ARIZONA CHAMBER FOUNDATION

PROSPER FOUNDATION

POLICY BRIEF

Water in Arizona: Our Past, Present, and Future

Introduction

Arizona's system of water planning and management is among the best in the world. Our state's water history, marked by groundbreaking infrastructure projects, revolutionary water management laws, and model collaboration, bipartisanship, and consensus-building have meant that Arizona has maintained a level of water certainty that has served as the cornerstone of major economic growth and development for decades, and allowed us to weather a still-ongoing 17-year drought.

Arizona's water history can be said to have gone through five eras, taking our state from an arid, sparsely populated desert to a state that boasts urban population centers, a robust agricultural community, and a water management and delivery system that is modern and efficient. Since 1957, Arizona's population has grown nearly 500 percent, to over 7 million residents. Its economy has exploded from a gross domestic income of $13.4 billion in 1957 to about $306 billion in 2016.

Yet, despite that astonishing growth, Arizona's total water use... declined. Today, Arizona uses less than 7 million acre feet of water per year—three percent less than users consumed almost 60 years ago.[1]

Yet Arizona's history of responsible water management and stewardship has not entirely insulated the state from effects of the ongoing drought. Water is economic development, and certainty with respect to our water supply is key to Arizona's continued economic growth. Arizona is now approaching a critical turning point in water stewardship.

This paper provides a guide to understanding water in Arizona. Part I outlines the basics and defines key terms. Part II provides a comprehensive overview of the history of water planning and management in Arizona. Part III discusses the status of Arizona's water situation right now in light of the ongoing drought. Finally, Part IV explores the path forward, with several options to consider as Arizona works to modernize and update its water management system.

I. Water 101: Understanding the Basics of Water in Arizona

Water in Arizona can be roughly divided into four basic categories: Colorado River water, surface water other than Colorado River water, groundwater, and effluent.

Surface water is essentially what it sounds like: water you can see that flows through rivers and streams. It also includes the underground parts of those rivers and streams, as well as water flowing in underground channels. Arizona statute defines 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, as well as Central Arizona Project water."[2]

Surface water includes Colorado River water, which is allocated among the seven Colorado River basin states (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) through the "law of the river," a term that refers to the numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines that collectively govern the Colorado River.[3] In Arizona, Colorado River water is allocated among mainstream users according to their historic priority.[4] Arizona's other surface waters include the Colorado River tributaries, including the Gila, Little Colorado, and Bill Williams Rivers; almost all other rivers and streams in Arizona ultimately flow into either the Gila or Little Colorado. Water rights to Arizona's "other surface waters" are based upon the prior appropriation doctrine defined and discussed below.

Like surface water, groundwater is also what it sounds like: water that is underground, i.e. not flowing through rivers and streams. It is defined in statute as water "under the surface of the earth regardless of the geologic structure in which it is standing or moving, and does not include water flowing in underground streams with ascertainable beds and banks."[5] In our predominantly arid state, groundwater is considered a non-renewable resource; this is in contrast to surface water, which is considered a renewable resource.

Effluent is water that has been collected in a sanitary sewer for subsequent treatment, and remains effluent until it acquires the properties of surface water or groundwater, for example through treatment and recharge.

In Arizona, surface water and groundwater are both held in trust by the government for the benefit of the public, who have a right to use the water but not own it. Yet surface water and groundwater are governed by different systems of management. Rights to surface water—water that flows in rivers, streams and tributaries—are generally determined by the prior appropriation doctrine, meaning "first-in-time, first-in-right." In other words, the person who first puts the water to beneficial use has a priority over later users.[6]

Rights to groundwater in Arizona depend on location. In certain parts of the state known as "Active Management Areas" ("AMAs"), groundwater is managed according to a system set up in Arizona's 1980 Groundwater Management Act, which specifies how much water may be pumped, by whom, and for what purpose. Arizona's five AMAs cover the major population centers primarily in the central and southern half of the state. Rights to groundwater in the rest of Arizona, outside the AMAs, are only subject to limited regulation; outside of an AMA, any person may withdraw and use groundwater for any reasonable and beneficial use.[7] (However, within special areas outside AMAs designated as irrigation

non-expansion areas (INAs), irrigation of land is limited to acres that were historically irrigated before the INA was established.)

Further complicating matters is the impact of "hydrologic connections" between surface water and groundwater. In many areas, this connection is certain, but the magnitude is not; establishing and delineating the connection is difficult and expensive, due in part to the fact that the connection may not be felt in any meaningful time frame (e.g. pumping from a well may not affect a stream for decades or centuries because the movement of water underground tends to be much slower than on the surface). In addition, causation may be difficult to determine, as when dozens of wells could be affecting a surface stream in varying degrees.[8] It is important to note that while nearly all surface water sources interact with groundwater, the converse is not the case: some groundwater aquifers are geologically discrete.

In the early part of Arizona's history, the use of surface water and groundwater went unchecked and the state was plagued by over-pumping and waste. But in the mid and late twentieth centuries, Arizona's stewardship of its water changed for the better. With the passage of the 1980 Groundwater Management Act, completion of the Central Arizona Project, and the development of Arizona's Department of Water Resources and Water Banking Authority, the state took control of its water use and supply, and changed the course of the state's future.

II. History of Water Planning and Management in Arizona

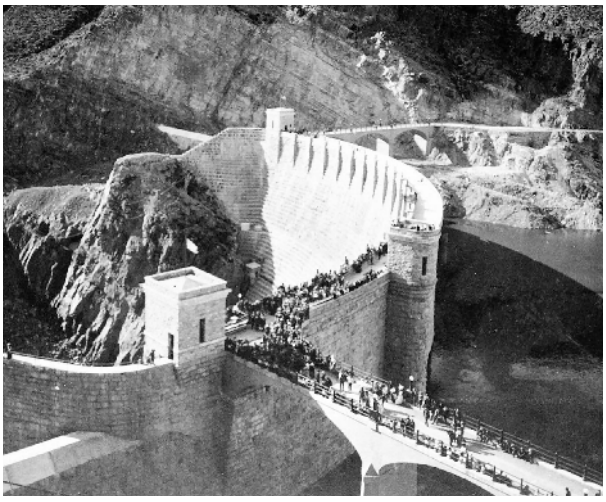
The history of water planning and management in Arizona until now can be divided into four eras: 1) the building of the Salt River Project system in the early twentieth century; 2) the creation and building of the Central Arizona Project in the mid-twentieth century; 3) the historic passage of Arizona's revolutionary 1980 Groundwater Management Act and the subsequent period thereafter; and 4) the Indian water rights settlements. Each of these eras has shaped Arizona's history and brought our state to where it is today. Starting at the turn of this century, Arizona entered a fifth era: the era of drought, marked by new water supply challenges. Understanding Arizona's history and the eras that have come before is critical to solving the challenges we face today.

1. The Salt River Project

As early pioneers settled in Arizona's Salt River Valley in the nineteenth century, they developed a haphazard series of canals to feed the settlements' agricultural needs. Toward the turn of the twentieth century, settlers were confronted with alternating droughts and floods, and they realized they needed a way to supply a consistent source of water.[9] Arizona farmers were instrumental in lobbying the federal government for help.

The National Reclamation Act, signed by President Theodore Roosevelt in 1902, authorized a financing mechanism for local organizations in the West to borrow money from the federal government to build water storage and delivery projects.[10] This new federal law provided the support Arizona needed.

After passage of the Reclamation Act, farmers in the Salt River Valley, an area spanning a large swathe of central Arizona, formed the Salt River Valley Water Users Association in 1903 to take advantage of the new law. They pledged their land as collateral for a large federal reclamation project to build a water collection, distribution, and delivery system to serve their lands. The Salt River Project was the first major multipurpose reclamation project and involved the



Dedication of Roosevelt Dam on March 18, 1911 | U.S. Bureau of Reclamation

construction of dams and modern canal and delivery systems.[11] Theodore Roosevelt Dam, completed in 1911, is still one of the highest masonry dams in the world. President Theodore Roosevelt traveled to Arizona and up a rough, winding dirt road to dedicate the dam upon its completion.

Unsurprisingly, controversy arose surrounding the rights to water in the Salt River Valley, and that controversy was ultimately resolved through litigation to settle water rights among 4,500 landowners. Culminating in the Kent Decree of 1910, the lawsuit determined that almost 240,000 irrigable acres had a right to water diverted from the Salt and Verde rivers for agricultural purposes. It also increased and decreed Salt River Indian Reservation rights and recognized Fort McDowell Indian Reservation water users. Further, it established the concept of normal flow rights (i.e. the land on which water was first used had first right to water normally flowing in the river), and determined that water other than normal flow (i.e. stored and developed water) was to be shared equally on lands within a water users association.[12] Essentially, the Kent Decree paved the way for the allocation and distribution via SRP of Salt and Verde River water.

SRP has operated pursuant to that determination since the early 1900s and, with the addition of power generation, is now the nation's third largest public power utility and the largest supplier of water from Arizona watersheds.[13]

2. The Central Arizona Project

By the middle of the twentieth century, it became clear that Arizona's burgeoning population centers would need more water. The completion of the Central Arizona Project (CAP) in the early 1990s brought a large, renewable supply of water to the most populated parts of the state, which was necessary for economic development and growth. In addition, it helped to better manage the overdraft of Colorado River water that was occurring annually in the absence of infrastructure to manage Arizona's surface water allocation.[14]

Like the Salt River Project before it, the Central Arizona Project began with the formation of an association in 1946 to educate Arizonans about the need for CAP and to lobby Congress to authorize its construction.[15] The first organized and coordinated efforts to obtain federal authorization for the project began in 1947. But it was not until twenty years later and after a protracted congressional battle that, on September 30, 1968, CAP was finally authorized by Congress as part of the Colorado River Basin Project Act.[16] Construction began five years later, on May 6, 1973, and was finally completed in 1993.

Importantly, congressional authorization of the project hinged on the level of priority to Colorado River water of Arizona's users in relation to the other basin state users. While some of Arizona's mainstream users continue to receive an allocation based on their historic priority, Arizona ultimately agreed, in exchange for federal financing of the construction of CAP, to be the junior priority holder of Colorado River water allocated to CAP and delivered via the canal. That agreement, in turn, enabled Arizona to bring Colorado River water to its growing population centers in Maricopa, Pinal, and Pima counties.[17]

The first CAP water deliveries reached Phoenix in November 1985.[18] On October 1, 1993, the federal Bureau of Reclamation finally declared the $5.2 billion project delivering Colorado River water 336

System Map | Central Arizona Project

miles into central and southern Arizona "substantially complete."[19] Central Arizona Project now delivers the single largest source of renewable water supplies in Arizona from the Colorado River, and is the largest single end-user of power in the state (to pump the water to its end delivery points).[20]

The Central Arizona Project is operated and maintained by the Central Arizona Water Conservation District (CAWCD) pursuant to an agreement with the United States, acting through the Bureau of Reclamation. CAWCD is a multi-county water conservation district established pursuant to state law to levy an ad valorem tax on property within Maricopa, Pinal, and Pima Counties for the purposes of paying administrative costs and expenses of CAWCD and to assist in the repayment obligation to the federal government of the construction costs of the CAP. CAWCD is authorized by state law to contract with the Secretary of the Interior to repay CAP construction costs and deliver CAP water.

3. Arizona's 1980 Groundwater Management Act

In the 1950s, Arizona's total annual water demand was about seven million acre feet, and demand peaked at over 9.5 million acre feet per year by the early 1980s.[21] By that time, Arizonans were annually using roughly 2.2 million acre feet more groundwater per year than was being replenished.[22] Arizona needed a tool to manage the allocation of its groundwater and deal with the massive annual overdraft. The time had come for the 1980 Groundwater Management Act (GMA).

Called one of the ten most innovative programs in state and local government at the time by the Ford Foundation and the John F. Kennedy School of Government,[23] the GMA was landmark legislation intended to control the unregulated use of groundwater in Arizona's most populous areas—Phoenix, Tucson, and Prescott. The GMA, though adopted by the Arizona Legislature over three decades ago, still serves as a model to other states; most recently, it was the model for California's 2014 Sustainable Groundwater Management Act, which for the first time allowed local California agencies to adopt groundwater management plans.[24]

The GMA has three primary goals: 1) to control the overdraft of Arizona's groundwater occurring in the more populous areas of the state; 2) to provide a means to allocate Arizona's groundwater resources within Arizona's more populous areas (designated in the Act as "Active Management Areas") to more effectively meet those areas' changing needs; and 3) to augment Arizona's groundwater through supply development.[25]

The GMA contains six key provisions applicable within AMAs: 1) a system of groundwater rights and permits; 2) a prohibition on irrigation of new agricultural lands; 3) a series of water management plans for each AMA designed to reduce groundwater withdrawals; 4) a requirement that developers demonstrate a 100-year assured water supply for new residential growth; 5) a requirement to measure water pumped from all large wells; and 6) a program for reporting annual water withdrawal and use.[26] Importantly, these provisions apply only within AMAs; outside AMAs, there is far less regulation of groundwater.

One of the most important provisions imposed on the AMAs by the GMA is the assured water supply program, which mandates that developers demonstrate that a 100-year supply of water is physically, legally, and continuously available

before plats are recorded or parcels are sold in a new development.

The GMA also set the stage for the creation, in 1996, of the Arizona Water Banking Authority (AWBA), a credit-based system of storing water underground for future use to meet the state's obligations pursuant to Indian water rights settlements; for use by CAP's municipal and industrial subcontractors during shortages and CAP system outages; for the benefit of Arizona's other Colorado River municipal and industrial users; and for other purposes.[27]

Part of the reason for the creation of the AWBA was that, prior to 1996, Arizona did not use its full allocation of Colorado River water. At the time, "Arizona was not expected to use its full allocation until the year 2030 and, during the interim period, the cumulative amount of water expected to be left in the Colorado River would have amounted to approximately 14 million acre feet."[28] Most of that water would have gone to southern California as a result of the allocation framework set out in the U.S. Supreme Court's 1964 decree in *Arizona v. California*, an historic court case that determined Arizona's Colorado River allocation. In addition, Arizona water planners feared that California would seek a permanent re-allocation of Colorado River water based on Arizona's apparent lack of need for the unused supplies. Therefore, using 100 percent of Arizona's entitlement to Colorado River water each year became a necessary strategy for ensuring a dependable water supply. Creating the AWBA allowed Arizona to capture and bank its unused share of Colorado River water, maintaining its full allocation and ensuring long-term water certainty even in times of shortage. Since its inception in 1996, approximately 4.3 million acre-feet of water have been delivered for AWBA storage.[29]

To accomplish its goals, the GMA set up a comprehensive management framework and established the Arizona Department of Water Resources to administer the new law's provisions. In addition, the GMA divided the state's main population centers into four "Active Management Areas" or AMAs—Phoenix, Pinal, Prescott, and Tucson. A fifth AMA, Santa Cruz, was split off from the Tucson AMA in 1994. The AMAs include 80% of Arizona's population and 70% of the state's groundwater overdraft. The GMA lays out the groundwater rights in the AMAs, including who may pump, how much, and for what purpose.[30] The GMA also created a market for groundwater credits and extinguishment credits, and, thus, changed the value propositions related to conservation, effluent, and recharge.

Groundwater Management Study Commission | Arizona Municipal Water Users Association

In the Phoenix, Prescott, and Tucson AMAs, the management goal set out in the GMA is to obtain "safe-yield" by 2025, which means a long-term balance between annual withdrawal in the AMA and the annual amount of natural and artificial recharge.[31] The management goal for the Pinal AMA is to allow development of non-irrigation uses and to preserve existing agricultural economies for as long as feasible. The management goal for the Santa Cruz AMA is to maintain a safe-yield condition. Under the framework established by the GMA, the AMAs will work to achieve their goals by meeting statutory requirements, including compliance with the "assured water supply program"; conservation requirements for municipal water providers, agriculture, and industries; underground storage and recovery; water rights and permitting requirements; and water use reporting requirements.[32]

In 1993, the Arizona Legislature gave CAWCD the responsibility of acquiring water to replenish groundwater pumped to serve subdivided land that otherwise would not be able to meet the statutory assured water supply criteria in the GMA.

Governor Bruce Babbitt signs the Groundwater Management Act on June 12, 1980 | Arizona Municipal Water Users Association

Land developers may satisfy their recharge obligations through enrollment in the Central Arizona Groundwater Replenishment District (CAGRD), which is required to replenish the groundwater pumped by a CAGRD member according to the management goal of the AMA in which the member is located. In this way, CAGRD provides a mechanism for developers to meet Arizona's strict statutory obligations imposed by the 100-year assured water supply statute.

The process for negotiating and ultimately passing the Groundwater Management Act was not easy. There were many diverse stakeholders at the table who often disagreed—vehemently—over key provisions of the new law. Yet the parties at the table understood the long-term ramifications of failure, and were committed to the future of Arizona. Ultimately, their determination, willingness to compromise, and ability to put aside partisan and interest-based differences to work toward a common goal—coupled with legislative and executive leadership within Arizona—resulted in one of the most ground-breaking pieces of water legislation ever passed in the United States.

4. Indian Water Rights Settlements

Overlaying the progress in Arizona's system of water management has been ongoing negotiations with Arizona's tribal communities over their water rights. The tribes are entitled to a certain allocation of Arizona's water under the federal "reserved rights doctrine," and determining the proper allocation has proven to be a complicated process. In some cases, negotiations have gone on for decades and involve competing interests including the federal government, tribes, and non-Indian users.[33]

Under the federal reserved rights doctrine, the law essentially holds back—or "reserves"—a sufficient quantum of water to fulfill the purposes of any federal land designation, whether it be a national park, monument, or tribal land designation, and it establishes a priority date as of the date of the land reservation.[34]

In Arizona, tribal land accounts for roughly one quarter of Arizona's territory. Because many of the Indian reservations were created either prior to or early in Arizona's statehood, some of the tribes' claimed rights are likely senior to many non-Indian water rights. So, tribal water rights claims collectively are significant.[35]

Stakeholders in Arizona have worked to resolve many of Arizona's tribal water rights claims, including those of the Ak-Chin Tribe, Tohono O'odham Nation, Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, San Carlos Apache Tribe, Yavapai-Prescott Indian Tribe, Zuni Tribe, Gila River Indian Community, and White Mountain Apache Tribe.[36] Settlements typically involve the acceptance of a quantified water right and waiver of other claims in exchange for financing for water infrastructure projects and receiving approval to lease water off-reservation for use by non-tribal parties, and must be approved by Congress.

For example, in 2004, thanks to the dedication

and leadership of then-Senator Jon Kyl, Congress passed the Arizona Water Settlements Act.[37] This historic piece of legislation settled competing claims of the Gila River Indian Community, the Tohono O'odham Nation, and numerous non-Indian water users after years of negotiation among the parties. It is "the largest and most comprehensive settlement in Arizona history."[38]

The construction of the CAP was pivotal in the settlement of many tribal water rights claims, as almost half of the CAP water is now allocated for Indian water rights. With the completion of the CAP and for the subsequent two decades, CAP water supplies "were the critical components of the water budgets for Indian water settlements in Arizona [because they] provided a new source of supply to meet the tribes' need."[39] With respect to the 2004 Arizona Water Settlements Act, for example, 67,300 acre-feet of CAP water per year was made available to "resolve Indian water claims in Arizona, and may be allocated . . . in fulfillment of future Arizona Indian water rights settlement agreements approved by a future Act of Congress." The availability of CAP water was essential in the 2004 settlement, and will continue to be an important component of future Arizona Indian water rights settlements.[40]

While Arizona has made progress, additional important Indian water claims remain unsettled. Those outstanding proceedings are nuanced and complex, and the claims exceed Arizona's total available water supply. While difficult, pursuing final settlement of the outstanding tribal water claims is essential to Arizona's future, and will require creative solutions and compromise to succeed.

III. Where We Are Now: The Era of Drought

Arizona has always faced water supply challenges, and through hard work, collaboration, consensus, and compromise has built a water planning and management system that has brought Arizona into the twenty-first century. Arizona has now entered a fifth era of water management challenges, characterized by drought, eventual limitations on available water supplies, and the need to complete the adjudications of competing claims to Arizona's surface water. This will require renewed commitment to collaboration as Arizona's leaders come together to forestall shortage in Lake Mead and address myriad other hurdles to Arizona's long-term water sustainability.

1. Lake Mead and the Drought Contingency Plan

The Colorado River system has been stressed by drought conditions for the past 17 years. In addition, the Lower Basin has a "structural deficit" problem of about 1.2 million acre feet per year. This structural deficit is due to unaccounted for evaporation loss of about .6 million acre feet per year, plus over-allocation of .67 million acre feet per year. As a result, water levels in Lake Mead, the reservoir that serves California, Nevada, Arizona, and Mexico, are declining. Under the 2007 Interim Guidelines[41] adopted by the Secretary of the Interior, if Lake Mead drops below elevation 1075 feet above sea level the federal government will declare a shortage on the Colorado River. That would mean reduced delivery amounts to Arizona, specifically to the Central Arizona Project in the near term, with potentially serious consequences. Because of the ongoing drought, concerns have arisen that shortages could be greater than expected. As a result, water planners have begun developing options for mitigating the effects of drought and structural deficit.

The Drought Contingency Plan (DCP) is a proposed

agreement among the Lower Basin states to forestall shortage by taking specified cuts earlier than what existing regulation requires.[42] The goal of the DCP is to "protect Lake Mead's elevation from dropping to critical levels by sharing responsibility for protecting the system among all Lower Basin Colorado River users."[43]

Under the DCP, Arizona and Nevada would take earlier reductions in their share of the Colorado River than those outlined in the 2007 shortage guidelines, and California would commit to a first-ever reduction in its share if the water levels in Lake Mead continue to drop.[44] Because of Arizona's junior priority, in the absence of DCP there is a risk that Arizona, and the Central Arizona Project in particular, would be required to take catastrophically deep reductions, with associated adverse impacts on Arizona's economy.

Formalizing the DCP will require a number of steps and agreement among diverse parties and interests: international, federal, interstate, and intra-state.

First, pursuant to a 1944 treaty, Mexico is entitled to 1.5 million acre-feet of water from the Colorado River. The treaty is implemented by the International Boundary and Water Commission, and the Commission's updates to the 1944 treaty are known as Minutes. Minute 319, which provides for a series of joint cooperative actions between Mexico and the United States to better manage the Colorado River, expires at the end of 2017. In September 2017, the United States and Mexico finalized an agreement on Minute 323, the successor to Minute 319. The updated Minute is an essential component in the future of the Colorado River system, and, therefore, Arizona's water future. Minute 323 extends, through 2026, Minute 319's program of joint cooperative actions to improve Colorado River water management. In addition, it "provides for the U.S. and Mexico to share proportionately in Lower Basin shortage and surplus, and [it] allows Mexico to create water savings in the Colorado River System in the U.S." Fortunately, in anticipation of agreement being reached on Minute 323, in early 2017 the Arizona Legislature passed, and the Governor signed, H.J.R. 2002 giving ADWR's Director the authority to approve the agreement on behalf of Arizona.[45]

Agreement must also be reached among the basin states as to the framework for the DCP. Once that agreement is in place, Arizona's State Legislature must pass a concurrent resolution pursuant to A.R.S. Sec. 45-106 that gives the ADWR Director the authority to enter into the agreement on behalf of Arizona.

Simultaneously, there must be agreement among all stakeholders within Arizona on how to "share the shortage" with respect to any voluntary reductions embodied in the final DCP agreement. The intra-state agreement, referred to as DCP-Plus, will hinge on the willingness of Arizona's major water users, including agricultural interests, Indian tribes, and cities, to forego some amount of water to which they are currently entitled. Without a DCP-Plus plan in place, Arizona cannot enter into an agreement with the other basin states.

While an agreement on DCP and DCP-Plus was expected in the first half of 2017, negotiations are still ongoing. To succeed, the DCP will require difficult compromises and legislative approval at both the state and federal level. The potential benefit for Arizona is a measure of certainty over Colorado River supplies that does not currently exist. In the long term, DCP will provide an important—and voluntary—opportunity for users to begin to consider how the state can build an economically robust future with limitations on surface water and groundwater use.

2. Ongoing General Stream Adjudications

Arizona's general stream adjudications have been called the longest and most complicated ongoing civil action in the history of American jurisprudence. Arizona's general stream adjudications (GSAs) are state court proceedings that determine the quantity, use, and priority of water rights in the river basins in Arizona, including those on federal and tribal land.[46]

Parties to Arizona's GSAs include cities, towns, utilities, Native American tribes, federal and state agencies, mining companies, developers, farmers, ranchers, individuals, and others. Many thousands of surface water rights claims in Arizona are tied up in these decades-long legal proceedings to determine the nature and priority of those rights; until those claims are resolved, Arizona will not have the kind of water certainty necessary for continued economic growth, as well as investment in additional water infrastructure, augmentation, and planning.

The adjudications originally began in 1974, when a request for adjudication was first filed in Arizona Superior Court. In the mid-1980s, the question of whether groundwater from wells was implicated in the adjudications first came to light; in 2000, the Arizona Supreme Court finally articulated legal rules for the interconnection between surface water and groundwater.[47]

Significant progress has occurred through settlement of many competing claims. While a large number of the big Indian claims implicated in the GSAs have been settled, the remaining claims are complex, interconnected, and very difficult to resolve for a number of reasons.

First, the GSAs involve both federal and state claims. Many of the federal claims do not involve diversion, but, rather, a requirement to maintain a certain level of in-stream flow. Up to now, those flows have not been much of a factor in non-federal water planning. With their adjudication, however, limits on other withdrawals will undoubtedly be required.

Second, although the GSAs represent one comprehensive proceeding over all the rights to surface water in Arizona, underground water is also implicated because of what is called "subflow"—that is, surface water that is flowing *beneath* the surface. The Arizona Supreme Court has made clear that when the pumping of underground water interferes with surface water flows, that underground water must be considered the flow of the river and is, thus, legally treated like surface water—not like groundwater. It is the job of ADWR to map subflow zones for each river and stream, and those subflow zone maps are to serve as guidance to the court in determining boundaries and flow rights.[48] Unfortunately, this mapping process has been delayed due to multiple factors, including disagreement among parties (and their attorneys) over delineation and inadequate judicial resources needed for the court to advance the process, among other things. In the meantime, the number of wells has increased dramatically; in the Verde Valley alone, there were roughly 1900 wells in 1974, but by 2015 that number had increased to nearly 7,000. Problematically, the vast majority of those well owners likely do not know that they do not have a right to the water they are pumping, and they will not know unless and until the adjudications are resolved.

Third, Arizona's existing legal framework for managing the GSAs involves a single Arizona Superior Court judge assisted by a part-time special master. It is important that the GSAs remain in Arizona state court (rather than federal court), but it is unrealistic to believe that a single judge—with a regular civil and criminal caseload—will succeed in timely resolving the adjudications when the individual claims number in the tens of thousands.

Clearly, there need to be reforms to the GSA process to more quickly conclude the litigation. Moreover, it would be helpful to ensure that those pumping water still have sufficient resources to satisfy their needs, even if they are found to lack the necessary rights. The Kyl Center for Water Policy at Arizona State University's Morrison Institute is working on some creative solutions that might include, for example, streamlining the adjudication process, promoting settlement of the outstanding federal claims, dedicating a judge or judges with water expertise to take over the adjudications, and developing a water management framework that could include the possibility of allowing the continued

pumping of existing wells up to a determined cap, water budgeting for municipalities, and/or sales of well rights under certain circumstances to create more certainty and flexibility in how water rights can be conserved, transferred, and sold. Ultimately, resolving the adjudications will require both urgency and a spirit of compromise.

Even with resolution of the adjudications, however, some uncertainty in Arizona's water future will remain. That is because Arizona's Groundwater Management Act only regulates the pumping of groundwater in the AMAs; groundwater in nearly half the state is entirely unmanaged, and many of the areas that are experiencing water controversy today are places that do not fall within existing groundwater management. For example, normal population growth in areas outside of AMAs, like Payson, Flagstaff, Mohave County, and communities along the Verde River and in Southern Arizona, have stressed Arizona's rural water supply.[49] While there has been some recent controversy surrounding out-of-state interests purchasing land in Arizona for agricultural purposes, it is important to recognize that Arizona landowners retain the right to sell their land to any buyer they choose. Yet Arizona has an interest in managing its water in arid areas regardless of who owns the land; as such, Arizona must contemplate some form of groundwater management statewide.

It is probable, therefore, that even in rural (non-AMA) areas, some new management of groundwater will be necessary for economic certainty and stability. That will undoubtedly entail difficult work. It will mean examining whether and how much communities should grow in the absence of a renewable water supply, limitations on existing pumping, and even the possibility of prohibiting new and additional pumping altogether in certain areas.

And, as we consider opportunities to update our policy framework governing groundwater and other issues, ensuring that Arizona's Department of Water Resources is adequately funded will undoubtedly impact our progress and ultimate success.

Just as the debate and passage of the 1980 Groundwater Management Act required collaboration and consensus to resolve difficult issues, so too will the resolution of the GSAs and the development of a statewide framework for groundwater management. But it is just as critical to our future now as it was then.

3. Active Forest Management and Watershed Health

The connection between Arizona's water supply and the state's forested watersheds is not just water quantity, as some might think, but both water quantity and water quality: a healthy forest equals a clean, reliable, and renewable water supply.

In fact, the federal legislation that created the National Forest Service (The Organic Administration Act of 1897) specifically identified "securing favorable conditions of water flows" as one of the objectives of the newly-created agency, and its first director recognized the important services provided by forested watersheds.[50] Indeed, one of the main reasons forests were set aside was to protect the watersheds of western communities.

In Arizona particularly, healthy forests are critically linked to maintaining a healthy watershed. "In Arizona, approximately 90% of surface water stream flow is generated within forested lands and the majority of these lands are managed by federal, state or tribal agencies. In the Salt and Verde River watersheds, ponderosa pine forests occupy only 20% of the watershed area, but provide 50% of the water yield. Fifty-nine percent of the watersheds that provide SRP and its members with high quality surface water are located on national forest lands. Additionally, Colorado River water originates in forested watersheds located primarily on national forest lands."[51] Given the quantity of Arizona's water generated within forested lands, ensuring those forests are healthy is essential to protecting Arizona's water supply.

For example, Prescott Forest Reserve (now known as Prescott National Forest), was set aside in 1898 to protect water sources. At that time, however, Forest Service managers had also instituted a policy of suppressing all fires, and this resulted in unhealthy and overgrown forests. By contrast, today's natural resource managers better understand the link between restoring health to forests and protecting water sources. That includes responsible forest thinning, removing invasive species, and repopulating native trees to reduce the risk and impacts of wildfires and help to ensure our watershed remains healthy and reliable.[52]

Forest health is important to water quantity because a healthy forest has fewer small diameter trees and intrusive brush, which means fewer plants competing for the relatively small amount of precipitation falling as snow or rain in Western states like Arizona. According to the Nature Conservancy, forest thinning in the Salt and Verde River basins could yield substantial additional water, possibly enough to offset water losses predicted from warming and drought conditions.[53]

Forest health is also important to water quality. In the absence of responsible forest and watershed management, catastrophic wildfires degrade the ability of forests to keep our watershed healthy: "burned watersheds are prone to increased flooding, changes in flow regime, and erosion that can shorten the lifespan of reservoirs and impair water quality, thus increasing costs of water treatment and infrastructure maintenance."[54]

Dr. Wally Covington, Ph.D., Executive Director of the Ecological Restoration Institute at Northern Arizona University, explains, "The ability of Arizona's forests to provide high-quality water has been compromised by degraded forest health." Overcrowded forests provide more fuel for unnaturally intense wildfires, which burn up vegetation and cause the soil to react in such a way as to not absorb water for a period of time after the fire. As a result, monsoon rains cause "serious erosion, moving tons of soil, downed logs and ash downstream where they clog up lakes and reservoirs."[55] Responsible forest thinning using modern modeling and technology can help to restore a natural, healthy balance in Arizona's forests, increase our water yield, and protect the quality of that water.

While there is a process in place that allows the U.S. Forest Service to thin forests, implementation of that process can be lengthy and cumbersome. Streamlining the process, and reducing costs by allowing for more private industry participation in forest thinning, will help to better protect Arizona's watersheds.

Specifically, when timber specialists work cooperatively with fire managers, they can help to restore forest health by removing the excess timber that crowds otherwise healthy trees, while at the same time providing jobs and supplying wood products for a variety of uses. As U.S. Senator Jeff Flake has pointed out, "Thinning too-dense forests in wildfire-prone areas and generating income by selling the trees and brush that have been removed can benefit the health of the forest, the nearby communities and the project partners."[56] Of course, monetizing forest thinning has its challenges, including rebuilding a once-thriving timber industry in parts of Arizona like Winslow, Holbrook and St. Johns, and finding a market for the kind of biomass like small trees and brush that are removed through treatment. The key is finding a balance between maintaining Arizona's forests as functional watersheds and allowing growth to be harvested at a sustainable market rate.

In addition, addressing the problem of "fire borrowing"—where federal funding for managing forests has been limited and forest managers have had to "borrow" from funds available to treat (or thin) forests to pay for fire management—is critical to ensuring Arizona's forests and watersheds remain healthy.[57]

IV. The Path Forward

Moving beyond the era of drought and litigation while enjoying robust growth will require creative solutions for water use, conservation, and augmentation. Governor Doug Ducey's Water Augmentation Council was formed to investigate long-term water augmentation strategies, additional water conservation opportunities, funding, and infrastructure needs to help secure water supplies for Arizona's future. The Council, led by ADWR Director Tom Buschatzke and comprised of water resource experts, watershed groups, local government, and industry leaders in Arizona agriculture, mining, and homebuilding, is considering a variety of opportunities for augmentation, including through desalination,[58] potable reuse, and infrastructure upgrades.

Before Arizona invests in expensive augmentation infrastructure, however, we must ensure that we have created a modern policy and legal regime that allows the kind of flexibility needed to put existing supplies and infrastructure to the most efficient and effective use.

For example, our SRP and CAP systems offer vast opportunities to move water around the state, provided we have the tools in place to allow conjunctive use of those systems. In February 2017, CAP and the Bureau of Reclamation signed a system use agreement that allows CAP to move non-project water through the canal.[59] This an important first step in obtaining more operational flexibility in how we use our water infrastructure.

In addition, increased flexibility in water use and management would allow cities or other entities to invest in efficiency projects that free up water and that, in turn, allow that saved water to be used in the future by the city or other entity making the investment. While water transfers raise numerous legal issues, there may be some situations where they make sense.

At the federal level, there are a variety of efforts that would also increase Arizona's ability to better manage our state's water supply. For example, even though entities within Arizona manage our state's reservoirs, the federal Army Corps of Engineers determines reservoir levels for flood control purposes. Yet those levels are not necessarily the most efficient given hydrological and other environmental considerations here in Arizona. While there is a process to request a review of a particular flood level, that process is bureaucratic and lengthy. Efforts to streamline the process for ruling on dam review requests would give Arizona the ability to better manage its own reservoirs. Senator Jeff Flake's 2016 drought bill, the Western Water Supply and Planning Enhancement Act (S. 2902), called for the re-evaluation of flood control operations to western storage reservoirs, including those under the domain of the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, or non-federal reservoirs, in order to use up-to-date forecasting methods and hydrology to enhance water storage and overall supply.[60]

The bill also directed a study by the National Academy of Sciences and an implementation plan by the Department of Interior on how to best control water-intensive invasive species like tamarisk. This type of legislation could be a helpful tool in beginning to get Arizona's invasive species under control (though some of Arizona's native species, like cottonwood and willow, do also consume significant water). These critical Arizona issues—Colorado River conservation programs, forestry and watershed health, tamarisk management, and reservoir flood release updates—are now part of a forthcoming federal legislative package that aims to "encourage development of needed water infrastructure, remove barriers to better management of existing infrastructure, and increase supply certainty for communities so they can attract greater private investment and innovation in water projects."[61]

Agricultural water use is also an important part of the equation. While Arizona's agricultural communities already employ some of the most innovative agricultural technologies in the country, technology is ever-evolving, and there may yet be opportunities in parts of the state for innovation. Increased use of drip irrigation,

laser leveling, automation, and other new technologies all offer opportunities to increase the efficiency of our agricultural water use, which can in turn yield more water for agriculture and other uses.[62]

Another arrangement being discussed by cities and growers is one where marginal lands are fallowed in dry spells (without losing legal rights) and the water that would have been used to irrigate them is instead dedicated for municipal and industrial uses. This kind of flexibility and investment in agricultural efficiencies will be important as demands on our growers continue to increase.

In Arizona, innovation in water use and conservation is not unique to agriculture. Companies like Intel, Boeing, and Tork have made significant investments in water conservation and efficiency programs in the state. Arizona's golf industry is also a leader in water conservation and efficiency and is a model for how the public and private sectors can work together, if provided the flexibility to do so: Scottsdale and Tucson, for example, desalinate treated effluent and deliver it to golf courses for irrigation purposes.[63] Likewise, Palo Verde Nuclear Generating Station, the largest nuclear power plant in the United States and the only one in the world not located next to a large source of water, uses treated wastewater from five Phoenix-area cities to cool its nuclear cores.[64] Collectively, our private and public sectors have proven that industry can thrive in Arizona.

It is also important to acknowledge Arizona's tribal communities, who collectively share a significant and high-priority allocation of Colorado River water and want to be part of the solution. Arizona's leaders and stakeholders should welcome opportunities to include tribal leaders in any future discussions, negotiations, and agreements to lease tribal water within Arizona, to leave additional water in Lake Mead, or another solution altogether.

Finally, during the summer and fall of 2017, Governor Ducey led an effort to convene stakeholders from across Arizona to discuss—and ultimately agree on—ways to update and modernize Arizona's water laws. The Governor's "water conversations," which include representatives from Arizona's municipalities and counties, agricultural community, private industry, tribes, and others, will ultimately culminate in legislative and regulatory recommendations aimed at addressing some of Arizona's most pressing water challenges.

Supporting a framework that provides greater flexibility, not only in the transferability of water among willing partners but also in how Arizona manages its surface water and groundwater, could address decades of water need while protecting Arizona's various industries and interests and providing the level of certainty necessary for Arizona's continued growth and development.

V. Conclusion

Arizona has a history of water stewardship it can be proud of, but we are now at a crossroads.

As we face down the effects of a 17-year drought, ongoing structural water deficit, unresolved water rights claims, and changing environmental considerations, Arizonans must do the difficult work of updating our legal and policy framework governing water.

Undoubtedly, this work will require the consideration of some difficult problems, including inter- and intra-state agreement on DCP; resolution of the general stream adjudications; and, finally, putting some regulations in place over the pumping of groundwater statewide. Overlaying all of these are larger questions about how much water we have, how much we should use, and what we should be using it for.

Even given the uncertainty we face, our state's history makes it clear that if we approach the task at hand with a spirit of compromise and collaboration and with an eye toward Arizona's long-term future, we will succeed.

Additional Resources

Groundwater: To Enact a Law for the Common Good
Film Documentary
http://www.groundwatermovie.com/

Arizona's Water Future: Challenges and Opportunities
85th Arizona Town Hall, 2004
http://aztownhall.org/85

Keeping Arizona's Water Glass Full
107th Arizona Town Hall, 2015
http://aztownhall.org/107_Town_Hall/

M. Byron Lewis, New Era of Arizona Water Challenges
Morrison Institute for Public Policy
Arizona State University, May 2014
https://morrisoninstitute.asu.edu/sites/default/files/content/products/waterchallenge.pdf

A Case Study in Efficiency, Agriculture and Water Use in the Yuma, Arizona Area
Yuma County Agriculture Water Coalition, February 2015
http://www.agwateryuma.com/

Reclamation: Managing Water in the West, Colorado River Basin Water Supply and Demand Study
U.S. Department of Interior, Bureau of Reclamation, December 2012,
https://www.usbr.gov/watersmart//bsp/docs/finalreport/ColoradoRiver/CRBS_Executive_Summary_FINAL.pdf

Kyl Center for Water Policy
Morrison Institute for Public Policy, Arizona State University
https://morrisoninstitute.asu.edu/projects/kyl-center-water-policy

End Notes

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2 A.R.S. 45-101.

3 *See* U.S. Department of Interior, Bureau of Reclamation, Lower Colorado Region, "Law of the River," https://www.usbr.gov/lc/region/g1000/lawofrvr.html.

4 *See* Arizona Department of Water Resources, Colorado River Management, Overview, http://www.azwater.gov/AzDWR/StateWidePlanning/CRM/Overview.htm.

5 ARS 45-101.

6 Kyl Center for Water Policy, Five Eras of Water Policy.

7 L. William Staudenmaier, Arizona Groundwater Law, The Water Report, Nov. 15, 2006, at 9.

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9 SRP, A History of Service, http://www.srpnet.com/about/history/.

10 Sen. Jon Kyl & Ryan A. Smith, Forward, 49 Ariz. L. Rev. 209 (2007); *see also* A Desert Transformed: Water Reclamation a Key to Growth, A History of the Salt River Project, http://www.srpnet.com/about/history/water.aspx.

11 SRP, A History of Service, http://www.srpnet.com/about/history/.

12 SRP, A History of Service, http://www.srpnet.com/about/history/; see also Active Management Area Water Supply - Surface Water, Arizona Department of Water Resources, www.azwater.gov.

13 Active Management Supply – Surface Water, Arizona Department of Water Resources, http://www.azwater.gov/azdwr/StatewidePlanning/WaterAtlas/ActiveManagementAreas/PlanningAreaOverview/WaterSupplySurfaceWater.htm.

14 History, Central Arizona Project, http://www.cap-az.com/about-us/history.

15 History, Central Arizona Project, http://www.cap-az.com/about-us/history.

16 Public Law 90-537 (82 Stat 885).

17 History, Central Arizona Project, http://www.cap-az.com/about-us/history.

18 Jennifer E. Zuniga, The Central Arizona Project (Bureau of Reclamation, 2000).

19 Mary A.M. Gindhart, The Babbitt Legacy—Water Management (1986).

20 Central Arizona Project, About Us, https://www.cap-az.com/about-us.

21 Demand has steadily declined since the 1980s, and current total annual demand is now slightly below the 1950s level.

22 Mary A.M. Gindhart, The Babbitt Legacy—Water Management (1986).

23 Arizona Department of Water Resources, Overview of the Arizona Groundwater Management Code, www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf.

24 "Arizona's historic Groundwater Management Act of 1980: How the state's most celebrated water management tool came to pass," Arizona Water News: 1980 Groundwater Management Act, Nov. 18, 2016.

25 ADWR, Securing Arizona's Water Future, Overview of the Arizona Groundwater Management Code.

26 *See* ADWR, Overview of the Groundwater Management Code.

27 The AWBA utilizes the CAP system to bring Colorado River into Central and Southern Arizona. Each year, the AWBA pays the water delivery and storage costs to bring Colorado River water via the CAP canal into Central and Southern Arizona, where the water is either stored underground in aquifers (called direct recharge) or is used by irrigation districts in lieu of pumping groundwater (called indirect recharge). The AWBA accrues long-term storage credits that can be recovered and used in the future during times of shortage. In 2014, the AWBA was also given the authority to purchase existing long-term storage credits for the same purposes for which the AWBA has historically stored water. *See* Arizona Water Banking Authority, Background, http://www.azwaterbank.gov/Background/.

28 Arizona Water Banking Authority, Background, http://www.azwaterbank.gov/Background/.

29 In 2015 alone, the AWBA recharged 70,340 acre-feet of CAP water, all of which was for Arizona uses. To break it down: Arizona's annual allocation of Colorado River water is 2.8 million acre feet; in 2015, Arizona's total consumptive use of Colorado River water was approximately 2.6 million acre feet. Of that, approximately 1.08 million acre feet were used directly along the Colorado River, and 1.52 million acre feet were used by CAP; the balance was stored and recharged by AWBA.

30 Arizona Department of Water Resources, Securing Arizona's Water Future, Overview of the Arizona Groundwater Management Act.

31 Arizona Department of Water Resources, Securing Arizona's Water Future, Overview of the Arizona Groundwater Management Act.

32 Arizona Department of Water Resources, Securing Arizona's Water Future, Overview of the Arizona Groundwater Management Act.

33 Kyl & Smith, Foreward at 215.

34 *See Winters v. United States*, 207 U.S. 564 (1908).

35 Kyl & Smith, Forward at 215, *citing* Colby et al.

36 Kyl & Smith, Forward at 215.

37 Pub. L. No. 108-451, 118 Stat. 3478 (2004).

38 Kyl & Smith, Forward at 215.

39 John B. Weldon, Jr. & Lisa M. McKnight, Future Indian Water Settlements in Arizona: The Race to the Bottom of the Waterhole? 49 Arizona Law Review Vol. 441, 442 (2006).

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41 Agreed to in 2007, the Interim Guidelines are officially called the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead.

42 The Colorado River Compact of 1922 (Arizona joined in 1944) divides the Colorado River equally between Upper Basin (upstream of Lee's Ferry, meaning small part of Arizona and all of Utah, Colorado, Wyoming and New Mexico) and Lower Bain (Arizona downstream of Lee's Ferry, California, and Nevada). Each basin received 7.5 million acre feet of water per year. The 1944 Rivers Treaty with Mexico allocates Mexico 1.5 million acre feet per year. In 1963, the United States Supreme Court ruled in *Arizona v. California* that all waters from Arizona's tributaries do not count against Arizona's allotment of mainstream Colorado River Water, and apportioned the Lower Basin's allotment based on the Boulder Canyon Project Act. As a result, California is entitled to 4.4 maf, Arizona is entitled to 2.8 maf, and Nevada is entitled to .3 maf. The 2007 Colorado Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead set shortage "trigger levels" that govern reduced delivery amounts. *See* Kyl Center for Water Policy, Five Eras of Water Policy; Central Arizona Project, Drought Contingency, https://www.cap-az.com/departments/planning/colorado-river-programs/drought-contingency.

43 Central Arizona Project, Lower Basin Drought Contingency Plan Fact

Sheet, www.cap-az.com/documents/shortage/FactSheet_ADWR_DCP.pdf.

44 Brandon Loomis, "Arizona Closes in on Water Compact," The Arizona Republic, A10, Jan. 23, 2017.

45 Press Release, Arizona Water Resources Director Joins U.S. & Mexico in Finalizing Epic CO River Agreement, Sept. 27, 2017, available at https://new.azwater.gov/news/articles/2017-27-09.

46 In *Winters v. United States*, the Supreme Court set the precedent that when the U.S. reserves public land, including Indian reservations, monuments and national parks, it implicitly reserves water rights sufficient to meet the primary purpose of the reservation. Kyl Center 5 eras of water policy; 1952 McCarran Amendment, which waived federal sovereign immunity in this context.

47 M. Byron Lewis, New Era of Arizona Water Challenges at 9, 11-12, Morrison Institute for Public Policy, May 2014, https://morrisoninstitute.asu.edu/sites/default/files/content/.../waterchallenge.pdf.

48 *See generally* M. Byron Lewis, New Era of Arizona Water Challenges, Morrison Institute for Public Policy, May 2014, https://morrisoninstitute.asu.edu/sites/default/files/content/.../waterchallenge.pdf.

49 *See* Kyl & Smith, Forward at 216.

50 Keeping Arizona's Water Glass Full, 107th Arizona Town Hall (November 2015), at 42.

51 Keeping Arizona's Water Glass Full, 107th Arizona Town Hall (November 2015), at 42.

52 Prescott National Forest, National Forest Service, U.S. Department of Agriculture, https://www.fs.usda.gov/resources/prescott/landmanagement/resourcemanagement.

53 Arizona, Restoring Our Forests for a Secure Water Future, The Nature Conservancy, https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/arizona/restoring-arizonas-forests.xml.

54 Keeping Arizona's Water Glass Full, 107th Arizona Town Hall (November 2015), at 42.

55 Forest Restoration on Watersheds, Northern Arizona University, May 3, 2012, https://www.nau.edu/centers-institutes/eri/publications-media/news-items/forest-restoration-on-watersheds/.

56 U.S. Senator Jeff Flake, Issues, Energy & Environment, https://www.flake.senate.gov/public/index.cfm/energy-and-environment.

57 See, e.g., Press Release, "Senators Work to Improve Forest Management and Wildfire Budgeting," U.56 S. Senate Committee on Natural Resources, May 25, 2016, available at https://www.energy.senate.gov/public/index.cfm/2016/5/senators-work-to-improve-forest-management-and-wildfire-budgeting.

58 While desalination technology is currently very expensive, as technology continues to evolve and costs come down, desalination could prove to be an important piece of Arizona's water augmentation strategy in the future.

59 Central Arizona Project, CAP System Use Agreement, http://www.cap-az.com/departments/planning/service-area-planning/cap-system-use-agreement.

60 *See* Western Senators Applaud Committee Passage of Drought Bill, July 16, 2016, https://www.flake.senate.gov/public/index.cfm/2016/7/western-senators-applaud-committee-passage-of-drought-bill.

61 Press Release, Energy and Natural Resources Committee Developing Western Water and Drought Legislation, U.S. Senate Committee on Energy and Natural Resources, Oct. 10, 2017.

62 There is also room for smaller-scale innovation. For example, a new technique called "vertical farming," in which crops are grown in beds stacked vertically inside a controlled-environment building without soil or natural light, could be a natural fit for Arizona's agricultural landscape. Using the same technology employed by NASA to grow plants on the International Space Station, vertical farming implements LED lights, a recycled cloth material, and a nutrient-rich mist to grow crops virtually identical to those grown conventionally; the main difference is that aeroponic crops, as they are being called, use up to 95% less water than their conventionally-grown counterparts. *See* http://www.cnn.com/2016/09/05/world/aerofarms-indoor-farming/.

63 Because of important Arizona Supreme Court precedent, cities have great flexibility in how they use effluent once it is treated.

64 Nuclear Energy, The Arizona Experience, http://arizonaexperience.org/innovate/nuclear-energy.

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