Mike Hightower *is a Distinguished Member of the Technical staff in the Energy Security Center at Sandia National Laboratories. He is a civil and environmental engineer with more than 25 years experience with research and development projects, including structural and geomechanics research in support of space and weapons systems, research and evaluation of innovative environmental technologies for industrial and nuclear waste treatment and cleanup, and security and protection of critical infrastructures. Currently, Mike supports research and development projects addressing water and energy resource sustainability and water and energy infrastructure security and protection. These efforts include developing new water treatment and water monitoring technologies, developing models and techniques to improve water resource use and management, desalination and produced water treatment, impact of water availability on energy security and reliability, and water, electric power, and natural gas infrastructure security and protection. Mike holds bachelor's and master's degrees in civil engineering from NMSU.*

Richard Kottenstette *is a Member of The Technical Staff in the Geochemistry Department at Sandia National Laboratories. He is an analytical chemist who has over 25 years experience in fossil fuel, environmental, and homeland security research. His current position is project leader for the Sandia Advanced Concepts for Desalination Program. Specifically, he is responsible for the Desalination Jumpstart Project, a new effort aimed at selecting and developing emerging technologies that will enhance our ability to desalinate water. The Jumpstart Program will work closely with the Tularosa Basin National Desalination Research Facility in Alamogordo, New Mexico.*

Larry Webb *has a bachelor's degree in environmental management from University of Houston-Clear Lake. He worked for 17 years with League City, Texas as Director of Utilities. Larry has been with the City of Rio Rancho for eight years as the Director of Utilities. He is the Past-President of the New Mexico Environmental Quality Association and currently Vice Chair for the NM Municipal League Domestic Well Task Force. Larry is on the New Mexico Environment Department's Water Reuse Regulations Task Group and is an active member of the American Water Works Association and the Water Environment Federation.*

REGIONAL TRENDS IN THE USE AND REUSE OF IMPAIRED WATERS

Mike Hightower
Energy Systems Analysis Department
Sandia National Laboratories
Albuquerque, NM 87185-0701

Richard Kottenstette
Geochemistry Department
Sandia National Laboratories
Albuquerque, NM 87123-0750

Larry Webb
City of Rio Rancho, PO Box 15550
Rio Rancho, NM 87124

Background

Access to fresh water is an increasingly critical national and international issue, especially since demand for fresh water in many regions of the world has already outstripped fresh water supplies. Based on the latest figures from the United Nation's "World Water Development Report," more than 50 percent of the nations in the world will face water stress or water shortages by 2025, and by 2050, as much as 75 percent of the world's population could face water scarcity (United Nations 2003). Like so much of the world, access to fresh water is an increasingly critical issue in the southwestern United States.

The Southwest is one of the fastest growing regions of the United States. Estimated growth rates exceed 35 percent over the next 25 years in many states in the Southwest. This growth will continue to increase the demand and competition for water resources in a region that already has limited and stressed fresh water supplies. While fresh water conservation has been implemented to help reduce future water demands, current planning efforts in many Southwestern states recognize the emerging need to utilize "nontraditional"

water resources to help meet expected future water demands. Desalination, indirect wastewater reuse, and direct wastewater reuse will be relied upon to supply 20 percent, and in some areas as much as 35 percent, of the future water supplies in regions of California, Arizona, New Mexico, and Texas.

Unfortunately, the policy and regulatory framework needed to enable the utilization of these "nontraditional" water resources is currently not in place in most of these states. Current water rights and water utilization and storage regulations were not developed to address the issues and needs required to fully and appropriately utilize brackish water, wastewater, and other "nontraditional" water resources. Unfortunately, many communities in the Southwest are being forced to move forward in developing and utilizing nontraditional water supplies, even in the face of inadequate regulations and policies, because of the lack of alternative fresh water supplies.

This paper provides an overview of emerging trends in using "nontraditional" and impaired waters across the Southwest, identifies current efforts to use these supplies, and outlines some of the regulatory and policy issues that need to be addressed to insure that these "nontraditional" water resources can be effectively and cost efficiently utilized to meet our emerging water needs.

Traditional and "Nontraditional" or Impaired Water Resources

Traditional water resources development is focused on the utilization of fresh water supplies. Commonly, "traditional" water resource options include the storage and use of surface fresh water, the development and use of fresh groundwater, water conservation and water reuse, and watershed management to improve the quality of surface water resources. The development and use of "nontraditional" or impaired water resources is commonly considered to include indirect wastewater reuse, such as irrigation of parks or for industrial applications, and direct wastewater reuse, such as direct use of waste water for drinking water, often unaffectionately referred to as "toilet to tap." Another option currently considered "nontraditional" is aquifer storage and recovery (ASR) of treated wastewater. This approach tries to add subsurface filtration, dilution, and possibly in situ treatment before the treated wastewater is extracted for reuse. ASR is also being considered for future fresh water storage as a way to reduce the need for additional surface water reservoirs (McCarthy 2005). Desalination of brackish groundwater and surface water and desalination of sea water round out what are commonly considered "nontraditional" or impaired water resources.

Trends in the Use of Impaired Waters

From Virginia and Florida to New Mexico and California, impaired waters are being used to supplement fresh water supplies for a wide range of industrial and domestic needs. The growing interest in the Southwest and other inland areas to use impaired waters include initiatives in a number of states that show a significant increase in the reliance on the use of impaired water to meet future water demands. Some examples include:

<u>Texas</u>
- 10 of 16 regional water plans expect from 20-34 percent of their future water supplies to come from wastewater reuse by 2050.
- Desalination has also been identified as a major water supply strategy in many of these water planning regions.

<u>Arizona</u>
- Fresh surface water supplies have been almost fully allocated since 1990.
- Statewide over 20 percent of future water supplies by 2025 will be from impaired waters.

<u>California</u>
- By 2030, California will need an additional four million acre-feet of fresh water to meet growing demands.
- Over half of this amount is expected to come from nontraditional resources, including wastewater reuse and desalination.

For example, desalination and water reuse applications are being evaluated and pursued by municipalities and industries across the Southwest. Las Vegas, Phoenix, and Tucson are considering desalination plant options to supplement or improve water supplies. Cities such as Scottsdale, Abilene, Ft. Stockton, and Galveston have already built moderate size desalination facilities. El Paso is currently constructing the largest inland desalination plant in the U.S., approximately 30 million gallons per day (mgd).

A good indicator of the interest in the use of impaired water is the number of membrane-based desalination and water reuse plants constructed in the

U.S. in the past 20 years. As shown in Figure 1, there has been a significant increase in the number of plants being built since 1995 (Mickley 2001). While many of these systems have been built in coastal areas for sea water desalination, many of the newer systems are being used in inland areas for both brackish water desalination and water and wastewater reuse applications. The data suggest that the use of impaired waters is not something that will occur in the future; it has been a widespread trend for almost 10 years.

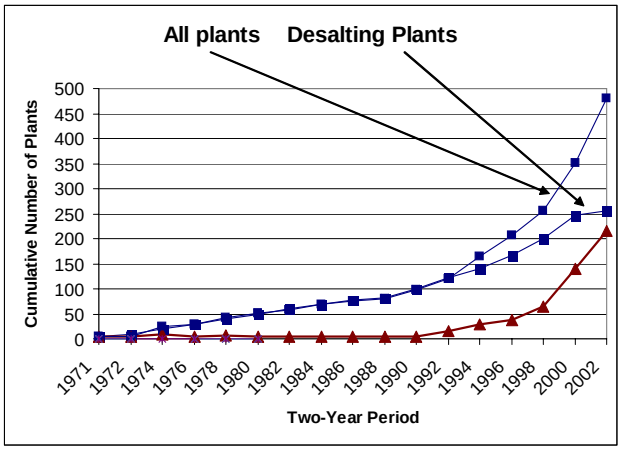


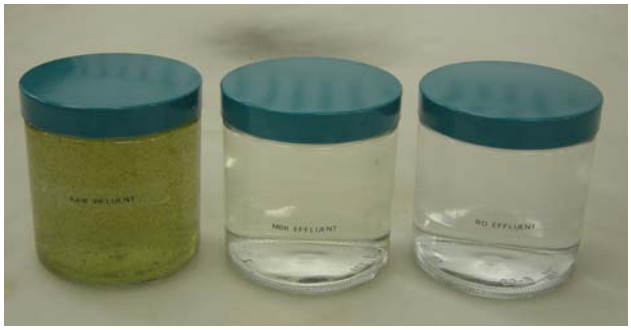
Figure 1. Construction of membrane treatment plants in the U.S.

Trends in the Use of Impaired Waters in New Mexico

Many cities in New Mexico are considering desalination or wastewater reuse to supplement fresh water supplies. Use of brackish groundwater resources is being considered in a number of cities including Albuquerque, Santa Fe, Las Cruces, and Santa Teresa, New Mexico. Cities, like Alamogordo, are already planning construction of approximately 10 mgd desalination plants to help supplement their fresh surface and groundwater resources to meet future growth.

Additional desalination applications, especially treatment of oil and gas produced water, are being evaluated throughout the west and in New Mexico. Several studies on the treatment and utilization of brackish produced water are currently underway in the San Juan Basin of northwestern New Mexico and in the Permian Basin in southeastern New Mexico.

Another impaired water application is to treat wastewater for either indirect or direct reuse. While water recycling is currently done in many cities in New Mexico, most of the recycled water is used indirectly to irrigate parks and turf areas and for use in construction. In the future, as cities continue to grow and fresh water supplies continue to diminish, cities may need to implement treatment of wastewater and reuse it as drinking water to fully utilize water resources. For example, Rio Rancho, New Mexico is currently testing and evaluating a combination of technologies for wastewater treatment and reuse (MWH 2005). Rio Rancho is planning in the future to rely on the reuse of treated wastewater to meet as much as 30 percent of their water demands in 20 years. Figure 2 shows an example of the influent treated wastewater and the final effluent water quality from a recent pilot testing program using a membrane bio reactor to remove much of the suspended solids and a reverse osmosis system to remove bacteria, viruses, and dissolved solids. Other cities, such as Cloudcroft, are implementing similar treatment systems to help extend limited fresh water supplies.



(a) (b) (c)

Figure 2. Example of Rio Rancho Wastewater Reuse Pilot Effluent Quality
(a) Treated wastewater influent,
(b) Membrane bioreactor effluent and
(c) Final reverse osmosis effluent (MWH 2005)

Lack of Adequate Policies for Impaired Water Use

While many areas in the Southwest and other areas of the country move into utilizing impaired waters as major elements of their water supplies, the policies and regulations to help support that move and insure adequate public health are lacking. While many of the states are moving forward, they have as yet not addressed all the major issues with the reuse of impaired waters. For example, while Texas has legislation covering indirect reuse of wastewater, they currently have no regulations on the direct reuse of wastewater. While Arizona has policies on some aspects of aquifer storage and recovery, they have no policies on direct

water reuse, nor do they have any policies to allow desalination concentrate injection disposal options. Additionally, California currently has 24 desalination plants under permitting or construction, but their concentrate discharge regulations are being reevaluated and may cause a number of delays in plant construction.

These issues suggest that the use of impaired waters to supplement fresh water resources is not adequately understood nor is it being addressed appropriately or quickly enough by water management organizations and agencies. The following issues will need to be addressed quickly in order to allow cities and communities to assess adequately the use of impaired water resources to help them better address their emerging shortfall of fresh water supplies.

Several major issues really impact use of impaired water resources. These include:

- Policies to better address and support water treatment residuals management
  - Residuals are often classified as hazardous waste, which they often are not
  - This designation often forces the application of residuals handling and disposal that is neither cost effective nor environmentally sound
- Policies for ASR that are economically sound and protect public health
  - Need graded standards for ASR depending on water reuse applications, such as management approach developed by Florida
  - Need to address the water rights issues of reinjected water, such as the approach adopted by Texas
- Reduce disincentives for impaired water use
  - Current policies often do not encourage fresh surface water or groundwater conservation
  - Treatment requirements and overlapping jurisdictions often prevent impaired water treatment and reuse
- Address the "water rights" of nontraditional water resources
  - Currently there are overlapping jurisdictions on the use, treatment, and residuals management of impaired water resources
  - Currently water rights for the development, treatment, and storage or use of impaired water resources is poorly defined and understood
- A better understanding of impaired water resource availability
  - The extent and yield of brackish groundwater
  - Extent of the recoverability and transport of ASR

Overall, the policy and regulatory framework needed to better utilize impaired or "nontraditional" water resources is currently not in place. Still, because of the lack of alternative fresh water supplies, many communities in the Southwest are being forced to move forward in developing and utilizing nontraditional water supplies. In the face of inadequate regulations and policies, many of these communities are developing approaches that are overly costly and moving forward slowly. Water rights and water utilization and storage regulations will need to be reworked in order to fully and appropriately utilize brackish water, reuse wastewater, and other "nontraditional" water resources. These regulatory and policy issues should be addressed over the next five years to insure that "nontraditional" water resources can be effectively and cost efficiently utilized to meet our growing water needs.

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