solutions”. While not exhaustive, this list gives a flavor of our solution options and sources of uncertainty. In these presentations, I also point out that many are working diligently to identify solutions for both the near term and the longer term.

Let me say very clearly that we are not in a water crisis, but also clearly state that we face some very serious challenges. This is the time for attention and participation of *all* stakeholders, not only the water community. We need to work with the Arizona Department of Water Resources as it engages in the dialogue envisioned when it released its “Strategic Vision

for Water Supply Sustainability”. We need active and continuing education and dialogue on these matters in order to foster better understanding of these challenges. Only if we understand them, can we develop and implement the necessary multi-faceted solutions, which are unlikely to come cheaply or quickly. We must work together. It is time for all to engage. 🏡

### Complex Water Management Issues, Challenges, and Solutions

- Growth and the need for additional supplies (competition)
- Drought/climate variability
- Water-energy nexus
- Water quantity assessments
- Water quality
- Desalination
- Use of recycled water for potable and other water needs
- Access to and utilization of renewable supplies
- Transboundary water issues
- The surface water/groundwater interface
- Riparian areas and other environmental considerations
- Water rights settlements
- Conservation programs
- Water storage and recovery (water banking)
- Groundwater replenishment
- Water cost/pricing
- Water planning

Uncertainty!





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Santa Cruz River-Photo by: Brian Powell



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