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Water Supply Assurance and Drought Mitigation Options for State Regulatory Commissions and Key Stakeholders

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WATER SUPPLY ASSURANCE AND DROUGHT MITIGATION: OPTIONS FOR STATE REGULATORY COMMISSIONS AND KEY STAKEHOLDERS

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EXECUTIVE SUMMARY

Although the timing, frequency, severity, location and duration of future dry spells are unknown, future droughts remain a certainty. A central message of this report for state regulatory commissions is to stay informed and involved in water supply assurance and drought mitigation matters, even after the current drought has passed. This report sets forth a variety of tools and approaches that commissions can employ with the utilities they regulate and others to develop water supply assurance strategies and drought management plans to be implemented to prevent or ameliorate drought.

Directly within state regulatory commission and water utility purview are a variety of tools and alternative approaches that may be initiated or done better to promote wise use and water system efficiency. Distribution system improvements, leak detection and remediation programs, water utility consolidation, wholesale purchasing agreements, demand management and integrated water resources planning, requests to conserve and water use restrictions, drought management planning and drought pricing, rate design alternatives, and communication and education are among the ways to bolster water supply and contend with drought that are presented in this report. Alternatives that may involve collaboration with a wider variety of stakeholders are also presented and their merits explored, including: water banking, nonpotable reuse, transfers and wheeling, regionalization of water utilities, interagency cooperation and desalination.

The report is intended to serve as a source of ideas and examples of practical techniques and programs that utility commissions may consider while necessarily taking into account the unique operating, hydrological, financial and institutional characteristics within a state, utility service territory and region. Throughout the document the merits of each option and its applicability are considered as "Considerations and Applicability." However, what a commission does concerning drought and water supply management is, in a sense, secondary to regulators making an institutional commitment to continue preparing now for the inevitable droughts ahead. Regulators have an opportunity to learn from recent experience what is helping and hindering various drought mitigation and water supply assurance approaches and apply that knowledge to their state in the future.[1]

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[1] *U.S. Drought Monitor* reported on Aug. 15, 2002, that 56 percent of the nation (excluding Alaska and Hawaii) was in at least moderate drought; 40 percent was in severe drought. Anthony R. Wood, "Severe Drought Cuts Costly Paths Across U.S." *Philadelphia Inquirer*, Aug. 16, 2002.

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FOREWORD

State utility commissions as the ratemaking entities and general overseers of investor-owned water utilities play an important role in water supply assurance and drought mitigation. Commissions are also an important policy development and implementation agency for state government during crises, including drought. This report discusses an array of policies and practices for state commissions, privately operated water utilities and key stakeholders to consider as they determine how best to assure adequate supplies of water for their states and regions. The report should be a useful resource for commissioners and staff as they work within their traditional spheres of activity and beyond to plan now for future droughts.

Raymond W. Lawton, Ph.D.
Director, NRRI
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CHAPTER 1

DROUGHT PUTS WATER SUPPLY ISSUES IN THE SPOTLIGHT; CREATES OPPORTUNITY TO ADDRESS THEM

As water shortages become more pronounced, not only do battles over shared supplies intensify, discussions about planning for the future reflect a degree of interest and a sense of urgency typically not present when water supplies are near normal levels. This concern about near-term-future conditions creates a unique opportunity for public utility commissions, other regulatory bodies and public officials to take innovative steps to address short-term supply issues and make strategic decisions on how best to manage water supplies for the future. An opportunity may exist for a range of public/private partnerships to design and implement innovative supply enhancement policies. In the absence of such steps and partnerships, crisis management may be the prevailing response during dry periods, followed by indifference and inertia (or a focus on other seemingly more pressing issues) when rains return to wash away the dust. Droughts, floods and supply interruptions from a myriad of causes remain a certainty; only their frequency, location, duration and severity are unknown. Thus, it makes good sense to plan, in order to reduce both the costs that result from droughts and the associated personal hardships.[2]

Water is a renewable yet transitory resource. It transpires, evaporates and precipitates over and over again in the hydrologic cycle. However, we do not always have the amount of water that we require or desire when and where we want it. Droughts and floods have interrupted or made water supplies scarce on innumerable occasions throughout history and will do so again. The need for and benefits of planning now for drought recurrences is a central component that underlies all of the approaches and techniques examined in this report. The report also endeavors to identify specific actions and policies that can be embraced near term to help mitigate the impact of current drought conditions and set the stage for better water resource planning and management. The report includes discussion of a variety of ways to

[2] W.R. Walker, M.S. Hrezo and C.J. Haley, *Management of Water Resources for Drought Conditions, 1991,* R.W. Paulson, E.B. Chase, R.S. Roberts and D.W. Moody, Compilers, National Water Summary 1988-89, *Hydrologic Events and Floods and Droughts: U.S. Geological Survey (USGS) Water-Supply Paper 2375*, 147-156.

manage water supply, lessons learned from prior droughts and the results of a recent survey of state commissions regarding water supply issues.

Public utility commissions (PUCs) are among numerous entities, authorities and organizations that have responsibility for and/or an interest in some aspect of water supply assurance. Commissioners have direct connections to and working relationships with important state (and local and federal) office holders, decision-makers and public opinion leaders. They also have an important, beneficial relationship with water utility management. Commissioners can play a role in assuring that water supplies are used wisely. They can fully employ existing regulatory tools and authority, develop new capabilities and take steps to establish, develop and maintain relationships with key stakeholders with whom they can craft beneficial statewide, regional and federal water policies.

Research Approach

Research efforts for this report included focused telephone interviews with water supply and water and wastewater utility experts, a literature review, and a survey of state PUCs conducted in spring 2002. Forty-five state commissions have ratemaking jurisdiction over water utilities. Fifteen state commissions responded to the survey for this project: Arizona, Arkansas, Indiana, Kentucky, Massachusetts, Missouri, Nevada, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina and West Virginia. The purpose of the research is to identify water supply and drought mitigation practices that are or may be utilized by regulatory commissions in concert with the water utilities that they regulate and other important stakeholders. A wide range of policies and practices is available for regulator consideration taking into account the unique challenges that exist and differing opportunities available in their particular state. Some of the alternatives may require legislation and new tools. Others may be accomplished through existing regulatory statutes and rules.

The Current Situation—Extant Drought Conditions and Responses in Selected States and Jurisdictions

Drought is among the most prominent issues in water supply today. But the current situation is not the only reason for heightened concerns. Spring floods, contamination of drinking water supplies, pressures on water supplies from economic growth and terrorist threats are all concerns. All of these intimate the need for greater attention to water supply issues on the part of utility commissioners and their staffs as well as other public policy professionals.

At the beginning of this study in March 2002, drought was plaguing more than 30 percent of the United States. Figure 1 shows a range of conditions ranging from abnormally dry to exceptional drought throughout the United States. By mid-August, 56 percent of the nation (excluding Alaska and Hawaii) was in at least moderate drought (see figure 2). Public officials and opinion leaders are responding in a variety of ways.

In a band of states running from Maine and New Jersey to Georgia and Florida, and from Montana to Texas, extremely dry conditions have persisted for several years, becoming the norm. Columbia, South Carolina, recorded its third driest year ever in 2001 with rainfall 20 inches below normal. The capital city, which averages nearly 50 inches of rain a year, is more than 59 inches below normal since the start of 1998. Greenville, Charleston and Florence are all 10 inches below normal rainfall this year, reflecting what has been seen across most of the state.[3]

In the northeast, New Jersey's northwest and southwest drought regions lie within the Delaware River basin, which encompasses portions of New Jersey, New York, Pennsylvania and Delaware.[4] The Delaware River Basin Commission (DRBC) declared a "drought warning" on Nov. 4, 2001, and put its Drought Operating Plan into effect on Dec. 1, 2001. On Dec. 18, 2001, the DRBC declared a drought emergency. In a drought emergency under the Drought Operating Plan, New Jersey's allowable diversion through the D & R Canal has been reduced from 70 million gallons a day (mgd) to 65 mgd. New Jersey may divert 100 mgd from the Delaware Basin when

[3] *U.S. Water News on Line*, "South Carolina drought's worst effects may be to come," January 2002. http://www.uswaternews.com/archives/arcsupply/2soucar1.html

[4] New Jersey is divided into six drought regions that have different water sources and usage restrictions.

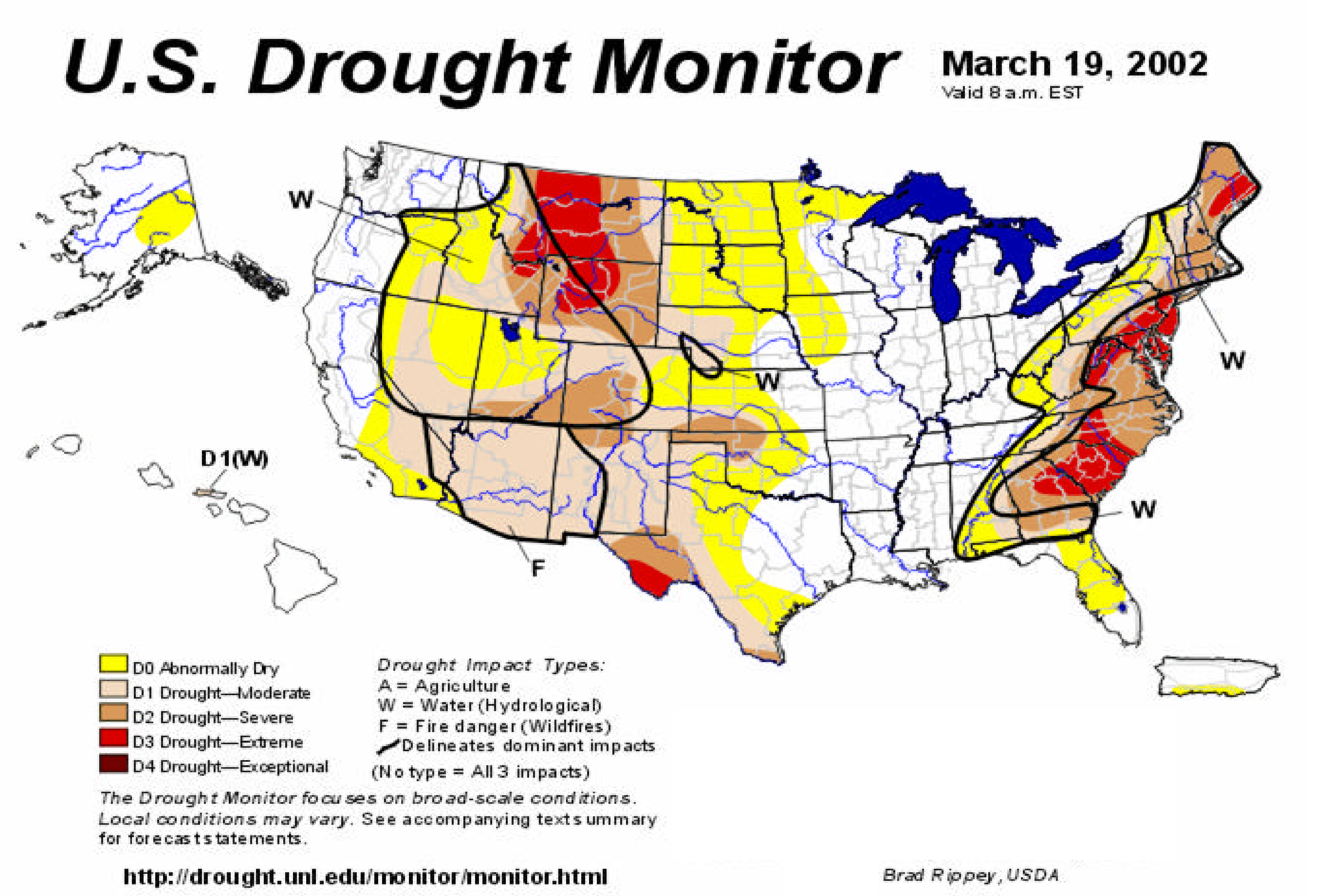

Fig. 1. U. S. drought monitor map, March 19, 2002

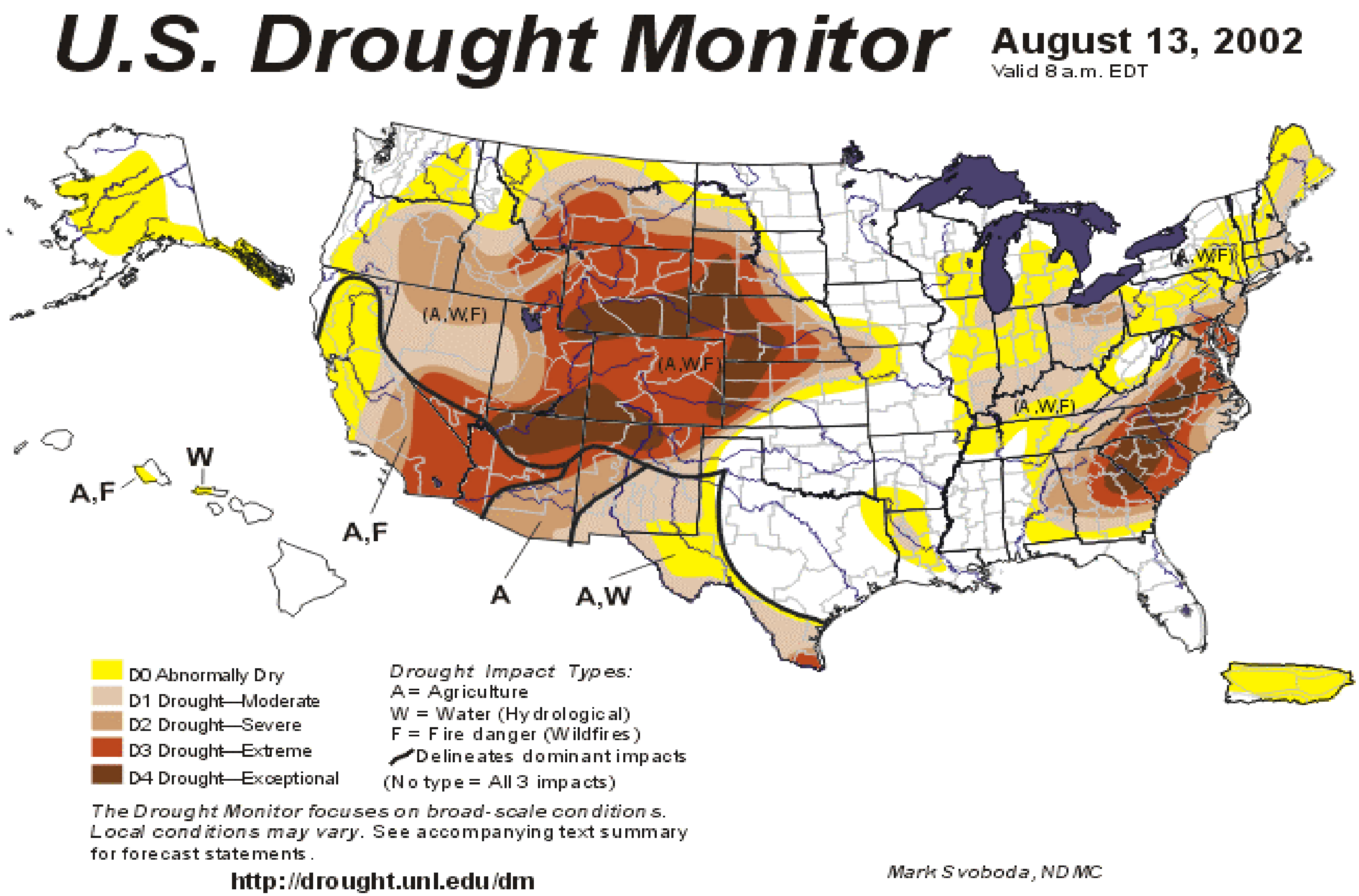

Fig. 2. U.S. drought monitor map, Aug. 13, 2002

storage in New York City's Delaware Basin reservoirs is at the normal or drought watch level. When storage in these reservoirs falls to the drought warning level, New Jersey may divert 70 mgd. When the reservoirs fall to drought level, New Jersey may take 65 mgd.

In an executive order issued on March 4, 2002, New Jersey Governor James E. McGreevey declared a water emergency for New Jersey. The order authorizes the New Jersey Commissioner of Environmental Protection to develop mandatory water restrictions and conservation measures throughout the state, tailored to the needs of each drought region. Reservoirs throughout the state were below normal, with northeast reservoirs the lowest—45 percent below normal levels. Stream flow levels were also declining, and many were at record lows. On April 9, 2002, the Commissioner took actions to increase the transfer of water among drought regions in the state in order to reduce demand upon source waters and reservoir storage in the northeast region. New Jersey American Water Company was ordered to "increase the amount of water accepted from the Elizabethtown Water Company…to the maximum amount practically possible." Several governmental entities and the two companies were required to jointly develop a plan for adapting the water supply infrastructure to increase the transfer of water by May 10, 2002. Each water company is also required to provide unaccounted-for water data. The Department of Environmental Protection had issued a drought warning on Jan. 24, 2002. It is noteworthy that *voluntary* efforts have not helped to curtail water use and have not been effective in maintaining adequate water levels. New Jersey previously declared water supply emergencies in 1999 and 1995.

In Administrative Order 2002-05 issued on March 11, 2002, by the New Jersey Department of Environmental Protection, Commissioner Bradley M. Campbell described the overall drought situation in New Jersey:

> Despite the coordinated water management measures implemented by water suppliers, municipalities, counties and the state, including transfers of water and reductions in passing flows, and voluntary water conservation efforts, water use demands remain at levels that cannot be sustained under current conditions. Rainfall throughout the state has been insufficient to moderate the severe precipitation shortfall. Despite efforts

> by New Jersey's residents and businesses to conserve water, the state continues to be threatened with drought due to a significant long-term precipitation deficit, compounded by below normal levels in surface and ground water supplies.

Administrative Order 2002-05 set forth statewide water use restrictions applicable to all six drought regions in the state. The order also authorized temporary use of nonpotable water, treated effluent which meets all New Jersey requirements for pollutant discharge elimination systems (NJPDES) as a substitute for potable water sources when certain criteria are met. Recommended applications of treated effluent include landscaping, street sweeping, nurseries, non-edible crops, golf courses, roadside plantings and mobile fire protection. The order requires commercial enterprises that use more than 100,000 gallons of water per day from any source to prepare drought emergency contingency plans. Each state agency was ordered to develop water conservation plans outlining specific measures that the agency will take to reduce water consumption. Draft plans were due in mid-April 2002.

On Aug. 20, 2002, as New Jersey's drought persisted, Commissioner Campbell announced a statewide ban on outdoor water use. Campbell also re-issued a letter to local law enforcement agencies emphasizing the drought emergency status and the need to enforce drought restrictions. Penalties may include fines of up to $1,000 or imprisonment.[5] Campbell also announced a tax incentive initiative geared to industrial facilities designed to encourage them to reuse effluent from sewage treatment plants instead of water from other sources.[6]

Reservoirs throughout New York were at low levels in early spring 2002. The Delaware River, which provides about 50 of New York City's water, also serves 12 million people downstream in New Jersey, Philadelphia and Delaware. Under extant sharing provisions, New York City is obligated to dump water from its reservoirs at quantities sufficient to sustain specified flow levels in the Delaware River. Here is why: On May 31, 1931, the U.S. Supreme Court issued a decree authorizing New York City to divert up to 440 million gallons of water per day from the Delaware River basin to its

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[5] New Jersey Department of Environmental Protection news release, Aug. 20,2002.
[6] New Jersey Department of Environmental Protection media advisory, Aug. 15, 2002.

water supply system in the Hudson River basin. The decree was issued to settle an interstate water allocation dispute between New York and New Jersey. The original decree was amended in 1954. The Delaware river master (the chief hydraulic engineer of the USGS) administers the provisions of the 1954 decree, which include restrictions on the amount of water that New York may divert from the Delaware River watershed, and provision that any diversions or releases shall be made under the supervision and direction of the river master of the USGS. The 1954 decree also authorized diversions by New Jersey of a monthly average of 100 mgd. The river master's duties include, among others, administering provisions of the decree related to yields, diversions and releases; conserving the waters of the river, its tributaries and any reservoirs; compiling data on water needs of the parties; checking and correlating pertinent stream flow gaugings; studying the effects of development on the Delaware and its tributaries upon water supply and its uses; and reporting yearly to the Supreme Court and parties to the decree.

Agreements made pursuant to the 1954 decree established drought operating plans of the DRBC.[7] Every spring pursuant to the advice of a river master advisory committee (representatives of the governors of the four compact states of Delaware, New Jersey, New York and Pennsylvania; and the mayor of New York City), a decision is made on whether or not to bank excess release quantity (an amount in excess of what will be needed to meet the city's water demand during a given year). The excess is then released during the summer and fall.

Drought Monitor's April 30, 2002, national drought summary described very dry conditions in north central Montana with local impacts including reports of blowing dust with visibility in some areas one tenth of a mile or less and dust drifting to several feet deep along fence lines in Liberty County. Drought emergencies have been declared by the governors of Arizona, New Mexico, Utah, Colorado, and by the Navaho Nation. Worsening soil moisture conditions, dropping reservoir levels and increasing threat of fire characterize the situation in the southwest. The report noted a very dry period along the Gulf Coast to the Tennessee border and also in the Carolinas.

[7] Supreme Court of the United States, No. 5, Original – October Term, 1950, *State of New Jersey v. State of New York and City of New York*, Commonwealth of Pennsylvania and State of Delaware, Intervenors, Amended Decree, June 7, 1954.

Governor Gary Locke of the State of Washington in a news release announcing a statewide drought emergency on March 14, 2001, said, “This is already the worst drought in our state since 1977.” Locke’s emergency declaration had the effect of activating tools the state’s department of ecology can use to ease the effects of drought: emergency water permits, temporary transfers of water rights and financial assistance.[8] In early February 2002 a drought emergency was declared for 24 counties in Pennsylvania by Governor Mark Schweiker, the fifth drought emergency declared in Pennsylvania during the last seven years.

New Jersey, along with other states in the relatively water-rich east, is not alone in having to address water supply assurance issues. In addition to policies already in place and the efforts of jurisdictional water utilities, this report identifies an array of potential wise use and drought preparation and mitigation practices. Some of the approaches reviewed may be suitable and provide positive results in New Jersey and other states along the eastern seaboard. Some may already be in the works. Depending upon local conditions and interests, these practices may be adapted and/or used in various combinations.

[8] Office of Governor Gary Locke, “Locke Announces Statewide Drought Emergency,” press release, March 14, 2001.

CHAPTER 2

ADDITIONAL CAUSES OF WATER SUPPLY SCARCITY AND INTERRUPTIONS

Floods Can Interrupt Supplies

Sometimes when it rains, it pours, and pours and pours. Like droughts, floods can impair water quality and interrupt drinking water supplies. Like droughts, floods also point to the need for multiple water sources, redundancy in treatment facilities, adequate storage, back-up electrical power, wise use, and other measures to ensure that drinking water needs are met – even when circumstances are extraordinary. In 1993, the Des Moines Water Works survived a flood during which its sole treatment plant was totally submerged and residents and businesses were entirely without service for 12 days and without drinking water for 19 days. In June 1998, flood gates closed again when the Raccoon River reached its second highest level on record, 20.43 feet. However, due to steps the utility took following the 1993 flood, treatment plant operations were uninterrupted during the flood of 1998.[9] The utility has since brought a second water treatment facility into service.

Some Other Factors Impinging Against Adequate Water Supply

The threat of sabotage, violations of standards for contaminants and population growth and sprawl are raising significant concerns for an adequate supply of water, as well as drought and flooding. Since the Sept. 11, 2001, attack on the World Trade Center, we have learned that our nation's water supplies are also potential targets for terrorists. Such malicious acts could also interrupt or diminish our supplies of potable water and suggest that we not only take or reinforce steps to protect the supply but that we also engage in contingency planning.

Violations of the maximum contaminant levels (MCLs) provided for in the Safe Drinking Water Act Amendments of 1996 occur. Such violations require water utilities to shift to an alternative source of supply or tell consumers how they can best protect themselves by boiling water from the tap or drinking bottled water, for example. Run-off

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9 Myron A. Olstein, Melissa J. Stanford and Charles E. Day, *Best Practices for a Continually Improving Customer Responsive Organization.* (Denver: American Water Works Association Research Foundation, 2001).

from farms during spring applications of herbicides and pesticides threatens water quality as do overflowing animal confines.

Inefficient agricultural water consumption is also an impingement to water supply. According to Peter H. Gleick of the Pacific Institute, there is great potential for reducing the amount of water needed to produce food by, among other methods, reducing wasteful applications of water.[10] Agriculture takes 70 percent of the water consumed worldwide and half or more of that water is lost to evaporation or runoff. Drip irrigation, which uses perforated tubing to deliver water to crops, uses 30-70 percent less than traditional methods and also increases crop yields. Drip systems were first developed in the 1960s but are used on less than one percent of irrigated land. The reason, according to *National Geographic*, is that irrigation is so heavily subsidized by most governments that farmers have little incentive to invest in more water-efficient irrigation methods.[11]

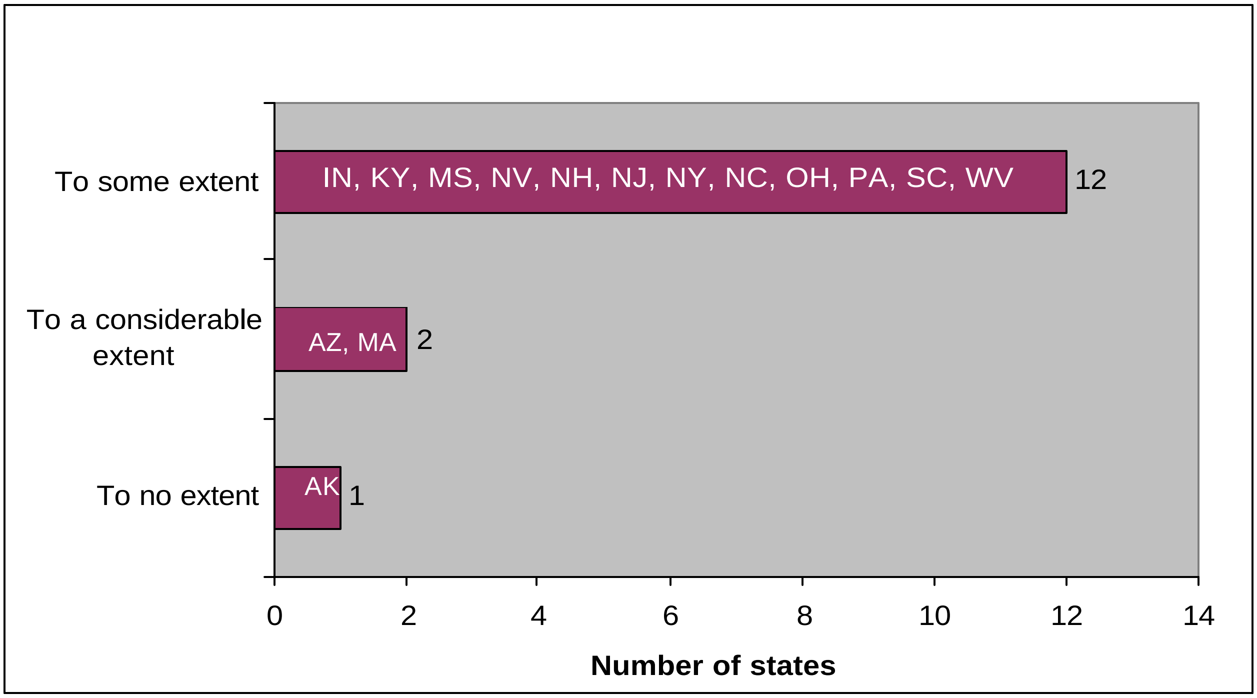
There are also the issues of economic development, growth and the sustainability of existing municipalities. "What comes first, the water supply or the housing? In a lot of cases, we see housing developments go in and then the search is on for a water supply," said Gary N. Paulachok, the deputy Delaware river master.[12]

Survey Responses to Questions Concerning Shortages, Interruptions of Service and the Causes

Not surprisingly, all but one state commission that responded to the NRRI survey of state public utility commissions reported experiencing water supply shortages in the last five years. Two states, Massachusetts and Arizona, said they have experienced water supply shortages "to a considerable extent." Twelve states have experienced supply shortages "to some extent." Twelve states reported that water service was interrupted at least six times in the last five years. Two experienced one to two interruptions, and one reported experiencing interruptions three to four times. A variety of causes were identified. Most prominent among them were water main breaks and

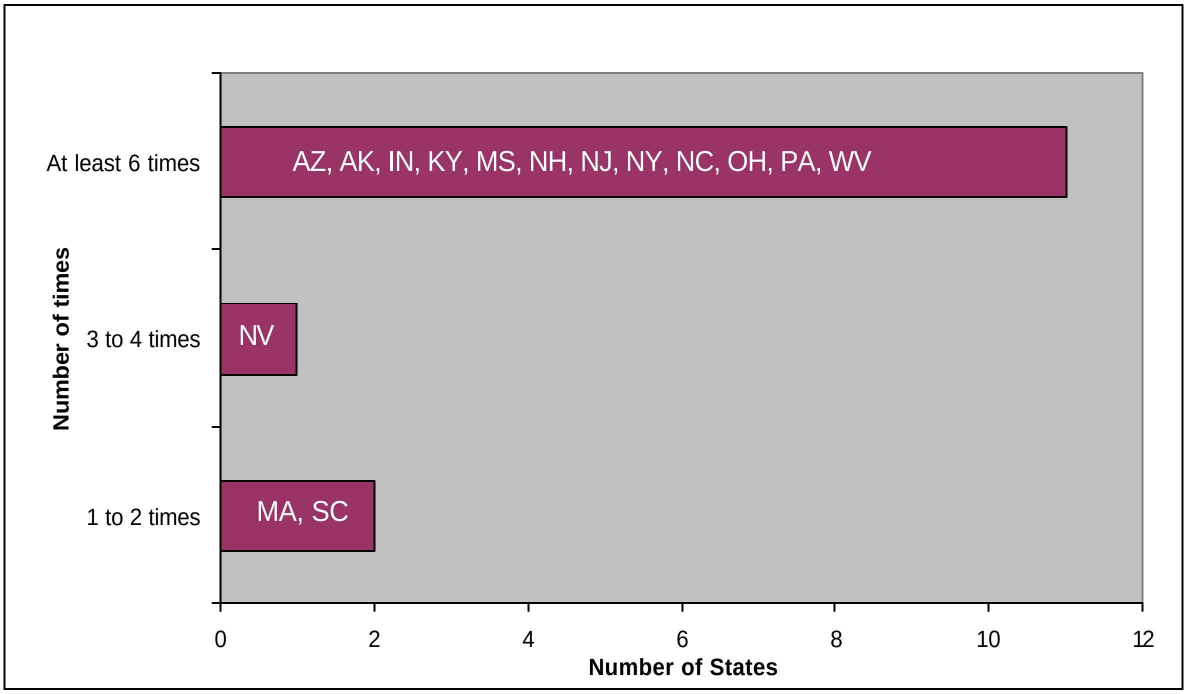
[10] Peter H. Gleick, "The Changing Water Paradigm: A Look at Twenty-first Century Water Resources Development," *Water International,* 25: 1, March 2000, 127-138.
[11] Fen Montaigne, "Water Pressure," *National Geographic*, September 2002, 2-51.
[12] *New York Times*, "Beyond a Doubt, Water Worries Grow", Feb. 24, 2002.

drought. Others were caused by electrical outages, MCL violations, flooding, treatment system failure, source water contamination, well pump failures, vandalism, sabotage and other causes (see figures 3, 4 and 5).



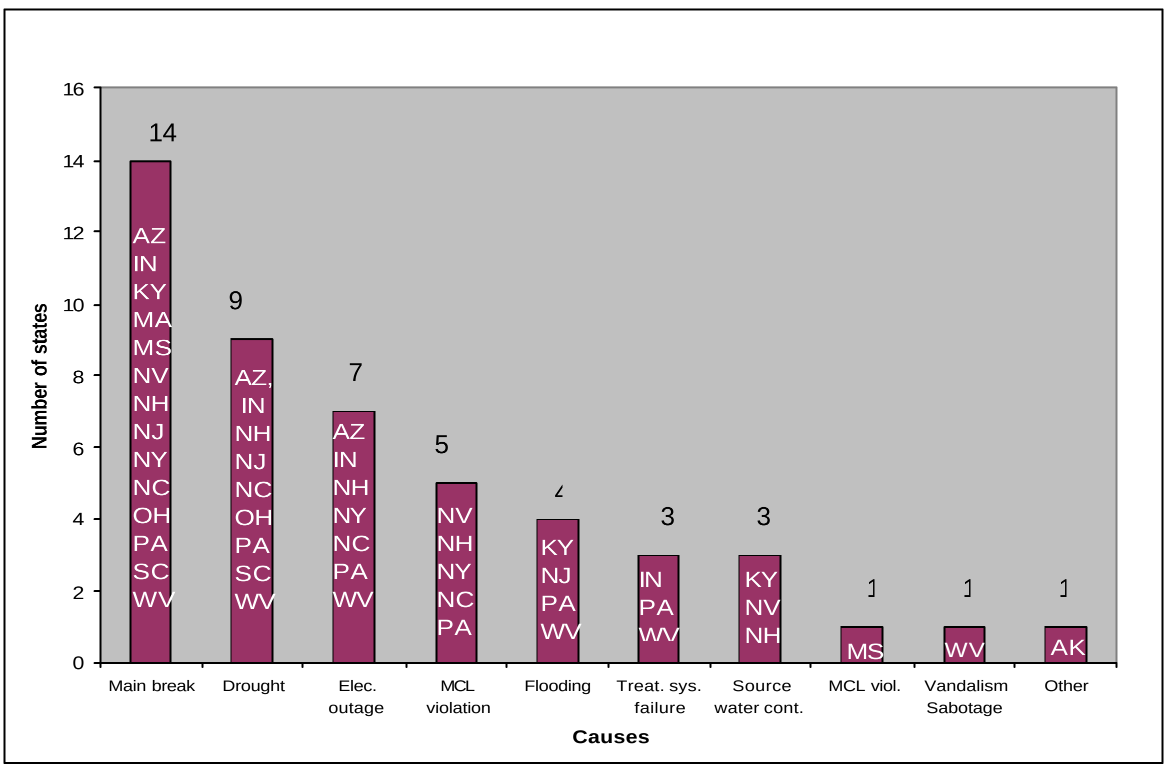
Source: NRRI survey of state public utility commissions, spring 2002.

Fig. 3. States experiencing water supply shortages



Source: NRRI survey of state public utility commissions, spring 2002.

Fig. 4. Interruption of service



Source: NRRI survey of state public utility commissions, spring 2002

Fig. 5. Causes of water supply limitations and/or interruptions

CHAPTER 3

APPROACHES TO WISE WATER SUPPLY MANAGEMENT

There are many reasons to take greater care of our nation's water resources. There are also a number of approaches that can contribute to careful, wise use of water. A number of these approaches are examined below. Some can be accomplished by jurisdictional water utilities with regulatory support and encouragement from state commissions. Others involve numerous stakeholders and other agencies and necessitate more planning and coordination.

The discussion of approaches and tools begins with a look at what water utilities themselves can do to minimize water losses and describes some tools that regulators can use to encourage and assist water utilities in those efforts. Methods of water storage and distribution are examined along with the merits and pitfalls associated with nonpotable reuse of water. Droughts are not new and thus regulators and other policy-makers can benefit from lessons learned. An Army Corps of Engineers assessment of the California drought of 1987-1992 appears to be instructive as water utilities and regulators endeavor to effectively address today's water shortages. Getting water to where it is needed is discussed in the form of water wheeling and inter-basin transfers. Consolidation of the water utility business and regionalization of regulatory efforts are considered with New Hampshire providing a current example. Impacts of drought on provision of electricity, very important in some areas of the country, are also noted.

Water resources planning and total water management are discussed along with demand-side management. Does a large, green, picture-perfect lawn remain appropriate when water is in short supply? Are river gages in your state working? Are new ones needed? River gages operated by the USGS provide important streamflow information for use in managing droughts and floods. Updates to this program and a potential role for jurisdictional utilities are discussed. Key regulatory (and utility) tools for managing water demand are rates and rate design. Types of drought pricing are reviewed along with other conservation-inducing rate structures, rate stabilization funds and wholesale purchasing arrangements. Customer education and communication do and should permeate any discussion of drought's effects and mitigation.

Communication principles are set forth for use by water utilities, state regulators and others. The paper concludes with a summary of tools and approaches and the considerations associated with each method (see table 5).

All or only a few of these tools, efforts and methodologies may be useful and ripe for a particular state commission and its jurisdictional utilities and other stakeholders to pursue. All should be examined with reference to the unique characteristics, costs, constraints and opportunities at local, state and regional levels.

One component of planning for and dealing with times of water scarcity is to regularly take steps to minimize the amount of water that is lost or wasted. Commissions can work with the utilities they regulate to ensure that drinking water supplies are used wisely and are not wasted. One of the most promising and timely ways is through appropriate leak detection and remediation efforts. Others include distribution system improvements, water banking, nonpotable water reuse, and drought pricing.

Water Loss Management: Leak Detection and Remediation

Consider this. According to the American Water Works Association (AWWA), 40 billion gallons of water are processed by U. S. water utilities each day, and 6 billion gallons are lost due to problems such as main leaks, tank overflow, pipe bursts, improperly open drains, system blow-off, inaccurate or no metering or unauthorized use. AWWA has called water loss management perhaps the greatest untapped opportunity for water utilities to use to combat drought, increase revenue, avoid capital expansion, reduce impact on watersheds and underground supplies, improve efficiency, reduce energy cost of water treatment and provide water for future growth. AWWA also asserts that supply-side water loss control will typically result in much greater gain for most systems than demand-side conservation.[13]

A leak-free network is not a realizable technical or economic objective, according to the International Water Association (IWA), and a low level of water losses cannot be avoided even in the best operated and maintained systems where water

[13] Robert A. Rosamond, letter to AWWA Members regarding Julian Thornton, "AWWA's Water Loss Control Manual," AWWA, 2002.

suppliers pay a lot of attention to water loss control. However, quantity of lost water is an important indicator of the positive or negative state of water distribution efficiency.[14] Calling high and increasing volumes of water losses an indicator of ineffective planning, poor construction and low operational maintenance activities, IWA says such indicators should be the trigger for initiating an active leakage control program: "In a well operated system, water losses should be continuously monitored and controlled, and noted in an annual report."[15]

In 1996, the operation and maintenance committee of the IWA's distribution division set up a task force to review existing methodologies and recommend a basic standard terminology for the calculation of real and apparent water losses that could be used for benchmarking. Their recommendations as reported by IWA in October 2000, stressed:

- The importance of reliable metering
- Standard definitions that can be used internationally to compare systems on the basis of water losses
- Best practice components of water balance and calculations
- Financial performance indicators
- Factors which influence real water losses
- Technical performance measures for real water losses

Definitions

The AWWA *Drinking Water Dictionary*[16] describes water losses in several ways:

- System Leakage: The quantity of water that goes through a distribution system but cannot be accounted for. The number is derived by subtracting the amount of water that is measured by meters and billed to customers from the water that is leaving treatment plants and well fields. The percentage varies greatly depending on how well the system is maintained.

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[14] IWA Blue Pages, "Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures," *IWA*, October 2000.
[15] IWA Blue Pages, *IWA*, October 2000.
[16] James M. Symons et al, *The Drinking Water Dictionary* (Denver: American Water Works Association, 2000).

- Unaccounted for Water (UFW): Water use that does not go through meters (such as that lost from leaks) and thus is not accounted for by the utility.
- Water Loss: In any water system that portion of water that leaves the system without being used as intended.

Metering Important For Quantifying Water Losses

Metering is the process of measuring and recording the quantity of water passing a given point in a system. According to IWA, "The most important part of determining how much water is being lost in a system is to accurately quantify the volume of water that is entering the system." IWA also asserts that "reliable metering of all water volumes should and must be an integral component of water supply, water demand management and loss determination."[17]

NRRI's John Wilhelm explains the significance of metering for small utilities:

> The recent work we have done with small utilities suggests that metering may be one of the most basic steps towards achieving better overall performance. The most obvious place for meters is at the point of sale. An equally important, and oftentimes overlooked, need for meters exists at other critical points throughout the utilities source, treatment, storage and distribution system. Of course, the costs associated with meters can be an important issue for small systems, but an issue that commissions are particularly well suited to help them address.[18]

Figure 6 provides an example of the various points in a water utility operation where installation of meters may be appropriate. Regulators can support wise use of water by working with utilities to ensure that meters are installed in appropriate numbers and sizes, that meters are regularly calibrated and are working well, and that meters past their useful life are expeditiously taken out of service and replaced. Des Moines Water Works maintains a policy of replacing meters beyond a certain age whenever distribution staff are already on customer premises for a service call.[19]

[17] *Drinking Water Dictionary*, 17.
[18] John Wilhelm, NRRI Research Associate, interview, May 2002.
[19] Scott Baker, DMWW Distribution Staff, interview, May 2000.

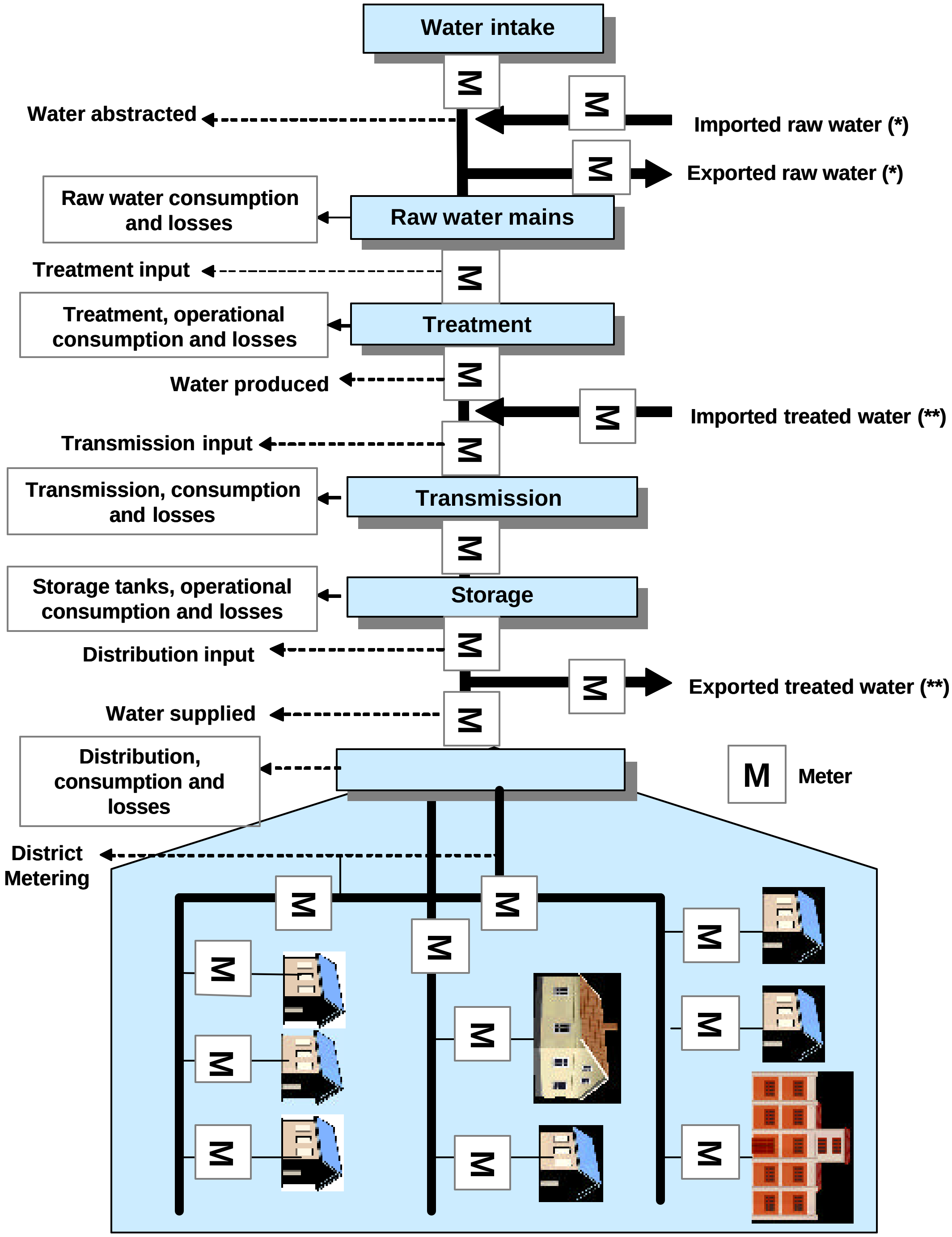
Of particular relevance for state regulators is the use of appropriate technical performance indicators of the real water losses experienced by the utilities they regulate. Water systems in the United States have traditionally used a calculation of unaccounted-for water as the main performance indicator for system leakage. The AWWA standard suggests that unaccounted-for water should be no greater than 10-15 percent of system input volume. However, such indicators are influenced by a system's operating pressure and amounts of rainfall or snowmelt.

> In a dry year, when greater volumes of water are being pumped, the unaccounted – for water percentage decreases and thus may give the appearance that water losses are decreasing as well. In a wet year, unaccounted – for water as a percentage of system input volume goes up. Viewed another way, leakage at a water utility with a high percentage of industrial demand, for example in the range of 40 -50 percent of output, could be obscured as its volumes remain relatively high even during wet years. A measurement that more accurately calculates real water losses by taking into account multiple influencing factors such as the number of service connections, the length of mains, operating pressure and other variables is superior to the conventional unaccounted-for water methodology as an indicator of the effectiveness of a utility's planning, construction and maintenance programs. Water loss per-year, per-mile of main is a simple metric that may more accurately assist with monitoring water loss.[20]

A. Lambert et al. in the IWA report assert that "real losses" expressed as a percentage of system input volume is unsuitable for assessing the efficiency of management of distribution systems because this performance indicator fails to take into account any of the following key influences on "real losses":

- Number of service connections
- Location of the customer meter on the service connection
- Length of mains
- Average operating pressure, when the system is pressurized

[20] Brian Bisson P.E., telephone interview, April 2002.



Source: IWA, October 2000.

Fig. 6. Water meter installation

- Percentage of time of year for which the system is pressurized
- Infrastructure condition, materials, frequencies of leaks and bursts
- Type of soil and ground conditions, insofar as they influence the proportion of leaks and bursts which show quickly at the ground surface

Also as explained above, differences in consumption influence the value of “real losses” expressed in percentage terms.

Considerations and Applicability

Although detailed examination of all of the approaches and practices for determining water losses recommended by the IWA (and others) is outside the parameters of this paper, their recommendations suggest policies that public utility regulators may wish to evaluate and pursue with water utilities in their jurisdictions. State regulators may wish to seek guidance from independent experts on the efficacy of various methodologies for calculating water losses and endeavor to put into place indicators that accurately reflect what is really going on with respect to lost water in a utility’s system. State regulators may find it beneficial to determine the extent to which a utility is engaged in leak detection efforts (routinely or periodically) and work with the utility to agree upon what an optimal leak detection and remediation program would look like for that utility. Such an assessment should take into account the corrosiveness of water in the area. Depending on a utility’s individual circumstances, there may be room to significantly reduce water losses.

Another place with leaks to plug is the plumbing inside a customer’s home or business. Some utilities follow the pipes through to the tap with their leak detection efforts. Service charges may be assessed when a utility performs work on a customer’s premises, such as repairs, replacement and improvements. Leak detection is one area of contract work that may make sense for investor-owned water utilities as a way to prevent waste from occurring on a customer’s property and as a source of revenues. Similarly, some utilities sell equipment to the customer or plumber who will install it. In some instances, utilities offer services or merchandise at reduced cost or at no interest to encourage customers to install water saving devices. In 1991, when drought was plaguing portions of Ohio, an investor-owned utility serving Washington Court House, Ohio, made water saving devices available to its customers at cost. A significant number of the utility's customers took advantage of the special offer.[21] Commissions may wish to consider encouraging such programs for their jurisdictional water utilities as a recoverable expense.

Infrastructure Replacement Costs Get Automatic Rate Treatment in Some States

Overall infrastructure replacement programs go hand in hand with efforts focused on finding and fixing system leaks. Main breaks (the most common cause of supply interruptions among NRRI survey respondents) begin to happen more frequently as systems age. Many systems throughout the United States are using pipe that is at or nearing the end of its useful life. The infrastructure issue is high on regulatory and legislative agendas as various infrastructure replacement funding approaches are debated. Some funding options are discussed below.

Distribution System Improvement Charges (DSIC)

DSICs have recently emerged as a vehicle for encouraging water utilities to undertake work that has always been a part of managing a water utility – managing, upgrading and replacing their distribution systems. Akin to fuel adjustment clauses for electricity and gas cost recovery charges, DSICs are a tool that some commissions have begun to employ with the passage of new state laws permitting their use.

The Illinois Commerce Commission adopted rules for water and sewer companies in December 2001 to implement a 1999 state law that permits water and sewer utilities to impose surcharges for the cost of purchased water and sewer treatment and for qualifying infrastructure plant improvements. The new rules include a provision for a fixed monthly charge and allowance for a variable charge for variable costs associated with the quantity of water used to meet the demands of the sewer customer. Rules pertaining to the imposition of a surcharge for qualified infrastructure

[21] Brian Bisson, 19.

plant (QIP), such as new mains or depreciation, permit a surcharge to be added to customer bills, capped at five percent of base rates billed to customers. Annual reconciliation cases will ensure that expenditures and revenues are equal. [22]

In Pennsylvania, P.A. C.S.A. §1307 allows rate recovery of costs related to distribution system improvement projects designed to enhance water quality, fire protection reliability and long term system viability. Water utilities may file tariffs establishing a sliding scale of rates, or another method for the automatic adjustment of rates of the water utility, to provide for the recovery of fixed costs (depreciation and pretax return) of certain distribution system improvement projects, as approved by the commission, that are completed and placed in service between rate proceedings.

In Delaware, water utilities may use a DSIC to recover depreciation expense and a pretax return on certain distribution system improvement projects between general rate cases. DSIC-eligible property is broadly defined by statute to include replacement of items of mass property (that is, mains, valves, services, meters and hydrants) and new water treatment facilities and/or equipment required to meet changes in state or federal water quality standards, rules or regulations. [23]

Federal Legislation May Bolster Water Utility, Commission Efforts

Coincident with statutes in a few states enabling automatic rate adjustments for distribution system improvements and other investments is federal infrastructure legislation. One bill, S. 1961, the Water Investment Act of 2002, would give privately owned water utilities (most of those regulated by state commissions) equal footing with municipal systems in terms of access to Clean Water Act and Safe Drinking Water Act

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[22] National Association of Water Companies (NAWC), "New Rules from Illinois Commission," *NewsFlow*, XII:2, April 2002, 4.

[23] Thomas P. Gadsden, "Infrastructure Surcharges Advance in Delaware and Illinois," NAWC *Water Currents* 4:1, January 2002.

State Revolving Fund Loans (SRF).[24] To receive SRF help under the bill, systems must consider private partnerships and consolidation, and have in place an asset management plan and a rate structure that reflects the actual cost of service. The Senate Environment and Public Works Committee passed S. 1961, May 17, 2002, with amendments. As of August 2002, S. 1961 had not been scheduled for full Senate action. S. 2813, a bill similar to S. 1961, was introduced July 29, 2002, by Republican Senators Smith, Crapo and Inhofe.[25]

Most investor-owned and some municipal water utilities are opposed to a so-called federal infrastructure "bailout" for water utilities. They have managed their assets and charged rates to support system requirements; they do not feel their shareholders and customers should pay again to assist others who have failed to do so. S. 1961 directs the National Academy of Sciences to study and provide information on best practices concerning rate setting, with a focus on utilities' ability to meet their own infrastructure needs without federal assistance.[26]

In March 28, 2002, testimony on drinking water infrastructure financing before a the Subcommittee on Environment and Hazardous Materials Committee on Energy and Commerce, U.S. House of Representatives, Perry Beider of the Congressional Budget Office made some compelling observations:

> The existing estimates of how much investment of drinking water infrastructure will be needed over the next 20 years are very uncertain and may be too large. The lion's share of the investment will be used to rehabilitate or replace water pipes, but there is no national inventory of pipes' ages and conditions on which to base estimates of investment needs. Moreover, the very concept of an investment "need" is a fuzzy one. The amount of money that water systems must spend in order to provide the necessary services can vary dramatically depending on how efficiently the systems operate and invest. Therefore, from the standpoint

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[24] The 1987 Amendments to the Clean Water Act created the State Revolving Loan Fund Program (SRF) to replace the construction grant program. This program provides grants from EPA to states to capitalize a revolving loan fund for wastewater infrastructure projects, including publicly owned treatment works, nonpoint-source water quality projects and estuary projects. The 1996 reauthorization to the Safe Drinking Water Act created the Drinking Water State Revolving Loan Fund Program (SRF) based on the SRF used for clean water. This program provides grants from EPA to states to capitalize a revolving loan fund for water infrastructure projects and funding for a number of set-asides to the program, such as source water protection, capacity development and operator certification programs.

[25] NAWC "Water Infrastructure Financing Legislation Stalls," *NewsFlow*, XII:4, August 2002.

[26] *AWWA Main Stream*, "Infrastructure Bill Amended," July/August 2002, 5.

> of economic efficiency, it is important that any federal support for water infrastructure be provided in a way that gives system operators and water users the appropriate incentives to keep costs and usage down.[27]

A similar perspective may inform decisions about infrastructure over which commissioners have influence at the state level. HR 3930, which applies only to the Clean Water State Revolving Loan Fund, awaits full House consideration. Neither Senate nor House legislation is expected to get to the President before the end of the 107th Congress. It is more likely that the bills will provide a starting point for the next Congress.[28]

Policy Guidance from Regulators

NARUC adopted a resolution on Feb. 24, 1999, that endorsed distribution system improvement charges as providing "benefits to ratepayers such as improved water quality, increased pressure, fewer main breaks, fewer service interruptions, lower levels of unaccounted-for water and more time between rate cases leading to greater rate stability."

In a July 26, 2000, NARUC resolution on water infrastructure financing, the association advocated a broad range of solutions to infrastructure renewal and increased operational and maintenance expense challenges including, among other alternatives, regionalization and consolidation to maximize financial, managerial and technical capabilities; public/private partnerships; full-cost rate structures and innovative ratemaking techniques. The resolution also opposed reliance on a "massive federal funding program" in order to avoid subsidizing systems that should be held accountable for "deferring the appropriate levels of investment in infrastructure maintenance, in part, due to under-pricing of their water service for political or other reasons."

DSICs may be attractive for use by commissions as a means for finally getting important infrastructure investments started in instances where a utility is under-capitalized and/or lacks managerial capability. Such investments are essential to protect water quality within the distribution system, avoid service interruptions due to

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[27] Perry Beider, Testimony before the Subcommittee on Environment and Hazardous Materials Committee on Energy and Commerce, U.S. House of Representatives, March 28, 2001.
[28] NAWC, "Water Infrastructure Financing Legislation Stalls," 25.

water main breaks and prevent waste due to excessive leakage. These benefits combined with the caveats contained in S. 1961 will impact directly or indirectly the amount of water that is used and a utility's ability to, for example, establish alternative, back-up sources of supply by interconnecting with another system as a part of consolidation.

Policy Guidance from Consumer Advocates

The National Association of State Utility Consumer Advocates (NASUCA) adopted a position in June 1999 (Resolution 1999-03) opposing use of automatic adjustment clauses for water utilities infrastructure replacement for several reasons including that:

- Automatic adjustment mechanisms circumvent regulatory review of increases to rate base for prudence and reasonableness and eliminate the built-in incentive for utilities to control costs between rate cases
- Automatic adjustment clauses reduce rate stability and distort price signals, and special incentives are not needed in order to ensure adequate water quality, pressure and a proper reduction of service interruptions
- Automatic adjustment mechanisms can inappropriately reward water companies that have imprudently fallen behind in infrastructure improvements
- Business risk should not be shifted away from water utilities in order to create an incentive for companies to fulfill their basic obligation to provide safe and adequate service

Considerations and Applicability

State regulators may wish to consider whether automatic rate adjustments categorically make sense for utilities in their jurisdictions. In remarks before the July 2001 Mid-Atlantic Conference of Regulatory Utilities Commissioners in White Sulfur Springs, W. Virginia, (distributed in an Illinois-American Water Company news release) J. James Barr, the President and CEO of the American Water Works Company, said, "There is absolutely nothing new or particularly complicated about the issue of infrastructure replacement…Through the combined efforts and intestinal fortitude of utility officials and economic regulators, we've taken the steps to secure reliable service for our customers." Barr said that since the early 1970s, American Water has invested more than $6 billion, or roughly $2,000 per customer, in infrastructure; an investment that was funded by private investors and supported by commission approved-rates.

The routine business of replacing aging infrastructure was accomplished through traditional ratemaking. Automatic rate adjustment mechanisms could be used selectively and creatively by commissions to get smaller systems started with infrastructure replacement programs or to enable utilities to build or acquire contingency supply alternatives, for example, by installing the pipe necessary to interconnect to another system, or making pipe already underground useful for exporting drinking water.[29] Automatic adjustments and/or dedicated capacity charges could be utilized to enable a distribution system to be installed to allow nonpotable use of reclaimed water. (Water reuse is discussed in detail below.)

Dedicated capacity is the portion of the water utility's total capacity that is set aside or dedicated for use by an individual large-use customer or group (class) of customers whose total use is a significant part of the utility's total capacity requirement. Dedicated capacity charges are intended to recover capital costs for system expansion associated with a capacity addition to serve an established area, or for capacity reserved for a specific customer.[30] A utility's unique financial, managerial and technical situation should be considered in determining whether allowing an automatic adjustment or a dedicated capacity charge will assist public utility commissions to achieve water resource objectives.

Commissions may wish to review existing statutes to ascertain whether they constrain or enable various innovative water supply funding alternatives and develop appropriate regulatory tools to be used at their discretion to accomplish water supply objectives. Various rate mechanisms currently in use to pay for costs associated with infrastructure replacement are shown in figure 7.

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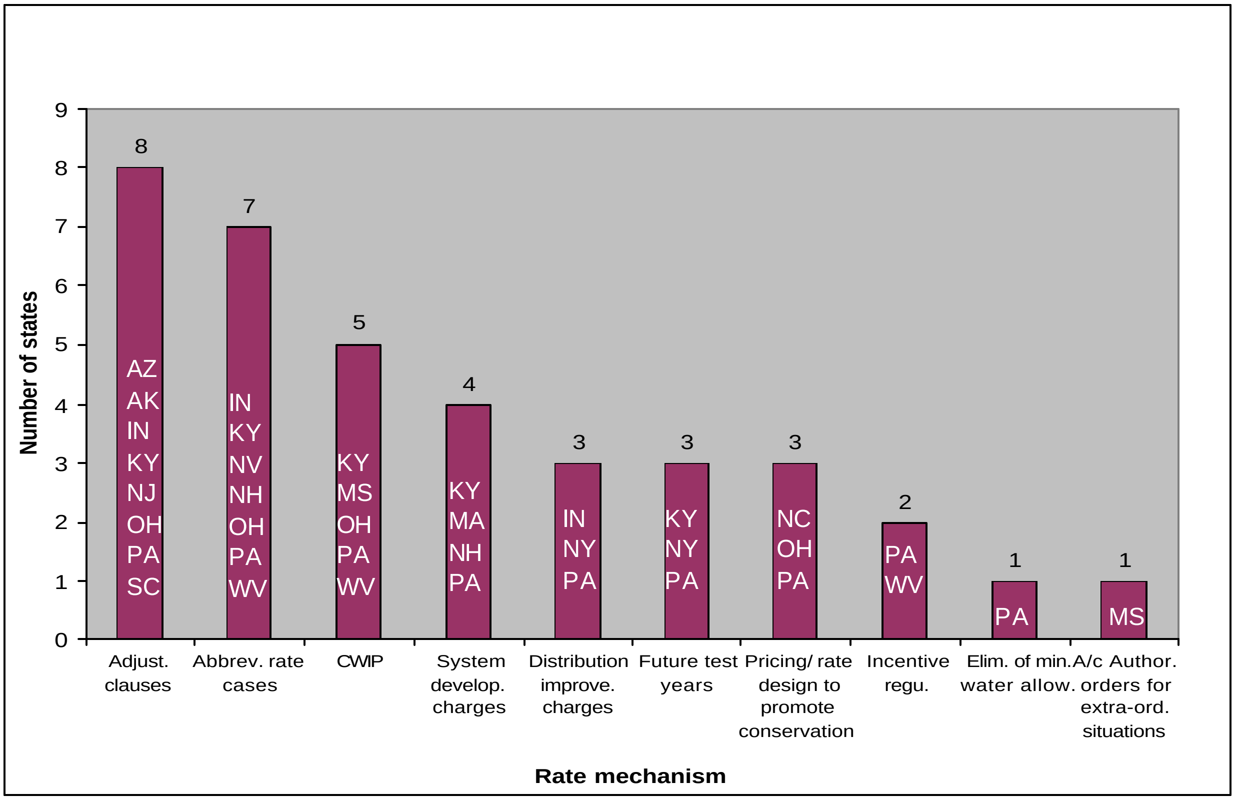
[29] During the drought of 1989 and 1990, the Des Moines Water Works was the only utility in the area that was not faced with a water supply shortage. It took the unusual step of rehabilitating an abandoned oil pipeline and used it to export water to a neighboring town for three months (until rains returned and the town could once again rely on its own supply of water). Randy Beavers, telephone interview April 2002.

[30] AWWA Manual of Water Supply Practices, *Principles of Water Rates, Fees, and Charges*, Fifth Edition, 2000.



Source: NRRI survey of state public utility commission, spring 2002.

Fig. 7. Rate mechanisms in use to pay for costs associated with infrastructure replacement

Water Banking Saves Water for the Right User at the Right Time

Methods for saving water for later use, or reallocating water or water rights to other users, including water banks, can play a role in promoting wise use and in coping with drought. One example of water banking is operated by the Kern Water Banking Authority (KWBA) in California.

Water Banking Defined

Ken Bonesteel and Morris Taylor, project managers associated with the KWBA in California's southern San Joaquin Valley, described water banking and its merits this way:

> Water banking is a conjunctive use operation that stores excess water as groundwater in wet years and extracts it for use during dry cycles. The procedure can offer several advantages over importing water or storing it in reservoirs. Water banking is less costly, more flexible and has less impact on the environment since the water is stored underground. In addition, aquifers do not lose water to evaporation as surface reservoirs do. KWBA expects to complete the KWB at a cost savings of 50-to-1 as compared to developing an above ground reservoir. However, certain geological features must be in place to make water banking feasible. Sandy soil is required to allow for permeability and to provide a good holding medium for water. Also, deep confining layers of clay are needed to keep the water in place. In addition, the site needs to be located near water supply and water delivery systems. [31]

Sometimes used as a synonym for water banking is aquifer storage recovery (ASR) – a water management technology in which water is stored underground in a suitable aquifer through a well during times when the water is available and recovered from the same well when needed.

The term water banking is also used to describe programs that market water rights, that is, provide a clearinghouse and rules for buying and selling or leasing water rights. In this type of "water banking" no water is actually stored. For example, the right to water that would have gone to a high priority agricultural user is leased for that year to a lower priority user. The water that would have been diverted based on "senior" rights simply stays in the aqueduct for use by the temporary leaseholder further downstream.[32]

Kern Water Bank Authority

The KWBA was formed in 1994. By 1995 KWBA had received the necessary permits from the California Department of Water Resources (DWA) and began recharging groundwater. The Kern Water Bank is located near the southern end of the San Joaquin Valley where the California aqueduct and the Kern River converge. The Kern River is controlled by a dam at Lake Isabella. The Lake Isabella reservoir storage level is 560,000 acre-feet, but snowmelt from the watershed can provide almost twice

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[31] Ken Bonesteel and Morris Taylor, "Banking Water to Alleviate Future Droughts", *PublicWorks*, June 1999, 18, 20, 22.
[32] Timothy Henley, Manager, Arizona Water Bank, telephone interview, May 2002.

that amount. As a result, massive quantities of water are frequently released in early spring before agricultural irrigation for the growing season has begun. The same situation is true for the federally controlled Central Valley Project; mandatory releases take place before crops need watering. Today, this extra water that is unusable in early spring is stored underground in aquifers with a storage capacity of one million acre-feet. The project incorporates a canal that runs two ways. The canal can receive water for recharge and deliver water back to the aqueduct that has been pumped by wells from the underground basins.

Arizona Water Banking Authority; Central Arizona Project

A project in Arizona provides another example of water banking. The Arizona Water Banking Authority Study Commission (study commission) and the Arizona Water Banking Authority (AWBA) were created through the enactment of HB 2494 by the Arizona legislature in 1996. Charged with helping the legislature evaluate the effectiveness of the powers and duties of the AWBA, the study commission issued the Arizona Water Banking Authority Study Commission Final Report in December 1998.

HB 2494 authorized the AWBA to import Colorado River water through the Central Arizona Project (CAP)[33] to be stored using underground storage techniques. The AWBA has, among other responsibilities, the ability to:

- Buy water available from within the state's annual entitlement, but not ordered for delivery by any other water user

[33] The CAP is designed to bring about 1.5 million acre-feet of Colorado River water per year to Arizona's Pima, Pinal and Maricopa counties. CAP carries water from Lake Havasu near Parker to the southern boundary of the San Xavier Indian Reservation southwest of Tucson. It is a 336-mile long system of aqueducts, tunnels, pumping plants and pipelines and is the largest single resource of renewable water supplies in the state of Arizona. CAP has more than 80 customers which fall into three groups: municipal and industrial, agricultural, and Indian users. The municipal and industrial customers include cities and water utilities. CAP's agricultural subcontractors are primarily irrigation districts. CAP also delivers water to Indian communities but, by law, is not permitted to contract directly with them. Tribal nations contract for CAP water with the federal government. Each fall customers are required to project the total amount of water they expect to use during each month in the coming year. CAP uses this information to create an annual forecast of total water deliveries. CAP offers customers such flexibility that even daily requests for changes in water deliveries are regularly accommodated.

- Use stored water to help provide a supplemental supply in times of drought or other shortage
- Permit establishment of an exchange mechanism that would allow assistance to authorized entities in Nevada and California (with associated costs to be borne by the interstate banking partner)
- Obtain water storage permits at underground storage or groundwater savings facilities (AWBA may not own or operate such a facility)
- Assign long term storage credits to the water users who will benefit from the water

Funding for the AWBA is provided by three sources:

- A four-cent ad valorem tax levied in Maricopa, Pinal and Pima Counties
- A $2.50 per acre-foot groundwater withdrawal fee assessed in the Phoenix, Pinal and Tucson AMAs
- Appropriations from the state general fund

Authorizing legislation was amended in 1999 based on recommendations of the AWBA study commission to expand the powers and duties of the AWBA to allow:

- "Loaning" of long term storage credits that have been previously earned for authorized purposes that will not need to be recovered for many years. These credits may be loaned to entities who may need supplemental or interim water supplies. The borrower must either repay the AWBA with similar long term storage credits or must pay the full cost of replacement.
- Centralized storage for other entities (which enables those entities to avoid the cost and time required to obtain their own permits). Effluent can be stored as a last resort.
- Interstate water banking (as of May 2002, approval of an agreement with Nevada was pending from the U. S. Secretary of the Interior)

Creation of the Arizona Water Bank was possible because Arizona gets more water than it needs each year from its entitlement of the Colorado River (Colorado River

Compact). The water bank's ultimate purpose is to store and preserve water for long-term future use (100 years out). Since its establishment, the AWBA has stored 1.5 million acre-feet of water (roughly 300,000 acre-feet a year). It was also fairly inexpensive to develop ($30 per acre-foot) due to favorable geologic/soil conditions. Spreading basins were built from which stored water trickles into vast aquifers below Arizona's many riverbeds that remain dry/unsaturated during most of the year. In Nevada, for example, the surface spreading approach is not possible as a layer of cemented soil exists underground and water simply cannot percolate down into the aquifer. To store water there, injection wells are used which are more expensive than above-ground storage.[34] Extra water is pumped under pressure down into the groundwater zone. However, water stored above ground needs to be used fairly quickly before quantities diminish significantly from evaporation. Water stored underground remains intact.

California's State Drought Emergency Water Bank

During the fifth year of the California drought of 1987-1992, the governor of California signed Executive Order W-3-91 on Feb. 1,1991, which established a state drought emergency water bank to meet critical water needs. The water bank created a voluntary market for the transfer of water on an economic basis. The bank began operating in 100 days, which was possible because of the extensive water storage and distribution network already in place in the state. California also has extensive groundwater reserves. The order also:

- Encouraged adoption of community rationing plans with up to 50 cutbacks in water use
- Directed the California Department of Fish and Game to work closely with the U.S. Fish and Wildlife Service to protect natural habitat
- Established a $100 million drought action fund to assist with conservation, water supply augmentation and other drought mitigation activities

[34] Timothy Henley, 29.

- Created a drought action team to represent the governor and provide local and state assistance in carrying out the order

Through December 1991, 351 contracts were awarded by the water bank, representing 820,000 acre-feet of water purchased. Water sources included fallowing, that is, irrigation water conserved by taking agricultural acreage out of production, groundwater and surface water.[35]

Kansas Water Banking Act of 2001

SB 237 signed into law on May 9, 2001, authorized creation of a water bank to enter into contracts with holders of water rights for deposit in the bank, and to lease water to others within the bank boundary and in the same hydrologic unit. The bank itself does not own, buy or sell water rights. The water bank is a part of the state water plan.

Considerations and Applicability

Deciding whether and what type of water banking makes scientific and economic sense, and feasibility under current law, is dependent, among other factors, on area hydrological conditions, an assessment of potential alternatives and the extent to which an area (or a set of users within an area) has more water than it needs at a given point in time that can be stored for future use or transferred to another user, and the availability of or ability to construct a distribution system for transporting water to those who need it. Annual recharge and recovery, for example, may make sense for an area that has very wet periods followed by dryer periods accompanied by higher demand for water for irrigation, recreational and environmental purposes.

A decision to bank water, like other water supply decisions, is a multi-disciplinary process involving geologists, hydrologists, engineers, attorneys, water resources planners and ultimately public officials and their constituents. Water banking would appropriately be considered in integrated water resource planning (IRP) which is discussed below. In the last five years, several water systems and a host of consulting

[35] Robert Brumbaugh, et al, "Lessons Learned From the California Drought (1987-1992)," Executive Summary, Institute for Water Resources, Army Corps of Engineers, October 1994, 13-15.

engineering firms have acquired experience with newer forms of water storage and recovery. Public utility commissioners and other public officials and opinion leaders can learn from these examples. As a matter of public policy, establishment of a water bank has the inherent benefit of keeping allocation of a valuable natural and economic resource within the public domain where allocations can, at least in theory, be made with broader public policy considerations in mind.

These few examples of water banking are provided to demonstrate some different ways and circumstances under which water banking may be used. Each geographical area has its own distinct characteristics and needs that must be considered to determine whether and what type of water banking might be appropriate.

Wastewater Reclamation and Nonpotable Water Reuse

Another means of using water more efficiently is to distinguish between the quality of water that is required for different users. Reusing water for nonpotable purposes is becoming more common and gaining public acceptance. Potable reuse is another story.[36]

Wastewater reclamation is the treatment or processing of wastewater to make it reusable, and water reuse is the planned and targeted use of treated wastewater for a beneficial use. Direct water reuse requires pipes or other facilities for containing and conveying reclaimed water. In new construction, dual systems can be built in. Indirect reuse results from the discharge of treated effluent to receiving water for assimilation and withdrawal downstream.

Nonpotable water reuse is defined as the use of reclaimed water for nonpotable purposes, such as the irrigation of agricultural lands, golf courses and landscaping; industrial cooling and processing, recycling and reuse, groundwater recharge and environmental enhancement; and nonpotable urban uses, such as fire protection, air conditioning and toilet flushing. Water recycling involves a single user. The effluent

[36] According to Linda Blankenship of the Water Environment Research Foundation (WERF), water recycling for potable reuse has not found broad public acceptance to date. Referencing a San Diego indirect potable reuse project, Blankenship described a plan to put highly treated recycled water into an aquifer at one point for eventual withdrawal further down for entry into the regular water treatment process. The media labeled the plan “From Toilet to Teacup” and its implementation was thwarted.

from the user is contained and redirected back through some type of industrial process. Water recycling is practiced in the pulp and paper industry.

Water Environment Research Foundation Weighs In on Management Practices for Nonpotable Reuse

According to a Water Environment Research Foundation (WERF) report:[37]

Underlying the development of nonpotable reuse is the economic value of treated effluent. Water reclamation and reuse generates a new water resource, limits effluent discharges into the environment and permits conserving freshwater resources for the highest quality need: drinking water supply. Other arguments in favor of reclaimed water as a source of nonpotable water supply include:

- Availability near urban areas
- Drought-proof dependability
- Availability of proven treatment technology
- Safety
- Broad public acceptance

A survey conducted as part of the WERF report referenced above showed 27 reuse projects located in the western United States, and 13 east of the Mississippi with project concentrations occurring in both California and Florida. Twenty-five systems were located overseas. Systems surveyed encompassed various types of reuse including, among others:

- Crop irrigation
- Landscape irrigation
- Ornamental lakes and streams
- Fire protection
- Toilet flushing
- Industrial/commercial washing

[37] Pier Mantovani et al, *Management Practices For Nonpotable Reuse*, (Alexandria, VA: Water Environment Research Foundation, 2001).

- Industrial processing
- Industrial cooling
- Construction
- Dust control
- Street washing/snow melting
- Groundwater recharge
- Sale to other agencies

The WERF survey also includes a wide range of system sizes. The basic premise of water reuse is that treated effluent should not be wasted and might be a cost-effective way to augment existing local and regional water supplies when compared to the development of new water resources. Benefits and challenges of nonpotable water reuse as summarized by Mantovani et al. are shown in table 1.

Role of Utility Commissions in Reuse

In their June 1997 NRRI report, John Borrows and Todd Simpson discussed the role of utility commissions with regard to reclaimed and reused water:

> The role of the public utility commission in the emergence of reclaimed water projects depends to a large extent on their participation in the broader issues of water resource management…Since reclamation may be less costly than treating water to standards for unrestricted release from the treatment plant, commissions with responsibilities for wastewater utilities may require those utilities to investigate reclamation…Some commissions participate to a greater extent in their states' management of water resources in general. Since there are benefits associated with reclamation beyond those reflected in the wastewater and potable water services to customers, commission consideration of these benefits may support a broader public interest agenda…Commissions with the broader public interest objective will need to gain substantial insight into the costs and benefits, both internal and external, to the providers and their customers.[38]

[38] John D. Borrows and Todd Simpson, *Water Reuse: Considerations for State Commissions* (Columbus: NRRI, 1997).

TABLE 1: POTENTIAL BENEFITS AND CHALLENGES OF NONPOTABLE WATER REUSE

Domains	Benefits	Challenges
Financial and Economic	Avoided costs for new freshwater resources development or advanced wastewater treatment and discharge Additional revenue from sales of reclaimed water Increased reliability of supply resource for economic development Elimination of adverse effects of effluent discharge on local economy Increases in land and property values savings in fertilizer costs	Cost of reclaimed water infrastructure (reclamation plant, dual distribution system, customer retrofits and storage) and operations and maintenance (cross-connection programs) Revenue and cost recovery, risk associated with development of new customer base, uncertain water reuse patterns, reclaimed water pricing and preexisting potable service Water rights and liability for potential loss of potable water revenue Inconveniences associated with dual distribution system construction (if retrofitted)
Public Health	Conservation of high-quality freshwater resources for potable water supply	Inadvertent exposure and /or unreliable operations
Environmental	Reduced pollutant discharge into receiving bodies Avoided impact of developing new freshwater resources (dams, reservoirs) Enhanced community/policy awareness	Potential detrimental impact of excess salinity and boron on soils and vegetation Potential long-term impact of leaching on groundwater quality

Source: WERF 2001 Final Report, “Management Practices for Nonpotable Water Reuse,” Project 97-IRM-6

The report contains information on wastewater treatment methods, uses of reclaimed water and externalities resulting from reclamation activities, and a very practical discussion of the demand, costs, prices, markets and regulatory issues associated with water reclamation. An adequate demand for reclaimed water depends upon the price of the reclaimed water, the price of potable water and establishment of a basic need for the water in terms of some intended uses. Reclamation may be used, for example, in place of potable water in order to defer installation of water treatment facilities. There are potentially multiple consumers of water to be used or reused for purposes that require less than potable water, including: industrial reuse, agricultural reuse, environmental reuse (streamflows and wetland augmentation), groundwater recharge, recreational reuse and urban reuse.

A table constructed by the authors and “reused” as table 2 may be helpful in considering the merits of a particular reclaimed water project from multiple perspectives.

The report reviews the arguments in support of and contrary to regulation of suppliers of reclaimed water by state commissions. Reclaimed water provision has many characteristics of a monopoly in that, once connected to a reclaimed water supplier, a customer will be captive to that supplier. As well, reclamation has effects on the costs and revenues of other regulated services. On the other hand, regulation with its application of uniform principles could hamper the development of business arrangements that are beneficial to both users and suppliers. The report sets forth six potential categories of commission regulation and the regulatory activities typically associated with each category. The report includes case studies detailing the circumstances and costs, uses identified for the reclamation activity and the benefits realized from the reclamation projects. The case studies demonstrate the applicability of the cost methodology presented by the authors in the report.

Considerations and Applicability

Whether drought conditions are present or not, it remains true that only about four percent of our nation’s centrally treated water supplies are used for potable

TABLE 2: WATER REUSE: AFFECTED PARTIES, COSTS AND BENEFITS

Affected Party	Cost	Benefit
Reclaimed-water provider	Reclaim or dispose of wastewater Operating costs	Revenues from sales
Reclaimed-water user	Price of reclaimed water	Availability of reclaimed water Avoided costs of potable water
Wastewater service provider	Provision of flow to reclaimed water provider	Avoidance of treatment requirements
Wastewater service user	No direct cost	Flow through of treatment savings
Potable-water supplier	Reduced sales of potable water	Reduced capacity requirements
Potable-water user	Higher allocation of supplier costs if total sales are reduced	Enhanced supply security Avoided plant expansion cost pass-through
Public	General tax support of projects where applicable	Enhanced development Greening of public space Improved raw water supply Enhanced environment

Source: John D. Borrows and Todd Simpson, *Water Reuse: Considerations for State Commissions*, NRRI, 1997

purposes (drinking and water used in the kitchen).[39] Reducing demand for our highly treated drinking water by using reclaimed water in selected nonpotable applications is an option for public utility commissions to explore with the water and wastewater utilities they regulate, other public officials and other relevant stakeholders. Major water-using industries or industrial complexes and a combination of residential, industrial and commercial properties can benefit from water distributed using dual distribution systems. Dual systems allow reclaimed water to be delivered to customers by a parallel

[39] Janice A. Beecher and Ann P. Laubach, *Compendium on Water Supply, Drought and Conservation* (Columbus: NRRI, 1989), 65.

network of distribution mains separate from the potable water distribution network. Storm water is also being used in some areas to replenish overdrawn aquifers.

Although the public in general may not be very well informed about water reuse, a 1992 U.S. EPA study found that initial acceptance of water reuse by the public depends, among other things, on:

- Public awareness of local water supply problems
- Perception of reclaimed water as an alternative source of water supply for nonpotable purposes
- Public understanding of the quality of reclaimed water and how it would be used
- Confidence in public utilities and technology
- Assurance that the reuse involves minimal risk of accidental exposure

A public outreach program that begins during the planning stages for the reuse project that emphasizes the importance of the resource in mitigating the effects of drought and the ways reclaimed water can be used safely will be an important part of any nonpotable water reuse venture. Attributes of effective water utility communication applicable to water shortage issues are discussed below.

Water Wheeling and Inter-basin Transfers

Water Wheeling

Water wheeling, the use of a utility's facilities by another utility, district or organization to transport water, is not nearly as common or economical as wheeling electricity, for example, but it does take place.

The success of water banks in some areas of the country is due in large part to the existence of networks through which water can be transported to the user who needs it most at a given point in time. Although during the first half of the 20th century an extensive system of water storage was constructed throughout the country for municipal water supplies, farm irrigation and flood control, these facilities are not necessarily well integrated and connected or designed to meet regional water management needs.

> Assuming locally available water resources, the cost of transporting water is very high relative to the cost of extracting and treating water. However, there are examples of water wheeling. The Metropolitan Water District of Southern California (MWD) supplies wholesale water to 27 member agencies that in turn provide retail service to nearly 60 of the region's population of 16 million. Other agencies in the region have asked to use MWD's extensive conveyance network to transport non-MWD water. Core methods of water delivery haven't changed much but supervisory control and data acquisition (SCADA) systems have advanced the ability of water and wastewater utilities to manage farther flung operations through remote monitors that keep track of valves, pumps, pressure readings, flows and other variables. [40]

Inter-basin Transfer

Inter-basin transfer is the movement of water from one watershed to another or from one river basin to another, usually involving water rights and intergovernmental relations.[41] Inter-basin transfers and other types of water wheeling are usually governed by state water law in the form of various types of "water rights." In the west, water rights pertain to the right to divert and use water for beneficial purposes or "beneficial use." In the east, riparian doctrines typically apply where the right to use water belongs to those who own the land contiguous to the water. When two states are sharing a water source, some kind of interstate compact will usually come into play, such as the agreement among states in the Delaware River basin. State policies can and are being developed to enable development of water supply options that may go beyond state borders and other jurisdictional boundaries.

> Tennessee passed the "Inter-basin Water Transfer Act" on May 31, 2000, in order to "have an explicit mechanism in place to regulate proposals for the diversion of water from one river basin to another." It contains permitting provisions for "new or increased withdrawal of surface water or ground water for the purpose of transferring and/or diverting some or all of

[40] Janice A. Beecher, *The Water Industry Compared: Structural, Regulatory and Strategic Issues for Utilities in a Changing Context*. (Washington, DC: the National Association of Water Companies, 1998), 60-61.
[41] *Drinking Water Dictionary*, 17.

it out of a river basin." Public Acts, 2000, Chapter No. 854, Senate Bill No. 3074, Sections 2 and 3.

Supreme Court Water Allocation Decision Considers Water Use Efficiency

The U.S. Supreme Court has heard 11 cases over time in which decrees were sought allocating water on interstate rivers and streams, yet no hard and fast rules have emerged from this litigative history, according to the *Handbook on Idaho Water Law*.[42] In the most recent case, however, *Colorado v. New Mexico,*[43] Colorado sued New Mexico on the basis that New Mexico was wasting water taken from the Vermejo River. Even though water uses in New Mexico were longstanding and senior to Colorado's potential uses of river water, Colorado asked the court to consider the inefficiency of New Mexico's irrigation system. The court ruled that Colorado should not be permitted to force New Mexico to improve the efficiency of the project in order to free up water for Colorado's use since Colorado had not demonstrated any stronger conservation program of its own. Handbook authors surmised that in the future water allocations may be shifted from one state to another based on the relative efficiency of water use of the parties.

Interstate Compacts

Interstate compacts have frequently been employed in the West to allocate the water of interstate streams among the states. An interstate compact is an agreement by two or more states that has been approved by Congress for the purpose of allocating the right to use a natural resource such as water among compacting states. These compacts usually take the form of an agreement to share water on a percentage basis, or one or more upper basin states agree to deliver a set amount of water to one or more lower states. Once Congress approves a compact it becomes a law of the United States. Compacts are provided for under Article 1, Section 10 of the United States Constitution.

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[42] Jeffrey C. Fereday, Christopher H. Meyer, and Michael C. Creamer, "The Handbook on Idaho Water Law," March 22, 2002, 185.

[43] 467 U.S. 310, 1984.

Considerations and Applicability

State regulators may find it beneficial to work with the utilities that they regulate and stakeholders outside their normal sphere to find innovative ways to finance needed interconnections among systems in a state or region. Legislation mandating that interconnections for supply or other emergencies be established may be necessary if parties are unwilling to voluntarily interconnect.[44]

Desalination or Desalting

Using water treatment processes such as distillation, reverse osmosis or electrodialysis to remove dissolved mineral salts and other dissolved solids from sea water or coastal streams is slowly becoming a somewhat more cost-effective possibility in highly populated areas where other water supply alternatives are also costly. It can provide benefits to communities along the coast that do not have adequate access to traditional supplies. Desalination does, however, require high capital investments and substantial energy requirements to operate facilities. Pipes and equipment require frequent backwashing to remove the accumulation of salt solids. The resources agency of California estimates that the cost of producing potable water from seawater ranges from $1,300-$2,200 per acre-foot. Los Angeles Metropolitan Water District water costs range between $27-$195 per acre-foot. In California, desalination tends to receive increasing attention during drought years when water supplies are greatly diminished. During above-average water years, permit requests for desalination facilities are often withdrawn. Desalination is used in several locations along the California coast.[45]

In Tampa, Florida, a desalination water project proposed wholesale prices slightly greater than $2 for 1,000 gallons, compared to a price range of between $1.18-1.23 for development of new ground water supply and $1.58 for development of new surface supplies. The Tampa area has had approximately 30 months of severe drought during a three-year period beginning roughly in mid-1999 and continuing into 2002. The

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[44] Those wishing to learn more about interstate compact law may wish to consult Frankfurter and Landix. "The Compact Clause of the Constitution—A Study in Interstate Adjustments," 34 Yale L.J. 685 (1925); and Zimmerman and Wendell, *The Interstate Compact Since 1925* (Council of State Governments, 1951).

[45] California's Ocean Resources: An Agenda for the Future – Chapter 5, the Resources Agency of California. http://resources.ca.gov/ocean/97Agenda/PDF/5I_desalinization_031297.pdf

Tampa Bay area, which must replace half its permitted groundwater supply, is implementing a $610 billion master water plan that includes drought-proof and drought-resistant sources like seawater desalination, a 15-billion gallon reservoir for surface water storage and aggressive conservation.[46]

Consolidation of the Water Utility Business is Likely

Some researchers have suggested that regional facilities may, in the long run, be found to be the most efficient way to treat and deliver water. As Dr. Janice Beecher explains:

> The existence of so many smaller community water systems and the prevalence of public ownership have limited the achievement of scale economies in the water industry. Public ownership precludes economies of scale when systems are not allowed to grow beyond geopolitical boundaries…In combination, the capital intensity of the industry and the substantial economies of scale have a direct bearing on capital facility planning…Generally, it is more cost-effective to add larger increments of capacity at once (in one lump)…In the utility business, the line between "surplus capacity" (for foreseeable needs) and "excess capacity" (the cost of which is not recoverable) can be a fine one. A certain amount of surplus capacity is needed by water utilities in order to provide a margin of safety (including "safe yield" from supply resources)...Larger, regional water systems could help water utilities achieve least-cost goals in terms of supply and demand management.[47]

Excerpts from New Hampshire's 2001 report on barriers to regional cooperation with regard to water supply and conservation are discussed below.

Debra G. Coy of Schwab Capital Markets expects larger water utilities to become more common as private entities, within and from outside the United States, take advantage of what she describes as a large market in the early stages of consolidation and privatization. Coy emphasized the financial ability of private, foreign companies to address water utility infrastructure investment needs.[48] The pending acquisition of the American Water Works company by German monolith RWE is a current example, as is

[46] Donald E. Lindeman, Tampa Bay Water, personal communication, June 24, 2002.
[47] Janice A. Beecher, 41.
[48] Debra G. Coy, Remarks Before the National Drinking Water Symposium, St. Petersburg, Florida, March 25, 2002.

the recent acquisition of Elizabethtown Water by Thames Water, which is also owned by RWE.

Considerations and Applicability

State commissioners involved in approving acquisitions and mergers may have an opportunity to explore state and regional water supply issues with the merging partners, including the merits of interconnections and contingency supply alternatives, and drought management planning.

Applying Lessons Learned From Prior Droughts

Information gleaned from an after-the-fact assessment of the California drought of 1987-1992 may be useful as commissioners endeavor to determine and implement policies designed to mitigate and manage drought.

Army Corps of Engineers Assesses California Drought of 1987-1992

Lessons learned by the Army Corps of Engineers team in their assessment of the California drought of 1987-1992 and prior droughts may be instructive:

- The complexity of impacts of a sustained drought demands equally sophisticated planning
- Severe drought can accelerate change in longstanding relationships and balances of power in the competition for water
- Irrigation can provide complementary environmental benefits
- Drought can convince communities to accept water management options that are not seriously considered during normal years
- Success of drought response plans should be measured in terms of the minimization and equitable redistribution of the impacts, as opposed to simply allocating shortages. The California emergency water bank allowed water to flow where it would do the most good, even if the allocation of the shortage was uneven.

- Severe droughts can expose inadequacies in the existing roles and performance of state and federal water institutions, stimulating significant institutional and legal changes (repeal of laws or passage of new laws)
- Increases in water rates should precede or accompany rationing plans
- Mass media can play a positive role in drought response, but water managers should be involved in designing the message
- Market forces are an effective way of reallocating limited water supplies. (Water has high value for many buyers and there are willing sellers even during drought.)
- The surest way to mitigate the adverse social, environmental and economic impacts of a sustained drought is to ensure that more water is made available in the future through a variety of management measures
- Early drought response actions and proper timing of tactical measures are essential in the short-term management of droughts. (The California Department of Water Resources concluded after the 1976-77 drought that urban water conservation began too late.)
- Local and regional interconnections among water supply systems are effective and flexible options against severe water shortages – local self-sufficiency can have disastrous consequences during a drought. In California, an increasing number of districts are hooking up to the statewide water network.

President's Interagency Drought Policy Committee of 1988

The Drought of 1988: Final Report of the President's Interagency Drought Policy Committee said that the drought exposed weaknesses in the government's ability to respond to drought. Several improvements to drought response capabilities were recommended, including, among others: preparation and update of drought contingency plans and low-flow operating guidelines for reservoirs, and development of water conservation and improved water use efficiency plans.[49]

Recent State Water Supply/Drought-Related Initiatives Provide Examples of Alternative Approaches to Managing Water Supplies

Examples of approaches to drought and water supply problems from New Hampshire and the state of Washington may echo concerns felt throughout many states and regions, and reveal approaches that could be applied in other jurisdictions.

State of Washington Water Law Revisions

Washington recently found that its water laws needed to be updated to enable policy-makers to respond to drought and other contemporary concerns. Following a statewide drought emergency declared in the spring of 2001, policy makers began working on legislation to, in the words of Governor Locke, "bring Washington's archaic water laws into the 21st century and provide important new tools to fight the drought."[50] The new law amends the state's reclaimed – water laws by authorizing permits for the use of industrial reuse water and provides expedited procedures for donating water rights to the trust water rights systems to assist in providing instream flows on a temporary or permanent basis. It establishes procedures for initiating watershed planning at the local level and also provides for expedited processing of reservoir applications for development of storage facilities or added capacity to an existing storage facility. The law authorizes the Public Works Board to make low-interest or interest-free loans to finance the repair, replacement or improvement of public works systems.

New Hampshire's Regional Approach to Water Supply Assurance

A study on regional cooperation was presented to the New Hampshire legislature on Aug. 14, 2001, pursuant to a year 2000 state law requiring the two agencies to undertake a study of regulatory structures that either encourage or discourage regional

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[49] Janice A. Beecher et al., The Drought of 1988: Final Report of the President's Interagency Drought Policy Committee, 58-63, cited in *Compendium on Water Supply, Drought, and Conservation,* 145.

[50] "Locke Announces Statetwide Drought Emergency," news release, (Alder Lake, Washington: March 14, 2001).

cooperation in drinking water resources management and water conservation.[51] Harkening back to the drought of 1999, the study's authors said, "the 1999 drought demonstrated that limited tools are available to water suppliers to curb customer demand, enforce conservation or to rapidly obtain backup or emergency supplies from contiguous water suppliers on a short-term basis." The drought also showed the need to develop long-range water supply planning capability and to "clarify the balance between the riparian rights of property owners for new withdrawals with the rights of other existing and potential future water users and the public trust." PUC-regulated water utilities and regional planning entities were surveyed. New Hampshire also used a committee of stakeholders, the "conservation and regionalization work group," to provide additional input. Among the study's numerous and substantial recommendations were to:

- Convene task forces to engage in regional water supply planning for the long-term management of New Hampshire's water resources
- Recommend legislation to enable the PUC to authorize rate premiums for intermunicipal retail water service to provide additional incentive for municipalities to serve retail customers outside of local boundaries
- Enhance state grant and loan programs to encourage regional approaches:
  - Propose legislation to expand eligibility for state-aid water supply grants to include projects with significant benefit to regional water supply needs, including system emergency interconnections
  - Propose legislation to ensure that regional water supply needs are considered by making it a condition of receiving grant and loan funds for municipal water supply infrastructure projects

[51] New Hampshire Department of Environmental Services (DES) and Public Utilities Commission (PUC). "Regulatory Barriers to Water Supply Regional Cooperation and Conservation in New Hampshire," a report to the New Hampshire Legislative as required by Chapter 64, Laws of 2000, (Barriers Study,) Aug. 14, 2001.

  - Propose changes to the administrative rules for state-aid grant and loan programs to provide higher priority for projects that address regional water supply needs
  - Develop cost estimates of fiscal impacts of proposed changes
- Propose legislation to establish a statute mandating intermunicipal extensions or connections under certain emergency conditions, such as when severe water supply quantity or quality problems exist
- Establish a legislative study committee to clarify the hierarchy of water uses to enable a determination of the "most beneficial use" for a given available water source and establish a process whereby new water users would be required to develop the "least impacting alternative" to require water users to collaborate on regional water management issues
- Develop a procedure by which a PUC-regulated utility may propose and obtain preapproval from both the PUC and DES to participate in advanced regional technical planning, including new source development: The goal of preapproval would be to obtain agreement on the scope of the project to be undertaken and the portion of the project which would be rate-recoverable. To allow rate recovery before improvements are used and useful, legislative changes to the statute forbidding use of construction work in progress (CWIP) would be required.
- Establish a formal state policy on water conservation for all state programs that affect the planning, use and management of the state's water resources by the following actions: recommend an executive order establishing this policy and propose legislation that integrates water conservation requirements into all applicable state statutes
- Amend ratemaking legislation to allow the PUC to provide more incentives for PUC-regulated utilities to promote water conservation practices
- Establish a mechanism to support water-use restrictions during times of drought and create a model ordinance for municipal water use restrictions (may include the ability to fine or terminate service to those who do not comply)

- Work to change SRF criteria to enable funding of end-user water conservation projects
- Develop a public outreach initiative for water conservation
- Convene a proceeding to consider innovative water utility ratemaking structures, rate design approaches, establishing a preapproval list of water conservation activities that are eligible for rate reimbursement and establishing efficiency programs, and developing policy recommendations for implementation at least on a pilot basis by Dec. 31, 2002

These extensive recommendations and New Hampshire's recently opened conservation docket are a timely source of water resource management ideas and policy alternatives that commissions can evaluate for their applicability in their states.

Drought and Electricity Generation

The most immediate concern for commissions in a period of drought is the impact on jurisdictional water utilities, but electricity suppliers may also be affected. Drought can constrain the availability and reliability of electricity generated from hydropower and steam. An Electric Power Research Institute (EPRI) report sets forth some key considerations.

The EPRI report notes that the direct and indirect effects of droughts on both steam-electric and hydroelectric generation can mean substantial costs for utilities and their customers. Drought has its most serious and direct impacts on hydroelectric plants but can also affect steam-electric generation facilities. Loss of large amounts of hydropower generating capacity due to droughts may necessitate that a utility rely on purchased power or in extreme cases curtail power. Challenges for hydroelectric power producers include estimating drought probabilities, incorporating the probabilistic nature of drought in the planning process and making operating decisions during drought. Recognizing the potential for severe droughts and understanding their impacts are essential aspects of the development of the overall approach to planning and operating hydroelectric facilities.[52]

[52] "*Strategies for Coping with Drought Problem Identification*," (Palo Alto, California: EPRI, 1986). Vol. 1: Section 5 – Conclusions 5-1- 5-5.

Considerations and Applicability

Commissioners in areas where hydropower is used will need to be aware of and foster adequate alternative plans for meeting the water requirements of hydroelectric and steam generation during droughts. As well, the pass-through of purchased power costs could cause rates to climb and burden customers already feeling drought's hardships.

Interagency Cooperation

Water is not bound by jurisdictional boundaries nor is drought and its impacts. Commissions will likely find it beneficial to reach across jurisdictional lines and work with others to combat and plan for drought. Our survey suggests that commissions are already moving in this direction.

Only two of the 15 PUCs that responded to the NRRI water supply survey have not participated at all in collaboration with other entities in their states around water issues. For those which have, some are single purpose efforts, such as the Arizona Corporation Commission's involvement in the Arizona Department of Environmental Quality's arsenic master plan, or those involving new system viability. Several are participants in multiagency working groups, task forces or committees that meet periodically to discuss water issues. Three states responding (Missouri, Massachusetts and Pennsylvania) have formal memoranda of understanding (MOU) with an environmental, natural resources or public health department. There is an emphasis on sharing information between departments and enabling participation by the other in cases or investigations. MOUs also include provisions for providing training to each other's staffs on what authority their respective agencies have and how that authority is exercised.

Considerations and Applicability

The existence of a MOU does not ensure that environmental, public health and economic regulators are working together at the time that policy decisions are being made or that a collaborative entity has any authority. For the important issue of ensuring adequate water supplies in times of drought, new laws may be needed that specify the content areas and methods of intergovernmental cooperation, and establish and clarify authority.

When one contemplates the challenges associated with water supply management and drought, the need to plan and plan better becomes not only a mantra but a call to action.

Water Resources Planning

Integrated Resource Planning

Integrated resource planning (IRP) is a comprehensive form of planning that encompasses least-cost analysis of demand-side and supply-side management options, as well as an open and participatory decision-making process and recognition of multiple institutions concerned with water resources and the competing policy goals among them.[53] AWWA sees IRP as a tool to be utilized in total water management, which it defines as "assuring that water resources are managed for the greatest good of people and the environment and that all segments of society have a voice in this process." AWWA's 1994 policy statement explains further:

> Total water management (TWM) recognizes the paradigm shift from considering water available in unlimited quantities to understanding water supply as a limited resource. All water issues revolve around three factors: water quantity, water quality and establishing priorities to deal with the limitations of quantity and quality…The major challenge to the drinking water industry is developing the process to establish priorities...The program must begin at the local level and integrate the activities of local, state and federal governments if total water management programs are to succeed.[54]

AWWA's TWM policy continues:

> There is an urgent need for a unified water resources policy that observes the principles of integrated land and water resource planning and management under a watershed framework…This would relieve the

[53] Janice A. Beecher, presentation given in Tallahassee, Florida on "The Water Industry: Coordinating Regulatory Functions and Resource Planning," Feb. 21, 1995.

[54] AWWA Government Affairs Policy Statement, "Total Water Management," *Mainstream,* November 1994. http://www.awwa.org/Advocacy/govtaff/totwapap.cfm

patchwork of conflicting objectives and jurisdictions at the federal, state, and local government levels.

AWWA's TWM position suggests that "because most economic and natural events that affect the quality of water resources occur principally within watershed boundaries, watershed boundaries are the most sensible way of taking action to restore and protect water resources. The USGSs 21 major water-resource regions, with their many subdivisions, provide a framework for the establishment of a basis for watershed management in the United States.

IRP includes the development of water resource alternatives that take into consideration communities and environments that may be affected, the numerous institutions concerned with water resources and the potential for competing policy goals. It requires utilities and utility commissions to take a more future-oriented view of utility regulation than is found in traditional planning and rate-of-return regulation with its criterion of "used and useful" for determining if investment costs may be recovered in rates.

IRP requires that regulators and utilities step outside of their typical spheres of activity into one that endeavors to take into account a much broader array of issues and concerns. It also incorporates management of demand for water (demand-side management) as a resource option for delaying or eliminating the need for new plant. And it requires that commissions take a more forward looking approach to water utility regulation.

Drought Management Planning

According to the South Carolina Department of Natural Resources (DNR), a drought management plan outlines a comprehensive program of action that enables communities to recognize and deal with drought. DNR states that an effective plan should be developed before drought occurs and that planning should involve the public and appropriate federal, state and local agencies to ensure that any drought management plan is politically, economically and socially workable. An effective plan provides for monitoring of water supplies and uses; identification of alternative water sources, including arranging hook-ups to neighboring water supplies; developing education programs and demand reduction strategies; defining implementation and enforcement mechanisms; and outlining review and update procedures.[55] A drought management plan may outline the specific actions that a utility will undertake during various drought stages.

Whatever form a plan (or whatever it is called) takes the important message is to work with other important water stakeholders to plan now for the inevitable droughts of the future, and disseminate the plan to all affected parties.

Reducing Demand for Water

Although water utilities have often been reluctant historically to take actions that would reduce the demand for water, some are now finding that wise use makes water available that they need to serve growing communities. One area ripe for water savings is lawn watering. As Maripat Murphy explains in the July/August 2002 AWWA *MainStream*, "The time when Americans could afford to lavish water on their lawns may have passed…For too many decades, Americans have expended a precious and increasingly scarce resource to fuel a futile love affair with lush lawns. With water shortages and water restrictions looming, water-conserving landscape and drought-resistant plants may no longer be a choice but an imperative."[56]

Denver, Colorado, where Denver Water coined the term "Xeriscape" 20 years ago to describe landscaping that conserves water, provided the testing ground for a challenge to Denver's local landscape laws which "prohibited unattended vegetation from exceeding six inches in height." In spring 2002, after three years, the Denver City Council passed two ordinances to eliminate discrimination against water conserving landscapes and prohibiting new neighborhood covenants from requiring home owners to plant turf grasses. Water utilities in some extremely arid areas, such as Albuquerque, New Mexico; San Antonio, Texas and Las Vegas, Nevada, give customers rebates or credits on their water bills for reducing water-thirsty turf and planting water-conserving landscaping.

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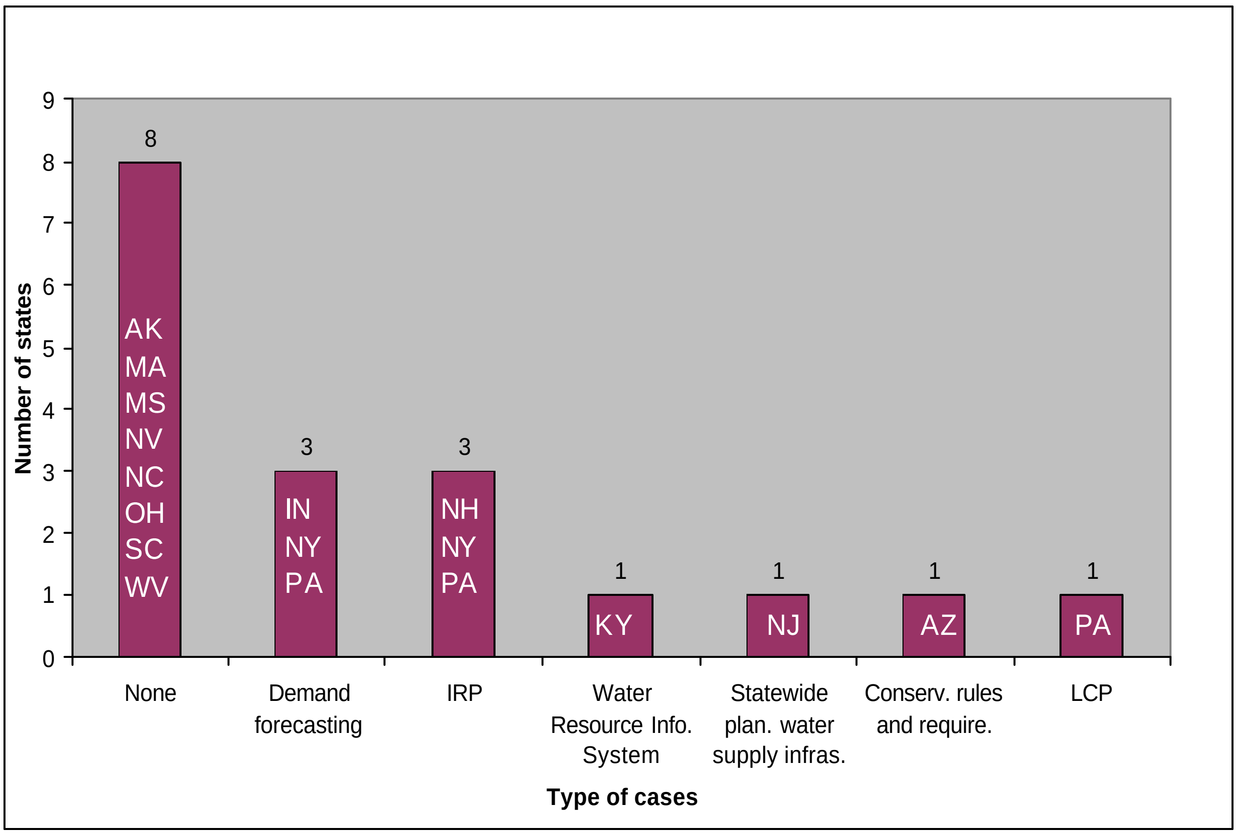
[55] South Carolina Department of Natural Resources, South Carolina Drought Response Program, Columbia, South Carolina. http://www.dnr.state.sc.us/water/climate/sco/drought/drought_response.html.

[56] Maripat Murphy, "Water-wise Landscaping…A Logical Alternative to Lawns," *AWWA MainStream*, July/August 2002, 6.

Considerations and Applicability

Of the 15 states which responded to the NRRI water supply survey, three indicated that they had IRP in place for water utilities. Types of cases at commissions pertaining to water supply demand management are shown in figure 8. A detailed discussion of the elements, methods, merits and challenges of IRP for water is beyond the scope of this paper. However, information from a variety of sources is available for those commissions that wish to explore the efficacy of IRP with the water utilities that



Source: NRRI Survey of state public utility commissions, spring 2002.

Fig. 8. Types of cases or filings pertaining to water supply demand management

they regulate, or those that wish to work with other water policy players toward IRP for their state, region or watershed. The latter would get both investor-owned and municipal systems involved in planning for the needs of a geographic area that goes beyond city limits or service territories. (State commission review of *electric* utility IRPs, required by 35 states by the mid-nineties, has been abandoned in jurisdictions implementing retail electricity access...but remains an important formal regulatory tool in Colorado, Georgia, Hawaii, Indiana, Kentucky, Minnesota, Nevada, Oregon, Utah and Vermont.[57]) State commissions wishing to pursue IRP for water may find a review of practices on the electric side helpful. Existing memoranda of understanding between economic and environmental regulators may be a basis for coordination that goes beyond new system viability, for example, to forward-looking water resource planning.

Stage II storm water regulations contained in the Clean Water Act encourage watershed approaches, and as a result watershed-based stakeholder committees are emerging.[58] Such groups could form the core membership of watershed-based approaches to drinking water supply and mitigation of drought. A 1995 inventory of commission-regulated water and wastewater utilities done by the Center for Urban Policy and the Environment at Indiana University found that commission authority over the area of forecasting and planning is somewhat limited. In some states, commissions may not have the ability to order jurisdictional utilities to conduct long-term resource planning.[59] In other states, another state agency handles planning and forecasting functions. (In a 1990 survey of state public utility commissions, 30 commissions reported that another state agency prepared a statewide water resource plan.)[60] Commissions may wish to seek additional planning and forecasting authority and/or a specified role in a process administered by a separate agency. Commissions may also use their traditional ratemaking authority to encourage wise use and water demand management during drought conditions and in general. A variety of ratemaking options are introduced below under "Rates and Ratemaking Statutes and Drought Management Planning," including among others drought pricing mechanisms, inclining block rates, seasonal rates and excess use rates.

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57 Kerry M. Stroup, NRRI Associate Director, *NRRI Executive Briefing*, September 2002.

58 Eric Pineiro, "The Sugar Creek TMDL Project: What Have We Learned?," Watershed Management Workshop, PowerPoint Presentation, Columbus: May 1, 2002.

59 Janice Beecher, "1995 Inventory of Commission-Regulated Water and Wastewater Utilities," Center for Urban Policy and the Environment, (Indianapolis, IN: Indiana University, 1995, 5).

60 Janice A. Beecher, James R. Landers and Patrick Mann, *Integrated Resource Planning For Water Utilities*, (Columbus: NRRI, 1991).

Streamflow Information Important for Planning and Mitigation

The USGS national streamflow information program (NSIP) is an information source that regulators, utilities and others can use to plan for and respond to droughts and floods. Accurate and unbiased information on the flow of rivers is necessary for, among other things, planning and managing water supplies and upholding interstate compacts. According to USGS, responsible water resources planning for supply and quality must be based on knowledge of the frequency with which high and low flows occur in a given river.

In a 1998 report to Congress, USGS described a decrease in the number of stream gages and limitations in the USGSs ability to continue operating high priority stream gages when state and local agency and other federal agency partners discontinue funding. The USGS has proposed a plan that includes provisions for a set of core USGS-funded stream gages to be strategically positioned across the country for continuous operation. They also propose to continue to work with many partners to operate additional needed stream gages. The NSIP plan calls for intensive data collection efforts during major floods and droughts.[61]

Considerations and Applicability

Commissions may wish to work with other agencies and water utilities in their states to find out the status of their river gages: whether they are active, inactive, in need of repair or newly proposed, and whether or not funds are available. It may make sense for utilities and others within a state to become funding partners with GSIS in order to ensure that information needed for supply planning and disaster mitigation is available.

[61] Robert M. Hirsh and J. Michael Norris, "*National Streamflow Information Program Implementation Plan and Progress Report*," (Reston, VA: U. S. Department of the Interior, USGS, April 2001).

Rates and Ratemaking Statutes and Drought Management Planning

Unlike some of the other approaches discussed in this report, water ratemaking, including rate design, is well within the realm and experience of commission jurisdiction. Marginal cost rates, inverted or inclining block rates and seasonal rates are among several drought management options available to water utilities and state regulators. Rates can be designed to foster wise, efficient use of water on an ongoing basis. A 1994 NRRI study found ten states with rate structures approved for conservation purposes: Ohio, New York, New Mexico, New Jersey, Nevada, Massachusetts, Louisiana, Kentucky, Florida, Connecticut, California and Arizona. Among the rate structures used were uniform, increasing-block, seasonal rates and excess-use rates. [62]

One of the four primary functions of public utility rates, according to James C. Bonbright, is the demand-control or consumer-rationing function in which the price is designed to restrict or influence demand. The other three functions identified by Bonbright are:

- The production motivation or capital attraction function
- The efficiency incentive function,
- The income distributive function[63]

Drought Pricing's Part

In addition, drought pricing as part of an overall drought management plan may be implemented during dry spells to quickly reduce the amount of water usage by customers and to maintain adequate revenues to meet the utility's revenue requirements. Drought pricing can take the form of a surcharge that is overlaid on the utility's existing rate structure or may be a distinct rate structure that is available for implementation during the drought.

AWWA encourages water utilities to have a drought pricing plan adopted *in advance* as part of an IRP. Given the potential complexity of implementing drought pricing, utilities are urged to thoroughly plan for and test their billing systems, data

[62] Janice A. Beecher, et al, *Revenue Effects of Water Conservation and Conservation Pricing: Issues and Practices* (Columbus: NRRI, 1994).
[63] James C. Bonbright, *Principles of Public Utility Rates*, (New York: Columbia University Press, 1961).

storage and bill printing capability. AWWA also advises utilities to engage in a "vigorous educational campaign to help the utility in explaining the drought pricing rationale and gaining its acceptance by customers."[64]

Rate Stabilization Funds

These can be used to supplement revenues instead of drought pricing if necessary reductions in demand can be accomplished in other ways. A rate stabilization fund may be established and funded via a surcharge on customer bills with the surcharge being removed once a set level of reserves has been accumulated. Or payments toward a reserve fund can be factored into base rates. However, this takes money from customers before it is actually needed to combat drought, and the fund may be raided for other uses if it is not earmarked exclusively as a drought contingency funding source.

Wholesale Sales and Rates

An investor-owned utility may purchase wholesale water from another utility for a variety of reasons including to supplement supplies during a drought. In some cases, regional water authorities provide wholesale water service. A wholesale customer might elect to purchase water to recharge a water storage facility. Some types of wholesale service include:

- Firm commitment contracts: more costly as facilities are designed and built to cover total demands of the supplier and customer combined
- Surplus water contracts: only provide water in excess of the supplying utility's needs

[64] A lesson learned from the California drought deserves repetition here: Increases in water rates should precede or accompany rationing plans. Increasing rates or adding surcharges demonstrates scarcity of water during a drought and gives customers knowledge of the costs caused by their decision to continue discretionary consumption.

TABLE 3: ADVANTAGES AND DISADVANTAGES OF WATER PRICING OPTIONS

Pricing Options	Explanation	Advantages	Disadvantages	Consideration
General Rate Surcharge	All rates are increased by a certain percentage estimated to yield demand reduction and generate required revenues	Easy to explain, well-accepted by public as all customers are being treated equally	May not target users most able to reduce demand or most likely to respond to price changes, may be regressive for small or low-income users	Useful to know characteristics of customer base
Individualized Rate Surcharge	Applied only to users whose demands exceed specified percentage of their base-period water use, e.g. 25 percent surcharge to any customer with use > 80 percent of that customer's average demand	Sets clear water reduction target for each user, provides conservation incentives to all customers	Customers who already use water efficiently have lowest potential for avoiding the surcharges; customers whose water use has been the least efficient have greatest opportunity to avoid surcharges	May need an appeals process for efficient customers to request special consideration
Class-Based Rate Surcharges	Establishes quantity limits per customer for different classes of users and applies surcharge to any user exceeding the limit for that class	Does not penalize users who are already conserving water	Variations within a class may cause concern; difficult to set fair quantity limits for commercial and industrial customers given diversity in size, type	Useful to evaluate the economic effects of setting limits on use for the business sector
Targeted Rate Increases	Targets customers for rate increases whose demand for water is viewed as partially discretionary	Can vary increase among customer classes: will not affect customers with extremely inelastic demand or those who, for a public health or policy reason, need to maintain existing levels of demand	May be applied arbitrarily or give the appearance of singling out some groups for rate increases	Suggests that clear explanation of rationale for rate differences to affected customers is desirable

TABLE 3: Continued

Pricing Options	Explanation	Advantages	Disadvantages	Consideration
Marginal Cost Rates (Sometimes Called "Scarcity Pricing" and Used Where Supplies Are Diminishing)	Water is priced equal to the unit cost of the next increment of supply, reflects implied cost of alleviating or mitigating the water shortage by establishing an additional water supply	Sends a price signal reflective of the amount of operations and maintenance expense and capital cost incurred for the additional supply facilities to meet the demand; marginal cost rate is sometimes the last block in an inverted block rate structure; likely to generate adequate revenues	Only the biggest users receive the price inherent in the high marginal cost rate; small and moderate users do not receive the strong price incentive to conserve; may create ability- to- pay problems for some users	Each unit of water used during a drought puts additional pressure on the utility to build the next increment of supply
Excess Use	Price level is significantly higher for all water used above average, usually determined by winter use	Best used for reducing peak consumption	Average is poor measure for large industrial customers, hard to implement efficient pricing scheme	Large volume users consider this structure to be equitable
Indoor/Outdoor	Price level for indoor use is lower than for outdoor use	Best used for reducing peak use, defined by outdoor use which is more elastic	Requires two meters or detailed data to implement	Meter installation a barrier
Seasonal Use	Price level during season of peak use (summer) is higher than during winter	Best used for reducing peak use; large volume users consider this structure equitable.	Only appropriate for systems with seasonally variable demand; may require changes in metering and billing	Effective for summer tourist community
Increasing or Inclining Block	Price per block increases as consumption increases	Useful for reducing average and sometimes peak demand	Large volume users consider this structure inequitable	Price may not curtail usage

TABLE 3: Continued

Pricing Options	Explanation	Advantages	Disadvantages	Consideration
Uniform Rates	Price per unit is constant as consumption goes up	May be somewhat effective in reducing average use; large volume users consider this structure equitable	Inefficient price signal	May not provide sufficient incentive to reduce excessive consumption
Sliding Scale	Price level per unit for all water used increases based on average daily consumption	Best used for reducing average use, sometimes peak use	Large volume users consider this structure inequitable	May be confusing to consumers
Conservation Surcharges (Capacity Deferral Benefit, Commodity Charge)	Unbundles water use in excess of average or normal levels and determines the incremental cost associated with that usage	Signals opportunity cost associated with discretionary usage; can be combined with other ratesetting methodologies; complements IRP; charge levied directly on specific customers continuing discretionary usage	May be difficult to implement and administer; is external to traditional revenue requirement determination	Conservation rates may not affect nominally discretionary use

Source: Author's construct. Several drought pricing options provided in table 3 are taken from *AWWA M1 – Manual of Water Supply Practices: Principles of Water Rates, Fees and Charges*. Others are from NRRI's November 1993 publication, *Meeting Water Utility Revenue Requirements: Financing and Ratemaking Alternatives* by Beecher, Mann, and J. Stanford, and the AWWA's *Before the Well Runs Dry: Handbook for Designing a Local Conservation Plan,* Volume 1–A 61-63, 1984.

- Emergency reciprocal contracts: viewed as inappropriate for drought condition peaking as compensation to supplier is insufficient to cover actual costs incurred
- Peak requirement contracts: commits supplier to provide service during peak use seasons or drought conditions only

Establishing the right type of wholesale contract and the right price between two entities is dependent, among other things, upon an assessment of the cost and availability (if any) of other alternatives.

Considerations and Applicability

PUCs may wish to work with their utilities to develop pricing plans that encourage wise use and drought-focused pricing plans that take into consideration a variety of factors, including ease of implementation and effectiveness in reducing water demand during drought, while enabling water utilities to maintain revenue levels adequate to cover fixed costs. Some type of wholesale purchasing arrangement may be appropriate in order to ensure that a regulated utility has another supply alternative in an emergency. Commissions may wish to initiate a rulemaking proceeding in order to establish a set of criteria that would automatically trigger implementation of drought pricing during an emergency. The type of pricing implementation can be triggered in accordance with the severity of the drought as demonstrated by a set of agreed-upon factors. This will help take the subjectivity and emotion out of such difficult decisions. It presents an opportunity to work with municipalities and others to develop consensus pricing policies covering a broader geographical area without the pressure of an existing drought.

Drought pricing is an important complement to water use restrictions, which can be difficult to monitor and enforce. Voluntary calls to conserve do not always work. And an investor-owned utility in the business of “finishing” and selling water is not usually eager to curtail supplies to customers and thereby see a decrease in revenues. Indeed, during drought periods customers typically are willing to buy more water, especially if it is not priced to reflect scarce conditions. In addition, investor-owned water utilities may not be inclined to enter into wholesale contracts once a drought is underway. Again, the need to plan during times of plenty for times of scarcity resounds. For more detailed information, commissions may wish to access NRRI reports on water utility revenue requirements and conservation pricing.[65]

Statutory Changes Could Tie Cost Recovery to Alternative Standard

Only three states responding to the NRRI water supply survey reported that they had used criteria other than "used and useful" to determine whether capital expenditures were allowable in rates. Since emergency supply investments may by their very nature not be *routinely* used and useful, commissions may wish to work with state legislatures to revise ratemaking statutes. Criteria such as "reasonably anticipated future needs," or "considered useful under specified emergency conditions" or "contingency plant available or held for future use" could be developed in order to evaluate whether expenditures associated with contingency purposes should be recoverable. In a 1992 NRRI survey of commission ratemaking practices for water utilities, only Tennessee reported permitting recovery for "plant held for future use with definite plans."[66] On the other hand, changes in used and useful statutes in order to allow the inclusion in rate base of plant used for emergency or contingency supply provision purposes may not be necessary if such expenditures are undertaken pursuant to some state or federal mandate pertaining to supply assurance or in accordance with an accepted industry/regulatory standard for expenditures of this nature.[67]

New Hampshire is considering a preapproval process for new source development projects. Preapproval involves an agreement between the utility and state regulatory commissions that sets forth, in advance of construction, the ratemaking treatment of associated expenditures. A benefit of preapproval, especially as applied to smaller water utilities, is that it makes it easier for them to secure financing. Pitfalls include difficulty reconciling preapproved and actual costs. In addition, there are fewer incentives for the utility to minimize costs.

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[65] Janice A. Beecher, Patrick Mann and John D. Stanford, *Meeting Water Utility Revenue Requirements: Financing and Ratemaking Alternatives*, (Columbus: NRRI, 1993) and Beecher, et al, *Revenue Effects of Water Conservation and Conservation Pricing: Issues and Practices*, (Columbus: NRRI, 1994).

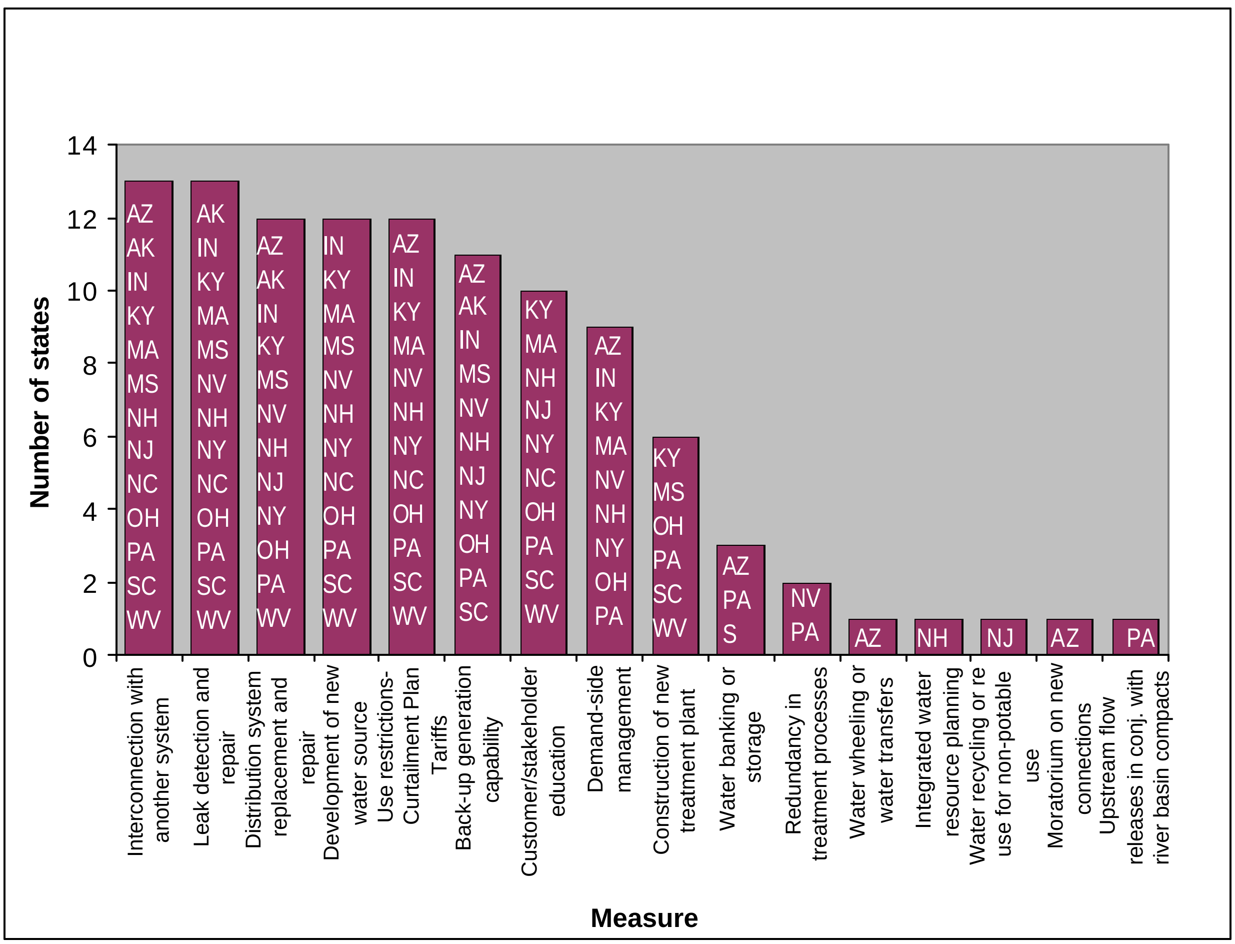
[66] Janice A. Beecher and Nancy N. Zearfoss, "1992 Survey On Commission Ratemaking Practices for Water Utilities," May 1992, 6.

[67] Robert Burns, NRRI Senior Institute Attorney, interview, April 2002.

Commissions may wish to work with their jurisdictional utilities and other stakeholders to craft an alternative set of rules and agree upon the triggers or conditions that would bring them into application.

State Commissions Respond to Water Supply Problems

States responding to the NRRI water supply survey reported a wide variety of measures taken by jurisdictional utilities to anticipate and mitigate the impact of shortages/interruptions. These measures, many which are described in this paper, are summarized in figure 9.



Source: NRRI Survey of state public utility commissions, spring 2002.

Fig. 9. Measures taken to anticipate and mitigate the impact of water supply shortages or interruptions

As an example of one eastern state's response to drought, a summary of water use restrictions in place in New Jersey as of April 30, 2002, from the New Jersey Department of Environmental Protection is shown below in table 4:

TABLE 4: SUMMARY OF WATER USE RESTRICTIONS IN PLACE IN NEW JERSEY AS OF APRIL 30, 2002

Drought Region	Watering Existing Lawns	Non-routine Lawn Watering	Shrubs, Trees, Vegetable and Flower Gardens
Central and Coastal North	Odd/even watering okay using any method • Odd house numbers water on odd numbered days, etc. • Time-of-day limits • 45 minutes per area	Watering lawns okay using any method if: • New, commercially applied sod or seed associated with new construction (may water for 45 days after planting) • After commercially applied fertilizer, herbicide or pesticide (may water for two days starting on date chemical is applied) • Testing of newly installed sprinkler system – for 10 minutes only	Odd/even watering okay using: • Watering can • Hose with auto shutoff • Drip system, soaker hose or similar equipment for two hours per area • Tree ring or tree bag • Installed sprinkler system for 45 minutes per area (previously not restricted to specific days, also previously allowed only watering can or hose)
Coastal South, Southwest and Northwest	(Until June 28th), two days per week watering okay using any method: • Odd house numbers, Tuesday and Thursday; even, Wednesday and Friday • Time-of-day limits • 45 minutes per area DEP will evaluate after this trial period (previously same as Northeast)		
Northeast	No watering of existing lawns		

Source: New Jersey Environmental Protection Agency.

Summary of water use restrictions in place as of April 30, 2002

- No serving of water in eating places unless specifically requested by the patron
- No washing of vehicles, except: Fire engines; hazardous materials transportation emergency vehicles
- Vehicle washing at a commercial car or truck wash that use certain water saving practices
- Vehicle washing at a car dealership that uses certain water saving practices

- Boat washing at boat dealerships and marinas that use certain water saving practices; and
- Flushing of boat engines to remove salt water
- No watering of lawns and other outdoor vegetation, except as indicated in [table 4].
- Watering of athletic fields okay every other day only at night, 45 minutes per area, and no water cannons
- No washing of paved areas except for specific exceptions
- No sewer flushing except with treated effluent and if necessary for public health
- No use of fire hydrants except for fire protection
- No power washing except for commercial power washer.
- No outdoor use of water for ornamental or aesthetic purposes including fountains, waterfalls and reflecting pools
- No use of water for outdoor recreational purposes except for specific exceptions
- Each state agency must develop a contingency plan to reduce water use
- Businesses using 100,000 gpd must prepare contingency plans
- Commercial establishments with showers must install low-flow fixtures
- No open burning permits except outdoor barbecues and religious ceremonies
- No aquifer pumping tests for large capacity wells
- Suspension of final decisions on applications for new water allocation permits
- Any local or county government may impose more stringent water use restrictions
- Municipal, county and state law enforcement agencies are responsible for enforcement
- Hardship exemptions available in limited cases
- Watering of agricultural food crops, sod at commercial sod farms and nursery stock at nurseries/retail outlets is exempt from restrictions but must use best practices and have a DEP water allocation registration if using more than 70 gallons per minute.

New Jersey Board of Public Utilities Establishes Working Group

New Jersey's Board of Public Utilities is spearheading a short-term issues working group which is examining the financial and smart growth (e.g., affect on environment and water allocation/availability) implications of the drought and studying conservation measures, including rate alternatives. Involved in the working group, among others, are the Department of Environmental Protection, private and public water utilities, the League of Municipalities, the New Jersey Chapter of the NAWC, New Jersey Association of Environmental Authorities, and the New Jersey Water Association. The team, which was organized in May 2002, met three times and will present a report of options and recommendations to the President of the Board of Public Utilities, with respect to the current drought as well as suggestions for the state water supply master plan review for long-term changes such as conservation measures.

Customer Communication and Education Is Important

Customer communication on water supply issues including drought is an area where commissions may wish to work closely with their jurisdictional utilities and other stakeholders. We have already noted the importance of customer understanding with regard to nonpotable reuse. It is also important as a means for securing compliance with requests to conserve water. Customers need to understand their place in the bigger water supply and demand picture. An advantage of customer communication, education and outreach efforts during a drought is that the drought emergency rivets attention to water supply issues that typically go unnoticed and unappreciated during periods of normal rainfall. To garner acceptance of drought pricing, for example, thorough explanations of the rationale behind the pricing will be necessary as users who are not able to reduce demand may find higher, drought-triggered rates punitive.

Customer communication and education is also important if we are to develop a stronger wise-use ethic among customers in the long run. Commissions may find it useful to conduct joint customer communication and education programs with jurisdictional and municipal utilities and other stakeholders. Commissions may also find it useful to team and encourage jurisdictional utilities to team with the Red Cross or other emergency planning organizations to communicate to customers how they can personally prepare for emergencies, including water supply interruptions.

To obtain support for policy initiatives that take the long view of drought planning and mitigation, commissions and other state leaders require the support of a variety of publics. Customer communication and stakeholder education is an important tool for gaining that support. The manner in which utilities and commissions communicate is also important. A national survey of water utility communication practices conducted by Bojinka Bishop with funding from Ohio University's College of Communication and with cooperation from the AWWA found the following attributes of communication, The Principles of Authentic Communication©, to be significantly correlated with communication success:

- Truthful: the communication is accurate, factually correct
- Fundamental: the communication deals with the core issues, the central facts of the situation
- Comprehensive: the communication tells the whole story, including the meanings and implications of the issue in question
- Relevant: the communication takes into account and makes connections with the interests of the parties involved
- Clear: the communication uses language that is appropriate for those involved, jargon is avoided, technical language is kept to a minimum and where needed is translated into lay language; and the organization and illustration of the information is logical and understandable
- Timely: information is provided when it is known; communication takes place so that it leaves sufficient time for response prior to actions taken or major decisions being made
- Consistent: this communication does not oppose or contradict the party's other words or actions
- Accessible: the information is made easily available to all parties; the major parties are available to discuss the information; meetings are promoted thoroughly so parties are aware of them, meetings are held in places that are

easy to find and get to; consideration is made for parties with sight, hearing, or language difficulties

- Allows for feedback: the communication seeks response, either through email, face-to-face meetings, telephone conversations, response cards or other feedback mechanisms
- Is compassionate: the communication shows respect and care for the circumstances, attitudes, beliefs and feelings of the other parties.[68]

The Principles of Authentic Communication may be applied to all types of communication methods, modes and formats. They can also serve as criteria for evaluating existing communication materials.

Sample public communication and outreach approaches being used during the drought in New Jersey include:

- Drought hotline
- Public Meetings
- Web Pages
- News releases

The North Carolina Drought Monitoring Council's web page at http://www.ncwater.org/water_supply_planning/drought_monitoring_council/feedback.shtml includes a feedback section where people can send comments on how the drought is affecting them.

[68] Bojinka Bishop, "Survey on Water Utility Communication Practices," PowerPoint Presentation, Ohio Section AWWA Conference, Aug. 31, 2001.

CHAPTER FOUR

CONCLUDING RECOMMENDATIONS AND CONSIDERATIONS FOR COMMISSIONS

State public utility commissions are only one of many entities at the federal, state and local levels that develop and implement policies pertaining to water supply and drought. The great challenge for commissions is to understand their role in the broader scheme of rules, regulations and practices and take steps to work with governmental entities and other stakeholders to formulate complementary policies and practices. Commissions can begin (and in many cases have begun) to do their part by addressing issues pertaining to drought and scarcity that are within their areas of authority and capability, including working with jurisdictional utilities on water resource planning (including drought management planning), infrastructure replacement, leak detection and remediation, rate design to encourage conservation and wise use, drought pricing and customer communication and education. Table 5 contains a summary of tools and alternative approaches for state commissions, water utilities and key stakeholders.

Commissions may also wish to work with others to review state ratemaking statutes to determine if criteria contained therein enable or constrain jurisdictional utility efforts to provide for contingency supplies. For example, the standard of providing rate recovery only on utility plant and equipment that is "used and useful" may not be useful if the goal is to ensure additional supplies for use primarily or wholly on a contingency or emergency basis. An alternative standard to be applied to certain types of expenditures may be appropriate. Among the recommendations in the New Hampshire study cited above is establishing a procedure whereby a jurisdictional utility may obtain preapproval for new source development and amendments to ratemaking statutes to provide utilities with incentives to promote water conservation practices. Commissions may wish to consult the regulated riparian model water code developed by the water laws committee of the water resources planning and management division of the American Society of Civil Engineers, which incorporates ideas from engineers, government, attorneys,

TABLE 5: SUMMARY OF TOOLS AND ALTERNATIVE APPROACHES FOR STATE COMMISSIONS, WATER UTILITIES AND KEY STAKEHOLDERS

Tools	Players	Implementation Considerations	Technical and Economic Requirements	Benefits
Leak Detection and Remediation	Jurisdictional water utilities and **state commissions**	Now and ongoing, periodically	Determine best way to calculate water losses, meter installation/repair	Saves water for potable use, possible revenue source, customer premises
Distribution System Improve/Replace.	Jurisdictional water utilities and **state commissions**	Now and ongoing	Various funding methods, can be done with traditional regulation; pay now or pay more later	Minimize losses, prevents emergency main breaks
Water Banking: • Storing water • Depositing water rights	Water Banking Authorities, state legislatures, Dept. of the Interior (if interstate) **state commissions**	Can be used for emergencies or ongoing, may require legislation	Appropriate under certain conditions, requires multidisciplinary decision process and assessment of alternatives	Puts water allocations into public domain, gets water to those who need it most during crisis
Nonpotable Reuse	Water and wastewater jurisdictional utilities, **state commissions**	Can be pursued under traditional regulation project basis	Should be accompanied by extensive public communication and education	Conserves high quality water for potable uses, cuts pollutant discharges
Transfers and Wheeling	Multiple jurisdictions: states, cities, federal, state environmental – natural resources entity, **state commissions**	May require legislation and interstate compacts	Costly, technically challenging	May foster regional approaches
Interconnections	Jurisdictional utilities, municipalities, **state commissions**, state environment or natural resources entity	May present engineering challenges, permitting processes, best done before emergency	Traditional tool, may require legislative mandate if not voluntary	Enables supplies to be shared in an emergency
Consolidation/Privatization/ Regionalization	Jurisdictional utilities, **state commissions**, municipalities	Trend to larger utility size expected to continue	May be more efficient way to provide water/ensure supply	More capital available to invest in infrastructure, may lead to interconnections/ coordination
Interagency Cooperation	Utilities, environmental agencies, **state commissions**, others	Long term relationship building	May require legislation to establish authority, accountability; communication essential, can be watershed based, may use stormwater groups	Fosters consistency in treatment of utilities by broader regulated community, enables complementary policies, actions

TABLE 5: Continued

Tools	Players	Implementation Considerations	Technical and Economic requirements	Benefits
Integrated Water Resources Planning/Demand-side Management	**State commissions**, utilities, other state agencies, e.g. environmental, natural resources entity, groups	Long-term planning; useful if new supplies are being considered, and in growing communities	Commission authority over some types of planning may be limited, involves multiple interests/parties, can be done on watershed basis	Gives more equal footing to demand measures, considers water in broader context of total water management (all tools/approaches may play part in total water management)
Rates/Rate Design Drought Pricing	**State commissions**, jurisdictional utilities, municipalities	Best to establish before drought with criteria for use and triggers identified up front	Different types of drought-focused and conservation inducing pricing options; requires extensive education/communication efforts, may wish to coordinate with non-jurisdictional utilities	Sends signal to water user, enables utilities to maintain revenues even if supplies curtailed and demand is reduced
Requests to Conserve, Water Use Restrictions	Jurisdictional utilities, state environmental, municipalities, **state commissions**	Voluntary requests may not work, must include extensive communication effort	Useful to tie restrictions to price increases to demonstrate genuine scarcity of the resource	Can result in reduced demand for water, best if mandatory
Wholesale Sales/Rates	Wholesale to retail utilities, **state commissions**	Easier to establish. agreements during times of plenty	Interconnections needed, appropriate price setting to cover costs	Can be used for supply augmentation
Desalination – Converting Saline Water Into Potable Water	Water utilities, **state commissions,** permitting authorities, water resources departments	Byproducts fall under Clean Water Act, National Pollutant Discharge Elimination System (NPDES)	Costly to build, operate, has environmental impacts	Seawater is available during drought, supply interruptions
Customer Communication and Education	Utilities, media, **state commissions**, others	Should permeate all drought/supply assurance efforts, useful for short and long-term efforts	Use of proven principles to guide communication will foster success	Increased ratepayer understanding and support for drought mitigation policies

Source: Author's construct.

business people and academics interested in improving the management of water allocations.[69]

IRP is a process through which commissions can explore an array of approaches with their jurisdictional utilities for assuring that future water needs are met even in times of drought. Demand-side measures may allow additional supply projects to be postponed or foregone. Both supply and demand-side approaches deserve careful consideration, as do alternatives such as nonpotable reuse. IRP processes should to the extent possible take into consideration and include other water players, such as municipal utilities and environmental regulators. They should also enable consideration and comparison of multiple approaches to achieving water resource objectives. Commissions may or may not be the lead agencies in broad–based integrated water resource planning, but they can certainly be a significant and valuable stakeholder in an IRP process spearheaded by a state environmental or natural resources agency.

In addition to fostering opportunities for utilities to make provisions for emergency supplies of drinking water, commissions may find that nonpotable reuse can be a part of the solution. Desalination may have a future in some areas. Treated wastewater effluent is being used in a number of areas for nonpotable purposes, and experience with the resource will continue to grow. For coastal regions, desalination costs are coming down into a range of cost comparability to other supply alternatives in some areas. Florida has become a desalination laboratory of sorts as has California. There are many possibilities for exploration with their efficacy dependent upon a comparison of available alternatives on both the supply and demand side in terms of their cost, technical feasibility, effectiveness and public acceptability.

Governors play a key role in addressing crises including drought. Those state commissions that wish to participate in their states' overall management of water resources may find that a drought crisis can be a catalyst for building relationships and getting greater cooperation among disparate entities and groups. Existing MOUs formed for other purposes could be the basis for collaboration on water supply issues over which no single participant has all of the answers or all of the authority to implement solutions.

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[69] Josepp W. Dellapenna, Editor, "The Regulated Riparian Model Water Code," Water Laws Committee of the Water Resources Planning and Management Division of the American Society of Civil Engineers (ASCE), (New York, NY: ASCE, 1997).

Commissions are well situated to work with governors and other key state agencies toward long-term policy initiatives to address water scarcity issues. They have general oversight authority over investor-owned water utilities, and areas of expertise that may complement those of other entities.

The options and ideas included in this report are for commission consideration in determining (with others in their states and regions) their own best alternatives for assuring adequate water supplies. Each state, and area within it, and each region has its own attributes and constraints that must be assessed in determining a sensible course of action. However, the choice of alternatives may be secondary to a firm commitment to address water supply issues and drought mitigation concerns even after the current drought has passed. Commissions can be a part of the solution by mobilizing their institutional will, exercising their ratemaking and oversight authority and remaining emphatically determined to play a part in crafting long-term solutions to issues of water supply scarcity and drought.

Droughts remain a certainty. Neither regulators nor utilities can control their frequency, duration, severity or location. However, both entities can continue existing efforts and initiate new attempts to prepare now for the inevitable dry spells that are ahead. During drought-water supply issues are more visible than usual to water customers and other important stakeholders. All that remains is for policy makers to take the reins and provide leadership even after rains return and the memory of drought and its costs and hardships fade.