Assessing the Value of National Water Reclaim Standards

The Dawn of the On Location "Water Appliance" Industry

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The Artemis Project
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Water—One of the Country's Greatest Challenges

One of the great challenges that the United States faces over the next decade will be ensuring an ample supply of quality water. Even under normal water conditions, water managers in 36 states anticipate water shortages within the next five years.[1] In addition, dramatic infrastructure decay[2] and climate change will make our existing centralized water treatment and delivery even more problematic for the steady supply and quality of water that are essential for human health and for economic activity.[3]

Decentralized water systems are central to the water challenge that the United States is facing. They are a public health challenge today, and yet offer the best solution for specific aspects of the adaptive, resilient water supply infrastructure we will need in the future.

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As a nation, we have to focus our national resources on ensuring water supply—if we enact national recycled water standards over the short term, we can bring in untapped economic resources to address the water crisis in the US and throughout the world. We can turn the national water challenge into a new global market opportunity for the country.

Decentralized Water Management—A Public Health Issue

An estimated 860 billion gallons of untreated or partially treated sewage overflow into US waterways each year as a result of more than 73,000 sewer spills.[4] Over 10% of the onsite systems in the US are non-compliant. The EPA estimates that 40 percent of our nation's waters are impaired for their most basic uses such as fishing and swimming.

Recent coastal surveys of the United States and Europe found that a staggering 78 percent of the assessed continental U.S. coastal area and approximately 65 percent of Europe's Atlantic coast exhibit symptoms of eutrophication, "dead zones" resulting from the over enrichment of waters by nutrients such as nitrogen and phosphorus.[5]

Both the U.S. Environmental Protection Agency (US EPA) and environmental organizations attribute significant improvements to water quality in lakes and streams to the construction and operation of centralized wastewater treatment plans. Centralized water management has brought dramatic improvements to safety and reliability in water management in the developed world during the second half of the 20th Century. In the US, water utility managers have focused primarily upon strengthening centralized water and sewage treatment since the Clean Water Act in 1972. The federal government invested more than $72 billion toward centralized systems construction over the last 35 years, but insufficient budget has been dedicated to maintaining existing systems, especially the delivery network from central plants to end users. Federal funds for water infrastructure have plummeted 70 percent since 1980 and almost 50 percent since 2001.

The American Society for Civil Engineers, in their report card issued on January 28, 2009, graded wastewater infrastructure with a D-, which is the lowest grade they gave, but the focus was on a small piece of the infrastructure that serves the densely populated areas of the US.

"New solutions are needed to what amounts to nearly a trillion dollars in critical water and wastewater investments over the next two decades. Not addressing the investments risks reversing the public health, environmental, and economic gains of the last three decades."[6] Going forward, the "funding gap" for maintaining existing centralized systems will continue to compound rapidly. The EPA estimates that the gap in funding at over $267 B during the 20 year period ending in 2020 (U.S. EPA, 2002), far beyond the resources of governmental authorities.

The EPA has recognized that decentralized approaches are necessary for addressing the toxic brew of oil, fertilizers and trash picked up by rain and snowmelt as the water flows over parking lots, roofs and subdivisions.[7]

Failing Centralized Infrastructure Shifts Focus to Onsite Solutions

As a result, the US EPA has begun a "Green Infrastructure Initiative." Rather than focusing upon hard, centralized infrastructure, the EPA has begun to promote green infrastructure techniques, technologies, and practices to reduce the amount of water and pollutants that run off a site and cause sewer overflows.[8]

About 70 percent of centralized wastewater treatment and collection facilities serve small communities, comprising only 10 percent (27.2 million people) of the population served by centralized collection (Source: WERF). These populations might be better served by onsite solutions if reliable systems were available. In addition, 25% of the population is served by onsite septic systems, at least 10% of which are non-compliant at any given time.

Making Decentralized Systems Part of the Solution[9]

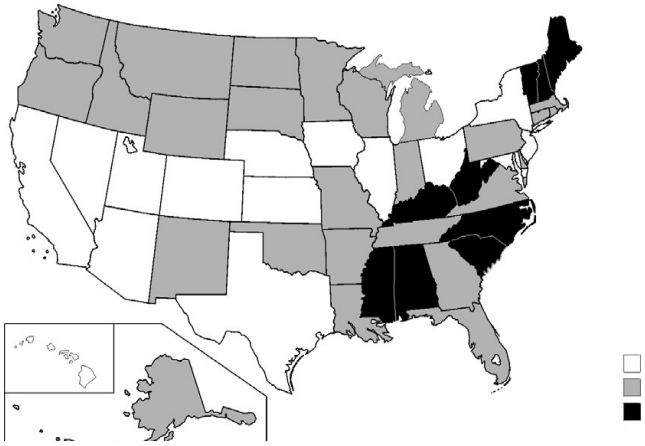

Figure 1-Distribution of Onsite Treatment Systems in the United States

While decentralized approaches are part of the solution to addressing the water crisis here in the US, the decentralized systems currently available on the market have historically failed to provide quality water management. More than half of all septic systems are more than 30 years old, and government oversight is limited. When a situation escalates to a true health hazard, fixing systems can cost more than the annual income of a rural family.[10]

Decentralized solutions are already an important part of the country's water infrastructure. About 25% of all existing households and 37% of new development is served by on-site or decentralized wastewater treatment. The development of advanced waste water processing capabilities for onsite water recycling will be *essential for the success of the U.S. EPA green infrastructure initiative. Only with national water quality standards for recycled water can the necessary solutions emerge from the market.*

The Water Challenge Is Already Hitting the Bottom Line for US Business:

Creating Decentralized Infrastructure for Uninhibited Economic Activity

Water scarcity, climate change and infrastructure decay are making water supply an operations issue for commercial businesses and institutions throughout the US. Financial analysts[11] are already beginning to discount the value of corporations based the risk that company operations will be affected by water shortages.[12] Water management is emerging as an element of competitive strategy for large water users, such as semiconductor and beverage manufacturers, as well as real estate concerns and retailers.

Storm water treatment is a legal requirement throughout the US and a significant site development expense. Leveraging the investment in storm water capture and treatment with onsite water management creates a new source of water for a business. However, at present, much of the equipment necessary for optimal water management is only cost effective for the largest industrial water users who use over 500,000 gallons per day.

Economic Opportunity

Building highly-reliable, robust, user-friendly onsite water solutions will emerge as an important new market segment that will foster the development of new innovative designs, advanced water technology and industrial design for new "plug and play" decentralized systems. The current market for water management equipment is estimated at $400 B. When decentralized water infrastructure is added on top of that market, this number grows by several factors of magnitude to trillions of dollars. If standard products for commercial and industrial customers emerged as major new markets, revenue and profitability from water industry equipment would grow dramatically.

Existing capabilities of Americans in industrial design and human interface design gained in a diverse group of unrelated industries such as the vehicle industry and consumer electronics make the US well placed to apply existing skills and create the "water management appliances" of the near future. New solutions could provide the ability for businesses to safely recycle their water onsite, combining storm water, reuse effluent and onsite recycled gray water to supplement the amount of potable water they receive from municipalities.

Conclusion

National recycled water quality standards promise to make one of the country's greatest challenges into a significant new global industry and a source of economic growth. Benefits would include

- Providing robust tools for saving energy and using water supplies more efficiently
- Improving tools for preserving and improving watershed health
- Alleviating a significant source of corporate business risk
- Economic stimulus and new global industries in a diversity of key industries—from industrial design and manufacture to biotech.

Recommendations

An Opportunity to Show True Leadership on an Issue of National and Global Importance

The water challenge that US business faces offers a unique opportunity for a new leader to emerge in the US business community. While the challenges are widely acknowledged, commercial operations have not gone beyond basic water conservation approaches.

In order to address the real operations risk that water scarcity poses, businesses must go beyond measuring water use and applying basic water efficiency equipment. They must examine how they can apply advanced technologies for onsite water management, using all sources of water—from rain to groundwater wells to onsite water recycling in order to prepare for scarcity and infrastructure breakdown.

Unlike the challenge in addressing energy efficiency and greenhouse gas emissions, bringing sufficient water to a site and storing it is both expensive and complicated. Each site has different water management challenges—from scarcity, flooding, storm damage.

Over the decade, water supply scarcity will require that leading companies take an active role in managing water supply at their key operations.

While the organizations that The Artemis Project met with during this project all showed interest in a national prescriptive standard for onsite water reclaim quality, none was prepared to lead the effort without a strong partner.

[1] U.S. General Accountability Office, *Freshwater Supply: States' Views of How Federal Agencies Could Help Them Meet Challenges of Expected Shortages*, GAO-03-514 (July 2003), available at http://www.gao.gov/news.items/d03514.pdf.

[2] An EPA 2004 report to Congress estimated that 850 billion gallons of storm water mixed with raw sewage pour into U.S. waters every year from older, combined sewer systems that were designed to overflow in wet weather. These combined systems, built by cities in the 19th and early 20th centuries, are now considered antiquated and a threat to public health and the environment, according to the EPA and environmental groups.

An additional 3 billion to 10 billion gallons of raw sewage spill accidentally every year from systems designed to carry only sewage, according to the 2004 report. Causes of these spills include improper connections, clogs from debris, construction accidents and cracks in aging pipes. The EPA estimates that as many as 5,500 people get sick every year from direct exposure to sewer overflows near beaches.
Larry Wheeler and Grant Smith, Gannett News Service, Aging systems releasing sewage into rivers, streams, May 8, 2008, Available online: http://www.usatoday.com/news/nation/2008-05-07-sewers-main_N.htm

[3]Barry Nelson, Monty Schmitt, Ronnie Cohen, Noushin Ketabi*, In Hot Water: Water Management Strategies* to Weather the Effects of Global Warming, July 2007., p.52.

[4] "Water Infrastructure Now: Clean and Safe Water for the 21st Century," Water Infrastructure Network, January, 2006, p.4-5. Available online at http://www.win-water.org/reports/winow.pdf. For example, Orange County, California recently, experienced its worst sewage spill in nearly a decade, when an aging sewer system spilled more than 500,000 gallons of sewage onto streets and into the ocean.

[5] The two most acute symptoms of eutrophication are hypoxia (or oxygen depletion) and harmful algal blooms, which among other things can destroy aquatic life in affected areas. Of the 415 areas around the world identified as experiencing some form of eutrophication, 169 are hypoxic and only 13 systems are classified as "systems in recovery."M. Selman, R. Greenhalgh, R. Diaz, Z. Sugg, *"Eutrophication and Hypoxia in Coastal Areas: A Global Assessment of the State of Knowledge,"* World Resource Institute Policy Note, Volume No. 1, March 2008.

[6] The Water Infrastructure Network, as well as the EPA and the Congressional Budget Office estimate the 20-year need for clean water infrastructure at approximately $300-$500 billion. "Water Infrastructure Now: Clean and Safe Water for the 21st Century," Water Infrastructure Network, January, 2006, p.4-5. Available online at http://www.win-water.org/reports/winow.pdf. For example, Orange County, California recently, experienced its worst sewage spill in nearly a decade, when an aging sewer system spilled more than 500,000 gallons of sewage onto streets and into the ocean.

[7] *EPA storm water rules are 'failure,' experts warn National Academy of Sciences report urges overhaul to curb pollution*, Associated Press, October 18, 2008

[8] "According to the EPA's Report on Its Green Infrastructure Initiative, Green infrastructure" is a relatively new and flexible term, and it has been used differently in different contexts. Thus, to date, there is no universally established definition of the term. For example, Benedict and McMahon, in their book Green Infrastructure (Island Press, 2006), have defined it broadly as "an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife." However, for the purposes of our efforts to implement the Green Infrastructure Statement of Intent (discussed below), we intend the term "green infrastructure" to generally refer to systems and practices that use or mimic natural processes to infiltrate, evapotranspirate (the return of water to the atmosphere either through evaporation or by plants), or reuse stormwater or runoff on the site where it is generated. (http://www.epa.gov/npdes/pubs/gi_action_strategy.pdf), http://www.epa.gov/npdes/greeninfrastructure/general

[9] U.S. Environmental Protection Agency, *Onsite Wastewater Treatment Systems Manual*, February 2002, EPA/625/R-00/008, p. 1-5, available online at http://www.epa.gov/nrmrl/pubs/625r00008/625R00008totaldocument.pdf

[10] *At the second in a series of 11 public workshops, officials and residents from the Mother Lode last week told state water pollution officials the proposed rules may actually make the problem worse, because low-income mountain residents afraid of big repair bills will simply ignore the rules and avoid contact with government agencies.."In the neighborhoods I'm mentioning, there's not the economic wherewithal to fix them," Calaveras County Supervisor Steve Wilensky said of an area along a fork of the Mokelumne River where leaking septic systems are suspected of causing high E. coli concentrations in it.Wilensky said the average family income in the area is $26,000 a year. State regulators estimate it could cost $45,000 or more, depending on conditions, to replace a failing septic system.* Dana M. Nichols, "Lode officials say septic rules tough for poor," December 18, 2008, *San Joaquin Record*, San Joaquin California

[11]Ernest Scheyder, Associated Press*, JPMorgan: Water supply a key issue*, March 31, 2008, available at http://www.boston.com/business/technology/articles/2008/03/31/jpmorgan_water_supply_a_key_issue/

[12] Fiona Harvey, "Supply strains are source of problem," *Financial Times*, Published: December 16 2008.

Appendix I—Coalition

While many of the diverse group of organizations see the value of national standards, none was willing to step forward to lead the initiative to date.

Laura Shenkar held the following meetings regarding coalition for National Standard for Onsite Water Reclaim Output Quality:

- **Centers for Disease Control** study on health impact of gray water recycling-- Max Zarate-Bermudez, Environmental Health Services Branch/Water Related Activities
- Regional "Green Industrial Jobs" Initiative—**The Michigan Economic Development Corporation** and the Oakland Water Commission
    1. Gil Pezza, Michigan Economic Development Corporation, (www.michigan.org)
    2. John P. McCulloch, the Oakland County (Michigan) Water Resources Commissioner (www.oakgov.com/drain
    3. Jim Ridgeway, Environmental Consulting Technology (www.ectinc.com)
    4. Sanjiv Sinha, Vice President at Environmental Consulting Technology (Focus on Environmental/ Water Policy and Sustainable Resources)
- NGOs—
    1. **World Wildlife Fund** (WWF),
        1. Wendy Smith, WWF Southeast Rivers and Streams
        2. Chris Williams, Head of Freshwater Program
        3. Kai Robertson
    2. **National Resources Defense Council** (NRDC),
        1. Ronnie Cohen, Director, National Water Conservation
        2. Nancy Sutley, Policy Director, Washington DC
    3. **Environmental Defense Fund** (EDF)
        1. Mary Kelly, Project Manager, Corporate Partnerships
        2. Michelle Mauthe Harvey, Project Manager, Corporate Partnerships
        3. Greg A. Andeck, Project Manager, Corporate Partnerships
        4. Andrew Hutson
- Water Associations—
    1. **Alliance for Water Efficiency** (AWE), MaryAnn Dickinson
    2. Valerie Nelson, **Coalition for Alternative Wastewater Treatment--**(www.ndwrcdp.org)
    3. **WERF** (Water Environment Federation Research Foundation), John Moeller, Glenn Rhinehart, Claudio Ternieden
    4. The **Water Reuse Association**—Richard Atwater, Chairman, Wade Miller, President
    5. **National Water Research Institute**, Jeff Mosher
- National Standards Certification—**NSF**--National Sanitation Foundation, Mike Hoover, Tom Buuresma
- Venture Capital—
    1. **Cleantech Investor Forum,** Nicolas Parker, Chairman
    2. **Kleiner Perkins, Caufield and Byers,** Ellen Kao Pao, Partner
    3. **Mohr Davidow Ventures**, Will Coleman, Partner