SUPERSTITION VISTAS: WATER MATTERS

This paper was prepared as a portion of the background research for *The Treasure of the Superstitions: Scenarios for the Future of Superstition Vistas.* That report is available at www.morrisoninstitute.org

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TABLE OF CONTENTS

FIGURES, TABLES AND APPENDICES

Figures

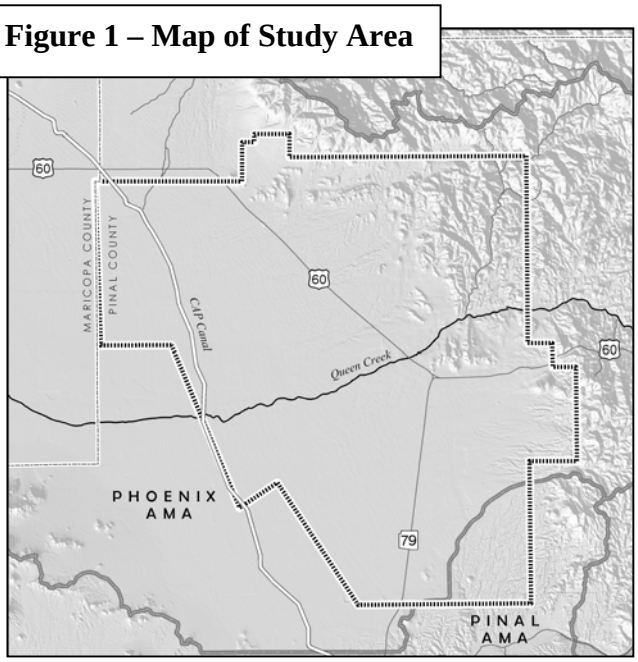
Tables

Appendices

INTRODUCTION

The purpose of this paper is to consider alternative assured water supply approaches for Superstition Vistas and to describe potential methods of providing water service to the property. Because this paper represents a cursory analysis of the study area and available supplies, the results should only be used for scoping more detailed planning efforts. The first issue examined is whether sufficient water supplies exist regionally to support projected growth including Superstition Vistas. Additionally, estimated demands for the property are presented. Finally, there a number of issues that complicate the process of acquiring supplies for an area like Superstition Vistas. This paper summarizes some of those issues.

Figure 1 – Map of Study Area



The Arizona State Land Department (ASLD) owns nearly all of Superstition Vistas. Superstition Vistas, located in south-central Arizona, in northeast Pinal County, is 275 square miles (over 175,000 acres)--equivalent to the size of Mesa and Gilbert combined. Similar to other areas in central Arizona, the geology of the Superstition Vistas study area is primarily loose clay, silt, sand and gravel deposited by streams in recent geologic times. The Superstition Mountains form a hard rock barrier that borders the northern and eastern portions of the property. The study area climate is semi-arid, with annual precipitation in the 7-8 inch range. The Superstition Mountains may receive higher amounts of precipitation as elevations increase. This higher terrain, however, constitutes a small portion of the study area. The major drainage is Queen Creek. Figure 1 displays the study area, county and groundwater basin (i.e. Active Management Areas or AMAs) boundaries, and other geographic features.

According to the Center for Business Research at the L. William Seidman Research Institute[1] (Seidman), estimates of Superstition Vistas growth range from 110,000 to 530,000 people in the 2040 time period. By 2060, population estimates for Superstition Vistas range from 270,000 to 900,000, with approximately 700,000 for the population estimate assumed in this analysis. At build-out, projected to be 2090 by Seidman, Superstition Vistas is expected to hold up to 1 million people.

[1] Rex, Tom, (2005). Superstition Vistas: Demographic Issues.

REGIONAL WATER SUPPLY ANALYSIS

Discussions about growth in central Arizona, particularly about new large developments, typically include questions about the adequacy of water supplies. Because no long-term regional analysis of water supply exists, the question of sufficient water supplies for future growth is briefly considered in this paper. Since some of the supplies that could potentially be used in Superstition Vistas may be transported through the Central Arizona Project (CAP), and because these supplies can be used in any of the three central Arizona Active Management Areas (AMAs)[2], a regional perspective that includes all three AMAs is incorporated into this regional analysis.

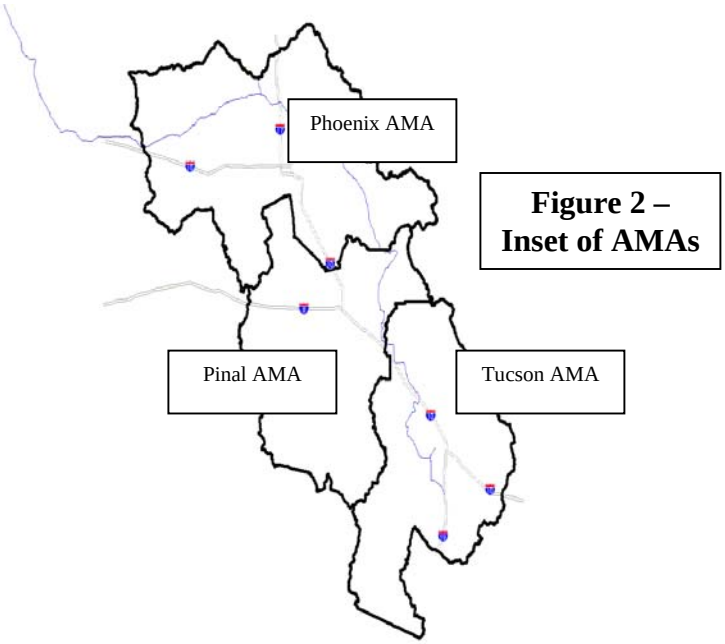


Figure 2 – Inset of AMAs

Water supply planning must occur decades in advance of meeting water demands, therefore there is significant uncertainty associated with anticipating major infrastructure improvements and acquiring new supplies. This uncertainty and complexity will only increase as the valley continues to grow. Clearly, remote water rights will have to be acquired, and those water supplies will have to be imported for population growth in central Arizona to continue. However, based on available information aggregated and presented in this section, sufficient water supplies should continue to be available for development in central Arizona for some time to come.

According to current socioeconomic data[3], today's population in the three AMAs is approximately 4.8 million people. By 2030, population is expected to increase to over 8 million people. Extrapolating this data beyond 2030, using the same rate of growth projected for the 2025 through 2030 period, population is estimated to increase by approximately 1.2% per year exceeding 10 million people by 2045 and reaching nearly 17.5 million people in 2090 when Superstition Vistas is projected to be built-out. Population projections for the three AMAs are presented in Figure 3.

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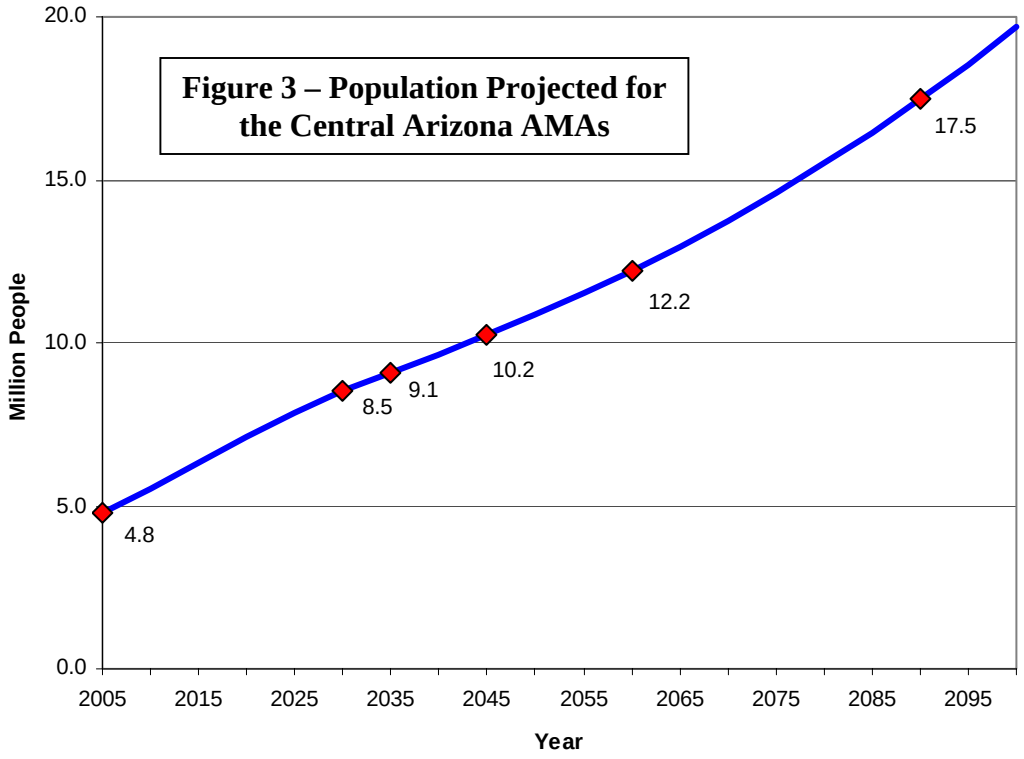
[2] An Active Management Area (AMA) is a groundwater basin regulated pursuant to the Groundwater Code (Title 45, Chapter 2, Article 2 of Arizona Revised Statutes). The AMAs encompass the vast majority of the population in Maricopa, Pinal and Pima Counties. Being in an AMA means water use is restricted. Additional information on AMAs is available through the Arizona Department of Water Resources website at www.water.az.gov.

[3] Maricopa Association of Governments, (2003) Interim Socioeconomic Projections and Pima Association of Governments, (2003) Interim Socioeconomic Projections. These projections end in 2030.

Based on forecasted population growth, projected municipal water demand in the three county-area[4] is expected to increase from today's levels of approximately 1.2 million acre-feet to around 2.1 million acre-feet in 2030, 2.4 million acre-feet in 2045, 2.9 million acre-feet in 2060 and 4.15 million acre-feet in 2090 when Superstition Vistas is expected to be built-out. Regional demands are depicted in Table 1 and Figure 4.



Regionally, there is an estimated 1.7 million acre-feet of water supply in use or currently secured for use in 2005 increasing to nearly 3 million acre-feet considered likely available by 2060. Beyond 2060, this analysis assumes necessary investments will be made to secure and convey additional water for development in central Arizona. Due to uncertainty over the source of these additional supplies and the need for major new infrastructure, these post 2060 supplies have been categorized as "Possibly Available". This information is described in more detail in Table 1[5] and in Appendix A. The years shown in Table 1

[4] Central Arizona Project, (2003). Outlook 2003. The population projections used in Outlook 2003 are for the three AMAs (Phoenix, Pinal and Tucson) and include most but not all of the population in Maricopa, Pinal and Pima counties. According to Outlook 2003, major water providers deliver water to 90% of the population in the AMAs today. By 2035, these water providers are projected to deliver water to approximately 77% of the population in the AMAs. The weighted average of the per capita demands of these water providers was used to project demands for this regional analysis. Note that these regional demands only include supplies and demands for municipal use. This analysis assumes agriculture will not be initiated on the property and that industrial uses will be served by reclaimed water assumed unavailable for use by water providers.

[5] These estimates are based on several sources of information. 1) Central Arizona Project, (2004). CAP Subcontracting Status Report. 2) Fluid Solutions, (2004). Water Supply Study Narrative Report: Evaluation

and Figure 4 coordinate with the current year, critical years when new supplies will be needed to meet increasing demands, and the year Superstition Vistas is projected to build-out.

Table 1

Current and Assumed Regional Water Supply

Degree of Availability	Current and Absolute	Virtually Certain	Highly Likely	Likely	Possible
	Today	2006 - 2030	2031 - 2045	2046 - 2060	2061 - 2090
CAP Water					
CAP M&I Subcontracts	621,000	621,000	668,000	668,000	668,000
Hohokam Water	47,000	47,000	0	0	0
Indian Leases	154,000	193,000	193,000	193,000	193,000
NIA Priority CAP Water	0	96,000	96,000	96,000	96,000
Surface Water					
SRP Water	520,000	520,000	520,000	520,000	520,000
Other Surface Water Supplies	50,000	50,000	50,000	65,000	65,000
Colorado River Water					
Indian Leases	0	0	117,000	140,000	140,000
Non-Indian Rights	0	0	158,000	335,000	335,000
Future Supply[6]	0	0	0	0	880,000
Groundwater[7]					
Grandfathered	208,000	229,000	239,000	245,000	263,000
Imported from Water Farms Outside AMAs	0	95,500	95,500	95,500	95,500
AMA Water Farms	0	22,500	22,500	22,500	22,500
Effluent	109,000	173,000	219,000	610,000	872,000
SUPPLY Total	1,709,000	2,047,000	2,378,000	2,990,000	4,150,000
DEMAND Total	1,207,000	2,055,000	2,429,000	2,903,000	4,150,000

of Water Supplies prepared for the Central Arizona Groundwater Replenishment District. 3) Salt River Project, (1996). Assured Water Supply Study for Salt River Project Member Lands. 4) numerous Indian water rights settlements including Ak-Chin Indian Community Water Rights Settlement Act 1984, Salt River Pima Maricopa Indian Water Rights Settlement Act 1988, Ft. McDowell Indian Community Water Rights Settlement Act of 1990, San Carlos Indian Community Water Rights Settlement Act of 1990 and Arizona Water Settlement Act (pending), Southern Arizona Water Rights Settlement Act of 1982 and 4) assumptions described in Appendix A . Additional potentially available supplies not considered for this analysis include San Carlos Irrigation and Drainage District's rights to Gila River water. Because the majority of industrial users rely on groundwater or effluent and since after approximately 2030 few agricultural users will have rights to CAP or SRP water, this analysis assumes no agricultural or industrial use of these supplies and that these supplies are all available for municipal uses.

The column headings in Table 1 also assign a level of certainty for the ability to secure the types of supplies and the estimated additional volumes displayed. Figure 4 provides a graphical summary of this information. According to these projections, demands are projected to exceed "Currently Secured" supplies by approximately 2030 and additional "Highly Likely Available" supplies by 2045 depending on actual population growth and how efficiently the projected growth uses the water. If additional "Likely Available" supplies are secured, and the CAP canal capacity is maximized to increase the ability to import water by 200,000 acre-feet and a higher percentage of reclaimed water is used, then demands are not projected to exceed these likely to be available supplies until 2060. Demands exceeding the estimated 2060 levels would have to be met with additional "Possibly Available" supplies and new infrastructure not envisioned today.

Portions of the supplies shown in Table 1 may be available for use in the Superstition Vistas area. However, the supplies shown as "virtually certain" (i.e. those supplies projected available for the 2006 through 2030 period) are for the most part already secured for use elsewhere. As an example, SRP water is associated with lands not located inside Superstition Vistas and is therefore unavailable. Specific information pertaining to these supplies is located in POTENTIAL SUPPLIES FOR SUPERSTITION VISTAS.

[6] The nearly 900,000 acre-feet of future supply represents new supplies and infrastructure not envisioned today. The most likely source of this new supply would be Colorado River water exchanges for desalinized water.

[7] Approximately 160,000 acre-feet per year of this groundwater supply is a fraction of a one-time volume of groundwater allowed under the assured water supply rules to east water providers off groundwater mining. This analysis assumes that the groundwater allocated will be used evenly over a one hundred year period. This volume, awarded in 1995, is assumed exhausted by 2095. Similarly, groundwater imported from outside AMAs and water farms located inside AMAs are also finite supplies assumed to be exhausted after 100 years. After which time, demands dependent on these supplies would need to secure alternative supplies and infrastructure capacity. The remaining grandfathered groundwater is incidental recharge allowed under the assured water supply rules. See Appendix B for more information about these rules.

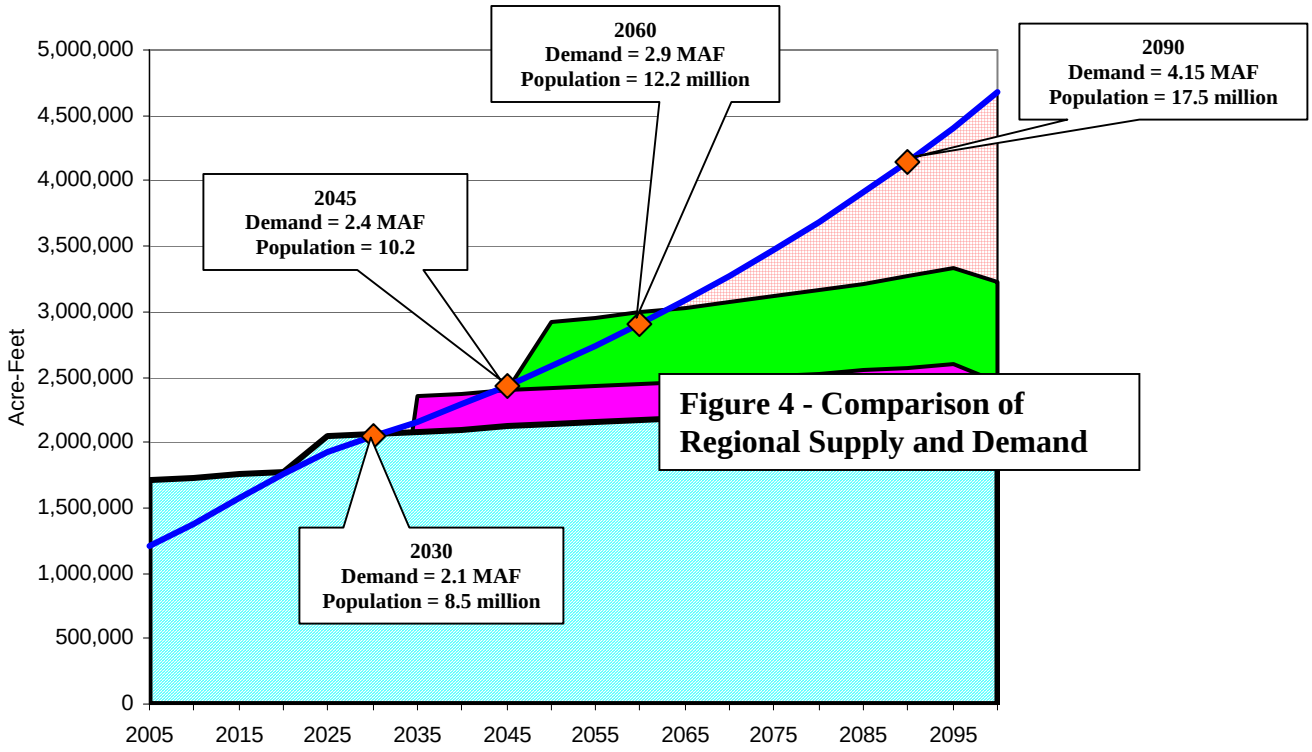


Figure 4 - Comparison of Regional Supply and Demand

Notes for Figure 4:

"Currently Secured Supply" is comprised of both a) "currently used and absolutely available" municipal supplies (i.e. SRP rights and CAP allocations that may no be fully utilized today) and b) "virtually certain" additional supplies that are already secured through ownership, contract or law for central Arizona water users. In addition, sufficient infrastructure exists to import all of these supplies. These supplies include groundwater farms in western and central Arizona.

"Highly Likely Available Supply" includes additional supplies which could be secured for importation through excess canal capacity in the CAP without changing current operating conditions or making infrastructure improvements. These supplies would include Colorado River rights

"Likely Available Supply" includes additional supplies that may be able to be secured for importation through CAP as a result of changing current operating conditions and making some infrastructure improvements. These supplies would be comprised of additional purchase or lease of approximately 200,000 acre-feet of Colorado River rights and other potential sources such as Planet Ranch surface water. Up to another approximately 300,000 acre-feet of reclaimed water is assumed available by raising the percentage of available effluent going to municipal use from 30 to 70 percent.

"Possibly Available Supply" includes additional possibly available supplies secured from the Colorado River or elsewhere. New infrastructure not currently envisioned would have to be built to import these supplies.

Based on the demands estimated and the supplies inventoried, sufficient regional supplies and canal capacity are considered likely to be available to satisfy all projected growth through 2060. By 2060 Superstition Vistas is projected to be at 70 percent of build-out. If Superstition Vistas were available for development in time to capture a greater share of regional growth and build-out by 2060, then sufficient "likely available" supplies could exist to meet 100% of Superstition Vistas demands. This analysis assumes Superstition

Vistas would compete for the available supply. This analysis does not suggest that Superstition Vistas would automatically be successful in attaining these supplies.

BUILD-OUT DEMANDS FOR SUPERSTITION VISTAS

Superstition Vistas, according to the Seidman projections would represent around 6% of the projected 2090 population. Between 2005 and 2090, Superstition Vistas would have captured less than 10% of growth in the three-county area. Comparing regional projections with the Seidman projections, there appears to be sufficient growth capacity to absorb Superstition Vistas.

Build-out annual water demands for Superstition Vistas are expected to reach nearly 210,000 acre-feet per year. Table 2 summarizes the rate of growth for Superstition Vistas and the projected demand. The demand volume is based on projected demands for nearly 400 new subdivisions in the Phoenix, Pinal and Tucson areas converted to the gallon per capita per day (GPCD) factor shown in Table 2[8]. These demands include an additional volume (15% of total deliveries) for non-residential use and an amount for system losses (10% of total water use). The GPCD factor was then multiplied by the Seidman projections for Superstition Vistas and converted to an acre-foot demand for 2010 through 2090 as shown in Table 2. Depending on how Superstition Vistas is designed and developed, the demand for the property could vary significantly from these estimates.

Table 2
Estimated Demands of Superstition Vistas

Year	Base GPCD	Population	Demand (AF)
2010	186	35,000	7,000
2020	186	175,000	36,000
2030	186	340,000	70,000
2040	186	485,000	100,000
2050	186	610,000	126,000
2060	186	710,000	147,000
2070	186	810,000	168,000
2080	186	910,000	189,000
2090	186	1,000,000	208,000

[8] Central Arizona Project, (2004). Outlook 2003. Projected demand and population for subdivisions enrolled in the CAGRD as of January 2003 were used to prepare annual GPCD factors for Superstition Vistas. The rational for using demands from CAGRD subdivisions is that these units represent current water use practices and technology accurately reflecting indoor and water use demands today. The factor used in this analysis, 186 GPCD, is significantly lower than the average current GPCD for the Phoenix and Tucson areas (225 GPCD). In addition to current water use practices, the Phoenix and Tucson area average GPCD incorporates a non-residential component of approximately 40% instead of 15%.

POTENTIAL SUPPLIES FOR SUPERSTITION VISTAS

Portions of these supplies (listed in Table 3) may be available for use in the Superstition Vistas area[9]. Some of these supplies as indicated above are assumed *not* to be available. As an example, SRP water is associated with lands not located inside Superstition Vistas. Because this water is generally appurtenant to the land, this analysis assumes these supplies would not be available for use in the Superstition Vistas area.

Table 3 Potentially Available Supplies for Superstition Vistas
CAP Water
CAP M&I Subcontracts
Indian Leases
NIA Priority CAP Water
Colorado River Water
Indian Leases
Non-Indian Rights
Groundwater
Imported from Water Farms Outside AMAs
AMA Water Farms
Local Groundwater
Reclaimed Water

Central Arizona Project (CAP) Water

Arizona is entitled to 2.8 million acre-feet of Colorado River water. Around 1.3 million acre-feet is used along the Colorado River by On-River users. The remaining approximately 1.5 million acre-feet is used in central Arizona by CAP water users. On-River and CAP users were originally divided into municipal and industrial (M&I), Indian and non-Indian agricultural (NIA). When the pending Arizona Water Rights Settlement Act is finalized, there will be no long-term CAP contracts for NIA water use[10]. In general, the CAP has the lowest priority on the Colorado River and is therefore subject to having its water supply reduced first during any shortages.

CAP M&I Subcontracts

A subcontract for CAP M&I water is considered desirable due to its higher priority status on the CAP system as well as its reasonable cost and acceptable water quality. While the approximately 620,000 acre-feet supply is fully allocated, Superstition Vistas could have access to a portion of these supplies through allocations held by the Arizona State Land Department[11] or through allocations held by neighboring jurisdictions (such as the Cities of

[9] Note the "Other Surface Water" supply category is not included in Table 3. This category included SRP water, Planet Ranch and other miscellaneous surface water rights. This category did not include Gila River rights associated with San Carlos Irrigation District. Some of the Gila River water may become available for future growth.

[10] At this point in time, Maricopa Stanfield Irrigation and Drainage District (MSIDD) has retained 11,040 acre-feet of its NIA subcontract entitlement at the request of ASLD and the University of Arizona. To date, however, ASLD and Uof A have not accepted assignments of that subcontract water from MSIDD. If ASLD and U of A do not accept the assignments, MSIDD may relinquish the rest of its entitlement.

[11] Arizona State Land Department has an M&I CAP Subcontract for 32,076 acre-feet. Subcontracts are also held by other surrounding utilities including City of Mesa, Arizona Water Company, Queen Creek Water Company and Water Utilities Community Facilities District (Town of Apache Junction).

Mesa and Apache Junction) if Superstition Vistas is served by these entities. Finally, to the extent others decide to relinquish their CAP allocations, the Superstition Vistas area could compete to acquire those relinquished supplies.

Indian Leases and Non-Indian Agricultural Priority CAP Water

Two other sources of CAP water are available to Superstition Vistas: leasing an Indian supply and securing a future allocation of non-Indian agricultural priority water (NIA water). As a result of both the original allocation of CAP supplies and applicable Indian water rights settlements, certain Arizona tribes have significant CAP allocations that can be leased for no more than 100 years. In the analysis presented in Appendix A, an estimated 40,000 acre-feet of additional CAP Indian water is assumed to be available for lease[12] beyond what is currently committed.

In addition to the M&I and Indian supplies discussed above, nearly 100,000 acre-feet of water previously allocated to non-Indian agriculture (NIA) will be re-allocated for municipal purposes. This NIA water will be allocated over time, with an initial allocation phase likely occurring in 2010[13]. Depending on when Superstition Vistas develops, water providers eventually serving Superstition Vistas could compete for this and later allocations of NIA water. NIA water holds a lower priority than M&I water, making NIA water a less reliable supply. Use of NIA water might require a back-up supply to make it reliable for long-term municipal use. NIA water could also be used as a back-up supply itself by storing NIA water underground to be available for future use.

Colorado River Water

Of Arizona's 2.8 million acre-foot allocation, about 1.3 million acre-feet is utilized along the Colorado River. The major users are several irrigation districts in the Yuma area and the Colorado River Indian Tribes. The Fort Mojave Indian Tribe and the Cibola Valley Irrigation District hold other significant allocations[14]. While municipal users hold additional allocations, these supplies are assumed unavailable for acquisition. Along the Colorado River, most, but not all of the Colorado River rights held by users are senior to the CAP.

An estimated 475,000 acre-feet[15] of Colorado River supplies could be moved to central Arizona if some of these senior water right holders are willing to lease or sell their rights.

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[12] Cullom, Chuck, (2005). Interview with staff hydrologist at Central Arizona Project. This volume is based on an analysis of the five Arizona Indian water rights settlements (Ak Chin, Salt River Pima Maricopa, Ft. McDowell, San Carlos and GRIC) authorizing leases. The analysis takes into account the volume of CAP water available to the Indian community, the volume already leased and assumptions about how much of the CAP water will be used on reservation.

[13] Draft Arizona Water Settlement Agreement approved by CAP Board January 2005.

[14] A portion of Cibola Valley Irrigation District is pending a sale to the federal government and a group of On-River users.

[15] Fluid Solutions, (2004). CAGRD Water Supply Study Narrative Report: Evaluation of Water Supplies prepared for the CAGRD Plan of Operation. Table 1, page 4. See footnote 14 for additional details on Indian water rights.

Water rights could be acquired through lease or sale by 1) fallowing currently irrigated lands, 2) investing in conservation improvements on currently irrigated lands or for irrigation district conveyance structures and then leasing or purchasing the "conserved" water and 3) purchasing lands with appurtenant rights. These water supplies could be made available permanently, for specified lease periods,[16] or only for shortage years as a backup supply. To date, no contracts have been negotiated to move Colorado River water by any of these mechanisms in Arizona. Should the water rights be acquired, in some cases, the legal right to sever the water right from the land would have to be secured as well.

The ability to convey any of these supplies to central Arizona is limited by the excess canal capacity of the CAP. In 2002, the CAP defined its excess canal capacity to be approximately 300,000 acre-feet per year[17]. With modifications to existing infrastructure and changes in operations, up to 500,000 acre-feet of excess canal capacity could be made available[18]. Although this analysis assumes some portion of this excess canal capacity would be available to entities such as Superstition Vistas, specific arrangements to secure capacity do not exist today.

Groundwater Imported From Outside of AMAs and AMA Water Farms

In 1991, the Groundwater Transportation Act grandfathered the right to transfer groundwater stored in certain aquifers of remote groundwater basins to the AMAs[19]. These remote groundwater basins are commonly referred to as water farms. There are three such farms: Butler Valley, Harquahala Valley and McMullen Valley. The Arizona State Land Department owns much of the land in Butler Valley and some lands in Harquahala Valley. Private parties and the city of Scottsdale own other parts of Harquahala Valley. McMullen Valley is owned by City of Phoenix. In addition to these water farms, because of waterlogging in the Yuma area, Arizona law authorizes the withdrawal and transportation of Yuma area groundwater to AMAs. The volume of water that can be exported from these farms and the Yuma area is approximately 190,000 acre-feet per year for 100 years[20]. This analysis assumes approximately half of this volume will become available for importation to central Arizona. Like Colorado River water, water pumped from these water farms could be conveyed through the CAP.

In addition to these water farms located outside AMAs, there are two farms located inside AMAs also authorized by State statute. One is located in the Pinal AMA, and one is located in the Tucson AMA. The annual volume of these farms over a 100-year period is

[16] Indian water rights cannot be sold. In Arizona, the only Indian water rights that can currently be leased off-reservation are CAP Indian rights pursuant to specific authorization by Congress. If leased, the term is typically for a maximum of 100 years. The assured water supply rules typically require a 100-year lease, however, 20 to 30 year lease terms may be easier to obtain.

[17] Central Arizona Project, (2002). Policy for Use of Excess Canal Capacity.

[18] Dozier, Larry, (2005). Interview with Deputy General Manager of Operations Planning and Engineering at Central Arizona Project.

[19] See Title 45, Chapter 2, Article 8.

[20] The Yuma groundwater exchange would not be a 100-year supply. This supply is anticipated to be a 200,000 acre-foot supply that will be withdrawn over a 20 to 30 year period. See also footnotes 5 and 14.

estimated at 45,000 acre-feet. For this analysis, these volumes were halved. The Pinal AMA farm, owned by the City of Mesa, may have acquisition potential if Mesa's future demands are sufficiently met. The Tucson AMA farm, owned by the City of Tucson, would not be a potential acquisition supply.

Local Groundwater in the Vicinity of Superstition Vistas

In the study area, the depth from land surface to bedrock ranges from a few hundred feet near the edges of the Superstition Mountains to more than 1,200 feet below land surface in the western areas of the study area[21]. At this western location, the aquifer thickness ranges from 500 to over 1,000 feet.

Based on standard procedures used by hydrologist to calculate the volume of groundwater in storage, approximately 10 million acre-feet of groundwater is present in the aquifer underlying the Superstition Vistas study area[22]. This estimate does not make any assumptions on whether the groundwater can be accessed or whether the groundwater is suitable for its intended end use. Additionally, other factors such as drought, land use, subsidence, recharge, water quality and pumping within or outside the study area will influence the volume of groundwater available. Groundwater is a dynamic resource and the quantity available will vary over time.

Reclaimed Water

As people use water, a wastewater stream is produced. Once cleaned to acceptable standards, this supply becomes a resource called reclaimed water. With the exception of areas dependent on septic tanks, the majority of the wastewater produced in central Arizona is treated in centralized wastewater treatment plants and available as reclaimed water. In this regional analysis, 30 percent of municipal water demand is assumed to return for wastewater treatment[23]. Of the reclaimed water produced, 30% is assumed available to meet the projected demand of municipal water providers until 2050. After 2050, this analysis assumes that 70% of the reclaimed water will be available for municipal use.

[21] United States Geological Survey, (1986). Water Resources Investigations Report 86-4147.
[22] ADWR Modeling Reports 6 and 8 (1993-1994) and ADWR Technical Memorandum on 2002 Water Levels (2004). Based on this report, SRP hydrologists estimate 10 million acre-feet based on a simplified geometric estimate of the volume of saturated alluvium present and applying an assumed porosity of 18%. This estimate is highly preliminary and suitable only for rough planning purposes.
[23] The 30% is based on comparisons of wastewater production to total water use for various utilities in the Phoenix area. Generally, wastewater production is based on estimates of indoor residential use. If 60% of total deliveries is residential and 50% of residential deliveries is indoor, then approximately 30% of total use would make up the wastewater stream.

Like the rest of the three-county area, development within Superstition Vistas will produce significant quantities of reclaimed water. While regional estimates of water supply assume between 30 to 70% of the reclaimed water produced will be used by water providers, this analysis assumes 100% of the reclaimed water produced at Superstition Vistas will be used by water providers serving the property. The reason for this is two-fold. First, demand projections for Superstition Vistas incorporate both residential and non-residential uses. To the extent large landscape users (e.g. golf courses, parks) are included in Superstition Vistas, they can directly use the reclaimed water produced. Second, since ASLD owns the majority of the land, decisions about how reclaimed water is reused directly, or recharged into local aquifers, could be stipulated by ASLD as part of a strategy to provide water service to the property (see section below on METHODS OF PROVIDING WATER SERVICE TO THE PROPERTY).

Table 4

Estimated Wastewater Production in Superstition Vistas

Year	Population	Demand	Wastewater Production
2010	35,000	7,000	2,100
2020	175,000	36,000	10,800
2030	340,000	70,000	21,000
2040	485,000	100,000	30,000
2050	610,000	126,000	37,800
2060	710,000	147,000	44,100
2070	810,000	168,000	50,400
2080	910,000	189,000	56,700
2090	1,000,000	208,000	62,400

Superstition Vistas is projected to produce over 60,000 acre-feet of reclaimed water at build-out. Table 4 summarizes the volume relative to projected growth of the area.

ASSURED WATER SUPPLY APPROACHES FOR SUPERSTITION VISTAS

Before any land can be subdivided in Maricopa, Pinal and Pima county, state regulations adopted in 1995, known as the assured water supply rules, require the demonstration of a 100-year water supply consistent with the water management goals of each AMA (Active Management Area)[24]. Generally speaking, in the Phoenix AMA, where Superstition Vistas is primarily located, this means that little or no groundwater can be used to serve new subdivisions unless the groundwater is replaced. There are two ways to obtain an assured water supply.

1. Certificate-Based Approach

   Under this approach, the developer/builder would obtain a certificate of assured water supply from ADWR. If the subdivision were served by a water provider

[24] For an overview of the Assured Water Supply rules, please refer to Appendix B. For further information, please see Arizona Revised Statutes section 45-576 through 45-578 and Arizona Administrative Code Title 12. Natural Resources, Chapter 15, Article 7.

more dependent on groundwater than allowed by regulation, the developer/builder would also enroll the subdivision in the CAGRD.

2. Designation-Based Approach

Under this approach, water providers decide to obtain a designation of assured water supply that acts as an umbrella assured water supply status. In this case, the developer/builder would not need to obtain a certificate, but would simply obtain service from the designated provider. Like with the certificate-based approach, if the utility were dependent on groundwater in excess of levels allowed by regulations, then it would also enroll its service area in the CAGRD.

Any groundwater, above levels allowed by law, served to the subdivision, regardless of whether the assured water supply was obtained through a certificate or designation approach, would have to be replenished by the CAGRD.

In determining the best water supply approach, an assured water supply strategy needs to be developed. There are three basic approaches to developing an assured water supply portfolio for Superstition Vistas:

- groundwater dependent
- renewable water dependent
- combination approach

For all three approaches, including the groundwater dependent approach, this analysis assumes that 100% of reclaimed water produced at Superstition Vistas will be reused inside the study area.

Groundwater Dependent Approach

This approach represents the usual method of development in areas like Superstition Vistas. Under this approach, the utility or utilities serving the area would develop wells and developers/builders would obtain certificates of assured water supply from the Arizona Department of Water Resources and enroll the lands in the Central Arizona Groundwater Replenishment District (CAGRD). Alternatively, the utility might decide to obtain an umbrella assured water supply status (referred to as a designation) and become a member service area of the CAGRD. Either way, the subdivisions would be served groundwater, and groundwater would be replenished by the CAGRD at some location in the AMA. The only difference between these CAGRD membership alternatives is how the retail water user would pay for the cost of replenishing the groundwater. In the first instance, the payment would be made through property tax bills. In the second case, the payment would be made through water bills. Under this approach development would be limited by the physical availability of groundwater. This matter is discussed further below in the evaluation of the approach.

Renewable Water and Imported Groundwater Approach

Under this second approach, the utility or utilities serving the area would acquire sufficient renewable water supplies or imported groundwater to meet the needs of its customers and assured water supply requirements. These supplies would likely be acquired from the supplies described in POTENTIAL SUPPLIES FOR SUPERSTITION VISTAS. Like in the first alternative, the utility could rely on a certificate-based approach for assured water supply, or the utility could obtain a designation of assured water supply. Either way, the utility would be independent of the CAGRD.

Combination Approach

Under this final approach, the utility or utilities serving the area would partially rely on the CAGRD for the following reasons. First of all, the only way groundwater can be secured for assured water supply purposes is to join the CAGRD. By doing this, the groundwater beneath the property would be "allocated" and not available for assured water supply use by others. Second, CAGRD membership could serve as a bridge in the early years before a water supply portfolio could be acquired. Finally, over the long term, CAGRD membership could act as a stabilizer should anticipated acquisitions prove difficult to realize or as regulations and laws change. The utility or utilities serving the area could decide to use a certificate-based approach or a designation approach to assured water supply.

EVALUATION OF ASSURED WATER SUPPLY APPROACHES

To evaluate the alternative assured water supply approaches, evaluation criteria were prepared and applied to a sample water portfolio for each of the three supply approaches.

Evaluation Criteria

Cost. Cost is defined relative to other supply alternatives. Costs to be considered include treatment, water quality, infrastructure improvements (e.g. pipes, pumps, wells), acquisition, mitigation (e.g. subsidence and environmental), transportation and other related costs. Alternatives with lower costs rate better against this criterion.

Accessibility. Accessibility is defined as how quickly and easily ASLD can obtain control of the supplies in the alternative. Alternatives including supplies that ASLD has immediate control over, or can reasonably expect to have control over, rate better on this criterion.

Reliability. Reliability is defined to include two parameters. First, reliability includes how well the alternative would respond to shortages and droughts. Diverse alternatives with redundancy rate better on this criterion. Second, reliability includes permanence. Supplies available in perpetuity or with longer-term leases rate better on this criterion.

Legal /administrative. Legal/administrative is defined as how well the alternatives work within existing regulatory structures and contractual arrangements. Administratively burdensome alternatives or alternatives that require legislative or regulatory change would rate poorly on this criterion. This criterion evaluates how difficult acquiring the supply will be in terms of institutional constraints.

Public acceptance. Public acceptance is defined as how well the alternatives would fair under public scrutiny. Alternatives that would be well received rate better on this criterion.

Water Supply Portfolios

To evaluate each assured water supply alternative, a sample portfolio was developed to provide context for understanding the advantages and disadvantages of each alternative. In this section, the sample portfolio is presented followed by a critical analysis. Each sample portfolio presents the demand described in Table 2. In all three alternatives, including the groundwater dependent alternative, reclaimed water is assumed to be a supply source. This was assumed because reclaimed water would have to either be discarded or reused.

Table 5 summarizes the results of the evaluation comparing the three alternatives to the criteria described above. A plus (+), minus (--), neutral (O) system was used to provide a quick impression of how each alternative compared to the criteria. A plus connotes the alternative rated favorably on the criterion. A minus means the alternative rated negatively on the criterion. A neutral sign indicates the alternative rated neither positively or negatively.

Table 5

Evaluation of Assured Water Supply Approaches

Criteria	Groundwater Dependent	Renewable Water Dependent	Combination Approach
Cost	+	--	O
Accessibility	O	--	O
Reliability	--	O	+
Legal/Administrative	+	--	O
Public Acceptance	--	+	O

Evaluation of Groundwater Dependent Approach

In this alternative, with the exception of reclaimed water, this option is dependent on the amount of groundwater available to the property: 10 million acre-feet[25]. Equally distributed over a 100-year period, this volume is 100,000 acre-feet per year. Assuming only 80% can be pumped, because some of the supply is located beneath 1,000 feet below

[25] See footnote 21.

land surface,[26] and because others are pumping groundwater in the vicinity[27], the volume of groundwater available is assumed to be approximately 80,000 acre-feet. Including the reclaimed water, there is still a deficit of over 100,000 acre-feet. A sample of what this water supply portfolio might look like is summarized in Table 6 including the deficit. Because there is a deficit, Superstition Vistas could only develop approximately 50% of its projected build-out potential.

Cost. Of the three approaches, this one rated best on cost, because of it requires the development of local groundwater. Under a groundwater-based approach, development can start small and grow with minimal upfront capital investment. Over the long-term, however, additional significant costs could be realized including subsidence mitigation and wellhead treatment for arsenic control.

Table 6
Groundwater Dependent Alternative

	Acre-feet
TOTAL DEMAND	208,000
CAP Water	
CAP M&I Subcontracts	0
Indian Leases	0
NIA Priority Water	0
Colorado River Water	
Indian Leases	0
Non-Indian Rights	0
Groundwater	
Local	80,000
Imported	0
Reclaimed Water[28]	24,000
TOTAL SUPPLY	104,000
DEFICIT	104,000

Accessibility. This approach rated relatively well on accessibility, because the supply portfolio was limited to locally produced water supplies. It was not rated highest on this criterion, because local supplies are insufficient to meet 100% of demands.

Reliability. Regarding reliability, while this option responds well to shortage and drought, it rated poorly on the permanence component of reliability, because the groundwater is not renewable. As the supply is used, it is depleted. After 100 years, it is assumed that no supply would be left. To the extent the CAGRD recharges water in a location that benefits the wells pumped, supply depletion would be reduced or eliminated. Of the three approaches, this one rated poorest on reliability.

Legal/administrative. The groundwater dependent approach rated the highest on the legal/administrative criterion. This approach represents the business as usual approach. Water providers would join the CAGRD and/or developers would enroll their subdivisions in the CAGRD. There is no reason to believe Superstition Vistas could not benefit from this approach. Over a longer perspective, however, assured water supply regulations and

[26] The assured water supply rules limit pumping of groundwater to no greater than 1,000 feet below the land surface.

[27] For example, Arizona Water Company pumps from inside the study area to serve the community of Superior.

[28] The volume of reclaimed water shown in Table 6 is reduced based on the volume of groundwater available.

water supplies utilized in central Arizona will change. This approach might limit Superstition Vistas ability to utilize new supplies requiring infrastructure to import the water or to adapt to new regulations. Further, if Superstition Vistas is dependent upon the physically available supply of groundwater, its full build-out potential will not be realized.

Public Acceptance. Regarding public acceptance, this approach rates poorly, primarily because of its dependence on groundwater. Generally, public perception argues that growth should only occur on renewable supplies.

Evaluation of Renewable Water and Imported Groundwater Approach

Under this approach, there is no use of local groundwater assumed. Instead, demands are met solely with renewable water supplies and imported groundwater. The first source of supply assumed is imported groundwater directly controlled by ASLD. This would include all of ASLD's holdings in Butler Valley and Harquahala Valley. This volume is estimated at 75,000 acre-feet per year for 100 years. While this analysis assumes the volume available for transfer is equally divided over a 100-year period, larger volumes could be used in any given year. Note that these imported groundwater supplies have limited volumes. The volume could as easily have been divided over 50 years. Irrespective of the number of years assumed, when the volume is depleted, the supply will be gone. At that point, a replacement supply will be needed.

Table 7

Renewable Water and Imported Groundwater Alternative

	Acre-feet
TOTAL DEMAND	208,000
CAP Water	
CAP M&I Subcontracts	2,000
Indian Leases	25,000
NIA Priority Water	6,000
Colorado River Water	
Indian Leases	5,000
Non-Indian Rights	33,000
Groundwater	
Local	0
Imported	75,000
Reclaimed Water	62,000
TOTAL SUPPLY	208,000
DEFICIT	0

The remaining demands could be met with Indian leases (both CAP and Colorado River), leased or purchased Colorado River rights, and a modest amount of CAP M&I subcontract and NIA water. As indicated earlier, ASLD has its own CAP allocation. Surrounding utilities also have allocations of CAP water. The blend of Indian leases to Colorado River rights is flexible and more dependent on the market at the time of acquisition. ASLD could position itself to acquire these supplies when the market is working in ASLD's favor. A sample of what this water supply portfolio might look like is summarized in Table 7.

Cost. This alternative was viewed as being the most costly, primarily because of its dependence on Indian leases and Colorado River rights. All of the supplies in this

alternative, except for reclaimed water, would have to be imported through the CAP. Of those supplies, only imported groundwater would require off-site infrastructure improvements. No wells would be developed avoiding wellhead treatment for arsenic.

Accessibility. Accessibility was rated the lowest, because this alternative relies heavily on supplies not immediately accessible by ASLD. A number of the supplies identified in this option have never been acquired for use in the central Arizona market. Because competition for these supplies would be rigorous, and because this alternative is so heavily dependent upon these competitive supplies, this alternative was viewed as less accessible to ASLD. Also, this option requires over 110,000 acre-feet/year of excess canal capacity in the CAP out of the total of 300,000 available. Given existing commitments, it is unclear whether sufficient excess canal capacity would be available[29].

Reliability. This option rated well on reliability, because the supply portfolio is heavily based on renewable supplies and many of the supplies assumed have higher priority than even CAP water. How well this alternative rates against this criterion also depends on the lengths of any leases secured. It did not rate the best, however, because this alternative is heavily dependent upon supplies being conveyed through the CAP system and delivery capability can be affected by operational constraints during peak periods on the CAP canal. Additionally, the imported groundwater supplies are finite, with the assumed available volume used up over a 100-year period. Finally, because there is no use of local groundwater, this approach would be more vulnerable during a drought or shortage.

Legal/administrative. On legal/administrative, this alternative rated poorly because of the risks associated with acquiring Indian leases and Colorado River rights. To the extent this approach would have to seek leases from non-CAP Indian Communities, the authority to permit a lease is unclear. Even if this authority were clear, there are significant institutional barriers impeding a positive outcome for ASLD. This issue is discussed further in ISSUES FOR FURTHER INVESTIGATION.

Public Acceptance. This alternative rated best on public acceptance because the project would be independent of local groundwater. While use of imported groundwater would not necessarily be unacceptable from the perspective of a public local to Superstition Vistas, people residing in areas near the groundwater farms may express strong opposition. In addition, Colorado River area communities may oppose efforts to sell or lease large volumes of mainstem Colorado River water rights for export to central Arizona.

Evaluation of Combination Approach

According to the combination approach, all supplies would be utilized including local groundwater. The volume of local groundwater used would serve several purposes. First,

[29] See footnote 16. In the Policy for Use of Excess Canal Capacity, the CAP Board established "interim set asides" that reserve excess canal capacity. The volume of these set asides exceeds 160,000 acre-feet out of 300,000 acre-feet of excess canal capacity defined in the policy. In March of 2005, this policy was revised and approximately 105,000 acre-feet of the set aside is reserved for the CAGRD. To the extent Superstition Vistas would benefit from the CAGRD, some of this capacity would also benefit Superstition Vistas.

the groundwater supply can be used in the early stages of the project while revenues are being generated to pay for renewable water supply acquisitions. Moreover, groundwater can serve as a swing supply, filling in short term gaps, during the subsequent development of the remaining portfolio. Finally, the groundwater supply can be used as a back-up supply during times of shortage on the Colorado River. Like the renewable water alternative, this alternative assumes ASLD's water farms are used. Under this alternative, reliance on Indian leases and Colorado River rights is substantially reduced. A sample of what this water supply portfolio might look like is summarized in Table 8.

Table 8	
Combination Approach	
	Acre-feet
TOTAL DEMAND	208,000
CAP Water	
CAP M&I Subcontracts	2,000
Indian Leases	15,000
NIA Priority Water	6,000
Colorado River Water	
Indian Leases	0
Non-Indian Rights	12,000
Groundwater	
Local	36,000
Imported	75,000
Effluent	62,000
TOTAL SUPPLY	208,000
DEFICIT	0

Cost. This alternative rated neutrally on cost, because of its supply diversity. This option does not rely heavily on local groundwater or Colorado River supply sources. Like the renewable water approach, offsite infrastructure improvements would be minimal. Because this approach incorporates the use of groundwater, costs associated with acquiring more expensive renewable supplies would not need to be incurred immediately.

Accessibility. On accessibility, this alternative rated the best of the three options because it maximizes all supplies directly under the control of ASLD. Further, this approach is not as dependent on supplies and infrastructure that would be out of ASLD's direct control. Requiring approximately 87,000 acre-feet of excess canal capacity, this alternative is not as dependent on CAP's excess canal capacity as the previous alternative.

Reliability. Of all the options, this alternative also rated best on reliability. This is due to the diversity of the supply, the reduced use of local groundwater, and also the use of local groundwater to back-up renewable supplies.

Legal/administrative. On legal/administrative, this alternative rated stronger than the renewable water alternative, but weaker than the groundwater dependent option. This is because this alternative will also require acquisition of Indian leases and Colorado River water. Still, this option is not as hampered by this criterion, because the option relies on its groundwater in the early years and is less reliant on imported supplies than the renewable supply alternative.

Public Acceptance. Public acceptance is not as high for this option as for renewable supplies, because this option continues to use, albeit a reduced amount, local and imported groundwater.

METHODS OF PROVIDING WATER SERVICE TO THE PROPERTY

There are several water utilities located inside or adjacent to Superstition Vistas. Figure 5 following this page shows the water utilities—both private and public—in or near the study area. In those areas where existing franchises exist, ASLD would need to either accept service from those water providers or secure the rights to serve in that area instead of the existing utility[30]. There are numerous methods of providing water service to Superstition Vistas. The assured water supply strategy assumed by ASLD will influence the method of providing water service. Three options are described in this paper:

- Passive Alternative
- Solicited Alternative
- Special District Alternative

Passive Alternative

This alternative is characterized by the following attributes:

- ASLD does nothing.
- Developers create own water utilities or coordinate with local utilities to extend service to new developments.
- Utilities in proximity to property attempt to serve parts of Superstition Vistas or new utility emerges.
- ALSD relies on water providers ultimately serving property to secure supplies, or ASLD secures supplies and determines method of releasing portions of supply, as need dictates.

The primary advantage of this alternative is that ASLD would not need to plan, strategize or expend resources on developing a method for providing water service. The primary disadvantage is that ASLD may lose the opportunity to position the property competitively relative to other areas.

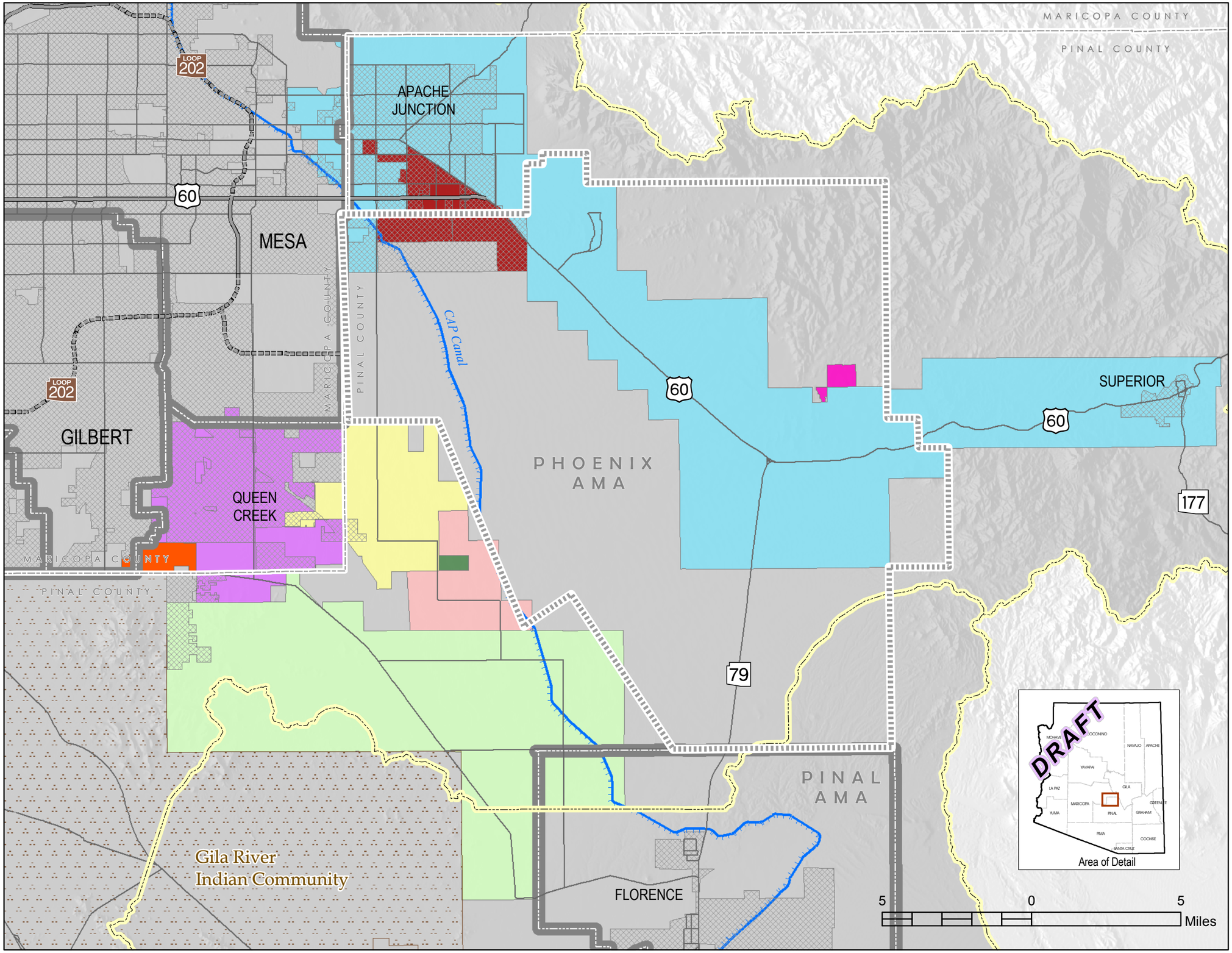
Solicited Alternative

This alternative is characterized by the following attributes:

- ASLD solicits specific utilities or others to provide water service (e.g. Arizona Water Company, Town of Apache Junction and City of Mesa).

[30] Securing the rights to serve in an existing utility's franchised area could be an endeavor. The costs to accomplish this would likely outweigh any benefit.

Superstition Vistas Growth Area



Study Area Boundary

Water Providers

- Arizona Water Company Apache Junction - Superior
- Chandler Heights Citrus Irrigation District
- Diversified Water Utilities, Inc.
- H2O Inc.
- Johnson Utilities, L.L.C.
- Queen Creek Water Company
- Queen Valley Domestic Water Improvement District
- Sun Valley Farms Unit VI Water Company
- Water Utilities Community Facilities District

Other Map Features

- Water Planning Area
- Active Management Area
- CAP Canal
- County Boundaries
- Existing Freeway
- Planned Freeway
- Major Roads
- Incorporated Areas
- Indian Communities

DRAFT

Map Prepared for Central Arizona Project by Maricopa Association of Governments May 2005

MARICOPA ASSOCIATION of GOVERNMENTS

CAP

- ASLD relies on water providers ultimately serving property to secure supplies or ASLD secures supplies and determines method of releasing portions of supply, as need dictates.

The primary advantage of this approach is that ASLD will have some control over how water service is provided potentially creating a structure that will make the property as a whole more competitive. At the same time, ASLD does not have to become a water provider. It can instead rely on the expertise and infrastructure of nearby utilities, or ASLD could solicit a major water company to create and operate a new water utility.

The primary disadvantage of this approach is that it will be difficult to balance the desires of local jurisdictions with establishing control over water service. The process of defining areas of control could become highly political, and ASLD would be at the center of the storm. Battles over jurisdiction could delay development. The passive approach could also result in controversy over which utility or city serves what parts of the study area. The difference between these two alternatives, on this particular point, is that ASLD would be at the center of the solicited alternative as opposed to on the periphery using the passive alternative.

Special District Alternative

This alternative is characterized by the following attributes:

- ASLD would lead a legislative effort to create a special district that could do everything from securing and providing an assured water supply for the property to treating and delivering water to retail customers to collecting and reusing wastewater.
- In areas where existing franchises exist, the special district could wholesale water to these utilities.
- In areas where no franchise exists, the special district could operate local water service.
- The special district could be operated as a private-public partnership through an operations and maintenance agreement with a private utility or through a public-public partnership where a city or town would operate the utility.

The primary advantage of this approach is that it allows ASLD the opportunity to incorporate an effective assured water supply strategy with providing water service. By providing a full service water solution for the property, ASLD could make the land more attractive for development. The cost of acquiring those supplies could also be lower than if each utility competed for the same supplies. Finally, a water utility in some form could provide revenue.

The primary disadvantage of this alternative is that there is no operating model in Arizona for ASLD to follow. It would likely require legislative, perhaps constitutional changes. Because the growth market is so competitive, there might be significant opposition to creating such a special district to provide water service to this or any other State Trust lands. Moreover, if ASLD were to be involved in providing water service in some fashion,

this would become an on-going concern for ASLD. By contracting the operation out to another entity, ASLD could mitigate much of the day-to-day concerns about running either a wholesale or retail utility.

ISSUES FOR CONSIDERATION

This final section summarizes a number of the issues that will impact water management in the Superstition Vistas area. Many of these issues are relevant to the initial conceptualization and design of potential developments. Others issues highlight water management policy decisions that could impact how water will be provided to Superstition Vistas.

Building a Water Supply Portfolio

Sufficient water supplies should continue to be available for Superstition Vistas. However, assembling water supplies for new large developments and rapidly growing cities will become increasingly complex, controversial and expensive. Cheaper, more reliable supplies, with longer term contracts will likely be exhausted earlier than less attractive supplies. Additionally, excess canal capacity in the CAP will likely be fully allocated before build-out of Superstition Vistas. Therefore, it will be advantageous to secure water supplies and infrastructure capacity as early as possible. To build a water supply portfolio sufficient to satisfy evolving regulatory requirements and provide perpetual water service, water providers serving Superstition Vistas will need to utilize all types of available supplies: CAP water, mainstem Colorado River water rights, groundwater and reclaimed water. Key issues to consider for potential Superstition Vistas development include:

- Building a diverse water supply portfolio will increase the overall reliability of the supply and increase the flexibility to adapt to changing circumstances over the lengthy development time frame.
- Joining the Central Arizona Groundwater Replenishment District (CAGRD) will provide access to local groundwater supplies, but will not provide sufficient supplies to fully develop the area.
- Fully and efficiently using all reclaimed water will reduce the need to import costly supplies.
- New supplies, such as purchasing or leasing mainstem Colorado River water rights (both Indian and non-Indian agricultural users) for transportation to Superstition Vistas will require developing new legal and contractual arrangements that do not exist today.
- ASLD may wish to examine the potential to utilize supplies under its control (e.g. Butler Valley groundwater) for Superstition Vistas.
- Backup supplies, (e.g. local groundwater, water stored underground, fallowing agreements with senior water right holders) will be necessary to put less reliable supplies to use.
- Individual developers will likely be able to independently secure an assured water supply for portions of Superstition Vistas, but this may become more difficult over

time particularly for developments located in areas further from existing infrastructure and lacking sufficient groundwater reserves. ASLD can likely bring greater value to the land by providing a comprehensive and consistent approach to securing sufficient supplies for the entire area.

Regional Water Infrastructure Needs

Superstition Vistas will rely heavily on existing regional water infrastructure, in particular, the CAP. Depending on how rapidly Superstition Vistas develops, Superstition Vistas may require significant improvements and possibly expansion of capacity in the CAP. Development in Superstition Vistas will also require treatment and delivery infrastructure to directly serve the area. Detailed hydrologic studies need to be completed and appropriate sites for water supply infrastructure need to be identified and protected prior to development occurring in the area. Additionally, lands in and around the Superstition Vistas area are subject to land subsidence and fissuring if groundwater is depleted. Efforts to prevent or mitigate these impacts need to be built into the long-range water supply and infrastructure planning. Further details and additional key infrastructure issues include:

- By approximately 2045, the CAP aqueduct is expected to be fully utilized (1.8 million acre-feet) given existing infrastructure and operations. Improvements will be needed to increase the CAP capacity by several hundred thousand acre-feet.
- Importing sufficient water to Superstition Vistas will require use of excess canal capacity to transport water through the CAP canal. CAP has only recently begun the process of determining how excess canal capacity will be used. Whatever mechanism eventually exists to access this capacity, Superstition Vistas will need to secure access.
- Prior to the projected build-out of Superstition Vistas, even the potential expansion of CAP canal capacity will have been fully utilized (projected to be around 2060) and new major water importation infrastructure.
- Identifying appropriate locations to pump groundwater as well as potential locations to store water underground (recharge) early will allow those sites to be protected and incorporated into the infrastructure design.
- Building infrastructure to utilize non-potable and reclaimed water for irrigation and other industrial uses will help to reduce water importation and treatment costs.

Water Management Implications for Development Design

The design of Superstition Vistas can significantly impact the water demands and supplies available to the resulting development. Important factors to consider in the initial stages of design include:

- Designing for water efficiency (e.g. low water use landscaping) and the maximum use of reclaimed and non-potable water supplies can greatly reduce total demand as well as water treatment costs.

- Designing to foster natural recharge along washes and to capture precipitation within the development (e.g. rainwater harvesting) can increase available supplies on site.
- Incorporating into Superstition Vistas certain uses that can be cut back during shortages (e.g. non-residential or landscaping uses that can be cut off during droughts) will greatly increase the overall water supply reliability and the flexibility to meet demands.

Significant Regulatory and Legal Water Management Issues

Because of its size, Superstition Vistas will develop over an extended period of time. During the projected 50 to 90 year build-out, regulatory programs and laws will likely undergo significant changes. The list below includes just a few issues applicable to Superstition Vistas.

- Rules for permitting new wells are currently being revised. These rules determine what rate of groundwater drawdown is permissible and in the future may address other issues relevant to Superstition Vistas (e.g. subsidence and fissuring).
- Assured water supply rules are the major regulation impacting what water can be supplied to the area. As these rules evolve, any changes should be monitored for potential impact on development of Superstition Vistas.
- Importing additional supplies into central Arizona will require use of excess canal capacity in the CAP. CAP has begun the process of determining how this capacity will be used and what contractual and other arrangements will ultimately be required. Eventually, additional mechanisms (i.e. new rules, statutes, funding authorizations and contractual arrangements) will be needed to import greater volumes of water. As the regulatory landscape changes, these new mechanisms should be monitored for potential impacts on development of Superstition Vistas.
- The structure of the CAGRD as well as its ability to take on new customers will continue to evolve over the build-out of Superstition Vistas. The CAGRD as well as other potential water importation mechanisms will impact development of Superstition Vistas.
- State Land Trust reform may impact how large developments like Superstition Vistas proceed.
- The ability to build a water supply portfolio for State Lands in advance of development or to create a water supply district to serve the area would facilitate development of the land, but would likely require legislative authority.

PRINCIPLE CONSIDERATIONS FOR SUPERSTITION VISTAS

- Use 100% of the reclaimed water produced by Superstition Vistas on site.
- Plan land use with lower demands and high water use efficiency to reduce supply acquisition volume.
- Use local groundwater to lower up-front investment, provide a long-term back-up supply for drought conditions and outages, reduce peaking capacity needs in treatment facilities and reduce supply acquisition volume.

- Mitigate use of local groundwater by concurrently recharging the local aquifer to avoid land subsidence and earth fissuring.
- Plan for and reserve well field and recharge site locations in advance prior to development.
- Evaluate use of Butler and Harquahala Valley water farms as a resource for the property.
- Create a sufficiently diverse supply portfolio to be adaptable to changing conditions, regulatory or otherwise.
- Secure water supplies and access to existing infrastructure sooner rather than later to avoid aggressive competition.
- Position Superstition Vistas for development prior to needing major regional infrastructure—estimated at between 2045 and 2060.
- Develop a water resource strategy that will enhance the competitive edge of the property.

APPENDICES

APPENDIX A

Regional Water Demands and Supplies - Detail

	Population	Estimated GPCD	Estimated Potable Demand (af)	Estimated Reclaimed Water (af)	CAP Water for M&I Uses (af)	Water Farms (af)	Colorado River Water (af)	Other Surface Water (af)	Grandfathered Groundwater (af)	Total Potential Supply (af)	% of Potential Supply Used
	Column 1	*Column 2*	*Column 3*	*Column 4*	*Column 5*	*Column 6*	*Column 7*	*Column 8*	*Column 9*	*Column 10*	*Column 11*
2005	4,784,000	225	1,207,000	109,000	822,000	0	0	570,000	208,000	1,709,000	71%
2010	5,510,000	224	1,382,000	124,000	822,000	118,000	0	570,000	214,000	1,848,000	75%
2015	6,315,000	222	1,569,000	141,000	822,000	118,000	0	570,000	219,000	1,870,000	84%
2020	7,119,000	220	1,755,000	158,000	822,000	118,000	0	570,000	225,000	1,893,000	93%
2025	7,871,000	218	1,920,000	173,000	958,000	118,000	0	570,000	229,000	2,048,000	94%
2030	8,543,000	215	2,055,000	185,000	958,000	118,000	0	570,000	232,000	2,063,000	100%
2035	9,068,000	212	2,156,000	194,000	958,000	118,000	274,500	570,000	235,000	2,350,000	92%
2040	9,625,000	212	2,288,000	206,000	958,000	118,000	274,500	570,000	237,000	2,364,000	97%
2045	10,216,000	212	2,429,000	219,000	958,000	118,000	274,500	585,000	239,000	2,394,000	101%
2050	10,843,000	212	2,578,000	541,000	958,000	118,000	474,500	585,000	241,000	2,918,000	88%
2055	11,508,000	212	2,736,000	575,000	958,000	118,000	474,500	585,000	243,000	2,954,000	93%
2060	12,214,000	212	2,903,000	610,000	958,000	118,000	474,500	585,000	245,000	2,991,000	97%
2065	12,963,000	212	3,082,000	647,000	958,000	118,000	474,500	585,000	248,000	3,031,000	102%
2070	13,758,000	212	3,270,000	687,000	958,000	118,000	474,500	585,000	251,000	3,074,000	106%
2075	14,602,000	212	3,471,000	729,000	958,000	118,000	474,500	585,000	254,000	3,119,000	111%
2080	15,498,000	212	3,684,000	774,000	958,000	118,000	474,500	585,000	257,000	3,167,000	116%
2085	16,449,000	212	3,910,000	821,000	958,000	118,000	474,500	585,000	260,000	3,217,000	122%
2090	17,458,000	212	4,150,000	872,000	958,000	118,000	474,500	585,000	263,000	3,271,000	127%
2095	18,529,000	212	4,405,000	925,000	958,000	118,000	474,500	585,000	266,000	3,327,000	132%
2100	19,666,000	212	4,675,000	982,000	958,000	118,000	474,500	585,000	109,000	3,227,000	145%

30% % of potable demand assumed to be wastewater

% of wastewater assumed available for municipal

70% use

Notes for Appendix A are located on the following page.

Notes for Appendix A

Column

1 Based on MAG and PAG Interim Population and Housing Unit Projections through 2035; extrapolated beyond 2035 assuming growth rate from 2030 to 2035.

2 Based on demands of Member Service Areas and Water Providers designated on their own for assured water supply purposes from Outlook 2003 converted to gallons per capita per day (GPCD) for the three county service area. This demand does not include demands associated with non-irrigation rights and effluent (including some golf courses and parks). To counter balance this, the analysis assumes sufficient effluent supplies will be reserved for these types of uses and estimated grandfathered groundwater does not assume non-irrigation rights.

3 Population X GPCD X 365 days / 325851 gallons per acre-foot.

4 The amount of effluent available for municipal providers is assumed to be 30% of effluent produced until 2050. After 2050, the percent of effluent available for municipal providers is assumed to increase to 70%.

5 This analysis assumes that some time between 2006 and 2030, (603,678 acre-feet M&I subcontract [note: assumes 555,031 acre-feet currently under subcontract, plus 65,647 acre-feet of uncontracted for M&I water allocated in the GRIC Settlement], 47,303 acre-feet Hohokom Irrigation District conversion, 96,295 acre-feet NIA conversion, 154,030 acre-feet Indian Lease, plus 39,198 acre-feet of additional Indian Leases as currently authorized in settlements) will become available. This transition is assumed to occur in 2025. Prior to 2025, Appendix A assumes all but additional Indian Lease and NIA conversion.

6 Water farms assumes five water farms: McMullen Valley (36,000 acre-feet), Harquahala Valley (80,000 acre-feet), Butler Valley (65,000 acre-feet), Yuma Groundwater Exchange (10,000 acre-feet) and Mesa's Pinal County water farm (25,000) and Tucson's Avra Valley water 20,000 acre-feet. City of Scottsdale has the right to 3,460 acre-feet of the Harquahala Valley water. Since these water farms will likely not be pumped for some time, and others may never be used, this analysis assumes that only half of the supplies will be used during the 100-year period. NOTE: Yuma Groundwater is a one time 200,000 acre-foot volume available for a 20 year period.

7 Prior to 2050, the volume of Colorado River water shown here assumes current CAP excess canal capacity (385,000 acre-feet) less the volume assumed for water farms not including Mesa or Tucson's water farms that do not require excess canal capacity. In 2050, as demands exceed existing excess canal capacity, the volume of Colorado River water increases assuming canal operations and infrastructure are optimized to a new excess canal capacity 585,000 acre-feet.

8 Assumes 520,000 acre-feet of assured water supply eligible SRP water (source: Salt River Project, (1996) Assured Water Supply Study for Salt River Project Member Lands.), 15,000 acre-feet of Planet Ranch water and 50,000 acre-feet additional surface water supplies. Does not include potential municipal conversion of San Carlos Irrigation District's rights to Gila River water. Does not assume irrigation customer supplies or agriculture.

9 Assumes a one-time volume of 1.6 million acre-feet of AWS groundwater allowances. Since this analysis assumes that this volume will be used evenly across the 100-year period, the 160,000 acre-feet allowance ends in 2095. Also assumes incidental recharge for designated water providers. This is ongoing and does not terminate in 2095. Assumes 75,000 acre-feet of grandfathered groundwater demands by water providers serving pre-95 subdivisions. Post 2035, assumes incidental recharge growth at 3% per year.

10 Sum of columns 5 through 9.

11 Column 4 divided by column 10.

APPENDIX D
ARIZONA'S ASSURED WATER SUPPLY PROGRAM

Excerpts from Governor's Water Management Commission Briefing Notebook, August 2000.

OVERVIEW

ASSURED WATER SUPPLY FOR NEW SUBDIVISIONS

Arizona's Assured Water Supply Program is designed to sustain the State's economic health by preserving groundwater resources and promoting long-term water supply planning. This is accomplished through regulations that mandate the demonstration of renewable water supplies for new subdivisions. The program is an integral component of Arizona's 1980 Groundwater Code, which was designed to address severe groundwater level decline rates in major urban and agricultural areas.

History

In 1973, the Arizona Legislature enacted a statewide water adequacy statute as a consumer protection measure (A.R.S. § 45-108). The law was passed in response to incidences of land fraud involving the sale of subdivision lots that were later found to have insufficient water supplies. This law required developers to obtain a determination from the State regarding the availability of water supplies prior to marketing new subdivision lots. Developers were then required to disclose any "inadequacy" of the supply to potential lot buyers.

The 1980 Groundwater Code contains more rigorous provisions for new subdivisions in the Active Management Areas (AMAs). The 1980 Code prohibits the sale or lease of subdivided land in an AMA without demonstration of an assured water supply. An assured water supply determination is required to gain approval of a subdivision plat by local governments, and to obtain authorization to sell lots by the Department of Real Estate. A subdivision is defined as land divided into six or more parcels where at least one parcel is less than 36 acres. Land divisions resulting in parcels larger than 36 acres are classified as "unsubdivided" lands and do not require an assured water supply determination.

1995 Assured Water Supply Rules

In 1991, the Arizona Department of Water Resources (ADWR) began developing formal administrative rules for meeting the statutory criteria. The effort, which involved considerable public input, culminated in the adoption of the Assured Water Supply (AWS) Rules in February 1995.

The two most common types of documentation for an AWS are a Certificate of Assured Water Supply (Certificate of AWS) and a Designation of Assured Water Supply (Designation of AWS). New subdivisions are required by the 1980 Groundwater Code to have a Certificate of AWS, unless a water provider designated as having an assured water supply serves them. The Certificate of AWS states that the developer has proven that sufficient water supplies exist for the subdivision for 100 years. If the new subdivision or development is within the service area of a Designated Water Provider, then a Certificate of AWS is not required; provided that the developer has obtained a written commitment of service from a water provider designated as having an assured water supply. As a example, if a subdivision is being built in the Tucson AMA within the City of Tucson's service area, the developer only needs to provide written proof to ADWR of the City of Tucson's commitment of service to meet the AWS requirements, since the City of Tucson has already met the AWS criteria and obtained a Designation of AWS.

For municipal private water providers, a Designation of AWS is issued. This Designation of AWS states that the municipality or private water provider has proven sufficient water supplies to service their current, committed and future demand for 100 years. Municipalities and private water providers are not required to apply for a Designation of AWS, but there are incentives to do so. A Designated Water Provider can deliver water to new developments within their service area, without the new subdivision having to apply for their own Certificate of AWS. The most populous cities within AMAs have obtained a Designation of AWS, and thus a majority of new subdivisions qualify through this process.

Assured Water Supply Criteria

1. To obtain an assured water supply determination, the statute requires a demonstration of:
2. Physical, legal and continuous water availability for 100 years;
3. Water quality standards attainment;
4. Financial capability to construct the delivery system and related features;
5. Consistency with the AMA's management plan; and
6. Consistency with the AMA's management goal.

Meeting the Assured Water Supply Criteria

Developers seeking a Certificate of AWS must demonstrate that sufficient qualifying water supplies are available to meet subdivision demands for at least 100 years. Water providers seeking a Designation of AWS must demonstrate that sufficient qualifying supplies are available to meet current demand, committed demand (i.e. that which is associated with recorded, undeveloped lots) and at least two years of projected growth for a 100 year period.

A. Assured Water Supply Regulations for Subdivisions

Two avenues exist for obtaining an AWS determination for a proposed subdivision. The method used will depend upon the access to a Designated Water Provider. If the water provider has acquired a Designation of AWS, then the developer may obtain a written commitment of service from that water provider. If the water provider has not acquired a Designation of AWS, the developer must independently obtain a Certificate of AWS by submitting an application to ADWR.

Commitment of Service by a Designated Water Provider

Designated water providers may include cities, towns, and private water companies that have previously satisfied the AWS criteria for current, committed, and projected customers. If a developer intends to take advantage of a provider's designated status, the developer need only obtain a written commitment from the provider to serve the proposed subdivision. The written commitment is presented to the platting entity, and must be noted on the subdivision plat. An application to ADWR is not required.

Certificate of Assured Water Supply

To acquire a Certificate of AWS for a proposed subdivision, the property owner must file an application with ADWR. If the application is found to meet the AWS criteria, public notification is posted in a local newspaper. If no protests are received, a Certificate of AWS is issued. A typical application is processed in about three months. The Certificate of AWS is issued in the name of the property owner, and is valid only for that owner. A Certificate of AWS may be reissued in the name of a new owner if ADWR is notified within 90 days of the transaction.

Certificates of AWS are issued only for subdivision plats. For "master planned" areas that are not yet platted, the developer may obtain a pre-qualification for an AWS determination by applying to ADWR for an Analysis of AWS.

Assured Water Supply Statutory Requirements

While these basic criteria have been required since 1980, the 1995 AWS Rules strengthen the management goal component significantly and establish standards for many sources of water, including Central Arizona Project water, other surface water and effluent. The 1995 AWS Rules also raise the depth-to-water standard, and simplify the financial capability requirements. The most important provisions of the five program criteria are discussed in the following sections.

1. Physical, Legal and Continuous Availability; R12-15-703

The applicant must describe the sources of water to be served to the subdivision. This involves demonstrating the actual water availability and the existence of a delivery system.

Water must be physically and continuously available to the subdivision to meet its demand for at least 100 years. This is typically demonstrated through a hydrologic study which must be submitted with the application, unless the entity providing water has previously submitted a valid study to ADWR. To show that supplies will be continuously available, adequate delivery, storage, and treatment works must also exist or be financed. Evidence of a legal right to the water supply or supplies is also required.

A legally recognized water provider must be committed to supply service. If a system does not presently serve the area, two options exist: a) a new water company or co-op may be established in accordance with the applicable Arizona Corporation Commission, ADEQ and ADWR requirements; or b) the subdivision may be developed as a "dry lot subdivision" where individual domestic wells will be drilled on each lot by purchasers. If the subdivision is to be served by a private water company, the proposed subdivision must be within the area prescribed in the company's Certificate of Convenience and Necessity.

2. Water Quality; R12-15-704

The applicant's proposed source(s) of water must satisfy existing state water quality standards as well as other water quality standards applicable to the proposed use after treatment. ADWR will consider the possible migration of poor quality water that may impact the applicant's source. Designated providers must continue to satisfy all applicable state water quality requirements in order to maintain their designation.

3. Consistency with Management Goal; R12-15-705

All five AMAs have water management goals related to reduction in groundwater use. The AWS Rules require that municipal users in growing areas limit the use of mined groundwater through the use of alternative supplies and conservation practices. Mined groundwater is groundwater that is used in excess of the goal of the AMA. A certain amount of mined groundwater is allocated to Certificate and Designation of AWS applicants to allow for the "phasing in" of renewable supplies. Renewable supplies must meet any demand over the groundwater allocations. Each AMA, except the Santa Cruz AMA, has its own formula to calculate the amount of mined groundwater that can be used when demonstrating an AWS, which is discussed in Part Three, Chapter IV, Section C. Although the applicant may meet the goal criterion through recharging a renewable supply outside of the service area and pump groundwater, the groundwater must still be physically available.

The following sections are general ideas for maintaining consistency with the management goal. It is important to keep in mind that dry lot subdivisions of 20 lots or less are exempt from the consistency with management goal requirement in all AMAs. For subdivisions that will be receiving groundwater in an AMA, the Certificate of AWS applicant may demonstrate consistency with the management goal through any or all of the following methods: membership in the Groundwater Replenishment District (GRD), extinguishment credits, use of poor quality water or use of water from a waterlogged area.

4. Consistency with Management Plan; R12-15-706

The applicant will need to estimate the amount of water use per lot and for any additional subdivision features such as golf courses, parks, or lakes. A build-out schedule must be supplied for all subdivisions. Demand estimates are evaluated in the context of water conservation guidelines.

If the subdivision is for more than 50 lots, a description of any proposed conservation measures will need to be provided. If the development is designed so that it conforms to water conservation practices, it will be easier for the serving provider to meet its conservation requirements as prescribed in the management plan for the AMA. While ADWR cannot deny a certificate application if the demand will make it more difficult for the provider to comply with its conservation requirements, the provider will be notified of the potential impact of the new subdivision. A certificate application will not be denied if the water provider is out of compliance with its conservation requirements.

5. Financial Capability; R12-15-707

The developer's financial capability to construct the water delivery system is typically considered through the platting entity's process of approving a plat. The developer's capacity to finance any features that are not included in the plat approval process, such as storage and treatment facilities, generally requires the posting of a performance bond.

B. Assured Water Supply Regulations for Water Providers

If a water company is designated as having an assured water supply then individual subdivisions to be served by the water company are relieved of having to independently demonstrate an AWS. The same basic criteria, which apply to Certificates of AWS, also apply to water providers seeking a Designation of AWS. Important items that are unique to the Designation of AWS are addressed in the following sections.

<u>Physical, Legal, Continuous Availability; R12-15-703</u>

Demand and supply information must be provided for the entire service area. The water must be physically and continuously available to the water provider in amounts sufficient to meet current demand, committed demand and a minimum of two years of projected

demands for at least 100 years. The water provider must have a legal right to all water to be served. If the provider is not a city or town, applicable Arizona Corporation Commission approvals must exist for private water company regulations.

Consistency with Management Goal; R12-15-705

"Consistency with the management goal" can be demonstrated through utilization of a CAP allocation, other surface water, recharge credits, extinguished grandfathered water rights, water exchange agreements or membership in the GRD. If the water provider meets the consistency with the management goal requirement through membership in the GRD, the service area must be enrolled as a member service area. The provider will pay an annual assessment to the GRD based on the amount of mined groundwater pumped for the entire service area.

Consistency with Management Plan; R12-15-706

Existing water providers can show consistency with the management plan if they are in compliance with their conservation requirements. If the provider is out of compliance, the violation must be remedied by entering into a stipulated agreement with ADWR. New water providers must describe the measures that will be implemented to meet ADWR's conservation requirements. If the water provider is out of compliance, the Designation could be lost.

Financial Capabilities; R12-15-707

To demonstrate financial capability for storage and treatment facilities, private water companies can show Arizona Corporation Commission approval of financing as evidence. Cities and towns can present evidence that financing is available for a five-year capital improvement plan containing these facilities.

C. Groundwater Allocation and Management Goal Accounting

Assured Water Supply applicants are allowed to utilize a certain volume of groundwater to allow for the "phasing in" of renewable supplies. This volume is calculated differently depending on the type of applicant and the AMA. Each AMA's groundwater allocation and goal were discussed in Part Three, Chapter IV, Section A- Consistency with Management Goal.

The methods for calculating the allocation, how the groundwater allocation may be used, and the accounting mechanism to determine compliance with the consistency with management goal criterion are explained below.

Calculating the Groundwater Allocation

The groundwater allocation is comprised of three components: the basic allocation, the incidental recharge factor and extinguishment credits. Each of the following sections describes how to calculate these parts of the groundwater allocation. Groundwater used above the total of the mined groundwater allocation, the incidental recharge allocation and the extinguishment credits must be replenished unless it is exempt.

Basic Allocation

Designation applications for existing water providers can pledge the 1994 demand (water usage) multiplied by 7.5% in the Phoenix AMA and by 15% in the Tucson AMA. For example in the Phoenix AMA, if an existing water provider's 1994 water usage was 1000 af, then 1000 af X 7.5% would equal their basic groundwater allocation. 75 af/yr would be the amount of groundwater that would not have to be replenished. New water companies formed after February 7, 1995 that apply for a Designation of AWS do not receive a basic allocation.

For Certificates of AWS in the Tucson and Phoenix AMAs, the 15-year demand of the development (which may be the build-out demand) is multiplied by the appropriate factor shown in the table below. This amount is the basic 100-year allocation and not an annual amount. For the Pinal AMA, the basic allowance is determined by multiplying the population of the subdivision by 125 gallons per person per day. For certificates in the Prescott AMA, the groundwater allowance is their 15 year demand of the development, multiplied by the number of years until 2025, divided by two. The rules do not establish a groundwater allowance for the Santa Cruz AMA.

Calculating the Basic Groundwater Allocation for Certificates

Location of Proposed Development	Management Period in Effect on Date of Application	Allocation Factor
Tucson	Third (2000-2010)	8
	Fourth (2010-2020)	5
	Fifth (2020-2025)	2
	After 2025	0
Phoenix	Third (2000-2010)	4
	Fourth (2010-2020)	2
	Fifth (2020-2025)	1
	After 2025	0

Incidental Recharge Factor

Holders of designations under the new rules (except those in the Pinal, Prescott, and Santa Cruz AMAs) annually receive an incidental recharge allocation based on 4 percent of the demand in the previous year. Designation applicants may also apply for a higher incidental recharge allocation factor if they can demonstrate that incidental recharge is higher than 4 percent in their service area.

Extinguishment Credits

Groundwater credits can be accumulated through the extinguishment of grandfathered groundwater rights. The credit is based on a calculation prescribed in the rules, which varies depending on the AMA in which the right is extinguished, the type of right, and the year that the right is extinguished. Extinguishment credits may be conveyed so long as they have not already been used as the basis of a Certificate of AWS.

Use of the Mined Groundwater Allocation

The mined groundwater allocation can be used at any time during the 100-year period. It may be spread out over a period of years or the use may occur during a specific time period. Private water companies that applied for a Designation of AWS by August 7, 1995 were given three years before they needed to show consistency with the management goal of the AMA. This means that for 1996, 1997, and 1998 they may use groundwater and not have it subtracted from their groundwater account. Similarly, if deemed providers (cities or towns with CAP allocations) applied for a Designation of AWS by January 1, 1997, they do not have to comply with the goal consistency provision until 2001.

Consistency with Management Goal Accounting

To determine compliance with the consistency with management goal requirements, ADWR establishes an account for each holder of a Certificate or Designation of AWS, which includes the water supply and demand status of the holder. The account is updated annually and includes the volume of the mined groundwater allocation, including any extinguishment credits and the incidental recharge allocation as applicable. As mined groundwater is used, it will be subtracted from the account unless it is exempt.

Wet Water v. Paper Water

The process of calculating the basic allocation, the incidental recharge factor and extinguishment credits produce an amount of "paper water." It may be the case that an existing water provider is entitled to an amount of groundwater on paper that does not exist in the aquifer. It is important to remember that physical availability of the water must still be proven, even if the applicant is entitled to a groundwater allocation.