

Four factors prevent us from getting the most benefit out of this precious resource — but technology isn't one of them.



# WATER REUSE: Barriers to Success... And How to Remove Them

**“Water’s pull is universal. It must be a tidal thing, the magnetic draw of that aromatic, blue surface. Water replenishes the senses and rinses the soul.**

**It is why a third of the world’s people live near a coast line. The comfort found in water runs deep.”**

**— D. H. Lawrence**

It is way more than comfort that keeps our attention on water, especially when we don't have it. It replenishes the senses, but more importantly, keeps us alive and rinses our bodies as well as our souls.

But this earth upon which we live and work has a finite water supply. The total of all water in the world available to the human population in all of the lakes, rivers, accessible aquifers and oceans is one percent. Joel E. Cohen — in his book, *How Many People Can The Earth Support?* — calculated there are 3,559 cubic miles (14,000 cubic kilometers) of fresh water.

That was the total available when Adam and Eve got into trouble in the Garden of Eden, and now with six billion of their cousins inhabiting the earth, the same amount of water is still all we have. And if projections are right, by 2050, 12 billion people will be sucking up the same finite quantity.

The earth is like a huge spaceship using the hydrological cycle to reuse water constantly. If we know this, why are there barriers to water reuse?

A shining example of why is the Metropolitan Wastewater Department in San Diego, which is currently spending tens of millions of dollars to treat 240 million gallons per day (gpd) of water coming from the Colorado River and the Sacramento Delta, only to use it once and dump it in the Pacific Ocean — when it could provide tertiary treatment recycle for reservoir augmentation.

## **The Water Crisis — A Clear and Present Danger**

Also, why do we build more homes with larger and larger bathroom facilities when we know about these barriers to water reuse? We are on an unsustainable course in the lower 48 states in the United States. Consider **Figure 1**, which charts water usage

versus U.S. population increase.

As indicated, in 1900 the population of the U.S. was 50 million and our per capita water use was about 25 gpd. As this is written, more than 300 million of us are using more than 200 gpd. This usage level is unsustainable. And estimates of U.S. population growth project 36%–100% more water users by 2050.

One hundred years ago, it was not uncommon to be directed to the backyard to find one's bathroom. Today, home planners are increasing the comfort of the residents, but at the same time using more and more water in the bathrooms (**Figure 2** on page 9).

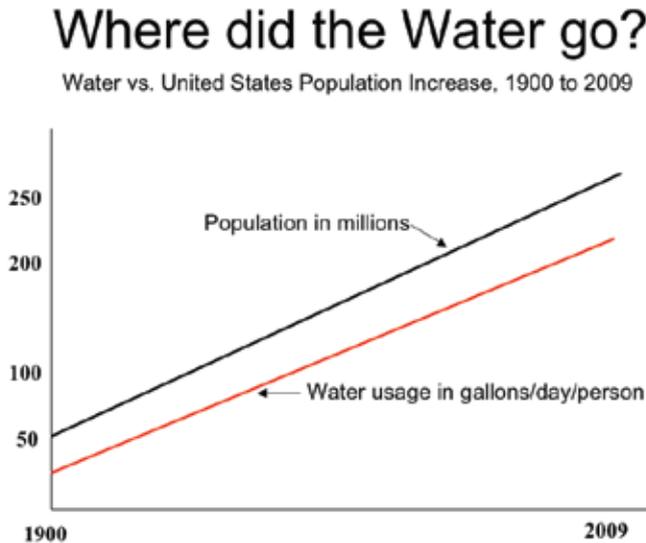
In the lower 48, 35 states are currently fighting over water. Robert Glennon, in his new book, *Unquenchable — America's Water Crisis and What To Do About it*, summarized some of the critical battles:

- Colorado farmers have watched their crops wither because of a lack of irrigation water.

- Atlanta, GA, came within three months of running out, so it banned watering lawns, washing cars and filling swimming pools.

- Orme, TN, did run out of water and was forced to truck water in from Alabama.

> Figure 1.



> Figure 2.



A 21st Century bathroom. Source: Kohler Co.

- Hundreds of workers lost their jobs at Bowater, a South Carolina paper company, because low water flows prevented the plant from discharging its wastewater.

- Lack of adequate water prompted the Nuclear Regulatory Commission to rebuff Southern Nuclear operating company's request to build two new reactors in Georgia.

- Water shortages have caused California farmers to cut the tops off hundreds of healthy, mature avocado trees in a desperate attempt to keep them alive.

- Lake Superior, the earth's largest freshwater body, was too shallow to float fully loaded cargo ships.

- Decimated salmon runs prompted cancellation of the commercial fishing season off the coasts of California and Oregon.

- Lack of adequate water forced regulators to deny permits in Idaho, Arizona and Montana for new coal-fired power plants.

- In Riverside County, CA, water shortages forced a water district to put on hold seven proposed commercial and industrial developments.

- Scientists at the Scripps Institute of Oceanography predict that Lake Mead, which supplies water to Los Angeles, San Diego and Phoenix, could dry up by 2021.

Another battle is taking place in California. Recently on Fox News, Sean Hannity focused on that state's Central Valley, where the unemployment rate is near 40% due to a judicial decision to shut off the water to farmers there. The reason? A small fish called the Delta smelt (about two inches long) is on the endangered species list, and salmon runs in Northern California are diminishing.

Water battles are also happening worldwide. More than 10 years ago, Dr. Paul Simon wrote a book called, *Tapped Out: The Coming World Crisis in Water and What We Can Do About It*. In it he stated:

- "Water is being withdrawn from (the world's) underground stores (aquifers) many times faster than it is being replaced by nature... The rate of net withdrawal today is roughly equal to the flow of the Colorado River."

- "9,500 children a day die either because of lack of water, or more frequently, because of diseases caused by polluted water."

Let's also not forget two other important facts:

- 1) There's a hidden Catch-22 within all of the water conservation initiatives currently underway by municipalities: The less water used, the less revenue

received by the water purveyors. At the same time, their fixed costs remain the same, driving up the cost per 1,000 gallons of water used.

- 2) About 80% of all water used in the U.S. is for agricultural production. Global warming (or climate change) is the darling of the media with a time horizon of hundreds of years. But the national water crisis is occurring now. It is a clear and present danger to the political, social and economic well-being of the U.S. And yet, the barriers to water reuse remain.

However, technology isn't one of the barriers. For example:

- Since the 1970s, the Millard H. Robbins Jr. Water Reclamation Plant in Centreville, VA, has treated sewage from the toilets of 275,000 nearby residents to help augment the water supply of the Occoquan Reservoir – made famous by its Civil War battles [source: Rob Davis, Jan. 7, 2009, www.VoiceOfSanDiego.org].

- The Tahoe Truckee Water Reclamation Plant (which I started in 1978) processes five million gallons per day (MGD) and disposes of the effluent in 100 wells. The same aquifer is used for the City of Truckee water supply.

### **To Find the (Four) Barriers, Follow the Money**

With water usage, as with most human endeavors, it is important to



## WATER REUSE

> Figure 3.



A favorite battle cry for those opposed to any kind of reuse. Source: Jessica Burgess.

follow the money to find the barriers to water reuse. There are four of them...

**First, tap water is relatively cheap, whereas bottled water, which has fewer statutory restrictions, is at least 900 times more expensive.** In 2008, Americans spent \$40 billion on bottled water (according to the 2008 documentary "Flow" by Irena Salina). Based on my experience, a pint of bottled water costs about \$1.50, or \$12 a gallon. In comparison, tap or potable water costs, on average, \$2.50 per 1,000 gallons.

Pricing tap water is a complicated matter. Robert Glennon discusses the issues in *Unquenchable*. "In many communities around the country, the existing water rate structure perversely rewards profligate water use through flat rates or, even more bizarrely, decreasing block rates....[so] each additional thousand gallons cost less than the earlier thousand gallon blocks. Is this the right incentive? Wouldn't it make more sense to have increasing block rates, where the unit price for water increases as the volume consumed increases?"

The concept of quantity discounts does apply to wholesalers and retailers. But the object there is to stimulate sales. With respect to selling water, it is a crazy concept. This is part of the mindset that must be changed, and it can be done. However, the poor and vulnerable in our society need protection, and what better

example than the electricity rates where a lifeline allowance is provided.

For example, my San Diego home water bill, just received, is twice the average at \$5.16 per 1,000 gallons. For those who rely on well water, the cost is less but not zero. They have to pay the power costs for pumping and sometimes large maintenance bills — hoping the aquifer from which they are pumping will not disappear.

**Second, there is a "yuck factor" connected with water reuse.** "Toilet to Tap" is a favorite battle cry for those opposed to any kind of reuse. It is a fallacious statement, since much of the potable water in the U.S. has been through several human alimentary canals before it comes out of the tap in most cities in the U.S. In Northern California, one sign says it all [see **Figure 3**].

And all along the major rivers in the U.S., cities process their sewage and dump the effluent into the nearest river, which is the water source for the next community downstream.

How do we remove the "yuck factor" barrier? By educating the voting public. The usual educational tools are TV, print advertising, public service announcements on the radio, and elementary and high school educational programs. An important related question is: Who will pay for this marketing campaign that could cost millions? In these tough economic times, such expenditures are unlikely if there is no cost benefit.

One possible way to fund this campaign is by increasing the cost of agricultural water — which, as we noted earlier, accounts for about 80% of all water used in the U.S. For sure, the agricultural water users will lobby hard against this. But unlike individual homeowners, these water users can pass their costs along to the consumer. Plus, long term the agricultural industry will benefit as more water, not less, will be available to the farmers.

Finally, if necessary, water reuse policies can be legislated. And there is precedent for federal legislation to mandate water policy — specifically, the 1972 Clean Water Act, which spawned hundreds of municipal sewage treatment plans.

**Third, there is the lack of political will to develop water independence for each community that imports water from hundreds of miles away.** Just the mention of price increases by the water utilities sends most politicians scurrying for cover.

Political will — what is it? It is courageous leadership, something in short supply most of the time. Most politicians are consumed with the next election cycle, but if the voting public can be educated about good public water policy and water reuse, the pols will come along.

**Fourth (but not least), is the reluctance of code authorities to include water reuse in model codes around the U.S.** The good news is the International Association of Plumbing and Mechanical Officials (IAPMO) is currently developing a "Green Initiative" to focus on water reuse with emphasis on emerging technologies.

Also, John Koeller of Koeller and Associates (a leader in greywater systems) in July 2009 submitted a proposal for packaged greywater systems to the ASME A112 Committee that develops national standards for plumbing material and equipment. This resulted in a decision to pass the proposal along to IAPMO since they are in the middle of getting a standard written. However, no such standard exists as of this writing.

But organizations like IAPMO are moving ahead, combining emerging technology with existing standards to provide guidance to state and municipal jurisdictions around the U.S. As soon as those standards are in place, city planners, architects and engineers can proceed to put those standards in building specifications.

Initially, there will likely be hundreds of water reuse systems. Eventually, the marketplace will pare that down to survivors that offer the highest value for the lowest cost.

A closing thought. In times of crisis, Americans join together and accomplish seemingly impossible obstacles. But it takes leadership coupled with education to break out of the "business-as-usual" place where most people get stuck. Those with the most knowledge

in the plumbing, wastewater and water supply industry have an obligation to lead the way. All we have to do is do it! [pme](http://pme.com)

*Milton N. Burgess, P.E., began consulting in 1988 following a 35-year construction career, the last 14 years with University Mechanical & Engineering Contractors of San Diego. He is licensed in California, Nevada and Idaho as a professional engineer, and is the resident managing officer for California contractor's licenses in eight classifications. He is a member of the main ASME A112 Plumbing Materials and Equipment Committee, a National Academy of Forensic Engineers Senior Member and a Board-Certified Diplomat in Forensic Engineering by NAFE.*

*Burgess has served in the San Diego Chapter of ASPE as Legislative Vice-President for a number of years and was honored in 2008 at the ASPE National Convention with a Certificate of Appreciation for his ongoing service to the ASME A112 Committee and promotion of green building initiatives. Burgess recently formed GreenTek, Inc., a contracting company specializing in the sales and installation of an emerging green technology called Hydrologix GRS, which nearly eliminates the pumping of restaurant grease interceptors. You can reach him at [milt@greenwaterprocess.com](mailto:milt@greenwaterprocess.com).*

## References

*Unquenchable – America's Water Crisis and What to do About It*, by Robert Glennon, Island Press, 2009.

*Tapped Out: The Coming World Crisis in Water and What We Can Do About It*, Dr. Paul Simon, Welcome Rain Publishers, 1998.

"Flow," a documentary about bottled water by Irena Salina, produced by Oscilloscope Laboratories, 2008.

## BREAKING BARRIERS: An ASPE Q&A on Water Reuse

On Oct. 24, 2009, I gave a presentation to a group of about 40 plumbing engineers at the American Society of Plumbing Engineers Technical Symposium in Dearborn, MI. The title of the presentation was "Making Sewage Sanitary: The Current Water Crisis and What You Can Do About It." I used some of the material from that presentation in the accompanying article with the permission of Cliff Reis of the ASPE Education Department.

Following the presentation a breakout session was held, where different questions were asked to four discussion groups. What follows are the questions and responses (in bold).

**1. Is it both possible and probable that chapters of ASPE and/or individual ASPE members can influence policy makers to develop good water policy to resolve the water crisis facing the United States?**

If yes, in what way? What are the steps that could be taken? What are the roadblocks to success? How do you identify those policy makers who can affect real results? How do you measure the results?

**Yes, policy makers can be influenced by ASPE. We need to reach out to policy makers, contractors, engineers and architects to get legislation moving. There is a need to identify who the policy makers are and start a grass roots movement. Also we should make proposals to water boards. It's very important to get their support.**

**2. In light of all the innovations being developed and tested, why is it we are still flushing our toilets with potable water?**

In answering this question, consider the human factors and legislative and code issues together with the commercial aspects that influence the marketplace. Be specific and practical. How long will it take to change? How much will it cost (order of magnitude)? What you can do to "move the ball?"

**Other sources of non-potable water are not readily available. High cost also is a deterrent. The public is happy with the potable water they have, and there is also a "yuck factor" with using non-potable water. Costs depend upon the scale of the situation. Other motivators are government mandates, education, regulations (who will regulate) and rebate dollars.**

**3. What is the price-point for the cost of water that will influence usage?**

In answering this question, consider levels of income, the poor and vulnerable parts of society and whether or not a given amount of potable water is a guaranteed right to everyone. United Nations Article 31 states, "Everyone has the right to clean and accessible water, adequate for health and well being of the individual and family, and no one shall be deprived of such access or quality of water due to individual circumstance."

How can the plumbing industry influence the cost of water? Is it a regional issue? Who sets the price? Do we know when it is fairly priced? Is the price subsidized? Is it ethical to make a profit on the cost of water? Should water systems be privatized?

**We will know it [the price point] when we see it – just like what happened with the gasoline "crisis." Establish baseline pricing, as is done with electrical rates. Charge higher amounts for potable water to irrigation systems. A water purveyor should be able to make a profit. As for UN Article 31, we leave this to smarter people. The price needs to be fair. Yes, water systems should be privatized.**

**4. What is the best solution for water reuse?**

Is it purple pipe systems? Package greywater systems? Is it practical to develop dual purple pipe systems for residential landscaping? Why or why not? How can existing homes be retrofitted for greywater systems? Is that cost-effective? Should there be legislation to require new homes have dual pipe systems? Why or why not?

**Municipal non-potable water systems should be in place for property owners to utilize for water reuse. Systems need to be identified with labels within the homes. Packaged greywater systems are viable for on-site use. Yes, some already separate landscaping from building/home use. Retrofitting package units in existing construction for greywater systems can be very costly. Rebates and subsidies could influence water reuse, but someone still has to pay for it. No, it is not cost-effective. How long is the payback? Yes, there should be legislation to mandate dual water systems.**