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Arizona at the Crossroads: Water Scarcity or Water Sustainability?

Karen L. Smith, Ph.D.
Fellow, Grand Canyon Institute

Imagine a much drier Arizona than exists today. Drought conditions persist or worsen, Colorado River flows have diminished and water storage at Lake Mead drops to levels requiring shortage declarations. Farmers send their water to cities, drying up land and sending regional economies dependent on agriculture into a tailspin. Groundwater pumping in excess of that amount replenished naturally has caused overdraft of Arizona's aquifers, reducing or eliminating river flows and drying up riparian areas, and transforming the land surface through fissuring and subsidence. Arizonans face strict water use limits and industry requiring large amounts of water in their processes will have to pay increased costs, conservatively $1,000-$2,000/acre-foot for additional water supplies. One economist has projected this increased water shortfall of surface and groundwater will cost the Southwest as a region between $7 billion to $15 billion annually. Sound far-fetched? These elements of a very dry Arizona are credible assumptions for water resource analyses over the next 100 years and if nothing is done to change how Arizona manages and uses its water resources, probably likely.[1]

[1] See Frank Ackerman and Elizabeth A. Stanton, *The Last Drop: Climate Change and the Southwest Water Crisis*, February 2011, Stockholm Environment Institute-U.S. Center (Tufts University), www.sei-us.org/Publications_PDF/SEI-WesternWater-0211.pdf ; *Securing Our Water Future*, Australia National Water Commission, www.environment.gov.au/water/publications/action/pubs/securing-water-future.pdf ; *Ecosystem Changes and Water Policy Choices: Four Scenarios for the Lower Colorado River Basin to 2050*, Sonoran Institute, 2007, www.sonoran.org/library/reports.html , accessed 19 July 2011. These are just three of multiple sources describing such a future over the next 50-100 years if nothing is done to mitigate and adapt to our changing water future.

The more distant time horizon (2035) when problems of water use sustainability will likely reach a critical threshold masks the stress Arizona's water resources are currently under. Water resource certainty drives Arizona's economy, including maintaining viable riparian and environmental flows so essential to the $10.5 billion recreation and tourism industries. Ensuring that water resource certainty requires policy changes now. Without new approaches to modifying water demand to more sustainable levels, economic growth in Arizona will be endangered. To ensure Arizona maintains sustainable economic growth requires recognizing the contribution of water as an engine of economic sustainability, focusing primarily on conservation while acknowledging the need for eventual water resource augmentation, and developing innovative financing mechanisms to facilitate that augmentation.

The recent report issued by Arizona State University's Morrison Institute, entitled *Watering the Sun Corridor,* is timely, and has placed the issue of water's importance in the three-county area of Maricopa, Pinal and Pima counties front and center, identifying existing water supplies and uses, and reminding us that while current supplies are adequate in those counties, the future poses many challenges.[2] This report from the Grand Canyon Institute, entitled *Arizona at the Crossroads: Water Scarcity or Water Sustainability,* differs from that report in three important ways: 1) our focus is on statewide water issues, and the challenges Arizona faces concerning water resources; 2) our analysis looks more closely at the economics of water supply and demand; and 3) we suggest five specific recommendations for legislative action that, if enacted, will place Arizona firmly on the path of more sustainable water use.

Introduction

There are clear signs that water resources are under immense stress in all parts of the world, including the United States and the Southwest, impacting food supply, energy production and use, environmental values and last and perhaps most important, sources of drinking water. In Arizona, water resource stress is seen:

- in groundwater pumped faster than it can be replenished, a disproportional allocation of water resources to this generation from the next;
- on the Colorado River where more than ten years of drought conditions have caused reservoir levels at Lake Mead to drop precipitously, more than 120 feet, leaving it half-full;

[2] *Watering the Sun Corridor*, Morrison Institute for Public Policy, Arizona State University, August 2011, www.morrisoninstitute.asu.edu.

- in the state's remaining running rivers where drought conditions have made water supplies uneven, and pressure from human use threatens fish, wildlife and riparian areas; and
- in the emerging conflict between urban and rural demands, between those that have water and those who need it.

A growing pressure on financing the infrastructure for water supply has placed many Arizona cities in difficult situations, with bond ratings dropping, rate increases hotly contested, and limited pay-as-you-go funds. Water for food, water for energy production and use, water for the environment, and water for people, all are competing demands for a resource that has always been finite and indeed, is becoming more limited. One need not look far to see troubled times ahead.[3]

Arizona is geographically complex, with Sonoran desert and alpine meadows in astonishing juxtaposition. Its water resource picture is equally complex. Nearly every major river in the state has been dammed for water storage and existing water supplies have been claimed for urban and agricultural uses in Maricopa and Pinal counties especially.[4] The Colorado River, which serves seven different states and the country of Mexico, provides 2.8 million acre-feet of water for Arizona tribal uses, on-river urban and agricultural uses, and urban and agricultural uses in Maricopa, Pinal and Pima counties through the Central Arizona Project (CAP). The River has been over-allocated since the original compact was signed in 1922, however, and there is insufficient flow under normal conditions to meet all the requirements embodied in the compact. The Basin and Range physiographic region that covers the lower half of Arizona, including metropolitan Phoenix and Tucson, contains few perennial streams, but large aquifers, providing a water supply which, to date, has been easily obtained. Other regions of the

[3] Arizona Revised Statutes defines groundwater as "water under the surface of the earth regardless of the geologic structure in which it is standing or moving;" effluent[reclaimed water] as "water that has been collected in a sanitary sewer for subsequent treatment in a facility that is regulated pursuant to title 49, chapter 2 and remains effluent until it acquires the characteristics of groundwater or surface water;" riparian area as "a geographically delineated area with distinct resource values, that is characterized by deep-rooted plant species that depends on having roots in the water table or its capillary zone and that occurs within or adjacent to a natural perennial or intermittent stream channel or within or adjacent to a lake, pond or marsh bed maintained primarily by natural water sources;" surface water as "the waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwater, wastewater or surplus water, and of lakes, ponds and springs on the surface." See A.R.S. §45-101. Title 49 refers to Arizona's environmental quality statutes.

[4] The Salt River Project operates six dams on the Salt and Verde rivers on behalf of agricultural and urban water users in the metropolitan Phoenix area. The San Carlos Project was constructed on the Gila River for the Gila River Indian Community and the San Carlos Irrigation District in Pinal County.

state, such as the Colorado Plateau, have more difficult groundwater conditions, where water is at much greater depths or non-existent.

Arizona's first water code in 1919 declared water as "belonging to the public"; it is "free" to those who obtain and perfect a right to use it. That, combined with the significant federal largesse in funding construction of the dams, pumps, power plants and canals that enabled creation of the Salt River Project, the Central Arizona Project, the Yuma projects, and the San Carlos Project has made the cost of water inexpensive.[5] But what is essentially a water subsidy masks the true value of water. As additional supplies are sought, infrastructure is needed and the price of water rises, Arizonans reflexively protest, as recent proposed rate increase hearings demonstrate.

This combination of inexpensive in-state surface water, groundwater and Colorado River water has enabled Arizona to grow in substantial ways. Arizona's population has increased to approximately 6.5 million people in 2011, and water use averages about 6.9 million acre-feet per year, including about 3 million acre-feet of non-renewable groundwater supplies (43%). Direct use of reclaimed wastewater, an important source of "new" supply, accounts for about 220,000 acre-feet of water in Arizona's water resource portfolio (4%).[6] That means about 3.5 million acre-feet in Arizona's water budget, or slightly more than 50% of all water supplies, arises from renewable surface water supplies, good from a sustainability perspective, but most at risk from climate change conditions. Water is an essential component in every aspect of Arizona's $255 billion economy, from traditional sectors like agriculture and mining to high-technology manufacturing at Intel, and everything in between.[7] In short, water has been, and will

[5] *Water Code of the State of Arizona,* as amended, Chapter 164, Laws of 1919 – amended 1921; the federal government constructed these reclamation projects and water users repaid some of the costs, but all of them were subsidized significantly. As an example, the cost of water alone is about $14/acre-foot on SRP; CAP municipal water is about $120/acre-foot and about $50/acre-foot for agriculture. See rates posted at www.srpnet.com and www.cap-az.com The cost to pump groundwater is highly variable depending on depth to water and the cost of electricity, and for a pumping lift of 1,000 feet, can range from approximately $50/acre-foot to more than $220/acre-foot. See Draft Unmet Demand Analysis, Water Resource Development Commission, Water Supply Sub-committee, 26 May 2011, www.azwater.gov , accessed 10 June 2011.

[6] Karen L. Smith, "Expanding Water Resources in Arizona: Role of Reuse in Reaching Sustainability," in forthcoming Sharon B. Megdal, Suzanne Eden and Robert Varady, eds., Aridity, Scarcity and Shared Water Resources: Arizona, Israel and Palestinian Perspectives on Solving Water Management Challenges, to be published by UNESCO Press. An acre-foot of water equals about 326,000 gallons, enough water to cover an acre of land with water one-foot deep. Historically, an acre-foot of water was enough to support a family of five for one year, which included more extensive outside water use on larger lots.

[7] United States Bureau of Economic Analysis, Gross Domestic Product by State for Industries, 2009, June 2011, www.bea.gov accessed 24 June 2011.

continue to be, critical to the state's economic growth. Certainty of water supplies to meet projected Arizona demand is therefore linked to its future economic sustainability.

Arizona's mix of water resources has served it well, and the combination of surface water and groundwater provided a reliable supply. But its water future may look less robust: long-term drought has raised the issue of eventual surface water shortage from concern to likely reality and an historic reliance on groundwater over the past 100 years not only has used far more water than can be replenished, but ignored the hydrologic connection between groundwater and surface water that supports riparian areas.[8] Arizona's excessive groundwater pumping is not sustainable for the future, robbing future generations of needed supplies and altering the landscape. Arizona's major water resource problems of unsustainable groundwater pumping and inadequate water supplies to meet projected growth and demand suggest the state is facing a future of potential water scarcity, unless significant demand side reduction and supply augmentation strategies are implemented. There are substantial costs to the state if nothing is done. Understanding what drives Arizona's water resource problems is essential to recognizing what harmful effects might occur to Arizona's future economy without some effort to mitigate them.

Crisis Drivers

Water Scarcity

Researchers define water scarcity and water stress in different ways, but a common measure is actual physical scarcity. This is defined both as insufficient water to meet all demands, including those for properly functioning ecosystems, and as a condition where water seems abundant, but water resources are over-committed to the point of declining groundwater levels and environmental degradation.[9] Dr. Peter Gleick of the Pacific Institute refined this idea further in defining "peak water". Here, he writes of "peak renewable water," which is the limit reached when humans take the entire renewable flow of a river or stream for use; "peak non-renewable water," which is when our use of water depletes or degrades the source like pumping aquifers faster than

[8] Arizona maintains a bifurcated water management system, where groundwater and surface water are considered separate and unrelated sources under the law. Advances in our understanding of hydrology and geology, however, demonstrate this is not the case always, and pumping groundwater can significantly affect nearby river's flows. See Robert Glennon, Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters, Washington, D.C.: Island Press, 2002, especially chapter three, "How Does a River Go Dry?" A very accessible explanation of the interconnection between surface and groundwater can be found in Joe Gelt's "Managing the Interconnecting Waters: The Groundwater-Surface Water Dilemma," www.cals.arizona.edu/azwater/arroyo/081con.html, accessed 14 July 2011.

[9] Water stress definitions at www.en.wikipedia.org accessed 21 June 2011.

nature recharges them; and "peak ecological water," which is the point where any additional human uses cause more harm than benefit.[10] Arizona's water resource picture meets both tests of water scarcity, particularly in more populated urban areas, but increasingly throughout the state as a whole. Arizona has to date assumed all water demand will be met with available supplies, if not surface water from instate rivers and the Colorado River, then from groundwater pumped to meet demand; less focus has been placed on altering demand.

Concern for preserving Arizona's precious, non-renewable groundwater supplies began nearly as soon as Arizona became a state in 1912. The inability of competing uses to agree on an approach to preserve groundwater for future citizens lasted until 1980, when a grudging consensus was wrung from those representing agriculture, mining and cities to reduce and limit pumping in critical areas called Active Management Areas (AMAs), eventually to achieve a balance in water demand and pumping called "safe yield"[11] (See Figure 1). Arizona's Groundwater Management Act (GMA) was hailed as a significant policy innovation in water resource management at that time, but the years since have demonstrated just how difficult it is to secure groundwater sustainability. Even with the GMA, groundwater allowances to water utilities, agriculture, and industry within AMAs remain very generous. While substantial progress has been made both in reducing pumping generally from the high volumes in the 1980s and 1990s and in municipal water use, the AMAs remain on a trajectory that will not allow them to meet the "safe yield" goal; groundwater overdraft is projected to continue in all four major AMAs. [12] While groundwater allocations, that is, the amount of groundwater water providers, farmers and industry are allowed to pump under the law, are not typically considered in evaluating safe yield, as they are permitted volumes of water authorized for pumping, they mask the true state of AMA aquifers. The Arizona Department of Water Resources (ADWR) recently completed assessments of groundwater conditions in each AMA, and crafted various scenarios estimating overdraft conditions with and without the groundwater allowance, recognizing that although the groundwater allowance is legal, it still contributes to mining of groundwater. When counting groundwater allowances as part of the total groundwater pumped, the overdraft

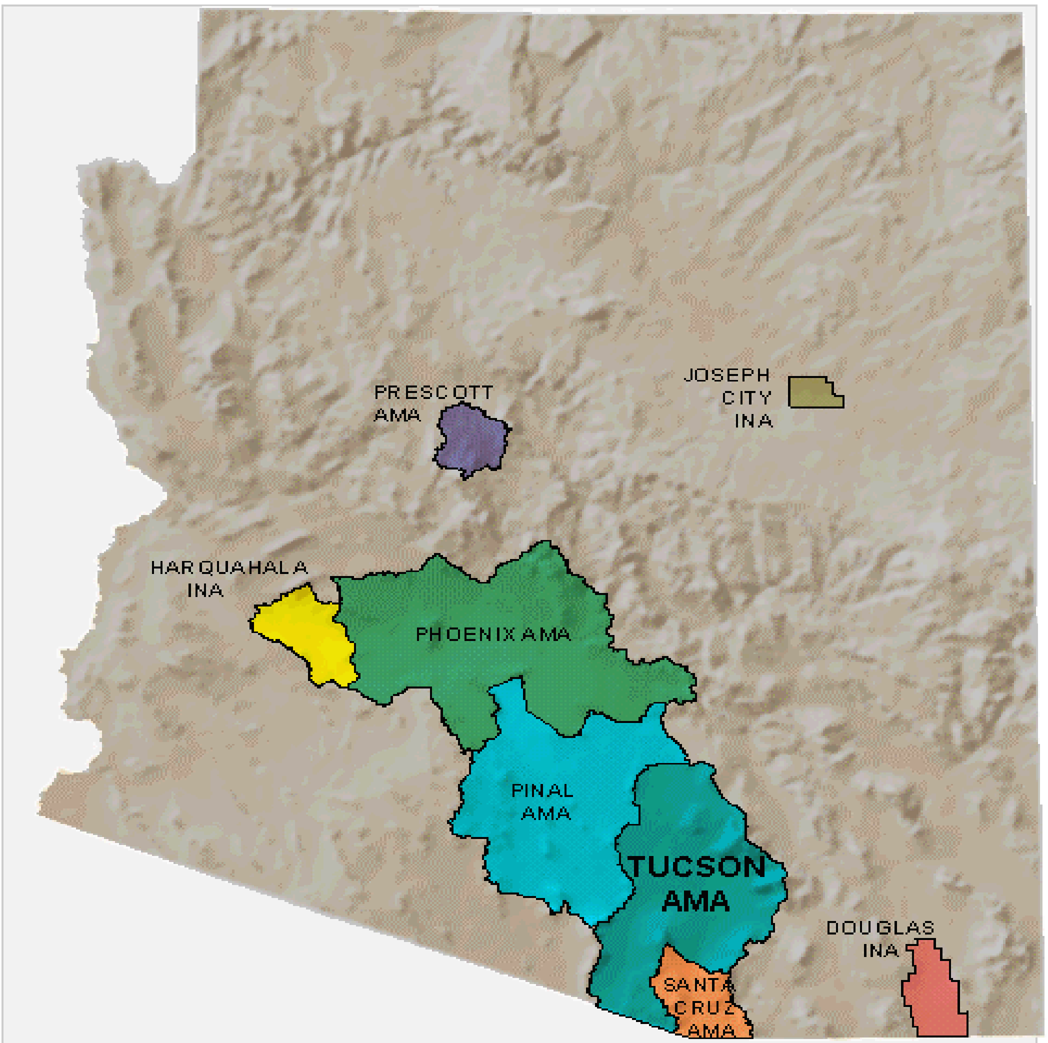
[10] Peter Gleick, "Peak Water," 22 January 2011, www.circleofblue.org/waternews/2011/world/peter-gleick-peak-water accessed 22 June 2011.

[11] A.J. Pfister, "Looking Ahead," in Athia L. Hardt, editor, Arizona Waterline, Phoenix, AZ: Salt River Project, c.1990: 251-258. The GMA also created three Irrigation Non-Expansion Areas, where no new lands can be used for agricultural purposes.

[12] Michael J. Cohen, "Municipal Deliveries of Colorado River Basin Water," Oakland, CA: The Pacific Institute, June 2011, pp.14, 41; Water Demand and Supply Assessments were prepared for each AMA over the period 2009-2011 and are available at www.azwater.gov .

situation increases dramatically.[13] This disproportional allocation of groundwater resources to the current generation is robbing our children and grandchildren of their water future. See Table 1 for the projected overdraft amounts by 2025 for each AMA.

Figure 1: Arizona Active Management Areas and Irrigation Non-Expansion Areas



Source: ADWR

[13] One estimate of the amount of groundwater overdraft in Arizona statewide from 2010 to 2110, under mild climate change conditions, is 394 million acre-feet. Under more severe climate change conditions, it is estimated at 403 million acre-feet. See Ackerman and Stanton, *The Last Drop: Climate Change and the Southwest Water Crisis*, p.5.

There are several reasons why the state will probably fall short in this effort, but some include the following: the erosion of regulatory requirements that strictly limit pumping; exemption for certain kinds of pumping from any limitation; ineffective mandates

Table 1: Projected AMA Overdraft, 2025

Ranges include overdraft projected with the groundwater allowance considered, so that the amount of overdraft is artificially reduced, and without the groundwater allowance, which illustrates the actual effect of pumping. The *latter figure* is a better representation of the effect of more pumping than is replenished on groundwater supplies.

Source: ADWR Active Management Area Demand and Supply Assessments, published 2009-2011, available HYPERLINK "http://www.azwater.gov" www.azwater.gov

requiring more conservation; lack of focus on appropriate pricing structures; a roll-back of conservation requirements for irrigated agriculture, limiting gains from irrigation efficiencies; and perhaps most importantly, the end of heavily subsidized CAP water to agriculture in-lieu of groundwater pumping.[14]

In 2009-2010, the growing recognition in central Arizona that available CAP water resources would be insufficient to meet projected demand by 2035 caused CAP to initiate a process to explore obtaining additional water supplies. Parts of rural Arizona already experience the lack of adequate water supplies, such as in Gila, Cochise, Yavapai and Coconino counties, and any meaningful growth will tip the scales for those communities whose water supply portfolios have no margin for more uses. Those counties are also analyzing, through the CAP process, how to address the gap between supply and existing demand, as well as projected use. Recently issued draft reports of projected state-wide water supply and demand in the year 2035, under normal and shortage conditions, suggest a sobering imbalance: projected unmet demand of one million acre-feet of water under normal conditions and nearly 1.6 million acre feet of water under shortage conditions. Most of the projected unmet demand is within the

[14] Examination of the Management Plans for each AMA from the First Plan in the 1980s through the Third Plan of 2000, along with review of statutory changes to A.R.S.45-401 *et. seq* suggest the erosion of initial efforts to regulate groundwater in a meaningful way. Management Plans are available at www.azwater.gov and the Arizona Revised Statutes are available at www.azleg.gov

Phoenix and Pinal AMAs, but nearly every significantly populated area of the state is projected to have unmet demands by 2035.[15]

Climate Change

Signs of climate change in the West are everywhere we look, becoming more apparent over the past decade: increasing temperatures, diminishing late season snowpack, northward-shifting winter storm patterns, increasing precipitation intensity, widespread vegetation mortality and sharply increasing frequency of large wildfires.[16] These changes, combined with the most severe drought since 1900, have caused the Colorado River's largest reservoirs, Mead and Powell, to decline by nearly half in the five year period beginning in 1999, when they were nearly full, to about 50 percent full in 2004. No appreciable recovery occurred until this year, when very heavy snowpack in Wyoming, Utah and Colorado melted, which estimates suggest will ultimately raise the water level of Lake Mead by more than 40 feet by the end of 2011.[17] While welcome news for those millions of people who depend on the river's flow, it does not mean all is well. Climate change is real and the West will likely become increasingly hot and more arid, with greater unpredictability in annual precipitation and water available for storage. Arizona and the West will need to adapt "to less water and more widespread landscape transformation."[18] Arizona has taken some steps to "drought-proof" its CAP supplies, as it is the most junior user on the Colorado River and will be the first to curtail water use in times of shortage. The Arizona Water Banking Authority (AWBA), created by the Legislature in the mid-1990s, purchases and stores "excess" CAP water underground in the CAP service area for future use in the CAP service area. Through calendar year 2010, the AWBA has stored over 2.9 million acre-feet of water in this way.

[15] The CAP staff initiated an effort in 2009-2010 to explore obtaining additional water supplies primarily for its existing contractors, called the "ADD Water" process. See the ongoing results of that effort at www.cap-az.gov .Water Resource Development Commission, Draft 2035 Unmet Demand Spreadsheet, 25 May 2011, www.azwater.gov accessed 10 June 2011.

[16] Jonathan Overpeck and Bradley Udall, "Dry Times Ahead," Science, vol.328, no. 5986, 25 June 2010: 1642-1643. The scientific bases for climate change are well represented in the Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report.* Contribution of Working Groups I, II and III to the Fourth Assessment Report of the IPCC, Geneva, Switzerland, 104pp. www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html. The EPA also has a very accessible collection of documentation concerning climate change at www.epa.gov/climatechange/.

[17] "Heavy snow, roar of water running off celebrated in some drought-ravaged areas of Southwest," *The Washington Post*, 13 June 2011. Earlier estimates of the projected rise in Lake Mead are somewhat lower at 30 feet. See www.azcentral.com/arizonarepublic/news/articles/2011/04/18/20110418lake-mead-replenished-by-snowfall.html

[18] Overpeck and Udall, "Dry Times Ahead," p.1643.

[19] This is water that will eventually need to be pumped from central Arizona aquifers in lieu of the delivery of CAP contracted supplies that would be limited due to drought. Other surface water providers will also look to increased groundwater pumping, with or without underground water storage, to meet their water needs when drought causes curtailment of supplies.

Water Security

Ensuring a population has access to potable water defines a nation, state or locality's "water security." All the components of water scarcity and climate change affect a place's water security, but water quality and adequate infrastructure also play large roles in achieving it. Much of Arizona currently has water security –a reliable supply of potable water for human consumption – but there are areas within our state where water security remains an unmet need, such as within the Navajo and Hopi nations, and in rural Arizona where water hauling is the only means of securing potable water supplies. Water security is threatened in areas of Arizona when: human activities discharge pollutants into surface water and groundwater, including increasing salinity levels of vital aquifers; the only available supplies involve drilling at greater depths where only poor quality water exists and/or the only available groundwater lies in shallow, brackish aquifers; and access to groundwater supplies is limited by the cost to drill a well. These water realities are faced by many cities and towns in Arizona today, particularly the rapidly increasing costs to drill and operate wells at great depths. As an example, the City of Williams was forced to drill a well more than 3,000 feet below land surface at an estimated capital cost of about $3 million and has monthly operational expenses of approximately $100,000. The City of Flagstaff experienced drilling costs near $1.5 million for a single well.[20]

Arizona's water and wastewater infrastructure in many areas of the state also nears the end of its useful life, and repair, rehabilitation and replacement of critical pumps and pipes is necessary to ensure availability of potable supply. The cost of water security is immense and Arizona requires substantial investment to secure it for the future. A 2008 study, conducted by Arizona State University (ASU) researchers and published by the Arizona Investment Council reported that Arizona would need to spend "in excess of

[19] Arizona Water Banking Authority, *Annual Report 2010*, http://www.azwaterbank.gov/Plans_and_Reports_Documents/documents/FinalAnnualReport2010.pdf. At $55/acre-foot, the cost to store the more than 2.9 million acre-feet of water was just over $163 million.
[20] Water Resource Demand Commission, Water Supply and Development Committee, Draft Unmet Demand Analysis, 26 May 2011, p.6 www.azwater.gov accessed 22 June 2011.

$109 billion over the next 25 years on its water and wastewater infrastructure."[21] In areas of the state with looming water supply augmentation needs, such as those in Cochise, Coconino, Gila and Yavapai counties, the expense is large and the communities' ability to meet it more problematic. See Table 2 for estimated water supply augmentation costs. This analysis stopped at the year 2032, just short of the period when central Arizona is projected to experience water shortage, and the water supply augmentation options for Maricopa, Pima and Pinal counties will also be expensive.

Financial

Current revenue streams to finance the billions of dollars required to acquire water supplies, and repair, rehabilitate and replace water infrastructure, are inadequate for Arizona's needs. The ASU report estimated over the 25-year period that revenue from user fees and bonding available to cover capital outlays, operations and maintenance, and debt service totaled about $79 billion, leaving a funding gap of about $30 billion.[22] The ASU study did not include estimated costs to augment supplies in central Arizona, and some analyses suggest water acquisition costs for this region might exceed $1,000/acre-foot, although it will depend on the source of water acquired. Desalination is a likely augmentation opportunity, both of existing brackish aquifers within the state and the potential for ocean desalination with partners in Mexico. The Texas Water Development Board recently published sample production costs to desalinate brackish

Table 2: Estimated Per Capita Water Supply Augmentation Costs in 4 Counties, for Current or Impending Water Supply/Demand Gaps

County	Total Supply Augmentation Capital Costs	Per Capita Costs
Coconino	$652 million	$4,752
Cochise	$217 million	$1,547
Yavapai	$197 million	$817
Gila	$31 million	$543

Source: Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University for the Arizona Investment Council, May 2008, p.xx

[21] L. William Seidman Research Institute, W.P. Carey School of Business, Arizona State University, *Infrastructure Needs and Funding Alternatives for Arizona, 2008-2032*, Arizona Investment Council, May 2008, p.xvii.

[22] Ibid, p.xix.

groundwater and seawater in Texas, where several projects are operational. These desalination costs ranged from $410/acre-foot to $847/acre-foot for brackish groundwater and $1,168/acre-foot to $1,881/acre-foot for desalinated seawater.[23] A large variable cost for any water augmentation project will be the price of electricity to pump, treat if brackish, and distribute additional water supplies to areas in need.

Additional costs to purchase any available CAP excess water to replenish overdrawn groundwater supplies are projected at about $600/acre-foot in 2015 and to store surplus water underground for use in shortage years about $140/acre-foot in 2015[24]. In contrast to current prices for SRP surface water at $14/acre-foot and groundwater pumping ranging from $50/acre-foot to $220/acre-foot, future water cost requirements undoubtedly will appear unbearable.[25] These estimated costs Arizona faces to secure additional water supplies dramatically underscores the value of water conservation; for example, the cost to replenish groundwater is much higher than the cost to pump it initially.

Moreover, the financial ability to pay for these costs is uneven across the state and the financial burden is most likely too heavy for many communities to bear alone. For example, the ASU study on infrastructure needs estimated that *each person* residing in Coconino County will need to pay nearly $5,000 more over the study period's twenty-four years in addition to existing user fees to pay for the water supply augmentation thought to be required by 2032; currently, the City of Flagstaff estimated annual costs for water and sewer only, *per average household*, nears $1,000.[26] Arizona

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[23] Jorge Arroyo and Saqib Shirazi, "Cost of Water Desalination in Texas," Analysis Paper 10-02, October 16, 2009, Texas Water Development Board., p.5.

[24] Central Arizona Project, Final 2011/2012 Rate Schedule Update, 2 June 2011, accessed www.cap-az.com

[25] See rates posted at www.srpnet.com and www.cap-az.com. CAP currently subsidizes the cost of water for agriculture at about $50/acre-foot. The cost to pump groundwater is highly variable depending on depth to water and the cost of electricity, and for a pumping lift of 1,000 feet, can range from approximately $50/acre-foot to more than $220/acre-foot. See Draft Unmet Demand Analysis, Water Resource Development Commission, Water Supply Sub-committee, 26 May 2011, www.azwater.gov , accessed 10 June 2011.

[26] See City of Flagstaff Water and Sewer Rates, effective January 1, 2011 at www.flagstaff.az.gov/DocumentView.aspx?DID=13920, accessed 14 July 2011. Average household assumes four people use an estimated 7500 gallons/month. The City also completed a long-term financial plan and rate and fee study that examines water and sewer rates for other providers in Coconino County and elsewhere. Adding projected water augmentation supply acquisition and infrastructure costs to current rates illustrates the financial burden counties with smaller populations will face. See City of Flagstaff Final Report, Long-Term Financial Plan and Rate and Fee Study, April 7, 2010 at www.flagstaff.az.gov/DocumentView.aspx?DID=11196, accessed 14 July 2011.

has some statewide financing mechanisms, such as the Water Infrastructure Finance Authority Revolving Fund (WIFA), that serves as a bond bank, providing low-interest loans to fund water and wastewater infrastructure. WIFA is largely dependent on the federal government, through the Environmental Protection Agency's (EPA) Clean Water and Safe Drinking Water revolving funds, to fund its base revenues; these are likely to be sharply reduced in coming years, leaving WIFA with less money to lend. The Arizona Legislature created a Water Supply Development Revolving Fund in 2007, but has not funded it to date.

The financial requirements for improving Arizona's water infrastructure and securing additional water supplies are considerable and traditional funding mechanisms (user fees and municipal bonding) will not likely be sufficient. Those counties listed in Table 2 have small populations relative to the state as a whole, and like the City of Flagstaff, will have difficulty assessing those costs on a per capita basis.[27] An infusion of funds to support water infrastructure from the federal government is unlikely; substantial cuts to the Clean and Safe Drinking Water Revolving Funds appear inevitable as budget reduction efforts continue. Even tribal water settlements, which have a significant federal nexus, have come under Congress' close scrutiny.

Water scarcity, climate change, water security and financial constraints are four of the key crisis drivers affecting Arizona's water future. How they might be resolved can be shaped by the following policy choices: modifying water demand; considering water as an economic good; and creating innovative financing mechanisms.

Key Water Policy Choices

Modifying Water Demand to More Sustainable Levels

It is a truism that the least expensive gallon of water for the future is the one not used today. One need only reflect on the projected cost of $1,000/acre-foot for "new" water as a reminder of this.[28] The reduced municipal use seen since the GMA passed in 1980 is, in part, an effect of conservation programs water providers are required to

[27] Per capita personal income for 2009 in Coconino County was $34,468; Yavapai was $29,242; Cochise, $34,466 and Gila $31,686. Arizona overall per capita personal income in 2009 was $33,248. See *Arizona Indicators*, a project managed by the Morrison Institute for Public Policy, Arizona State University, www.arizonaindicators.org/economy/personal-income , accessed 14 July 2011.

[28] The range of costs for "new" water is between $1,000 and $2,000, depending on the type of water and the costs to build necessary infrastructure to access, transport, treat and deliver the water. See Ackerman and Stanton, *The Last Drop*,p.8; Morrison Institute, *Watering the Sun Corridor,* p.17; and ASU *Infrastructure Needs for Arizona*, p.xx. Costs for water transfers or long-term leases will be negotiated, as recent leases of tribal settlement water to urban areas suggest.

implement.[29] To date, conservation programs required by the GMA have been dominated by education efforts to limit water use, and improved plumbing and landscape standards; they have been largely successful in getting the AMAs to where they are today. There remain three areas, however, where much more can be done to reduce water use: technology, information and pricing.

<u>Technology</u>: Plumbing still can provide opportunities for conserving water, through lower flow fixtures on the inside of a building, rainwater harvesting and provisions for gray water use outdoors, and advanced recycling of water, bringing reclaimed wastewater back into neighborhoods for outdoor use and for indoor flushing of toilets. EPA reports that as much as 70 percent of household water use in arid regions, like Arizona, is for outdoor irrigation, where potable water is not required. The concept of "water fit for purpose" encourages the appropriate source of water for the use – treated, potable water for cooking, drinking and bathing; gray water, rainwater and/or recycled water for outdoor irrigation and toilet flushing.

Many communities in Arizona directly use some of their reclaimed wastewater for turf irrigation and power plant cooling, and some for recharge into aquifers and discharged to support riparian areas. Reclaimed water can also be used for irrigating non-food agriculture, like cotton, and at least two out of thirty-four irrigation districts within the Phoenix AMA use it as a water supply.[30]This is considered basic water recycling. Much more can be done, however, as direct use of reclaimed water constitutes only about four percent of the total amount of water used in Arizona as of 2006 (220,000 acre-feet); a growing population will also "grow" the availability of reclaimed wastewater as a viable water supply. Advanced recycling of water is appropriate for new development, where construction of a reclaimed water distribution center and pipes back through neighborhoods is best done when all infrastructure is put into place. The capital cost for advanced recycling is estimated at about $8,200 per household and the projected water demand per house drops from .5 acre-feet/year/household average to about .3 acre-feet/year/household. More than 65,000 gallons of water could be conserved annually, by a single house, under advanced recycling. Multiply that savings by a new development full of houses and commercial buildings using reclaimed water in this fashion and the water savings could be immense.[31]

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[29] The Pacific Institute, "Municipal Deliveries of Colorado River Basin Water," p.16

[30] Smith, "Expanding Water Resources in Arizona;" *Arizona Water Atlas, Volume 8*, www.azwater.gov.

[31] Trevor Hill, Graham Symonds, Wesley Smith and Paul Walker, "Total Water Management: Resource Conservation in the Face of Population Growth and Scarcity," Developer's Water Forum, Global Water Center, Maricopa, AZ, August 28, 2007. Presentation in author's possession. Trevor Hill and Graham Symonds lead Global Water Resources, a Phoenix-based water resources company specializing in innovative

- **SUGGESTED LEGISLATIVE INITIATIVE: *Arizona Must Maximize Its Sustainable Water Resources, Especially Reclaimed Water.* The Legislature should indicate its intent that reclaimed water be used for all purposes for which ADEQ believes it safe and where it is physically possible to do so. To ensure that this is implemented, the Legislature should direct Arizona's water agencies to:**

1) Provide incentives for all new development within AMAs to implement advanced water recycling when new infrastructure is placed into the ground, through suggested price incentives, accelerated permitting or improved allowed density in Assured and Adequate Water Supply considerations;

2) Agriculture within AMAs should use reclaimed water to irrigate crops as deemed appropriate by the Arizona Department of Environmental Quality (ADEQ) and where it is physically practical to do so. The Legislature should task ADEQ to evaluate its reclaimed water quality standards for additional flexibility in agriculture's use of reclaimed water, while protecting public health;

3) To implement the overall concept of "water fit for purpose", and the specific requirements for use of reclaimed water for non-food agriculture and advanced recycling of water in new development, the Legislature should consolidate ADWR within ADEQ to take advantage of the synergies of combining water quality and water resource data gathering, permitting and reporting. Modest financial savings can also be obtained by such an agency consolidation, primarily in the areas of agency overhead and administrative support, but the combined policy areas of water resources and water quality should inspire greater innovation, permitting and reporting efficiencies, and greater customer satisfaction through "one-stop" transactions. The Legislature should task the combined Water Division within ADEQ to develop rules for implementation of required use of reclaimed water for all purposes deemed fit.

<u>Information:</u> Advanced metering and monitoring technology (AMI) also can help control the amount of water used by influencing customer behavior through real-time notification if water use exceeds a defined threshold, set either by the customer or the utility. Such a system can also monitor water distribution systems for leaks, a common

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water resource management. Typical water demand of .5 acre-feet/year/household unit is the amount of water used to calculate demand under the Arizona Assured Water Supply Program within AMAs, and includes both interior and exterior use. Global Water Resources, an Arizona leader in advanced recycling of water, estimates a reduction in demand under a basic recycled water scenario of about 30 percent from this typical amount, where reclaimed water is used outside the home, and about 40 percent reduction in the advanced reclamation scenario where reclaimed water is used outside the home and inside the home for toilet flushing.

reason for water wasting. Within the AMAs, water utilities are tasked with reducing such lost and unaccounted for water to ten percent or less of water delivered; many utilities throughout Arizona are not close to the ten percent figure. EPA calculates that leaks, on average, can account for more than 10,000 gallons wasted in homes each year. [32] Reducing Arizona's lost and unaccounted for water on both sides of a water meter needs to be a priority.

AMI can provide customers with real-time consumption data, and provide message alerts when use surpasses a threshold amount either the utility or the customer has set. These smart meters are slightly more expensive than traditional meters, however, and, unlike electric utilities, most water utilities in Arizona have not yet implemented a smart meter program. Even without smart meters, there is critical information that water utilities should be able to provide customers relative to their water use: how their water use stacks up to an average use and to their neighborhood's. This tailored information can suggest when excessive or wasteful water use is occurring. Illustrating the different price points in tiered rates or inverted block rates, can also be effective in modifying demand, yet very few Arizona water utilities show their customers on their bills the costs incurred for using more water. Presenting that information with other information about desired water use might reduce demand without any coaxing from a utility.

Pricing: Aside from advanced water recycling, changes to water pricing remain an opportunity for obtaining greater water efficiency. While most Arizona water utilities have multi-tiered rate structures that charge a base rate for average water use, and increasing amounts for water use above the average, few have significantly high rates for those consumers of excessively large amounts of water. For example, Irvine Ranch Water District in southern California has five tiers for its water commodity charge: low volume, base rate, inefficient, excessive and wasteful. The rates in effect through 2010 ranged from $0.91/ccf to $9.30/ccf.[33] The City of Phoenix, by contrast, calculates its rates with a base monthly rate and then rate tiers based on seasonality, not usage. The highest summer months' usage above the base rate is $3.77/ccf with no tier for excessive or wasteful use.[34] The average monthly water bill for a family of four in

[32] See http://www.epa.gov/watersense/faq.html, accessed 14 July 2011.
[33] Irvine Ranch Water District, Residential Rates effective July 1, 2009 at www.irwd.com/AboutIRWD/rates accessed 10 June 2011. A ccf is one hundred cubic feet, a basic measurement of potable water use, or approximately 748 gallons.
[34] City of Phoenix Water Rates effective April 2011 at www.phoenix.gov/waterservices/customerservices/rates accessed 24 June 2011.

Phoenix is significantly less than that of the City of Boston or the City of Santa Fe.[35] The City of Tucson, by contrast, charges about $10/ccf for its top tier of water use.

Economists continue to debate whether demand for water is perfectly inelastic; that is, increased water rates do not lead to generally reduced consumption. A likely reason for the conclusion that price does not affect demand is the relative unimportance of water and sewage bills, historically, relative to the rest of household expenses, estimated nationally at about 0.5 percent of household income.[36] More recent demand side management research conducted in places as diverse as Aurora, Colorado and New England suggests, however, there can be price responsiveness in high user groups if the top tier is priced high enough, for example, more than $9.00/1,000 gallons; at this level, water demand was modestly reduced.[37] A wide-ranging study of managing water demand by the New England-based Pioneer Institute for Public Policy suggests that on average, in the United States, a ten percent increase in the marginal price of water can reduce water demand in the urban residential sector by three to four percent, similar to averages reported for residential electricity and gasoline demand.[38] Water rates for many western utilities now reflect this higher rate for the most excessive water use for residential customers, but many in Arizona do not. Importantly, an informal survey of Arizona's water utilities' bills suggests the main communication that takes place between water providers and customers provides very little information for consumers on tiered rate pricing; there are few clues relating the cost of water as more water is used.[39]

- **SUGGESTED LEGISLATIVE INITIATIVE: *Arizona Needs Better Information on Water Use and Pricing of Wasteful Water Consumption.* The Legislature should require Arizona water providers to provide detailed information in monthly billing to**

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[35] Brett Walton, "The Price of Water: A Comparison of Water Rates, Usage in 30 U.S. Cities," in Circle of Blue Water News, 26 April 2010, www.circleofblue.org/waternews/2010/world/the-price-of-water-a-comparison-of-water-rates accessed 10 June 2011.

[36] *Infrastructure Needs and Funding Alternatives for Arizona: 2008-2032*, p.490.

[37] John Briscoe, "Water as an Economic Good: The Idea and What It Means in Practice," Paper presented to the World Congress of the International Commission on Irrigation and Drainage, September 1996. www.jzjz.tripod.com/icid16 accessed 24 June 2011. See also Sheila M. Olmstead and Robert N. Stavins, "Managing Water Demand: Price vs. Non-Price Conservation Programs," a Pioneer Institute White Paper, No. 39, July 2007, www.hks.harvard.edu/fs/rstavins/.../Pioneer_Olmstead_Stavins_Water.pdf and Douglas S. Kenney, et al, "Residential Water Demand Management: Lessons from Aurora, Colorado," 2007, www.colorado.edu/water_management_and_drought/Kenney_etal_AuroraStudy.pdf .

[38] Olmstead and Stavins, "Managing Water Demand," p.36

[39] Survey of Arizona water utilities' bills by the author conducted in 2009. The City of Flagstaff recently increased the rate for the top block of water use to $9.01/1,000 gallons for use inside the City and $9.91/1,000 gallons for use outside the City.

customers on water use versus average or threshold use, and clear pricing for each block of water used. Those water providers within AMAs should be required to implement tiered rate pricing with a category of water use that is excessive or wasteful, with appropriate rates to discourage excessive use.

Simply put, opportunities to save more water through more aggressive conservation practices are plentiful. If the City of Phoenix saved 130,000 acre-feet of water with existing practices, as the Pacific Institute's recent study on municipal use from 1990-2008 in the Colorado River Basin suggested, there is no reason much more could not be had with these enhanced conservation ideas. If the price of additional water supplies will indeed be in the $1,000/acre-foot range, investment in smarter technology, information and pricing will be well worth it.

Achieving greater efficiency in water use across all sectors, including agriculture, will require additional regulatory requirements; more stringent mandatory policies, when well-enforced, tend to have stronger effects than voluntary policies and education programs. [40] While some would chafe at the thought, the reality is some regulatory requirements can stimulate innovation and market solutions to reduce water use. This has been clearly evident in the area of household plumbing and appliances, where Arizona has established conservation plumbing standards as part of new construction requirements. While EPA does not itself regulate water conservation, it has created a national program to identify and advertise people and products that meet enhanced water conservation standards, called *WaterSense.* The list of "partners" on EPA's *WaterSense* website numbers more than 2,100 organizations and professionals in all 50 states who have produced more than 3,200 new or enhanced products to conserve water.[41] A requirement to conserve more water will open a marketplace of ideas on how best to accomplish it.

Considering Water as an Economic Good

For Arizona surface water other than the Colorado River, the water allocation system is the 19th century doctrine "prior appropriation", or first in time, first in right to use the water. Nearly all Arizona surface water has been appropriated for historic economic sectors like agriculture and mining. While beneficial use is the measure and limit of the right, there is no requirement that water be used for higher valued purposes. Contracts between agricultural districts and cities and towns that are growing within the boundaries of the district have provided an important mechanism to transfer old

[40] Olmstead and Stavins, "Managing Water Demand," p.36.

[41] EPA, "Five Years of Savings," www.epa.gov/WaterSense/docs/WSAR2010_Final, accessed 30 June 2011.

irrigation rights to new, highly valued uses, but this "transfer" is limited to water only for lands within the district boundaries. This limitation, caused by historic artifact, constrains municipal water providers from best leveraging their available water resources in the most efficient manner. It also remains very difficult to transfer water rights for environmental flows and riparian purposes.

- **SUGGESTED LEGISLATIVE INITIATIVE: *Simplify Arizona Surface Water Laws for Environmental Purposes.* The Legislature should create a Commission to investigate Arizona's surface water legal framework and provide recommendations for any changes that will provide greater flexibility in securing in-stream flow and riparian water rights. Such a Commission would be well-served chaired by the Salt River Project and The Nature Conservancy.**

Colorado River water is allocated by the federal government, based upon the Colorado River Compact of 1922 and subsequent pieces of federal law and policy. Change in use and location of River water is not limited in the same way as for in-state rivers, but it is a bureaucratic process that must ultimately be approved by the federal government. Groundwater in the AMAs is largely permitted, with existing uses "grandfathered" in as allowable uses and only certain types of grandfathered rights can be transferred for other use; elsewhere in the state, groundwater can be pumped without limit on the volume or type of use.

A growing literature, in the West and internationally, explores the idea that water has an economic value in all its competing uses and should be recognized as an economic good. The idea is simple: water has a value to users, who are willing to pay for it. Like any other good, consumers will continue to use water as long as the benefits from use of an additional gallon exceed the costs. Consistent conclusions from research conducted in this area suggest the value of water for many low-value crops is very low; for household use it is very high. In Arizona and many other places, the cost of water, however, is calculated as a "use" cost; for irrigation, typically a historic use cost based on paying the debt incurred in constructing the irrigation system and for municipal consumers, an average cost. Rarely is the opportunity cost of water considered, which reflects the "value of water in its best practical alternative." In an era of water scarcity, consideration of different market-based approaches to water allocation and management is in order.[42]

Current efforts to consider water an economic good include land-fallowing contracts with acreage along the Colorado River, where farmers are paid during water shortage

[42] Briscoe, "Water as an Economic Good,"p.6.

conditions not to irrigate their lands for short periods of time, allowing the water to be used for a higher valued purpose, such as municipal and industrial use. The federal government has been a proponent of these kinds of agreements and they serve as a model for how high value municipal uses can obtain temporary water supplies. Other market mechanisms in use or under consideration include an auction or bidding process. The Town of Prescott Valley "auctioned" some of its reclaimed wastewater to be recharged underground for development purposes, allowing home construction under the AMA's assured water supply program when it might not have been allowed otherwise. The CAP's ADD Water process initially envisioned a bidding mechanism for the pricing of new sources of supply that included an opportunity cost-like provision, but this idea has been removed from consideration, at least for now.

Arizona will need to find other, creative ways to transition from a water economy that subsidizes low-value uses to one that allows for market mechanisms to define both the value and cost of water. As well, reconsideration of arcane allocation mechanisms that privilege historic uses while disallowing change for environmental flows and riparian restoration is in order. As water users explore the varying sources of "new" water to augment existing supplies, consideration of water as an economic good will surely need to enter the discussion.

- **SUGGESTED LEGISLATIVE INITIATIVE: *Arizona Needs Innovative, Market-Based Approaches to Water Allocation and Management.* The Legislature should create a Commission to investigate market-based approaches to water allocation and management within Arizona and make recommendations concerning any needed changes to Arizona law to enable their implementation in a fair and equitable manner.**

Creating Innovative Financing Mechanisms

It is said that necessity is the mother of invention, and this will be true as Arizona grapples with ways to fund the more than $109 billion for water augmentation and infrastructure we know we will need, and the hundreds of millions more we don't know about. Municipal partnering to build joint-use projects, public/private partnerships to share the costs and benefits of water infrastructure, and market mechanisms for valuing water are all efforts underway in our state. While still in the early phases, they hold promise as ways to finance Arizona's water requirements.

Other financing mechanisms that might be explored include state bonding for water projects, much like California did in 2010 when the Legislature authorized an $11 billion water general obligation bond package to go before the voters for approval. The benefit of a statewide bond is that smaller cities and towns can access funds for projects more easily than if they had to bond on their own. A state bond is also an appropriate way to fund projects that provide public benefit, such as environmental flows and riparian restoration projects. Much care would need to be given as to how such a state bond would work, and WIFA could serve as a useful model.[43]

Additional regional partnerships, such as the Mohave County Water Authority, might arise to leverage individual communities' ability to share and finance infrastructure in specific areas of the state. The regional associations of governments might be an initial place to explore forming meaningful regional water partnerships where financial and water resource needs can be managed more effectively. Recently, the Water Resource Development Commission proposed creating a Statewide Water Augmentation Authority, where financial resources of water buyers could be pooled to fund water acquisition and infrastructure construction, and where the Authority would serve as a "buyer's broker." Such an Authority would mirror the function that WIFA provides as a revolving fund as well as acquire new authority to hold title to water rights and water contracts on behalf of its "member" buyers and sellers. While every community would be eligible to participate, including private parties, not every community in Arizona has the financial capacity by itself to do so. The state itself must participate.[44]

Creating reliable revenue streams to fund state water supply development is critical for the future and could include things like a small assessment on all water used in the state, a fee added to every bottle of water sold, or a small property assessment, to name just a few.[45] Even though the water supply imbalance is not uniform across the state, having any area of Arizona continue to experience water insecurity will not improve our state's economy. A century ago, the federal government played an historic role in providing funding for Arizona's largest water projects. Now, those projects must play a part in helping the rest of the state.

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[43] The Pacific Institute, "The 2010 California Water Bond: What Does It Say and Do?" August 2010.

[44] The Legislature authorized creation of the Water Resource Development Commission through H.B. 2661 in the second regular session, 2010. The purpose of the Commission is to compile and consider the projected water needs of each Arizona county in the next 25, 50 and 100 years, including identifying and quantifying water supplies currently available to meet projected water demand in the next 25, 50 and 100 years, and identify potential sources of new supply as well as financial mechanisms to aid in acquiring, treating and distributing those supplies. The final report is expected to be released in fall, 2011.

[45] As examples, ADWR and the WRDC have estimated revenue streams for a $0.05 to $0.10 per 1,000 gallons transaction privilege tax at $24 million to $48 million annually; from a $0.02 and a $0.05 bottled water tax at $15 million to $38 million annually. See Minutes, WRDC Recommendation Committee, May 16, 2011, http://infoshare.azwater.gov/docushare/dsweb/View/Collection-384#

- **SUGGESTED LEGISLATIVE INITIATIVE: *Arizona Needs A Statewide Financing Mechanism for Water Acquisition and Infrastructure.* The Legislature should consider expanding the authorities of WIFA to allow for enhanced water acquisition and augmentation or create a new Statewide Water Augmentation Authority that would have the ability to service all parties, including private parties, in water supply acquisition. The Legislature should consider authorizing a new reliable and sufficient revenue stream to fund water resource infrastructure, including acquisition costs.**

Conclusion

Water resource certainty drives Arizona's economy, including maintaining viable riparian and environmental flows so critical to the recreation and tourism industries. Ensuring water resource certainty requires policy changes now that will inspire the necessary actions to allow Arizona's economic future to be as robust as its past. Appreciating the key crisis drivers behind Arizona's water uncertainty – scarcity, climate change, security and financial constraints – allow for creative discussion of important water policy choices. First and foremost of these is modifying demand. The least expensive water for the future is the gallon of water conserved today. Arizona has made progress in this area, but much more can be done. Success here will require a mix of regulatory enhancements spurring market innovations, changes to how information about water use is provided and to pricing structures that do not include a cost for wasteful uses. Second, is the consideration of water as an economic good. The great expense involved with most water augmentation projects requires that water find its highest value and be priced accordingly. This is not an easy task, as competing demands for food, people, energy and the environment must be addressed fairly. Finally, the need for creative financing and management mechanisms for water resources – for augmentation projects, needed infrastructure, environmental purposes and leveraging existing supplies more efficiently –is more apparent than ever. There can be no economic sustainability without them.

These five suggested Legislative initiatives, if enacted, will move Arizona forward on the path of greater water sustainability, and therefore greater economic sustainability:

1. **Maximize Arizona's Reclaimed Water Resources for Improved Water Sustainability.** The Legislature should direct Arizona's water agencies to incorporate in all its programs the concept of water "fit for purpose" and (1) provide incentives for furthering advanced reclaimed water use throughout Arizona. These incentives might include encouraging competitive pricing where appropriate, accelerated permitting timetables,

greater conservation credits within Active Management Areas, and improved allowed density within the Assured and Adequate Water Supply Program. (2) The Legislature should task ADEQ to evaluate its reclaimed water quality standards and develop rules to implement additional flexibility in all reclaimed water uses and transportation, especially related to agriculture, while protecting public health. (3) Finally, the Legislature should consider consolidating the Department of Water Resources within the Department of Environmental Quality to take advantage of the programmatic synergies that could be obtained by combining water quality and water resource data gathering, permitting and reporting. While modest financial savings might also be obtained through agency consolidation, the greater benefit will be in program innovation, permitting and reporting efficiencies, and improved customer satisfaction through "one-stop" transactions.

2. **Improve Information on Arizona Water Use and Pricing of Wasteful Water Use.** The Legislature should require water providers to price wasteful use of water at appropriate levels and present useful information on average versus wasteful water use to customers through more detailed monthly billing and clear pricing for each block of water used. The Legislature should direct ADWR to implement within AMAs required tier rate pricing to include a category of water use that is excessive or wasteful, with appropriate rates to discourage excessive use.

3. **Begin Examination of Ways to Modify Arizona's Surface Water Laws for Environmental Purposes.** The Legislature should consider creating a Commission to investigate needed changes to simplify Arizona's surface water laws to allow for greater flexibility to use water for aesthetic and environmental purposes and provide recommendations to the Legislature for any modification to existing laws the Commission deems appropriate. Such a Commission would be well-served co-chaired by Salt River Project (SRP) and The Nature Conservancy (TNC).

4. **Begin Examination of Innovative, Market-Based Approaches to Water Allocation and Management.** The Legislature should consider creating a Commission to investigate innovative market-based mechanisms for water resource management and allocation and provide recommendations to the Legislature for any needed changes to Arizona law to enable their implementation in a fair and equitable manner.

5. **Authorize a Statewide Financing and Funding Mechanism for Water Acquisition and Infrastructure.** The Legislature should consider either expanding the authorities of the existing Water Infrastructure Finance Authority to allow for enhanced water acquisition and augmentation, including the temporary holding of water rights, or authorize

creation of a new Statewide Water Augmentation Authority that would have the ability to service all parties interested in water supply augmentation, including private parties. The Legislature should also consider creating a reliable revenue stream for the Water Resource Development Fund that will assist smaller communities within Arizona, as well as the larger metropolitan water providers, with water supply development and infrastructure loans and grants.

Karen Smith, a former deputy director at the Arizona Department of Water Resources and water quality director at the Arizona Department of Environmental Quality, is a Fellow at the Grand Canyon Institute.

Reach the author at KSmith@azgci.org or contact the Grand Canyon Institute at (602) 595-1025.

Grand Canyon Institute
P.O. Box 1008
Phoenix, AZ 85001-1008
GrandCanyonInstitute.org