Fostering Public Engagement in Water Choices: Lessons from a Sun Corridor Workshop

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Abstract

Water is an essential component of growth, sustainability and land policy throughout the Colorado River Basin. As Mark Twain famously said of the American west; “whiskey is for drinking and water is for fighting over”. Today these “fights” most often occur in the form of policy debates about water rights, water policy, infrastructure investments, and climate. Western Lands and Communities (WLC) is seeking to inform these debates and advance efforts to expand public engagement. Toward this end, WLC sponsored a workshop in January 2012 to engage the public on the topic of water and on our key water policy choices, the values that underlie these choices and the challenges we face. This paper provides a brief overview of these challenges, and synthesizes information from the workshop including: background essays prepared in advance of the workshop, identification of the fundamental value choices, the results from both small group discussions and key pad polling conducted during the workshop and potential next steps in this engagement effort.

Prominent themes from the workshop covered in the discussion of workshop results include: strong support for the continuation of agriculture, an increasing priority for allocating water to support the natural environment, and a call for increased dialogue and public engagement on water issues. Participants also recognized the significant uncertainties in our water future and the need to address these issues.

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Jim's principal areas of interest include western water policy, linkages between water and growth, land use management, and mechanisms to empower communities to shape their future. Jim earned his bachelor's degree in Political Science from Cornell University and both a Ph.D. and Masters in Regional Planning from the University of North Carolina. Jim was recently inducted into the College of Fellows of the American Institute of Certified Planners.

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Paula Randolph led the Sonoran Institute efforts with respect to the logistics for the workshop including ensuring the agenda feasibility, vetting of the background material, creation of all public relations material and marketing the workshop. Mia Stier is responsible for upkeep of our web presence. Erika Mahoney learned the keypad polling system for this workshop and provided outstanding "on the fly" modifications including creation of "instant" additional questions. Erika also provided initial analysis of the polling results and Ray Quay conducted the supplementary analysis by group and cluster analysis of the polling data.

Our expert speakers and commentators for the workshop were: Grady Gammage, Ray Quay, Gary Nabhan, George Frisvold and Joseph Marlow

We benefited from an informal advisory committee that provided feedback on the overall workshop objectives and design as well as initial drafts of the water policy issues prepared by Alexandra Arboleda. Our advisory committee, who of course, bear no responsibility for any mistakes or shortcomings in the workshop included: Lisa Atkins, Grady Gammage, Bruce Hallin, Ken Seasholes, John Shepard and Ray Quay. Ray Quay also provided significant assistance with the keypad polling questions. Sarah Bates also provided advice on workshop approaches for facilitating value discussions.

We are grateful to the University of Arizona's Water Resources Research Center and their staff for allowing us to conduct this interactive workshop in conjunction with their annual water conference. We particularly acknowledge Jane Cripps for all of her help on the workshop registration and logistics, as well as securing the keypad polling devices.

The Morrison Institute for Public Policy at ASU was our collaborator on this workshop and the producer of the Watering the Sun Corridor report which informed and motivated the workshop. In addition to the Lincoln and Sonoran Institutes, other major funders of the Morrison Institute report included the Decision Center for a Desert City at Arizona State University and the Salt River Project. We particularly appreciated the assistance of Grady Gammage, lead author on the report. David Daugherty and Joseph Garcia assisted with the overall conceptualization of the workshop

And finally, we extend our appreciation to the approximately 85 participants who joined us for the workshop at the University of Arizona and to the volunteer table recorders and facilitators at each of the eleven tables.

About Western Lands and Communities

Now in its ninth year, Western Lands and Communities (WLC) focuses on shaping growth, sustaining cities, protecting resources, and empowering communities in the Intermountain West. It addresses these challenges through applied research, tool development, exploring policy linkages between land and related natural resources, and engagement of policy makers. We regularly rely on demonstration projects to apply and test innovative approaches and focus on dissemination of the lessons learned through working papers, Policy Focus Reports, presentations, and engagement with policy and decision makers. The geographic scope of WLC is the Intermountain West, from the Sun Corridor megaregion in Arizona to Montana's Crown of the Continent. Partners since 2003, the Lincoln Institute of Land Policy and the Sonoran Institute established the joint venture to further their complimentary and overlapping missions to shape the future of the Intermountain West by informing land use and related natural resources policy. WLC's efforts are organized into four major integrated areas:

Urban Form and Smart Growth Research
Visioning and Planning Tools
State Trust Land Management
Western Land, Water, Energy and Climate Policy Linkages

To learn more, please visit our webpage at www.westernlandsandcommunities.org.

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Introduction

Water is an essential component of growth, sustainability and land policy in the desert southwest. As Mark Twain famously said of the American west; "whiskey is for drinking and water is for fighting over"[1] Today these fights most often occur in the form of debates about water rights, water policy, infrastructure investments, and climate. Although these debates typically involve only small groups of experts and elected officials, effective water management will increasingly require broader public engagement and more participatory governance mechanisms.

Western Lands and Communities' Water Engagement Initiative seeks to inform these efforts. Western Lands and Communities supported a recent report "Watering the Sun Corridor," which highlights issues around managing water choices in central Arizona. A workshop was held in January 2012 to follow-up on the report and advance efforts to engage the public on the topic of water. This paper synthesizes the fundamental value choices identified and the background essays prepared for the workshop, the workshop discussions and the results from both small group discussions and key pad polling conducted during the workshop. The fundamental questions asked were:

- What are our key water policy choices?
- What values underlie these choices?
- Will we face difficult tradeoffs between different uses of water?
- What are our priorities and how will we address the challenges we face?

This workshop, as well as the larger Western Lands and Communities (WLC) initiative, is based on the premise that a variety of voices need to be heard and more people need to be engaged as we shape the major water policy choices that will impact our quality of life and the sustainability of our region in the future. Because water policy often becomes complicated and technical, the general public typically is not engaged in decisions about how we use and manage water in Arizona. Looking forward, when our water demands exceed our current supplies, we will increasingly be faced with difficult choices involving a variety of trade-offs. These choices, however, are not at their core legal or technical questions. The choices involve our community's underlying values about water. We all benefit if a wide array of voices participate in the conversation about how we use and manage the future of Arizona's water. In fact, this larger public engagement may well be necessary to support future investment in water infrastructure, institutions and policy. Before turning our attention to the workshop issues and discussion, the section

[1] Although this quote is attributed to Mark Twain, assumed to be in reference to water issues in California, there is no veracity as to its attribution.

below provides some context for Arizona water management. For additional background, see the fact sheet in the appendix or the full "Watering the Sun Corridor" report.

The Context – Arizona and the Colorado River Basin

The Colorado River Basin

Central Arizona receives approximately 38 percent of its water from the Colorado River, and looks to the river as the mostly likely source of additional supply for future growth. However, the Colorado River supplies the water needs of more than 30 million people and more than 2.4 million acres of irrigated farmland in the U.S. and Mexico. Seven fast-growing metropolitan areas — Denver, Las Vegas, Los Angeles, Salt Lake City, San Diego, Phoenix, and Tucson — and a greater number of smaller communities and Native American communities rely, at least partially, on Colorado River water. This river also supports a wide array of native biodiversity and a globally significant ecosystem, the Colorado River Delta.

The sustainability of this region and many of the threats facing the Colorado River are directly related to how the river is managed. River flows have been significantly altered to meet urban and agricultural needs and they bear little resemblance to the natural, historic flows that coursed through all seven basin states and into Mexico.

Over the past decade, it has become clear that the management system for Colorado River water may be inadequate for the challenges we face. Continued growth in demand, in combination with a persistent drought and the uncertainties associated with climate change, are creating critical water supply challenges throughout the Colorado River Basin that will increase in severity in the decades to come.

Water providers, conservationists, and others who are intimately familiar with Colorado River water management are evaluating actions to address likely shortfalls. There is also growing recognition among some leaders in the Basin that future water management discussions will need to be more inclusive. Given the difficult choices facing various interests in the Basin — expanding metro areas, Native American communities, farmers, energy developers, and conservationists, to name a few — there will be a need to build broad support among these groups and across the Basin to address these challenges.

Arizona's Sun Corridor: A Lynchpin for the Lower Basin?

With the Colorado River's water rights in the Lower Basin now fully utilized and subject to shortages, the Lower Basin states of Arizona, California and Nevada, and Mexico face significant challenges in the years to come in meeting their growing water needs.

In this context, the Sun Corridor's growing dependence on Colorado River water via the Central Arizona Project (CAP) and the possibility of transporting additional amounts of water from the river (from agricultural and tribal water users with rights to Colorado

River water) to meet growing demand represents one of the most significant variables in planning the future of Lower Basin water supplies. Unlike California or Nevada, long–term water right holders in Arizona are not fully utilizing their share of the Colorado River. A portion of Arizona's water from CAP is currently stored underground for later use, and in central Arizona, agricultural users who retain no rights to CAP water, avail themselves of the supplies that are not yet required for municipal and industrial users. Moreover, central Arizona retains significant groundwater reserves that could be tapped in times of need, providing greater flexibility in future water management decisions, especially in terms of how much of the Colorado River it will require to sustain its population. As such, how water is managed to serve current and future populations in central Arizona will profoundly shape the future of the entire Colorado River Basin.

Arizona's Sun Corridor has been identified by demographers as the youngest but fastest growing of the nation's 11 megaregions. This region stretches from the middle of Yavapai County to the border with Mexico. It is now home to approximately five million people — more than three quarters of Arizona's population. In the next 30–40 years, the Sun Corridor's population is expected to expand notably, although projections are now in flux considering the recession and the slowdown in migration and immigration. As the state looks to position itself for a better future, the choices concerning governance, transportation, competitiveness, livability, and, in particular, water come into sharp relief.

In any conversation about the future of Arizona's water, there is an expectation, both within Arizona and from the outside looking in, that water supplies will constrain the continued urbanization of the state. On the other hand, there is a strong countervailing tendency on the part of many Arizona water managers and policy makers to dismiss such concerns. Western Lands and Communities supported the "Watering the Sun Corridor" report and workshop to provide information for policy makers or interested parties to critically analyze the big picture of urban Arizona's water future at the scale of the overall Sun Corridor megaregion.

Within the Sun Corridor, coordinated water management is also lacking at a regional scale. Encompassing five counties and over 40 local jurisdictions, the Sun Corridor includes five separate Active Management Areas (AMAs are groundwater basins subject to comprehensive water management programs in Arizona) and additional rural areas outside of AMAs.

The lack of a regional perspective on water issues also reflects the fact that there is no framework for identifying, evaluating, or implementing appropriate policies related to water supply and demand at a megaregion scale. Tension currently exists between rural water needs and urban demand centers as well as between major water users and providers within the urban areas that could greatly benefit from a dialogue focusing on the mutual benefits of new policy approaches.

Defining Water Challenges and Opportunities in the Sun Corridor

Development of a clear picture of the challenges and choices this region faces still requires progress in several areas. First, discussions need to involve a long-term (40 to 50 years) view. We also need to adopt a basin-wide perspective. Additionally, most management and policy efforts have focused on securing new water supplies or slightly modifying the existing regulatory framework. These efforts will need to consider the more profound implications for water management in an era of water supply uncertainty triggered by climate change or periodic prolonged droughts as well as uncertainty about future population growth and the economy that drives water demand. Finally, these discussions need to extend beyond the usual cadre of experts.

Historically, water policy in Arizona has been the purview of professional water managers and attorneys affectionately referred to as "water buffalos"[2]. Their traditional approach to water policy is "It's water; it's complicated; the experts all agree; so trust us." This approach was instrumental in putting into place current legal and management frameworks. Future reforms, however, will be costly and controversial, involving trade-offs and politically difficult choices. Such reforms will require broad-based leadership that draws from local jurisdictions and business and civic leaders within the Sun Corridor and throughout Arizona as well as the broader southwestern United States including the Colorado River Basin.

Climate change and growth are two central challenges in determining the nature and extent of necessary water policy changes and infrastructure investments. The historic reality of drought cycles and climatic uncertainty, combined with the need to project distant future conditions for water management, provide an opportunity to engage in research and dialogue about how global climate change could impact Colorado River Basin supplies. In fact, water is quite likely the issue around which climate change impacts will first be addressed in Arizona and the West and, ultimately, acknowledged as a reason to pursue more sustainable water management within the Colorado River Basin.

Workshop Objectives and Issues

Drawing on these perspectives, WLC identified a number of objectives for the Watering the Sun Corridor Policy Workshop and longer term efforts.

- Initiation of a broad-based policy dialogue on our water management future that engages civic and business community leaders and Arizonans generally and provides an opportunity to establish a "consensus" vision for how we use and manage water.
- An understanding of the key policy choices and the implications of those choices, including trade-offs, initially focused on the big picture "value" choices, but

[2] Water Buffalo is a term used to describe the experts who have spent much of their careers working on water policies in the West, usually representing a particular water user perspective but sometimes as senior officials or administrators of state and federal water management agencies as well.

ultimately drilling down to shape the detailed water management policies, rules and statutes.

- An understanding of the key driving forces that will shape Arizona's water management needs, challenges and opportunities and recognition of the need to take long-term perspectives that can address the uncertainty of these driving forces.

Ultimately, the goal for this effort is to help secure broad-based long-term support for necessary policy changes and infrastructure and institutional capacity investments

Highlighted Water Policy Issues

We selected four areas of water use to initiate dialogue about our community's values regarding water: Agriculture, Natural Environment, Public (Aesthetics and Urban Environments), and Household (Our Lifestyle of Affluence). These four areas of water use were selected because they illuminate high value choices and the role of individual water users. The Workshop discussions revolved around these issues and were informed by four brief issue synopses. The four synopses were intended to stimulate discussion and highlight the value and policy choices Arizonans need to make in a thought-provoking and balanced way. Although some water managers may take exception to the underlying assumption of eventual water scarcity and the portrayal of choices as involving difficult trade-offs between different water uses, this approach was a useful way to focus the discussion.

Workshop participants were invited to formulate their own list of water issues facing Arizona and then come to the workshop prepared to share their ideas, concerns, and questions. As participants reviewed the advance materials and evaluated the four issues, they were asked to consider a number of overarching questions that would apply to these as well as other water issues, and also to consider the uncertainties that will impact water choices, and the constraints that might limit available options.

Questions:

- Who will decide what our underlying values are about water?
- How will these value choices be made and implemented?
- Should policies be established to influence how water is used in the future or do we want to rely more on market mechanisms?
- Are the current governing institutions and rules sufficient to establish and implement our vision?

Uncertainties:

- Several driving forces that will shape the future of our region are increasingly uncertain, including population growth, climate change, and the economy.

- How can we best prepare for an unknown future and ensure we will be able to adapt to whatever we may face?

Constraints:

- There will certainly be legal, physical and economic constraints that limit our ability to implement our future vision for water use.
- How will we overcome such obstacles with respect to each issue we consider?

Water Management Issues and Choices

Discussions concerning agriculture, the natural environment, public and household uses of water raise a number of value and factual questions as well as differing perceptions and priorities. In order to prepare workshop participants for these discussions, WLC distributed a fact sheet (see appendix), an overview of the workshop with questions to consider (see the "highlighted water policy issues" section above) and four brief issue papers. The material in the following section was extracted directly from the four issue synopsis papers distributed in advance of the workshop[3].

Introduction of Selected Issues

Development in the Sun Corridor began with agriculture. Early Native American people who lived in the area relied on local rivers, capturing storm run-off to grow their crops, and initial settlers also found the water supply and climate conducive to agricultural abundance. Over time, the economy in Maricopa and Pima counties has transitioned to urban uses of water and away from agrarian uses. In other parts of the State, agriculture still accounts for a large portion of the economy.

Living in an arid climate, we truly appreciate the life-sustaining force of water. A desert stream evokes a sense of beauty and reverence with its ribbon of cottonwood and willow trees teeming with birds in stark contrast to the desert vegetation surrounding it. Such juxtapositions remind us of our own fragility and dependence on water for our survival, and help us understand that the worth of our society will be measured by our ability to give true value to the resources that we use from the Earth. In the past we have viewed water as a public right that is always available for our use if we can harness its potential. More recently, we have begun to realize that we have a limited supply of water in the desert, and that there a number of economically valuable services provided by healthy watersheds that are still not recognized or provided a water right.

People who live in an arid environment truly celebrate water. The life-giving force of water is deeply ingrained in who we are and in what our culture values. We celebrate rain and congregate around aesthetic water features. Public water uses that benefit all rather

[3] The content from the four issue papers has been combined here and reorganized. The issue papers provided at the workshop as well as the other materials related to the workshop, are available on the workshop webpage at: http://www.sonoraninstitute.org/watering-the-sun-corridor-workshop.html.

than just a few individuals include parks, lakes, fountains, pools and canals. These water uses represent another value choice that a community makes about how to use its water. Tempe Town Lake, an approximately 200 acre lake in the otherwise dry Salt River bed, is the most recent example of a major and controversial use of water to create an urban amenity. The lake serves as a vibrant social and recreational hub for the community and has encouraged surrounding economic development, but it also requires consistent infusion of water to keep full. In addition, several other water and habitat projects comprise efforts to use effluent to artificially restore degraded stretches of rivers and create new wetlands thus providing significant environmental and recreational values to their respective communities.

Although there are large variations by community, in Arizona's Sun Corridor, residents typically live in single family homes with good-sized yards, which often include irrigated lawns and backyard pools. Irrigated golf courses and lushly landscaped resorts with swimming pools and water slides can be found in many Sun Corridor communities. Increasingly, we cool ourselves in the summer by dining or relaxing under high pressure water misters. The Sun Corridor lifestyle may seem ostentatious to some, but it is what draws many people to southern Arizona and encourages them to stay.

Our lifestyle and our uses of water are choices and raise a number of important questions for us to consider. How important are these types of water uses to our community and are we willing to make sacrifices to maintain them? If we don't want to change these uses, what else are we willing to give up to garner more water for urban uses and to accommodate additional growth? If in fact we do want to change our lifestyle and encourage more conservation, what is the most effective way to encourage water conservation?

Challenge Statements and Questions

Agriculture

Agriculture accounts for approximately 70 percent of water use in Arizona, 47 percent in Maricopa County, 96 percent in Pinal County and 32 percent in Pima County. Some people believe that agriculture should be preserved in the Sun Corridor, while others argue that the market should decide and urban uses should be allowed to replace agriculture. What is your vision for the future of agriculture in the Sun Corridor and why?

Natural Environment

Throughout Arizona, we have removed water from our natural environments to serve our populations, supply our industries and irrigate our farms. We have provided water rights to these new uses, but generally have not provided a means to sustain our natural environments. When we are faced with trade-offs, will we choose to grow cotton in the desert, have backyard swimming pools, and build artificial lakes or will we leave water in the stream for cottonwood trees, flycatchers and fish? What is the "right" or "best" choice and who should decide?

Public and Aesthetic Use

Aesthetic uses of water that are enjoyed by many people in an urban environment are an important part of many Sun Corridor communities. Examples include urban lakes, fountains, and other water features. Because they are primarily aesthetic, some people question whether they are a wise use of water in a desert community. Are the benefits of aesthetic water uses worth the costs, especially if a large number of people enjoy them? Are we willing to limit our private water use or move water away from agriculture and the natural environment so that we can have public uses of water for aesthetic value?

Household Use

The Sun Corridor is one of the fastest growing areas in the country, in part because of opportunities that are available for a prosperous lifestyle. To maintain our lifestyle and a healthy economy in the future, we may have to make difficult choices about household water use. Are we willing to live in homes without lawns and backyard pools so that we can accommodate more people, save water for business development, continue agriculture, sustain the environment, or use water for our public landscapes?

Water Use Considerations and Perspectives

Agriculture

- Some people believe that Arizona is an ideal place to grow crops because of the year round sunshine, which allows for an extended growing season. Arizona has a competitive advantage over other places because it can produce more foodstuffs and goods with the longer growing season.
- Agricultural preservation in the United States reduces our dependency on other countries for our vital needs.
- Local production of food and fiber gives people an appreciation of where their food comes from and encourages sustainable farming.
- Locally grown food and fiber may reduce the carbon emissions used to produce and transport products from other localities.
- Irrigation practices in Arizona are highly efficient compared to other regions because growers have historically been water-use sensitive.
- Preservation of agricultural water uses offers more management flexibility than municipal uses. In times of drought, agricultural land can be fallowed (with compensation) to ensure water availability for essential uses such as drinking water.
- There is a direct link between the preservation of open space and land used for agricultural purposes and adding more concrete to our cities thus contributing to the heat island effect.

- Some believe that it is not sustainable to grow high-water-use crops, such as alfalfa and cotton, in the desert if they can be grown in other places that are not as arid.
- Some crops that are grown in Arizona are not used locally; rather, they are exported to other countries for manufacturing.
- Some contend that without government involvement, the market would move water from agricultural to urban uses because urban users typically pay more for water.

Natural Environment

- Arizona is known for the beauty of its natural environment. Tourism is a major revenue source for Arizona and preservation of the natural environment benefits the economy of the State.
- Protection of our rivers and streams and the ability to sustain healthy watersheds often involves legal and regulatory requirements on local jurisdictions, public land managers, and private property owners that can be expensive and controversial.
- The use of market mechanisms to achieve protection of public resources can be effective but markets do not capture all values or services associated with healthy watersheds.
- Municipalities, private water providers and resorts have developed creative ways to pay for investment in watersheds, such as providing the opportunity for customers to check a box on their water bills to donate money for watershed restoration or charging resort users a fee that directly benefits the headwaters of the area where they are staying.
- As businesses become more aware of their interdependence with the natural environment and their customers begin to make conscious buying decisions as it relates to the environment, they are taking a proactive approach to its preservation.
- As fresh surface and ground water resources are increasingly spoken for, the value of effluent increases. This source of water has been shown to be an effective resource when used for conservation and restoration purposes.

Public and Aesthetic Use

- Aesthetic water uses celebrate the intrinsic beauty of water.
- They can serve as community gathering places that everyone can enjoy rather than just a few individuals.
- They can generate tourism and stimulate economic development.
- They can provide environmental benefits such as reducing the urban heat island effect or providing habitat for birds and wildlife.

- They can require significant amounts of water to maintain and typically do not serve an essential function.

Household Use

- One way to achieve water conservation is through a pricing structure that increases the price consumers pay for water based on the quantity of water used. Consumers pay less money for essential water use and more for non-essential uses. Another way to encourage conservation is to charge more for water during particularly high water use seasons, such as in the summer.
- Price based approaches are popular and are being adopted in many communities, but vary according to the degree of surcharge for higher water use. Such price based approaches may be less costly to implement and enforce than restrictions on water use.
- Many communities also encourage consumer water conservation through voluntary incentives, rebates, education and smart water meters. Some communities pay individuals to voluntarily eliminate grass. These methods can play an important role in changing behavior.
- Some communities also have regulations and mandatory water use restrictions, such as bans on grass lawns. These can be effective but require more resources to enforce than some other methods.

Water Policy Questions and Value Choices

Agriculture

- How important is agriculture in the Sun Corridor?
- Do we want a policy that seeks to preserve agriculture in Arizona or do we want to allow or facilitate the conversion of agricultural water uses to urban uses?
- Should we facilitate the use of reclaimed water on farms?
- If we want to preserve some agriculture, what kinds of crops should be grown and where should agriculture be preserved? Who should decide?
- How can we facilitate cooperation between cities and farms for drought management?
- Will we rely on the free market to shape the future of agriculture or will we try to provide some framework based on our values and an agreed upon strategy?

Natural Environment

- How would we choose between urban water environments, such as the artificial Tempe Town Lake in the dry Salt River bed or Rio Santa Cruz restoration versus maintaining in-stream flows in some of our most valued natural areas such as Aravaipa Canyon or Oak Creek Canyon?

- Do we want to reserve water to sustain natural environments? If so, how much and what are we willing to invest to do so?
- Does the number of people who will enjoy a natural resource that is sustained with water matter?
- Are regulatory environmental laws effective? Is the benefit they provide worth the cost to society? Are there alternative voluntary or market based solutions or government incentives? Are they effective?
- Should water users pay optional or mandatory fees for the protection and restoration of watersheds as part of their water bills? Who should do the work and control the money?
- What is the future conservation role of the use of effluent?

Public and Aesthetic Use

- Do we want to encourage or discourage public uses of water such as fountains, pools, public golf courses, canals, artificial lakes and wetlands?
- When faced with real trade-offs, would we still choose to maintain public water uses? For example, would we choose to maintain an artificial lake in a desert community instead of leaving flows in a stream to support a natural waterway?
- Does it matter how many people enjoy an aesthetic water use? Is an artificial lake or fountain more valuable than a public golf course because more people can enjoy it?
- Does the economic value generated by the aesthetic use matter? A golf course may have more economic value than a fountain, for example.
- Do we want to allow non-drought tolerant shade trees in parks, along canals and washes, but discourage large private yards with non-drought tolerant landscaping?

Household Use

- Do we want to reduce household water use to make water available for other purposes?
- Do we want to develop incentives, bans or pricing structures that promote water conservation? What are the most effective methods for influencing water conservation?
- How can we get people more involved and engaged in water conservation? Does education work?
- In order to reduce residential landscaping, do we want to encourage higher density developments or rely more on multi-family homes rather than single-family homes?
- Do we want to encourage the elimination of private swimming pools or require pool covers to reduce evaporation?

- Do we want to encourage the elimination of existing non-desert landscaping such as lawns and large non-native trees?
- Should price structures be different for new developments than for older, existing residential properties? Should it vary by areas within a city?
- If you had to choose between restrictions, price increases, technology or individual responsibility to lower water use, which would you choose?
- If you had to change your lifestyle to use less water, would you still choose to live in the Sun Corridor? What would you be willing to give up and what would cause you to leave?

Workshop Results

Eighty individuals plus a number of facilitators gathered to discuss these water policy issues and questions during a half day workshop held prior to the Water Resources Research Center's annual conference in January 2012. The Sonoran Institute, in collaboration with the Morrison Institute and with funding from the Lincoln Institute of Land Policy, sponsored this workshop. There was a lively discussion on some of the fundamental policy and value choices we will face about water in the Sun Corridor, on the factors that will shape these choices and Arizona's water future, and on the difficult trade-offs that we may ultimately need to make concerning how we supply and use our water.

Workshop Overview

We began with a presentation of the Morrison Institute's "Watering the Sun Corridor" report on central Arizona's water supply and demand, the adequacy of this supply for future growth and key policy choices faced by the region[4]. This report was followed with a presentation from Sonoran staff about the driving forces of change for central Arizona, and the uncertainty that these create for future water supply and demand conditions. The issues raised in this presentation included:

1. Population growth and location: The Sun Corridor has experienced rapid growth, but future projections are uncertain.
2. Climate variability and climate change: The Sun Corridor has been in drought conditions for most of the last decade. This has led water managers to recognize the significant variability in water supply and the uncertainty about future trends and how climate change may impact both the amount and variability of water supplies.

[4] Watering the Sun Corridor may be downloaded from the Morrison Institute's website. The Lincoln Institute and Sonoran Institute contributed to the funding of this report and served on the report advisory committee. Download the report at: http://morrisoninstitute.asu.edu/publications-reports/2011-watering-the-sun-corridor-managing-choices-in-arizonas-megapolitan-area/view.

3. Potential future scenarios: We can evaluate different alternative futures to develop water management policies and infrastructure that will be robust across a variety of future conditions.

Most of the afternoon focused on small group discussions in several rounds at eleven separate tables to delve deeper into water policy choices. These discussions were initiated with brief presentations on two of the four issues and then two commentators sharing their perspectives on the key policy choices and significance of each issue area. These presentations were followed by facilitated discussions in each of the small groups. The first round of presentations and discussions focused on agriculture and the natural environment. Public and aesthetic uses as well as household uses were covered in the second round of discussions. Key pad polling questions were also asked after each round.

Workshop Data

This discussion of results is based on the two types of input collected from the workshop: key pad polling and a series of facilitated small group discussions among diverse groups of six to eight people at eleven separate tables. Throughout the afternoon, the workshop alternated between brief presentations and thirty to forty minute small group discussions. Interspersed throughout the afternoon were key pad polling questions designed to provide ad-hoc full group responses, illuminate value and policy choices, and provoke discussion. For the results discussed in this paper, the workshop participants were not a representative selection of Arizonans. Nevertheless, as the numbers below demonstrate, a wide range of perspectives was represented in the room. In addition, this type of instant polling and the notes from the table discussions of a self-selected audience do not qualify as a systematic or random sampling. The results do, however, provide interesting food for thought, provide insight into key issues and perspectives for a number of stakeholders, and point to areas for further work and dialogue[5].

Participant Demographics

The participants were evenly split between Pima (Tucson region) and Maricopa (Phoenix metro area) County residents with approximately twelve percent from outside central Arizona. Participants indicated they represented the following sectors:

Education	27 percent
Environmental Group	19 percent
Business/Agriculture/Industry	14 percent

[5] The key pad polling questions were primarily designed to provoke discussion and highlight value choices. We did not apply the level of social science rigor one should exercise to ensure a survey instrument that minimizes bias and isolates key variables. This being said, we do believe the results provide interesting and valuable information. This discussion of results is primarily based on simple frequencies for individual questions. We did however also conduct some analysis by group that revealed significant group differences on a few issues and a cluster analysis on the identification of priority water issues. These results are also presented in the following discussion.

Municipal Water Provider / City	13 percent
Citizen	13 percent
Civic Organization	5 percent
Other	10 percent

Finally, there were a large number of water buffalo's in the room with 45 percent of participants indicating they had been at "too many water meetings to count" in the last two years, another 10 percent attended more than 5 meetings, and only 10 percent indicated this workshop was their first water meeting in the last two years. Analysis of the keypad polling results by group did reveal an interesting difference in the voting approach of different sectors. Those identifying themselves as representing education or environmental groups were more likely to target their voting. For example, on the question about their top priority water issues, although they could vote on five of these choices, they only selected between one and three priorities. Individuals representing other groups voted more broadly and included more choices in their selections.

Driving Forces

As part of the keypad polling testing, and also to get a sense from the audience on their reaction to the brief presentation about driving forces of change, we asked them about population growth and climate. 77 percent indicated they believed the region would experience either moderate (11 million by 2060) or low (8 million in 2060) population growth (the region is approximately 5 million today). High growth was defined as 12 million or more. However, 33 percent were somewhat uncertain and another 51 percent were highly uncertain about their growth estimates. When asked about climate in 2060, 51 percent thought it would be somewhat hotter and 35 percent indicated much hotter than today. The audience felt a higher degree of certainty concerning climate with only 30 percent indicating they were either somewhat or highly uncertain, and 42 percent were highly certain of their climate estimate.

In subsequent small group discussions at each of the tables, a number of additional driving forces were identified[6]. Two additional issues of particular note were identified independently in about half of the table discussions. One recurring concern was regulation and public policy and the interplay between regulation and market forces in driving water supply and demand issues. A second concern was a focus on local economic development decisions and recognition that these economic decisions could be more critical to driving population growth and water demand than national level driving forces.

Priority Water Topics

The first task at the tables was to identify the priority water policy topics for each participant, discuss what issues the group was most concerned about, and discuss whether

[6] A detailed summary of the notes from table discussions, including the full list of additional driving forces identified, can be downloaded from the workshop website at: http://www.sonoraninstitute.org/watering-the-sun-corridor-workshop.html.

the Watering the Sun Corridor report identified the most important water policy choices. We captured the approximately 50 different issues identified within the small groups and combined these into 14 broad topics. In the final round of small group discussions, participants considered whether any additional topics needed to be included, at which point three additional topics were added. At the end of the day, participants were asked to vote for their five top priorities from amongst those 17 water policy issues using key pad polling devices. Six of the 17 issues clearly came out on top. Given that we asked participants only to select their top five issues, the order of issues ranked 7 through 17 (based on how many votes they received to be one of the top five) does not necessarily reflect an accurate prioritization. All 17 issues and the number of votes they received are shown below (bold type issues indicate those highlighted in this workshop):

1. **The natural environment and uses of water** (43 votes)
2. Water policy decision making process (33 votes)
3. Economics of water and water pricing (31 votes)
4. Climate change and variability (29 votes)
5. Ensuring water sustainability for Arizona (25 votes)
6. Water and growth (23 votes)

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7. **Future of Agriculture and Water Use** (18 votes)
8. Water Conservation (15 votes)
9. Water Quality (14 votes)
10. Securing Water Supplies (11 votes)
11. Future Economy and Industrial Uses of Water (9 votes)
12. Water Education (8 votes)
13. Equity (8 votes)
14. Energy Production and Water Use (6 votes)
15. Higher priority to water for local needs (5 votes)
16. **Lifestyle of Affluence and Household Uses of Water** (3 votes)
17. **Aesthetics and Public (Urban Environment) Uses of Water** (3 votes)

Notably, both private landscape uses of water (lifestyle of affluence and household uses of water) and urban amenity uses of water (aesthetics and public uses of water), two topics highlighted in the workshop, received the lowest number of top five issue votes. To evaluate these priority identification results further we conducted a cluster analysis on the voting patterns. Three clusters emerged of about equal size in terms of the number of participants within each cluster.

1. Individuals who voted on only two issues and did not rate anything except the environment and public process;
2. Those that rated environment and public process highest, but rated other things as well, just slightly lower and;
3. Those that rated about eight items equally high, including environment, but rated public process and climate very low.

There is a significant correlation between these groups and sector representation. Educators and environmental representatives comprised approximately 80 percent of the first group, city and business representatives comprised 50 percent of the second group, and the third group was equally distributed among all the various groups represented at the workshop. The next two sections cover the small table discussions and key pad polling answers for the four highlighted issue areas: Agriculture, Natural Environment, Public and Household uses of water.

Agriculture and Natural Environment Water Issues

The first round of small group issue discussions focused on both agriculture and natural environmental water uses and issues. A few themes emerged from the many points made at one or more of the small table discussions. One theme focused on recognizing the importance of agriculture and food security and the related need for public education regarding agriculture in Arizona including: its economic and social value, the distinction between commercial and small scale local agriculture, and the economic role of export crops. Additionally, the points were made that crop choices are market driven and that a changing climate could impact the types of crops suitable for Arizona.

A second major theme was the discussion about the potential role of agriculture as a buffer for drought (and perhaps open space and heat island effects as well), with the potential to establish shortage contingencies that would compensate agriculture and allow water to move to urban areas during drought. Participants wondered about the practicality of successfully integrating a drought buffer role with a viable production agriculture economy. Additionally, participants questioned the ability to address the interplay between private property rights, market forces, local land use and water planning and state and national policy related to agriculture. Another major theme was the recognition of the inextricable linkages between agriculture and the natural environment and the belief that we do not necessarily face an either/or situation. Wineries were cited as an example of agriculture capitalizing on natural environmental conditions and also creating new tourism economies. This area of interplay, including the relationship of ecosystem services[7] to agriculture was considered an important area for research.

[7] Ecosystem services refers to the benefits that appropriate agricultural practices could provide in terms of healthy functioning ecosystems and environmental quality. Such services might include: regional cooling provided by irrigated crop lands, aquifer recharge from irrigation return flows, habitat for birds and other species, etc.

Additional small group discussions focused on natural environment issues and identified the need to quantify the water required for environmental health and priority natural areas and to monetize the environmental benefits so that the value of water for the natural environment could be considered in the existing policy framework. Determining who should pay and how we should pay for environmental water uses and management, as well as questions of who represents natural systems, and whether our current water management framework is at odds with environmental needs were other important considerations.

Additional results on agricultural and environmental issues from the keypad polling included:

- A majority of the participants recognized that some agriculture water would likely move to urban uses, but 83 percent put a priority on maintaining a viable production agriculture economy in central Arizona for the long term. 76 percent would support transferring at least some water from agriculture to the natural environment if that was the only source of water to maintain natural areas.
- Water for the natural environment was a, and sometimes the, top priority water issue and area for water allocations both in the key pad polling and during the individual table discussions. 77 percent indicated allocating sufficient water to sustain current natural environmental areas should be a priority; another 15 percent said maybe. This result is not typical in Arizona water discussions and was the source of continued discussion and some disagreement following the workshop. Given the depth of the support for natural environment uses of water both in the polling and at the majority of the individual tables, we suspect this result was not simply due to self selection of those who attended the workshop but may in fact represent an evolving shift in Arizona's water discourse. Nevertheless, there was evidence from group analysis of the results that the larger than typical number of education and environmental group representatives in the room may have dominated the voting and discussions at some of the tables[8].
- Participants also indicated a significant willingness to pay to sustain natural areas. When asked how much they would be willing to pay to maintain or even restore water supplies to critical natural areas, 41percent were willing to pay $10/month, another 29 percent we willing to pay more. With respect to a participant supplied question asked in the final round of voting about "*How much would you be willing to support water earmarked for the restoration of riparian areas?",* 57 percent indicated very much and an additional 37 percent responded somewhat. In another user supplied question about "*How much are you as an urban water user*

[8]There was a significant correlation between the "sector being represented" and several assessment questions. Analysis showed there was a high correlation between the participants identifying themselves as environmentalists or educators and the Environmental Issue ranking. The question "should growth be a driver question", and "How much are you willing to pay?" versus the environmental tradeoff question was strong. Educators, environmentalists and those associated with civic groups weighted this issue a high priority with a willingness to pay more to provide water to the environment. Municipal professionals, business professionals, citizens, and others rated this issue much lower. This difference is probably an area worthy of follow-up survey efforts.

willing to pay for environmental service enhancement outside your urban center?", 40 percent were willing to pay an additional $15/month and another 26 percent indicated they would pay $10/month.

Public and Household Uses of Water Issues

The second round of small group issue discussions considered household uses of water including landscaping around individual homes and public uses of water in our communities. Within the group discussions a number of interesting points were made. Several groups discussed the relationship between urban design, affluence and lifestyle, and questioned whether an affluent lifestyle necessarily needed to mean high water use. Questions were also raised about changing household preferences and since higher density residences were more efficient water users what could be done to make such designs more desirable. Participants recognized the existing disconnect between the high value of water and the low price we pay for our water supply and considered the ability for new growth to pay the true cost of water.

Participants recognized the trade-offs between private (in our yards) and public (in common areas and parks) uses of water as well as the need for more analysis of the trade-offs between landscaping, aesthetics, quality of life, public health and water use. Additional information was also deemed necessary to quantify the water needs and costs for different types of public uses.

Finally, in some more generally applicable discussions, participants pointed out the generally accepted experience that although public education is indeed important, people will generally not react until faced with a crisis. There was recognition of the values nature of the choices that we face and questions about both who will make these decisions and the nature of the decision making process itself, including the interplay between market forces and public policy.

Additional results on issues concerning public and household uses of water from the keypad polling included:

- A majority of participants indicated they would be willing to reduce their household water use to provide water for other uses, with 58 percent responding "yes, absolutely" and an additional 20 percent "maybe". On a related question on the types of policies that should be used to achieve efficient household water use, perhaps surprisingly, 70 percent elected to do so using "all" tools , including regulatory, education, voluntary incentives and pricing approaches.
- When asked about the importance of public uses of water, 48 percent responded they were very important and another 48 percent ranked them as important.
- When asked whether it is okay to take water from a natural area to create an urban lake that would generate greater economic activity, the majority of responses were in the middle two categories with 27 percent saying maybe, and 29 percent probably not, with 40 percent saying absolutely not and only 4 percent saying yes.

- Another participant supplied question asked: "*We collectively decide to set aside 500,000 acre-feet/year of water for a protected use. Pick one use."* 68 percent selected environmental restoration and protection, 15 percent a pool of water for agriculture, and 17 percent selected urban uses.

Final Discussions and Keypad Polling Results

A final round of small group discussions revisited the question of top priority water issues and individual groups were allowed to select the issues they wanted to cover in this final session. We closed the workshop with a final round of keypad polling that included questions about priorities, the basic assumptions underlying the workshop, and participant provided questions.

When asked to prioritize eight different categories of water use, allocating water for new growth was by far the lowest priority. As would be expected, providing sufficient water to meet basic household needs was by far the top priority. The complete list in rank order, with the number in parenthesis being a weighted vote (based on 8 points for a top priority response, 7 for second priority, etc.) was[9]:

1. Household — essential uses based on average use of an efficient household (501)
2. Natural Environment (370)
3. Other Employment and Industrial (310)
4. Public Amenity/Urban Uses (292)
5. Agriculture (289)
6. Household — Amenity Uses, above the average use of efficient household (237)
7. Mining (221)
8. Population Growth (136)

Participants overwhelmingly supported some of the basic assumptions behind the workshop. Of course, there is a selection bias in terms of who attended the workshop, but water audiences are not shy about expressing their disagreement over basic assumptions and we were surprised by the high level of agreement registered in this final round of key pad polling.

[9] Analyses of these results by group (who the individual represented) provides evidence that some individuals may have been confused by this question and were uncertain whether voting an issue as a priority meant a priority to "protect" that area of use or a priority or to "cut" water allocated to that area of use. The analyst of this data pointed out that the group with one of the largest percentages voting to allocate water for population growth was the environmental group representatives. We are not sure this necessarily evidences confusion, but we do realize that this was the most complicated series of questions asked and that it came at the end of the day. Again, this would be another appropriate area for follow-up survey work.

- Future water scarcity. We asked:

"The issue descriptions assumed that at some point demand would exceed supply thus requiring potentially difficult water allocation and management choices. Do you agree?"

  - 52 percent strongly agreed and another 35 percent agreed.

- Uncertainty. We asked:

"We assumed that we would face increasing uncertainty about driving forces impacting both water supply and water demand in the future, and that we will need to develop effective mechanisms for addressing this uncertainty. Do you agree or disagree?"

  - 63 percent strongly agreed and another 27 percent agreed.

- Engagement in Water Policy. We asked:

"This workshop was also based on an assumption that future water management would benefit greatly from a broader engagement of civic and business interests and average citizens on the fundamental values and policy choices that underlie water management decisions. Do you agree or disagree?"

  - 64 percent strongly agreed and another 23 percent agreed.

In the concluding discussions about priorities and policy choices at the separate tables, issues related to insufficient water management capacity and decision making were the most frequently discussed topics, highlighted at six of the eleven tables. Other issues identified at this point as important and not previously discussed included:

- The need to question assumptions about growth and to identify who benefits from growth.
- The need to diversify our economy to be less dependent on growth.
- The existence of opportunities for water technology advancements that improve efficiency and the related economic opportunity represented by the ability to market local water management expertise and the new technologies.
- The belief that climate change is not a separate issue, but for some participants it was an overarching component while for others it was just one more factor to consider.
- The contribution the Universities and Arizona Department of Water Resources could make if they worked together to develop a consensus long term climate forecast that can be used for planning.
- The need for a legal framework and process for agriculture water transfers to other uses.
- The need to find better ways to price water and how the best use of water can be determined.
- The need for a regional, or even statewide, vision or plan for water management.

- The need for a unified voice on water education so that we don't continue to have a public confused by conflicting messages.

Lessons Learned

There were several lessons learned in conducting this workshop that may be worthy of consideration in future water engagement efforts. In several cases, the basic approach of creating diverse groups for the small table discussions led to unproductive arguments and an inability to facilitate genuine sharing and understanding of different perspectives. At a few tables, vocal individuals were only interested in advocating their position. An alternative approach could be to create small groups of more homogeneous participants. They would be more likely to focus on the same particular topic, or at least have compatible approaches and work together effectively. Though such focused discussions could serve as good incubators of creative thinking, the proposals they develop will need to be tested in a broader and potentially more critical forum. Ideally a workshop or series of workshops could be conducted to allow both focused creativity and a broader testing and refinement of ideas. Another important aspect of the workshop design was the keypad polling. The polling was a very successful component of the workshop and did, in fact, motivate discussion and provoke debate. This debate even continued at the full water conference the following day. However, there was criticism by some participants who felt the questions were not constructed as neutrally and rigorously as would be expected in social science survey research. Future efforts could give more care to question construction. We could also use what was learned in this workshop to construct a scientifically valid instrument and follow-up with a survey of central Arizona residents and key water stakeholders to further inform these discussions and catalyze continued dialogue. Finally, more work is needed to reach out to business and civic organizations as well as typically underrepresented groups and increase their participation in future workshops. One effective technique would be to take future workshops on the road and bring the discussion to groups at their regular meetings, conferences and community events.

Conclusions and Next Steps

This workshop was a successful first effort to expand public engagement on water policy and related value choices. The workshop attracted a diverse group, generated thoughtful debate within many of the table discussions, produced numerous ideas for follow-up action, and certainly dug a bit deeper than usual in consideration of the values and choices that underlie water policy and management decisions.

The three most prominent themes heard throughout the workshop were: strong support for continued agriculture, an increasing priority to allocate water for the support of the natural environment, and a call for increased dialogue and public engagement on water issues. The discussions and voting also evidenced clear broad based agreement on the importance of protecting lifeline water use and the value of public uses of water. Participants also recognized the significant uncertainties in our water future and the need

to address these. Some of these topics may be more controversial, but they are all worthy of additional discussion and could serve as issues to motivate further public engagement.

The polling and the small group discussions also evidenced strong support for maintaining an agricultural economy, but recognized that some water would likely move from agricultural to urban uses. An important area for additional discussion would be the future of agriculture throughout Arizona and the related water management implications and opportunities as well as the potential connections between agriculture, urban water reliability, and water to sustain the natural environment. These discussions could also provide an opportunity for educating Arizonans about the role and importance of agriculture in our state.

The relationship between water policy and the natural environment was another area where workshop discussions highlighted valuable follow-up opportunities. Future discussions and research could evaluate the water needs of natural areas and critical ecosystem services, quantify the benefits of these water uses, identify what natural environment uses are a priority, and consider how best to support these uses.

Concerns about inadequate water management capacity to address our current and future challenges, and a need for improved decision making (a comment mostly directed at the Arizona State Legislature) came up throughout the discussions. Further dialogue on how to best resolve these specific concerns would be another promising follow-up activity. An ongoing forum to host these discussions at a regional level that includes all interested parties and engages a broader community would be one key. Conversations about the topics above could serve as starting points. More attention, including additional background issue papers, could also be given to some of the water issues that were not the focus of the workshop, but were identified as a high priority. These other priority issues included: water economics and pricing; water supply reliability, security and robustness (what some might call sustainability); the connection between water and growth; and climatic variability and the potential impacts of climate change.

Education of the public is certainly central to all of these efforts, in particular to any aspiration for broader public engagement on Arizona water issues. The need for consistent messaging and the recognition that many Arizonans are confused about water uses and issues was clearly identified in the workshop discussions. As one example, consider water conservation. Why should individuals conserve water? What is the benefit of conservation? How would the water you save be used? Do we need to conserve because our supply is inadequate, because we are in a drought, in order to supply water to new growth and jobs, or to protect our natural environment? Since the answers to these questions are not clear, and are certainly not agreed upon, it should be no surprise that our messaging on water is confusing. As we consider how to improve education about water use and public engagement, we might consider storytelling approaches and efforts to hear and share the voices of average Arizonans about what water means to them.

Water is indeed essential to our sustainability. We will face significant water policy decisions over the next several decades and we will have to make these choices in the

context of increasing uncertainty about water supply, water demand, and even our climate. Effectively addressing these challenges will require a responsive and open forum in which to educate and engage stakeholders, decision-makers, and concerned citizens on these choices. This workshop, along with support for the Watering the Sun Corridor report, were initial steps in Sonoran Institute's efforts to help establish a broad based regional dialogue on the future of water management in the Sun Corridor and the Colorado River Basin. Our goals are: to broaden discussions about water; engage a larger community of organizations, individuals, and leaders; ensure we have a forum where the entire Sun Corridor can come together to consider the fundamental value and policy choices involved; and move toward an agreed "vision" that can guide our region's water policy choices. Ideally this effort will serve as a model that can be extended to other regions within the larger multi-state Colorado River Basin. This workshop and the strong interest evidenced by participants have begun the process and helped identify several important issues around which further dialogue can be focused.

Appendices

Appendix I - Fact Sheet: Highlights from the Watering the Sun Corridor Report

Definition: For purposes of finding specific references in this document please note that the information cited is from the Watering the Sun Corridor, Managing Choices in Arizona's Megapolitan Area (WSC) by the ASU Morrison Institute for Public Policy,2011. The Sun Corridor refers to Maricopa, Pima and Pinal Counties, but will ultimately include Yavapai and Santa Cruz Counties. For reference below, each statistic includes the page number from the report.

1. Population

- The five county Sun Corridor's population in 2005 was 4,988,564 people. *Page 9.*
- The most likely population projection for the five county Sun Corridor in the year 2040 is 9 million people. *Page 10.*
- Net migration to the five county Sun Corridor will be approximately an average of 80,000 people per year between 2015 and 2040. *Page 10.*

2. Sources of Water

- The Sun Corridor's water sources can deliver approximately 2,810,000 acre feet of water per year. *Page 17.*
- Rain: Average rainfall throughout the Sun Corridor is probably about 8–9 inches per year. *Page 13.*
- Salt and Verde Rivers: The Salt and Verde River systems deliver on average approximately 800,000 acre feet each year to the Sun Corridor. *Page 14.*
- Other Surface Water: Other surface water supplies in the Sun Corridor will deliver approximately 250,000 acre feet per year. This is based on an estimate of 50,000 af/yr from surface water in the Phoenix AMA not counted in the Salt and Verde Systems, 50,000 af/yr in the Tucson AMA, and 150,000 af/yr that might be available in the Pinal AMA from the Upper Gila River. *Page 15.*
- Groundwater: Groundwater supplies in the Sun Corridor have been estimated down to a depth of 1,000 feet at approximately 180 million acre feet (maf). This is based on an estimate of 80 maf in the Phoenix AMA, 35 maf in the Pinal AMA, and 65 maf in the Tucson AMA. *Page 15.*
- Colorado River: We can assume the Central Arizona Project (CAP) will deliver to the Sun Corridor approximately 1.5 maf/yr of Arizona's 2.8 maf/yr allocation from the Colorado River. *Page 16.*
- Climate Change: The most recent projections suggest a 9 percent decline in flows on the Colorado River by 2050. Other studies suggest between 10–30 percent declines in flows. A 15 percent decline in flows would reduce the Sun Corridor's water sources to 2.4maf/yr. *Page 17.*
- Other Possible Water Supplies: 200,000 af/yr could be available by moving water to the Sun Corridor from western Arizona agriculture. Another 200,000 af/yr of groundwater could also be transported from rural Arizona. De-salinated ocean

water is also another potential source, but costs range from $1,000–$2,000 per acre foot of water. *Page 17.*

3. Water Supply

- Salt River Project: Salt River Project's (SRP) system delivers on average about 950,000 af/yr. SRP operates 8 dams, 251 groundwater wells and 1,300 miles of canals and laterals serving about 250,000 acres. SRP's reservoirs can store about 2.3 maf of water, or about 2 years' worth of runoff. Annual maximum delivery capacity of groundwater is 325,000 af/yr. *Page 20.*
- Central Arizona Project: Lake Mead and Lake Powell can store about 25 maf each, more than 3 years of annual flow. *WSC 20.* The Central Arizona Project's (CAP) long-term (mainly municipal) contractors use just over 800,000 af/yr of Colorado River water. "Excess" contractors, including most farmers, use another nearly 800,000 af/yr. CAP has junior priority on the Colorado River so in times of shortage, it would take most of the first cut — before California agriculture, Nevada and Arizona on-river use. Even with a reduction of 432,000 af/yr, the highest level of reduction considered in the current shortage sharing guidelines, CAP would still receive about 1,000,000 af/yr. *Page 21.*
- Groundwater: Although groundwater pumping has been significantly reduced since 1980 when the Groundwater Management Act was passed, 45 percent of the 3 county supply of water still comes from groundwater pumping. Arizona has, however, recharged over 4 million acre feet of water to underground aquifers in central and southern Arizona since the inception of the Arizona Water Bank and the Central Arizona Groundwater Replenishment District. *Page 23.* Artificial groundwater recharge stores about 1.5 years worth of water. *Page 25.*
- Reclaimed Water: The Phoenix AMA reuses or recharges 49 percent of its treated wastewater, the Pinal AMA reuses or recharges 58 percent and the Tucson AMA reuses or recharges 15 percent. The Sun Corridor may produce approximately 500,000 af/yr of effluent. *Page 24.*

4. Water Demand

- Water Use Profiles: In 2010, 70 percent of Arizona's water use was agricultural, 22 percent municipal and 8 percent industrial. In Maricopa County, 53 percent was urban (municipal and industrial) and 47 percent was agricultural. In Pinal County 4 percent was urban and 96 percent was agricultural. In Pima County, 68 percent was urban and 32 percent was agricultural. *Page 26.*
- Urban Water Use:
    - Gallons Per Capita per Day: Each acre foot of non-agricultural water in the Sun Corridor supports about 5 people (4.2 in the Phoenix AMA, 5.5 in the Tucson AMA in 2008). In 2008, the Phoenix AMA used 216 gallons per capita per day (GPCD), the Pinal AMA used 192 GPCD and the Tucson AMA used 163 GPCD. The U.S. national average is 150 GPCD. In urban, arid regions of Australia, residential use has been as low as 34 GPCD. *Page 26.*

    - Total urban water use in the Sun Corridor is approximately 1,295,000af based on an estimate of 1,120,000af for GPCD uses in 2008(200GPCD x 5,000,000 pop.) and 175,000af for non-GPCD uses in 2006 (non-farming uses such as factories, mining and golf courses with their own water supply, dairies, and untreated water used for flood irrigation of lawns). *Page 27.*
    - Residential use: Interior home water use is on average approximately 60 GPCD in Phoenix and Tucson. Exterior water use in the Sun Corridor accounts for about 45–50 percent of home water use, but varies widely depending on the neighborhood one lives in. *Page 27.*
- Agricultural Water Use:
    - In 2010, about 1,800,000 af/yr of water were used for irrigated agriculture in the Sun Corridor. *Page 29.*
    - Based on 2006 numbers, commercial farming in the Sun Corridor accounted for about 2,028,000af/yr of water use, with Non-Indian Agriculture using 1,638,000af/yr and Indian Agriculture using 390,000af/yr. *Page 33*.
- Price and Conservation: In a comparison of monthly water bills in the 50 largest cities in the U.S., Phoenix and Tucson both ranked in the middle for the first 3,750 gallons used, but because of Tucson's aggressive block pricing structure, it has the second highest water bill in the country for 15,000 gallons or more of water use, while Phoenix remains in the middle. *Page 31.*

5. Choices

- The Sun Corridor can theoretically sustain a population of 10 to 12 million people based on the assumptions that our current demand is about 3maf/yr, our renewable supply (excluding groundwater) is 2.4 maf/yr, non-GPCD urban uses remain static at 175,000af/yr, GPCD is between 150–200GPCD, and there is no more commercial agriculture. *Page 33.*
- At current rates of consumption, a 2.4 maf/yr water supply could support about 9.5 million residents in the Sun Corridor if there is no more commercial agriculture. *Page 12.*

Appendix II - Links and Resources

Watering the Sun Corridor Workshop Webpage, including the following materials:

- Workshop Agenda
- Workshop Presentations
- Pre-Workshop Materials
    - Overview
    - Agriculture
    - Natural Environment
    - Lifestyle of Affluence
    - Aesthetics and Urban Environment
    - Summary of Facts
- Workshop Participants
- Discussion Table Notes
- Polling Highlights
- Polling Data

http://www.sonoraninstitute.org/watering-the-sun-corridor-workshop.html.

Morrison Institute for Public Policy at Arizona State University. Link to their Watering the Sun Corridor report and follow-up essays as part of a series "Let's Talk Water" http://morrisoninstitute.asu.edu/lets-talk-water.

University of Arizona's Water Resources Research Center. Organizer of the annual water conference, of which the Watering the Sun Corridor Water Policy Workshop was a part. Access to additional information and publications concerning water in Arizona is available on their website.
http://www.ag.arizona.edu/azwater/

Other links related to Arizona Water

- Arizona Department of Water Resources. www.azwater.gov.
- Central Arizona Project. http://www.cap-az.com/.
- Salt River Project. https://www.srpnet.com/.
- Arizona Municipal Water Users Association (AMWUA). http://www.amwua.org/.
- Southern Arizona Water Users Association. http://www.sawua.org/index.html.
- Arizona Agri-Business Council. http://agribusinessarizona.org/.
- U.S. Bureau of Reclamation – Lower Colorado Region. http://www.usbr.gov/lc/