DRAFT
ENVIRONMENTAL IMPACT STATEMENT
JUNE 2000

VOLUME 3
Technical Appendices I-P

ALLOCATION OF WATER SUPPLY AND LONG-TERM CONTRACT EXECUTION

CENTRAL ARIZONA PROJECT

U.S. Department of the Interior
Bureau of Reclamation

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

JUNE 2000

VOLUME 3

TECHNICAL APPENDICES

APPENDIX I	GROUNDWATER ANALYSIS
APPENDIX J	MAINSTEM IMPACTS ANALYSIS
APPENDIX K	CAP COST ALLOCATION AND REPAYMENT ANALYSIS
APPENDIX L	INDIVIDUAL ENTITY DESCRIPTION MUNICIPAL AND INDUSTRIAL NON-INDIAN AGRICULTURE INDIAN
APPENDIX M	RELEVANT CENTRAL ARIZONA WATER CONSERVATION DISTRICT BOARD BRIEFS
APPENDIX N	ADWR CAP ALLOCATION RECOMMENDATION LETTER
APPENDIX O	STIPULATION FOR CAWCD V UNITED STATES
APPENDIX P	COMMON CONVERSION FACTORS TO METRIC UNITS

APPENDIX J

MAINSTEM IMPACTS ANALYSIS

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

APPENDIX J — IMPACTS TO THE COLORADO RIVER MAINSTEM DUE TO NAVAJO/HOPI CAP DIVERSIONS

Under Non-Settlement Alternatives 2 and 3, the Navajo Nation and Hopi Tribes (Navajo/Hopi) receive a combined allocation of 13,500 acre-feet annually (afa). It is anticipated that this water will be used solely for municipal and industrial (M&I) purposes and will be diverted from Lake Powell at a constant rate of less than 20 cubic feet per second (cfs). This appendix estimates the impacts of this diversion to the Colorado River mainstem.

As all other Central Arizona Project (CAP) diversions occur at Parker Dam, the flow regime of the Colorado River is potentially altered from Glen Canyon Dam to Parker Dam. Lake Mead, situated between Glen Canyon and Parker Dams, is a large regulating reservoir and would completely mask the impact of Navajo/Hopi diversions downstream of Hoover Dam. Therefore, this analysis is restricted to the reach of the Colorado River between Glen Canyon Dam and Lake Mead.

The impacts analyzed are lost power revenues at Glen Canyon Dam and the change in Colorado River water surface elevation.

J.I. VALUE OF FOREGONE ENERGY GENERATED AT GLEN CANYON DAM

One of the alternatives being considered by the Bureau of Reclamation (Reclamation) in connection with the CAP allocations is diversion of 13,500 afa from Lake Powell to serve M&I demand on the Navajo/Hopi Reservations. This section analyzes the value of the foregone energy production at Glen Canyon Dam as a result of this diversion of water.

Energy production at Glen Canyon was 6,626 gigawatt hour (GWh) in fiscal year 1998 and 6,700 GWh in fiscal year 1997. Installed generation capacity is 1,356 megawatts (MW). Actual operating capacity was 1,288 MW on July 1, 1998.[1]

During 1999, 11,706,000 acre-feet (af) of water were released at Glen Canyon Dam for power production.[2] Diversion of 13,500 af represents 0.12 percent of 1999 power releases. Forecast releases for 2000 and 2001 are less than 1999 actual releases, and the diversion would be about 0.19 percent of 2000 releases and 0.13 percent of 2001 releases. Thus, the impact of the diversion of water is likely to be small.

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[1] These data are from Western Area Power Administration (WAPA), 1998 Annual Report, Statistical Appendix.

[2] Water release and reservoir elevation data for 1999 and forecasts for 2000 and 2001 are from the Reclamation: www.uc.usbr.gov/wrg/crsp/crsp_gc.txt.

In order to estimate the value of foregone energy, the following assumptions were made:

J.I.a.

The amount of power produced in a given hour at Glen Canyon is a function of lake elevation and volume of water going through the turbines measured in cfs. This function was estimated by taking six days of Glen Canyon records[3] that provide hourly MW of generation, lake elevation, and releases of water for power production. The total number of observation points is six days times 24 hours per day = 144 points. A regression analysis was estimated which indicates that in any hour, each additional cfs of water adds 0.0408 MW of power production, and each additional foot of lake elevation adds 1.24 MW of power production.[4]

J.I.b.

For ease of computation, it is assumed that power production is constant over all hours of a given month, but that power generation varies from month to month. Specifically, MW of power production in each hour of each month were estimated using the regression analysis described above, assuming that the hourly water releases equal the average water releases in that month in 1999 and that the lake elevation equals the elevation at the end of the month in 1999. Since the regression equation estimates average power production in one hour, total energy production megawatts per hour (MWh) in a month is computed by multiplying the estimated MW generated by the number of hours in the month.[5]

J.I.c.

Diversions of water are assumed to be 20 cfs continuously throughout the year.

J.I.d. Monthly MWh generation was re-estimated with the regression equation for 1999 conditions minus the continuous diversion of 20 cfs. The difference between the results from step 2 above and this analysis represents foregone energy generation. Foregone energy generation is about 7,148 MWh per year.

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[3] Hourly records are from the WAPA web site: www.wapa.gov/crsp/operatns.dir. The dates selected for the analyses were January 15, 1999, March 27, 1999, June 2, 1999, July 29, 1999, August 31, 1999, and November 29, 1999. These dates were selected to represent the range of water releases that would occur at various times of the year.

[4] The regression equation is: MW = -4569.972 + .0408cfs + 1.240E, where MW is MW of power production in a given hour, cfs is cubic feet per second of water releases during that hour, and E is elevation of the reservoir in feet at that hour. R squared = 1.0 because the analysis simply uncovers engineering relationships.

[5] The representativeness of the data and the applicability of the method were checked by comparing actual monthly MWh generation with calculated monthly MWh for 1999. The sum of the absolute values of differences between calculated and actual MWh generation is only 1.05 percent of the actual generation.

J.I.e.

Foregone energy generation may be replaced with spot market purchases plus transmission costs. These costs represent the value of foregone hydro generation at Glen Canyon.[6] Monthly spot market prices for 1999 were estimated using the Dow Jones Palo Verde Index for firm energy for on-peak and off-peak periods. It was assumed that 57 percent of the foregone generation would have occurred during on-peak hours. Transmission costs were estimated for the associated MW rounded up to the next whole MW of reserved capacity, averaged over five transmission utilities: Arizona Public Service, Salt River Project, Nevada Power Company, Tucson Electric Power Company, and Public Service Company of New Mexico.[7] Transmission service is assumed to include point-to-point service plus Ancillary Services 1 and 2 (Scheduling, System and Dispatch Service and Reactive Supply and Voltage Control from Generation Sources Service). Other Ancillary Services would typically be required only in the control areas where the load is located and were omitted from this calculation.

Under these assumptions, the value of foregone generation under 1999 conditions would have been about $226,000. To put this annual impact into perspective, in fiscal year 1998, WAPA's Salt Lake City Area Integrated Projects (SLCAIP) power sales were $152.5 million dollars. Glen Canyon generation was about 77 percent of SLCAIP MWh sales.[8] The value of the foregone energy generation is, thus, roughly 0.19 percent of the portion of SLCAIP revenues attributable to Glen Canyon.

The present value of 51 years of the foregone generation, assuming a real growth rate in spot market electricity prices of 2 percent per year[9] and a real growth rate in transmission service prices of 0 percent per year, is $7.8 million (in 2001 dollars) computed with a real discount rate of 3.43 percent.[10]

J.II. CALCULATION OF COLORADO RIVER WATER SURFACE ELEVATION CHANGE DUE TO NAVAJO/HOPI CAP DIVERSIONS

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[6] Strictly speaking, the value of foregone generation should be the difference between spot market prices plus transmission costs and avoided variable costs of hydropower production. It is assumed that the variable cost of hydropower production is zero.

[7] Transmission and ancillary service costs are from the utilities' Open Access Transmission Tariffs.

[8] WAPA, 1998 Annual Report, Statistical Appendix.

[9] For comparison, the Energy Information Administration, *Annual Energy Outlook 2000* provides the following annual average real growth rates in prices for the period 2001 to 2020 for the Mountain Region (Supplemental Table 18): electricity prices in the industrial sector, -0.46 percent; natural gas prices paid by electric generators, 1.80 percent; and fossil fuel prices paid by electric generators, 0.08 percent.

[10] Concomitant with the diversion of 13,500 af of water from Lake Powell, there would be less water to distribute in central Arizona, thereby lowering pumping costs along the CAP canal. The draft preliminary 2001 water rate schedule for the CAP sets forth a pumping energy rate of $29 per af. At this rate, avoided pumping costs associated with the 13,500 af of water diverted at Lake Powell would be about $392,000 per year. In addition, the Lake Powell diversion would also result in less water available for agriculture and M&I use in central Arizona and in more power (generated by power plants, which serve CAP) for sale in power markets.

Colorado River channel characteristics were taken from the *Operation of Glen Canyon Dam, Final Environmental Impact Statement.* Table J-1 shows the eleven Colorado River reaches analyzed with the channel characteristics of each. These channel characteristics were inputs to Manning's equation, which estimates a depth of flow given certain channel characteristics.

Table J-1
CAP Allocation Draft EIS
Colorado River Channel Characteristics

Reach Number	River Miles	Reach Name	Width Type	Average Channel Width (feet)	Average Depth (feet)	Channel Slope (feet per mile)	Percentage of Bed Composed of Bedrock and Boulders	Estimated Manning's n
0	-15.50-0	Glen Canyon	Wide	450	27	1.4	>80	NA
1	0-11.3	Permian Section	Wide	280	24	5.2	42	0.055
2	11.3-22.6	Supai Gorge	Narrow	210	27	7.4	81	0.055
3	22.6-36	Redwall Gorge	Narrow	220	24	7.9	72	0.055
4	36-61.5	Lower Marble Canyon	Wide	350	18	5.3	36	0.04
5	61.5-77.4	Furnace Flats	Wide	390	15	11.1	30	0.04
6	77.4-117.8	Upper Granite Gorge	Narrow	190	27	12.1	62	0.055
7	117.8-125.5	Aisles	Narrow	230	21	9.0	48	0.055
8	125.5-140	Middle Granite Gorge	Narrow	210	26	10.6	68	0.055
9	140-160	Muav Gorge	Narrow	180	23	6.3	78	0.055
10	160-213.8	Lower Canyon	Wide	310	19	6.9	32	0.04
11	213.8-236	Lower Granite Gorge	Narrow	240	30	8.4	58	0.055
12	236-278	Lake Mead	Not Applicable					

The Manning's roughness coefficient (or Manning's n)varied based on the percentage of bed composed of bedrock and boulders. The roughness coefficients were taken from the Arizona Department of Transportation's *Highway Drainage Design Manual* Hydrology for channel material composed of cobbles and boulders. The roughness coefficient for cobbles (0.04) was used for bed compositions of less than 40 percent bedrock and boulders, while the roughness coefficient for boulders (0.055) was used for bed compositions of more than 40 percent. Various river depths were inserted into Manning's equation to achieve the minimum and maximum flows of the preferred alternative as well as the diminished flows due to the Navajo/Hopi diversion.

In the *Operation of Glen Canyon Dam, Final Environmental Impact Statement,* the preferred alternative was the modified low fluctuating flow alternative. In this alternative, the minimum releases fluctuate between 5,000 cfs at night and 8,000 cfs during the day. The maximum release was 25,000 cfs. Using these minimum and maximum flows, the change in depth in the Colorado River associated with the 20 cfs diversion was calculated.

Table J-2 shows the change in depth of the Colorado River associated with the 20 cfs decrease in flows. It is assumed that the slightly lower water surface does not have a significant impact to the habitat.

TableJ-2
CAP Allocation Draft EIS
Colorado River Changes in Depth

Reach	Glen Canyon EIS Preferred Alternative Flow Regime (cfs)	Flow Regime Due to Navajo/Hopi Diversion (cfs)	Change in Depth Due to Navajo/Hopi Diversion (inches)
Reach 1 – Permian Section	5,000 8,000 25,000	4,980 7,980 24,980	0.0144 0.0120 0.0072
Reach 2 – Supai Gorge	5,000 8,000 25,000	4,980 7,980 24,980	0.0108 0.0096 0.0060
Reach 3 - Redwall Gorge	5,000 8,000 25,000	4,980 7,980 24,980	0.0144 0.0120 0.0072
Reach 4 - Lower Marble Canyon	5,000 8,000 25,000	4,980 7,980 24,980	0.0096 0.0072 0.0048
Reach 5 - Furnace Flats	5,000 8,000 25,000	4,980 7,980 24,980	0.0084 0.0060 0.0036
Reach 6 - Upper Granite Gorge	5,000 8,000 25,000	4,980 7,980 24,980	0.0144 0.0120 0.0072
Reach 7 – Aisles	5,000 8,000 25,000	4,980 7,980 24,980	0.0132 0.0108 0.0072
Reach 8 - Middle Granite Gorge	5,000 8,000 25,000	4,980 7,980 24,980	0.0132 0.0108 0.0072
Reach 9 - Muav Gorge	5,000 8,000 25,000	4,980 7,980 24,980	0.0168 0.0156 0.0096
Reach 10 - Lower Canyon	5,000 8,000 25,000	4,980 7,980 24,980	0.0096 0.0084 0.0060
Reach 11 - Lower Granite Gorge	5,000 8,000 25,000	4,980 7,980 24,980	0.0132 0.0084 0.0072

Based on the small decrease in water surface elevation throughout the reaches and flow regimes, the impacts to aquatic and other wildlife are considered insignificant.

APPENDIX K

CAP COST ALLOCATION AND REPAYMENT ANALYSIS

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

APPENDIX K CENTRAL ARIZONA PROJECT COST ALLOCATION AND REPAYMENT ANALYSIS

In 1998, the Bureau of Reclamation revised the Interim Final Cost Allocation for the Central Arizona Project (CAP) for Stages I and II, dated December 1996. The date of the revised cost allocation, known as Revised CASII, is September 1998. Revised CASII is the latest official cost allocation of the CAP. Under Revised CASII, the estimated repayment obligation assigned to the CAWCD is $2,182,532,000.

The allocation of CAP water to various uses over the repayment period is an important determinant of the repayment obligation assigned to the Central Arizona Water Conservation District (CAWCD). In this draft Environmental Impact Statement, the alternatives represent varying allocations of CAP water to different uses. Different project water allocations result in different financial obligations (e.g., between reimbursable and non-reimbursable, between Indian and non-Indian, and between municipal and industrial [M&I] and irrigation). Therefore, a new cost allocation and repayment analysis was conducted for each alternative in order to ascertain how the results of each could modify the results of Revised CASII. The full cost allocation model was not employed and instead a spreadsheet approximation on Excel software, known as the "mini-model" closely approximates the results of the more detailed official model for cost allocations.

Table K-1 provides a summary of six runs, one for each alternative, and a comparison of the results. The data provided include allocated costs to the allocable functions of the CAP, i.e., non-Indian and Indian irrigation, commercial power, M&I water, fish and wildlife, recreation, and flood control. Changes in CAP water allocation do not affect the allocation of costs to fish and wildlife, recreation, commercial power, and flood control. Changes in CAP water allocation impact costs assigned to non-Indian and Indian irrigation and M&I water supply. Line item values do not always sum to the total values because of rounding and slight changes in reimbursable interest during construction. The total project cost line includes all expenditures by the United States in constructing the CAP plus interest during construction. The total project cost is just under $5 billion.

In the repayment section of Table K-1, the principal obligation of CAWCD (the primary repayment entity) is shown. In addition to the almost $500 million reduction in CAWCD's capital repayment obligation under the Settlement Alternative, compared to the No Action Alternative, CAWCD will experience an approximate reduction of $450 million in interest payments to the United States over the repayment period.

Finally, the difference between total project costs and the portion, which is to be repaid by local beneficiaries, become construction costs that are not recovered by the United States through repayment. The difference in cost to the United States between the Settlement Alternative and the No Action Alternative, in terms of a reduction in the repayment amount, is about $500 million.

Table K-1
CAP Allocation Draft EIS
Summary of CAP Allocated Costs and Repayment Obligations
(all values in thousands of dollars)

	Settlement Alternative	No Action Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B
Allocation of Costs to Project Purposes						
Irrigation:						
Non-Indian	$507,409	$465,702	$465,702	$467,320	$429,413	$409,989
Indian	$1,255,694	$947,663	$947,663	$1,165,692	$1,306,265	$1,247,177
Commercial Power	$0	$675,952	$675,952	$675,576	$675,576	$675,576
Municipal & Industrial	$1,212,148	$1,373,066	$1,373,066	$1,153,134	$1,059,597	$1,142,787
Fish and Wildlife	$6,532	$6,532	$6,532	$6,532	$6,532	$6,532
Recreation	$184,997	$184,997	$184,997	$184,997	$184,997	$184,997
Flood Control	$149,449	$149,449	$149,449	$149,449	$149,449	$149,449
Total Allocation	$3,316,229	$3,803,361	$3,803,361	$3,802,700	$3,811,829	$3,816,507
Total Project Cost	$4,991,225	$4,991,225	$4,991,225	$4,991,225	$4,991,225	$4,991,225
Repayment of Costs Assigned to CAWCD						
CAWCD-principal	$1,650,000	$2,182,532	$2,182,532	$1,964,365	$1,832,922	$1,896,688
Note	(a)	(b)	(c)	(c)	(c)	(c)

Notes:
(a) For the Settlement Alternative, the repayment obligation is a fixed, negotiated number.
(b) For the No Action Alternative, the repayment obligation shown is based on the CASII repayment analysis. It is noted that in the *CAWCD v. United States* litigation, the court ruled in its Phase One decision the repayment ceiling is $1.781 billion, absent an amendatory contract.
(c) In order to provide a basis of comparison, the repayment obligation shown for all non-settlement alternatives is based on costs resulting from changes in water allocation only.

APPENDIX M

RELEVANT CENTRAL ARIZONA WATER CONSERVATION DISTRICT BOARD BRIEFS

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

BOARD AGENDA BRIEF

ITEM NO. 5.

INFORMATION ONLY

CONTACT: Larry Dozier
Phone: 623-869-2377
Fax: 623-869-2332

DATE: March 30, 2000

SUBJECT: Discussion of Excess Water Marketing for Non-Indian Agricultural and Other Uses

PREVIOUS BOARD ACTION/ACTIVITY:
(For copies of documents or related information, please call the contact person listed above.)

ISSUE SUMMARY:

The Repayment Settlement Stipulation provides that CAWCD may, at its discretion, establish programs for the sale of Excess Water in various categories and with different charges. It specifically provides for categories reserved exclusively for Non-Indian Agriculture (NIA) and the Arizona Water Banking Authority (AWBA). It also provides that the U.S. or Indian contractors may purchase water from any categories not so reserved. Staff and representatives of a cross-section of our customers have spent several months discussing potential categories and prices. The most crucial of these categories is the category of NIA.

As part of the overall water allocation resolution and to allow the GRIC settlement to proceed, the NIA subcontractors must give up claims to long-term NIA water allocations. To convince them to do so, they must have an assurance of a reasonable supply of reasonably priced Excess Water. Attached is a draft discussion paper, *CAP Excess Water Categories and Pricing - 2004-2030*. The paper considers the marketing of Excess Water in many different categories. We already have policies and prices for most categories. Also attached is a draft policy for marketing Excess Water for NIA purposes. Our current approach of providing a five year plan for water marketing works well. However, NIA users feel they need a plan through 2030 to provide some future certainty to convince the landowners to release their claims to their long-term subcontracts.

The discussion paper proposes an exclusive category of NIA Excess Water beginning at 400,000 af with stepped reductions to 225,000 af ending in 2030. The price would be only the energy

component of costs. There are certain restrictions that require use of some NIA water to be eligible for participation as a groundwater savings facility with a partner that is purchasing incentive priced recharge water. This part of the proposal is controversial with some municipal and Ag customers who have enjoyed cost sharing of incentive priced CAP water to accrue underground storage credits.

Development of a long-term program to market NIA Excess Water will be controversial and challenging. To keep the momentum going for overall settlement of Arizona water issues, we need to adopt a policy in the next few weeks, preferably at the May Board meeting.

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Attachments

DRAFT
03/27/00

CAP EXCESS WATER CATEGORIES AND PRICING - 2004-2030

Summary

The Repayment Settlement Stipulation provides that CAWCD may, at its discretion, establish programs for sale of Excess Water in various categories and with different charges. The Stipulation provides for, and anticipates categories reserved exclusively for non-Indian Agriculture use (NIA) and for the Arizona Water Banking Authority (AWBA). It also provides that the U.S. or Indian contractors shall have the right to purchase Excess Water from any category not reserved exclusively for NIA or the AWBA. This discussion paper describes a proposal for establishing categories of Excess Water, with particular eligibility criteria, priority, and price for each category.

The first category is for NIA use and is priced at energy rate 1. It is a limited pool beginning at 400,000 acre-feet (af) and declining to 225,000 af, and ending in 2030. It is the highest priority use for Excess Water. The second category is reserved for the AWBA for in-state underground storage purposes. It is priced at an incentive recharge rate which is energy rate 2 plus other costs as set by current policy (about $5). The third category of Excess Water is set at full price, including any capital charge, and is available for sale to any user including the CAGRD, cities, Ag entities, water companies, private entities, Indians, or federal. The Board may limit the amount of water available in this category. The fourth category would be any remaining available water for any use including NIA, Indian, federal, and recharge. There may be various subcategories and differing prices depending on the amount of water and competing demands.

The fifth category is the last priority and is to be used by the AWBA for interstate storage purposes. The price will be as established by the Board consistent with state laws.

Excess Water is generally considered to be all Colorado River water available for delivery through the CAP under normal, shortage, or surplus conditions on the Colorado River that is in excess of the amounts scheduled for delivery under long-term contracts and subcontracts. It is specifically defined in the Stipulation. The categories and pricing discussed apply only to Excess Water; all long-term contract and subcontract orders will be scheduled ahead of Excess Water. Monthly delivery capacity limitations on those orders will be as established by contract or agreement. Staff analysis of the CAP system operational capability indicates we can meet the commitments of our long-term contractors and subcontractors and provide a similar level of service to Excess Water contractors.

The availability of Excess Water is determined annually. A contract for Excess Water does not provide any right for recurring use and does not imply right for permanent service.

The Board will commit to a NIA category and pricing methodology through 2030. All other categories will be identified and established for a five year period. Each succeeding year, the Board will extend or change the program to identify the fifth year program.

Discussion

CAWCD will establish a category of water for NIA use available at a reasonable price for the period 2004 through the year 2030 in order to facilitate several important purposes. Most

importantly, a CAP objective was and is to replace Agricultural groundwater use with CAP water use to preserve groundwater resources. The Stipulation fixed the non-interest bearing portion of the CAP repayment at 27%. This agreement was based on the assumption that an NIA program similar to the program proposed would be implemented. Agricultural use is a must if we intend to bring most or all of our Colorado River allocation into Arizona. In the past few years, use of the current Ag pool water has exceeded 500,000 af per year, about 35% to 50% of total CAP use. In addition, Ag has participated through in-lieu recharge for an additional 200,000 af to 350,000 af. Also, as a part of the GRIC settlement, the GRIC insists that certain irrigation districts have a reasonably priced long-term Ag pool available so that the irrigation districts will use CAP water instead of pumping groundwater which contributes to groundwater moving away from the GRIC reservation area.

In order to make water available to facilitate the Indian water rights settlements, NIA users must terminate their long-term subcontract rights. The NIA users insist upon access to a supply of CAP water in reasonable amounts and at a reasonable price as a condition of release of their long-term rights.

CAWCD recognizes it is desirable that NIA water be available to all NIA users at the same price, regardless of whether or not the irrigation district has or had a subcontract or federal distribution system debt. All irrigation districts and other current Ag users will be given the opportunity to elect to participate or not participate in the NIA category Excess Water program.

As part of CAP's role in helping to manage central Arizona's groundwater resource, it is important that we continue to have direct Agricultural use of CAP water in addition to in-lieu recharge. We recognize that as a result of cost sharing with the AWBA or other incentive recharge partners, the price of the NIA Excess Water, at variable cost (energy rate 1), will probably be more expensive for the agricultural entity than in-lieu water delivered to a groundwater savings facility (GSF). In order to ensure continued direct Ag use of CAP water, CAWCD will require the use of NIA Excess Water as a condition of participating in in-lieu arrangements with purchasers of CAP water at the incentive recharge rate, or in the alternative, the in-lieu partner will leave an additional 10% for a total of 15% of the recharged water as a "cut for the aquifer." More specifically, M&I entities wbo purchase CAP water at the incentive recharge rate for long-term underground storage will have the following options if using an agricultural user for an in-lieu partner at a GSF.

1. The Ag user must use all of its allocated share of the NIA Excess Water, then it can take as much incentive-priced in-lieu water as is consistent with availability, need, and the GSF permit. NIA category and in-lieu water can be delivered concurrently, but end of calendar-year total use must account for all NIA category usage.

2. If the Ag user does not participate in the NIA category or does not use all of its allocation of the NIA category, then incentive priced in-lieu water from the AWBA category or possibly the fourth category may be available to the GSF storing partner at one acre foot of in-lieu for each acre foot of NIA water purchased. Some NIA category water may be

available for others if not all of the NIA category water is ordered by the participants or if other NIA Excess Water is available in the fourth category.

3. If the Ag user does not order NIA category Excess Water due to pricing, RRA ineligibility, or any other reason, the M&I partner may be able to purchase Excess Water at the rate established in the fourth category, but will be required to accept a lesser credit for later recovery. Current state law requires a 5% reduction in the recovery of stored water as a "cut for the aquifer" to help meet overall groundwater management goals. In recognition of these goals and the lower cost incentive recharge rate, the M&I partner will leave an additional 10% "cut for the aquifer" for a recovery right of 85% of the stored water. A second option is to allow credits for 95% of the stored water if the irrigation district, which is the GSF Partner, also delivers a surface water supply and 50% of the credits are committed to use to offset shortages in those surface water supplies. The other 50% of the credits will be available for use by the M&I partner as permitted by appropriate state law.

4. If the M&I partner and the Ag user (GSF operator) do not wish to participate under any of the above conditions, the M&I entity may purchase Excess Water from the full cost category, if available, or regular subcontract water for in-lieu recharge.

Attached is a NIA Category Allocations paper that includes a table that illustrates some options of allocations of NIA category Excess Water to agricultural entities.

We believe that customers for Excess Water at the full OM&R plus capital rate, such as CAGRD, should have the opportunity to purchase Excess Water. However, it will be necessary to make certain commitments to the NIA users who relinquish their subcontract allocations. In addition, it is important that a reasonable supply of water be available for the AWBA in order to meet shortage protection goals.

In consideration of the principles stated above, CAWCD proposes to establish the following categories of Excess Water:

NIA Category - This category is exclusively for non-Indian Ag use and is the highest priority Excess Water category. For the period 2004 through 2030, CAWCD will establish an NIA pool beginning at 400,000 af, declining to 300,000 af beginning in 2017, and further declining to 225,000 af in 2024. All irrigation districts and other Ag user entities would be given an opportunity to elect to participate in the pool. The level of participation (water share) will be based on the CAP eligible irrigable acres within the entity's service area. The acreage included to determine the proportionate share will be CAP eligible acres that are capable of receiving CAP water service and are dependent on a groundwater supply. If eligible acres convert to M&I use, the proportionate share for the participant will be recalculated. Such review and recalculation will be done every three (3) years. If the initial allocation does not require the entire available pool or if in any year a participant does not elect to schedule its full share, the remaining amount will be offered to other pool participants pro rata until it is fully scheduled or there are no further requests. Participants should keep in mind the requirement to use the NIA category Excess Water as one of the prerequisites to in-lieu participation with incentive recharge partners.

The price for this NIA category shall be the energy rate 1 as established by the CAWCD Board of Directors.

AWBA Category - This category is established exclusively for use by the AWBA for underground storage to meet the in-state purposes of the AWBA. The size of the pool and price shall be as established by the CAWCD Board of Directors. Current Board policy has established the price at energy rate 2, plus 10% of the fixed OM&R rate component, and a component for lost revenues.

Full Cost Category - This is the most expensive category. It may be used for the CAGRD, direct M&I, recharge, Ag, Indian, federal, or any other use at the full OM&R and capital cost or at the rate established by the CAWCD Board if different from full cost recovery. The Board shall, if necessary, limit the size of the pool after taking into account the available Excess Water supply and commitments to deliver water to the NIA category and the AWBA category.

Other Category - The remaining available water supply after meeting the orders in NIA, AWBA and Full Cost categories will be available for other Ag use, Indian use, miscellaneous use, federal use, or underground storage by Arizona entities (other than CAGRD) who do not have long-term contracts or subcontracts or who have used all water available under such contracts. Different prices, eligibility criteria, or delivery constraints may be established for different uses. The price will be as established by the Board of Directors, but is expected to be no less than incremental delivery cost - energy rate 2, an OM&R component and a lost revenue component.

Interstate Storage Category- Any remaining Excess Water may be marketed to the AWBA for interstate storage. The price will be as established by the Board of Directors and will include full OM&R, energy rate 2, a capital charge, an in-lieu tax charge, and an administrative charge.

If in any year the orders for water in any category exceeds the water available in that category, CAWCD will develop a procedure to apportion the supply.

Attachments
G:\data\gm\dozier\agwtrpool2003-2030opts.rdr-tmc3-24.wpd
March 27, 2000 (1:02PM)

PROJECTED CAP DELIVERIES RESULTING FROM SETTLEMENT

UNITS = 1,000 AF

03/23/2000

	Long Term Contracts				Excess Water			
Year	Indian On Reservation (Inc. Ak-Chin)	Total M&I Demand	Indian Leases	M&I Sub	Ag Pool	CAGRD & Full Cost Excess	AWBA & Other Uses	Total
1999	68	241	33	200	558	8	383	1,250
2000	65	249	50	189	619	10	458	1,391
2001	89	271	41	218	584	12	530	1,474
2002	102	293	47	232	539	14	481	1,415
2003	107	315	79	219	498	17	495	1,415
2004	117	337	85	234	400	18	561	1,415
2005	126	359	99	240	400	20	530	1,415
2006	138	382	113	247	400	22	495	1,415
2007	150	403	127	259	400	17	462	1,415
2008	162	425	141	266	400	18	428	1,415
2009	174	447	155	273	400	19	394	1,415
2010	186	470	169	280	400	21	359	1,415
2011	198	482	183	277	400	22	335	1,415
2012	210	495	197	275	400	23	310	1,415
2013	222	508	211	273	400	24	285	1,415
2014	234	521	225	271	400	25	260	1,415
2015	246	534	225	283	400	26	235	1,415
2016	258	546	225	294	400	27	211	1,415
2017	270	559	225	307	300	27	286	1,415
2018	282	572	225	319	300	28	261	1,415
2019	294	585	225	330	300	30	236	1,415
2020	306	598	225	341	300	32	211	1,415
2021	318	611	225	353	300	33	186	1,415
2022	330	624	225	365	300	34	161	1,415
2023	342	637	225	376	300	36	136	1,415
2024	354	650	225	387	225	38	186	1,415
2025	366	663	225	398	225	40	161	1,415
2026	378	677	225	410	225	42	135	1,415
2027	390	690	225	421	225	44	110	1,415
2028	402	703	225	432	225	46	85	1,415
2029	414	716	225	443	225	48	60	1,415
2030	440	729	225	454	225	50	21	1,415
2031	440	740	225	463	235	52	0	1,415
2032	440	751	225	469	224	57	0	1,415
2033	440	762	225	477	213	60	0	1,415
2034	440	773	225	483	202	65	0	1,415
2035	440	784	225	489	191	70	0	1,415
2036	440	795	225	495	180	75	0	1,415
2037	440	806	225	506	169	75	0	1,415
2038	440	816	225	516	159	75	0	1,415
2039	440	827	225	527	148	75	0	1,415
2040	440	838	225	538	137	75	0	1,415
2041	440	849	225	549	126	75	0	1,415
2042	440	860	225	560	115	75	0	1,415
2043	440	871	225	571	104	75	0	1,415
2044	440	882	225	582	93	75	0	1,415
2045	440	893	225	593	82	75	0	1,415
2046	440	904	225	604	71	75	0	1,415
					Total =		9,446	

DRAFT
03/27/00

AG POOL ALLOCATIONS
2004 - 2030

CAWCD will establish an incentive price Ag water pool for the period 2004-2030 as discussed in the companion document entitled CAP Excess Water Pools and Pricing 2004-2030. Attached are some examples of how this pool might be allocated.

The initial pool will consist of 400,000 af. Allocation of the pool among users will be based on CAP eligible, irrigable acres that are RRA eligible. If any entity has a surface water supply, the eligible acreage will be reduced to represent only the acreage that is dependent on a groundwater supply. Eligible acreage will be determined by CAWCD after consultation with the Ag users and the DWR. Information regarding RRA eligibility must be consistent with information provided by the USBR. Also, the conditions of the Groundwater Savings Facility permit will be considered.

As a part of the GRIC Settlement, it is desirable that those irrigation districts that border the reservation or potentially impact groundwater levels within the reservation boundaries, be allocated a significant amount of CAP Ag water. Therefore, MSIDD, CAIDD, Hohokam ID, SCIDD, and NMIDD were allocated 1.3 af/acre. The HVID has a history of purchasing substantial amounts of Ag water and has not been used as a Groundwater Savings Facility with in-lieu partners. To help support their historic demand, HVID was allocated 1 af/acre. The

remaining irrigation districts and Ag user entities were allocated .5 af/acre. Under most circumstances, this will not fully allocate the 400,000 af pool. Any amount remaining will be offered to the participating districts and if necessary, will be prorated based on the eligible acres of those districts requesting additional water. If any pool water remains unscheduled, it may be offered to other CAP eligible Ag users who did not elect to participate in the pool.

It is possible that some entities may be able to use Ag pool water only if surplus conditions on the Colorado River result in waiver of certain RRA eligibility requirements. CAWCD will consider expanding the size of the Ag pool under surplus conditions or will make the additional water available to Ag users from Pool excess water.

Attachments
G:\data\gm\dozier\agpoolalctns2004-2030
March 27, 2000 (12:59PM)

CAP NIAg Pool

Standard Allocation

	Eligible Acres	Acre-feet per Acre	Initial Volume
Central Arizona	85,979	1.3	111,773
Chandler Heights	1,119	0.5	560
Cortaro-Marana	11,500	0.5	5,750
Harquahala	33,007	1.0	33,007
Hohokam	26,356	1.3	34,263
Maricopa-Stanfield	85,994	1.3	111,792
MWD	8,000	0.5	4,000
New Magma	27,310	1.3	35,503
Queen Creek	18,112	0.5	9,056
Roosevelt ID	19,130	0.5	9,565
Roosevelt WCD	18,000	0.5	9,000
SRP	12,000	0.5	6,000
San Carlos	25,884	1.3	33,649
San Tan	2,826	0.5	1,413
Tonopah	3,470	0.5	1,735
Total	378,687		407,065

Non-RRA Allocation

	Eligible Acres	Acre-feet per Acre	Initial Volume
BKW	5,000	0.5	2,500
FICO	6,194	0.5	3,097
Kai	2,000	0.5	1,000
Total	13,194		6,597

draft

CAWCD POLICY FOR MARKETING OF EXCESS WATER FOR NON-INDIAN AGRICULTURE USE - 2004 THROUGH 2030

BACKGROUND

The Repayment Settlement Stipulation provides that CAWCD may, at its discretion, establish programs for the sale of Excess Water in various categories and with different charges. It specifically provides for a category reserved exclusively for Non-Indian Agriculture (NIA).

As part of the overall water allocation resolution and to allow the GRIC settlement to proceed, the NIA subcontractors are being required to give up claims to long-term NIA water allocations. To convince them to do so, they must have an assurance of a reasonable supply of reasonably priced Excess Water beginning in 2004 when the current program expires and continuing through 2018.

The attached discussion documents describe an exclusive category of NIA Excess Water beginning at 400,000 af with stepped reductions to 225,000 af ending in 2030. The price would be only the energy component of costs. There are certain restrictions that require use of some NIA water to be eligible for participation as a groundwater savings facility with a partner that is purchasing incentive priced recharge water.

POLICY

It is the policy of CAWCD to promote the continued use of Excess CAP Water by Non-Indian Agriculture (NIA). This policy establishes a program that provides:

A. As long as Excess Water is available, CAWCD shall reserve and make available for exclusively NIA use at least 400,000 af/year for the period 2004 through 2016, 300,000 af/year for the period 2017 through 2023, and 225,000 af/year for the period 2024 through 2030. This use shall be the highest priority use for Excess Water.

B. The charge for NIA use Excess Water will be equal to the Pumping Energy Charge established for delivery of water to long-term contractors and subcontractors.

C. The right to monthly delivery capacity for scheduled NIA water shall be equal to the rights of long-term contractors and subcontractors.

[D. A program for determining the allocation of the NIA pool among eligible users and for predicting the eligibility to participate as a groundwater savings facilities established in the manner described in the accompanying discussion documents.]

NOTE: The definitions for Excess Water, Pumping Energy Charge, and long-term contractors and subcontractors are the definitions provided in the Repayment Settlement Stipulation.

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BOARD AGENDA BRIEF

ITEM NO. 6
INFORMATION ONLY

CONTACT: John Newman
Phone: 623-869-2338
Fax: 623-869-2674

DATE: January 14, 2000

SUBJECT: Forward Pricing Program and Proposed 2001 Water Rates

PREVIOUS BOARD ACTION/ACTIVITY:

The Board approved the preliminary 2000 Water Rate Schedule in February 1999 and approved the final 2000 Water Rate Schedule in June 1999.
(For copies of documents or related information, please call the contact person listed above.)

ISSUE SUMMARY:

As provided in the District's rate setting policy, staff has developed a proposed rate schedule and analysis which recommends firm rates for 2001 and advisory rates for 2002 through 2005. The policy provides for Board approval of the preliminary 2001 water rate schedule in February and approval of the final 2001 water rate schedule in June. The proposed rates and rate design were derived from the long range financial analysis and forecast. A draft preliminary water rate schedule, water rate design table, and selected graphs are attached.

Capital Charges

The District's forward pricing program included a scheduled increase in the capital charge from $48 per acre-foot in 1999 to $54 per acre-foot in 2000 for M&I subcontractors. However, based upon a staff recommendation, the Board approved leaving the capital charge at $48 per acre-foot for 2000. The water rate design and long-range financial plan which supported the 2000 water rate schedule showed an increase in the capital charge to $54 per acre-foot beginning in 2001. Staff continues to recommend that reserve levels be maintained at about their current level until financial issues associated with the repayment litigation are resolved. Maintaining capital charges at $48 per acre-foot over the next five years will achieve this goal. In other words, it is not necessary to increase capital charges to $54 per acre-foot in order to maintain stable reserve fund levels over the next five years. A graph of projected reserves at various levels of capital charges is attached.

AWBA and M&I Incentive Recharge Programs

A separate "postage stamp" energy rate has been established for deliveries to the AWBA and to M&I Incentive Recharge customers. This rate includes the actual cost of any additional energy requirements, 10 percent of the District's fixed OM&R cost, and a component to recover lost revenue from federal deliveries.

The delivery price for AWBA and M&I Incentive Recharge is the energy rate 2 component ($40 per acre-foot) plus 10 percent of the fixed OM&R charge ($2.90 per acre-foot) plus a component representing recovery of lost revenue from federal deliveries ($2.22 per acre-foot) which yields a total rate of $45 per acre-foot for 2001. This rate is $1 per acre-foot higher than the 2000 rate.

A draft Preliminary 2001 Water Rate Schedule is attached.

G:\newman\bdbriefs\wrates-pre-2001-fa.brf.wpd
Attachments

DRAFT

PRELIMINARY 2001 WATER RATE SCHEDULE
CENTRAL ARIZONA PROJECT

	2001	2002	2003	2004	2005
COST COMPONENTS	Firm		Advisory		
M&I Capital Charges [1]	$48/af	$48/af	$48/af	$48/af	$48/af
Ag Capital Charges [2]	2/af	2/af	2/af	2/af	2/af
Water Delivery Costs					
Fixed OM&R [3]	29/af	Determined Annually			
Pumping Energy Rate 1 [4]	29/af	Determined Annually			
Pumping Energy Rate 2 [5]	40/af	Determined Annually			

DELIVERY RATES		Firm		Advisory		
A)	M&I	$58/af	$66/af	$69/af	$72/af	$75/af
	Ag					
B)	Pool 1 (200,000 af)[6]	34/af	35/af	36/af	37/af	38/af
C)	Pool 2 (200,000 af)	24/af	25/af	26/af	27/af	
D)	Pool 3 [7]	36/af	Determined annually			
E)	AWBA and M&I Incentive Recharge [8]	45/af				
F)	Federal	58/af	66/af	69/af	72/af	75/af
G)	Miscellaneous Uses [9]	34/af	Determined Annually			

(Qualifications for A through G footnoted on reverse side)

1/ Paid on full allocation regardless of deliveries, not included in delivery rates.

2/ Paid on actual deliveries and included in delivery rates.

3/ $42.1 million fixed OM&R costs ÷ 1,474,330 af of projected deliveries ≈ $29/af. This amount is collected on all ordered water whether delivered or not.

4/ Applies to all water deliveries except AWBA and M&I Incentive Recharge. $27.6 million pumping energy costs ÷ 938,026 af of projected deliveries ≈ $29/af. This amount is collected only for water actually delivered.

5/ Applies to AWBA and M&I Incentive Recharge deliveries. $21.5 million pumping energy costs ÷ 536,304 af of projected deliveries ≈ $40/af. This amount is collected only for water actually delivered.

6/ Ag Pool volume after 2003 is assumed to be 400,000 af (single pool) and rate is assumed to be energy rate 1 only.

7/ Rate is the pumping energy rate 1 component plus $5/af contribution towards fixed OM&R plus the $2/af Ag capital charge. Rate includes Surplus Water.

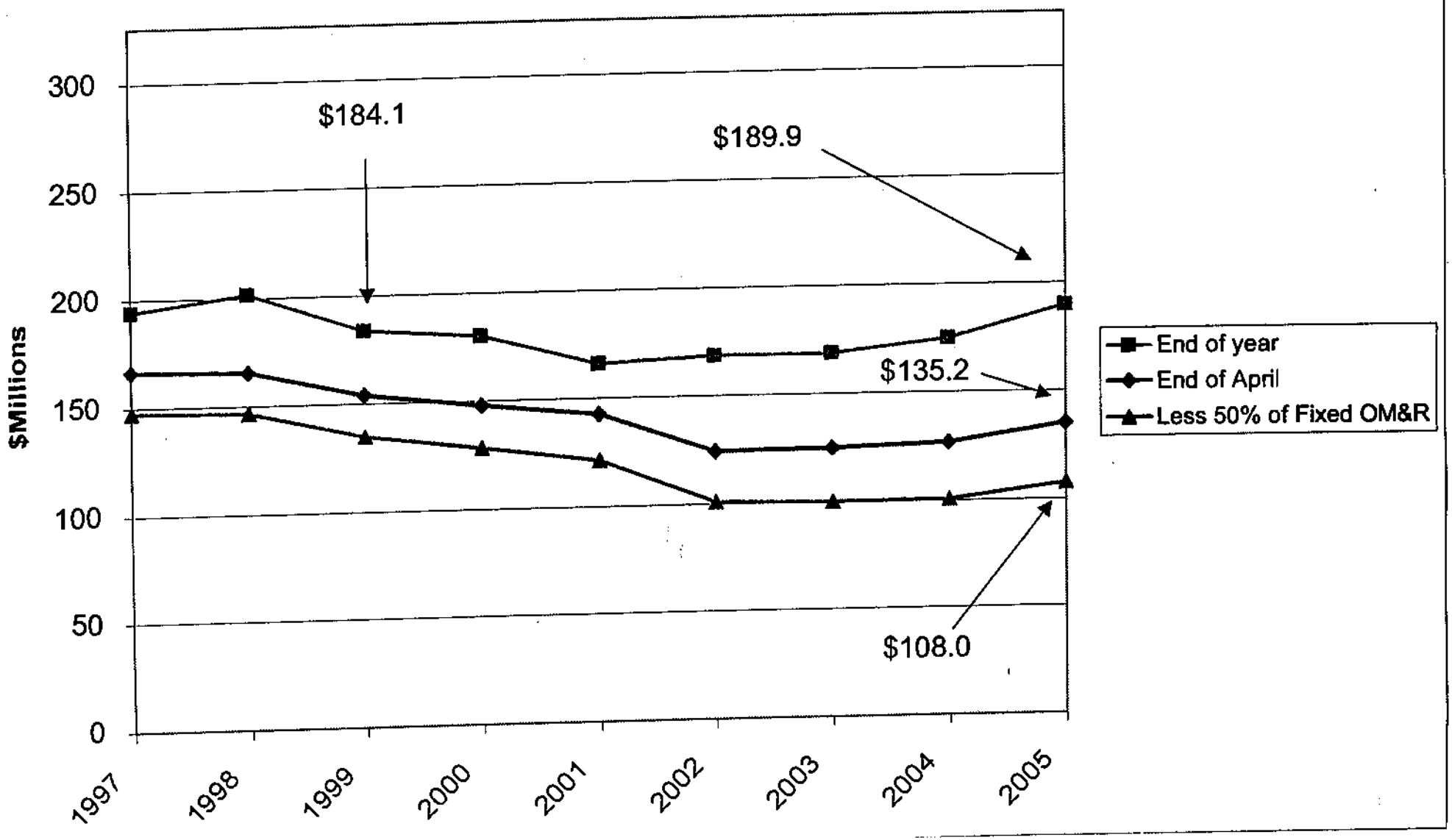
LONG-RANGE FINANCIAL PLAN
WATER RATE DESIGN

:OST COMPONENTS	YEAR												
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
ixed OM&R Costs ($000)	36,786	37,198	37,208	38,861	42,097	46,857	49,755	52,499	54,497	57,692	59,563	61,789	64,245
umping Energy Costs Rate 1 ($000	36,755	30,895	40,345	23,220	27,646	30,052	32,050	30,813	32,474	34,146	36,199	38,371	40,629
umping Energy Costs Rate 2 ($000	0	0	0	16,734	21,473	19,562	18,796	21,065	20,445	19,846	18,935	18,018	17,108
otal Pumping Energy Costs ($000)	36,755	30,895	40,345	39,954	49,119	49,614	50,846	51,878	52,920	53,991	55,134	56,389	57,737
eliveries Rate 1 (AF)	1,364,715	1,024,978	1,249,713	932,305	938,026	921,992	941,400	866,060	891,781	916,000	949,000	983,000	1,017,000
eliveries Rate 2 (AF)	0	0	0	458,327	536,304	493,008	473,600	548,940	523,219	499,000	466,000	432,000	398,000
otal Deliveries (AF)	1,364,715	1,024,978	1,249,713	1,390,632	1,474,330	1,415,000	1,415,000	1,415,000	1,415,000	1,415,000	1,415,000	1,415,000	1,415,000
:OST COMPONENTS:													
M&I Capital Charge ($/AF)	$39	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48
Ag Capital Charge ($/AF)	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2
Water Delivery Costs: 1/													
Fixed OM&R ($/AF)	$36	$29	$31	$28	$29	$33	$35	$37	$39	$41	$42	$44	$45
Pumping Energy Rate 1 ($/AF)	31	36	38	26	29	33	34	35	36	37	38	39	40
Total M&I Delivery Cost ($/AF)	$67	$65	$69	$54	$58	$66	$69	$72	$75	$78	$80	$83	$85
Pumping Energy Rate 2 ($/AF)				$39	$40	$40	$40	$38	$39	$40	$41	$42	$43
VATER RATES ($/Acre-Foot)													
lunicipal & Industrial													
Subcontract	$67	$65	$69	$54	$58	$66	$69	$72	$75	$78	$80	$83	$85
Non-Subcontract	67	65	69	54	58	66	69	72	75	78	80	83	85
AWBA Interstate Banking	0	0	0	0	90	93	95	97	102	106	110	114	117
CAGRD	67	65	69	54	58	66	69	72	75	78	80	83	85
Temp Permits	95	145	152	154	155	157	158	160	161	163	185	166	168
Misc. (recr., fish & wildlife)	$36	$41	$43	$31	$34	$38	$39	$45	$46	$47	$49	$50	$51
gricultural 2/													
Pool 1	$28	$29	$30	$31	$32	$33	$34	$35	$36	$37	$38	$39	$40
Pool 2	18	19	20	21	22	23	24						
Pool 3	36	41	43	31	34	38	39						
Surplus	36	41	43	31	34	38	39						
Subcontract	$67	$65	$69	$54	$56	$66	$69	$72	$75	$78	$80	$83	$85
ederal	$67	$65	$69	$54	$58	$66	$69	$72	$75	$78	$80	$83	$85
Recharge													
Direct Incentive	$36	$41	$43	$44	$45	$48	$46	$45	$46	$47	$49	$50	$51
Direct AWBA	36	41	43	44	45	48	46	45	46	47	49	50	51
Indirect Incentive	36	41	43	44	45	46	46	45	46	47	49	50	51
Indirect AWBA	$36	$41	$43	$44	$45	$46	$46	$45	$46	$47	$49	$50	$51

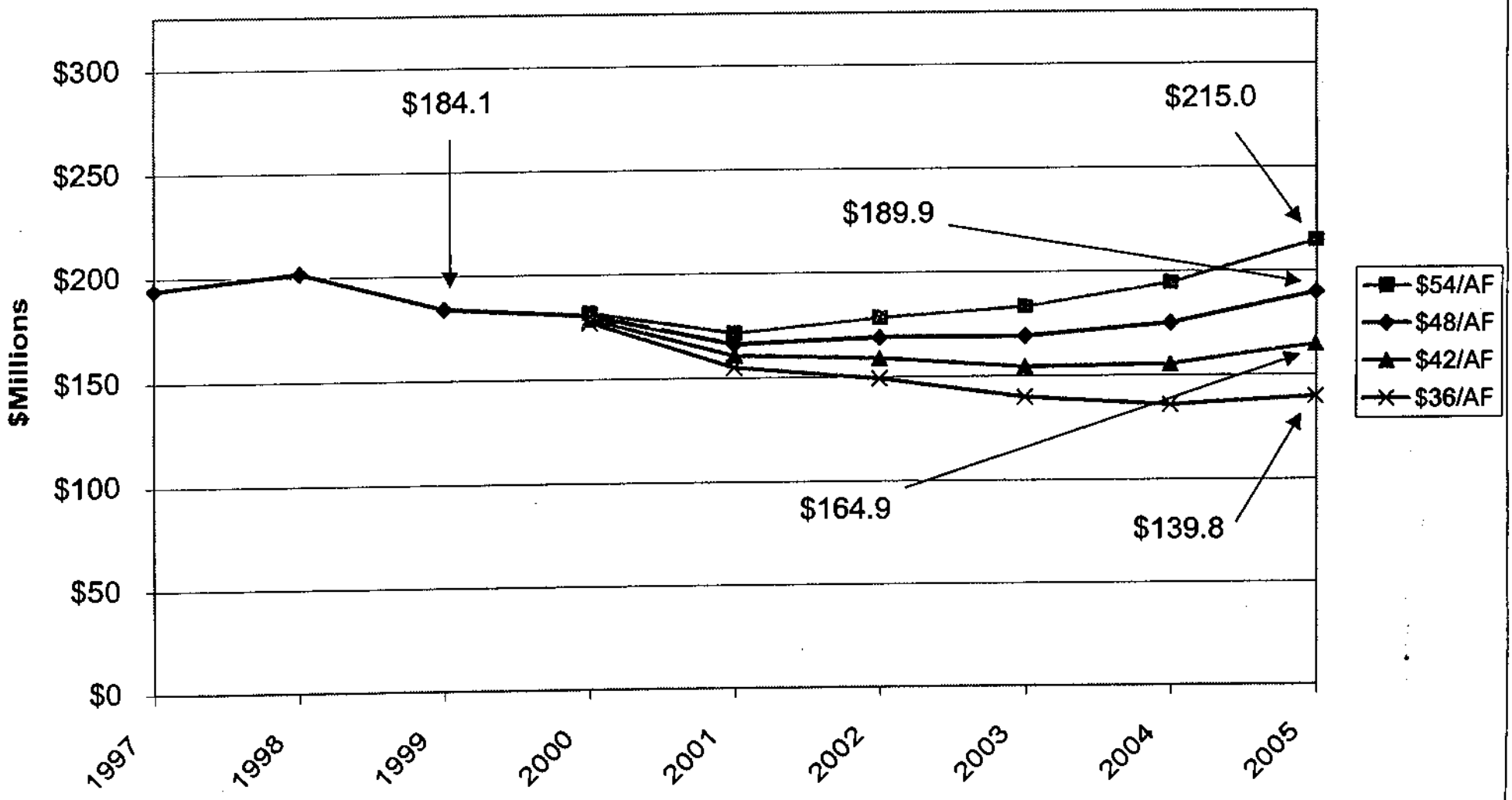
1/ 1997-2000 rates are preset rates; 2001-2009 rates are calculated by dividing fixed OM&R cost or energy pumping cost by projected delivery acre-feet.

[illegible] (non-operating revenue) for consistency with income statement operating revenues.

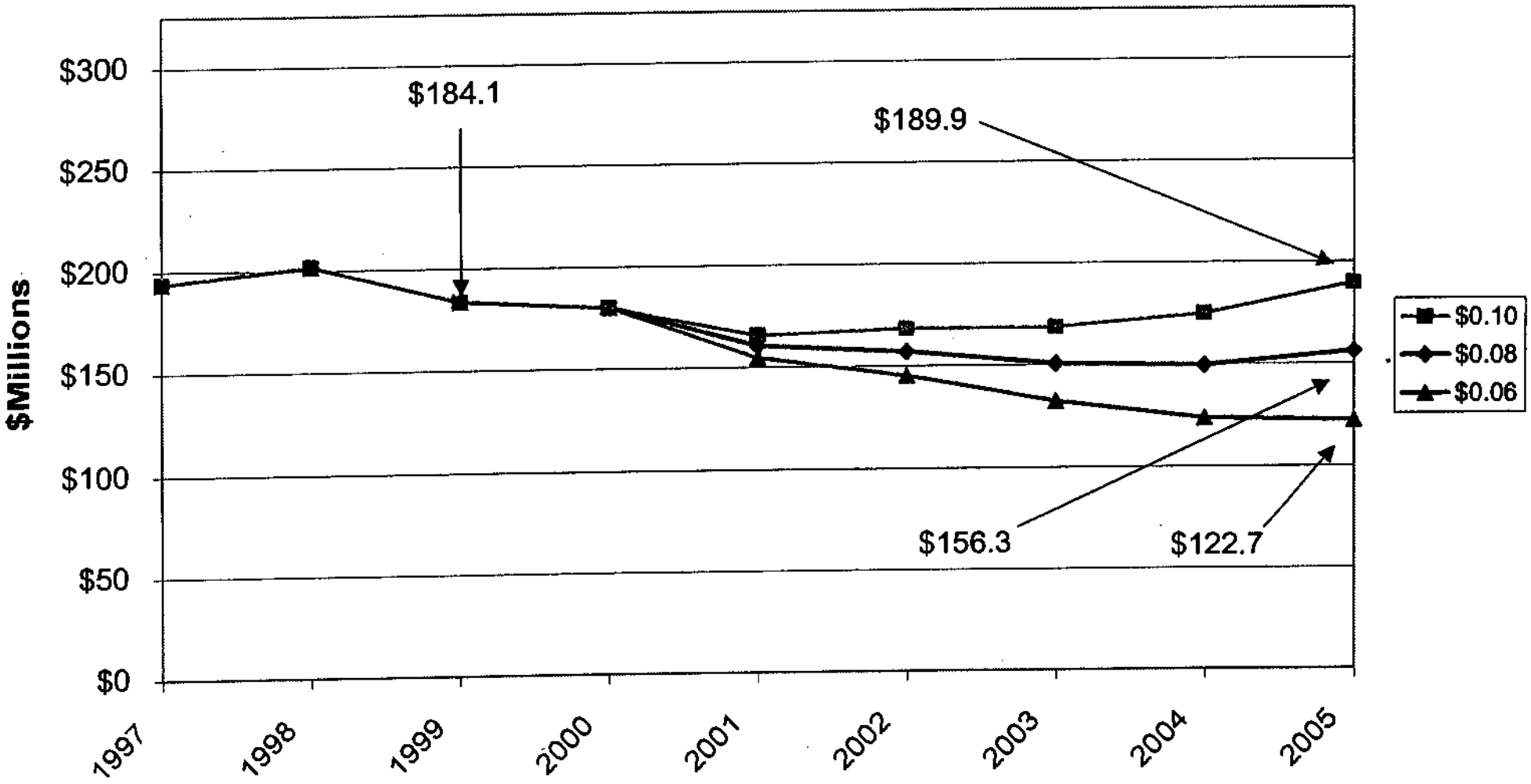
CAP Reserve Trend Analysis
(General Fund Non-Master Contract Reserves)
Reserve Planning



CAP Reserve Trend Analysis
(General Fund Non-Master Contract Reserves)
Capital Charge Sensitivity Analysis



CAP Reserve Trend Analysis
(General Fund Non-Master Contract Reserves)
Property Tax Sensitivity Analysis



APPENDIX N

ADWR CAP ALLOCATION RECOMMENDATION LETTER

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North Third Street, Phoenix, Arizona 85004
Telephone 602 417-2410
Fax 602 417-2415

JANE DEE HULL
Governor

RITA P. PEARSON
Director

January 20, 2000

The Honorable Bruce Babbitt
Secretary of the Interior
1849 C. Street NW, #1615
Washington, D.C. 20240

RE: Final Recommendation of 65,647 acre-feet of Central Arizona Project Municipal and Industrial Use Water

Dear Secretary Babbitt:

By letter of December 2, 1999, I notified you that the Arizona Department of Water Resources was prepared to recommend the final reallocation of 65,647 acre-feet of Central Arizona Project Municipal and Industrial Use water. At the same time I asked for comments from all of the entities in Arizona who are interested and materially affected by the recommendation. I received several requests for more water to meet the needs of our growing communities. Unfortunately, I cannot consider these new requests given the small amount of water that is available for reallocation. Therefore no changes will be made to the recommended allocations that were described in my December 2, 1999 letter.

By this letter and the enclosed copy of the previous letter, I submit the final recommendation for the allocation of the remaining 65,647 acre-feet of water, which was originally allocated in 1983 by the Secretary of the Interior for non-Indian municipal and industrial water uses within the Central Arizona Project.

Sincerely;

Rita P. Pearson

Rita P. Pearson
Director

Enclosure

RPP:mjp:kd

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North Third Street, Phoenix, Arizona 85004
Telephone 602-417-2410
Fax 602-417-2415

JANE DEE HULL
Governor

RITA P. PEARSON
Director

December 2, 1999

The Honorable Bruce Babbitt
Secretary of the Interior
1849 C. Street NW, #1615
Washington, D.C. 20240

RE: Final Recommendation of 65,647 acre-feet of Central Arizona Project Municipal and Industrial Use Water

Dear Secretary Babbitt:

The Arizona Department of Water Resources (Department) is prepared to recommend the reallocation of 65,647 acre-feet (af) of Central Arizona Project (CAP) water for municipal and industrial (M&I) purposes. This volume of water is part of the 638,823 af that was originally allocated in 1983 by the Secretary of the Interior (Secretary) but was not subcontracted. By this letter, I am transmitting to you the recommendations of the State of Arizona (State) for the reallocation of this portion of the CAP M&I water supply.

In May 1993, the U.S. Bureau of Reclamation (Bureau) asked the Department to initiate a process to develop a recommended reallocation of this water. In 1994, a process was initiated and preliminary allocations of CAP water were determined for 26 applicants. However, the process was never completed due to an intervening lawsuit between the Bureau and the Central Arizona Water Conservation District (CAWCD) regarding the CAWCD's repayment obligation for the CAP.

With the recent announcement in the Federal Register that the environmental assessment was to be initiated for the reallocation of CAP water, the Department is again prepared to submit to you recommendations for reallocating the 65,647 af of CAP M&I water.

As you are aware, under State law, the Department is responsible for formulating plans and programs for the development, management, conservation and use of surface water and groundwater within Arizona. With respect to Colorado River water in particular, the Department is authorized to consult, advise and cooperate with the Secretary on a variety of contract and subcontract issues. Over the years, the Department of the Interior and the Department have developed an excellent history of cooperatively evaluating and determining requests for allocations of Colorado River water for use within Arizona. The Department respects the authority granted the Secretary concerning these issues and, likewise, the Secretary has consistently given careful consideration to the recommendations of the Department.

As a former Governor of this State, I am sure you are aware of the critical need for M&I CAP water among our municipal providers. Many cities within our population corridors remain overly

dependent on finite groundwater supplies for their municipal service. State based programs, such as our Assured Water Supply Program and our effluent incentive programs within our Management Plans have made great strides this decade in reducing long-term reliance on groundwater. If the State is to achieve its goal of safe-yield, however, we need access to additional renewable supplies such as the CAP. The CAP water set aside for M&I priority is an important component of that supply and we are very pleased to be able to describe to you today the method by which we have proposed apportionment of the small remaining amount of this valuable resource against a large and ever-growing demand.

Background

In February 1983, Secretary James Watt released his decision regarding the final allocation of CAP water. Under that decision, 638,823 af of the annual water supply was allocated to M&I users. Subsequently, subcontracts were offered for the total available CAP water supply. By March 1, 1993 the subcontracting process was essentially completed. However, some entities that were allocated M&I water declined to enter into a subcontract, leaving a total of 80,312 af of the M&I supply available for reallocation. Of this amount, 14,665 af had initially been allocated to the Phelps-Dodge Corporation and was later assigned to the San Carlos Apache Indian Tribe by the United States as part of the San Carlos Apache Indian Tribe Water Rights Settlement Act of 1992. This resulted in 65,647 af of water being available for reallocation to CAP M&I water users. This was not an unanticipated result. Both the Department and Secretary Watt expected a marginal refusal rate in the contracting process. The reallocation of uncontracted M&I water was expressly acknowledged in the 1983 Record of Decision. 48 Fed. Reg. 12,447. The understanding was that any water declined would be reallocated to municipal providers based on demonstrated need.

1994 Reallocation Process

In February 1994, after the CAP was finally completed, the Department initiated a process to develop a recommended reallocation for the 65,647 af of uncontracted M&I CAP water. The Department developed and distributed a discussion paper that presented potential alternatives and issues. From the public comments received, the Department determined that the recommended approach should take into account the following considerations: 1) consistency with the criteria in the original allocation process; 2) availability of renewable supplies relative to demand; 3) the need to encourage early utilization of CAP water; 4) expectations regarding the ability to actually pay for and use the CAP water; and, 5) the need for a reliable (high priority) water supply.

In April 1994, the Department solicited applications for the reallocation. A total of 53 entities applied, requesting more than 350,000 af of water. Based on the comments received from the interested parties and applicants, the Department evaluated three reallocation methodologies to apportion the available water across this demand: 1) apportion the water to provide a full, dependable supply for contractors assuming a uniform 180 gallons per capita per day (GPCD) rate for all applicants; 2) apportion the water based upon the projected year 2040 population at a uniform 180 GPCD rate for all applicants; and, 3) apportion the water to provide a dependable water supply using a demand rate which reflects the maximum use rates set by the Second Management Plan (SMP) in the Active Management Areas.

Twenty-seven of the applicants were excluded from consideration. These applicants either: 1) did not identify the purpose and amount of use; 2) proposed a use which was not considered an M&I

use; 3) were located within an existing subcontract service area; 4) requested the water for proposed development that had no approved subdivision plats; 5) had access to alternative water supplies; 6) could use lower priority or interim water supplies; 7) indicated that they could not afford CAP water; or, 8) were located where direct use of CAP water was not feasible.

The 26 remaining applicants were apportioned water based on the third alternative. Using the SMP GPCD requirements, all applicants were allocated a portion of the 65,647 af of CAP water to meet their net demand (demand minus dependable water supplies) through the year 2023.

1999 CAP M&I Reallocation Process

In February 1999, the Department reinitiated the reallocation process for the 65,647 af of M&I CAP water. The 27 applicants that were excluded in 1994 were excluded again on the same criteria, but the Department reevaluated the methodology used to determine the apportionment of water to the remaining 26 applicants.

The Department prepared a reallocation recommendation for each of the remaining applicants using the same basic methodology that was used to generate the 1994 allocations. Service area populations were projected using the latest official projections prepared by the Arizona Department of Economic Security. To allocate the water more equitably to all applicants, including those that are projected to experience significant growth after 2020, it was determined that the allocations would be based on a proportionate share of the 65,647 af relative to the population projections and water demand for the year 2040.

In brief, the water demand for each applicant was projected for the year 2040 by multiplying the projected service area population by the lesser of a use rate of 180 GPCD or the use rate equivalent to the first requirement of the Third Management Plan - 2000. Because lands in the Phoenix area that are located within the Salt River Project (SRP) are presumed to have adequate water supplies, the population was projected only for those areas located outside of SRP. The resulting annual demand was converted to acre-feet.

To determine each applicant's need for additional water, other dependable water supplies were subtracted from the projected demand. Other dependable water supplies used in the methodology include:

1. CAP water currently under subcontract to an applicant.
2. CAP water that will be transferred to an applicant by the Arizona State Land Department (ASLD) per ASLD subcontract.
3. CAP water allocations that have already been transferred to an applicant.
4. CAP water transfers that are pending approval by CAWCD and the Bureau.
5. "Gate Credit" water rights for the Verde River held by the City of Phoenix.
6. Conversion of irrigation water rights to municipal use within the Roosevelt Water Conservation District and the Maricopa Municipal Water Conservation District #1.
7. M&I priority CAP water that was obtained from the agreement with the Hohokam Irrigation and Drainage District as part of the Cliff Dam Replacement supply.

Projected demand minus dependable water supplies determined the projected water need for each applicant. The 65,647 af water supply was distributed between applicants on a pro rata basis based

on the projected need. However, because the total projected need of the applicants were considerably greater than the supply, the total amount of water that could be allocated to any applicant was limited to 8,206 af or 12.5% of the total supply of 65,647 af.

In March 1999, the Department informed the applicants of its intent to recommend to the Secretary that 65,647 af of CAP water be reallocated for M&I use. In the letter, the Department presented the revised recommended allocation for each of the applicants.

The applicants were asked to review the information and respond to the Department indicating whether they were willing to subcontract for the additional CAP water and whether they were committed to pay the past capital repayment obligation for that water. Of the original 26 applicants considered in the reallocation process, the Town of Buckeye and Litchfield Park Service Company have elected to not participate in the 1999 reallocation process. The Department also received comments from some of the applicants regarding corrections to the assumed dependable water supplies and water use rates. Where appropriate, corrections were made to the analysis. From this process, we are able to make a reallocation recommendation that allocates the available water fairly, based on need, and which provides reasonable certainty that all water so allocated will be immediately accepted for contract.

The final recommendation regarding the reallocation of the 65,647 af of M&I CAP water is shown in Table 1.

Table 1. 1999: Recommended Reallocation of 65,647 af

Applicant	Amount (Acre-Feet)	Applicant	Amount (Acre-Feet)
Town of Superior*	285	AVRA Cooperative	808
Cave Creek Water Co.	806	City of Chandler	4,986
Chaparral Water Co.	1,931	Del Lago (Vail) Water Co.	1,071
Town of El Mirage	508	City of Glendale	3,053
City of Goodyear	7,211	Community Water Co. of Green Valley	1,521
H2O Water Co.	147	Metropolitan Domestic Water Improvement District	4,602
City of Mesa	7,115	Town of Oro Valley	3,557
City of Peoria	5,527	City of Phoenix	8,206
City of Scottsdale	2,981	City of Surprise	2,876
Tucson Water	8,206	Valley Utilities Water Co.	250
		Total	65,647

* If the allocation is not accepted, then the 285 af will be recommended for the Arizona Water Company for use in its Superior or Apache Junction system.

In the unlikely event that a subcontract for this reallocation of CAP M&I water is refused, the Department recommends that the allocation be immediately transferred to another municipal water provider pursuant to the State's policy of August 23, 1996 regarding the transfer of CAP M&I subcontracts. This will ensure that the CAP water will be quickly and equitably allocated to the water provider(s) with the most need.

Thank you for your consideration of this recommendation.

Sincerely,

Rita P. Pearson

Rita P. Pearson
Director

RPP:tgc:kd

APPENDIX P

COMMON CONVERSION FACTORS TO METRIC UNITS

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Central Arizona Project

Table P-1
CAP Allocation Draft EIS
Common Conversion Factors to Metric Units

Class	Multiply	By:	To Get:
Area	acre	404.7	m^2
	acre	0.4047	ha (10 000 $m^2$0
	ft^2	0.0929	m^2
	yd^2	0.8361	m^2
	mi^2	2.59	km^2
Length	ft	0.3048*	m
	in	25.4*	mm
	mi	1.6093	km
	yd	0.9144*	m
Volume	ft^3	0.0283	m^3
	gal	3.785	L**
	fl oz	29.574	mL**
	yd^3	0.7646	m^3
	acre ft	1233.49	m^3
Mass	oz	28.35	g
	lb	0.4536	kg
	kip (1,000 lb)	0.4536	tonne (1000 kg)
	short ton (2,000 lb)	907.2	kg
	short ton	0.9072	tonne (1000 kg)
Density	lb/yd^3	0.5933	kg/m^3
	lb/ft^3	16.0185	kg/m^3
Pressure	psi	6894.7	Pa
	ksi	6.8947	Mpa (N/mm^2)
	lb/ft^2	47.88	Pa
Velocity	ft/s	0.3048*	m/s
	mi/h	0.447	m/s
	mi/h	1.6093	km/h
Light	footcandle	10.764	lux (lx)
	(lumen/ft^2)		(lumen/m^2)
Temperature	^oF	$t_{oC} = (t_{oF}-32)/1.8$	^oC

*Exact
**Both "L" and "l" may be used for liter. However, "L" is preferred so as not to be confused with the numeral "1".

APPENDIX I

GROUNDWATER ANALYSIS

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

APPENDIX I
GROUNDWATER ANALYSIS

Allocation of Water Supply and Long-Term Contract Execution Central Arizona Project

Draft Environmental Impact Statement

June 2000

APPENDIX I TABLE OF CONTENTS

I. ANALYSIS METHODOLOGY 1

I.A. Hydrologic Inventory Methodology 1
I.A.1. Selection of Analysis Methodology 2
I.A.2. Hydrologic Inventory Analysis 3
I.A.3. Limitations of the Hydrologic Inventory Analysis 4
I.B. Methodology to Estimate Hydrologic Inventory Inputs for Evaluation Alternatives 5
I.B.1. M&I Sector 6
I.B.1.a. Definition of Portfolio of Supplies 8
I.B.1.b. Definition of Projected Water Demands 10
I.B.1.c. Assign Supplies to Meet Demands 12
I.B.1.d. Calculate Input to Hydrologic Inventory 15
I.B.1.d.(1). Groundwater Pumpage 15
I.B.1.d.(2). Groundwater Recharge 15
I.B.1.e. Analysis of Process 15
I.B.1.e.(1) Assumed Water Demand Rates 16
I.B.1.e.(2). Location of Water Demands 16
I.B.1.e.(3). Assumption Regarding the Deployment of Water Supplies 16
I.B.1.e.(4). Effluent Recharge and Use 16
I.B.1.e.(5). Water Supplies for Shortage Conditions 16
I.B.2. Indian Sector 17
I.B.2.a. GRIC 17
I.B.2.a.(1). Settlement Alternative 17
I.B.2.a.(2). No Action Alternative 19
I.B.2.a.(3). Non-Settlement Alternative 1 20
I.B.2.a.(4). Non-Settlement Alternative 2 21
I.B.2.a.(5). Non-Settlement Alternative 3 22
I.B.2.b. TON 22
I.B.2.b.(1). Schuk Toak District 22
I.B.2.b.(2). San Xavier District 24
I.B.2.c. SC Apache Tribe 25
I.B.3. NIA Sector 26
I.B.3.a. Groundwater Pumping for NIA 26
I.B.3.b. Irrigated Acres 27
I.B.3.c. Applied Water Requirements 27
I.B.3.d. Surface Water Supplies 28
I.B.3.e. Groundwater Supplies 28
I.B.3.f. Incidental Recharge from NIA 28
I.B.4. CAP Water Supplies 30
I.B.4.a. Distribution of CAP Water Supplies by Sector 30
I.B.4.b. Methodology for Distributing the Ag and Recharge Pools 30
I.C. Methodology to Evaluate Water Quality Impacts 32
I.C.1. Lateral Movement 32
I.C.2. Lowering Levels into Poorer Quality Zones 32
I.C.3. Direct Recharge of CAP Water 33
I.D. Methodology to Evaluate Subsidence Impacts 33

II. RELATIONSHIPS BETWEEN ANALYSIS INPUTS AND GROUNDWATER LEVEL IMPACTS....34

II.A. Basis of Groundwater Level Impacts....34
II.A.1. Net Pumping....34
II.A.2. Groundwater Flows Between Sub-areas....35
II.B. Typical Patterns of Groundwater Level Impacts....35
II.B.1. NIA Entities....35
II.B.2. Indian Entities....37
II.B.3. Municipal and Industrial Entities....38
II.C. Shortage Conditions....39

III. EVALUATION OF ALTERNATIVES....40

III.A. Analysis Process....40
III.A.1. Develop Conceptual Understanding of Hydrologic System....41
III.A.2. Develop Hydrologic Inventory Analyses and Evaluate Historical Conditions....41
III.A.3. Evaluate Impacts of CAP Allocation on Groundwater Levels....42
III.A.4. Identify Potential Water Quality and Subsidence Impacts....42
III.B. Groundwater Level Analysis for the Tucson Area....42
III.B.1. Existing Groundwater Conditions....43
III.B.1.a. Geology....43
III.B.1.b. Groundwater Occurrence and Movement....44
III.B.1.c. Groundwater Quality....44
III.B.1.c.(1) General Minerals....44
III.B.1.c.(2) Other Constituents....44
III.B.1.d. Subsidence....45
III.B.2. Details of Analysis Methodology....45
III.B.3. Evaluation of Historical Conditions and "Calibration"....46
III.B.4. Analysis of Alternatives....47
III.B.4.a. No Action Alternative....47
III.B.4.a.(1). Groundwater Levels....47
III.B.4.a.(2). Groundwater Quality....48
III.B.4.a.(3). Subsidence....48
I.B.4.b. Impacts of the Settlement and Non-Settlement Alternatives....49
III.B.4.b.(1) Groundwater Levels....49
III.B.4.b.(1).(i) San Xavier Sub-area....49
III.B.4.b.(1).(ii) CMID East, MDWID, Tucson East, and Tucson West Sub-areas....50
III.B.4.b.(1).(iii) Green Valley Central Sub-area....50
III.B.4.b.(2). Water Quality....50
III.B.4.b.(3). Subsidence....51
III.C. Groundwater Level Analysis for the Avra Valley Area....51
III.C.1. Existing Groundwater Conditions....52
III.C.1.a. Geology....52
III.C.1.b. Groundwater Occurrence and Movement....52
III.C.1.c. Groundwater Quality....52
III.C.1.c.(1). General Minerals....53
III.C.1.c.(2). Other Constituents....53
III.C.1.d. Subsidence....53
III.C.2. Details of Analysis Methodology....54

III.C.3. Evaluation of Historical Conditions and "Calibration" 54
III.C.4. Analysis of Alternatives 55
III.C.4.a. No Action Alternative 55
III.C.4.a.(1). Groundwater Levels 55
III.C.4.a.(2). Water Quality 56
III.C.4.a.(3). Subsidence 56
III.C.4.b. Impacts of the Settlement and Non-Settlement Alternatives 57
III.C.4.b.(1). Groundwater Levels 57
III.C.4.b.(2). Groundwater Quality 57
III.C.4.b.(3). Subsidence 58
III.D. Groundwater Level Analysis for the Pinal/Salt River Valley Area 58
III.D.1. Existing Groundwater Conditions 58
III.D.1.a. Geology 58
III.D.1.b. Groundwater Occurrence and Movement 59
III.D.1.c. Groundwater Quality 60
III.D.1.c.(1). General Minerals 60
III.D.1.c.(1).(i). Pinal County Area 60
III.D.1.c.(1).(ii). GRIC 61
III.D.1.c.(1).(iii). East Salt River Valley 61
III.D.1.c.(1).(iv). West Salt River Valley 61
III.D.1.c.(2). Other Constituents 62
III.D.1.c.(2).(i). Pinal County Area 62
III.D.1.c.(2).(ii) GRIC 62
III.D.1.c.(2).(iii) East Salt River Valley 63
III.D.1.c.(2).(iv). West Salt River Valley 63
III.D.1.d. Subsidence 63
III.D.2. Evaluation of Historical Conditions and "Calibration" 64
III.D.3. Analysis of Alternatives 65
III.D.3.a. No Action Alternative 66
III.D.3.a.(1). Pinal County Area 66
III.D.3.a.(1).(i). Groundwater Levels 66
III.D.3.a.(1).(ii). Groundwater Quality 67
III.D.3.a.(1).(iii). Subsidence 67
III.D.3.a.(2). GRIC 67
III.D.3.a.(2).(i). Groundwater Levels 67
III.D.3.a.(2).(ii). Groundwater Quality 68
III.D.3.a.(2).(iii). Subsidence 68
III.D.3.a.(3). East Salt River Valley 68
III.D.3.a.(3).(i). Groundwater Levels 68
III.D.3.a.(3).(ii). Groundwater Quality 70
III.D.3.a.(3).(iii). Subsidence 70
III.D.3.a.(4). West Salt River Valley 71
III.D.3.a.(4).(i). Groundwater Levels 71
III.D.3.a.(4).(ii). Groundwater Quality 72
III.D.3.a.(4).(iii). Subsidence 72
III.D.3.b. Impacts of the Settlement and Non-Settlement Alternative 73
III.D.3.b.(1). Pinal County Area 73
III.D.3.b.(1).(i). Groundwater Levels 73

III.D.3.b.(1).(ii). Groundwater Quality 74
III.D.3.b.(1).(iii). Subsidence 74
III.D.3.b.(2). GRIC 75
III.D.3.b.(2).(i). Groundwater Levels 75
III.D.3.b.(2).(ii). Groundwater Quality 76
III.D.3.b.(2).(iii). Subsidence 76
III.D.3.b.(3). East Salt River Valley 77
III.D.3.b.(3).(i). Groundwater Levels 77
III.D.3.b.(3).(ii). Groundwater Quality 78
III.D.3.b.(3).(iii). Subsidence 78
III.D.3.b.(4). West Salt River Valley 79
III.D.3.b.(4).(i). Groundwater Levels 79
III.D.3.b.(4).(ii). Groundwater Quality 80
III.D.3.b.(4).(iii). Subsidence 80
III.E. Groundwater Level Analysis for the San Carlos Apache Area 81
III.E.1. Existing Groundwater Conditions 81
III.E.1.a. Geology 81
III.E.1.a.(1) Tertiary and Quaternary Basin Fill 81
III.E.1.a.(2). Quaternary Stream Alluvium 81
III.E.1.b. Groundwater Occurrence and Movement 82
III.E.1.c. Groundwater Quality 82
III.E.1.d. Subsidence 83
III.E.2. Details of Analysis Methodology 83
III.E.3. Analysis of Alternatives 84
III.E.3.a. Groundwater Levels 84
III.E.3.b. Groundwater Quality 85
III.E.3.c. Subsidence 85
III.F. Groundwater Level Analysis for the TID 85
III.F.1. Existing Groundwater Conditions 85
III.F.1.a. Geology 86
III.F.1.b. Groundwater Occurrence and Movement 86
III.F.1.c. Groundwater Quality 86
III.F.1.c.(1). General Minerals 87
III.F.1.c.(2). Other Constituents 87
III.F.1.d. Subsidence 87
III.F.2. Details of Analysis Methodology 87
III.F.3. Evaluation of Historical Conditions and "Calibration" 88
III.F.4. Analysis of Alternatives 88
III.F.4.a. No Action Alternative 88
III.F.4.a.(1). Groundwater Levels 89
III.F.4.a.(2). Groundwater Quality 89
III.F.4.a.(3). Subsidence 89
III.F.4.b. Settlement and Non-Settlement Alternatives 89
III.F.4.b.(1). Groundwater Levels 89
III.F.4.b.(2). Groundwater Quality 89
III.F.4.b.(3). Subsidence 90
III.G. Navajo/Hopi Indian Reservations 90

III.G.1. Existing Groundwater Conditions 90
III.G.1.a. Geology 91
III.G.1.b. Groundwater Occurrence and Movement 91
III.G.1.c. Groundwater Quality 92
III.G.1.d. Subsidence 92

III.G.2. Details of Analysis Methodology 92

III.G.3. Analysis of Alternatives 93
III.G.3.a. No Action Alternative 93
III.G.3.b. Settlement and Non-Settlement Alternatives 94
III.H. Carefree Sub-basin 94
III.H.1. Existing Groundwater Conditions 94
III.H.1.a. Geology 94
III.H.1.b. Groundwater Occurrence and Movement 95
III.H.1.c. Groundwater Quality 95
III.H.1.d. Subsidence 95
III.H.2. Details of Analysis Methodology 95
III.H.3. Evaluation of Historical Conditions and "Calibration" 95
III.H.4. Analysis of Alternatives 96
III.H.4.a. No Action Alternative 96
III.H.4.a.(1). Groundwater Levels 96
III.H.4.a.(2). Groundwater Quality 97
III.H.4.a.(3). Subsidence 97
III.H.4.b. Settlement and Non-Settlement Alternatives 97
III.H.4.b.(1). Groundwater Levels 97
III.H.4.b.(2). Groundwater Quality 97
III.H.4.b.(3). Subsidence 97
III.I. Chaparral Area of Fountain Hills Sub-Basin 98
III.I.1. Existing Groundwater Conditions 98
III.I.1.a. Geology 98
III.I.1.b. Groundwater Occurrence and Movement 98
III.I.1.c. Groundwater Quality 99
III.I.1.d. Subsidence 99
III.I.2. Methodology 99
III.I.3. Evaluation of Historical Conditions 99
III.I.4. Analysis of Alternatives 100
III.I.4.a. No Action Alternative 100
III.I.4.a.(1). Groundwater Levels 100
III.I.4.a.(2). Groundwater Quality 100
III.I.4.a.(3). Subsidence 101
III.I.4.b. Settlement and Non-Settlement Alternatives 101
III.I.4.b.(1). Groundwater Levels 101
III.I.4.b.(2). Water Quality 101
III.I.4.b.(3). Subsidence 101

APPENDIX I

List of Figures

Figure No.	Description
I-1	Groundwater Sub-areas-Pinal/Salt River Valley Area
I-2	Methodology for Distributing Water from CAGRD & Recharge Pools to Direct Recharge Facilities
I-3	Methodology for Distributing Water from CAGRD & Recharge Pools to Indirect Recharge Facilities
I-4	Groundwater Sub-areas-Tucson
I-5	Estimated Groundwater Levels for Alternatives for Oro Valley Sub-Area
I-6	Estimated Groundwater Levels for Alternatives for East CMID Sub-Area
I-7	Estimated Groundwater Levels for Alternatives for MDWID Sub-Area
I-8	Estimated Groundwater Levels for Alternatives for Tucson West Sub-Area
I-9	Estimated Groundwater Levels for Alternatives for Tucson East Sub-Area
I-10	Estimated Groundwater Levels for Alternatives for San Xavier West Sub-Area
I-11	Estimated Groundwater Levels for Alternatives for San Xavier East Sub-Area
I-12	Estimated Groundwater Levels for Alternatives for Vail Sub-Area
I-13	Estimated Groundwater Levels for Alternatives for Green Valley West Sub-Area
I-14	Estimated Groundwater Levels for Alternatives for Green Valley Central Sub-Area
I-15	Estimated Groundwater Levels for Alternatives for Green Valley East Sub-Area
I-16	Estimated Groundwater Levels for Alternatives for Tubac West Sub-Area
I-17	Estimated Groundwater Levels for Alternatives for Tubac Central Sub-Area
I-18	Estimated Groundwater Levels for Alternatives for Tubac East Sub-Area
I-19	Change in Groundwater Levels in the Tucson Area from 2001 to 2051 for the No Action Alternative
I-20	Groundwater Levels Impacts of Settlement Alternative for Year 2051 in the Tucson area
I-21	Groundwater Levels Impacts of Non-Settlement Alternative 1 for Year 2051 in the Tucson area

Figure No.	Description
I-22	Groundwater Levels Impacts of Non-Settlement Alternative 2 for Year 2051 in the Tucson area
I-23	Groundwater Levels Impacts of Non-Settlement Alternative 3A for Year 2051 in the Tucson area
I-24	Groundwater Levels Impacts of Non-Settlement Alternative 3B for Year 2051 in the Tucson area
I-25	Comparison of Groundwater Level Impacts in Year 2051 for Selected Sub-Areas in the Tucson Area
I-26	Comparison of Groundwater Level Impacts in Year 2051 for Selected Sub-areas in the Tucson Area to additional CAP M&I Allocation and Indian Leases
I-27	Groundwater Sub-Areas - Avra Valley
I-28	Estimated Groundwater Levels for Alternatives for Picacho Sub-Area
I-29	Estimated Groundwater Levels for Alternatives for Tortolita Sub-Area
I-30	Estimated Groundwater Levels for Alternatives for Red Rock Sub-Area
I-31	Estimated Groundwater Levels for Alternatives for West CMID Sub-Area
I-32	Estimated Groundwater Levels for Alternatives for Central CMID Sub-Area
I-33	Estimated Groundwater Levels for Alternatives for North Avra Valley Sub-Area
I-34	Estimated Groundwater Levels for Alternatives for AVRA Coop Sub-Area
I-35	Estimated Groundwater Levels for Alternatives for South Avra Sub-Area
I-36	Change in Groundwater Levels in Avra Valley from 2001 to 2051 for the No Action Alternative
I-37	Groundwater Levels Impacts of Settlement Alternative for Year 2051 in Avra Valley
I-38	Groundwater Levels Impacts of Non-Settlement Alternative 1 for Year2051 in Avra Valley
I-39	Groundwater Levels Impacts of Non-Settlement Alternative 2 for Year 2051 in Avra Valley
I-40	Groundwater Levels Impacts of Non-Settlement Alternative 3A for Year 2051 in Avra Valley
I-41	Groundwater Levels Impacts of Non-Settlement Alternative 3b for Year 2051 in Avra Valley
I-42	Comparison of Groundwater Level Impact in Year 2051 for Selected Sub-Areas in the Avra Valley
I-43	Comparison of Groundwater Level Impacts in South Avra Valley Sub-Area To Schuk Toak CAP Water Use
I-44	Groundwater Sub-Areas-Pinal/Salt River Valley Area
I-45	Location of Areas Used to Organize Discussion-Pinal/Salt River Valley Area
I-46	Historical Groundwater Levels in the Scottsdale South Sub-area to Schuk Toak CAP Water Use
I-47	Estimated Groundwater Levels for Alternatives for MSIDD North Sub-Area

Figure No.	Description
I-48	Estimated Groundwater Levels for Alternatives for MSIDD South Sub-Area
I-49	Estimated Groundwater Levels for Alternatives for Casa Grande Sub-Area
I-50	Estimated Groundwater Levels for Alternatives for CAIDD Sub-Area
I-51	Estimated Groundwater Levels for Alternatives for Hohokam-SCIDD Sub-Area
I-52	Estimated Groundwater Levels for Alternatives for SCIDD Sub-Area
I-53	Change in Groundwater Levels in the Pinal/Salt River Valley Area from 2001 - 2051 for the No Action Alternative
I-54	Estimated Groundwater Levels for Alternatives for GRIC Sacaton Sub-Area
I-55	Estimated Groundwater Levels for Alternatives for GRIC East Sub-Area
I-56	Estimated Groundwater Levels for Alternatives for GRIC North Sub-Area
I-57	Estimated Groundwater Levels for Alternatives for GRIC South Sub-Area
I-58	Estimated Groundwater Levels for Alternatives for GRIC Komatke Sub-Area
I-59	Estimated Groundwater Levels for Alternatives for GRIC Maricopa Village Sub-Area
I-60	Estimated Groundwater Levels for Alternatives for NMIDD Sub-Area
I-61	Estimated Groundwater Levels for Alternatives for Florence Junction Sub-Area
I-62	Estimated Groundwater Levels for Alternatives for QCID Sub-Area
I-63	Estimated Groundwater Levels for Alternatives for Superstition Sub-Area
I-64	Estimated Groundwater Levels for Alternatives for Apache Junction Sub-Area
I-65	Estimated Groundwater Levels for Alternatives for Mesa East Sub-Area
I-66	Estimated Groundwater Levels for Alternatives for Williams Airport Sub-Area
I-67	Estimated Groundwater Levels for Alternatives for Mesa West Sub-Area
I-68	Estimated Groundwater Levels for Alternatives for Chandler North Sub-Area
I-69	Estimated Groundwater Levels for Alternatives for Chandler South Sub-Area
I-70	Estimated Groundwater Levels for Alternatives for Tempe South Sub-Area
I-71	Estimated Groundwater Levels for Alternatives for Tempe North Sub-Area

Figure No.	Description
I-72	Estimated Groundwater Levels for Alternatives for Salt River Indians Sub-Area
I-73	Estimated Groundwater Levels for Alternatives for Scottsdale South Sub-Area
I-74	Estimated Groundwater Levels for Alternatives for Scottsdale North Sub-Area
I-75	Estimated Groundwater Levels for Alternatives for McDowell Sub-Area
I-76	Estimated Groundwater Levels for Alternatives for Phoenix South Sub-Area
I-77	Estimated Groundwater Levels for Alternatives for Phoenix North Sub-Area
I-78	Estimated Groundwater Levels for Alternatives for Phoenix SW Sub-Area
I-79	Estimated Groundwater Levels for Alternatives for Glendale-Peoria Sub-Area
I-80	Estimated Groundwater Levels for Alternatives for Sun City West Sub-Area
I-81	Estimated Groundwater Levels for Alternatives for West Side M&I Sub-Area
I-82	Estimated Groundwater Levels for Alternatives for MWD Sub-Area
I-83	Estimated Groundwater Levels for Alternatives for Avondale Sub-Area
I-84	Estimated Groundwater Levels for Alternatives for East Buckeye Sub-Area
I-85	Estimated Groundwater Levels for Alternatives for West Buckeye Sub-Area
I-86	Groundwater Level Impacts of Settlement Alternative for Year 2051 in the Pinal/Salt River Valley Area
I-87	Groundwater Level Impacts of Non-Settlement Alternative 1 for Year 2051 in the Pinal/Salt River Valley Area
I-88	Groundwater Level Impacts of Non-Settlement Alternative 2 for Year 2051 in the Pinal/Salt River Valley Area
I-89	Groundwater Level Impacts of Non-Settlement Alternative 3a for Year 2051 in the Pinal/Salt River Valley Area
I-90	Groundwater Level Impacts of Non-Settlement Alternative 3b for Year 2051 in the Pinal/Salt River Valley Area
I-91	Comparison of Groundwater Level Impacts in Year 2051 for Pinal Sub-Areas to Changes in Ag Pool Volume and NIA Allocations
I-92	Comparison of Groundwater Level Impacts in Year 2051 for Selected Sub-Areas in GRIC to Net Pumping on GRIC
I-93	Comparison of Groundwater Level Impacts in Year 2051 for Selected East Salt River Valley Sub-Areas to Reductions in Recharge Pool

Figure No.	Description
I-94	Comparison of Year 2051 Impacts in QCIDD and NMIDD Sub-Areas
I-95	Comparison of Groundwater Level Impacts in Year 2051 for Selected Sub-Areas in the West Salt River Valley to Reductions in CAP Recharge Pool
I-96	San Carlos Indian Reservation
I-97	Tonopah Irrigation District Area
I-98	Historical Groundwater Levels in Tonopah Irrigation District Area
I-99	Projected Groundwater Elevations for Tonopah Irrigation District
I-100	Comparison of Groundwater Level Impacts in Year 2051 in TID to Change in Total Excess CAP Water
I-101	1964 Groundwater Levels in the Area of Analysis for the Navajo and Hopi Indian Reservation
I-102	Location of Carefree Basin
I-103	Historical Average Groundwater Elevations for Cave Creek Area
I-104	Estimated Groundwater Elevations for Alternatives
I-105	Location of Fountain Hills Sub-Basin
I-106	Estimated Historical Groundwater Levels in Chaparral Area Compared to Selected Well Hydrographs
I-107	Estimated Groundwater Levels in Chaparral Sub-Area for Alternatives

APPENDIX I

List of Tables

Table No.	Description
I-1	M&I Demands and Uses: Settlement Alternative – Avondale Sub-Area
I-2	Gila River Indian Community Water Budget-Settlement Alternative
I-3	Gila River Indian Community Water Budget-No Action Alternative
I-4	Gila River Indian Community Water Budget-Non-Settlement Alternative 1
I-5	Gila River Indian Community Water Budget-Non-Settlement Alternative 2
I-6	Gila River Indian Community Water Budget-Non-Settlement Alternative 3
I-7	Tohono O'odham Nation, Schuk Toak District Water Budget-Settlement Alternative and Non-Settlement Alternatives 2 & 3
I-8	Tohono O'odham Nation, Schuk Toak District Water Budget-No Action Alternative and Non-Settlement Alternative 1
I-9	Tohono O'odham Nation, San Xavier District Water Budget-Settlement Alternative and Non-Settlement Alternatives 2 & 3
I-10	Tohono O'odham Nation, San Xavier District Water Budget-No Action Alternative and Non-Settlement Alternative 1
I-11	San Carlos Apache Tribe Water Budget-Settlement Alternative, No Action Alternative, and Non-Settlement Alternative 1
I-12	San Carlos Apache Tribe Water Budget-Non-Settlement Alternative 2
I-13	San Carlos Apache Tribe Water Budget-Non-Settlement Alternative 3
I-14	Characteristics of Agricultural Districts
I-15	Projected NIA Ag Pools Distribution by District for 2001-2003, No Action Alternative
I-16	Projected NIA Ag Pools Distribution by District for 2001-2003, Settlement Alternative
I-17	Projected NIA Ag Pool Distribution by District for 2004-2051, No Action Alternative
I-18	Projected NIA Ag Pool Distribution by District for 2004-2051, Settlement Alternative
I-19	CAP Ag Pool Percentage Distribution
I-20	Indian Sector Water Use
I-21	Summary of Water Balance for GRIC for Alternatives

Table No.	Description
I-22	Analysis of Groundwater Impacts of Alternatives on San Carlos Apache Tribe Lands

APPENDIX I GROUNDWATER ANALYSIS

This appendix describes the analyses performed to evaluate impacts of the proposed allocations on groundwater levels and quality, and the potential for subsidence. The analyses rely on published data and utilize standard methods. The analyses were prepared for several large areas that include a number of entities which would receive allocations of Central Arizona Project (CAP) water under the alternatives. These large analysis areas are the Pinal/Salt River Valley area, the Tucson area, and the Avra Valley area. For other entities, analyses were prepared to evaluate each individual entity (San Carlos Apache Tribe (SC Apache Tribe), Navajo and Hopi Indians, Tonopah Irrigation District (TID), Cave Creek, and Chaparral).

The groundwater analysis was developed to address issues raised in the scoping process with regard to how reallocation of CAP water could impact the groundwater resources. The analysis needs to have sufficient resolution to define impacts on possible recipients of CAP water and the relative impacts between different potential recipients. At its most fundamental level, the groundwater analysis must address identification of the continued availability of groundwater to entities in the future. The analysis focuses on identifying the impacts of the federal action on allocation of CAP water and does not focus on evaluating the details of plans for future groundwater development and use by potential CAP recipients that are not part of the Federal action. For example, the analysis does not attempt to evaluate potential impacts relating to alternative siting of required wells or prioritization of the use of existing wells.

The first section of this appendix discusses the methodology used to evaluate groundwater level impacts, water quality impacts, and subsidence impacts. This is followed by a discussion of how the inputs to the hydrologic inventory analysis drive the observed groundwater level impacts. The remainder of the appendix addresses specific geographic areas considered in the analysis, including discussion of existing conditions and estimated future conditions under the No Action, Settlement, and Non-Settlement Alternatives.

I. ANALYSIS METHODOLOGY

The sub-sections which follow discuss the methodology used to estimate impacts to groundwater levels, groundwater quality, and subsidence. The hydrologic inventory method used to estimate groundwater levels and the methods used to estimate the inputs to the hydrologic inventory are presented first. The methodologies used to evaluate potential water quality and subsidence impacts, which depend in part on the estimated groundwater level impacts, are then presented.

I.A. Hydrologic Inventory Methodology

Groundwater levels were analyzed using the hydrologic inventory method of analysis, in which the components of recharge to and discharge from groundwater are quantified to estimate the change in groundwater storage and related change in groundwater levels. This section discusses the rationale for selection of the hydrologic inventory as the method of analysis, the hydrologic inventory methodology, and the limitations of that method.

I.A.1. Selection of Analysis Methodology

The hydrologic inventory method was selected to evaluate impacts and implemented by developing spreadsheets to perform the required computations. The primary alternative method of analysis which was considered was the use of numerical groundwater models. Development of such models was beyond the scope of this process. However, consideration was given to the use of existing models (where available) to perform the analyses. Existing models include the following:

- **WESTCAPS Model –** This model was originally developed by the ADWR and was refined during studies performed by the Reclamation on potential future groundwater conditions in the West Salt River Valley.

- **Pinal AMA Model –** This model was developed by the ADWR to evaluate groundwater conditions in the Pinal AMA.

- **Tucson Area Model –** This model was developed by the USGS to evaluate groundwater conditions and future subsidence potential in the Tucson area.

- **Avra Valley Model –** This model was developed by the USGS to evaluate groundwater conditions and future subsidence potential in the Avra Valley.

- **Hopi/Navajo Model –** This model was developed by the USGS to evaluate groundwater conditions in the N-Aquifer underlying the Hopi/Navajo lands.

Each of the existing numerical models offers the ability to perform more extensive and detailed evaluations of the groundwater impacts, relative to the hydrologic inventory analysis. These models have also been published and are subject to public review.

The decision to use a simpler hydrologic inventory analysis rather than existing numerical models was made on the basis that:

- The numerical models would be relatively difficult to use in the short time frame available for these studies;

- The additional capabilities of the numerical models, while critical in many applications, are not required to address the more regional groundwater issues to be considered in this analysis; and

- The uncertainties in defining detailed inputs to the models over the relatively long 50-year analysis period would significantly limit the utility of the additional capabilities of the numerical models.

Uncertainties in defining the inputs to the numerical models over the 50-year period become a greater concern as the level of detail in those inputs increases. For example, prediction of the

potential need for groundwater within an entity in the future would tend to be more reliable than a prediction of specific plans for recovery of the water.

While the existing numerical models were not used directly in the analysis, the documentation of the available models was used as a primary source of data to develop the hydrologic inventory analyses.

I.A.2. Hydrologic Inventory Analysis

Groundwater levels were evaluated through consideration of the hydrologic inventory. Quantified estimates of the various components of recharge to and discharge from the groundwater are used to evaluate the change in groundwater storage. The change in groundwater storage is then used to estimate the associated change in groundwater level. The hydrologic inventory was evaluated on an annual basis, and the resulting groundwater levels represent the average groundwater levels in the impacted area. This provides a general assessment of the groundwater level impacts, but it is noted that localized groundwater levels may vary from the sub-area average.

Typical components of the hydrologic inventory include:

- Recharge
  - Percolation from streams
  - Incidental recharge (from M&I and agricultural uses) and canal seepage
  - Mountain front recharge
  - Groundwater inflow
  - Artificial recharge

- Discharge
  - Phreatophyte consumptive use
  - Discharge to springs
  - Groundwater outflow
  - Groundwater pumping

The hydrologic inventory, while evaluated for groundwater, needs to consider the water demands and the surface water supplies used to meet those demands. For example, the volume of groundwater pumping can be estimated as the demands which are not met with surface water supplies within legally prescribed limits. Also, the surface water supplies contribute to incidental recharge and canal seepage.

In general, interactions between groundwater and surface water (i.e., stream percolation and rising water contributing to stream flows) and phreatophyte consumptive use are input directly to the hydrologic inventory, reflecting available data to estimate these values. However, these interactions are particularly significant and variable along the Gila and Salt Rivers, and the analysis for the Pinal/Salt River Valley attempts to estimate these quantities to reflect the groundwater conditions. This additional analysis for that area (discussed in further detail in the

subsection which addresses the Pinal/Salt River Valley area analysis) provides flexibility in the analysis to reflect the changing groundwater/surface water interactions.

Sub-areas were defined for the large analysis areas. For example, Figure I-1 depicts sub-areas used for the Pinal/Salt River Valley analysis. Hydrologic inventories were evaluated for each sub-area. Sub-areas were defined in order to provide sufficient detail in the analysis to identify impacts for specific entities and to allow the groundwater flow pattern to be reflected.

The groundwater underflows between sub-areas are computed, using Darcy's Law, by multiplying the aquifer transmissivity by the width of the boundary between the sub-areas and the hydraulic gradient (i.e., the slope of the groundwater surface). The hydraulic gradient is computed in the analysis by dividing the difference in average groundwater elevations between the two sub-areas under consideration by the approximate distance between the centroids of the sub-areas. In addition to underflows between sub-areas, consideration is given to groundwater inflows from areas outside of the hydrologic inventory analysis into sub-areas. One of the assumptions of this analysis is that the aquifer transmissivity is constant. However, the transmissivity of an unconfined aquifer is at least in part a function of the saturated thickness of the aquifer, with the transmissivity declining with declining groundwater levels.

The change in groundwater storage, computed in the hydrologic inventory as the difference between total recharge and total discharge, can then be used to estimate the resulting change in groundwater elevation. This is accomplished by dividing the change in groundwater storage by the area in which the change in storage occurs (generally the acreage of the sub-area used for the analysis), and by the specific yield of the aquifer (i.e., the volume of groundwater yielded by draining a unit volume of aquifer material by gravity).

The hydrologic inventories evaluate groundwater levels essentially assuming conditions as a single unconfined layer. While there may be several aquifer units underlying some sub-areas, in general, the deeper zones would be in hydraulic continuity with the upper unconfined zones. In particular, the finer grained materials tend to "pinch out" at the margins of the basins, and most sub-areas extend into these areas where deeper zones would be connected with the upper unconfined zones. Based on this, the unconfined aquifer assumption is considered reasonable for this analysis.

I.A.3. Limitations of the Hydrologic Inventory Analysis

The hydrologic inventory analysis, while appropriate for the objectives of this study, does have some significant limitations that should be recognized in interpreting the results. Key limitations of the analysis methodology include:

- **Large sub-areas used for analysis –** The analysis is performed for relatively large sub-areas. Groundwater level impacts identified represent average impacts within these sub-areas, and the analysis does not consider the variability in groundwater conditions within each sub-area.

- **One-year time step –** The use of a one-year time step in the analysis precludes identifying seasonal changes in groundwater levels due to either natural variations in hydrology or changes in pumping and recharge patterns during the year.

- **Simplifying assumptions used to characterize the aquifer –** The aquifer systems evaluated are relatively complex, typically consisting of multiple aquifers and with aquifer parameters that vary laterally and vertically, and which can vary depending on the groundwater levels. The hydrologic inventory evaluates the aquifers essentially as single layer systems. While lateral variability in aquifer parameters can be reflected (at least at the scale of the sub-areas), the hydrologic inventory analysis does not reflect vertical variations in the aquifer parameters and how they could change with changing groundwater levels.

- **Less rigorous evaluation of some technical issues –** An example is that hydraulic gradients used to estimate groundwater underflows between sub-areas are evaluated based on the groundwater levels in the prior year. In contrast, numerical groundwater models typically "balance" the groundwater flows for the period being evaluated through an iterative process.

These limitations are generally of limited concern in identifying the regional impacts of concern in this study, but do limit the utility of these results if used outside of the context and scope of this study.

Particular caution is needed in directly comparing these results with projections prepared for other studies, particularly studies that are addressing groundwater operations at a finer geographic or temporal scale. Also, the assumed future water demands and water supplies are a dominant factor in estimating potential future groundwater levels, and the future conditions assumed in this study differ from those in other analyses. An important factor in the analysis of CAP allocation impacts is that assumptions on groundwater demands and supplies need to be consistent for the many different areas considered. The projection assumptions used in this analysis, therefore, would tend to have some differences from projection assumptions used in other studies. These different assumptions do not represent any improvement in the projections; rather, they reflect that the purpose of this analysis is different from the purposes of other analyses performed with numerical groundwater models.

I.B. Methodology to Estimate Hydrologic Inventory Inputs for Evaluation Alternatives

A methodology was developed to estimate hydrologic inventory inputs for the 2001 to 2051 period. This analysis involved estimating the future water demands for sub-areas, and the water supplies which would be used to meet those demands. Based on that information, groundwater pumping and recharge were estimated and used as inputs to the groundwater hydrologic inventory.

The inputs for the hydrologic inventory reflect the background assumptions discussed in detail in Appendix A, including assumptions on the following:

- Amount of CAP water available;
- Distribution of CAP water among the M&I, Indian, and non-Indian Ag (NIA) sectors;
- Build-out schedules for development on Indian lands;
- Distribution of excess water.

Much of the methodology to estimate hydrologic inputs is concerned with "fleshing out" the background assumptions with some additional detail, in order to identify a breakdown of supply and demand for the sub-areas used for the groundwater analysis. In addition to the information contained in Appendix A, the development of the hydrologic inputs also incorporates information discussed in detail in:

- Appendix C – Discussion of the basis for the estimated future water use by municipalities and private water providers;
- Appendix D – Discussion of the economic basis of changes in demand by NIA;
- Appendix L – Water use by the Indian sector.

It is also noted that supply and demand were estimated throughout the various groundwater analysis areas. This involved projecting future demands for some entities that are not specifically evaluated in the draft EIS (i.e., entities that may or may not have CAP allocations presently, and which would not receive a proposed CAP allocation as part of this proposed action.

The demands and water supplies were evaluated for five-year time steps, which were linearly interpolated within the five-year period.

Further details on the analysis methodology are presented in the sub-sections which follow. This includes sub-sections which consider supply and demand for each of the sectors considered (i.e., M&I, Indian, and NIA). The supply and demand for a given sub-area ultimately used in the analysis reflect the sum of the supplies and demands estimated for the M&I, Indian and NIA sectors for that sub-area. Because this analysis is particularly focused on CAP supplies, and because the CAP supplies for each sector are inter-related, a subsection is also included which discusses how CAP water is allocated between the various sectors, and to specific entities under the various pools of available CAP water.

I.B.1. M&I Sector

Fundamental to the use of the hydrologic inventory models was the preparation of a hydrologic inventory and physical water budget for each groundwater sub-area within each model domain. The individual components of the hydrologic inventory and water budget for each sub-area form groundwater pumpage and recharge inputs to the model. Quantifying the water demands and uses by all users for each time step for each sub-area is necessary to develop these

primary model inputs. This section of Appendix I discusses the development of the water budget for the M&I portion of each groundwater sub-area within the extent of the five models (Maricopa – Pinal, Chaparral, Cave Creek, Tucson, and Avra). It should be noted that the M&I uses include the M&I entities analyzed in the draft EIS as well as all other municipal water providers that are within the model domains or develop water resources from within the model domains.

In addition, water budgets for M&I uses for each time step, coupled with the timing and use of each M&I users' portfolio of water supplies, provide the basis for assessing the financial impacts of additional costs associated due to development and use of alternative supplies. This section provides the details of developing the water budget and assessment of the timing and use of water supplies used.

The process used to define the water budgets, inputs to the hydrologic inventory models and the use of water supply components may be summarized in the following steps:

- Identify the portfolio of water supplies available to each M&I water provider who is within the model domains or who receives water from within the water model domains;
- Quantify existing M&I water uses, per groundwater sub-area;
- Define the projected water demands per groundwater sub-area and per model time step;
- Apply the water supplies for each M&I user to meet the projected water demands per sub-area and per time step; and
- Calculate groundwater pumping and recharge inputs to the hydrologic inventory models.

The application of water supplies from an M&I user's portfolio of supplies relies on the assumption that M&I water providers would provide the least cost water supply within existing institutional and legal constraints. This assumption generally implies that the last increment of demand would be met by the most expensive water supply. Stated another way, the most costly water supplies are used last. The portfolio of supplies was identified from Assured Water Supply (AWS) applications, ADWR CAP water allocation studies, and water resource master plans.

The inputs to the hydrologic inventory models rely on an assessment of M&I uses and supplies, which is based on available information and assumptions. Taken as a whole, the assessment of M&I uses captures the relative uses and demands for the study to the extent necessary to provide groundwater pumping and recharge inputs to the hydrologic inventory models and assess costs for additional infrastructure. It must be recognized that each individual entity would make unique water supply delivery decisions based on that entity's unique circumstances.

The following sections discuss the steps used to develop the M&I water budgets and the inputs to the hydrologic inventory models.

I.B.1.a. Definition of Portfolio of Supplies

The first step in the analysis is to identify the M&I water providers within the CAP service area to be included in the analysis. GIS spatial database processes were used to determine the geographic extent of each provider's service and planning area within the Phoenix, Pinal and Tucson AMAs that falls within each groundwater sub-area. Each provider was identified using ADWR's GIS database of municipal water providers (ADWR, 1999 cd rom). Some water providers' service or planning areas entirely or partially fall outside of the model domains. Since areas adjacent to but outside the groundwater sub-areas were considered to be poor candidates for groundwater development, it was assumed that absent direct delivery, the provider would develop water resources available from its service area from within the groundwater sub-area. Population projections were based on municipal planning areas (MPAs) for 2000 through 2050 consistent with the projections used by ADWR for water planning.

Once the M&I entities were identified, their available supplies were defined based upon review of each provider's AWS application or certificate of designation, ADWR CAP water allocation studies (ADWR, 03,1999 tables), and provider master plans. The supplies were categorized based on the existing institutional framework. The sources of water included in the water supply portfolio are listed below, in order of decreasing preference of use, based primarily on cost.

- **Salt River Project Water.** Includes surface water as well as groundwater. For the purposes of this analysis, other supplies may be included for surface water irrigation districts such as Roosevelt Water Conservation District (RWCD) and Buckeye Irrigation District (BID).

- **CAP Water.** Original allocations, leases, assignments, and settlement exchanges, and per alternative, reallocated water, and Gila River Indian Community (GRIC) settlement lease.

  - **Original CAP Water.** Original CAP water – Allocated pursuant to the 1983 ROD, including transfers and amendments.
  - **Reallocated CAP Water.** Reallocated CAP water – M&I water reallocated as proposed by ADWR (ADWR, 1999).
  - **Settlement Alternative GRIC Lease.** CAP water provided pursuant to a GRIC water rights settlement that includes the ability to lease CAP water for use outside Reservation lands.

- **Groundwater.** Includes groundwater that ADWR will count toward an AWS, i.e., the phase-in allowance and incidental recharge allowance.

  - **Phase-In Allowance.** ADWR rules allow a small quantity of mined groundwater to be pumped to allow providers time to "phase-in" renewable water supplies. For example, the phase-in allowance for Phoenix AMA providers is calculated by multiplying the entity's 1994 total water demand by 7.5.

- **Incidental Recharge Allowance.** This is calculated as four percent of water uses to account for recharge through the distribution system and residential uses. For this analysis, incidental recharge is held at current levels and is assumed not to increase through time.

- **CAP Surface Water.** Includes Salt River Pima-Maricopa Indian Community (SRPMIC) Settlement water, Hohokam Irrigation and Drainage District (HIDD) water, and existing Indian leases.

- **Other Surface Water.** Includes gatewater, Roosevelt Conservation Space (RCS), and Wellton-Mohawk water.

- **Effluent.** The volume of effluent pledged to meet demands as outlined in AWS designation documents. In the case of the City of Phoenix, additional effluent was assumed to be available to meet water demands and reduce the volume necessary from the Central Arizona Groundwater Replenishment District (CAGRD).

- **CAGRD Membership.** Membership in the CAGRD was included as a vehicle to obtain water supply. Several of the entities are currently service area members or have pledged membership to obtain AWS designation. Membership in the CAGRD is assumed to provide the most expensive water supply, and was assumed to meet the last increment of demand after other supplies were used or as specified by existing agreements. In addition it was assumed that the total demand for CAGRD services from the entities could not exceed 200,000 af/year (afa). It was also assumed that the CAGRD members could overcome physical availability limitations by using recent changes in the CAGRD laws that now allow for limited direct delivery of water from CAGRD to members, including recharge and recovery, as well as direct use.

To complete the water balance, a certain quantity of water is recharged for several entities. To determine this amount, the other surface water supplies for all alternatives were held constant at the lowest amount, which occurs under the Settlement Alternative. It is possible, however, that instead of recharging the water not needed for direct use, the entities would directly use the water and correspondingly offset their groundwater pumping. In either case, the incremental impacts would be the same.

The available supplies were evaluated within the framework of the Settlement Alternative, Non-Settlement Alternative 1, Non-Settlement Alternative 2, Non-Settlement Alternative 3, and the No Action Alternative to determine if the municipal water providers' available water supplies were impacted by differences among the alternatives. As is shown in Appendix C, the alternatives result in three water supply scenarios for M&I entities:

- Settlement – Approximately 65,647 afa of CAP M&I priority water are allocated to 20 of the 21 M&I entities[1] evaluated in the draft EIS (see Appendix C for summary), and

[1] The ADWR recommended 20 M&I entities to receive a CAP allocation, see Appendix N. If the Town of Superior declines their allocation, then ADWR recommends that allocation to the Arizona Water Company for use in Apache Junction or Superior.

approximately 41,000 afa are made available for long-term leasing from GRIC to M&I users (see Appendix C). Additionally, Mesa and Chandler exchange 40,600 afa of effluent to the GRIC for 32,500 afa of CAP water.

- No Action, Non-Settlement Alternative 2, Non-Settlement Alternative 3A – No additional CAP water supplies are provided.

- Non-Settlement Alternative 1 approximately 65,647 afa of CAP M&I priority water are allocated to 20 of the 21 M&I entities evaluated in the draft EIS.

- Non-Settlement Alternative 3B – approximately 71,815 afa of CAP NIA-priority are allocated to 20 of the 21 M&I entities evaluated in the draft EIS. Being lower priority water than is allocated under the Settlement Alternative or Non-Settlement Alternative 1, it is assumed that the difference between the NIA and M&I priority water (71,815-65,647=6,168 afa) will be recharged to provide firming and the 65,647 afa will be directly used.

From the institutional framework, the water supplies were defined based on hydrologic water source per water supply scenario. The sources of water were aggregated into their respective hydrologic source as either groundwater or surface water. For example, CAGRD as a source is pumped groundwater, although it is replenished with surface water. The water budgets require an understanding of which water supply is pumped or delivered from surface water. The hydrologic sources are defined below:

- Groundwater – includes Salt River Project (SRP) groundwater, phase-in allowance, incidental recharge allowance, and CAGRD uses.

- Surface water – includes SRP surface water, CAP water, effluent, and other surface water.

The water supply portfolio for each water supply scenario was calculated for each M&I water provider within the scope of the study. Water providers with varying water supplies that had different water are described in Appendix C per water supply scenario. The other water providers' water supplies were the same for each of the water supply scenarios. For example, the City of Avondale was not recommended by ADWR to receive an additional allocation and therefore was assumed to have the same water uses across all alternatives.

I.B.1.b. Definition of Projected Water Demands

To develop water budgets for each groundwater sub-area, projected water demands are compared to supplies for each time step during the study period. The projected water demands are prepared based on population projections and assumptions regarding industrial uses within the extent of the hydrologic inventory models.

As discussed in Appendix C, population projections were used to assess the water demands for 2001 through 2051 in five-year time steps. The 1997 DES population projections used by ADWR for water planning purposes served as the basis for population projections. The process used

for each water provider not recommended to receive an additional CAP allocation, but within the study area, is similar to the process used for each M&I entity analyzed specifically in the draft EIS, as discussed in Appendix C.

The geographic extent of the population projections was developed from analysis of population planning data developed from TAZ-based population projections from County planning agencies. The population was distributed into the groundwater sub-areas based on the projected growth patterns developed from the analysis of TAZ data.

The general location of population that was projected to fall within existing surface water irrigation districts in the Phoenix AMA was identified for each sub-area. Surface water irrigation districts are those irrigation districts that have extensive water rights to non-CAP surface water sources. Examples include SRP, RWCD, and Buckeye ID.

The population that was identified as occurring within a surface water irrigation district was termed "on-project" population. The on-project population was identified by using GIS spatial database processes to overlay the population projections with the extent of the surface water irrigation districts within each sub-area.

Population within a sub-area that did not fall within a surface water irrigation district was termed "off-project" population. It should be noted that there are no surface water irrigation districts in the Tucson AMA; therefore, all population in the Tucson and Avra models are "off-project."

In addition, population outside of the sub-areas that would be served from water sources within the sub-area was identified. The population that fell outside of the sub-areas was defined as "outside" population. The outside population was identified by a spatial database process that overlaid population with groundwater sub-areas. If population for a provider fell outside of the groundwater sub-area (the assumed limit of groundwater supplies), then the outside population had to rely on direct delivery or water resources provided from the adjacent sub-areas.

The water use rates were developed from the ADWR Third Management Plan (TMP) for the Phoenix and the Tucson AMAs (ADWR, 1999). The water use rates were specified in gallons per capita per day (gpcd) as mandated by the Groundwater Management Act (GMA). The gpcd rates were selected from the final conservation requirement in the management period (2005 – 2010) outlined for M&I providers. For providers not identified in the TMPs, the water use rate or a provider in an adjacent area with similar residential and turf characteristics was used. The gpcd rates used for this analysis include a seven-percent increase to accommodate lost and unaccounted-for water. Lost and unaccounted-for water includes leaks, spills, and flows too low to meter. The seven- percent increase was derived from a review of several water providers including Peoria, Scottsdale, and Phoenix. Lost and unaccounted-for water is typically between five and ten percent of total water use.

The projected water demands were calculated by multiplying the projected population by the water use rate (gpcd) and converting to afa. The issues and assumptions relevant to the gpcd water use rates are discussed in detail in Appendix C.

The water use rates were used to calculate the water demands per M&I provider per groundwater sub-area per time period. The same water demand rates were applied for populations "on-project," "off-project," and "outside" within each groundwater sub-area.

In addition to the M&I provider demands, a review of the TMPs showed that many groundwater sub-areas had industrial uses not captured using the population-based gpcd method. A review of the TMP data showed that industrial demands are approximately 10 percent of the total M&I provider demands. It is assumed for the purposes of the draft EIS that industrial demands are distributed equally across all groundwater sub-areas that include M&I provider demands at a rate of 10 percent of the provider demands in each sub-area.

In the Cave Creek area, industrial demands were adjusted to reflect the six golf courses within this sub-area. Each golf course was assumed to cover 90 acres with a five-af per acre demand. The additional industrial demand was met with CAP water and effluent until the M&I demands completely use Cave Creek's CAP allocation. As this point, the additional industrial demand is met by effluent.

In the Green Valley central sub-area, an additional industrial demand was added to account for the Cyprus Sierita Mine. This constant demand (26,000 af) was met entirely by groundwater pumping. Another mine was added to the San Xavier east sub-area to account for the ASARCO Mission Mine. Again, the constant demand (13,000 af) was met entirely by groundwater pumping.

In recognition of the water demands for surface water to irrigate residential landscape within portions of the SRP service area in the Phoenix AMA, urban irrigation was included. Urban irrigation demand is assumed to be approximately 140,000 af (Phoenix AMA TMP, 1999). It is assumed that the urban irrigation is spread evenly over 10 SRP dominated sub-areas.

Tables were developed which summarize the total water demands for each groundwater sub-area for each water supply scenario, Table I-1, which shows that information for the Chandler South sub-area for the Settlement Alternative, is provided as a sample of those tables.

I.B.1.c. Assign Supplies to Meet Demands

The water supply from each M&I provider was assigned to meet water demands projected for each provider in each sub-area per time step. The application of supplies was based on assumed least cost supply. The assumption is that the M&I providers will use their least costly supplies first with the last increment of demand met from the most costly supplies. The assignment of supplies to meet demands is based on the following assumptions:

- Surface water irrigation district supplies are available to meet all "on-project" demands. The water supply and demands fall primarily upon SRP lands or other surface water irrigation district lands such as RWCD, Roosevelt Irrigation District (RID), BID, or Maricopa Water District (MWD).

- Off Project demands are met from the following in order of use:

  - Groundwater phase-in allowance
  - Groundwater incidental recharge allowance
  - CAP water
  - Other surface supplies including effluent
  - CAGRD supplies.

- Outside demands are met by the same priority as off-project demands.

- In the Tucson and Avra models, on-project demands do not exist.

  - CAP water is "phased-in" within the first five-year period of the study. During this period, M&I entities gradually increase the amount of CAP water used and equally decrease the amount of groundwater to meet their demands.

  - The Tucson and Avra Valley M&I entities utilize "put and take" recharge and recovery facilities to use their CAP water. This involves recharging their CAP water in recharge facilities such as the Avra Valley Recharge Project, Central Avra Valley Storage and Recovery Project (CAVSARP), Pima Mine Road Recharge Project and the Santa Cruz Managed Recharge Project. The M&I entities use wells to "recover" their CAP water with a 5 percent "cut to the aquifer" requirement. This "recovery" occurs within the Cortaro-Marana Irrigation District (CMID) East, Metropolitian Domestic Water Improvement District (MDWID), Tucson West, and Tucson East sub-areas of the groundwater model.

  - The City of Tucson is assumed to use CAGRD water prior to using effluent because the City is under contract for 12,500 afa of CAGRD obligation after 2005.

  - The City of Tucson has pledged to build a well field to provide groundwater from Avra Valley to the City. The groundwater model begins utilizing this facility in 2017 as an additional place to "recover" CAP water.

- Industrial demands are met by:

  - Groundwater equal to 85 percent of the 2001 demand with groundwater pumping held constant moving forward in time.

  - Effluent meets 15 percent of the 2001 demand and meets the incremental increase in industrial demands moving forward from 2001.

  - CAP water and effluent for the Cave Creek model of additional industrial demand (golf courses). CAP water is used until the M&I demands equal the CAP allocation. For the Settlement Alternative and Non-Settlement Alternatives 1 and 3B, this occurs in 2026. For the No-Action Alternative and Non-Settlement Alternatives 2 and 3A,

this occurs in 2016. At this point, the additional industrial demands are met entirely by effluent.

- Groundwater for the San Xavier East and the Green Valley Central sub-areas of the Tucson groundwater model for additional industrial/mining demands.

The total water demands and the supplies used to meet those demands are summarized for each groundwater sub-area for each water supply scenario per time step. As shown on the sample presented in Table I-1, the tables summarize the water supplies from the standpoint of hydrologic source and institutional source.

- CAP Water – Includes all types of CAP water including:

  - No Action and All Alternatives
  - Original Allocation
  - Assignments, existing settlements, leases and exchanges
  - Settlement Alternative - Reallocated and GRIC lease water in addition to the No Action Alternative supplies
  - Non-Settlement Alternative 1 and 3B - Reallocated water in addition to the No Action supplies

- Municipal Groundwater - Groundwater including:

  - Phase-In Allowance
  - Incidental Recharge Allowance

- Industrial Groundwater - Other groundwater pumped for industrial uses

- Municipal Effluent - Recharge and recovered effluent or direct use of effluent

- Industrial Effluent - Direct use of effluent for industrial uses including turf (for example, parks and golf courses)

- Other Surface Water

- CAGRD Membership

- SRP water - Includes other surface water irrigation district demands.

  - Surface water is 70 percent of supply.
  - Groundwater is 30 percent of supply.
  - Includes urban irrigation demands as well as residential demands.

These categories were developed to capture the hydrologic components of the water supply within the context of the institutional constraints of water uses provided by current water use laws and policies.

I.B.1.d. Calculate Input to Hydrologic Inventory

Water budgets were calculated from the detailed analysis of the temporal and spatial distribution of water uses and supplies, as illustrated on the sample presented in Table I-1. From the water budgets, two inputs were provided to the hydrologic inventory models. The inputs are groundwater pumping and groundwater recharge. These inputs to the hydrologic inventory models were calculated from the water budgets for each groundwater sub-area per time period, as discussed in the following sub-sections:

I.B.1.d.(1). Groundwater Pumpage

Groundwater pumpage was calculated as the sum of:

- SRP groundwater
- Municipal groundwater
- Industrial groundwater
- Pumping during shortage conditions (2044 – 2051)

Groundwater pumpage is increased for sub-areas in the Phoenix area by the volume of CAP shortage, to simulate recovery of Arizona Water Banking Authority (AWBA) credits. No recovery occurs in the Tucson area.

I.B.1.d.(2). Groundwater Recharge

Groundwater recharge was calculated as the sum of:

- **Four percent of total municipal uses** to account for assumed four percent of system losses due to distribution, residential, non-residential and losses.

- **Twelve percent of total industrial uses** to account for recharge associated with turf and other facilities.

- **One hundred percent of direct recharge** located within any sub-area.

- **Twenty-four percent of urban irrigation** based on ADWR TMP for Phoenix AMA.

I.B.1.e. Analysis of Process

The inputs to the hydrologic inventory models derived from the foregoing analysis may be sensitive in the areas discussed in the following sub-sections.

I.B.1.e.(1) Assumed Water Demand Rates

If the water demand rates are significantly higher in the future than required by State law in the TMP, the volume of groundwater pumping would likely increase as a result of increased membership in the CAGRD. The discussion in Appendix C illustrates historic water use trends. With the exception of areas that include large non-residential uses or low persons per household, water use rates are moving toward the TMP requirements.

I.B.1.e.(2). Location of Water Demands

The physical location of demands relative to "on-" vs. "off- project" may impact the inputs to the hydrologic inventory models. For example, if the population off-project is underestimated (conversely, if on-project is overestimated), groundwater pumping may be overstated because 30 percent of the demands for on-project use are assumed to be met by groundwater. In addition, it may be that the location of on-project pumping varies from the assumed even spread across the sub-areas. The assumption of even spread may tend to underestimate groundwater pumping in sub-areas that have concentrated pumping while overstating the impacts in other areas.

I.B.1.e.(3). Assumption Regarding the Deployment of Water Supplies

The assumption used may show an accelerated use of CAP supplies relative to current projections. It is assumed that water providers would develop facilities to meet the demands as soon as the demands appear. That is to say, as soon as additional population and, thus, demands appear, the infrastructure is in place to meet the demands. There is no assumed lag time for new facilities. It appears that the ongoing planning activities such as the WESTCAPS process seem to support an accelerated use of CAP supplies. In the Tucson area, it is assumed that the entities would take CAP water as soon as the water becomes available. To do this requires "put and take" recharge and recovery facilities, also termed "annual storage and recovery facilities." The facilities do not require use of additional treatment plants. These facilities are either under construction or are in place for Tucson and other providers in the area. It appears that this assumption is consistent with current planned water use and policy in the Tucson area, although full use of CAP supplies starting in year 2001 may prove to be an overly optimistic assumption.

I.B.1.e.(4). Effluent Recharge and Use

Effluent is used to the extent that entities have pledged their supplies for AWS purposes. Additional effluent is used to satisfy industrial uses including golf courses. The effluent that may be available for local recharge is assumed to be disposed of in the current manner at regional wastewater treatment plants. It appears that the effluent water supplies available to those treatment plants would remain at least at current levels, if not increase through time.

I.B.1.e.(5). Water Supplies for Shortage Conditions

It is assumed that CAP shortages would be met by AWBA recovery programs that would pump groundwater from the Phoenix AMA and deliver full CAP supplies to the Tucson area. This

assumes that M&I entities in the Phoenix AMA use existing wells and have sufficient capacity to meet current demands and shortage demands. During shortage, the calculation of groundwater pumpage is increased by the amount of CAP shortage. This pumpage would be the recovery of stored AWBA groundwater credits and is spread equally among ten sub-areas in the Salt River Valley portion of the model.

I.B.2. Indian Sector

Methodology and assumptions used to estimate inputs to the groundwater analysis for Indian entities are discussed in this section. The sub-sections, which follow, provide discussion for the GRIC, the Tohono O'odham Nation (TON) (including the Schuk Toak and San Xavier Districts), and the SC Apache Tribe. The Navajo Nation and Hopi Tribe were evaluated using a more qualitative analysis, and so are not included in this section. All of the Indian entities have high priority CAP water supplies, so that the full supplies shown in the water budgets for each alternative are assumed to be available in almost all years.

I.B.2.a. GRIC

Based on the hypothetical non-binding plans to take water discussed in Appendix L, water budgets were developed for GRIC under each of the alternatives. These water budgets take into account existing water development plans, analysis of existing contracts and agreements, and data provided from Reclamation staff. All of the alternatives assume a five-percent diversion loss and an on-farm efficiency of 78 percent, which reflects improvements in the GRIC distribution system as described in the PMIP PEIS. An overall groundwater pumping limit was imposed at 157,000 afa for all alternatives. The GRIC is located within six groundwater model sub-areas of the Pinal and Salt River Valley groundwater model. The total amount of farmed acreage was equally distributed among these six sub-areas to provide inputs to the groundwater model. Under shortage conditions, beginning in the year 2044, the GRIC does not receive their NIA priority water. To simulate the shortage in the groundwater model, acreage was fallowed and/or supplemental groundwater pumping was allowed to occur.

I.B.2.a.(1). Settlement Alternative

The water budget for the Settlement Alternative is presented in Table I-2.

Table I-2
Gila River Indian Community
Water Budget
Settlement Alternative

Source	Quantity (afa)
Groundwater	157,000
Original CAP Allocation	173,100
Globe Equity Decree	125,000
Haggard Decree	5,900
RWCD CAP	18,600
RWCD	4,500
Harquahala Valley Irrigation District (HVID) CAP	17,800
ASARCO	17,000
SRP	20,000
Chandler Reclaimed Water	4,500
Net Reclaimed Water Exchange	8,100
New CAP Allocation	102,000
Total Settlement Budget	653,500
Water for Agriculture	531,000

Of the 653,500 afa total settlement water budget, 102,500 afa would be leased or exchanged for off-Reservation use, and 20,000 afa would be used on-Reservation for M&I purposes, leaving 531,000 afa for on-Reservation agricultural use.

For the Settlement Alternative, a total of about 118,000 acres could be farmed with the 531,000 af of water for agriculture using a water duty of 4.5 af per acre. A linear build-out schedule of the water supplies is followed for the GRIC starting in the year 2005 and reaching complete build-out by 2020. During shortage conditions, 33,191 acres are temporarily fallowed due to the GRIC not receiving 149,359 afa of NIA priority water.

I.B.2.a.(2). No Action Alternative

The water budget for the No Action Alternative is presented in Table I-3.

Table I-3
Gila River Indian Community
Water Budget
No Action Alternative

Source	Quantity (afa)
Groundwater	80,000
Original CAP Allocation	173,100
Globe Equity Decree	125,000
Haggard Decree	5,900
RWCD	4,500
SRP	13,104
Chandler Reclaimed Water	4,500
Total No Action Alternative	406,104

For the No Action Alternative, a total of about 85,800 acres could be farmed with the 386,104 af of water for agriculture using a water duty of 4.5 af per acre. The other 20,000 afa is used for GRIC M&I purposes, and no off-Reservation leases would occur. A linear build-out schedule of the water supplies is followed for the GRIC, starting in the year 2005 and reaching complete build-out by 2020. The schedule utilizes all of the water sources available to the Tribe. For the No Action Alternative, groundwater pumping starts at 40,000 af in the year 2005 and linearly increases to 80,000 af in the year 2020, at which level it continues for the study period duration. Shortage conditions do not affect CAP water deliveries in the No Action Alternative.

I.B.2.a.(3). Non-Settlement Alternative 1

The water budget for the Non-Settlement Alternative 1 is presented in Table I-4.

Table I-4
Gila River Indian Community
Water Budget
Non-Settlement Alternative 1

Source	Quantity (afa)
Groundwater	80,000
Original CAP Allocation	173,100
Globe Equity Decree	125,000
Haggard Decree	5,900
RWCD CAP	18,600
RWCD	4,500
HVID CAP	17,800*
ASARCO	17,000
SRP	13,104
Chandler Reclaimed Water	4,500
Total Non-Settlement Alternative 1 Budget	459,504

* Water reserved for future final water rights settlement consistent with Fort McDowell Indian Water Rights Settlement Act Provisions.

Under Non-Settlement Alternative 1, 17,800 afa are designated but not allocated (or used), 20,000 afa are used for GRIC M&I purposes, and no off-Reservation leases occur, so 421,704 afa are available for on-Reservation agricultural purposes. A total of 93,700 acres could be farmed with the 421,704 af of water for agriculture using a water duty of 4.5 af per acre. A linear build-out schedule of the water supplies is followed for the GRIC, starting in the year 2005 and reaching complete build-out by 2020. The schedule utilizes all of the water sources available to the Tribe. For the Non-Settlement Alternative 1, groundwater pumping starts at 40,000 af in the year 2005 and linearly increases to 80,000 af in the year 2020. It continues at that level for the study period duration. During shortage conditions, groundwater pumping increases by 18,600 afa due to the GRIC not receiving NIA priority water.

I.B.2.a.(4). Non-Settlement Alternative 2

The water budget for the Non-Settlement Alternative 2 is shown in Table I-5.

Table I-5
Gila River Indian Community
Water Budget
Non-Settlement Alternative 2

Source	Quantity (afa)
Groundwater	80,000
Original CAP Allocation	173,100
Globe Equity Decree	125,000
Haggard Decree	5,900
RWCD CAP	18,600
RWCD	4,500
HVID CAP	17,800*
ASARCO	17,000
SRP	13,104
Chandler Reclaimed Water	4,500
New CAP Allocation	34,499
Total Non-Settlement Budget	499,003

* Water reserved for future final water rights settlement consistent with Fort McDowell Indian Water Rights Settlement Act provisions.

Under Non-Settlement Alternative 2, 17,800 afa are designated but not allocated (or used), 20,000 afa are used for GRIC M&I purposes, and no off-Reservation leases occur, so 461,203 afa are available for on-Reservation agricultural purposes. A total of 102,500 acres could be farmed with the 461,203 af of water for agriculture using a water duty of 4.5 af per acre. A linear build-out schedule of the water supplies is followed for the GRIC, starting in the year 2005 and reaching complete build-out by 2020. The schedule utilizes all of the water sources available to the Tribe. For the Non-Settlement Alternative 2, groundwater pumping starts at 40,000 af in the year 2005 and linearly increases to 80,000 af in the year 2020. It continues at that level for the study period duration. During shortage conditions, groundwater pumping increases by 54,440 afa due to the GRIC not receiving NIA priority water.

I.B.2.a.(5). Non-Settlement Alternative 3

The water budget for the Non-Settlement Alternative 3 is shown in Table I-6.

Table I-6
Gila River Indian Community
Water Budget
Non-Settlement Alternative 3

Source	Quantity (afa)
Groundwater	139,396
Original CAP Allocation	173,100
Globe Equity Decree	125,000
Haggard Decree	5,900
RWCD CAP	18,600
RWCD	4,500
HVID CAP	17,800*
ASARCO	17,000
SRP	13,104
Chandler Reclaimed Water	4,500
New CAP Allocation	134,600
Total Non-Settlement Budget	653,500

* Water reserved for future final water rights settlement consistent with Fort McDowell Indian Water Rights Settlement Act provisions.

For the Non-Settlement Alternative 3, 17,800 afa are designated but not allocated (or used), 20,000 afa are used for GRIC M&I purposes, and no off-Reservation leases occur, so 615,700 afa are available for on-Reservation agricultural purposes. A total of 136,800 acres could be farmed with the 615,700 af of water for agriculture using a water duty of 4.5 af per acre. A linear build-out schedule of the water supplies is followed for the GRIC, starting in the year 2005 and reaching complete build-out by 2020. The schedule utilizes all of the water sources available to the Tribe. Groundwater pumping starts at 40,000 afa in the year 2005 and linearly increases to 139,396 afa in the year 2020. It continues at that level for the study period duration. During shortage conditions, groundwater pumping increases by 17,604 afa and 29,319 acres are temporarily fallowed due to the GRIC not receiving 149,541 afa of NIA priority water.

I.B.2.b. TON

The TON includes the Schuk Toak and San Xavier Districts. Inputs to the groundwater analysis were developed separately for these districts, as described in the following sub-sections.

I.B.2.b.(1). Schuk Toak District

Based on the hypothetical non-binding plans to take water described in Appendix L, water budgets were developed for each of the alternatives. These water budgets take into account existing water development plans, analysis of existing contracts and agreements, and data provided from Reclamation staff. All of the alternatives assume a water duty of 5.0 af per acre

and an irrigation efficiency of 76 percent. The total amount of farmed acreage was placed within the South Avra Valley sub-area (discussed later) to provide inputs to the groundwater model.

The water budget for the Settlement Alternative and Non-Settlement Alternatives 2 and 3 is shown in Table I-7.

Table I-7
Tohono O'odham Nation, Schuk Toak District
Water Budget
Settlement Alternative and
Non-Settlement Alternatives 2 and 3

Source	Quantity (afa)
Original CAP Allocation	10,800
New CAP Allocation	5,200
Total Water Budget	16,000

All CAP water is assumed to be used for agricultural purposes.

A total of about 3,200 acres could be farmed under these alternatives using a water duty of 5.0 af per acre. It was assumed that the Schuk Toak District would take a portion of their original CAP allocation in 2001 and take the complete allocation within a year. For the new CAP allocation, the Schuk Toak District would take a portion of the new CAP allocation in 2005 and take the complete new allocation within a year. No significant groundwater pumping is assumed to occur.

The water budget for the No Action Alternative and Non-Settlement Alternative 1 is shown in Table I-8.

Table I-8
Tohono O'odham Nation, Schuk Toak District
Water Budget
No Action Alternative and Non-Settlement Alternative 1

Source	Quantity (afa)
Original CAP Allocation	10,800
New CAP Allocation	0
Total Water Budget	10,800

All CAP water is assumed to be used for agricultural purposes.

A total of about 2,200 acres could be farmed under these alternatives using a water duty of 5.0 af per acre. It was assumed that the Schuk Toak District would take a portion of their original CAP allocation in 2001 and take the complete allocation within a year. No significant groundwater pumping is assumed to occur.

I.B.2.b.(2). San Xavier District

Based on the hypothetical non-binding plans to take water, discussed in Appendix L, water budgets were developed for the San Xavier District under each of the alternatives. These water budgets take into account existing water development plans, analysis of existing contracts and agreements, and data provided from Reclamation staff. All of the alternatives assume a water duty of 5.0 af per acre and an irrigation efficiency of 76 percent. The total amount of farmed acreage was placed within the San Xavier East sub-area of the Tucson groundwater analysis.

The water budget for the Settlement Alternative, and Non-Settlement Alternatives 2 and 3 is shown in Table I-9.

Table I-9
Tohono O'odham Nation, San Xavier District
Water Budget
Settlement Alternative and Non-Settlement Alternatives 2 and 3

Source	Quantity (afa)
Original CAP Allocation	27,000
New CAP Allocation	23,000
Total Water Budget	50,000

Of the 50,000 afa, 8,000 afa would be used for direct groundwater recharge, leaving 42,000 afa for on-Reservation agricultural use.

A total of about 8,400 acres could be farmed with the 42,000 af of water for agriculture using a water duty of 5.0 af per acre. A build-out schedule for the original CAP allocation is followed for the San Xavier District that starts in 2001 and reaches complete build-out in 2012. The new CAP allocation would follow a build-out schedule that starts in 2015 and is completed within five years. No significant groundwater pumping is assumed to occur.

The water budget for Non-Settlement Alternative 1 is shown in Table I-10.

Table I-10
Tohono O'odham Nation, San Xavier District
Water Budget
No Action Alternative and Non-Settlement Alternative 1

Source	Quantity (afa)
Original CAP Allocation	27,000
Total Water Budget	27,000

All of the 27,000 afa would be used for on-Reservation agricultural purposes.

A total of about 5,400 acres could be farmed with the 27,000 af of water for agriculture using a water duty of 5.0 af per acre. A build-out schedule for the original CAP allocation is followed for the San Xavier District that starts in 2001 and reaches complete build-out in 2012. No significant groundwater pumping is assumed to occur.

I.B.2.c. SC Apache Tribe

Based on the hypothetical non-binding plans to take water discussed in Appendix L, water budgets were developed for each of the alternatives. These water budgets take into account existing water development plans, analysis of existing contracts and agreements, and data provided from Reclamation staff. All of the alternatives assume a water duty of 5.0 af per acre for the CAP allocations, and a water duty of 6.0 af per acre is assumed for the Globe Equity Decree. The SC Apache Tribe lands are located within a separate groundwater study area (discussed later).

The water budget for the Settlement Alternative, No Action Alternative, and Non-Settlement Alternative 1 is shown in Table I-11.

Table I-11
SC Apache Tribe
Water Budget
Settlement Alternative, No Action Alternative, and Non-Settlement Alternative 1

Source	Quantity (afa)
Original CAP Allocation	61,645
Globe Equity Decree	6,000
Total Water Budget	67,645

Of the 67,645 afa total water budget, 29,980 afa are leased for off-Reservation use (see Appendix A), leaving 37,665 afa for on-Reservation agricultural purposes.

A total of about 7,300 acres could be farmed with the 37,665 af of water for agriculture. A total of about 6,300 acres could be farmed using the CAP allocation and associated water duty, and an additional 1,000 acres could be farmed using the Globe Equity Decree water duty. The build-out schedule for the original CAP allocation starts in 2005 and reaches complete build-out in 2010.

The water budget for the Non-Settlement Alternative 2 is shown in Table I-12.

Table I-12
SC Apache Tribe
Water Budget
Non-Settlement Alternative 2

Source	Quantity (afa)
Original CAP Allocation	61,645
Globe Equity Decree	6,000
New CAP Allocation	23,447
Total Water Budget	91,092

Of the 91,092 afa total water budget, 29,980 afa are leased for off-Reservation use (see Appendix A), leaving 61,112 afa for on-Reservation agricultural purposes.

A total of about 12,000 acres could be farmed with the 61,112 af of water for agriculture using a water duty of 5.0 af per acre. A total of 11,000 acres could be farmed using the CAP allocation and associated water duty, and an additional 1,000 acres could be farmed using the Globe Equity Decree water duty. The build-out schedule for the original CAP allocation starts in 2005 and reaches complete build-out in 2010. The new CAP allocation would follow the same build-out as the original CAP allocation.

The water budget for Non-Settlement Alternative 3 is shown in Table I-13.

Table I-13
SC Apache Tribe
Water Budget
Non-Settlement Alternative 3

Source	Quantity (afa)
Original CAP Allocation	61,645
Globe Equity Decree	6,000
New CAP Allocation	40,000
Total Water Budget	107,645

Of the 107,645 afa total water budget, 29980 afa are leased for off-Reservation use (see Appendix A), leaving 77,665 afa for on-Reservation agricultural purposes.

A total of about 15,300 acres could be farmed with the 77,665 af of water for agriculture using a water duty of 5.0 af per acre. A total of 14,300 acres could be farmed using the CAP allocation and associated water duty, and an additional 1,000 acres could be farmed using the Globe Equity Decree water duty. The build-out schedule for the original CAP allocation starts in 2005 and reaches complete build-out in 2010. The new CAP allocation would follow the same build-out as the original CAP allocation.

I.B.3. NIA Sector

The groundwater pumping and recharge components of the hydrologic inventory analyses include inputs attributable to NIA. This section discusses how these inputs were estimated for the evaluation of the alternatives. Spreadsheets were developed to implement the process discussed herein.

I.B.3.a. Groundwater Pumping for NIA

The basic process used to estimate groundwater pumping is:

- Estimate irrigated acres, broken down by district, for each sub-area or analysis area;
- Estimate the applied water requirement for the irrigated lands;
- Estimate the surface water supplies available to meet irrigation demands, and
- Compute the groundwater pumping as the applied water requirements in excess of the available surface water supplies.

- Groundwater pumping schedule evaluated in socioeconomic model to determine economic feasibility and be adjusted, if necessary.

Characteristics of agricultural districts used to estimate groundwater pumping are summarized in Table I-14.

I.B.3.b. Irrigated Acres

Irrigated acres were estimated by several means. The acres were estimated as described in the discussion of the socio-economic analysis for Central Arizona Irrigation and Drainage District (CAIDD), HIDD, New Magma Irrigation and Drainage District (NMIDD), Maricopa-Stanfield Irrigation & Drainage District (MSIDD), QCID and TID. The irrigated acres for these entities can vary over time under each alternative. For other entities, the acreage was estimated based on the grandfathered groundwater rights lands in those entities. This includes some entities which may receive CAP water from the Ag Pool under some alternatives (San Carlos Irrigation & Drainage District (SCIDD), San Tan Irrigation District (STID), and CHCID).

The potential for urbanization was also considered in defining the irrigated acres. This evaluation was based on consideration of projected population changes in sub-areas that presently include irrigated agriculture, number of persons per household, and households per acre based on local development patterns. The relationship between sub-area boundaries to county census divisions was used to estimate how much of the impact for a given county census division would apply to a particular sub-area.

The agricultural acreage within each sub-area was identified by comparison of boundaries for each district with the sub-area boundaries. The amount of irrigated acres within each sub-area was assumed to be proportional to the total district acreage in the sub-area.

I.B.3.c. Applied Water Requirements

Applied water requirements were estimated by several different means in this analysis. For those districts which may receive CAP water under some of the alternatives (i.e., CAIDD, HHID, NMIDD, MSIDD, QCID, TID, SCIDD, STID, CHCID), the applied water requirements (and the acreage which would be irrigated) were estimated as described in the discussion of the socio-economic analysis.

There are also irrigated lands within the analysis areas for entities which will not receive CAP allocations under any of the alternatives. Where available, information from the TMP for the AMAs were used to define the cropping pattern and the weighted average consumptive use. Those data are summarized in Table I-14 from the Phoenix and Tucson AMAs. The weighted average consumptive use estimated from data for the Phoenix AMA (3.19 af per acre) appears to be low, and for the purpose of this analysis, a weighted average consumptive use of 3.43 af per acre has been used.

The applied water requirements were then estimated by dividing the consumptive use by the irrigation efficiency. For both the Tucson and Phoenix AMAs, the TMP indicates an irrigation efficiency of 76 percent, which has been used in this analysis.

I.B.3.d. Surface Water Supplies

Surface water supplies include CAP water and surface water available from other sources. The non-CAP water was generally estimated with reference to the Water Service Organizations book, prepared by ADWR. For the purpose of this analysis, the identified surface water supplies were assumed to be available in every year, and the values are shown in Table I-14.

The availability of CAP water depends on the availability and distribution of water from the Ag Pool and the Recharge Pool. The evaluation of the operation of these pools is based on the background assumptions presented in Appendix A. The details on the evaluation of CAP supplies are presented in Section I.B.4. which addresses CAP water supplies.

I.B.3.e. Groundwater Supplies

Groundwater supplies are assumed to meet applied water requirements in excess of surface water supplies.

I.B.3.f. Incidental Recharge from NIA

A portion of the irrigation applications in excess of the crop consumptive use requirements can percolate and provide recharge to groundwater. Assumptions used to estimate the incidental recharge were developed from the TMP for the AMAs where available. In other areas, assumptions were made to estimate the incidental recharge reflecting estimated irrigation efficiencies.

For irrigated lands in the Phoenix, Pinal, and Tucson AMAs incidental recharge was generally estimated to be 24 percent of the total applied water. An exception is that incidental recharge is estimated to be 28 percent for SCIDD, reflecting the relatively high seepage losses which have historically occurred in the unlined canals of this district. Under Alternative 3A, these canals are assumed to be lined, and a 24 percent incidental recharge is assumed for SCIDD.

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I.B.4. CAP Water Supplies

CAP water is supplied to each of the sectors considered in this analysis (M&I, Indian, and NIA). While in general, separate discussion is provided for each sector, the amount of CAP water for each sector depends in part on the amounts of CAP water available for the other sectors. Therefore, this section discusses how available CAP water was distributed to each sector. Appendix A contains a comprehensive discussion of CAP water distribution to contractors, subcontractors, and pools.

The overall availability of CAP water for this analysis was assumed to be 1,415,000 afa delivered from 2001 to 2043. This represents normal CAP deliveries. From 2044 to 2051, it is assumed that there would be shortages, with a total CAP supply available of 925,000 afa delivered.

I.B.4.a. Distribution of CAP Water Supplies by Sector

M&I and Indian contractors would have allocations for CAP water, which would vary for the various alternatives considered. Indian contractors and M&I sub-contractors have the combined highest priority of CAP water. After their contracted deliveries are satisfied, the remaining water (termed "Excess Water") is available for several different pools. Water from these pools is made available for groundwater recharge and for agricultural use, as discussed below.

I.B.4.b. Methodology for Distributing the Ag and Recharge Pools

Excess Water is placed into an Ag Pool (available for irrigation uses) and a Recharge Pool (available for both direct and in-lieu recharge uses for both M&I and NIA entities). The Recharge Pool includes Excess Water used by CAGRD for recharge in certain of the direct recharge facilities. Appendix A contains a thorough discussion of the distribution of water into the Ag and Recharge Pools. The following discussion focuses on the distribution of water out of those pools to individual entities.

Under the Settlement Alternative, the Ag Pool water is distributed to NIA entities based on CAWCD's March 30, 2000 memorandum, "Discussion of Excess Water Marketing for Non-Indian Agricultural and Other Uses." Under the Non-Settlement Alternatives, the Ag Pool water is distributed to NIA entities based on an evaluation of NIA percentages published by Central Arizona Water Conservation District (CAWCD).

Initially, the Ag Pool is further broken down into three sub-pools. The water from the sub-pools is distributed between the various entities as discussed above; however, the costs vary for each of the sub-pools. Based on the July 8, 1999 CAWCD memorandum, "Calendar Year 2000 Central Arizona Project Water Rates," there are three Ag Pools from 2001 to 2003. Ag Pools One and Two are set at 200,000 af each, while any additional water available to the Ag Pools is distributed to Ag Pool Three. For example, the Settlement Alternative has a total of 550,000 af available to the Ag Pools in 2001. Ag Pool One and Two would each have 200,000 af and Ag Pool Three would have 150,000 af. After 2003, there is assumed to be a single Ag Pool.

Tables were prepared to show the distribution of Ag Pool water to the various entities. For years 2001, 2002, and 2003, the Ag Pool was broken down by Ag Sub-pool and tables were prepared for each alternative. Sample tabulations are presented in Table I-15 for the No Action Alternative and in Table I-16 for the Settlement Alternative. Similar tables were prepared for years 2004 to 2051 for each alternative, and sample tabulations are presented in Table I-17 for the No Action Alternative and in Table I-18 for the Settlement Alternative.

Figure I-2 illustrates the methodology for distributing the Recharge Pool water between direct and in-lieu recharge. It is anticipated that the CAWCD would make water available and AWBA would continue to provide recharge water through its in-lieu program through 2016. The direct and in-lieu amounts are consistent with current recharge volumes and current AWBA policy, as outlined in their Annual Report for 2000 (see Table A-2). After 2016, the funding for the AWBA would sunset. At this point, it is assumed that M&I entities would continue to recharge directly, and in lieu with nearby agricultural entities.

The CAGRD water, which is included in the Recharge Pool, was split among the East and West Salt River Valley members and Tucson area members. The East Salt River Valley members include H2O Water Company, Chaparral Water Company, Apache Junction, Cave Creek, Mesa, Chandler, Scottsdale, and Superior. The West Salt River Valley members include Peoria, Glendale, Surprise, El Mirage, Phoenix, Goodyear, and Valley Utilities. The Tucson members include Oro Valley, MDWID, Tucson, Avra Coop, Green Valley, and Del Lago. The CAGRD pool includes CAP water necessary to meet the projected replenishment obligation of existing CAGRD members of the CAP EIS M&I entities. It is assumed that M&I entities who were not identified by ADWR for allocation of CAP water would not require additional CAGRD supplies.

The distribution of CAGRD recharge demands has been split between East Salt River Valley, West Salt River Valley, and Tucson area based on the location of the M&I entities' replenishment demands. The split shows where CAGRD would likely replenish (recharge) CAP water over the study period. The split is based on a review of the CAGRD demands for each entity over the period (Appendix C) and the location of the entity relative to the East Salt River Valley, West Salt River Valley, and Tucson AMA boundaries.

The Recharge Pool was broken down into direct facilities and in-lieu facilities. If the available Recharge Pool is greater than the total capacity of all the direct facilities for the period of 2001 to 2016, the facilities receive their full amounts. The remaining Recharge Pool is then distributed to the in-lieu facilities.

The distribution of water from the Recharge Pool for in-lieu recharge is illustrated on Figure I-3. The Pinal County in-lieu facilities (CAIDD, HIDD, and MSIDD) are held at constant capacities as set in the AWBA 2000 Plan of Operation until 2017, when they no longer receive in-lieu water. The remaining in-lieu facilities are NMIDD, Queen Creek Irrigation District (QCID), Chandler Heights Citrus Irrigation District (CHCID), TID, MWD, RWCD, SRP, Kai Farms (KAI), CMID, and Bing K. Wong Farms (BKW). If the remaining Recharge Pool (after direct facilities are full) exceeds the total capacity of the remaining in-lieu facilities, it is distributed to the in-lieu facilities in direct proportion to their 1998 actual deliveries (i.e., the recharge is constrained to remain within the 1998 actual deliveries). Any remaining water in the Recharge

Pool is then distributed to SRP's in-lieu facility. SRP was chosen as the recipient of additional in-lieu water because it already has a substantial surface water supply and would be least likely to skew the groundwater impacts analysis. The AWBA and M&I entities have a total of 200,000 afa of Groundwater Savings Facility permits for SRP. If the remaining pool is less than the total capacity of the in-lieu facilities, it is distributed to all of the facilities in direct proportion to their 1998 actual deliveries.

If the available Recharge Pool is less than the total capacity of all the direct facilities, the facilities receive an amount in direct proportion to their share of the total overall direct capacity, and no amount would be available to the in-lieu facilities.

I.C. Methodology to Evaluate Water Quality Impacts

The quality of groundwater is a factor in the suitability of the groundwater supply for irrigation, municipal, and industrial uses. Changes in groundwater quality related to the proposed CAP allocations could, therefore, have a significant impact on the use of those supplies.

The potential for water quality impacts was evaluated on a qualitative basis. The CAP reallocation could impact groundwater quality through the following three basic mechanisms:

- Changes in the flow pattern could induce or retard the lateral movement of poor quality water to wells;
- Lowering of groundwater levels could result in production of water from deeper aquifer zones containing poor quality water; and
- Direct recharge of CAP water could impact the quality of groundwater in the aquifer receiving recharge.

Methodology to identify impacts associated with these three potential impact mechanisms are discussed in the sub-sections which follow.

I.C.1. Lateral Movement

Evaluation of potential impacts due to changes in the flow pattern involves evaluating changes in the pattern of groundwater movement with respect to the location of bodies of poor quality water. The flow patterns were evaluated by identifying the direction of groundwater flow between sub-areas. For areas within the Phoenix, Pinal, and Tucson AMAs, existing water quality conditions are identified by reference to the TMP for the associated AMA. The total dissolved solids (TDS) concentration is used as the primary indicator of water quality.

I.C.2. Lowering Levels into Poorer Quality Zones

Evaluation of the potential water quality impacts due to lowering of groundwater levels into bodies of poorer quality water involves comparing the estimated groundwater levels to the depth of poorer quality water. For areas within the Phoenix, Pinal, and Tucson AMAs, existing

water quality conditions are identified by reference to the TMP for the associated AMA. When the saturated thickness above the poor quality water zone is reduced, there is the potential for wells to be impacted by the poorer quality water. These results were modified based on judgment, considering such factors as geologic conditions at depths that might influence water quality in wells.

I.C.3. Direct Recharge of CAP Water

Direct recharge of CAP water would influence the water quality of the ambient groundwater through the mixing of these waters. The potential impacts were evaluated by comparing the TDS concentration of CAP water (about 500 to 750 parts per million (ppm)) to the concentration of groundwater in the vicinity of the direct recharge sites.

I.D. Methodology to Evaluate Subsidence Impacts

Subsidence has occurred in many areas of central Arizona since the early 1940s. For example, the USBR's 1976 report, "Geology and Groundwater Resources Report, Maricopa and Pinal Counties," indicated that at least 1,000 square miles in the study area have been affected by subsidence. In addition to lowering of the ground surface, earth fissures can form in response to subsidence.

The mechanism for the subsidence is the compression of saturated clay layers. This compression occurs when groundwater levels decline in adjacent aquifer materials; the lower levels induce flow from the saturated clays, and that flow results in compaction of the clay layers. The subsidence continues until the pore pressure in the clay layers reaches a new equilibrium with the aquifer materials.

The potential for subsidence was evaluated on a qualitative basis. The potential for subsidence was identified if both of the following conditions were present:

- **Geologic Conditions Conducive to Subsidence.** The subsidence potential depends in part on the geologic conditions, specifically the presence of clay materials which are subject to compaction. For areas that have experienced significant groundwater declines, the potential for substance can be identified simply by the identification of historical subsidence. For areas without significant historical groundwater declines, it requires consideration of the presence of clay materials and an evaluation of whether these clays would be susceptible to compaction.

- **Groundwater Levels Dropping Below Historical Low Levels.** Under the assumption that conditions in compressible clays would be in equilibrium with historical low groundwater levels, it is assumed that a drop in groundwater levels below the historical minimum could trigger subsidence. While it is possible that subsidence could begin with levels above the minimum historical level (if conditions in the compressible clay did not reach equilibrium with this groundwater level), it is a reasonable assumption for the purpose of this analysis.

The identification of areas with historical subsidence and geologic conditions conducive to subsidence was accomplished by review of available published reports that addressed the areas of interest. The evaluation of groundwater levels is based on the projected future groundwater levels for the area, as presented earlier in Section A of this appendix. In particular, the maps show changes in groundwater levels in sub-areas for the No Action Alternative from 2001 to 2051, and showing groundwater level impacts in year 2051 by sub-area is helpful in identifying potential subsidence impacts.

This evaluation provides a qualitative assessment of subsidence potential. It does not attempt to quantify the magnitude of subsidence that might ultimately occur, or to locate subsidence impacts other than within the sub-area. Impacts of the Settlement and Non-Settlement Alternatives are evaluated against the No Action Alternative. To the extent that subsidence would occur under the No Action Alternative, a reduction in subsidence potential from the No Action Alternative would be a positive subsidence impact.

II. RELATIONSHIPS BETWEEN ANALYSIS INPUTS AND GROUNDWATER LEVEL IMPACTS

The groundwater level impacts estimated in this analysis are in large part a reflection of the inputs to the analysis presented above. A detailed discussion of the inputs as defined in the background assumptions may be found in Appendix A. This section presents a general description of how these inputs are ultimately reflected in the estimated groundwater levels. The discussion of impacts in particular sub-areas presented in the later sections of this appendix provide a brief indication of the basis of those impacts, in relation to the conceptual background presented here.

II.A. Basis of Groundwater Level Impacts

Groundwater level impacts reflect both the influence of net pumping (i.e., differences between pumping and recharge) within a sub-area, and the influence of groundwater flows between sub-areas.

II.A.1. Net Pumping

All other things being equal for a given sub-area, groundwater levels would be higher with less net pumping, and lower with greater net pumping. The magnitude of that impact would reflect several factors, such as specific yield and the intensity of the net pumping. The specific yield governs how much the groundwater level would change for a given change in groundwater storage.

The intensity of the net pumping is related to how much net pumping there is in relation to the size of the sub-area. For example, an increase in net pumping of 5,000 afa would have a larger impact on groundwater levels for a sub-area with an area of 10,000 acres (0.5 af per acre) than for a sub-area with an area of 50,000 acres (0.1 af per acre).

II.A.2. Groundwater Flows Between Sub-areas

Groundwater underflow between sub-areas is one of the components considered in the hydrologic inventory analysis. Changes in those underflows can, therefore, impact the groundwater levels estimated for sub-areas. Changes in the groundwater underflows reflect changes in groundwater levels in adjacent sub-areas, with greater changes of groundwater levels in the adjacent sub-areas resulting in greater impacts to groundwater levels in the sub-area of interest. The sensitivity of a given sub-area's groundwater level to adjacent groundwater levels would reflect the parameters used to estimate the groundwater flows using Darcy's Law (transmissivity, underflow perimeter width, and distance used to estimate hydraulic gradients).

The largest groundwater level impacts occur in response to changes in net pumping within a sub-area. Groundwater level impacts resulting from changes in underflow from adjacent areas can be difficult to clearly recognize in a sub-area, except when impacts due to changes in net pumping are relatively small and/or there are relatively large groundwater level changes in the adjacent sub-area.

II.B. Typical Patterns of Groundwater Level Impacts

The specific groundwater level impact for any specific alternative and sub-area depends on the individual characteristics of that sub-area and on the specific operations considerations for the entities within that sub-area. However, there are some typical patterns in the estimated inputs to the groundwater analysis that apply to a number of entities in various sub-areas. This section discusses these "typical" patterns, and how they generally show up as groundwater level impacts. These patterns guide the evaluation of the analysis results for specific areas, which are presented later.

While the typical patterns of groundwater level impacts discussed in the sub-sections which follow are useful in evaluating results, it should also be recognized that there are a number of complicating factors which must be considered to evaluate groundwater level impacts in a specific sub-area. One factor is that the impacts in a given sub-area often reflect a mix of these impacts. For example, some sub-areas would include pumping and recharge reflecting both NIA and M&I entities. A second factor is that if the changes in pumping and recharge are not very intense in a sub-area, the groundwater level impacts for the sub-area may be dominated by changes in groundwater flows caused by larger groundwater level impacts in adjacent sub-areas.

II.B.1. NIA Entities

Groundwater level impacts for NIA entities reflect an interplay between a number of factors including the following:

- **Size of Ag Pool and NIA Allocations**. While there are variations in the distribution of the Ag Pool and NIA allocations, the total of the Ag Pool volume and (for Alternative 3B) the NIA allocation over the 50-year period often explains the relative impacts of alternatives.

These volumes are discussed in some detail in Appendix A. The total volume of these pools for the various alternatives are:

Alternative	Total Ag Pool and Allocation (Million af over 50-year period)
No Action	11.2
Settlement	12.6
Non Settlement 1	11.2
Non-Settlement 2	10.2
Non Settlement 3A	11.6
Non Settlement 3B	8.9

- **Ag Pool Allocation**. The amount of the Ag Pool water that each entity receives depends on the assumptions used to allocate that water. For the Settlement Alternative, the Ag Pool is distributed based on the CAWCD's proposed distribution [CAWCD Board Agenda Brief, Item No. 5, for April 6, 2000 Board Meeting, Larry Dozier]. For all other alternatives, the Ag Pool is distributed based on the percentages listed in Table I-19.

Table I-19
CAP Ag Pool Percentage Distribution

	Settlement Alternative	All Non-Settlement Alternatives
CAIDD	27.02%	33.1%
CHCID	0.14%	0.5%
CMID	1.39%	-
HVID	7.98%	5.3%
HHID	8.28%	4.5%
MSIDD	27.02%	32.4%
MWD	0.97%	-
NMIDD	8.58%	10.3%
QCID	2.19%	7.8%
RWCD	2.18%	3.8%
RID	2.31%	-
SCIDD	8.13%	-
STID	0.34%	1.1%
TID	0.42%	1.3%
Total	96.95%	100.0%

While the No Action Alternative should generally be, on average, the best alternative for NIA entities, the different distribution of the Ag Pool used for the Settlement versus Non-Settlement Alternatives may change that assessment for individual NIA entities. For example, MSIDD receives a smaller percentage (27.02 percent) of a larger Ag Pool under the Settlement Alternative than under the No Action Alternative (32.4 percent) with the net effect of MSIDD receiving less Ag Pool water under the Settlement Alternative.

- **In-Lieu Recharge Pool**. NIA entities participate to varying degrees in the in-lieu Recharge Pools. The size of that pool and the distribution of that pool to NIA entities influence the groundwater level impacts. Also, the groundwater level hydrographs would often reflect the reductions in the availability of recharge water over time (for example, for CAIDD, MSIDD, NMIDD, QCID, and HIDD, in-lieu recharge is not available after 2017, which appears as a point of inflection on the groundwater level hydrographs in the sub-areas containing these entities). While the Recharge Pool is separate from CAP recharge supplies for CAGRD (which is not available to NIA entities), the size of the CAGRD supplies influence how much of the Recharge Pool is available to NIA for in-lieu recharge. Thus, the combined volume of the Recharge Pool and the CAGRD supplies provides an indication of the potential impact of in-lieu recharge supplies on groundwater for NIA. This volume is summarized below for each alternative:

Alternative	Combined Recharge Pool and CAGRD Supplies (Million af over 50-year period)
No Action	18.3
Settlement	10.2
Non-Settlement 1	17.0
Non-Settlement 2	16.4
Non-Settlement 3A	14.1
Non-Settlement 3B	13.7

- **Reductions in Cropped Acreage**. In interpreting the estimated groundwater levels, it should be recognized that the cropped acreage (and, therefore, water demands) can vary based on the socioeconomic analysis and to reflect urbanization lands presently developed for irrigated agriculture. These impacts can vary between the different entities. For example, these factors are primary in understanding the projected groundwater elevations in the Queen Creek area.

II.B.2. Indian Entities

The impacts to Indian entities for the various alternatives vary in response to the allocation of CAP water that is generally specific to each Indian entity. CAP water available to Indian entities by entity and alternative is summarized in Table I-20. The impacts also reflect the assumptions of the analysis with respect to the timing of build-out under each alternative. Those build-out assumptions result in differences in the timing of demands and availability of supplies for the alternatives.

Table I-20
Indian Sector CAP Water Use
(in thousand afa)

Alternative	GRIC	TON: San Xavier District	TON: Schuk Toak District	SC Apache Tribe	Navajo And Hopi	GRIC Groundwater Pumping
Settlement	266.6	42.0	16.0	31.7	0.0	157.0
No Action	173.1	27.0	10.8	31.7	0.0	80.0
Non-Settlement 1	208.7	27.0	10.8	31.7	0.0	80.0
Non-Settlement 2	248.2	42.0	16.0	55.1	13.5	80.0
Non-Settlement 3A	343.3	42.0	16.0	71.7	13.5	139.4
Non-Settlement 3B	343.3	42.0	16.0	71.7	13.5	139.4

The changes in the pumping and recharge associated with the Indian entities is often relatively intense, so there are often relatively large impacts in these areas

II.B.3. Municipal and Industrial Entities

Impacts due to changes in pumping and recharge between alternatives for M&I entities generally reflect the volume of CAP water available to M&I entities, recharge supplies for M&I areas, and use of effluent. These factors are discussed below:

- **Volume of CAP Water Available to M&I Entities**. The volume of water available to M&I entities includes contracted M&I water, NIA-priority allocations to M&I entities, and M&I leases. The differences in supply from the No Action Alternative are relatively small, and these supplies are generally widely distributed, so that impacts associated with these supplies are relatively diffuse and difficult to identify in an individual sub-area. For perspective, currently 538,031 afa of CAP water are contracted to M&I users, and Salt River Valley users have access to considerable Salt and Verde River supplies. The total of the additional supplies for the various alternatives are summarized below:

Alternative	Additional CAP Allocation to M&I Users (afa)	Additional Indian Leases to M&I Users (afa)
No Action	0	0
Settlement	65,647	41,000
Non-Settlement 1	65,647	0
Non-Settlement 2	0	0
Non-Settlement 3A	0	0
Non-Settlement 3B	71,815*	0

*71,815 afa is NIA-priority. For purposes of analysis, 65,647 afa are considered for direct use with the remainder being recharged to firm up its priority.

- **Recharge Supplies**. The availability of recharge water to M&I entities can strongly influence the groundwater level impacts. Where direct recharge facilities are present and used for long-term storage, the impacts related to the recharge activities tend to completely dominate the impacts associated with the CAP water available for M&I use. For recharge operated on a "put and take" basis (i.e., water is recovered within one year of recharge), the analysis has treated such CAP deliveries as direct deliveries (i.e., there is no impact to groundwater at the level of geographic and temporal refinement of the analysis).

- **Use of Effluent**. Effluent can be used as a supplemental supply by entities which do not receive additional CAP water under an alternative. Currently, substantial amounts of effluent generated in the Salt River Valley are treated at the 91st Avenue wastewater treatment plant and discharged to the Gila River. This analysis assumes that this practice would continue to occur for the current levels of effluent generation. Additional effluent would be generated with increasing population. Some of this effluent would serve industrial demands; some would be treated and discharged on-site. This analysis assumes that effluent used to satisfy M&I demands would not be of a quantity to impact current levels of discharge to the Gila River. It is also assumed that on-site recharge of effluent would not significantly impact groundwater levels or quality.

II.C. Shortage Conditions

The hydrologic sequence used to evaluate groundwater conditions includes "normal" years of CAP availability from 2001 to 2043, and "shortage" years from 2044 to 2051. This sequence is generally representative of the most recent USBR water supply analyses, which show an average of eight years of shortage over the 50-year period and, further, that the shortages generally occur at the end of the 50-year period. More detail is available in the discussion of shortage in the "Discussion of Key Assumptions" section of Appendix A.

The impact of the assumed shortage condition tends to vary reflecting the sector, as described briefly below.

- **NIA Entities.** The availability of CAP water to NIA entities is already limited before 2044 due to the "pinch out" of the Ag Pool, so that the shortage conditions do not tend to result in a dramatic change in CAP availability or in groundwater level trends. However, for entities which are continuing to receive NIA-priority CAP water for in-lieu recharge in the later years, the reduction in CAP water available under shortage does produce increased declines in groundwater levels.

- **Indian Entities.** In general, Indian entities receive high priority CAP water that is generally not impacted by shortage, so that the shortage conditions do not tend to result in dramatic changes in CAP water availability or in groundwater level trends. The exception is that a portion of the CAP water available to GRIC for some alternatives has a NIA priority and a portion of the GRIC's Indian-priority CAP water is affected by the shortage conditions.

- **M&I Entities.** The shortage conditions do produce relatively large impacts in M&I areas in the vicinity of direct recharge facilities. Those impacts reflect the reductions in the Recharge Pool.

The magnitude of the groundwater level changes during the shortage period near direct recharge facilities also tend to vary between alternatives, with greater drops in groundwater levels occurring under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B. The greater drops in groundwater levels in some sub-areas for these alternatives relative to the No Action Alternative and Non-Settlement Alternatives 1 and 3A result from additional pumping for recovery of AWBA groundwater credits in those areas.

III. EVALUATION OF ALTERNATIVES

Groundwater conditions were evaluated for the No Action, Settlement, and Non-Settlement Alternatives using the methodology previously described. These evaluations cover the period from 2001 to 2051. The process used for the evaluations is presented first. This is followed by discussion of groundwater conditions broken out by geographical area.

Water level, water quality, and subsidence impacts are defined as the incremental difference between the conditions under the Settlement and Non-Settlement Alternatives relative to the conditions under the No Action Alternative. Because the No Action Alternative is the basis of comparison, the discussion of conditions under the No Action Alternative tends to focus on "absolute" changes in groundwater conditions. In contrast, discussion of the Settlement and Non-Settlement Alternatives focus on changes relative to the No Action Alternative. Because of this different focus, conditions for the No Action Alternative are presented in separate sections for each geographic area, while the discussion of the Settlement and Non-Settlement Alternatives has been combined.

The distinction between the focus of these alternatives results in different results being discussed. For example, groundwater level condition discussions under the No Action Alternative tend to focus on the change in groundwater levels from year 2001 to year 2051, while discussions for the Settlement and Non-Settlement Alternatives tend to focus on the difference in year 2051 groundwater levels relative to the No Action Alternative. It is noted that the analysis performed is expected to provide a better estimate of the impact (i.e., change from the No Action Alternative) than of the absolute groundwater levels.

III.A. Analysis Process

The analysis process included four general steps:

- Review of published studies and reports and development of a conceptual-level understanding of the hydrologic inventory, and water quality and subsidence conditions.

- Development of a hydrologic inventory analysis for historical conditions and comparison of the resulting estimated historical groundwater levels to observed

historical levels, as a means to evaluate the capabilities of the hydrologic inventory analysis.

- Use of the hydrologic inventory to evaluate projected future groundwater elevations for alternatives and to estimate the impacts for each alternative (where the impacts represent the changes in groundwater elevations from the No Action Alternative for the alternative under consideration).

- Evaluation of potential changes in groundwater quality and subsidence due to changes in groundwater levels.

These four steps are discussed in the sub-sections which follow.

III.A.1. Develop Conceptual Understanding of Hydrologic System

The first step in the analysis process was to develop a general understanding of the geology, hydrology, water quality, and subsidence potential in the area being considered by review of published studies and reports. This review provided a conceptual understanding of the hydrologic inventory needed to implement the hydrologic inventory analyses used for this study. Basic data used in the analyses were also identified during this initial review process.

III.A.2. Develop Hydrologic Inventory Analyses and Evaluate Historical Conditions

Information from published sources was used to estimate aquifer parameters (specific yield and aquifer transmissivities) and historical components of the hydrologic inventories. For some years, the estimated components could be taken directly from existing model studies, which also depend on identifying the components of the hydrologic inventory. In other years, the components needed to be estimated based on other reported values. Typically, substantial judgment was needed to evaluate these historical components of the hydrologic inventories and reconcile information from the various available sources. In some cases, data were limited and the estimated quantities were largely based on judgment.

The hydrologic inventories were generally developed using a relatively long period of historical record. This is consistent with the ultimate use of the hydrologic inventory analyses is to evaluate impacts over a relatively long projection period (from year 2001 to 2051). The emphasis on evaluating trends over a relatively long period is also consistent with the level of detail that could be developed for the hydrologic inventories. Some of the simplifying assumptions required for the analyses (such as the evaluation for some components of the hydrologic inventory on a long-term average basis rather than year-by-year) limit the capability to identify short-term trends.

The results of the hydrologic inventory analyses using historical data were compared to observed groundwater level trends. Because the groundwater levels estimated using the hydrologic inventories represent average levels within sub-areas, the most appropriate basis of comparison is with historical average groundwater levels for the same areas estimated using groundwater elevation contour maps. An average groundwater elevation for an area was obtained by measuring areas defined by groundwater elevation contours and developing a

weighted average. In some cases, comparisons were made with hydrographs for individual wells. Changes in the groundwater flow pattern implied from the hydrologic inventory results were also compared to historical flow patterns.

III.A.3. Evaluate Impacts of CAP Allocation on Groundwater Levels

The hydrologic inventories were used to evaluate the impacts of CAP allocations on groundwater levels over the 2001 to 2051 period. The projected components of the hydrologic inventory were estimated based on projected water demands and surface water supplies (with demands in excess of surface water supplies being met by pumping groundwater within legally prescribed limits).

The impacts are computed as the difference between the alternative being considered and the No Action Alternative. The hydrologic inventory analyses are expected to provide a better estimate of the relative impacts (i.e., a comparison of two analyses to identify the incremental impacts of the changed hydrology on groundwater levels) than of the absolute groundwater levels. This is because non-CAP components of the hydrologic inventory would be the same for both the No Action Alternative and the alternative under consideration. Because the influence of non-CAP components is present in both the No Action Alternative and the alternative under consideration, errors associated with a component of the inventory present in both alternatives would tend to cancel out in the comparison.

Because the No Action Alternative is the basis of comparison to determine impacts for the other alternatives, the discussion of the No Action Alternative must focus to some extent on absolute groundwater levels, rather than impacts. Further, recognizing the limitations in the hydrologic inventory analysis and in estimating inputs to the hydrologic inventory analysis over the 50-year analysis period, emphasis was given to evaluating and discussing the larger groundwater level impacts. While a 25-foot impact over a 50-year period is relatively small, discussion was in general focussed on impacts of at least that magnitude.

III.A.4. Identify Potential Water Quality and Subsidence Impacts

The estimated groundwater level impacts were used to help evaluate the potential for water quality and subsidence impacts. As with the water level impacts, water quality and subsidence impacts were not considered to be very significant where the water level impacts were less than 25 feet.

III.B. Groundwater Level Analysis for the Tucson Area

A hydrologic inventory analysis was performed for groundwater in the alluvium and basin fill materials in the Tucson area. The study area considered for the Tucson area and the sub-areas used in the analysis are shown on Figure I-4. It essentially is bounded by the Santa Catalina and Santa Rita Mountains to the east and the Tucson, Sierrita, and Tumacacori Mountains to the west. The analysis area runs from Tubac in the south to the Cortaro-Marana Irrigation District (CMID) and the Oro Valley area in the north.

Drainage in the study area is primarily provided by the Santa Cruz River, which enters the study area at the southern end and flows northerly to the Cortaro-Marana area and, thence, out of the study area to the Avra Valley. Drainage is also provided by various creeks and washes which are tributary to the Santa Cruz River, such as the Canada Del Oro, Sonoita Creek, Rillito Creek, Sabino Creek, Agua Caliente Wash, Tanque Verde Creek, and Pantano Wash. Before 1870, flow was intermittent for most of the river. Development has resulted in more regular flow in parts of the Santa Cruz River (particularly downstream of Tucson), supported by return flows and effluent discharges to the river.

Development in this area includes urban (particularly Tucson and nearby areas) and agricultural development. Much of the development has occurred along the Santa Cruz River. Also, there are significant mining operations, particularly along the Sierrita Mountains.

III.B.1. Existing Groundwater Conditions

The existing groundwater conditions were described in the USGS WRI-93-4196, "Simulation of Ground-Water Flow and Potential Land Subsidence, Upper Santa Cruz Basin, Arizona." The following discussion is primarily based on information presented in that report.

III.B.1.a. Geology

The groundwater resources of interest are contained in the alluvial deposits that fill the basin between the adjacent mountains. These deposits consist of gravel, sand, silt and clay. In general, the sediments are coarser along the edges of the basin and finer grained toward the central axis of the upper Santa Cruz Basin. There are also evaporitic deposits in the central portions of the basin.

The USGS split the basin fill materials into an upper and lower unit. In the context of the geology described elsewhere (see the section on the Pinal/Salt River Valley), the upper unit for the Tucson area appears to be analogous to the "upper alluvial unit," while the lower unit for the Tucson area appears to be analogous to a combination of the "Lower Conglomerate Unit" and the "Middle Fine-Grained Unit."

The upper alluvium in the Tucson area consists of gravel, sand and clayey silt. It ranges in thickness from 100 to more than 1,000 feet. The USGS study indicates these deposits tend to be more coarse-grained in the northerly part of the basin (apparently corresponding to the MDWID, Oro Valley, and CMID East sub-areas). The USGS study indicates that the upper alluvium may have greater potential for subsidence due to lowering groundwater levels than the lower alluvium.

The lower alluvium in the Tucson area consists of gravel, conglomerate, evaporites, clayey silt, and mudstone. The lower alluvium can be thousands of feet thick in the central portions of the basin.

III.B.1.b. Groundwater Occurrence and Movement

Groundwater generally occurs under unconfined to partially confined conditions to a depth of about 1,500 feet.

The pattern of flow in the Tucson area is generally from south to north, paralleling the Santa Cruz River. There is also generally a component of flow from the margins of the basin toward the Santa Cruz River. This pattern has been maintained over a long time period for the Tucson area.

III.B.1.c. Groundwater Quality

Existing groundwater quality conditions were identified with respect to both general mineral constituents and for specific contaminants of interest.

III.B.1.c.(1) General Minerals

The 1974 USGS Map I-844-I ("Dissolved-Solids Content of Ground Water in the Tucson Area, Arizona") was used to define these conditions. Information on TDS was also reviewed from the TMP for the Tucson AMA (Figure 7-3 of that document). That information is consistent with the USGS map. In general, groundwater along the margins of the valley has less than 500 ppm TDS. Most of the water in the central portion of the valley, associated with the Santa Cruz River and generally beneath Interstate 10, has concentration of TDS between 500 and 1,000 ppm. There are also some pockets of water with TDS in the range of 1,000 to 3,000 ppm, in areas located in portions of the San Xavier East, Tucson East, Tucson West, and CMID East sub-areas. The text which accompanies USGS Map I-844-L indicates that, in general, TDS concentrations tend to decrease with increasing depth.

The general distribution of other constituents was identified from the 1974 USGS Map I-844-L ("Map Showing Chemical Quality of Ground Water for Public Supply in the Tucson Area, Arizona") which shows the quality for the upper 300 feet of the saturated alluvium with respect to fluoride, nitrate, and hardness. This was supplemented with consideration of more recent water quality data presented in the TMP for the Tucson AMA. In general, hard water (exceeding 150 ppm) occurs beneath the Santa Cruz River, beneath Interstate 10, and in the sediments between the Santa Cruz River and the Santa Rita Mountains.

Pockets of water with high nitrate (over 45 ppm) and fluoride (over 1.4 ppm) also occur beneath the Santa Cruz River. These pockets are located from approximately Green Valley in the south to the Cortaro-Marana area to the north. Also, the TMP for the Tucson AMA shows some water with fluoride exceeding four ppm in the vicinity of Interstate 10 east of the Santa Cruz River.

III.B.1.c.(2) Other Constituents

Other water quality constituents were considered with reference to information presented in the Tucson AMA TMP. Information in that document included discussion for metals, volatile organic compounds, petroleum hydrocarbons, and pesticides. Maps are also included showing the locations and results of test analyses for metals and volatile organic compounds. The TMP

also identifies several "specific contamination areas." For the Tucson area, the sites shown in the Management Plan are located in the Tucson East, Tucson West, CMID East, and San Xavier East sub-areas.

III.B.1.d. Subsidence

Subsidence has occurred historically in the Tucson area. The TMP for the Tucson area indicated that about one-half foot of land subsidence had occurred south of Davis-Monthan Air Force Base by 1980, and that between 1980 and 1995, from 0.02 to 0.18 feet of compaction subsidence had occurred at sites monitored by Tucson Water.

The USGS prepared estimates of potential future subsidence in the Tucson area as part of its groundwater modeling studies. Maximum potential subsidence was estimated as follows in that study:

- **Tucson Central Well Field.** The maximum potential subsidence was estimated to range from about 1.2 to 12 feet, depending on the assumptions used with regard to aquifer compressibility. These estimates are based on water levels declining more than 400 feet below 1940 levels. This subsidence would occur on lands within the Tucson East and Tucson West sub-areas.

- **Tucson Santa Cruz Well Field.** The maximum potential subsidence was estimated to be as much as four feet in this area and could impact lands in the San Xavier East, Vail, Green Valley Central, and Green Valley East sub-areas.

The USGS modeling study indicated that the upper aquifer unit may be more susceptible to subsidence than the lower aquifer unit.

III.B.2. Details of Analysis Methodology

The sub-areas were defined so that the hydrologic inventory could reflect the historical pattern of flow in the Tucson area. The locations of the sub-areas were shown earlier on Figure I-4. In general, sub-areas were defined along the Santa Cruz River, with other sub-areas to the immediate east or west. This allows the analysis of the Tucson area to reflect both the overall north-south groundwater flow beneath the Santa Cruz River and the flow toward the river from the adjacent mountains. Also, it is noted that much of the historical water use and groundwater pumping were developed near the Santa Cruz River. Divisions between sub-areas from north to south were generally made to allow impacts to be identified for specific entities of interest for this study.

The analysis for the Tucson area is "linked" to the analysis for the Avra Valley. This link is between the CMID East sub-area of the Tucson area and the CMID Central sub-area of the Avra Valley.

Several assumptions specific to the Tucson area were made while performing the analysis. These assumptions include the following:

- Use of CAP water for M&I purposes in the Tucson area would be phased in during the first five years of the analysis.

- CAP M&I allocations will be used to perform "put and take" recharge at direct recharge facilities as a first priority, and additional direct use is assumed as needed to utilize the allocations. Recharge would be performed at presently proposed sites in both the Tucson area and Avra Valley, and recovery would be performed at existing well fields and at City of Tucson wells in the south Avra Valley.

III.B.3. Evaluation of Historical Conditions and "Calibration"

The hydrologic inventory analysis was used to evaluate groundwater conditions from about 1941 to 1999. Aquifer parameters for the sub-areas were developed from model parameters presented in USGS WRI 93-4196. Specific yields were estimated based on review of Figure 15 of that report, while transmissivities were estimated based on review of Figure 12 of that report, which presents an overall transmissivity under pre-development conditions (i.e., before impacts of dewatering).

Estimates were prepared for the components of the historical hydrologic inventory. These components include:

- Recharge
  - Mountain front recharge
  - Groundwater inflows from margins of the analysis area
  - Streamflow infiltration
  - Incidental recharge

- Discharge
  - Phreatophyte evapotranspiration
  - Groundwater outflows from margins of the analysis area
  - Groundwater pumping

Table 4 of the USGS modeling study was used to estimate these components for the 1941 to 1986 period covered by the USGS study. For later years, the components were estimated through review of other published sources, including records of the AMA and data presented in the management plans for the Tucson AMA.

Groundwater level hydrographs were prepared to compare groundwater levels estimated using the hydrologic inventory to observed groundwater levels and groundwater levels estimated using the USGS numerical groundwater model. The hydrologic inventory is able to reflect the large scale trends in groundwater levels which have historically occurred.

Evaluation of the estimated historical groundwater levels also included a comparison of the flow pattern indicated by the results of the hydrologic inventory analysis to the observed flow pattern. The hydrologic inventory analysis showed essentially the same pattern of flow, with

flow from the margins of the basin towards the Santa Cruz River, and flow beneath the Santa Cruz River from south to north.

III.B.4. Analysis of Alternatives

The hydrologic inventory analysis was used to estimate the groundwater impacts for each alternative, where the impacts are defined as the difference between the groundwater levels projected for a given alternative and the groundwater levels projected for the No Action Alternative. The analysis for each alternative reflects estimated future demands, an assessment of the water supplies used to meet those demands, and consideration of recharge (both artificial and incidental).

The No Action Alternative serves as the basis of comparison to determine impacts for the other alternatives, and, therefore, focuses to some extent on absolute groundwater levels, while discussion of the Settlement and Non-Settlement Alternatives focuses on impacts (differences from the No Action Alternative).

III.B.4.a. No Action Alternative

Changes in groundwater levels, groundwater quality, and subsidence are discussed in the sub-sections which follow.

III.B.4.a.(1). Groundwater Levels

Projected hydrographs of average annual groundwater levels for the No Action Alternative for each sub-area in the Tucson area are shown on Figures I-5 through I-18. Projected levels for the other alternatives are also shown on those same figures and will be discussed later in the section that addresses the Settlement and Non-Settlement Alternatives. In addition to these hydrographs, Figure I-19 shows the change in the average groundwater elevation for each sub-area from 2001 to 2051 under the No Action Alternative.

As shown on Figure I-19, changes in groundwater levels under the No Action Alternative during the 2001 to 2051 period range from a decline of 111 feet to a rise of 57 feet. Most of the sub-areas experience declines in groundwater levels over the 2001 to 2051 period, reflecting continued reliance on groundwater to meet demands and increases in demands associated with increased population. In contrast, groundwater levels rise in the Tucson West and San Xavier East sub-areas by nine to 57 feet respectively.

The groundwater levels reflect the transition to full use of CAP supplies during the period 2001 to 2005. The use of CAP water includes both direct use and recharge. For sub-areas with direct use or with recharge facilities, the buildup in CAP use can be seen by the groundwater level trends shown on the hydrographs. For example, the hydrograph for the MDWID sub-area, presented on Figure I-7, shows the rate of groundwater level decline slowing during the first five years. For other locations, recovery occurs at some distance from the associated recharge, and the transition to full use of CAP water is not seen on the hydrographs in such recovery areas. An example is the Green Valley Central sub-area, where the transition to full CAP use cannot be seen clearly on the hydrograph shown on Figure I-14.

Direct recharge of CAP M&I allocations occurs at facilities in both the Tucson area and the Avra Valley area. In the Tucson area, M&I allocations are recharged in the Pima Mine Road facilities (located in the San Xavier East sub-area), the Santa Cruz Managed Recharge Project facilities (located in the Tucson West and CMID East sub-areas), and the Avra Valley Recharge Project facilities (located in the CMID East sub-area, and the CMID Central sub-area of the Avra Valley analysis). Also, a portion of the CAP water available to the San Xavier District would be directly recharged in the San Xavier East sub-area. The rise in groundwater levels from 2001 to 2051 in the San Xavier East and Tucson West sub-areas are, in part, a reflection of the direct recharge in those sub-areas.

The amount of CAP water recharged depends in part on the available recharge capacity. It is assumed that the full recharge capacity is available in year 2017. The increased rate of groundwater level rise in the San Xavier East sub-area in year 2017, shown on Figure I-11, is a reflection of greater recharge due to greater available recharge capacity.

Under the No Action Alternative, a groundwater mound would develop beneath the San Xavier East sub-area in response to direct recharge of both M&I and Indian CAP allocations. The mound would result in a flow reversal between the San Xavier East and Vail sub-areas by year 2051 (i.e., there would be flow from the San Xavier East sub-area to the Vail sub-area).

III.B.4.a.(2). Groundwater Quality

The regional pattern of flow for the No Action Alternative would generally be similar to existing conditions, with flow from the margins of the basin toward the Santa Cruz River, and beneath the Santa Cruz River from south to north. The exception is the flow reversal which would occur between the San Xavier East and Vail sub-areas. That flow reversal could result in the movement of poorer quality water beneath the Santa Cruz River toward the Vail area to the east. However, the CAP water being used for recharge would have a lower TDS concentration than the poorer quality water in the San Xavier East sub-area and would tend to provide for an offsetting improvement in groundwater quality. Therefore, substantial changes in groundwater quality would not be anticipated under the No Action Alternative for these flow conditions.

Groundwater depressions did not develop for any of the Tucson sub-areas for the No Action Alternative. This flow pattern would tend to help maintain the existing regional salt balance.

Bodies of poor quality water at depth were not identified in the Tucson area. Therefore, there would not be anticipated potential water quality impacts due to lowering of groundwater levels into such bodies of groundwater.

III.B.4.a.(3). Subsidence

There is the potential for subsidence in the Tucson area, as groundwater levels decline in most sub-areas by year 2051. Based on consideration of the geological conditions and documented subsidence in the Tucson area, it is reasonable to anticipate potential subsidence in areas that experience a drop in groundwater levels from present conditions. Increases in groundwater levels in the Tucson West and San Xavier East sub-areas would tend to prevent subsidence in these sub-areas.

I.B.4.b. Impacts of the Settlement and Non-Settlement Alternatives

Changes in groundwater levels, groundwater quality, and subsidence relative to the No Action Alternative are discussed in the sub-sections which follow.

III.B.4.b.(1) Groundwater Levels

Projected average annual groundwater level hydrographs under the Settlement and Non-Settlement Alternatives for each sub-area were shown previously on Figures I-5 through I-18, which show how groundwater levels within a sub-area vary over the 50-year period. Projected levels for the No Action Alternatives are also shown on those same figures. The geographic distribution of the groundwater level impacts between sub-areas in year 2051 (i.e., difference in groundwater levels from the No Action Alternative) is shown for the various alternatives on Figure I-20 (Settlement Alternative), Figure I-21 (Alternative 1), Figure I-22 (Alternative 2), Figure I-23 (Alternative 3A), and Figure I-24 (Alternative 3B).

The Settlement Alternative and all of the Non-Settlement Alternatives would have the same reversal in flow in year 2051 between the San Xavier East and Vail sub-areas as occurs under the No Action Alternative. Also, all of these alternatives would have a reversal in flow between the San Xavier East and Green Valley Central sub-areas, so that a groundwater level depression would develop beneath the Green Valley Central sub-area.

While all of the sub-areas show some impacts under the alternatives, those impacts are often less than 25 feet. Such impacts are not considered to be very significant, given the nature of the analysis performed, the 50-year analysis period, and the assumptions made with regard to water supply and demands. Therefore, the discussion in the following sub-sections focuses on the sub-areas that experience impacts of more than 25 feet under at least one of the alternatives.

III.B.4.b.(1).(i) San Xavier Sub-area

The largest groundwater level impacts occur in the San Xavier East sub-area. The San Xavier District of the Tohono O'odham Nation receives CAP water under all alternatives except Alternative 1. The CAP water is used to meet irrigation demands and for direct recharge. As shown on Figure I-25, there is a positive impact of 73 to 83 feet due to the CAP allocations under those alternatives.

The relatively small differences in impacts for the Settlement Alternative and Non-Settlement Alternatives 2, 3A, and 3B reflect in part differences in groundwater underflows from adjacent areas. As shown on Figure I-25, slightly larger positive impacts occur under the Settlement Alternative and Non-Settlement Alternative 3B, when there are relatively large impacts in the Tucson West sub-area to the north.

Another small difference between the alternatives is the assumed schedule of build-out for irrigated lands in the San Xavier District. The impact of those differences on groundwater levels can be seen on the hydrograph for the San Xavier East sub-area (Figure I-11) as divergences in groundwater levels between alternatives.

III.B.4.b.(1).(ii) CMID East, MDWID, Tucson East, and Tucson West Sub-areas

The patterns of groundwater level impacts in these sub-areas are similar to each other. These patterns reflect the expected "typical" pattern for municipal entities, which dominate these sub-areas. Specifically, entities in these sub-areas receive allocations of additional CAP water under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B, and as shown on Figure I-26, groundwater levels range from 26 to 42 feet higher than the No Action Alternative. In comparison, under Non-Settlement Alternatives 2 and 3A (in which M&I entities do not receive additional allocations of CAP water), the impacts range from a drop of one foot to a rise of 11 feet relative to the No Action Alternative.

The relatively small differences in impacts for the Settlement Alternative and Non-Settlement Alternatives 1 and 3B reflect in part differences in groundwater underflows from adjacent areas. As shown on Figure I-26, groundwater level impacts under the Settlement Alternative and Non-Settlement Alternative 3B are slightly larger than under Non-Settlement Alternative 1, which appears to relate to the larger positive groundwater level impacts in the San Xavier East sub-area.

III.B.4.b.(1).(iii) Green Valley Central Sub-area

Impacts in the Green Valley Central sub-area appear to primarily reflect the influence of changes in groundwater underflow between the Green Valley Central and San Xavier East sub-areas. While the Community Water Company of Green Valley (CWCGV) does receive an allocation of CAP water under some alternatives, that water is used for direct recharge in other locations. Therefore, groundwater pumping is the same for all alternatives, and groundwater levels in CWCGV do not reflect differences in the CAP allocations. As shown on Figure I-25, the magnitude of the groundwater level impacts for each alternative reflects the magnitude of the impact in the San Xavier East sub-area.

III.B.4.b.(2). Water Quality

Groundwater levels in year 2051 throughout the Tucson area are generally higher for the Settlement and Non-Settlement Alternatives than under the No Action Alternative. The only exceptions are one-foot negative impacts (groundwater levels lower than the No Action Alternative) under Non-Settlement Alternatives 2 and 3A in the CMID East sub-area. The generally higher groundwater levels relative to the No Action Alternative and the lack of identified bodies of poor quality water at depth would prevent adverse quality impacts due to lowering levels into deeper bodies of poor quality water.

All of the action alternatives would have a similar flow reversal between the San Xavier East and Vail sub-areas as occurs under the No Action Alternative. Similar to the No Action Alternative, the potential for movement of higher TDS water from beneath the Santa Cruz River to the east could be offset by improvements in TDS concentrations resulting from recharge of CAP water. The development of a groundwater level depression in the Green Valley Central sub-area could result in an adverse salt balance for that sub-area.

There is some potential for improvement of groundwater quality in the vicinity of the direct recharge facilities. The TDS concentration of the CAP water (500 to 750 ppm) is less than the TDS concentration of some groundwater along the Santa Cruz River. Therefore, direct recharge in the San Xavier East, Tucson West, and CMID sub-areas could result in some improvements in groundwater quality in those locations.

III.B.4.b.(3). Subsidence

The Settlement Alternative and all Non-Settlement Alternatives result in positive estimated groundwater level impacts (groundwater levels higher than under the No Action Alternative) for almost all sub-areas. The only exceptions are some very small (one-foot) negative impacts in the CMID East sub-area for Non-Settlement Alternatives 2 and 3A. This indicates that most alternatives would have a positive impact with respect to subsidence in all sub-areas.

In most sub-areas, the positive impact reflects that there is a reduced potential for subsidence. In the Tucson West and San Xavier East sub-areas, the estimated groundwater levels would rise above current levels for the Settlement Alternative and all Non-Settlement Alternatives, so that subsidence would not be anticipated in these areas.

III.C. Groundwater Level Analysis for the Avra Valley Area

A hydrologic inventory analysis was performed for groundwater in the alluvium and basin fill materials in the Avra Valley area. The study area considered for the Avra Valley and the sub-areas used in the analysis are shown on Figure I-27. It is located between the Tucson and Tortolita Mountains to the east and the Silverbell and Roskruge Mountains to the west.

Drainage in the study area is provided by the Santa Cruz River (which enters in the Cortaro-Marana sub-area and exits from the Red Rock sub-area) and its tributaries Brawley, Blanco, and Los Robles Washes. Flow in the Santa Cruz River is strongly influenced by effluent releases to the river in this area.

Development in Avra Valley has primarily been for irrigated agriculture with some limited urbanization and associated M&I use, probably primarily in the Cortaro area along the Santa Cruz River. Much of the land in Avra Valley is also within the Tucson service area, and some urbanization is anticipated in the future.

The AVRA Water Cooperative (Avra Coop) (located in the Avra Coop sub-area) and the Schuk Toak District of the Tohono O'odham Nation (with lands included primarily in the South Avra Valley sub-areas) could receive proposed allocations of CAP water under the alternatives. Lands in Avra Valley in the Tucson service area may receive CAP water as they urbanize. Also, lands in CMID, Kai Farms, and BKW farms would receive CAP water for in-lieu recharge. CAP water would also be used for direct recharge in the Avra Valley Recharge Project located in the West CMID and Central CMID sub-areas, and the Central Avra Valley Storage and Recovery Project (CAVSARP) located in the Avra Coop sub-area. CAP water will also be used for direct recharge in several facilities in the Avra Valley.

III.C.1. Existing Groundwater Conditions

The existing groundwater conditions were described in the USGW WRI 90-4178, "Simulation of Ground-Water Flow and Potential Land Subsidence, Avra Valley, Arizona." The following discussion is primarily based on information presented in that report.

III.C.1.a. Geology

The groundwater resources of interest are contained in the alluvium and basin fill between the adjacent mountains. These deposits consist of gravel, sand, silt and clay. In general, the sediments are coarser along the edges of the Avra Valley and finer grained toward the central axis of the valley. There are also evaporitic deposits in the central portions of the valley.

The USGS (WRI 90-4178) split the basin fill materials into an upper and lower unit. In the context of the geology described elsewhere (see the section on the Pinal/Salt River Valley), the upper unit for Avra Valley appears to be analogous to the "upper alluvial unit," while the lower unit for Avra Valley appears to be analogous to a combination of the "Lower Conglomerate Unit" and the "Middle Fine-Grained Unit."

The upper alluvium in Avra Valley consists of gravel, sand and clayey silt and ranges in thickness from 100 to 1,000 feet. The USGS study indicates that the upper alluvium may have greater potential for subsidence due to lower groundwater levels than the lower alluvium.

The lower alluvium in Avra Valley consists of gravel and conglomerate at basin margins and in the southern part of the basin. Evaporites, clayey silt, and mudstone occur in the north-central part of the basin. The lower alluvium can be thousands of feet thick in the central portions of the valley.

III.C.1.b. Groundwater Occurrence and Movement

Groundwater in the upper 1,000 feet of the underlying sediments generally occurs under unconfined conditions. Under pre-development conditions, groundwater flow was generally from south to north through the Avra Valley. There was groundwater inflow at the south end of Avra Valley from the Altar Valley and from the Tucson area between the Tucson Mountains and the Tortolita Mountains. In the northern part of the Valley, there was also some flow southwesterly toward the Santa Cruz River. Groundwater flow then generally paralleled the Santa Cruz River, exiting the Avra Valley as underflow to the Eloy area between Picacho Peak and Silverbell Mountains. The 1995 water level elevations (presented on Figure 2-7 of the TMP for the Tucson AMA) show a similar pattern of flow under current conditions.

III.C.1.c. Groundwater Quality

Existing groundwater quality conditions were identified with respect to both general mineral constituents and for specific contaminants of interest.

III.C.1.c.(1). General Minerals

The TDS are considered as the general indicator of groundwater quality. The 1974 USGS Map I-844-I ("Dissolved-Solids Content of Ground Water in the Tucson Area, Arizona") was used to define these conditions. Information on TDS from the TMP for the Tucson AMA (Figure 7-3 of that document) was also reviewed, and that information is consistent with the USGS map. In general, groundwater in the Avra Valley area has less than 500 ppm TDS. There are some areas beneath the Santa Cruz River (corresponding to the CMID Central, Red Rock, and the southeastern portion of the CMID West sub-areas) which have a higher TDS concentration in the range of 500 to 1,000 ppm, as do some areas in the Picacho and Tortolita sub-areas.

The general distribution of other constituents was identified from the 1974 USGS Map I-844-L ("Map Showing Chemical Quality of Ground Water for Public Supply in the Tucson Area, Arizona") which shows the quality for the upper 300 feet of the saturated alluvium with respect to fluoride, nitrate, and hardness. This was supplemented with consideration of more recent water quality data presented in the TMP for the Tucson AMA. In general, hard water (exceeding 150 ppm) occurs in the Avra Valley west of Brawley Wash, along the southern end of the Avra Valley lying north of the Sierrita Mountains, and beneath the Santa Cruz River.

A body of high nitrate water (over 45 ppm) occurs beneath much of the Santa Cruz River in the Avra Valley. There is also a pocket of water with high fluoride concentrations (over 1.4 ppm) in the sediments northwesterly of the Tucson Mountains.

III.C.1.c.(2). Other Constituents

Other water quality constituents were considered with reference to information presented in the Tucson AMA TMP. The Tucson TMP includes discussion for metals, volatile organic compounds, petroleum hydrocarbons, and pesticides. Maps are also included in the TMP showing the locations and results of test analyses for metals and volatile organic compounds. These maps indicate very limited data available for the Avra Valley.

The TMP also identifies several "specific contamination areas." One of the sites is located in the Avra Valley (the "ESCO" site).

III.C.1.d. Subsidence

Subsidence has occurred historically in the Avra Valley. The Tucson AMA TMP indicated that subsidence of at least 1.1 feet has occurred in the northern Avra Valley and that an earth fissure developed in 1988 which damaged the CAP Aqueduct.

The USGS prepared estimates of potential future subsidence in the Avra Valley as part of its groundwater modeling studies. The maximum potential subsidence was estimated to range from about 0.9 to 14.7 feet, depending on the assumptions used with regard to aquifer compressibility. Lands with projected subsidence based on the USGS study were located in the Cortaro-Marana Central sub-area, Cortaro-Marana West sub-area, Red Rock sub-area, and the Avra Valley North sub-area.

Based on consideration of the geologic conditions throughout the Avra Valley and the documentation of historical subsidence, it is reasonable to anticipate that subsidence could occur in any of the Avra Valley sub-areas if the groundwater levels decline in that sub-area.

III.C.2. Details of Analysis Methodology

Eight sub-areas were defined for the Avra Valley area, located as shown on Figure I-27. The sub-areas were selected to reflect the general south to north flow in Avra Valley, and flow parallel to the Santa Cruz River. The analysis for Avra Valley is "linked" to the analysis for the Tucson area. This link is between the CMID East sub-area of the Tucson area and the CMID Central sub-area of the Avra Valley.

Several assumptions specific to the Avra Valley were made to perform the analysis. These assumptions include:

- Use of CAP water for M&I uses in the Avra Valley would be phased in during the first five years of the analysis.

- CAP M&I allocations will be used to perform "put and take" recharge at direct recharge facilities as a first priority, and additional direct use is assumed as needed to utilize the allocations. Recharge would be performed at presently proposed sites in both the Tucson area and Avra Valley, and recovery would be performed at existing well fields and at City of Tucson wells in the south Avra Valley.

III.C.3. Evaluation of Historical Conditions and "Calibration"

The hydrologic inventory analysis was used to evaluate groundwater conditions from about 1941 to 1999. Aquifer parameters for the sub-areas were developed from model parameters presented in the USGS WRI 90-4178. Specific yields were estimated based on review of Figure 13 of that report, while transmissivities were estimated based on review of Figures 8 (transmissivity in layer 2 of the USGS model) and 9 (pre-development transmissivity in layer 1 of the USGS model). The sum of these transmissivities was used in the hydrologic inventory analysis.

Estimates were prepared for the components of the historical hydrologic inventory. These components include:

- Recharge
  - Groundwater inflows from margins of the analysis area
  - Streamflow infiltration
  - Incidental recharge

- Discharge
  - Groundwater outflows from margins of the analysis area
  - Groundwater pumping

Information from the USGS modeling study was used to estimate these components for the 1940 to 1985 period covered by the USGS study. For later years, the components were estimated through review of other published sources, including records of the AMA and data presented in the management plans for the Tucson AMA.

Groundwater level hydrographs were prepared to compare groundwater levels estimated using the hydrologic inventory to observed groundwater levels and groundwater levels estimated using the USGS numerical groundwater model. The hydrologic inventory is able to reflect the large-scale trends in groundwater levels that have historically occurred.

Evaluation of the estimated historical groundwater levels also included a comparison of the flow pattern indicated by the results of the hydrologic inventory analysis to the observed flow pattern. The hydrologic inventory analysis showed essentially the same pattern of flow, with flow from south to north in Avra Valley toward the Santa Cruz River, and flow beneath the Santa Cruz River from the southeast to the northwest.

III.C.4. Analysis of Alternatives

The hydrologic inventory analysis was used to estimate the groundwater impacts for each alternative, where the impacts are defined as the difference between the groundwater conditions projected for a given alternative and the groundwater conditions projected for the No Action Alternative. The analysis for each alternative reflects estimated future demands, an assessment of the water supplies used to meet those demands, and consideration of recharge (both artificial and incidental).

The No Action Alternative serves as the basis of comparison to determine impacts for the other alternatives. The discussion of the No Action Alternative therefore focuses, to some extent, on absolute groundwater levels, while discussion of the Settlement and Non-Settlement Alternatives focuses on impacts (differences from the No Action Alternative).

III.C.4.a. No Action Alternative

Changes in groundwater levels, groundwater quality, and subsidence relative to the No Action Alternative are discussed in the sub-sections that follow.

III.C.4.a.(1). Groundwater Levels

Projected hydrographs of average annual groundwater levels for the No Action Alternative for each sub-area are shown on Figures I-28 through I-35. Projected levels for the other alternatives are also shown on those same figures and will be discussed later in the sections that address each of those alternatives. In addition to these hydrographs, Figure I-36 shows the change in the average groundwater elevations for each sub-area from 2001 to 2051 under the No Action Alternative.

As shown on Figure I-36, changes in groundwater levels during the 2001 to 2051 period in Avra Valley vary widely. The largest changes in groundwater levels occur in the southerly portion of the Avra Valley, with groundwater levels more than 300 feet higher than under the No Action

Alternative in the Avra Coop sub-area, and levels more than 150 deeper in the South Avra Valley sub-area.

Groundwater levels generally rise in the sub-areas which have direct recharge facilities (the Avra Coop, CMID Central, and CMID West sub-areas) or which receive CAP water for in-lieu recharge (the CMID West and North Avra Valley sub-areas). The groundwater levels reflect the amounts of recharge water available over time. In the Avra Coop sub-area, the rate of groundwater level rise increases after 2017, reflecting the assumption that the full recharge capacity would be phased in at that time.

The relatively large decline in groundwater levels in the South Avra Valley sub-area reflects the assumption in the analysis that the City of Tucson would utilize a well field in the South Avra Valley sub-area to help meet demands in the Tucson metropolitan area beginning in year 2017. The pumping is assumed to be equal to the direct recharge in the Avra Coop sub-area, less a five-percent "cut" to the aquifer.

Directions of groundwater flow in the Avra Valley in year 2051 estimated using the hydrologic inventory would be similar to current flow directions, except that the flow between the Avra Coop sub-area and the South Avra Valley sub-area would reverse. This flow reversal would result in the development of a groundwater level depression within the South Avra Valley sub-area.

III.C.4.a.(2). Water Quality

The general pattern of flow for the No Action Alternative would be similar to the existing flow pattern, with the exception of the flow reversal between the Avra Coop and South Avra Valley sub-areas. Changes in groundwater quality due to changes in the flow pattern would not be anticipated. While a groundwater level depression would form in the South Avra Valley sub-area, much of the groundwater pumped would be used outside of the sub-area, so that the development of an adverse salt balance would not be expected.

Bodies of poor quality water at depth were not identified in the Avra Valley. Therefore, potential groundwater quality impacts due to lowering of levels into a deeper zone of poor quality water are not anticipated.

The TDS concentration of CAP water being directly recharged is generally similar to the TDS concentration in the underlying groundwater. Therefore, substantial changes in groundwater quality due to direct recharge are not anticipated.

III.C.4.a.(3). Subsidence

Under the No Action Alternative, over the 2001 to 2051 period, groundwater levels were estimated to decline by a relatively small amount in the Picacho and Tortolita sub-areas (eight and 34 feet respectively), and substantially in the South Avra Valley sub-area (more than 150 feet). There would be the potential for subsidence in these sub-areas, and particularly in the South Avra Valley sub-area.

III.C.4.b. Impacts of the Settlement and Non-Settlement Alternatives

Changes in groundwater levels, groundwater quality, and subsidence relative to the No Action Alternative are discussed in the sub-sections which follow.

III.C.4.b.(1). Groundwater Levels

Projected hydrographs of average annual groundwater levels under the Settlement and Non-Settlement Alternatives for each sub-area were shown previously on Figures I-28 through I-35. Projected levels for the No Action Alternative are also shown on those same figures. In addition, the groundwater level impacts in year 2051 (i.e., difference in groundwater levels from the No Action groundwater levels) are shown in Figure I-37 (Settlement Alternative), Figure I-38 (Alternative 1), Figure I-39 (Alternative 2), Figure I-40 (Alternative 3A), and Figure I-41 (Alternative 3B).

Groundwater level impacts show up on the hydrographs as small divergences from the No Action Alternative groundwater levels. Impacts for all alternatives in all sub-areas are very small. In year 2051, the largest impact is a decrease in groundwater levels of 14 feet in the North Avra Valley sub-area under the Settlement Alternative and Non-Settlement Alternative 3B. Directions of groundwater flow in Avra Valley for the Settlement Alternative and all of the Non-Settlement Alternatives would remain the same as for the No Action Alternative.

While the impacts are very small in Avra Valley, an evaluation was made of those impacts for the Avra Coop sub-area (which contains Avra Coop) and the South Avra Valley sub-area (which contains the Schuk Toak District of the Tohono O'odham Nation). Impacts in the North Avra Valley sub-area were also considered, reflecting that this sub-area has the largest impacts, and is adjacent to the Avra Coop sub-area.

Figure I-42 presents a graphical comparison of groundwater level impacts in year 2051 for the North Avra Valley and Avra Coop sub-areas for the Settlement and Non-Settlement Alternatives. The Avra Coop receives CAP water in the Settlement Alternative and Non-Settlement Alternative 3B. However, the impact associated with this CAP water is masked by changes in groundwater underflow from the adjacent North Avra Valley sub-area and changes in direct recharge of M&I water in the Avra Coop sub-area.

The Schuk Toak District receives additional CAP water relative to the No Action Alternative under the Settlement Alternative, and Alternatives 2, 3A, and 3B. This CAP water results in higher groundwater levels for those alternatives than under the No Action Alternative, as shown on Figure I-43. Under Non-Settlement Alternative 1, in which the Schuk Toak District does not receive additional CAP water, the resulting groundwater level would be the same as for the No Action Alternative.

III.C.4.b.(2). Groundwater Quality

None of the alternatives result in substantial changes in gradients or the flow pattern relative to the No Action Alternative. Therefore, similar to the No Action Alternative, substantial changes in groundwater quality are not anticipated for any of these alternatives.

III.C.4.b.(3). Subsidence

Groundwater level changes under the Settlement Alternative and all Non-Settlement Alternatives would be similar to the No Action Alternative, so that the anticipated subsidence would also be similar. Specifically, there would be the potential for subsidence in the Picacho, Tortolita, and South Avra Valley sub-areas, and the potential subsidence in the South Avra Valley sub-area would be the most substantial.

III.D. Groundwater Level Analysis for the Pinal/Salt River Valley Area

A hydrologic inventory analysis was performed for groundwater in the basin fill materials in the Pinal and Salt River Valley areas. The study area considered for the Pinal/Salt River Valley areas and the sub-areas used in the analysis are shown on Figure I-44.

Major drainage features within the study area are the Gila, Salt, Agua Fria and Santa Cruz Rivers. Each of these rivers carries periodic flood flows and spills, and the Gila and Salt Rivers are perennial in some of their reaches. The Gila, Salt, and Agua Fria Rivers each have storage developed, in upstream reservoirs, which affects the flows in these rivers.

The lands considered in this study area have been extensively developed. Both the Salt River Valley and Pinal County areas had extensive historical development for irrigated agriculture, and there has been substantial urbanization of these lands, particularly in the Salt River Valley. The analysis for the Pinal and Salt River Valleys covers an extensive geographic area. In order to facilitate presentation of these results, they are discussed in the context of four general geographic areas (Pinal County, GRIC, East Salt River Valley, and West Salt River Valley). The sub-areas that comprise each of these geographic areas are shown on Figure I-45. The GRIC is centrally located between these areas, with Pinal County lands lying south of GRIC, East Salt River lands lying northeasterly of GRIC, and West Salt River lands lying northwesterly of GRIC.

III.D.1. Existing Groundwater Conditions

There are a number of studies that describe the existing and historical groundwater conditions in all or a portion of the study area. These studies, including studies prepared by the USBR, USGS, and ADWR, provided the basis for the discussion presented below.

III.D.1.a. Geology

The description of geology has been primarily based on discussion presented in the 1976 USBR study, *Geology and Groundwater Resources Report, Maricopa and Pinal Counties, Arizona*. Groundwater is contained in the basin fill materials that have been deposited between the essentially non-water-bearing igneous and metamorphic rocks of the adjacent mountain ranges. The basin fill, similar to that described for the Avra Valley and Tucson areas, can be divided into three units on the basis of lithology. These units (from the deepest to the most shallow unit) are commonly termed the "Lower Conglomerate Unit," the "Middle Fine-Grained Unit," and the "Upper Alluvial Unit."

The Lower Conglomerate Unit was only briefly described in the USBR 1976 geology report, so this discussion primarily relies on information presented for the deeper materials presented in the ADWR Modeling Report No. 6. This unit consists of conglomerate and gravel at the basin margins, and grades into finer deposits toward the center of the basins. It typically ranges in thickness from a few hundred feet at the valley margins to thousands of feet in the central portions of the basins.

The Middle Fine-Grained Unit, which overlies the Lower Conglomerate Unit, was deposited in lacustrine or playa depositional environments. This unit generally consists of fine interbedded sands and silty clay in the upper portions, silt and clay with interbedded sands and re-worked evaporites in the middle portions, and evaporites with some clay and silt in the lower sections. This unit generally occurs in the central portions of the deeper alluvial basins and is often absent toward the margins of the basins. Within the study area, the Middle Fine-Grained Unit occurs in the central portions of the East and West Salt River Valley areas and the Eloy and Maricopa sub-basins of the Pinal area. It is generally absent from the margins of these areas, and may be absent beneath portions of GRIC. This unit tends to become thicker toward the central portion of the basins.

The Upper Alluvial Unit is the uppermost unit. It overlies the Middle Fine-Grained Unit (where present) or the Lower Conglomerate Unit. It is composed of unconsolidated alluvial materials, and these deposits may tend to become finer-grained toward the centers of the valleys and in the deeper portions of this unit. This unit is more uniform in thickness along both the margins and central portions of the basins, typically being about 200 to 400 feet thick.

The alluvial fill is relatively thin adjacent to the mountains, and these bedrock "highs" define distinct but interconnected groundwater basins. This includes the East and West Salt River Valley basins in the Phoenix area, and the Maricopa-Stanfield and Eloy sub-basins in the Pinal area. These sub-basins are recognized in ADWR's reports for the Phoenix and Pinal AMAs.

III.D.1.b. Groundwater Occurrence and Movement

Groundwater occurs under confined, semiconfined, and unconfined conditions within these deposits. Where present, the Middle Fine-Grained Unit often provides confinement to the deeper Lower Conglomerate Unit and to coarser deposits within the Middle Fine-Grained Unit. Groundwater in the Upper Unit can occur under "semi-confined" conditions in which the confining beds have limited lateral extent or are "leaky" and the groundwater behavior is intermediate between the confined and unconfined conditions. Typically, groundwater elevations in different levels of a semi-confined aquifer can differ vertically under pumping stresses but tend to return to approximately the same elevation over time after the pumping is stopped.

Under pre-development conditions, groundwater flow was generally from the mountain fronts toward the major drainages and along the major drainages paralleling the stream flows. This pattern of flow has changed over time in response to the development of irrigated agriculture and urbanization, which have substantially lowered groundwater elevations in many areas. Groundwater depressions have formed in the Eloy and Maricopa-Stanfield sub-basins in the

Pinal area, north and south of the Salt River in the East Salt River Valley area, and in the area north of the Gila River and west of the Agua Fria River in the West Salt River Valley area.

III.D.1.c. Groundwater Quality

Existing groundwater quality conditions were identified with respect to both general mineral constituents and for specific contaminants of interest.

III.D.1.c.(1). General Minerals

The TDS concentration is used as the general indicator of groundwater quality. The 1974 USGS Map I-845-G ("Dissolved-Solids Content of Ground Water in the Phoenix Area, Arizona") was used to define these conditions. Information on TDS was also reviewed from the TMP for the Phoenix AMA (Figure 7-3 of that document). Information on other general minerals as evaluated using USGS Map I-845-F ("Chemical Quality of Ground Water for Public Supply in the Phoenix Area, Arizona") and information from the Phoenix AMA.

For the southern portion of the Pinal County area, information was also reviewed from USGS Map I-844-I ("Dissolved-Solids Content of Ground Water in the Tucson Area, Arizona") and USGS Map I-844-L ("Map Showing Chemical Quality of Ground Water for Public Supply in the Tucson Area, Arizona"). Those maps presented information on the TDS, hardness of groundwater, and the distribution of fluoride and nitrate for the upper 300 feet of saturated aquifer in the 1965 to 1972 period.

The following discussion of general minerals has been organized by general geographic areas. Locations of each geographical area were previously shown on Figure I-45.

III.D.1.c.(1).(i). Pinal County Area

In the Maricopa-Stanfield sub-basin of the Pinal AMA, the USGS Map I-845-G shows the concentration of TDS generally decreases from the margins of the sub-basin (where TDS concentrations are generally from 500 to 1,000 ppm) to the center of the sub-basin (where TDS concentrations are generally less than 500 ppm). There is a similar pattern of TDS concentrations in the Eloy sub-basin of the Pinal AMA, with TDS concentrations of 500 to 1,000 ppm generally at the margins of the basin, and less than 500 ppm in the central portions of the basin. There are also some pockets with higher TDS concentrations (in the range of 1,000 to 3,000 ppm), including in the vicinity of Casa Grande, Coolidge, and the Picacho Reservoir area. The map of TDS measurements in the Pinal AMA TMP are generally consistent with this pattern, although it does often show higher TDS concentrations (almost one-half of the samples shown have a TDS concentration which exceeds 1,000 ppm) and higher TDS concentrations in the central portion of the Maricopa-Stanfield sub-area.

The USGS map I-845-G does show poorer quality water occurring at depth in parts of the Eloy sub-basin of the Pinal AMA, within the HIDD/SCIDD and CAIDD sub-areas. These poorer quality water zones can have TDS concentrations in excess of 3,000 ppm.

Relatively hard groundwater (hardness exceeding 150 ppm) is present beneath the northern portions of the Eloy sub-basin and the northeasterly portions of the Maricopa-Stanfield sub-basins. There are also several areas with relatively high fluoride concentrations (over 1.4 ppm), including the western and southwestern margins of the Maricopa-Stanfield sub-basin, lands adjacent to the Sacaton Mountains, and pockets in the vicinity of Arizona City and Coolidge. No areas were shown with nitrates exceeding 45 ppm.

III.D.1.c.(1).(ii). GRIC

The concentration of TDS in groundwater beneath GRIC generally increases from east to west. In the GRIC Sacaton, GRIC South Central, and the eastern portions of the GRIC East Central sub-areas, the TDS concentration generally ranges from about 500 to 1,000 ppm. Beneath most of the rest of GRIC, the TDS concentration is generally between 1,000 and 3,000 ppm, although there is also a band of groundwater which runs through the northerly part of the GRIC North Central, GRIC Komatke, and GRIC Maricopa Village sub-areas where the TDS concentration exceeds 3,000 ppm.

The USGS Map I-845-F shows that essentially all of the groundwater underlying GRIC is relatively hard, with hardness exceeding 150 ppm. There are also relatively high fluoride concentrations (over 1.4 ppm) beneath much of GRIC, specifically adjacent to the San Tan and Sacaton Mountains, and between the Sacaton and Sierra Estrella Mountains. No areas were shown with nitrates exceeding 45 ppm.

III.D.1.c.(1).(iii). East Salt River Valley

The concentration of TDS in groundwater beneath the East Salt River Valley generally increases in the direction of groundwater flow under pre-development conditions. Relatively low concentrations (below 500 ppm) are generally present in the Scottsdale North, McDowell, Superstition, Apache Junction, and East Mesa sub-areas. Somewhat higher concentrations (500 to 1,000 ppm) are generally present under the Salt River Indian, Scottsdale South, NMIDD, Florence Junction, QCID, and Williams Airport sub-areas. Relatively high concentrations (from 1,000 to 3,000 ppm) of TDS are present beneath the remainder of the East Salt River Valley.

The USGS Map I-845-F shows that most of the groundwater underlying the East Salt River Valley is relatively hard, with hardness exceeding 150 ppm. There is some relatively soft water (hardness less than 150 ppm) in the westerly portion of the Scottsdale North sub-area, the Apache Junction sub-area, and the eastern portions of the Florence Junction and Superstition sub-areas.

There are relatively high fluoride concentrations (over 1.4 ppm) in the northern portion of the East Mesa sub-area. The TMP for Phoenix shows some areas with relatively high nitrate concentrations (greater than maximum containment level of 45 ppm).

III.D.1.c.(1).(iv). West Salt River Valley

The concentration of TDS in groundwater beneath the West Salt River Valley generally increases in the direction of groundwater flow under pre-development conditions. Relatively

low concentrations (below 500 ppm) are generally present in the northernmost areas, corresponding to the Sun City West, MWD, West Side M&I, and northern portions of the Glendale/Peoria sub-areas. Somewhat higher concentrations (500 to 1,000 ppm) are generally present in the central portions of the Glendale/Peoria, MWD, and West Side M&I sub-areas. Relatively high concentrations (from 1,000 to 3,000 ppm) of TDS are present beneath the remainder of the West Salt River Valley, with TDS concentrations exceeding 3,000 ppm in a band generally located along the Gila River below the confluence with the Agua Fria River. USGS Map I-845-G also indicates that the southern portion of the MWD and West Side M&I sub-areas may be underlain by more saline water (from 1,000 to over 3,000 ppm) at depths greater than about 500 to 700 feet. This poor quality water is associated with the Luke Salt Dome.

The USGS Map I-845-F shows that most of the groundwater underlying the West Salt River Valley is relatively hard, with hardness exceeding 150 ppm. There is some relatively soft water (hardness less than 150 ppm) in the northwestern portion of the area (corresponding to the MWD sub-area, and portions of the West Side M&I and Sun City West sub-areas).

There are relatively high fluoride concentrations (over 1.4 ppm) in several locations. Specifically, this includes a fringe along the northern and eastern margin of the North Phoenix sub-area, in the Avondale sub-area, in the southern portion of the MWD and West Side M&I sub-areas, and the East and West Buckeye sub-areas.

The USGS Map I-845-F showed much of the West Salt River Valley is underlain by groundwater with relatively high concentrations of nitrate (more than 45 ppm). This includes all or a portion of the lands in the South Phoenix, North Phoenix, Southwest Phoenix, Avondale, Glendale/Peoria, and East Buckeye sub-areas. The TMP for the Phoenix AMA also showed high nitrates being prevalent in the vicinity of the Gila River.

III.D.1.c.(2). Other Constituents

Other water quality constituents were considered with reference to information presented in the TMPs for the Phoenix and Pinal AMAs. Information in those documents included discussion for metals, volatile organic compounds, petroleum hydrocarbons, and pesticides. Maps are also included showing the locations and results of test analyses for metals, volatile organic compounds, and pesticides in the Phoenix AMA. The TMP also identifies several "specific contamination areas."

III.D.1.c.(2).(i). Pinal County Area

Only one water quality study area in Pinal County was identified in the Pinal AMA TMP. This is a chromium disposal site located about five miles northwest of Casa Grande.

III.D.1.c.(2).(ii) GRIC

No water quality study areas on GRIC were identified in either the Phoenix or Pinal AMA TMPs.

III.D.1.c.(2).(iii) East Salt River Valley

Water quality study areas identified in the Phoenix AMA TMP are mostly concentrated in the vicinity of the Salt River, in areas corresponding to the Williams Airport sub-area, West Mesa sub-area, Tempe North sub-area, and the Scottsdale South sub-area. These are the same areas that show high metals and volatile organic concentrations on the maps in the plan.

III.D.1.c.(2).(iv). West Salt River Valley

A number of the water quality study areas identified in the Phoenix AMA TMP are mostly concentrated in areas corresponding to the Phoenix South, Phoenix North, Phoenix Southwest, and the southeasterly portion of the Glendale/Peoria sub-areas. There are also some water quality study areas in the Avondale sub-area and the southerly portion of the West Side M&I sub-area. Areas with high concentrations of volatile organic compounds and pesticides generally occur in these same sub-areas. These are the same areas that show high metals and volatile organic concentrations on the maps in the plan.

III.D.1.d. Subsidence

Subsidence has occurred historically in a number of locations in both the Pinal area and the Salt River Valley. These areas, as identified in the TMPs for the Pinal and Phoenix AMAs and on a map prepared by the USGS (Map I-845-H, "Land Subsidence and Earth Fissures in Alluvial Deposits in the Phoenix Area, Arizona") include:

- **Luke Air Force Base Area.** In this location, subsidence has been as much as 17 feet and has affected an area of about 140 square miles. Earth fissures have also developed in this area in response to the subsidence. The area shown on USGS Map I-845-H generally corresponds to the MWD and West Side M&I sub-areas and relatively limited areas of the Sun City West and Glendale/Peoria sub-areas.

- **Queen Creek Area.** More than three feet of subsidence had occurred over an area of about 230 square miles in this area by 1977.

- **East Mesa Area.** This area has experienced over five feet of subsidence from 1948 to 1981. The USGS map shows that the areas of greatest subsidence in Mesa and Queen Creek are part of a larger area of subsidence. This subsidence likely includes portions of the Mesa West, Mesa East, Williams Airport, QCID, NMIDD, Chandler North, and Chandler South sub-areas.

- **Apache Junction Area.** This area has experienced over two to three feet of subsidence since the early 1970s. Earth fissures are also present in this area.

- **Central Scottsdale.** This area has subsided at least one-half foot.

- **Maricopa-Stanfield Sub-basin.** There has been substantial subsidence in the Maricopa-Stanfield sub-basin of the Pinal AMA. Subsidence of 11.8 feet was measured near Stanfield in 1977. There is also earth-fissuring present. The USGS map indicates that the

subsidence is extensive in this area, including lands in both the MSIDD North and MSIDD South sub-areas.

- **Eloy Sub-basin.** There has been subsidence of more than 15 feet by 1985 south of Eloy. There are also extensive earth fissures in this area. The USGS map indicates subsidence is extensive within the CAIDD sub-area and extends into the HIDD sub-area.

As shown by this list, there are a number of areas identified as having historical subsidence. Most of these areas correspond to areas that have experienced substantial lowering of groundwater levels and/or the development of groundwater depressions (i.e., the Luke Cone area corresponding to the MWD and the West Side M&I sub-areas, the Queen Creek area (QCID sub-area), east Mesa area (East Mesa sub-area), central Scottsdale (Scottsdale South sub-area), and the Maricopa-Stanfield sub-area (MSIDD North sub-area)). Based on the widespread occurrence of subsidence and the similarity of geologic materials throughout this area, it is assumed that all of the sub-areas in the Pinal/Salt River Valley area have geologic conditions conducive to subsidence.

III.D.2. Evaluation of Historical Conditions and "Calibration"

The hydrologic inventory analysis was used to evaluate groundwater conditions from about 1910 to 1999. Estimates of aquifer transmissivities were primarily based on Plate 2 of USGS WSP 1860, which shows transmissivities used in the analog model developed by the USGS. While the transmissivities used are not the most recent evaluation of aquifer transmissivities (estimates could be made using hydraulic conductivity values in the models more recently developed by the ADWR for the Phoenix and Pinal AMAs), they provide reasonable values for the purpose of this analysis. Also, these values can be used more directly than the hydraulic conductivity values used in the ADWR models, in that the transmissivity can be determined directly from the plate, rather than computed based on hydraulic conductivity.

Aquifer storage characteristics were represented by specific yield values. For this analysis, specific yields were estimated by visual inspection of figures in the ADWR Model Report No. 8 for the Phoenix AMA groundwater model which show specific yields by model cells.

Estimates were prepared for the components of the historical hydrologic inventory. These components include:

- Recharge
  - Mountain front recharge
  - Groundwater inflows from margins of the analysis area
  - Streamflow infiltration
  - Incidental recharge

- Discharge
  - Phreatophyte evapotranspiration
  - Groundwater outflows from margins of the analysis area
  - Groundwater pumping
  - Discharges to springs

The components of the hydrologic inventory were estimated based on review of a number of sources, including modeling studies performed by the USGS (WSP 1860), modeling studies performed by ADWR for the Salt River Valley and the Pinal area, the hydrologic survey report prepared by ADWR for conditions on GRIC, records of the Pinal and Phoenix AMAs including the published management plans.

In evaluating the portfolio of supplies historically used, consideration was given to the sources of surface water supply available in the Pinal and Salt River Valley areas, which include supplies from the Salt, Gila, and Agua Fria Rivers, as well as from the CAP.

Groundwater level hydrographs were prepared to compare groundwater levels estimated using the hydrologic inventory to observed groundwater levels. In contrast to the comparisons discussed for the Avra Valley and Tucson areas, the historical groundwater levels are estimated average levels for sub-areas estimated by evaluation of historical groundwater level maps. A sample comparison hydrograph is presented on Figure 46 for the Scottsdale South sub-area. While there is not an ideal match, the comparison does indicate that the hydrologic inventory is able to reflect the large-scale trends in groundwater levels that have historically occurred.

Evaluation of the estimated historical groundwater levels also included a comparison of the flow pattern indicated by the results of the hydrologic inventory analysis to the observed flow pattern. The hydrologic inventory analysis showed changes in the groundwater flow pattern over time that corresponded reasonably well with historical conditions. In particular, groundwater level depressions are generally predicted by the hydrologic inventory in locations and timeframes that correspond with historical conditions.

III.D.3. Analysis of Alternatives

The hydrologic inventory analysis was used to estimate the groundwater impacts for each alternative, where the impacts are defined as the difference between the groundwater levels projected for a given alternative and the groundwater levels projected for the No Action Alternative. The analysis for each alternative reflects estimated future demands and an assessment of the water supplies used to meet those demands, as well as consideration of recharge (both artificial and incidental).

The No Action Alternative serves as the basis of comparison to determine impacts for the other alternatives, and therefore, focuses to some extent on absolute groundwater levels, while discussion of the Settlement and Non-Settlement Alternatives focuses on impacts (differences from the No Action Alternative).

III.D.3.a. No Action Alternative

The analysis for the Pinal and Salt River Valleys covers an extensive geographic area. In order to facilitate presentation of these results, they are discussed in the context of four general geographic areas (Pinal County, GRIC, East Salt River Valley, and West Salt River Valley). The sub-areas that comprise each of these geographic areas were shown previously on Figure I-45.

III.D.3.a.(1). Pinal County Area

Changes in groundwater levels, groundwater quality, and subsidence under the No Action Alternative are discussed in the sub-sections that follow.

III.D.3.a.(1).(i). Groundwater Levels

The projected average annual groundwater levels for the No Action Alternative for each sub-area are shown on Figures I-47 through I-52. Projected levels for the other alternatives are also shown on those same figures and will be discussed later in the section which addresses the Settlement and Non-Settlement Alternatives.

Groundwater levels decline from 2001 to 2051 throughout the Pinal County area, as shown on Figure I-53. These estimated declines range from 27 feet in the SCID sub-area to 77 feet in the HIDD/SCIDD sub-area. The declines largely result from continued reliance on groundwater to meet irrigation demands in Pinal County. The groundwater level declines are moderated by reductions in cropped acreage and the associated decrease in water demands.

While groundwater levels are projected to decline, the depth to groundwater would remain substantially above the 1,000-foot depth "floor" established in the Pinal AMA. Therefore, groundwater use is not curtailed in the Pinal AMA due to this institutional consideration.

One of the factors affecting the groundwater levels under the No Action Alternative is the availability of water for in-lieu recharge to MSIDD, CAIDD, and HIDD from the Recharge Pool. That water is only available to these districts until the year 2017. As shown on the hydrographs for the MSIDD North, MSIDD South, CAIDD, and HIDD/SCIDD sub-areas, groundwater levels are either stable or rising through year 2017 while the in-lieu recharge water is available. After year 2017, the loss of the in-lieu recharge water and associated increase in groundwater pumping results in groundwater level declines in all of these sub-areas.

The pattern of flow in the Pinal County area for year 2051 estimated using the hydrologic inventory would be similar to current conditions. A groundwater depression would remain beneath MSIDD (under the No Action Alternative, the MSIDD North and MSIDD South sub-areas would have the same estimated groundwater elevation so that both sub-areas define the groundwater depression). The MSIDD North and HIDD/SCIDD sub-areas would continue to receive groundwater inflow from the north from the GRIC South-Central and Sacaton sub-areas.

III.D.3.a.(1).(ii). Groundwater Quality

Major changes in groundwater quality in the Pinal County area would not be expected. This reflects consideration that the flow pattern is similar to the existing flow pattern, and CAP water is not being directly recharged.

Groundwater levels would decline in the HIDD/SCIDD and CAIDD sub-areas, indicating some potential to produce water from deeper bodies of high TDS water at some locations in those sub-areas.

The discussion of existing conditions indicates that there may be an existing trend of increasing TDS, possibly related to the influence of recharge derived from irrigation return flows. While not one of the mechanisms for water quality impact, this possible trend of increasing TDS might continue in the future due to the continued impact of irrigation return flows.

III.D.3.a.(1).(iii). Subsidence

There is the potential for subsidence in the Pinal County area under the No Action Alternative, reflecting that estimated groundwater levels decline over the 2001 to 2051 period in all of the Pinal County sub-areas. Based on the magnitude of the predicted declines and the historical occurrence of subsidence, this would be of particular concern for the following areas:

> **Maricopa-Stanfield Area**. This area has experienced substantial subsidence historically, and the groundwater level in the MSIDD North sub-area is projected to experience further declines by year 2051.
>
> **Eloy Sub-basin.** Estimated groundwater levels would decline by 68 feet in the CAIDD sub-area and by 77 feet in the HIDD sub-area. These declines, in an area that has historically experienced subsidence, indicate the potential for continued subsidence in the future.

III.D.3.a.(2). GRIC

Changes in groundwater levels, groundwater quality, and subsidence under the No Action Alternative, are discussed in the sub-sections that follow.

III.D.3.a.(2).(i). Groundwater Levels

The projected average annual groundwater levels for the No Action Alternative for each sub-area are shown on Figures I-54 through I-59. Projected levels for the other alternatives are also shown on those same figures and will be discussed later in the section that addresses the Settlement and Non-Settlement Alternatives.

Groundwater levels generally decline in the GRIC sub-areas from 2001 to 2051, as shown on Figure I-53. Changes in estimated groundwater levels are very small in the western portion of GRIC, with groundwater levels unchanged in the GRIC Maricopa Village sub-area and a rise in groundwater levels of one foot in the GRIC Komatke sub-area. Larger declines occur to the

east, ranging from 12 feet in the GRIC South sub-area to 48 feet in the GRIC North sub-area. Under the No Action Alternative, additional lands would be developed for irrigated agriculture, and additional supplies would be provided to meet those demands. Based on the assumptions for this analysis, there would be a net recharge for GRIC absent consideration of groundwater underflows to adjacent areas. The declines in groundwater levels for GRIC appear to be a reflection of the groundwater level declines in the adjacent sub-areas.

The average hydrologic inventory for the GRIC area was also evaluated, prepared by combining the hydrologic inventory analyses for the various sub-areas, which comprise GRIC. This balance is shown on Table I-21, as is the corresponding average balance for the 1990 to 1999 period.

Under the No Action Alternative, there would be some changes in groundwater flow directions beneath GRIC by year 2051. Under the No Action Alternative in 2051, all the flow between GRIC and the East Salt River Valley would be from GRIC to the East Salt River Valley. Also, there would be some flow reversals, so that groundwater in 2051 would flow from the GRIC Komatke sub-area to the GRIC North and GRIC South sub-areas, and groundwater would flow from GRIC South to GRIC North.

III.D.3.a.(2).(ii). Groundwater Quality

Changes in groundwater quality on GRIC would not be expected. This reflects consideration that: (1) the flow pattern is not being greatly modified; (2) while groundwater levels are declining, there are not well defined bodies of groundwater of differing water quality which occur at depth; and (3) CAP water is not being directly recharged. It is noted that recharge of irrigation return flows might tend to add salts to groundwater, and thereby increase the TDS. While not one of the mechanisms for water quality impact, it is noted that this possible trend of increasing TDS might continue in the future due to the continued impact of irrigation return flows. However, in the case of GRIC, the continued outflow of groundwater (and associated salts) to the north and south would help to maintain the salt balance.

III.D.3.a.(2).(iii). Subsidence

There is the potential for subsidence on GRIC lands. This potential is greater in the eastern portion of GRIC, where the larger groundwater level declines from 2001 to 2051 occur.

III.D.3.a.(3). East Salt River Valley

Changes in groundwater levels, groundwater quality, and subsidence under the No Action Alternative are discussed in the sub-sections that follow.

III.D.3.a.(3).(i). Groundwater Levels

The projected average annual groundwater levels for the No Action Alternative for each sub-area are shown on Figures I-60 through I-75. Projected levels for the other alternatives are also shown on those same figures and will be discussed later in the section that addresses the Settlement and Non-Settlement Alternatives.

Changes in groundwater elevation in the East Salt River Valley vary widely, including increases and declines in groundwater levels in various locations as shown on Figure I-53.

The rise in groundwater levels in the Salt River Indian and Mesa West sub-areas largely reflect recharge in the Granite Reef Underground Storage Project(GRUSP) facilities. The magnitude of that recharge dominates other factors that may impact groundwater levels in those sub-areas. As shown on the hydrographs for those sub-areas, groundwater levels rise each year until the assumed shortage period that begins in year 2043. From year 2043 to year 2051, groundwater levels decline due to the elimination of recharge and increased pumping. The recharge in the Salt River Indian and Mesa West sub-areas also affects other sub-areas through changes in groundwater underflows. For example, the stable or rising groundwater levels shown on the hydrographs for the Scottsdale South and Mesa East sub-areas appear to reflect those groundwater flows.

The areas of the East Salt River Valley between the Salt River and GRIC (including the Tempe North, Tempe South, Chandler North, and Chandler South sub-areas) all show substantial declines in estimated groundwater levels over the 2001 to 2051 period, ranging from 123 to 154 feet. The hydrographs for these sub-areas are also similar, showing a relatively rapid decline in groundwater levels in the early years of the period, and a reduced rate of decline in later years. The declines in groundwater levels reflect continued reliance on groundwater to meet demands in these areas.

The Queen Creek sub-area shows an overall rise in groundwater levels over the 2001 to 2051 period. The hydrograph for this sub-area shows a number of inflection points, as the groundwater levels reflect the interplay of a number of factors in this particular sub-area, such as urbanization and changes in irrigated acreage due to economic considerations.

The New Magma sub-area experiences a rise in groundwater levels through year 2017. Groundwater levels are relatively stable through year 2043, reflecting continued availability of CAP water until the assumed shortage. Under the shortage conditions from 2043 to 2051, groundwater levels decline, as all the irrigation demands in those years would be met by pumping groundwater.

The Scottsdale North sub-area experiences groundwater declines over the entire 2001 to 2051 period. The total decline over the 2001 to 2051 period is about 147 feet.

There would be several changes in the flow pattern for the East Salt River Valley by year 2051. The rise in groundwater levels in the Scottsdale South and QCID sub-areas would eliminate the groundwater level depressions in these areas by 2051. A new groundwater depression would develop beneath the Tempe South sub-area. Recharge at GRUSP would result in a groundwater mound beneath the Salt River Indian sub-area, and flow would radiate out to the adjacent sub-areas in 2051. In fact, the mound is less pronounced in year 2051 due to the declines in groundwater levels in the Salt River Indian sub-area that occur during the shortage period.

III.D.3.a.(3).(ii). Groundwater Quality

There would be some changes in the groundwater flow pattern by year 2051. These changes include the development of a groundwater level depression in the Tempe South sub-area, which is located in an area with relatively high TDS concentrations. Existing groundwater level depressions in the QCID and Scottsdale South sub-areas would not be present (there would be outflow from the Scottsdale sub-area to the Tempe North sub-area, and outflow from the QCID sub-area to the Chandler South and Williams Airport sub-areas). The changes in flow directions would tend to inhibit the movement of water from areas with high TDS concentrations to areas with low TDS concentrations.

Direct recharge of CAP water at GRUSP would not be anticipated to cause changes in groundwater quality, because the TDS concentrations in CAP water is similar to the TDS concentration in the underlying groundwater.

Bodies of poor quality water at depth were not identified in this area. Therefore, there would not be anticipated potential water quality impacts due to lowering of groundwater levels into such bodies of groundwater.

III.D.3.a.(3).(iii). Subsidence

There is the potential for subsidence in the East Salt River Valley area in those sub-areas that experience declines in groundwater levels over the 2001 to 2051 period. Based on the magnitude of the predicted declines and the historical occurrence of subsidence, this would be of particular concern for the following areas:

- **Southwestern Portion of East Salt River Valley**. This area has historically experienced subsidence, and estimated groundwater level declines are projected to range from 123 to 154 feet in the Tempe North, Tempe South, Chandler North, and Chandler South sub-areas.

- **Apache Junction Area.** Groundwater levels under the No Action Alternative were estimated to drop by 72 feet in the Apache Junction sub-area from 2001 to 2051. This may result in subsidence impacts in this area, particularly as this area has historically experienced subsidence.

- **North Scottsdale Area.** While not an area with documented historical subsidence, the deposits in this area are probably similar to other areas which have historically experienced subsidence. The estimated 147-foot decline in the North Scottsdale sub-area could result in subsidence.

While most sub-areas experience declines in estimated groundwater levels, there are some sub-areas in which groundwater levels would rise. This includes areas with historical subsidence (such as the Queen Creek and Mesa East sub-areas). Based on these estimated groundwater level impacts, subsidence would not be expected in these areas.

III.D.3.a.(4). West Salt River Valley

Changes in groundwater levels, groundwater quality, and subsidence under the No Action Alternative are discussed in the sub-sections that follow.

III.D.3.a.(4).(i). Groundwater Levels

The projected average annual groundwater levels for the No Action Alternative for each sub-area are shown on Figures I-76 through I-85. Projected levels for the other alternatives are also shown on those same figures and will be discussed later in the section that addresses the Settlement and Non-Settlement Alternatives.

Changes in groundwater elevation in the West Salt River Valley include both increases and declines in groundwater levels in various locations, as shown on Figure I-53. Substantial declines are estimated for the eastern part of the West Salt River Valley (ranging from 160 to 295 feet in the Phoenix South and Phoenix North sub-areas). Large declines were also estimated in the vicinity of the existing Luke Cone groundwater level depression (ranging from 136 to 150 feet in the West Side M&I and MWD sub-areas).

The decline in groundwater levels in the Phoenix North sub-area reflects, at least in part, the assumption that population in areas of North Phoenix which are not underlain by recoverable groundwater would be supplied with groundwater pumped from the Phoenix North sub-area. It also reflects an assumption that groundwater would be pumped in preference to using other supplies available to Phoenix. This assumption may not be fully consistent with the City's present and future operations. However, because this same assumption is made for the other alternatives, the impacts of those alternatives should be correctly portrayed.

The substantial groundwater level declines from 2001 to 2051 in the West Side M&I and MWD sub-areas (corresponding to the existing Luke Cone groundwater level depression) reflect continued reliance on groundwater to meet much of the demands in these sub-areas. The hydrograph for the MWD sub-area shows a relatively rapid decline in groundwater levels until 2017. The rise in groundwater levels from 2017 to 2042 reflects the operation of future West-side direct recharge facilities. During the shortage period (after year 2042 to year 2051), groundwater levels again decline, reflecting that groundwater recharge would not occur during that period. The West-side M&I sub-area groundwater levels show similar trends.

Groundwater levels increase beneath the Salt and Gila River in the Avondale, Buckeye East, and Buckeye West sub-areas and only show a small decline (11 feet) in the Phoenix Southwest sub-area. Groundwater levels in these sub-areas are influenced by recharge in the Salt and Gila Rivers.

The groundwater level hydrograph for the Glendale/Peoria sub-area shows the influence of the direct recharge operations. The Glendale/Peoria sub-area shows a rise of more than 25 feet in groundwater levels during the early years. This rise is followed by a stabilization in groundwater levels through about year 2042, at which time groundwater levels decline in response to reduced direct recharge and increased groundwater pumping during shortage conditions.

There would be several changes from the present flow pattern by year 2051 under the No Action Alternative. This included development of groundwater level depressions in the North Phoenix and MWD sub-areas.

III.D.3.a.(4).(ii). Groundwater Quality

There are several potential changes in groundwater quality possible for the West Salt River Valley. Under the No Action Alternative, groundwater flow from south to north would continue from the poorer quality water along the Gila River (with relatively high TDS and nitrate concentrations) to areas with presently better quality water. This flow could eventually result in a decline in groundwater quality in the northerly sub-areas. This potential might be of particular significance in the Luke Cone area, where the persistence of a groundwater depression would tend to cause an adverse salt balance.

An adverse salt balance might also develop in the Phoenix North sub-area, due to the development of a groundwater level depression. However, the assumed use of a portion of the pumped water in northerly areas of Phoenix that do not have access to groundwater might tend to prevent the development of an adverse salt balance.

Direct recharge of CAP water in the Agua Fria and future West-side recharge facilities could result in groundwater quality impacts. Concentrations of TDS in the CAP water are higher than TDS concentrations in the underlying groundwater. Recharge of CAP water could, therefore, eventually result in higher TDS concentrations in the underlying groundwater.

The quality of groundwater in the Luke Cone area (corresponding to the MWD and West-side M&I sub-areas) might also decline due to the lowering of groundwater levels into the deeper body of relatively poor quality water (with TDS concentrations in the range of 1,000 to 3,000 ppm).

III.D.3.a.(4).(iii). Subsidence

There is the potential for subsidence at some locations in the West Salt River Valley under the No Action Alternative. This potential would be of particular concern for the following areas which have relatively large groundwater level declines and which have historically experienced subsidence:

- **Phoenix Area**. While not identified as an area of substantial historical subsidence, the relatively substantial drop in groundwater levels projected for the North Phoenix sub-area (295 feet) and the South Phoenix sub-area (160 feet) would have the potential to result in subsidence in this area. As noted earlier in the section discussing groundwater level impacts, these groundwater level declines result in part from assumptions on the City of Phoenix use and distribution of non-CAP surface water.

- **Luke Cone Area**. This area has experienced historical subsidence, and the substantial drop of estimated groundwater levels (from 132 to 149 feet for the West-side M&I and MWD sub-areas) could result in continued subsidence.

III.D.3.b. Impacts of the Settlement and Non-Settlement Alternative

The analysis for the Pinal and Salt River Valleys covers an extensive geographic area. In order to facilitate presentation of these results, they are discussed in the context of four general geographic areas (Pinal County, GRIC, East Salt River Valley, and West Salt River Valley). The sub-areas that comprise each of these geographic areas were shown previously on Figure I-45.

III.D.3.b.(1). Pinal County Area

Changes in groundwater levels, groundwater quality, and subsidence under the Settlement and Non-Settlement Alternatives are discussed in the sub-sections that follow.

III.D.3.b.(1).(i). Groundwater Levels

Projected average annual groundwater level hydrographs under the Settlement and Non-Settlement Alternatives were shown previously on Figure I-47 through I-52. The hydrographs show how groundwater levels within a sub-area vary over the 50-year period. Projected levels for the No Action Alternative are also shown on those same figures. The geographical distribution of the groundwater level impacts between sub-areas in year 2051 (i.e., difference in groundwater levels from the No Action Alternative) are shown for the alternatives on Figure I-86 (Settlement Alternative), Figure I-87 (Alternative 1), Figure I-88 (Alternative 2), Figure I-89 (Alternative 3A), and Figure I-90 (Alternative 3B).

Groundwater level impacts in Pinal County for all of the alternatives are relatively small, with the greatest impact under any alternative being a rise of 29 feet in the HIDD/SCIDD sub-area under the Settlement Alternative. A comparison of groundwater level impacts in year 2051 for all sub-areas and all alternatives is presented in Figure I-91.

The groundwater level impacts in the Pinal area reflect those factors that influence the availability of CAP water to agricultural entities. Because water for in-lieu recharge is only available to entities in Pinal County through the year 2017, variations in the availability of recharge water between alternatives has a more limited influence than for entities in other areas that continue to receive in-lieu recharge water. The hydrographs for the MSIDD North, MSIDD South, CAIDD, and HIDD/SCIDD sub-areas (i.e., sub-areas which include entities that receive in-lieu recharge water) for all alternatives show an inflection in year 2017 for all alternatives, with declining groundwater levels after year 2017.

Because the magnitudes of the groundwater level impacts are relatively small, changes in groundwater underflow can exert a significant influence on the relative impacts for a given sub-area between the various alternatives. The discussion that follows focuses on the larger groundwater level impacts.

The groundwater level impacts between alternatives generally tend to follow the trends in the availability of CAP water from the Ag Pool and under NIA allocations, as shown on Figure I-91. The largest positive groundwater level impacts for the MSIDD North, MSIDD South, and CAIDD sub-areas are for Alternative 3A (in which NIA entities receive allocations), while the largest negative groundwater level impacts occur under Alternative 3B, in which there is the

smallest availability of water for NIA. While the Settlement Alternative has the greatest total volume of CAP water available to agricultural users from the Ag Pool and Ag allocations, MSIDD and CAIDD receive a smaller proportion of the available water than under the Non-Settlement Alternatives, so that Alternative 3A provides more CAP water for these particular districts. Impacts for the other alternatives tend to be very small, and can be highly influenced by changes in groundwater flow from adjacent areas.

Changes in the availability of CAP water to SCIDD reflect factors that are unique to SCIDD. This results in a pattern of groundwater level impacts in the SCIDD and HIDD/SCIDD sub-areas (which contain a substantial proportion of the irrigated acres in SCIDD) which are distinct from those observed in other Pinal sub-areas. These same patterns also appear in the groundwater level impacts for the Casa Grande area, which also contains some lands in SCIDD. SCIDD only gets water from the Ag Pool under the Settlement Alternative. This provides an additional increment of surface water to SCIDD under the Settlement Alternative, which in turn tends to improve the groundwater levels in the SCIDD, HIDD/SCIDD, and Casa Grande sub-areas for this alternative. For example, the Settlement Alternative is the only alternative in which the year 2051 groundwater levels in the SCIDD and HIDD/SCIDD sub-areas are higher than under the No Action Alternative.

The pattern of groundwater flow in the Pinal County area in year 2051 was evaluated for each alternative based on groundwater levels estimated using the hydrologic inventory analysis. The pattern for the Settlement and Non-Settlement Alternatives are similar to the No Action Alternative. A groundwater level depression would remain under MSIDD (although under some alternatives, it shifts from the MSIDD North to MSIDD South). No flow reversals occur, except between the MSIDD North and MSIDD South sub-areas if the location of the pumping depression shifts.

III.D.3.b.(1).(ii). Groundwater Quality

Changes in 2051 groundwater levels relative to No Action Alternative levels in the Pinal County area are generally small (less than 25 feet) for all alternatives and all sub-areas. The one exception is the 29-foot rise in the 2051 groundwater level relative to the No Action Alternative in the HIDD/SCIDD sub-area. The pattern of groundwater flow in year 2051 for the Settlement and all Non-Settlement Alternatives is similar to the pattern of flow under the No Action Alternative. Groundwater quality impacts would not be anticipated for these small changes in groundwater levels.

III.D.3.b.(1).(iii). Subsidence

The Settlement and Non-Settlement Alternatives result in relatively small impacts in all sub-areas in Pinal County. These groundwater level impacts would not be anticipated to result in substantial changes in the subsidence potential relative to the No Action Alternative

III.D.3.b.(2). GRIC

Changes in groundwater levels, groundwater quality, and subsidence under the Settlement and Non-Settlement Alternatives are discussed in the sub-sections that follow.

III.D.3.b.(2).(i). Groundwater Levels

Projected average annual groundwater level hydrographs under the Settlement and Non-Settlement Alternatives were shown previously on Figure I-54 through I-59. The hydrographs show how groundwater levels within a sub-area vary over the 50-year period. Projected levels for the No Action Alternative are also shown on those same figures. The geographical distribution of the groundwater level impacts between sub-areas in year 2051 (i.e., difference in groundwater levels from the No Action Alternative) are shown for the alternatives on Figure I-86 (Settlement Alternative), Figure I-87 (Alternative 1), Figure I-88 (Alternative 2), Figure I-89 (Alternative 3A), and Figure I-90 (Alternative 3B).

Groundwater level impacts in GRIC sub-areas reflect a number of factors that vary for each alternative. These factors include the amount and priority of CAP water allocated to GRIC, the total acres developed for irrigation and the buildout schedule for those acres, the assumed proportion of the demands which are met with groundwater, and changes in underflow between sub-areas. In interpreting results, it should be noted that there are differences in cropped acres between alternatives. The acreage differences include consideration that lands would be fallowed under some alternatives during shortage conditions.

Groundwater levels in three of the GRIC sub-areas (GRIC East, GRIC Komatke, and GRIC Maricopa Village) are influenced strongly by interactions with the Gila River and potential phreatophyte consumption, which tend to reduce the impacts in these sub-areas. The hydrographs for each of these sub-areas show that groundwater levels for several of the alternatives tend to approximately stabilize at a constant elevation, which is the assumed 25-foot depth that phreatophytes could reach to draw water. For this reason, the discussion in this section focuses on the larger groundwater level impacts in the GRIC Sacaton, GRIC North, and GRIC South sub-areas.

In order to aid the evaluation of impacts for GRIC, the average components of the hydrologic inventory for the GRIC area as a whole over the 50-year period were summarized in Table I-21 for each alternative. The bottom of the table shows the difference in the net pumping (groundwater pumping less incidental recharge) for the Settlement and Non-Settlement Alternatives relative to the No Action Alternative. The net pumping number reflects the various differences in the alternatives (such as cropped acreage and differences in CAP supplies and groundwater pumping). Differences in net pumping explain much of the difference in groundwater level impacts in year 2051 for the alternatives, as shown on Figure I-92. Smaller differences between alternatives and between the different sub-areas for a given alternative appear to reflect differences in groundwater flows from areas adjacent to GRIC.

The Settlement Alternative is the only alternative in which the net pumping is negative (pumping exceeds incidental recharge by about 29,000 afa), and the relatively large negative groundwater level impacts reflect this. The relatively small impact in the GRIC Sacaton sub-

area may reflect higher groundwater levels (relative to the No Action Alternative) in the HIDD/SCIDD sub-area located south of the GRIC Sacaton sub-area.

Alternative 3A and Alternative 3B have a positive average annual net pumping of about 10,000 afa. There are negative groundwater level impacts for these alternatives, but these impacts are less negative than for the Settlement Alternative. The particularly small negative impact for the GRIC South sub-area under Alternative 3A appears to reflect the influence of the positive groundwater level impact in the MSIDD South sub-area on groundwater outflow from the GRIC South sub-area.

Alternatives 1 and 2 have the largest positive average annual net pumping (from about 34,000 afa under Non-Settlement Alternative 2 to about 40,000 afa under Non-Settlement Alternative 1). The resulting groundwater level impacts are slightly positive for Non-Settlement Alternative 1 and slightly negative for Non-Settlement Alternative 2.

The pattern of groundwater flow beneath GRIC in year 2051 was evaluated for each alternative based on groundwater levels estimated using the hydrologic inventory analysis. The pattern for the Settlement and Non-Settlement Alternatives are similar to the No Action Alternative. Flow directions between GRIC and neighboring areas would generally remain similar to the No Action Alternative, except that under the Settlement Alternative and Non-Settlement Alternative 3B, groundwater flow would be from the Chandler South sub-area to the GRIC North sub-area. Within GRIC, there is a flow reversal between the GRIC Komatke and GRIC South sub-areas under Alternative 1 (with flow from GRIC South to GRIC Komatke for this alternative).

III.D.3.b.(2).(ii). Groundwater Quality

Changes in groundwater quality on GRIC would not be expected for the Settlement and Non-Settlement Alternatives. This reflects consideration that: (1) the flow pattern is not being greatly modified; (2) while groundwater levels are declining, there are not well defined bodies of groundwater of differing water quality which occur at depth; and (3) CAP water is not being directly recharged. It is noted that recharge of irrigation return flows might tend to add salts to groundwater, and thereby increase the TDS. While not one of the mechanisms for water quality impact, it is noted that this possible trend of increasing TDS might continue in the future due to the continued impact of irrigation return flows. However, in the case of GRIC the continued outflow of groundwater (and associated salts) to the north and south would help to maintain the salt balance.

III.D.3.b.(2).(iii). Subsidence

There is the potential for subsidence on GRIC lands for all of the alternatives, and particularly for the easterly portions of GRIC. With the exception of Non-Settlement Alternative 1, this potential is greater than under the No Action Alternative.

III.D.3.b.(3). East Salt River Valley

Changes in groundwater levels, groundwater quality, and subsidence under the Settlement and Non-Settlement Alternatives are discussed in the sub-sections that follow.

III.D.3.b.(3).(i). Groundwater Levels

Projected average annual groundwater level hydrographs under the Settlement and Non-Settlement Alternatives were shown previously on Figure I-60 through I-75. The hydrographs show how groundwater levels within a sub-area vary over the 50-year period. Projected levels for the No Action Alternative are also shown on those same figures. The geographical distribution of the groundwater level impacts between sub-areas in year 2051 (i.e., difference in groundwater levels from the No Action Alternative) are shown for the alternatives on Figure I-86 (Settlement Alternative), Figure I-87 (Alternative 1), Figure I-88 (Alternative 2), Figure I-89 (Alternative 3A), and Figure I-90 (Alternative 3B).

Groundwater level impacts in the East Salt River Valley reflect different influences in different locations of the analysis. The discussion of these impacts in this section has been structured to discuss impacts on the basis of the primary factors that cause those impacts. This discussion also focuses on sub-areas that have relatively large groundwater level impacts.

The groundwater level impacts in the Salt River Indian, West Mesa, East Mesa, Tempe North, Chandler South, and Tempe South sub-areas appear to be closely related to recharge. Figure I-93 shows the groundwater level impacts in year 2051 for these sub-areas by alternative, compared to the reduction (relative to the No Action Alternative) in the availability of recharge water. As shown, the groundwater level impacts for the Non-Settlement Alternatives appear to reflect changes in available recharge water. The magnitude of the impact tends to decrease with increasing distance from the GRUSP facilities (which recharge the Salt River Indian and West Mesa sub-areas). Also, the pattern of groundwater level impacts in GRIC are similar (see Figure I-92), so that the impacts in some sub-areas reflect changes in groundwater flow from sub-areas influenced by both GRUSP and GRIC. Some of the differences between the various alternatives can also be seen on the hydrographs. For example, the hydrograph for the Salt River Indian sub-area reflects that recharge amounts are similar for all alternatives in the early years of the period, and that the CAP water available for recharge is reduced at different times under each alternative.

The groundwater levels for the Settlement Alternative are not as closely related to the reduction in the recharge pool. Specifically, while the Settlement Alternative has the greatest reduction in the recharge pool, there are relatively small groundwater level impacts (less than 15 feet) as shown on Figure I-93. These impacts reflect that under the Settlement Alternative, the cities of Mesa and Chandler would receive additional CAP water from GRIC in exchange for effluent that would otherwise be unused. Without that additional CAP supply, the largest negative groundwater level impacts would have been expected for the Settlement Alternative.

Groundwater level impacts in year 2051 for the QCID and NMIDD sub-areas are shown for all alternatives on Figure I-94. Both of these sub-areas have similar impacts, with relatively large negative groundwater level impacts under the Settlement Alternative and Non-Settlement

Alternatives 2, 3A, and 3B, and relatively small impacts under Non-Settlement Alternative 1. However, while the year 2051 impacts for the various alternatives are similar for both sub-areas, the impacts at other times during the 2001 to 2051 period can differ significantly, as shown on the hydrographs for those sub-areas.

The pattern of groundwater flow in the East Salt River Valley in year 2051 was evaluated for each alternative based on groundwater levels estimated using the hydrologic inventory analysis. The pattern for the Settlement and Non-Settlement Alternatives are generally similar to the No Action Alternative. The primary difference is that, in addition to the groundwater level depression which develops in the Tempe South sub-area for all alternatives, a groundwater level depression also develops beneath the Chandler South sub-area under Non-Settlement Alternative 2. Also, the QCID sub-area would remain as a groundwater level depression under the Settlement Alternative.

III.D.3.b.(3).(ii). Groundwater Quality

Water quality impacts due to lowering of groundwater levels into deeper poor quality zones are not anticipated, because bodies of poor quality groundwater at depth were not identified in the East Salt River Valley.

The pattern of groundwater flow in year 2051 for the Settlement and Non-Settlement Alternatives are generally similar to the pattern of flow under the No Action Alternative. The exception is that a groundwater level depression develops in the Chandler South sub-area under Non-Settlement Alternative 2 and a groundwater level depression would remain in the QCID sub-area under the Settlement Alternative. Groundwater quality impacts would not be anticipated for the generally small changes in groundwater flow patterns relative to the No Action Alternative flow pattern. Because groundwater is already of relatively poor quality in the Tempe South and Chandler South sub-areas (i.e., where groundwater level depressions develop), impacts are not anticipated due to the development of an adverse salt balance. There would be some potential for adverse water quality impacts in the QCID sub-area for the Settlement Alternative, related to the groundwater level depression under that alternative.

Direct recharge of CAP water at GRUSP would also not be anticipated to result in substantial impacts to groundwater quality. The TDS concentration of CAP water (about 500 to 750 ppm) is similar to the TDS concentration of the underlying groundwater.

III.D.3.b.(3).(iii). Subsidence

The Settlement Alternative and all Non-Settlement Alternatives result in both positive and negative estimated groundwater level impacts for sub-areas. The following sub-areas would experience relatively large changes in the potential for subsidence.

The largest groundwater level impacts generally occur in NMIDD and QCID. Substantial subsidence potential was not identified for these sub-areas under the No Action Alternative. However, groundwater level declines would occur for the Settlement and all Non-Settlement Alternatives in the NMIDD sub-area, indicating the potential for subsidence. In the QCID sub-area, groundwater levels would decline from present levels under the Settlement Alternative,

and Non-Settlement Alternatives 2 and 3A. There would be the potential for subsidence under those alternatives.

In general, the Settlement and Non-Settlement Alternatives result in estimated groundwater levels in the vicinity of GRUSP and in the southwestern portion of the East Salt River Valley (i.e., the Tempe North, Tempe South, Chandler North, and Chandler South sub-areas) which are lower than under the No Action Alternative. In particular, estimated groundwater levels are lower than the No Action Alternative under the Settlement Alternative and Non-Settlement Alternatives 3A and 3B. In the southwestern portion of the East Salt River Valley, these groundwater level impacts could result in greater potential for subsidence. However, in the vicinity of GRUSP, year 2051 groundwater levels are still generally higher than year 2001 groundwater levels, so that subsidence impacts would not be anticipated in this area.

Groundwater levels in the Apache Junction and North Scottsdale sub-areas under the Settlement Alternative and Non-Settlement Alternative would be similar to levels under the No Action Alternative. There would be substantial potential for subsidence in both of these sub-areas under all alternatives.

III.D.3.b.(4). West Salt River Valley

Changes in groundwater levels, groundwater quality, and subsidence under the Settlement and Non-Settlement Alternatives are discussed in the sub-sections that follow.

III.D.3.b.(4).(i). Groundwater Levels

Projected average annual groundwater level hydrographs under the Settlement and Non-Settlement Alternatives were shown previously on Figure I-76 through I-85. The hydrographs show how groundwater levels within a sub-area vary over the 50-year period. Projected levels for the No Action Alternative are also shown on those same figures. The geographical distribution of the groundwater level impacts between sub-areas in year 2051 (i.e., difference in groundwater levels from the No Action Alternative) are shown for the alternatives on Figure I-86 (Settlement Alternative), Figure I-87 (Alternative 1), Figure I-88 (Alternative 2), Figure I-89 (Alternative 3A), and Figure I-90 (Alternative 3B).

Groundwater level impacts in the West Salt River Valley reflect relatively small impacts associated with additional allocation of CAP water and additional leases of CAP water to M&I entities, and relatively large impacts associated with direct recharge.

Figure I-95 presents groundwater level impacts in year 2051 for selected sub-areas in the West Salt River Valley area. It provides a means to readily compare the impacts for the various alternatives. The selected sub-areas were those that showed an impact of 25 feet or more for at least one of the alternatives. These sub-areas are particularly influenced by recharge, with direct recharge facilities located within each of these sub-areas. The groundwater level impacts for each of these sub-areas track with the changes in water available for recharge (which are also shown on Figure I-95). For example, the greatest reduction in recharge water occurs under the Settlement Alternative, which also has the largest negative groundwater level impacts.

Some of the differences between the various alternatives can also be seen on the hydrographs. For example, the hydrograph for the Glendale/Peoria sub-area reflects that recharge amounts are similar for all alternatives in the early years of the period, and that the CAP water available for recharge experiences reductions at different times for each alternative. The hydrographs for the MWD and the West-side M&I sub-areas (which also include direct recharge facilities that begin operation in 2017) also reflect changes in the availability of CAP water for recharge and in the assumed build-up of recharge capacity.

The pattern of groundwater flow in the West Salt River Valley in year 2051 was evaluated for each alternative based on groundwater levels estimated using the hydrologic inventory analysis. The groundwater flow patterns for the Settlement and Non-Settlement Alternatives are generally similar to the No Action Alternative. All alternatives result in groundwater level depressions in the MWD and Phoenix North sub-areas by year 2051, and all alternatives have groundwater flow from beneath the Salt and Gila Rivers to the more northerly areas of the West Salt River Valley.

III.D.3.b.(4).(ii). Groundwater Quality

Changes in 2051 groundwater levels relative to No Action Alternative levels in the West Salt River Valley vary in different locations. Groundwater level declines relative to the No Action Alternative are as much as almost 70 feet in the MWD sub-area under the Settlement Alternative. The groundwater level declines in the West-side M&I sub-area and the MWD sub-area could result in increased TDS concentrations in wells in the southern portions of those sub-areas, due to lowering of water in the vicinity of the "Luke Salt Dome," where poorer quality water is present at depth.

The patterns of groundwater flow in year 2051 for the Settlement and Non-Settlement Alternatives are generally similar to the pattern of flow under the No Action Alternative. Therefore, groundwater quality impacts relative to the No Action Alternative would not be anticipated due to changes in the flow pattern.

Changes in the volume of direct recharge of CAP water at the Agua Fria and future West-side recharge facilities could result in changes in groundwater quality. All of the action alternatives would result in reduced recharge of CAP water. That reduced recharge would lessen the potential degradation to the underlying groundwater that would occur under the No Action Alternative, due to the greater TDS concentration in CAP water.

III.D.3.b.(4).(iii). Subsidence

Estimated groundwater levels for the northwestern portion of the West Salt River Valley area (generally including the Glendale/Peoria, West-side M&I, and MWD sub-areas) generally show lower groundwater levels under the Settlement and Non-Settlement Alternatives than under the No Action Alternative. These impacts are relatively small under Non-Settlement Alternatives 1 and 2, and are relatively large under the Settlement Alternative and Non-Settlement Alternatives 3A and 3B. These groundwater level impacts indicate the potential for additional subsidence in these areas under the Settlement and Non-Settlement Alternatives.

III.E. Groundwater Level Analysis for the San Carlos Apache Area

The potential impacts of the CAP reallocation on the SC Apache Tribe were evaluated primarily on the basis of information presented in USGS WRI 89-4152. In comparison with many of the other areas considered in the reallocation analysis (such as the Tucson, Avra Valley, Pinal County, and Salt River Valley areas), there are relatively limited data available, and the analysis is, therefore, dependent on a greater degree of judgment.

A hydrologic inventory analysis was performed for the SC Apache Tribe area, shown on Figure I-96. Impacts on groundwater contained in the basin fill materials associated with the San Carlos and Gila Rivers on the SC Apache Tribe lands, located upstream of the San Carlos Reservoir, were evaluated.

III.E.1. Existing Groundwater Conditions

Because it is assumed that the CAP water allocated to the SC Apache Tribe is used to develop lands along the Gila and San Carlos Rivers, the groundwater resources evaluation focuses on this area of the Reservation. The Gila River is perennial during most years, while the San Carlos River is dry for at least part of most years.

Groundwater is currently used on the SC Apache Reservation for domestic uses and to supply a portion of the irrigation requirements. Most of the large capacity wells are completed in the stream alluvium and the upper portions of the basin fill materials, and such wells can produce more than 900 gallons per minute (gpm).

III.E.1.a. Geology

Rocks occurring on the Reservation in the vicinity of the Gila and San Carlos Rivers include mountains composed of igneous, metamorphic, and sedimentary rocks. The Gila and San Carlos Rivers are underlain by alluvial materials, generally of Tertiary and Quaternary age. Of primary interest for this study are the "Tertiary and Quaternary Basin Fill" and the "Quaternary Stream Alluvium."

III.E.1.a.(1) Tertiary and Quaternary Basin Fill

The Tertiary and Quaternary basin fill materials overlie consolidated rocks. The upper few hundred feet of these deposits consist of fine sand, silt, limestone and clay, with interbedded volcanic tuff deposits. These materials occur in well-bedded, but laterally discontinuous, layers. On the Reservation, the basin fill may be more than 3,200 feet deep.

III.E.1.a.(2). Quaternary Stream Alluvium

The Quaternary stream alluvium overlies the Tertiary and Quaternary fill materials along the Gila and San Carlos Rivers. It consists of poorly sorted sandy gravel and gravelly muddy sand. These materials are up to about 85 feet thick along the Gila River, and occur in the 4,000 to 8,000-foot wide river channel. For the San Carlos River, these materials are generally about 60 to 80 feet thick and occur in channel deposits about 1,200 to 4,900 feet wide.

III.E.1.b. Groundwater Occurrence and Movement

Groundwater occurs in the stream alluvium and the basin fill materials. The saturated thickness of the stream alluvium is about 30 to 40 feet beneath the Gila River and about 40 to 65 feet beneath the San Carlos River. This groundwater likely occurs under unconfined conditions.

Groundwater in the basin fill occurs under both confined and unconfined conditions. The unconfined conditions tend to occur at the margins of these materials, and the groundwater becomes confined toward the axis of the valleys.

Groundwater flow in the stream alluvium beneath the Gila and San Carlos Rivers generally parallels the flow in the associated river, with flow toward the San Carlos Reservoir at the western end of the Reservation.

Groundwater in the basin fill associated with the Gila River generally flows from the margins of the valleys, where it is recharged by percolation along the mountain fronts, toward the center of the valley. The groundwater levels in the basin fill beneath the river are higher than the levels in the overlying stream alluvium and indicate an upward flow of groundwater from the basin fill to the stream alluvium. While this pattern of flow is not explicitly discussed in USGS WRI 89-4152 for the San Carlos River, it is considered likely that the same flow pattern occurs at that location.

Transmissivity for the stream alluvium along the Gila River is estimated in the USGS report to be about 9,800 square feet per day from a flood wave propagation analysis, and about 28,000 square feet per day from an aquifer test. Transmissivity for the stream alluvium beneath the San Carlos River near Peridot was estimated to be about 19,000 square feet per day based on an aquifer test. The specific yield of the alluvium was estimated to be about 15 percent.

The specific yield of the basin fill of 10 percent was used for volume calculations presented in USGS WRI 89-4152. Limited data available on aquifer transmissivities indicate that transmissivity is significantly lower in the basin fill materials than in the stream alluvium, with observed values ranging from about 1,200 to 2,500 square feet per day.

III.E.1.c. Groundwater Quality

The existing groundwater quality conditions were evaluated by reference to material presented in the USGS Water Resources Investigation 89-4152, "Geology and Ground-Water Resources of the San Carlos Indian Reservation, Gila, Graham, and Pinal Counties, Arizona. Those data primarily addressed the general mineral constituents, and discussion in this section is restricted to TDS.

The quality of groundwater varies between the stream alluvium and basin fill associated with the Gila and San Carlos Rivers. Groundwater in the deposits associated with the Gila River generally has a TDS concentration greater than 500 ppm, and some wells adjacent to the Gila River produce water that contains more than 4,000 ppm of TDS. Those high TDS values were attributed to inflow of high TDS water from the underlying basin fill, percolation of irrigation

return flows with high TDS, and concentration of TDS (salts) by use of groundwater by phreatophytes. The TDS concentration of water in wells in the basin fill deposits at least two miles from the Gila River and in silt and sand materials were about 240 to 380 ppm, while groundwater in basin fill adjacent to the Gila River contains from 370 to 2,570 ppm of TDS.

Groundwater in stream alluvium and the upper portions of the basin fill beneath the San Carlos River generally contains less than 500 ppm of TDS.

III.E.1.d. Subsidence

Information on historical subsidence on SC Apache Tribe lands was not located. The occurrence of clay materials in the basin fill does indicate that there may be the potential for subsidence if groundwater levels are lowered substantially.

III.E.2. Details of Analysis Methodology

USGS WRI-89-4152 does not present information that readily supports the development of a quantified hydrologic inventory from the SC Apache Tribe lands. It does indicate that components of the hydrologic inventory include:

- Recharge
  - Mountain front recharge
  - Recharge from streams
  - Irrigation return flows

- Discharge
  - Phreatophyte consumptive use
  - Groundwater pumping

Also, it is indicated that groundwater levels on the Reservation generally do not demonstrate either rising or falling groundwater trends, although the information does not appear to be definitive. While the information is limited, it appears to be most consistent with the groundwater on the SC Apache Tribe lands remaining within the safe yield under the demands present at the time of the USGS study. This information is also consistent with the limited level of development at present.

The mechanism for the SC Apache Tribe to receive CAP water would be through an exchange in which SC Apache Tribe would essentially use Gila River water, and, in exchange, downstream users dependent on those supplies would receive CAP water allocated to the SC Apache Tribe. For the purpose of this analysis, this irrigation is assumed to occur on lands located in the river bottoms of the Gila and San Carlos Rivers, which are upstream of the San Carlos Reservoir. Other lands which have been identified as irrigable, such as those in the "Arsenic Flat" area of the Reservation, were not considered as a part of this scenario. Development of those lands would generally involve construction of much more extensive facilities than needed to develop lands along the Gila and San Carlos Rivers.

It is assumed that the lands would be irrigated by surface water diverted from the San Carlos Reservoir. On a conceptual level, the groundwater impact would be a limited rise in groundwater levels during the early years of irrigation, due to percolation of irrigation return flows and the resulting filling of presently dewatered alluvium. As groundwater levels rise, discharge to the San Carlos and Gila Rivers would increase. Eventually, a new groundwater "equilibrium" would be established, such that the discharge to the rivers would equal the irrigation return flows, and the return flows would be recaptured in San Carlos Reservoir.

A preliminary evaluation has been prepared to help quantify these impacts. Assumptions of the analysis include the following:

- Irrigated lands would be located over the stream alluvium and would be dispersed evenly on this alluvium on the Reservation (so that groundwater impacts should be estimated based on the total area of stream alluvium, rather than just the stream alluvium which directly underlies irrigated lands).

- The specific yield is 15 percent in the stream alluvium.

- The average unfilled storage is about 15 feet along the San Carlos River and about 50 feet along the Gila River.

- About five af per acre would be applied to irrigated lands, of which 2.5 af per acre would be consumptively used. The remaining 2.5 af per acre would recharge groundwater, to the extent that there is unfilled storage in the stream alluvium.

III.E.3. Analysis of Alternatives

Discussion is presented below regarding the effects of the alternatives on groundwater levels, groundwater quality, and subsidence. Because additional CAP water relative to present conditions would be used for all alternatives (including the No Action Alternative), the groundwater impacts are all similar and are discussed together for all alternatives in the following sub-sections which address groundwater levels, groundwater quality, and subsidence.

III.E.3.a. Groundwater Levels

A quantified evaluation of each alternative is presented in Table I-22. The volume of CAP water available for irrigation for each alternative reflects that a portion of the CAP allocation would be leased to others (see Appendices A and L). The total acres for each alternative are estimated by dividing the CAP irrigation supply by the application rate of five af per acre.

The estimated total stream alluvium acreage associated with the San Carlos and Gila Rivers is shown in Table I-22. The storage beneath each river was estimated based on that acreage, the average depth to water indicated from USGS WRI 89-4152 (about 15 feet for the San Carlos River and about 50 feet for the Gila River) and a 15 percent specific yield. All alternatives result in the same groundwater level impact by year 2051 (i.e., essentially filling available storage

space). The time needed to fill this storage from irrigation return flows was then estimated by dividing the storage by the annual irrigation return flows.

The estimated time needed to fill this storage (ranging from about two to 10 years, depending on the alternative and the location) probably reflects an upper bound of the "lag time" before applications begin returning to San Carlos Reservoir. Depending on soil conditions and topography, there could be drainage issues associated with this intensity of irrigation on these lands.

III.E.3.b. Groundwater Quality

The impacts of alternatives on water quality for the SC Apache Tribe reflect use of water from the San Carlos Reservoir to irrigation lands associated with the Gila and San Carlos River Valleys. The quality of water in the San Carlos Reservoir was not identified directly. However, based on water quality measurements for the Gila River upstream of the reservoir, that quality probably varies. TDS concentrations tend to be about 600 to 700 ppm during low flow periods, and about 300 to 500 ppm during higher flow periods. It is anticipated that most of the flow would be captured during the higher flow periods and that the quality of water in the reservoir would reflect this. For the purpose of this analysis, it was assumed that the reservoir water would contain about 500 ppm of TDS.

For lands along the San Carlos River, the TDS concentration of the reservoir water is similar to that of the stream alluvium and upper portions of the basin fill aquifer. Therefore, water quality impacts are not expected in that area. The quality of San Carlos Reservoir water would tend to be better than the existing quality of groundwater associated with the Gila River. This indicates some potential for improved groundwater quality in the alluvium and basin fill materials associated with the Gila River.

III.E.3.c. Subsidence

Under all alternatives, additional lands would be irrigated with surface water supplies, which would result in potentially higher groundwater levels. Because groundwater level declines are not anticipated on the SC Apache Tribe lands, subsidence is not anticipated.

III.F. Groundwater Level Analysis for the TID

A hydrologic inventory analysis was performed for the TID. The location of TID is shown on Figure I-97. TID is located in the "Tonopah Desert" portion of the Hassayampa sub-basin of the Phoenix AMA, south of the Belmont and Big Horn Mountains, and north of the Gila Bend Mountains. The closest major drainage to TID is the Hassayampa River, located east of TID, which is an unregulated ephemeral stream tributary to the Gila River.

III.F.1. Existing Groundwater Conditions

The existing groundwater conditions were identified through review of several published sources, including the ADWR Hydrologic Map Series Report No. 10, the USBR 1976 Geology

Report, and the Pinal AMA Management Plans. The discussion which follows is based on those sources.

III.F.1.a. Geology

Groundwater occurs in the basin fill materials beneath and adjacent to TID. This fill includes the same three general units discussed in the earlier section on the Pinal and Salt River Valley areas. However, the Upper Alluvial Unit is generally de-watered in the Tonopah Desert area, so that the Middle Fine-Grained Unit and the Lower Conglomerate Unit generally comprise the aquifer in the basin fill for this area. Groundwater also occurs in volcanic bedrock underlying the Tonopah Desert. The total thickness of the basin fill and water-bearing volcanic bedrock is more than 1,200 feet in the central part of the Tonopah Desert.

III.F.1.b. Groundwater Occurrence and Movement

Groundwater in the Hassayampa area generally occurs under unconfined conditions. This includes the Tonopah Desert area in which TID is located.

The general pattern of groundwater flow in the Hassayampa basin is from north to south, with some flow going to the east to the northern portion of the West Salt River Valley. The Hassayampa basin also receives groundwater inflow from the West Salt River Valley area beneath the Gila River. In the Tonopah Desert area, the present pattern of flow is probably similar to that in 1982 (shown on Sheet 1 of the HMS No. 10). That map showed a groundwater depression generally located beneath TID which results in a radial pattern of flow toward that depression. Under pre-development conditions, flow was probably generally from the adjacent Belmont Mountains and Palo Verde Hills toward the center of the Tonopah Desert area, and then to the east toward the Hassayampa River.

Aquifer transmissivity was estimated based on specific capacity for selected wells, which indicated a range of aquifer transmissivity from about 18,000 to about 71,000 gallons per day (gpd) per foot. For the purpose of this analysis, the average aquifer transmissivity of about 38,000 gpd per foot from the specific capacity data was used. An estimate of specific yield was not located for the Tonopah Desert area. For this analysis, a value of nine percent has been used, which is similar to specific yield values shown for the lower alluvial unit in the West Salt River Valley area used in the ADWR model (as shown on Figure 5 of that report).

At a conceptual level, the primary recharge components of the hydrologic inventory would probably be groundwater inflow and incidental recharge from irrigation applications. Primary components of groundwater discharge would probably be groundwater underflow and groundwater pumping.

III.F.1.c. Groundwater Quality

Existing groundwater quality conditions were identified with respect to both general mineral constituents and for specific contaminants of interest.

III.F.1.c.(1). General Minerals

The TDS are considered as the general indicator of groundwater quality. The 1974 USGS Map I-845-G ("Dissolved-Solids Content of Ground Water in the Phoenix Area, Arizona") was used to define these conditions. Information on TDS was also reviewed from the TMP for the Phoenix AMA (Figure 7-3 of that document), and that information is consistent with USGS I-845-G. TDS concentrations of groundwater in the Tonopah Desert area were inferred by the USGS to be in the range of 500 to 1,000 ppm. In general, TDS concentrations tend to decrease with increasing depth (USGS Map I-844-L).

The general distribution of other constituents was identified from the 1974 USGS Map I-845-F ("Map Showing Chemical Quality of Ground Water for Public Supply in the Phoenix Area, Arizona") which shows the quality for the upper 300 feet of the saturated alluvium with respect to fluoride, nitrate, and hardness. This was supplemented with consideration of more recent water quality data presented in the TMP for the Tucson AMA. It appears that limited data were available for the Tonopah Desert area, but that groundwater generally contains fluoride in excess of 1.4 ppm.

III.F.1.c.(2). Other Constituents

No water quality study areas were identified in the Tonopah Desert area in the Phoenix AMA TMP.

III.F.1.d. Subsidence

Discussion of historical subsidence for the TID area was not located in available published reports. However, this lack of discussion could reflect that limited data are available to quantify any subsidence, or that damage or physical expression of subsidence that would prompt study using existing data has not occurred. For this reason, the geologic conditions were considered to evaluate the potential for subsidence.

Groundwater occurs in the "Lower Conglomerate Unit" and "Middle Fine-Grained Unit" beneath TID. The Middle Fine-Grained Unit is predominantly clay and silty clay, which would indicate some potential for subsidence. These deposits are similar to those in the Salt River Valley in which there has been substantial subsidence. Based on these considerations, lowering of groundwater levels in TID would be expected to have the potential to cause subsidence.

III.F.2. Details of Analysis Methodology

Because this area is relatively distant from other areas of intense groundwater development, a hydrologic inventory was developed for the TID area, rather than for a number of sub-areas as discussed for some of the other areas analyzed in this study. For the purpose of this analysis, the evaluation essentially considers all of TID and irrigated lands located south and west of TID. Information on historical hydrology is also relatively limited in this area, so that a number of assumptions were made, as documented in the following section.

III.F.3. Evaluation of Historical Conditions and "Calibration"

The hydrologic inventory analysis was used to evaluate groundwater levels from 1950 to 1999. Relatively limited data were available to evaluate historical groundwater levels in this area, so that a number of assumptions were made to perform this historical analysis.

Estimates were prepared for the components of the historical hydrologic inventory. These components include:

- Recharge
  - Groundwater inflows from margins of the analysis area
  - Incidental recharge

- Discharge
  - Groundwater outflows from margins of the analysis area
  - Groundwater pumping

The components of the hydrologic inventory were estimated based on limited available data and on judgment where data were not located.

A groundwater level hydrograph was prepared to compare groundwater levels estimated using the hydrologic inventory to groundwater levels in several wells in the area, as presented on Figure 98. This comparison indicates that the hydrologic inventory is able to reflect the large-scale trends in groundwater levels that have historically occurred.

III.F.4. Analysis of Alternatives

Groundwater levels were estimated for each alternative using the hydrologic inventory analysis, and groundwater level hydrographs are shown on Figure I-99 for all alternatives. As shown, groundwater levels are similar for all alternatives.

The results of the analysis are presented in two sub-sections, which discuss: (1) the No Action Alternative; and (2) the Settlement and Non-Settlement Alternatives. The No Action Alternative serves as the basis of comparison to determine impacts for the other alternatives. The discussion of the No Action Alternative, therefore, focuses to some extent on absolute groundwater level impacts, while discussion of the other alternatives focuses on impacts in comparison to the No Action Alternative.

III.F.4.a. No Action Alternative

Discussion is presented below regarding the effects of the alternatives on groundwater levels, groundwater quality, and subsidence.

III.F.4.a.(1). Groundwater Levels

Under the No Action Alternative, groundwater levels rise by more than 45 feet during the early years of the projection (from 2001 to 2016) and then decline through year 2051. From year 2001 to 2051, the net estimated impact is a decline in groundwater levels of about 17 feet.

The rise in groundwater levels from 2001 to 2016 reflects the availability of CAP water to the TID from both the Ag Pool and Recharge Pool. There is reduced availability of CAP water in later years. This reduced availability of CAP water essentially reverses the trend of rising groundwater levels, and groundwater levels drop through the remainder of the analysis period.

III.F.4.a.(2). Groundwater Quality

The No Action Alternative does not result in substantial changes in groundwater elevations and would not be anticipated to substantially change the pattern of groundwater flow near TID. Based on this, changes in groundwater quality are not anticipated.

III.F.4.a.(3). Subsidence

Under the No Action Alternative, estimated groundwater levels would be higher than the 2001 level for most of the 50-year analysis period, except for the very end of the period. At that time, groundwater levels would be about 17 feet deeper than in year 2001. Significant subsidence impacts would not be anticipated for that limited amount of groundwater level decline.

III.F.4.b. Settlement and Non-Settlement Alternatives

Discussion is presented below regarding the effects of the alternatives on groundwater levels, groundwater quality, and subsidence.

III.F.4.b.(1). Groundwater Levels

Under the Settlement and Non-Settlement Alternatives, groundwater levels in year 2051 would range from about 17 to 41 feet deeper than under the No Action Alternative. Those impacts are shown graphically on Figure I-100. Also shown is the change in the total excess CAP water over the 50-year analysis period (relative to excess CAP water available under the No Action Alternative). The excess CAP water includes the pools of CAP water that would be available to TID (i.e., the Ag Pool, CAP NIA allocations, and the Recharge Pool) The changes in the groundwater level impacts generally track with the changes in the total excess CAP water.

III.F.4.b.(2). Groundwater Quality

The Settlement and Non-Settlement Alternatives considered do not result in substantial changes in groundwater elevations, and would not be anticipated to substantially change the pattern of groundwater flow near TID. Based on this, changes in groundwater quality are not anticipated.

III.F.4.b.(3). Subsidence

The Settlement and Non-Settlement Alternatives all result in lower estimated groundwater levels than the No Action Alternative. There is some potential for subsidence impacts in TID under all alternatives.

III.G. Navajo/Hopi Indian Reservations

The potential impact of the CAP reallocation on groundwater underlying the Navajo and Hopi Indian Reservations was evaluated based on review of published studies. The analysis of impacts for the Navajo and Hopi Reservations was performed on a more qualitative basis than the analyses for other areas. This reflects several considerations, including the following:

- While the potential amount of CAP water available to both the Navajo and Hopi Tribes is known to be 13,500 afa for Non-Settlement Alternatives 2, 3A and 3B, the distribution of that water between the two Tribes is contingent on resolution of issues outside the scope of this draft EIS.

- Similarly, specifics on future water use are contingent on resolution of issues outside the scope of this draft EIS.

- The details of the physical groundwater system are still the subject of study, and firm values describing the physical system which has the consensus of the involved entities has not yet been developed.

The Navajo and Hopi Indian Reservations have an area of about 25,000 square miles, including lands in the northeastern part of Arizona, in New Mexico, and in Utah. Consistent with the Boulder Canyon Project Act, the analysis only considers those lands that are located in the Lower Colorado River Basin, and thus, can receive CAP water.

The analysis summarizes the Black Mesa hydrologic basin, as defined on Figure 1 of USGS Open-File Report 00-66 (Truini, Baum, Littin, and Shingoitewa-Honanie, 2000). That basin covers approximately 5,400 square miles, and includes all of the Hopi Indian Reservation lands, the Black Mesa Coal Mine, and the M&I use zones shown on Figure L-IND-4 of Appendix L. Most of the Black Mesa hydrologic basin is drained by the Little Colorado River and its various tributaries, although the eastern portion is drained by Chinle Wash. As shown on Figure 16 of USGS Professional Paper 521-A, most reaches of the drainages are intermittent, although there are some reaches that have been perennial for some period of time.

III.G.1. Existing Groundwater Conditions

Groundwater has been developed to supply a number of municipal and industrial uses in the Black Mesa basin. Groundwater supplies essentially all the domestic water needs of the population in the area. It also supplies the industrial needs, with the largest need being for a coal slurry pipeline for the Black Mesa Mine. Current groundwater conditions are described in the sections that follow.

III.G.1.a. Geology

The ADWR's "Hydrographic Survey Report for Indian Lands in the Lower Colorado River System" provides a summary discussion on the geology and was used to develop the discussion in this section. This was supplemented with information from the USGS studies in this area. The Navajo and Hopi Indian Reservations are underlain by about 1,000 to 10,000 feet of sedimentary rocks which overlay Precambrian igneous and metamorphic rocks. Recoverable groundwater generally occurs in sandstone layers between relatively impermeable siltstone and mudstone layers. While the siltstone and mudstone that separate these aquifers are relatively impermeable, there are fractures in these layers which allow some flow between the various aquifer units.

Three principal aquifers have been identified in the area. The deepest aquifer is the Coconino or C-Aquifer. This extensive aquifer which underlies most of the two Reservations has an average thickness of about 400 feet. The Navajo/Lukachukai Aquifer or N-Aquifer is above the C-Aquifer. It underlies the northwestern portion of the Navajo Reservation and the Hopi Indian Reservation. USGS WSP 561-A indicates that the N-Aquifer has an average thickness of about 400 feet. The Dakota/Cow Springs Aquifer or D-Aquifer underlies the Hopi Reservation and the north-central portion of the Navajo Reservation. It occurs as isolated, semi-connected aquifers.

According to USGS WSP 2201, the N-Aquifer is the main source of groundwater in the Black Mesa area. Most wells in the Black Mesa area do not tap into the deeper C-Aquifer. The USGS (WSP 2201) indicated that there is not significant movement of groundwater between the N- and C-Aquifers in the Black Mesa area. The D-Aquifer, which overlies the N-Aquifer, provides some water supply for uses along the Shonto Wash in the northern portion of the Black Mesa area. Leakage from the D-Aquifer also provides water to the N-Aquifer. Based on this, the remainder of the discussion and the analysis of impacts focus on the N-Aquifer.

The N-Aquifer is more than 1,200 feet thick at Kaibito. It thins and eventually "pinches out" to the west. The analysis herein considers the portion of the N-Aquifer modeled by the USGS, as shown on Figure I-101. The N-Aquifer extends northwesterly of the area modeled by the USGS, at the location of a groundwater flow divide. The thickness of the N-Aquifer in the area modeled by the USGS ranges from less than 100 feet in the south to over 900 feet near the Black Mesa Coal Mine.

III.G.1.b. Groundwater Occurrence and Movement

Groundwater occurs under confined and unconfined conditions in the N-Aquifer. The N-Aquifer outcrops along the eastern, northern, and western edges of the Black Mesa area, and water in those areas is generally unconfined.

Groundwater level contours for 1969, shown on Figure I-101, indicate groundwater flow was from Shonto south and southeast toward the location of the present Black Mesa Coal Mine. From there, some flow travels to the west toward Moenkopi Wash as well as easterly and northeasterly toward Laguna Creek and Chinle Wash. The USGS Water-Resources

Investigations Report 96-4190 (1997) also indicated that the same general pattern of flow was present in 1996, with some changes in flow reflecting pumping at the mine and the associated local lowering of groundwater levels.

III.G.1.c. Groundwater Quality

Table 12 of USGS Open-File Report 00-16 (2000) presents ranges of concentrations of chemical constituents for the various aquifers that underlie the Navajo and Hopi Indian Reservations, including the Navajo Aquifer. Ranges for selected constituents are summarized below:

Sulfate	1.6 to 250 mg/l
Chloride	1.3 to 140 mg/l
Total Dissolved Solids	94 to 714 mg/l

III.G.1.d. Subsidence

Groundwater supplies have primarily been developed from consolidated sedimentary rocks. Subsidence would not be a concern for this geologic condition, and so is not included in the discussion of alternatives.

III.G.2. Details of Analysis Methodology

The qualitative evaluation was developed based on consideration of the conceptual (rather than a quantified) hydrologic inventory for the N-Aquifer, using information from the available published sources. The groundwater flow pattern discussed above indicates that percolation of precipitation on the outcrop areas, and particularly in the Shonto area, provides some recharge. The flow pattern also indicates discharge from the aquifer to the Moenkopi Wash at the western end of the N-Aquifer, and to Laguna Creek and Chinle Wash to the east and northeast.

As discussed in USGS WSP 2201, field data are not adequate to quantify the hydrologic inventory. However, that report does present an estimated budget for pre-development conditions (pre-1964) and for development conditions (1979) prepared during the modeling process. The pre-development condition shows a balance between recharge and discharge. For the 1979 condition, there is a decrease in storage, reflecting that the withdrawals have only had a minor impact in reducing discharges to springs, streams, alluvium, and evapotranspiration.

The specific yield values used in the USGS model for unconfined areas ranged from 0.10 to 0.15 (10 to 15 percent). The storage coefficient for the confined areas (similar to the specific yield for an unconfined aquifer, except that it represents water yielded from the aquifer through a unit drop in the pressure head, rather than dewatering of a unit volume) used in the USGS model was about 0.0004. This value is several orders of magnitude smaller than the specific yield for the unconfined areas and indicates that the storage in the confined areas of the N-Aquifer is negligible in comparison to the storage in the unconfined areas.

As presented in USGS progress reports and results of the Black Mesa N-Aquifer monitoring program (1978 through 2000, Open-File Reports and Water-Resources Investigations Reports), groundwater levels observed in wells in the unconfined areas have been relatively stable over time and water levels have declined in the confined areas. This is consistent with the observations made in USGS WSP 2201 stating that, while water has been taken out of storage over this period, the change in storage is minimal with respect to the total volume of water in storage in the Black Mesa area. In contrast, groundwater levels have dropped–in areas of the confined aquifer where pumping has occurred. The groundwater level declines reflect changes in the levels required to induce groundwater flows rather than changes in storage.

In order to provide some indication of the potential impact of CAP availability on groundwater levels, a simple computation was made of the potential incremental difference in groundwater storage in year 2051 with the CAP allocation versus without the CAP allocation. The total volume of CAP water would be about 675,000 af (13,500 afa multiplied by 50-year analysis period).

To the extent that the CAP water offsets groundwater pumping, the incremental difference in groundwater storage would be an increase of 675,000 af with the availability of CAP water. By comparison, USGS WSP 2201 indicates that the total storage in the N-Aquifer was at least 180,000,000 af in 1964, and that there have only been limited withdrawals from the aquifer since 1964. More recent findings by the USGS (Water-Resources Investigation Report 96-4190, 1997) indicate storage in the saturated N-Aquifer to be 293,000,000 af. These values indicate that the CAP water potentially available would result in an incremental increase of groundwater storage in the N-Aquifer of 0.23 to 0.38 percent.

III.G.3. Analysis of Alternatives

Due to the qualitative nature of the analysis, evaluation of alternatives was limited to identifying potential incremental differences in the volume of groundwater in storage. This evaluation is presented in the sub-sections that follow, which discuss the No Action Alternative and the Settlement and Non-Settlement Alternatives.

III.G.3.a. No Action Alternative

Under the No Action Alternative, the Navajo and Hopi Tribes would not receive CAP water. The impacts of the Settlement and Non-Settlement Alternatives would be measured by the incremental change in groundwater storage equal to the CAP water received for those alternatives.

The drawdown effects of ongoing N-Aquifer withdrawals will be greatest near the centers of pumping. The greatest withdrawals from the confined part of the aquifer are at the Peabody mining complex, and the communities of Kayenta, Pinon and Polacca. The greatest withdrawals from the unconfined part of the aquifer are at the communities of Tuba City, Shonto and Moenkopi. N-Aquifer characteristics that determine the response to pumping vary greatly throughout the basin. Accurately predicting local impacts requires analyses outside the scope of this EIS. However, it is likely that future drawdowns in certain local areas will be substantial, and could impair the ability to recover groundwater using existing wells.

III.G.3.b. Settlement and Non-Settlement Alternatives

CAP water would not be available under the Settlement Alternative and Non-Settlement Alternative 1. Therefore, there would not be an incremental change in groundwater storage for these alternatives relative to the No Action Alternative.

The additional increment of CAP water under Non-Settlement Alternatives 2, 3A and 3B would result in a reduction in groundwater pumping of 675,000 af over the 50-year period. This would result in an incremental increase in groundwater storage relative to the No Action Alternative of 675,000 af or about 0.23 to 0.38 percent of the overall N-Aquifer storage. The increased groundwater storage would result in higher average groundwater levels overall in the N-Aquifer for these alternatives relative to the No Action Alternative. However, as previously discussed, evaluation of local impacts is outside the scope of this draft EIS, and the improvement in overall N-Aquifer storage may not translate into significant improvements in groundwater levels for all local areas that experience substantial drawdowns under the No Action Alternative.

III.H. Carefree Sub-basin

The community of Cave Creek obtains groundwater from the Carefree sub-basin of the Phoenix AMA. Discussion presented herein is largely based on information presented in the Phoenix AMA Management Plans and in the 1974 ADWR report "Arizona Water Resources Assessment."

The total area of the sub-basin (which includes lands underlain by both basin fill and alluvium) is about 140 square miles. The developed lands (including the Cave Creek and Carefree communities) are located in the southern portion of the basin, while the northern area includes mountainous undeveloped desert lands. The area is drained by the ephemeral Cave Creek, which flows from north to south across the sub-basin. For the purpose of this analysis, groundwater conditions were evaluated in the portion of the Carefree sub-basin that is underlain by the valley fill and which is within the Municipal Planning Area (MPA) for Cave Creek. That area (about 14 square miles) is shown on Figure I-102.

III.H.1. Existing Groundwater Conditions

The sub-sections which follow summarize information on the geology and the occurrence and movement of groundwater in the Carefree sub-basin. The information has have largely been taken from the 1974 ADWR report "Arizona Water Resources Assessment" and the Management Plans for the Phoenix AMA.

III.H.1.a. Geology

The Carefree sub-basin is underlain by partially consolidated to consolidated sedimentary rocks, which are as much as about 2,000 feet thick. The primary aquifer consists of alluvial fan and playa deposits. These deposits are underlain by volcanic rocks (which do not yield significant water to wells) and weathered granite (in which well yields of as much as 600 gpm

have been achieved). The ADWR report characterized the weathered granite as "a potential future source of groundwater," which indicates only limited development to date.

III.H.1.b. Groundwater Occurrence and Movement

Groundwater level contours for 1992 are shown on Figure 2-5 of the draft TMP for the Phoenix AMA. Those contours show that a groundwater depression has developed in the portion of the Carefree sub-basin considered in this analysis.

III.H.1.c. Groundwater Quality

The ADWR's report "Arizona Water Resources Assessment" indicates that in general, groundwater in the Carefree sub-basin is suitable for most uses, including domestic use. TDS concentrations were indicated to range from about 200 to 700 ppm in 1977. Fluoride concentrations ranged from 0.5 to 8.0 ppm.

III.H.1.d. Subsidence

Discussion of historical subsidence for the Carefree sub-basin was not located in published reports. Portions of this sub-basin have experienced groundwater level declines. The lack of discussion could reflect that limited data are available to quantify any subsidence or that damage or physical expression of subsidence that would prompt study with existing data has not occurred. For this reason, the geologic conditions were considered to evaluate if subsidence could occur in this area.

As described earlier in the section on groundwater level impacts, the basin fill materials include partially consolidated to consolidated sedimentary rocks. Consolidated sedimentary rocks would be anticipated to be less susceptible to subsidence. While not definitive, this indicates that there may be less potential for subsidence in the Carefree sub-basin that in the basin fill materials located in the adjacent East Salt River Valley area.

III.H.2. Details of Analysis Methodology

Because this area essentially covers a separate groundwater basin, a hydrologic inventory was developed for the portion of the Carefree sub-basin within the Cave Creek MPA, rather than for a number of sub-areas, as discussed for some of the other areas analyzed in this study.

III.H.3. Evaluation of Historical Conditions and "Calibration"

The hydrologic inventory analysis was used to evaluate groundwater conditions from about 1955 to 1999. Estimates were prepared for the components of the historical hydrologic inventory. Information presented in the 1994 ADWR report "Arizona Water Resources Assessment" indicates that major components of the hydrologic inventory for the Carefree sub-area are:

- Recharge
  - Mountain front recharge in northeast and east
  - Streambed recharge from Cave Creek in northwest
  - Recharge from ephemeral washes

- Discharge
  - Groundwater outflow in Cave Creek alluvium to the south
  - Groundwater pumping

These components were estimated for the 1955 to 1999 period based on limited data presented in the ADWR "Arizona Water Resources Assessment" and in the TMP for the Phoenix AMA. Judgment was used to extrapolate from data presented in those documents.

Average estimated groundwater levels from 1955 to 1999 based on the hydrologic inventory analysis are shown on Figure I-103 as is a selected historical groundwater level hydrograph. The hydrologic inventory shows a trend of declining groundwater levels. The hydrograph also shows decline but also has much more variability in groundwater levels. There is a limited correspondence of the levels estimated using the hydrologic inventory to the well hydrograph. It may reflect, at least in part, that the hydrologic inventory result represents an average groundwater level for the entire sub-basin, while the hydrograph reflects the level at a specific well.

III.H.4. Analysis of Alternatives

Groundwater levels were estimated for each alternative using the hydrologic inventory analysis. Ground level hydrographs are shown on Figure I-104 for all alternatives. The results of the analysis are presented in two sub-sections, which discuss: (1) the No Action Alternative; and (2) the Settlement and Non-Settlement Alternatives. The No Action Alternative serves as the basis of comparison to determine impacts for the other alternatives. The discussion of the No Action Alternative, therefore, focuses to some extent on changes in absolute groundwater level over the 2001 to 2051 period, while discussion of the other alternatives focuses on impacts in comparison to the No Action Alternative.

III.H.4.a. No Action Alternative

The sub-sections which follow discuss the effects of the No Action Alternatives on groundwater levels, groundwater quality, and subsidence.

III.H.4.a.(1). Groundwater Levels

Under the No Action Alternative, groundwater levels would rise during the early years of the analysis. That rise reflects full use of available CAP supplies to meet demands. Groundwater pumping increases over time to meet the additional demands and that increased groundwater pumping eventually results in groundwater level declines later in the analysis period. Over the entire 50-year period, groundwater levels decline by about 13 feet.

III.H.4.a.(2). Groundwater Quality

Changes in groundwater quality in the Carefree sub-basin would not be expected for the No Action Alternative. This reflects consideration that: (1) the flow pattern would probably not be modified; (2) no well-defined bodies of groundwater of differing quality at various depths were identified; and (3) CAP water is not being directly recharged.

III.H.4.a.(3). Subsidence

Under the No Action Alternative, estimated groundwater levels would decline by about 12 feet from 2001 to 2051. This small amount of estimated groundwater level decline and the limited potential for subsidence in consolidated deposits indicate that subsidence impacts would not be anticipated in the Carefree sub-basin.

III.H.4.b. Settlement and Non-Settlement Alternatives

The subsections which follow discuss the impacts of these alternatives on groundwater levels, groundwater quality, and subsidence.

III.H.4.b.(1). Groundwater Levels

The impacts of each alternative reflect the changes in the availability of CAP water under that alternative. The Non-Settlement Alternatives 2 and 3A would have the same CAP supplies and groundwater pumping amounts as the No Action Alternative. Therefore, there would not be groundwater level impacts for these alternatives relative to the No Action Alternative.

Under the Settlement Alternatives and Non-Settlement Alternatives 2 and 3B, groundwater levels would be higher than under the No Action Alternative, resulting in positive groundwater level impacts. The positive impacts reflect the additional CAP water supplies available under these alternatives. In year 2051, groundwater levels are estimated to be 58 feet higher than under the No Action Alternative (in other words, these alternatives have a positive impact of 58 feet on groundwater levels).

III.H.4.b.(2). Groundwater Quality

Changes in groundwater quality relative to the No Action Alternative in the Carefree sub-basin would not be expected for any of the alternatives. This reflects consideration that: (1) the flow pattern would probably not be greatly modified; (2) no well-defined bodies of groundwater of differing quality at various depths were identified; and (3) CAP water is not being directly recharged.

III.H.4.b.(3). Subsidence

The Non-Settlement Alternatives 2 and 3A would have the same estimated groundwater levels as the No Action Alternative. Therefore, similar to the No Action Alternative, subsidence would not be anticipated for these alternatives.

The Settlement Alternative and Non-Settlement Alternatives 1 and 3B would have higher estimated groundwater levels in year 2051 than the No Action Alternative. Subsidence would not be anticipated for these alternatives.

III.I. Chaparral Area of Fountain Hills Sub-Basin

The Chaparral City Water Company obtains groundwater from the Fountain Hills sub-basin of the Phoenix AMA. Limited data were located for that area, and the discussion presented herein is largely based on information presented in the Phoenix AMA management plans and in the 1994 ADWR report "Arizona Water Resources Assessment."

The total area of the sub-basin (which includes lands underlain by both basin fill and alluvium) is about 360 square miles. Major drainages are the perennial Verde River (which is regulated by the upstream Bartlett Dam) and the Salt River between Stewart Mountain Dam and Granite Reef Dam. There are also several intermittent drainages tributary to the Verde River. Figure I-105 shows the Chaparral/Fountain Hills MPA in relation to the Fountain Hills sub-basin of the Phoenix AMA. Groundwater conditions were evaluated for the portion of the Chaparral/Fountain Hills MPA that overlies the alluvium and basin fill.

III.I.1. Existing Groundwater Conditions

Limited information was available on existing groundwater conditions. The sub-sections which follow discuss the geology, occurrence and movement of groundwater, groundwater quality, and subsidence based on those limited data.

III.I.1.a. Geology

Groundwater occurs primarily within unconsolidated alluvium associated with the Verde River and in the deeper basin fill materials. The unconsolidated alluvium is generally about one mile wide along the Verde River and more than 90 feet thick. It consists of gravel, sand, and sandy silt.

The thickness of the basin fill varies, with the depth to bedrock exceeding 1,200 feet in the center of the valley. The basin fill deposits include fanglomerate at basin margins and grade into interbedded fine sand, silt and clay toward the center of the basin. Near the center of the basin, the materials are predominantly clays, silts, and evaporites.

In some areas, there is some hydraulic separation of the unconsolidated alluvium and the basin fill by clay materials.

III.I.1.b. Groundwater Occurrence and Movement

As noted in the available references, there are few wells in the Fountain Hills sub-basin, so that the occurrence and movement of groundwater are less well defined than many of the other areas considered in this document. Groundwater generally flows from north to south (paralleling the flow in the Verde River), and there is likely also lateral flow from the margins of the valley to the center of the valley. The 1994 ADWR "Arizona Water Resources Assessment"

indicates that this pattern of flow is probably relatively unchanged from the pre-development conditions. The ADWR Hydrologic Map Series Report 27 shows a few contours in the vicinity of the Chaparral/Fountain Hills MPA for 1991-92. Flow is generally southwesterly, including a component of flow from the Verde River toward the Chaparral area.
Information on confinement was not presented in the materials reviewed. Based on judgment, considering the relatively coarse nature of the unconsolidated alluvium, it is considered likely that groundwater in those materials would be unconfined. In the deeper basin fill deposits, it seems likely that the tendency of the deposits to become finer grained toward the center of the valley would result in a greater level of confinement in the center of the valley.

III.I.1.c. Groundwater Quality

As discussed earlier with regard to existing groundwater level conditions in the Fountain Hills sub-basin, limited data are available on existing groundwater quality conditions. The ADWR's 1994 report "Arizona Water Resources Assessment" indicates that, in general, groundwater in the Fountain Hills sub-basin is suitable for most uses, including domestic. TDS concentrations were indicated to range from about 300 to 850 ppm in the early 1980s. Fluoride concentrations ranged from 0.4 to 9.2 ppm.

III.I.1.d. Subsidence

Discussion of historical subsidence for the Carefree sub-basin was not located in published reports. Portions of this sub-basin have experienced groundwater level declines. The lack of discussion could reflect that limited data are available to quantify any subsidence, or that damage or physical expression of subsidence that would prompt study with existing data has not occurred. For this reason, the geologic conditions were considered to evaluate if subsidence could occur in this area.

As described earlier in the section on groundwater level impacts, the basin fill materials include partially consolidated to consolidated sedimentary rocks. Consolidated sedimentary rocks would be anticipated to be less susceptible to subsidence. While not definitive, this indicates that there may be less potential for subsidence in the Carefree sub-basin than in the basin fill materials located in the adjacent East Salt River Valley area.

III.I.2. Methodology

A hydrologic inventory analysis was developed for the Chaparral sub-area (corresponding to the portion of the Chaparral MPA which overlies basin fill in the Fountain Hills sub-basin). For the Chaparral sub-area, components considered include incidental recharge and groundwater underflow from the east and estimated groundwater pumping.

III.I.3. Evaluation of Historical Conditions

The hydrologic inventory analysis was used to evaluate groundwater conditions from about 1990 to 1999. Estimates were prepared for the components of the historical hydrologic inventory. Components evaluated for the historical hydrologic inventory are:

- Recharge
  - Groundwater inflows from margins of the analysis area
  - Incidental recharge

- Discharge
  - Groundwater outflows from margins of the analysis area
  - Groundwater pumping

The components of the hydrologic inventory were estimated based on limited available data and on judgment where data were not located.

Historical groundwater levels estimated using the hydrologic inventory and measured in wells are shown on Figure I-106. Both the hydrographs and the groundwater levels estimated using the hydrologic inventory analysis show relatively stable groundwater levels. This is consistent with the assessment (presented earlier) that the groundwater flow pattern has probably not changed significantly from the pre-development conditions.

III.I.4. Analysis of Alternatives

Groundwater level impacts for each alternative were estimated using the hydrologic inventory analysis. The results of the analysis are presented in two sub-sections which discuss: (1) the No Action Alternative; and (2) the Settlement and Non-Settlement Alternatives. The No Action Alternative serves as the basis of comparison to determine impacts for the other alternatives. The discussion of the No Action Alternative, therefore, focuses to some extent on changes in absolute groundwater level over the 2001 to 2051 period, while discussion of the other alternatives focuses on impacts in comparison to the No Action Alternative.

III.I.4.a. No Action Alternative

Effects on groundwater levels, groundwater quality, and subsidence for the No Action Alternative are summarized in the sub-sections which follow.

III.I.4.a.(1). Groundwater Levels

Estimated groundwater levels for the No Action Alternative are shown on Figure I-107. As shown, groundwater levels would rise by about 14 feet during the first 10 years of the projection period. This reflects relatively plentiful CAP supplies relative to demands during that period. As the demands continue to increase, the groundwater pumping would also increase, resulting in falling groundwater levels for the remainder of the period. From year 2001 to 2051, the average groundwater level would fall about 50 feet.

III.I.4.a.(2). Groundwater Quality

Changes in groundwater quality in the vicinity of Chapparal City Water Company would not be expected for the No Action Alternatives. This reflects consideration that: (1) the flow pattern would probably not be modified; (2) no well-defined bodies of groundwater of differing quality at various depths were identified; and (3) CAP water is not being directly recharged.

III.I.4.a.(3). Subsidence

Under the No Action Alternative, estimated groundwater levels would decline by about 50 feet from 2001 to 2051. There would be a potential for subsidence impacts under the No Action Alternative. However, this conclusion is tentative, given that the basin has not been stressed historically to the extent needed to confirm the subsidence potential with the same level of confidence as in the adjacent East Salt River Valley area.

III.I.4.b. Settlement and Non-Settlement Alternatives

Groundwater level, groundwater quality, and subsidence impacts for these alternatives are summarized in the sub-sections which follow.

III.I.4.b.(1). Groundwater Levels

Estimated groundwater levels for these alternatives are shown on Figure I-107. The impacts of each alternative reflect the changes in the availability of CAP water under that alternative. The Non-Settlement Alternatives 2 and 3A would have the same CAP supplies and groundwater pumping amounts as the No Action Alternative. Therefore, there would not be groundwater level impacts for these alternatives relative to the No Action Alternative.

The groundwater level trends for the Settlement Alternative and Non-Settlement Alternatives 1 and 3B are similar to the No Action Alternative, except that more plentiful CAP supplies extend the period of groundwater rise (to about 15 years) and reduce the decline in the later years. From 2001 to 2051, the average groundwater level would fall about 30 feet. The Settlement Alternative and Alternatives 1 and 3B would have a positive 20-foot impact on groundwater levels (in other words, groundwater levels would be 20 feet higher than under the No Action Alternative).

III.I.4.b.(2). Water Quality

Changes in groundwater quality in the vicinity of Chapparal City Water Company would not be expected for any of the alternatives. This reflects consideration that: (1) the flow pattern would probably not be modified; (2) no well-defined bodies of groundwater of differing quality at various depths were identified; and (3) CAP water is not being directly recharged.

III.I.4.b.(3). Subsidence

The Non-Settlement Alternatives 2 and 3A would have the same estimated groundwater levels as the No Action Alternative. Therefore, these alternatives would not have subsidence impacts (i.e., subsidence would not differ from the No Action Alternative).

The Settlement Alternative and Non-Settlement Alternatives 1 and 3B would have higher groundwater levels than the No Action Alternative. Therefore, these alternatives would have positive subsidence impacts relative to the No Action Alternative (i.e., less potential for subsidence than the No Action Alternative). However, it is noted that groundwater levels

would be about 30 feet deeper than in the No Action Alternative, so that there would still be some potential for some subsidence under these alternatives.

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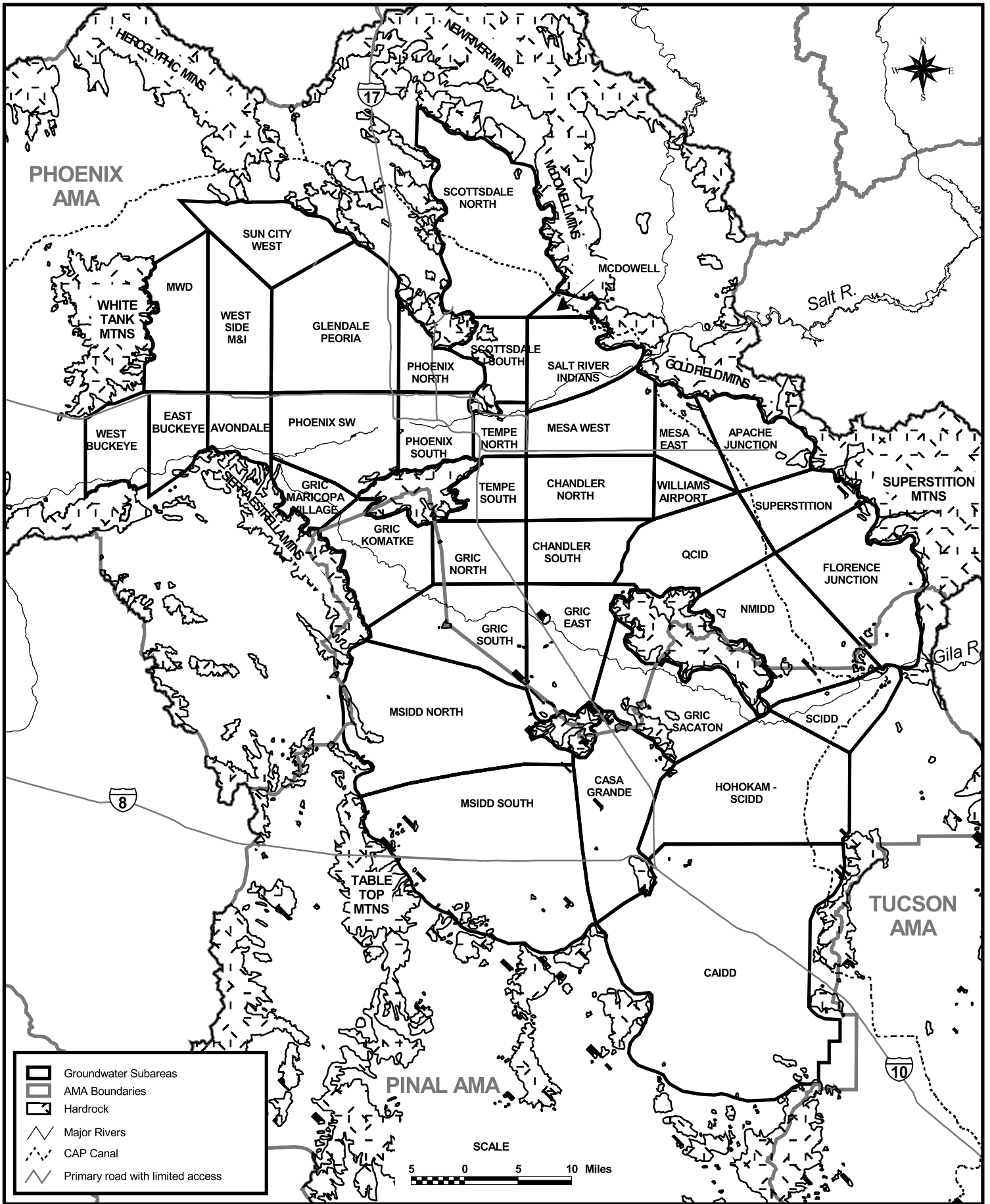

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June 2000

CAP Allocation Draft EIS

Groundwater Subareas - Pinal / Salt River Valley Area

Figure I-1

Prepared for:

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

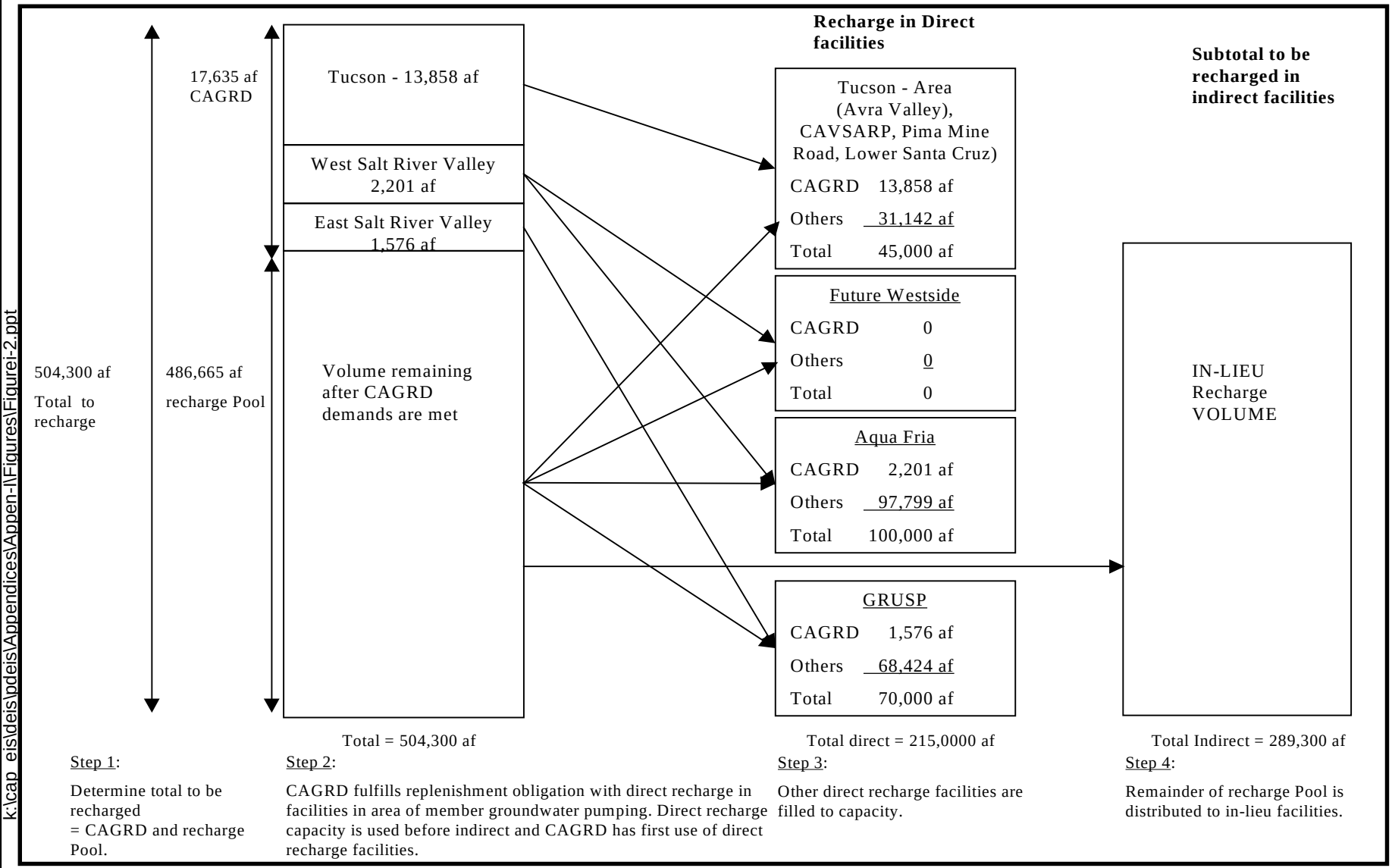
June 2000

FIGURE I-2

CAP Allocation Draft EIS

Methodology for Distributing Water from CAGRD & Recharge Pools to Direct Recharge Facilities

Example Calculation: Settlement Alternative, Year 2001



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Prepared for:

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BUREAU OF RECLAMATION

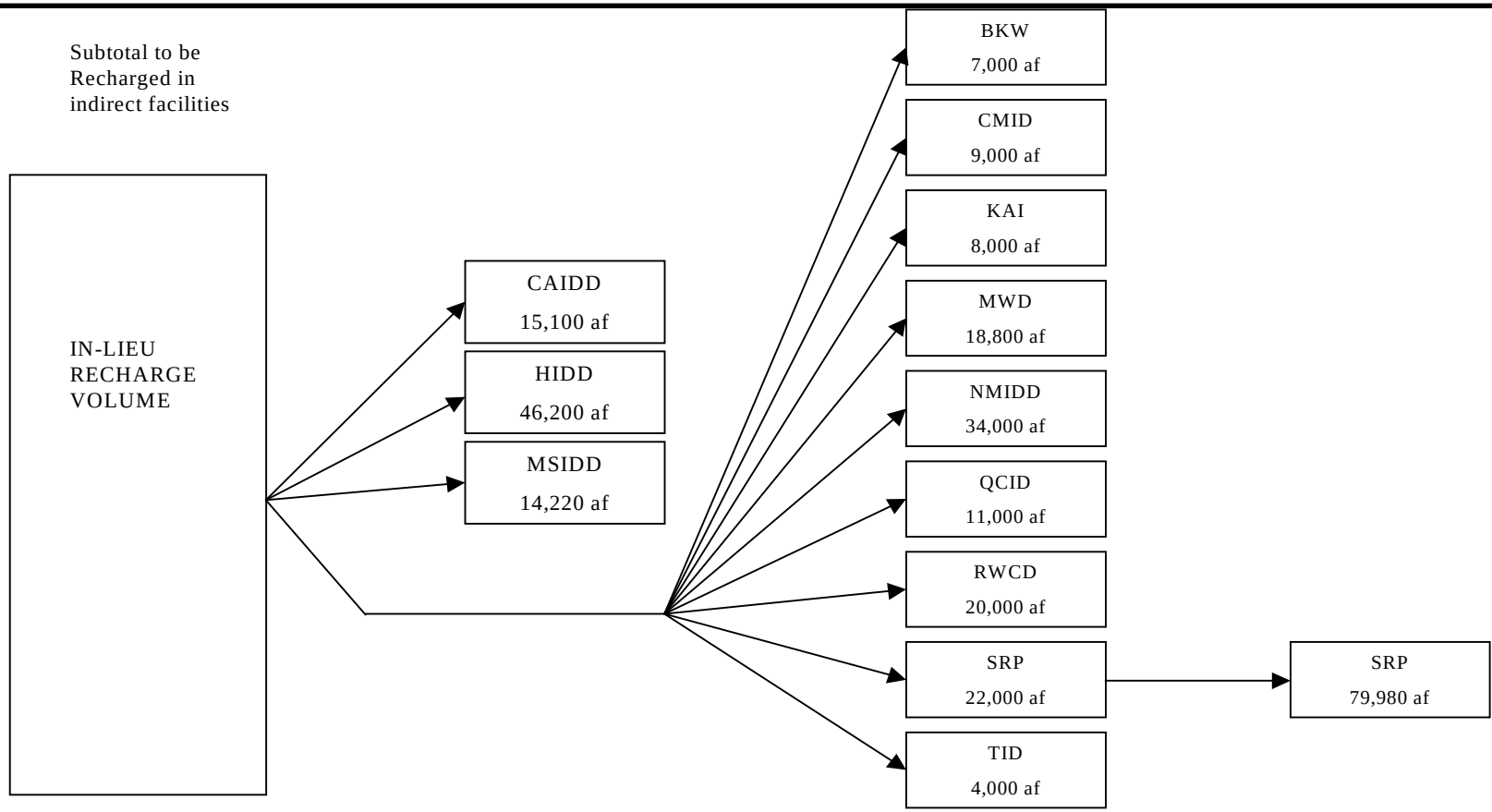
June 2000

FIGURE I-3

CAP Allocation Draft EIS

Methodology for Distributing Water from CAGRD & Recharge Pools to Indirect Recharge Facilities

Example Calculation: Settlement Alternative, Year 2001



Total indirect = 289,300 af

Three ID Subtotal = 75,520 af

Remaining ID Subtotal = 133,800 af

Recharge Pool Residual = 79,980 af

Step 5:

Remainder of Recharge Pool is distributed to indirect facilities.

Step 6:

If 2001- 2016 the Pinal County ID's use no more than approximately 75 kaf, after 2016 they use none.

Step 7:

Rest of Recharge Pool is distributed to remaining indirect facilities proportional to their 1998 deliveries and facility capacities.

Step 8:

If residual remains after all indirect facilities are satisfied remainder goes to SRP.

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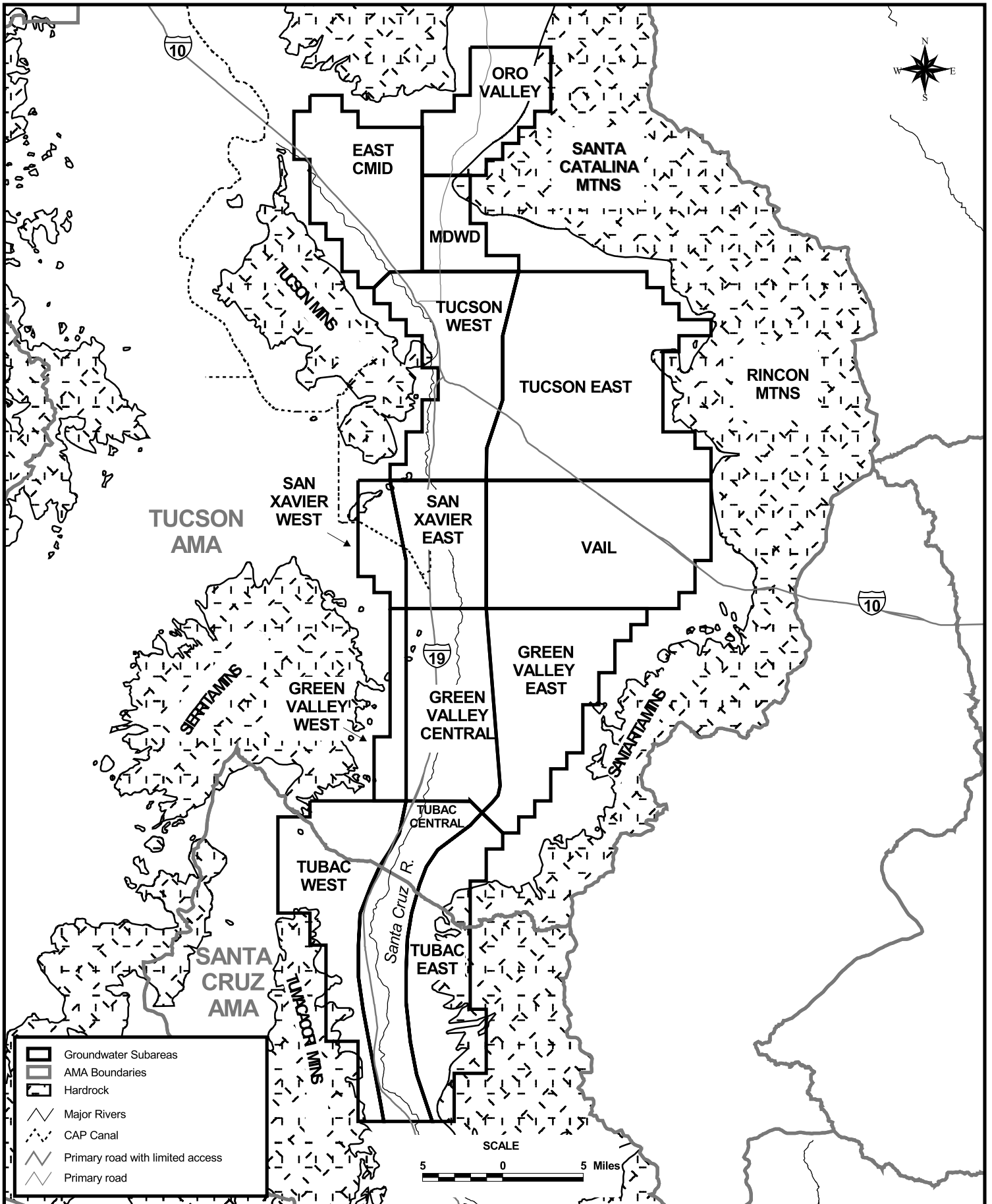

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June 2000

CAP Allocation Draft EIS

Groundwater Subareas - Tucson

Figure I-4

FIGURE I-5
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR ORO VALLEY SUB-AREA

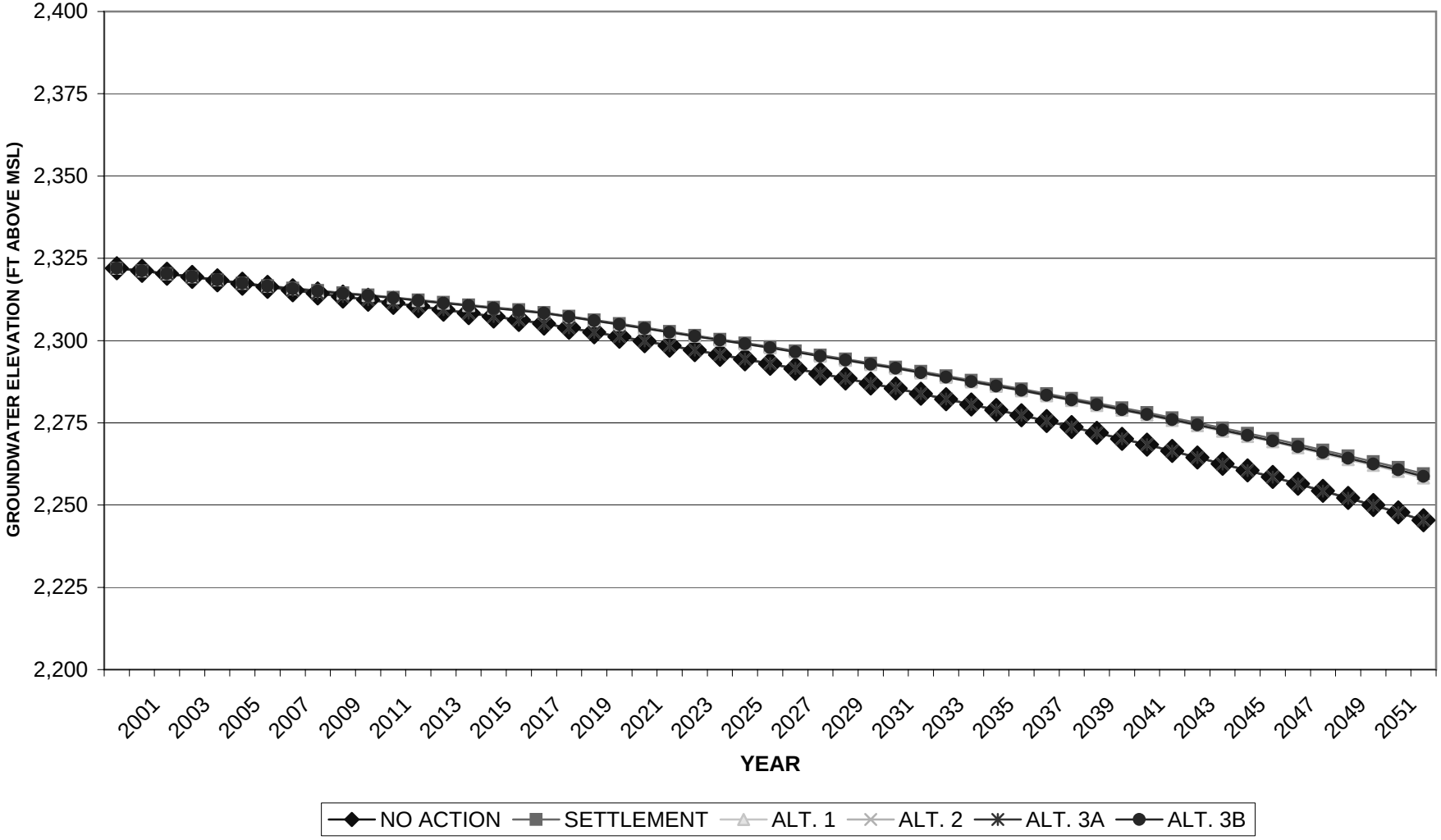


FIGURE I-6
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR EAST CMID SUB-AREA

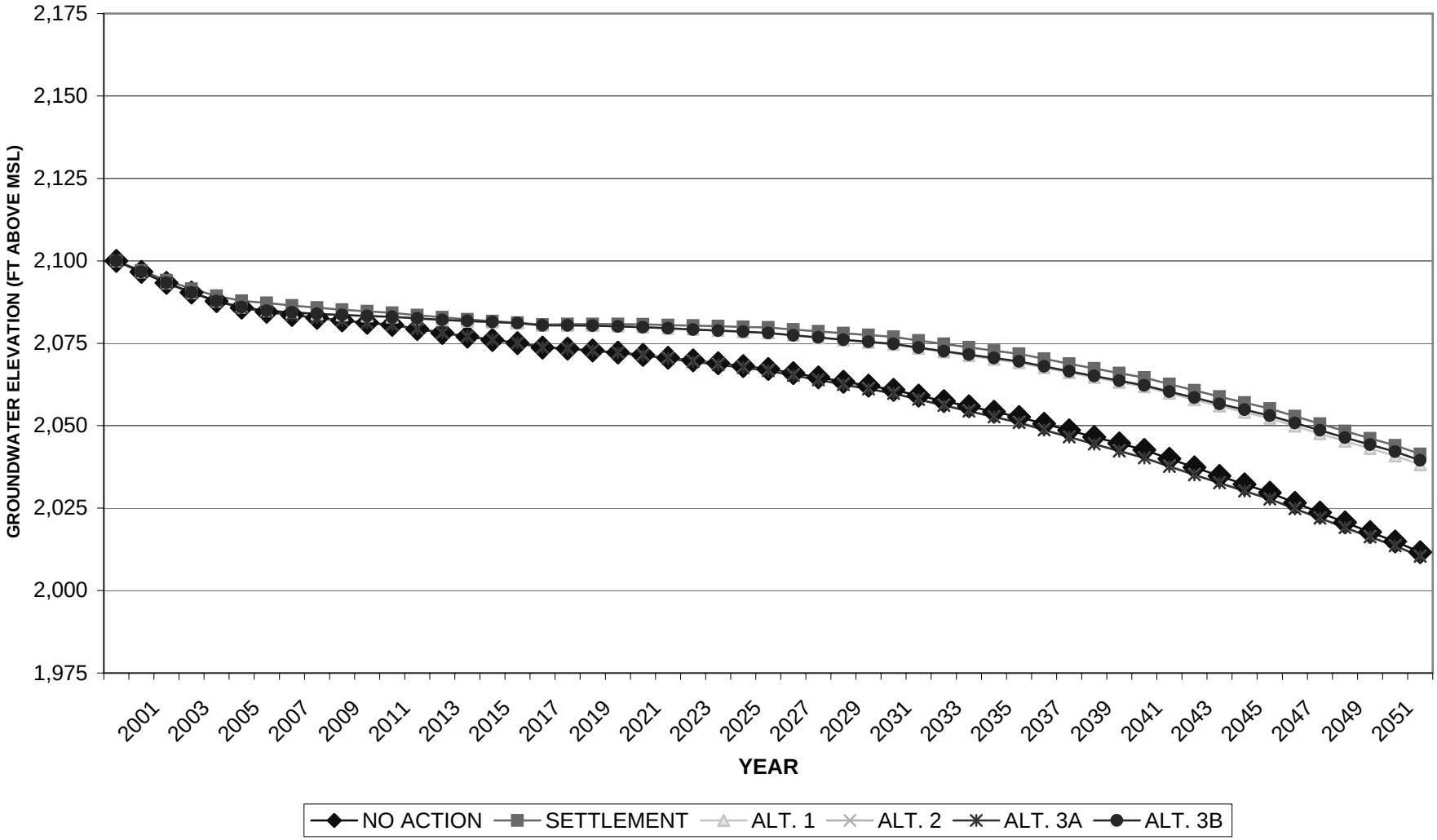


FIGURE I-7
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR MDWID SUB-AREA

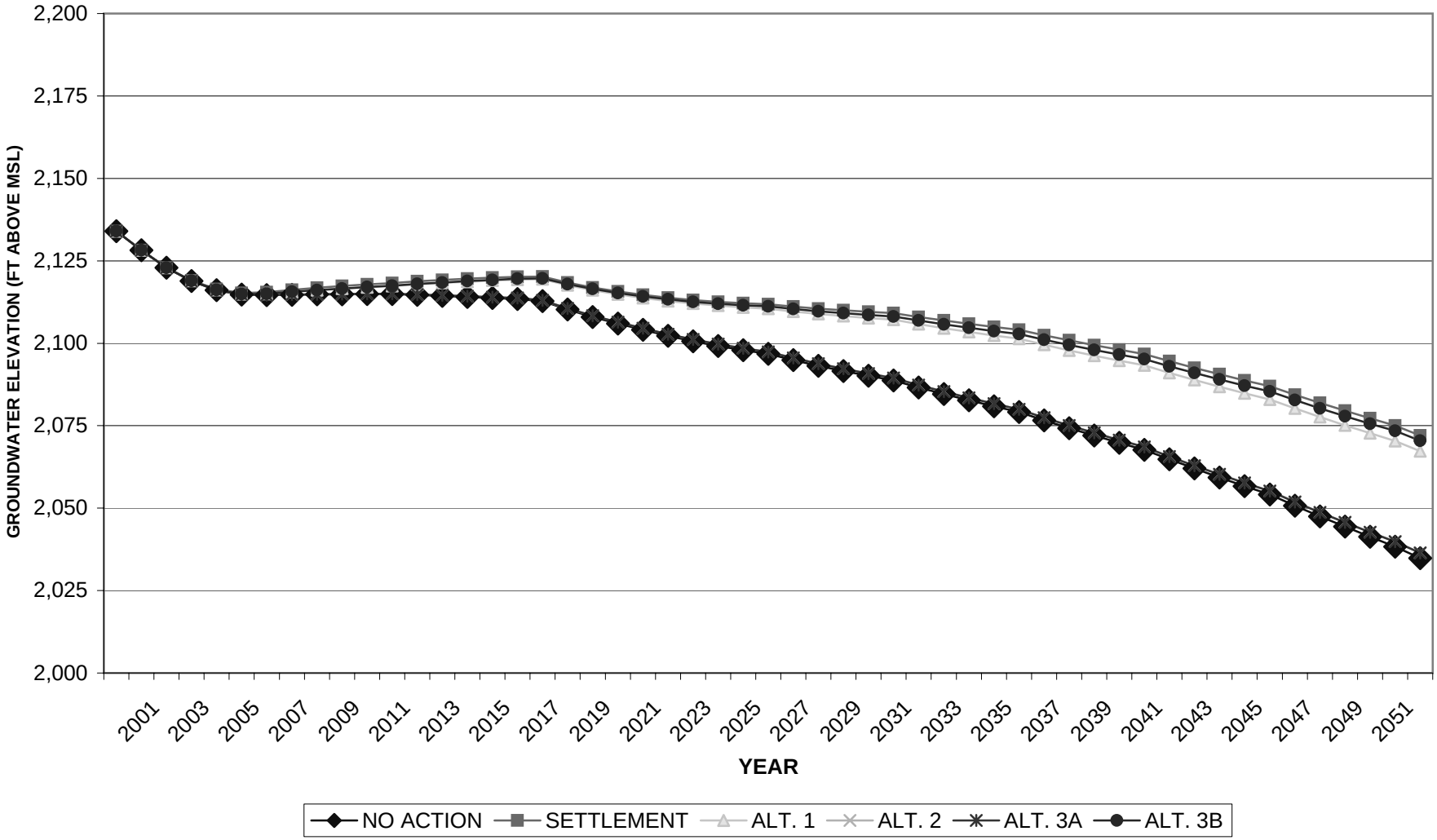


FIGURE I-8
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TUCSON WEST SUB-AREA

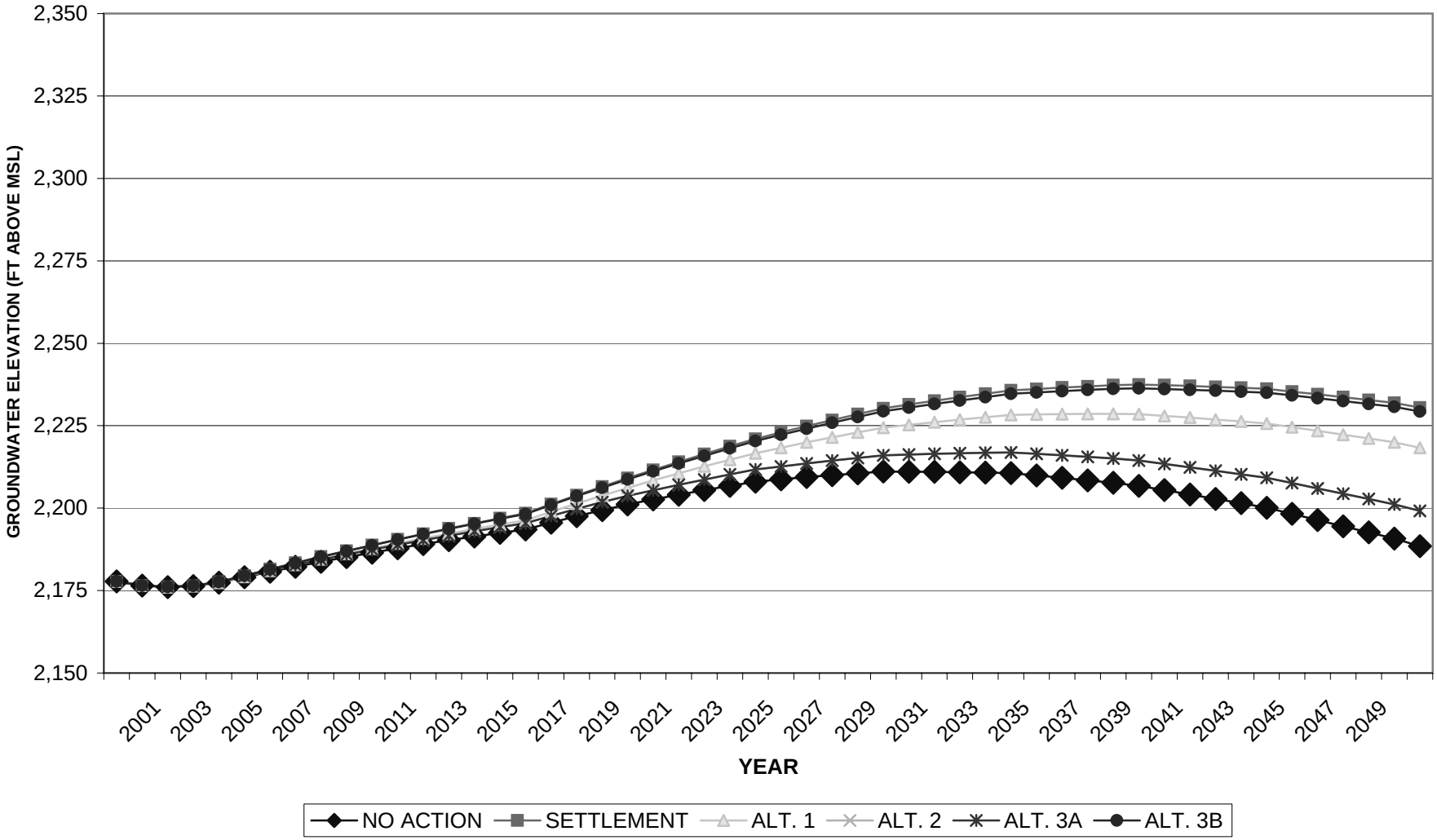


FIGURE I-9
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TUCSON EAST SUB-AREA

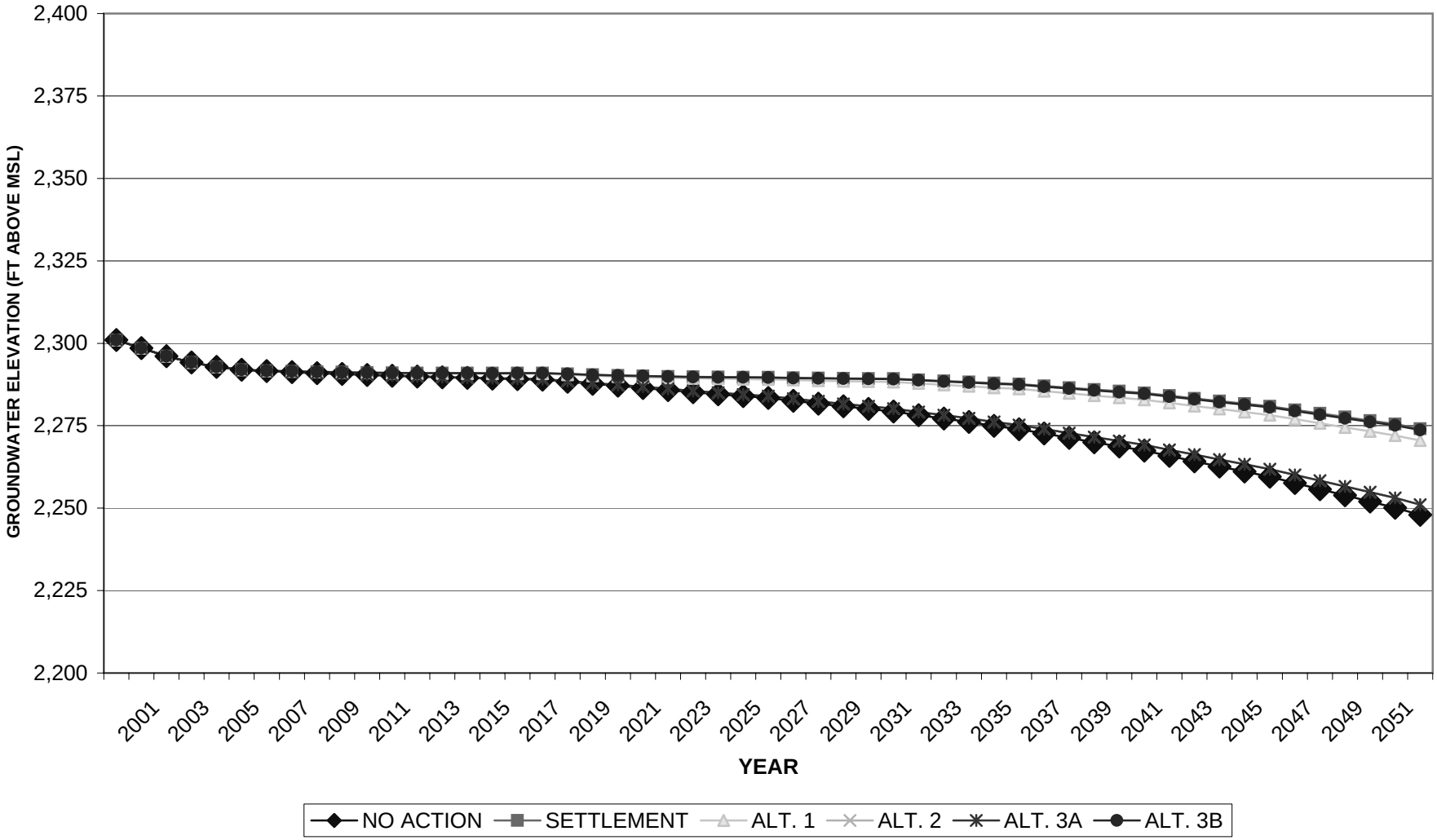


FIGURE I-10
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SAN XAVIER WEST SUB-AREA

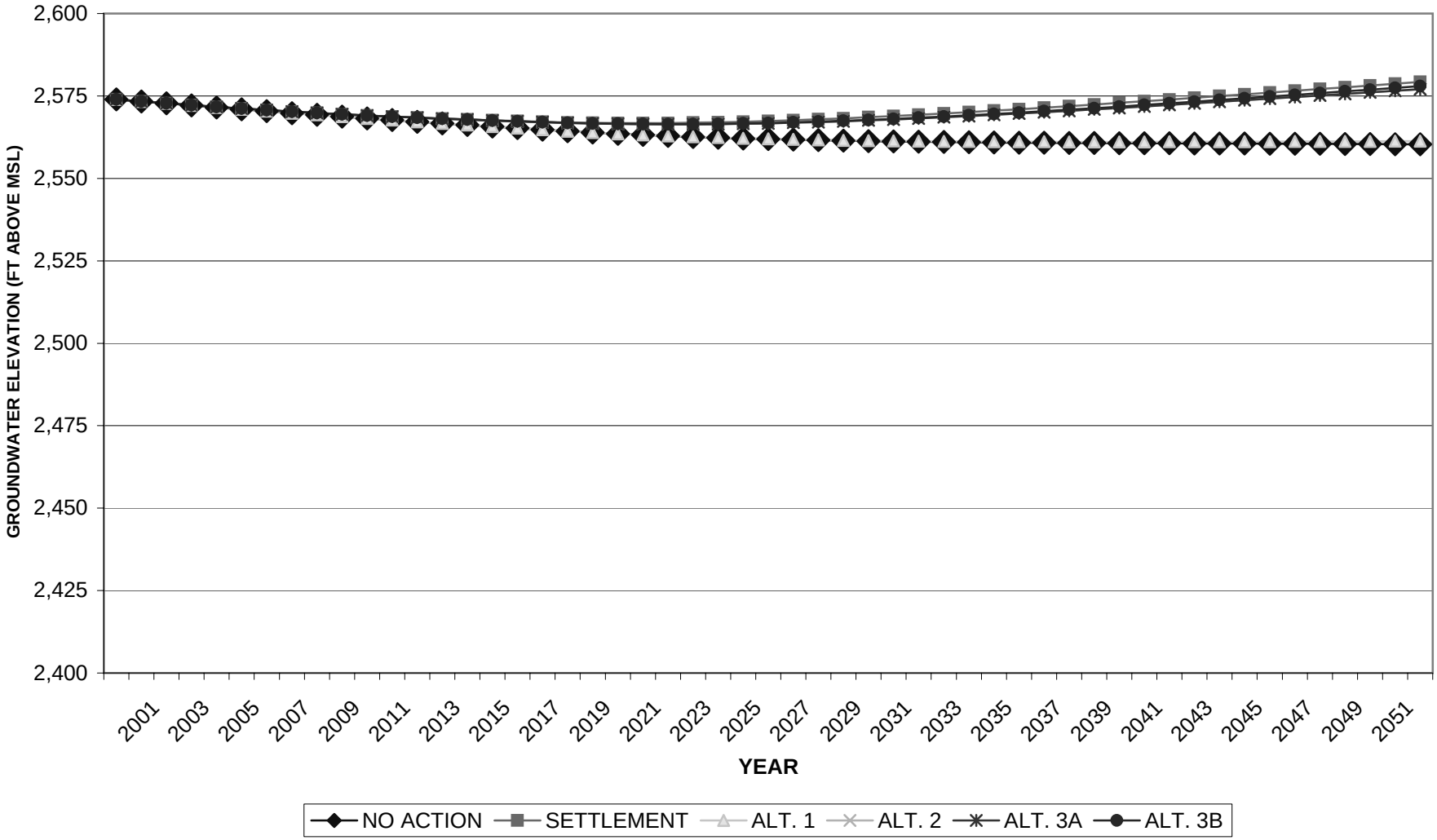


FIGURE I-11
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SAN XAVIER EAST SUB-AREA

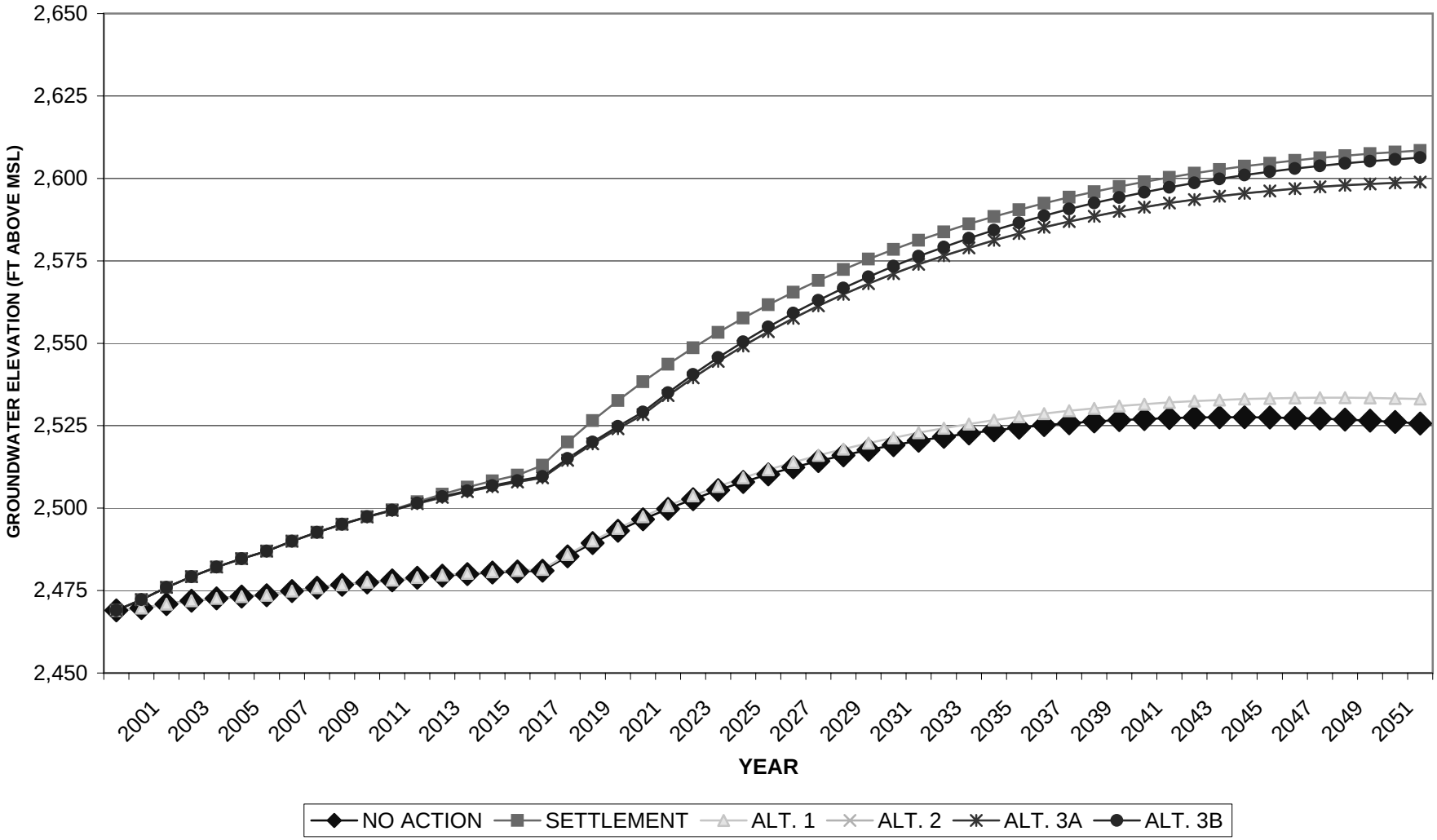


FIGURE I-12
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR VAIL SUB-AREA

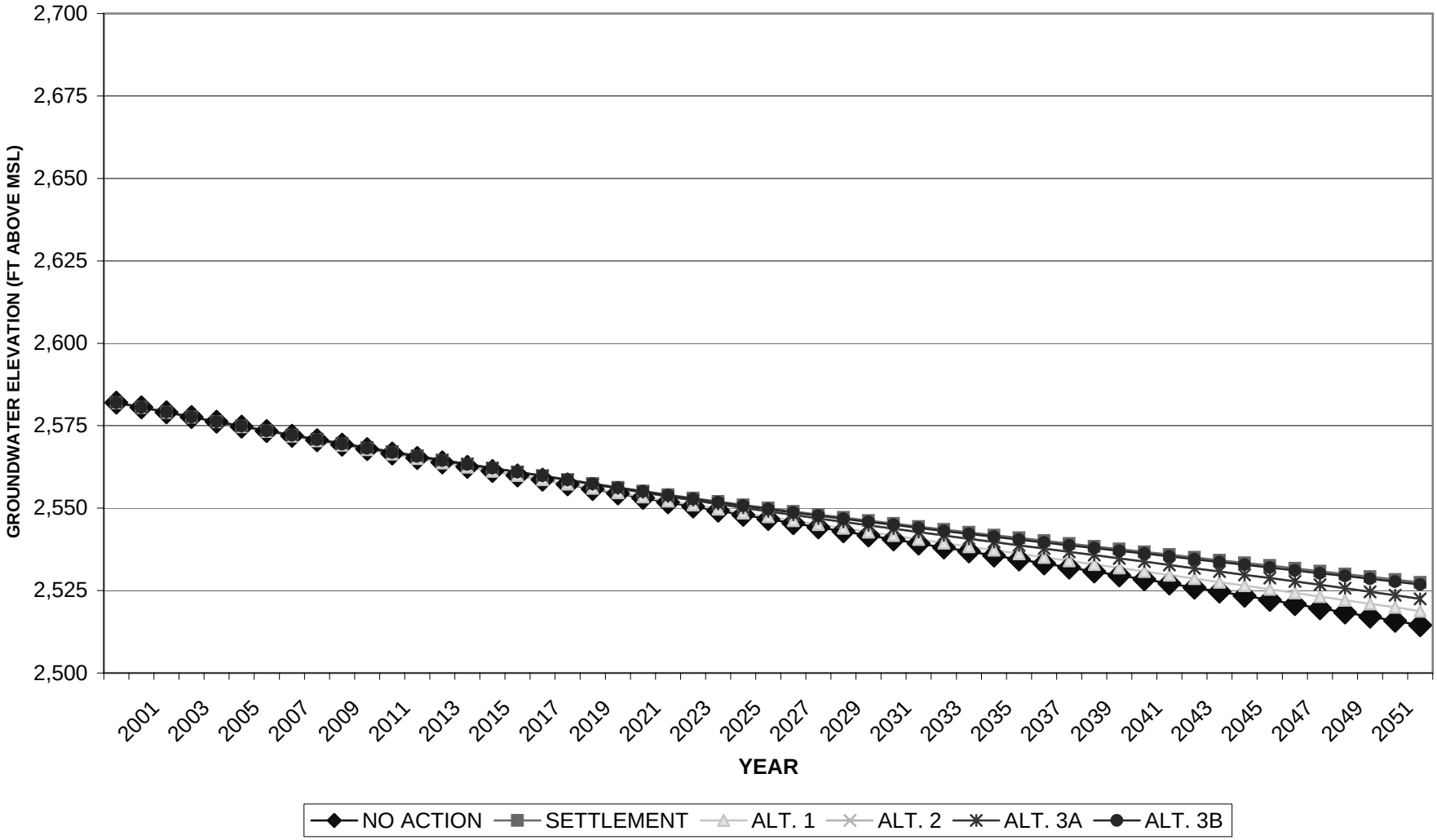


FIGURE I-13
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GREEN VALLEY WEST SUB-AREA

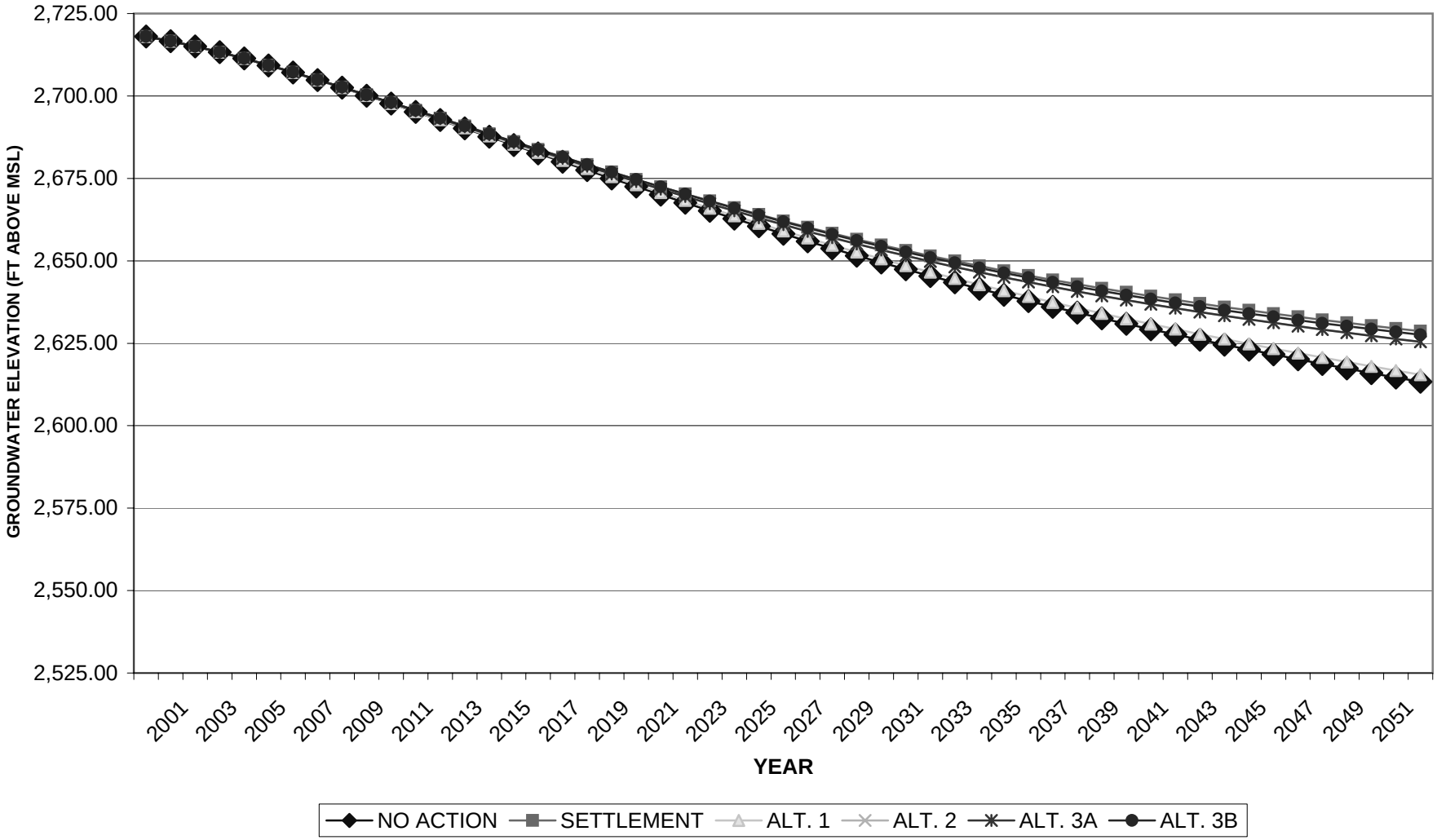


FIGURE I-14
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GREEN VALLEY CENTRAL SUB-AREA

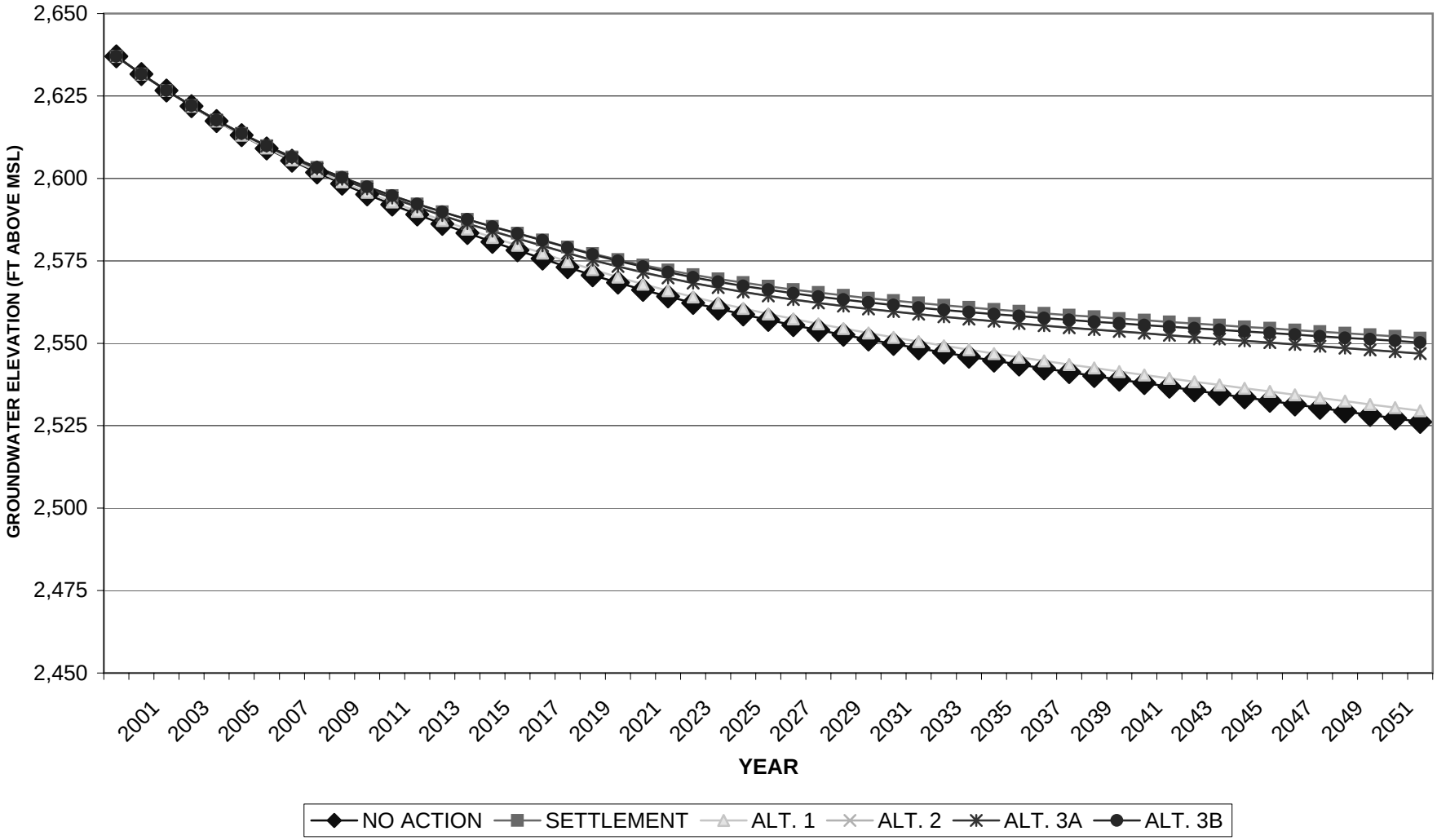


FIGURE I-15
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GREEN VALLEY EAST SUB-AREA

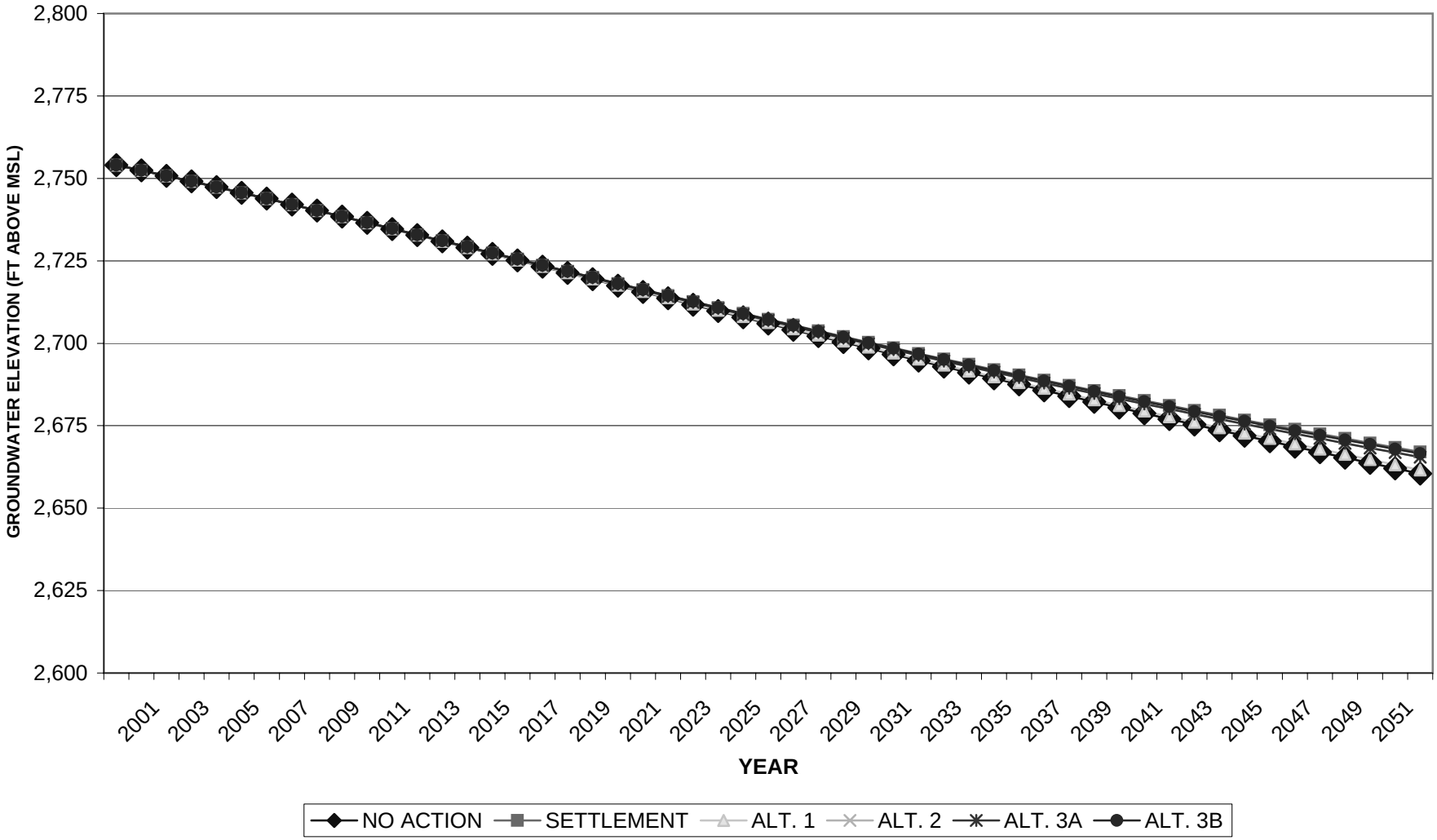


FIGURE I-16
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TUBAC WEST SUB-AREA

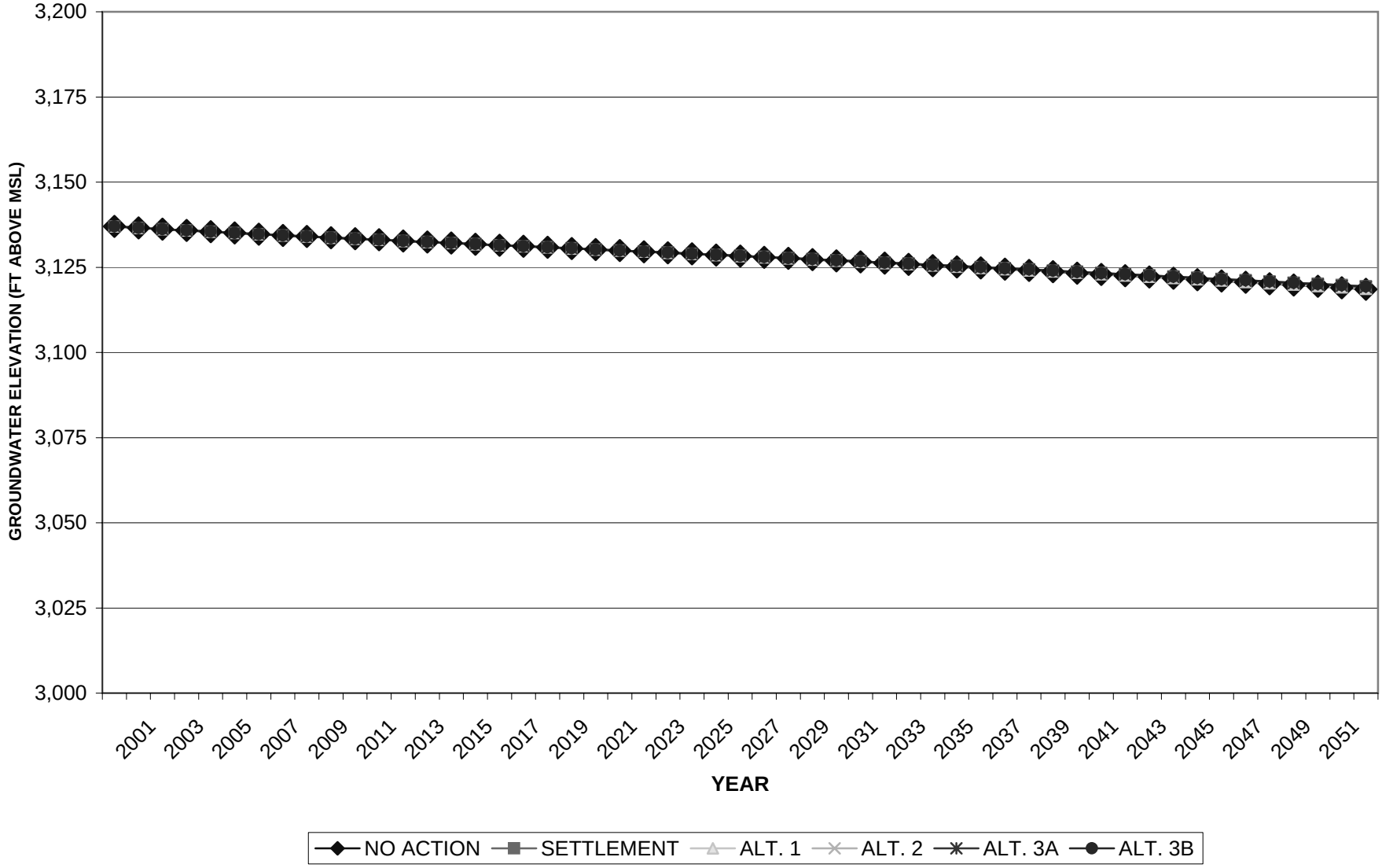


FIGURE I-17
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TUBAC CENTRAL SUB-AREA

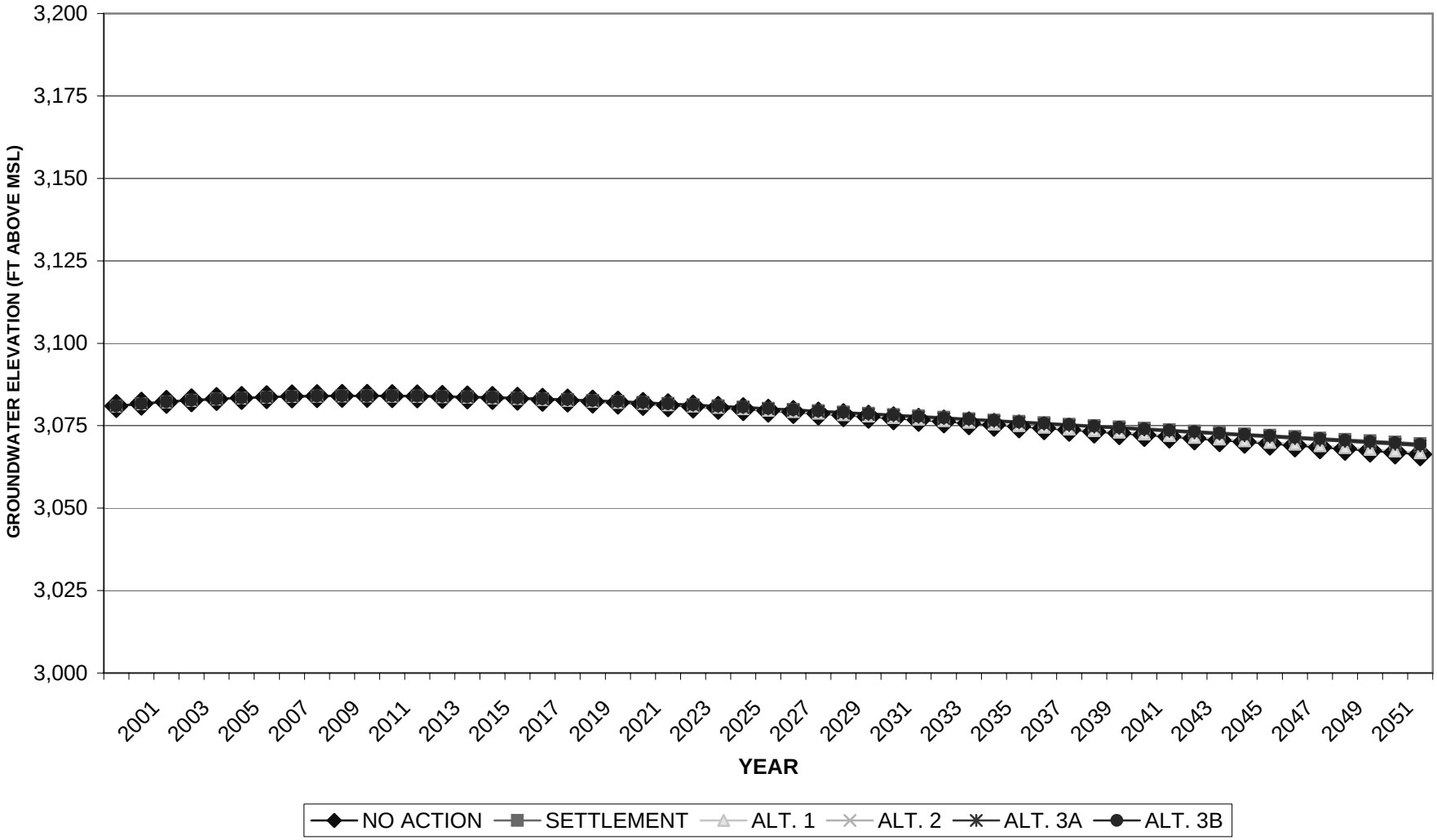
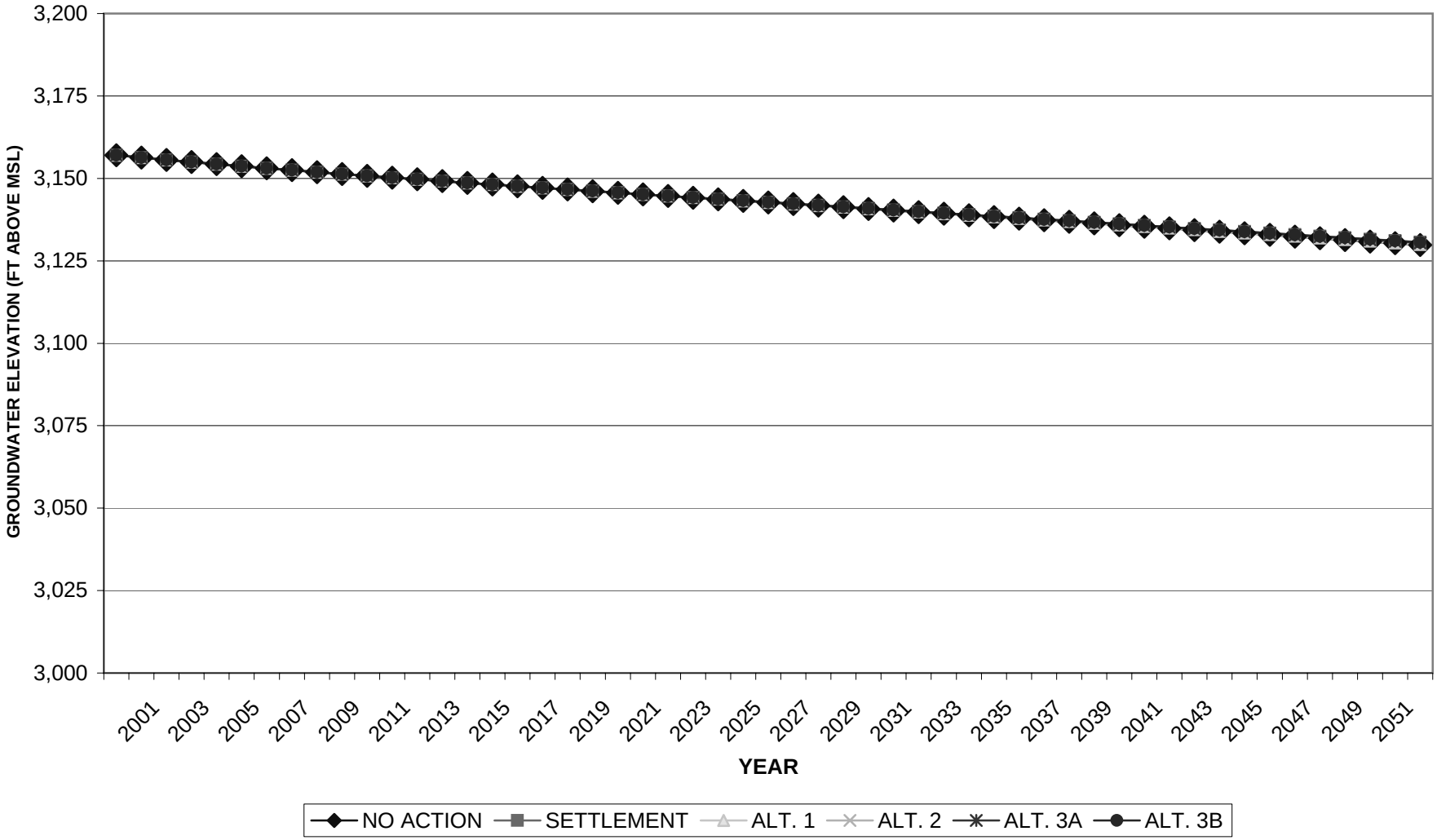
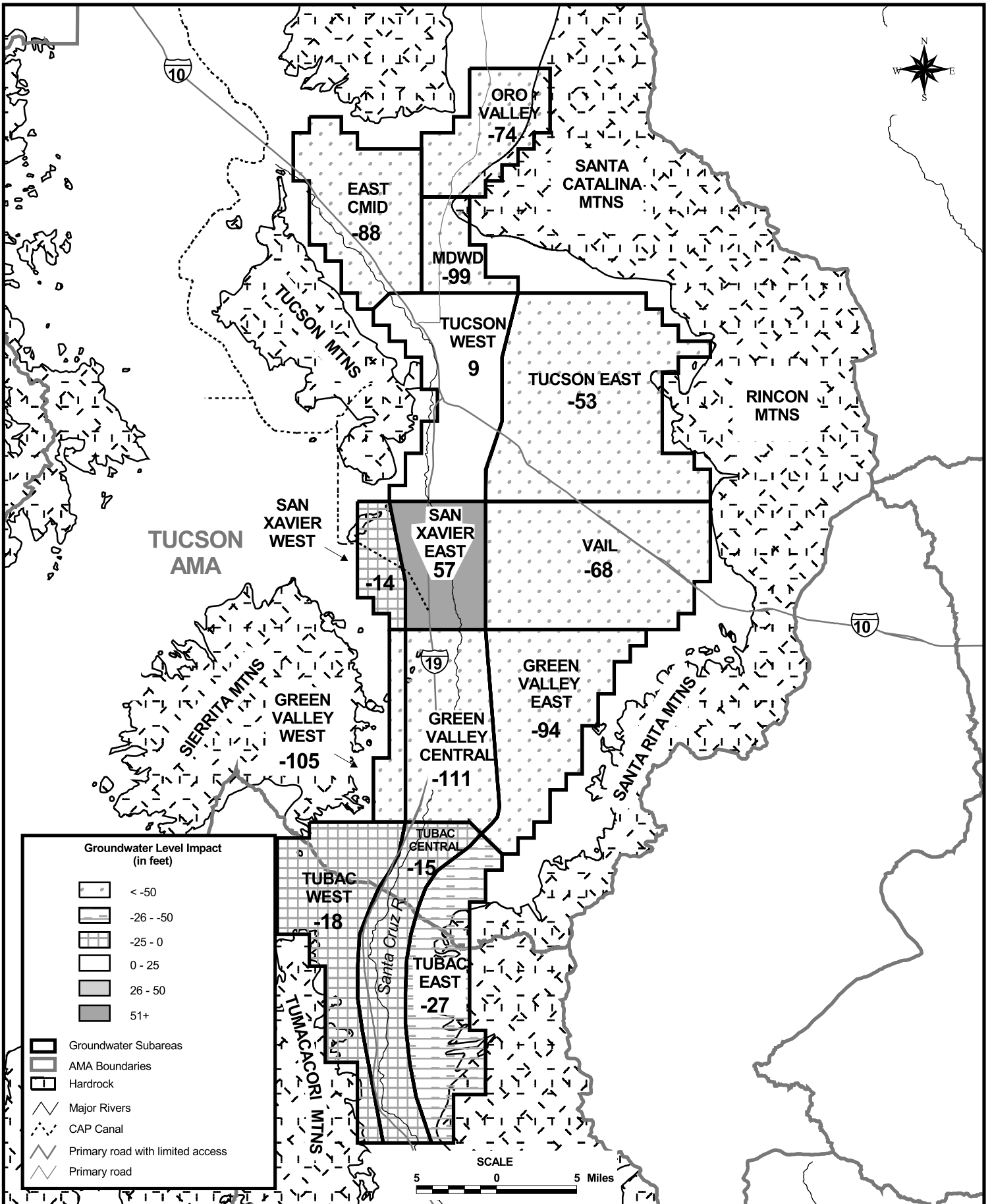


FIGURE I-18
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TUBAC EAST SUB-AREA





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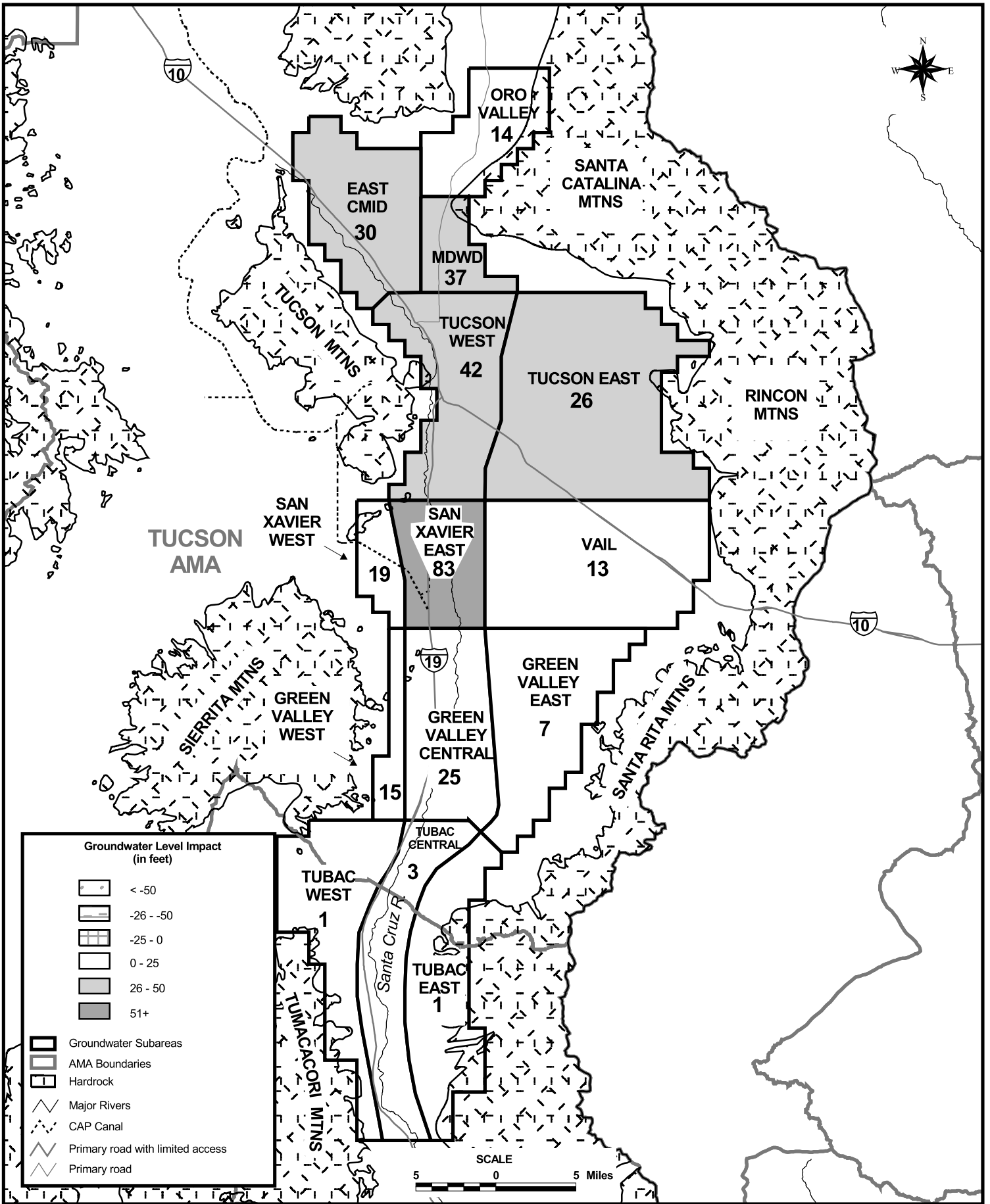
Change in Groundwater Level in the Tucson Area from 2001 to 2051 for the No Action Alternative

Figure I-19



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Groundwater Level Impacts of Settlement Alternative for Year 2051 in the Tucson Area

June 2000

Figure I-20

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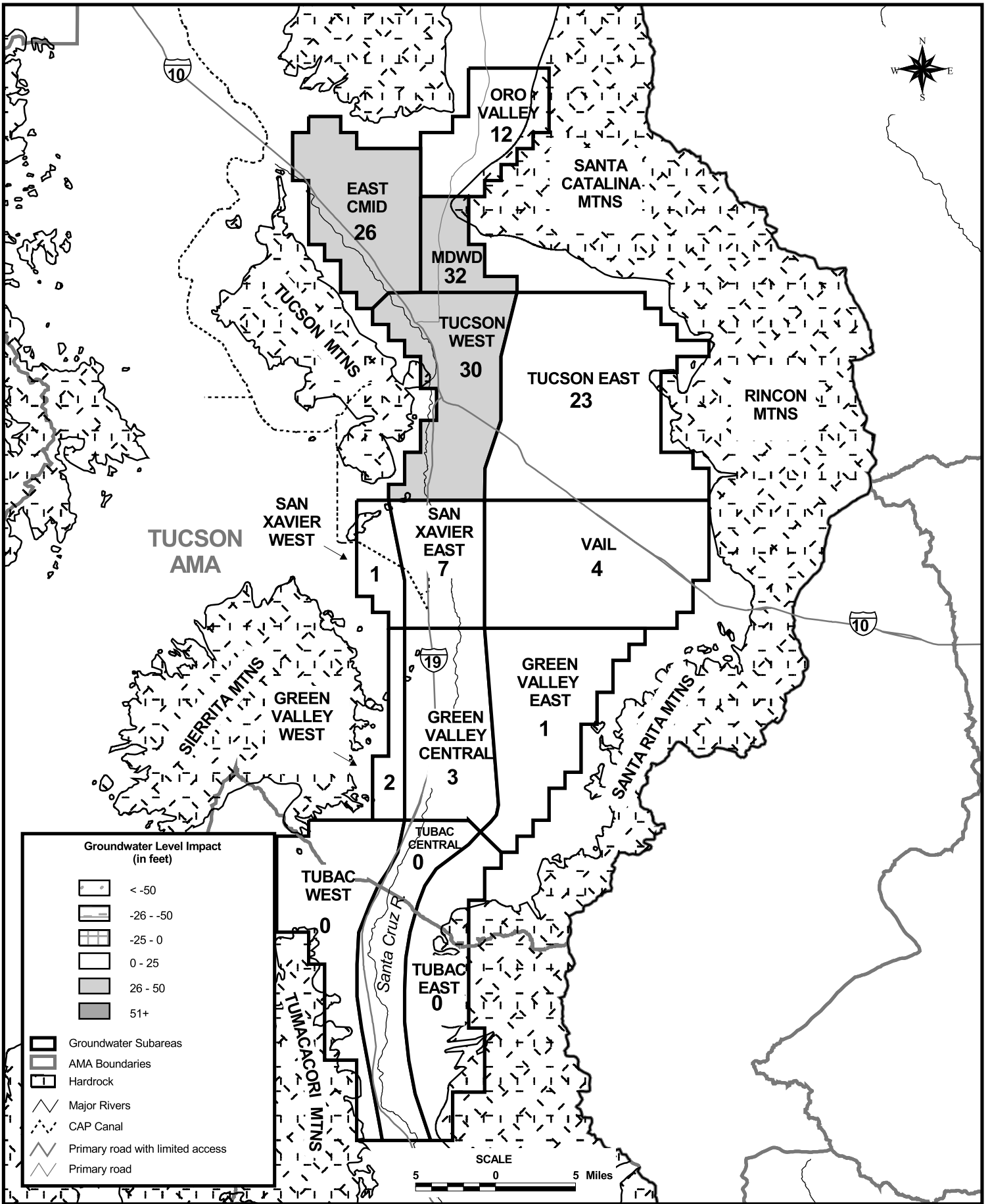

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Groundwater Level Impacts of Non - Settlement Alternative 1 for Year 2051 in the Tucson Area

June 2000

Figure I-21

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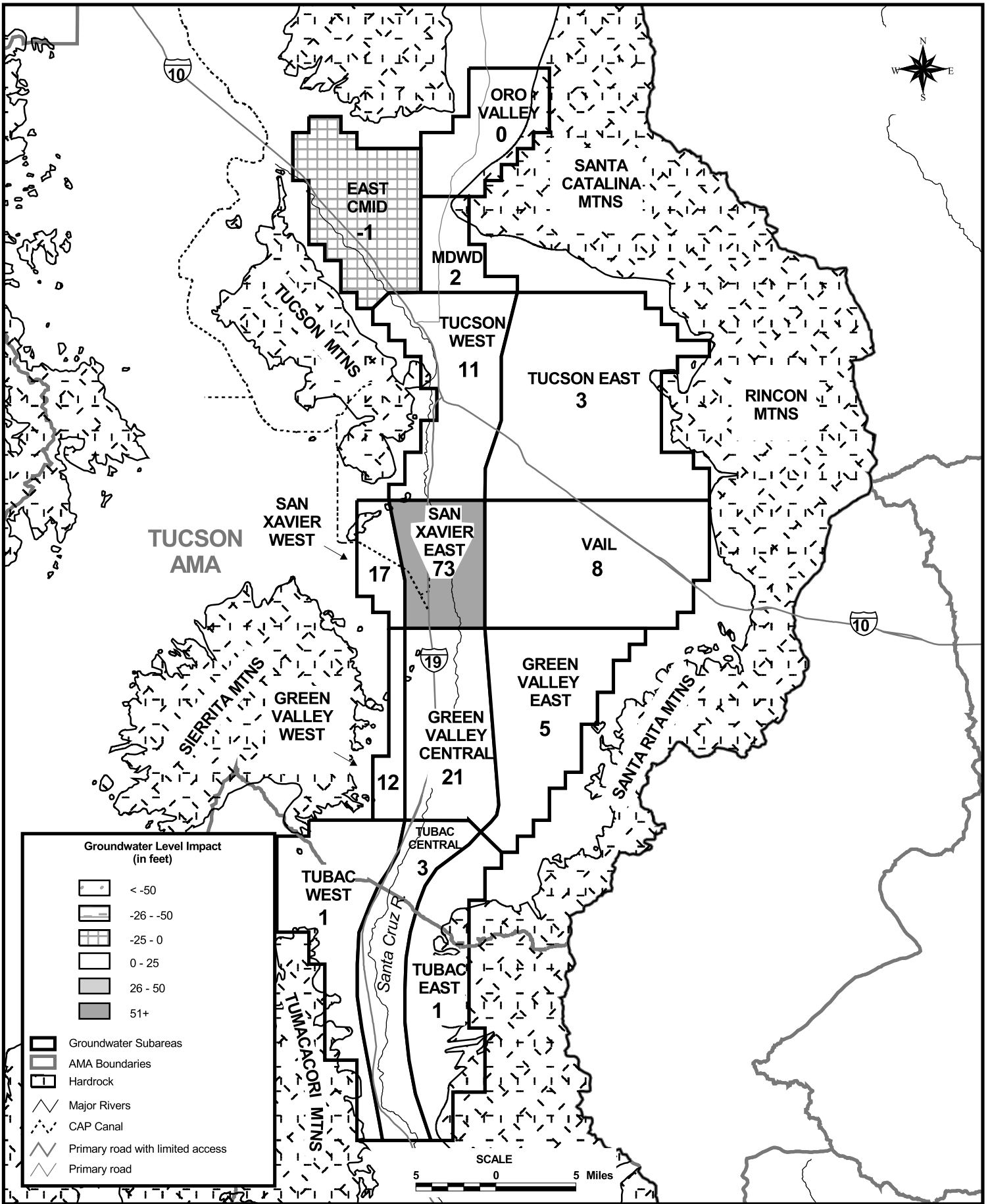

CAP Allocation Draft EIS

Groundwater Level Impacts of Non - Settlement Alternative 2 for Year 2051 in the Tucson Area

Figure I-22

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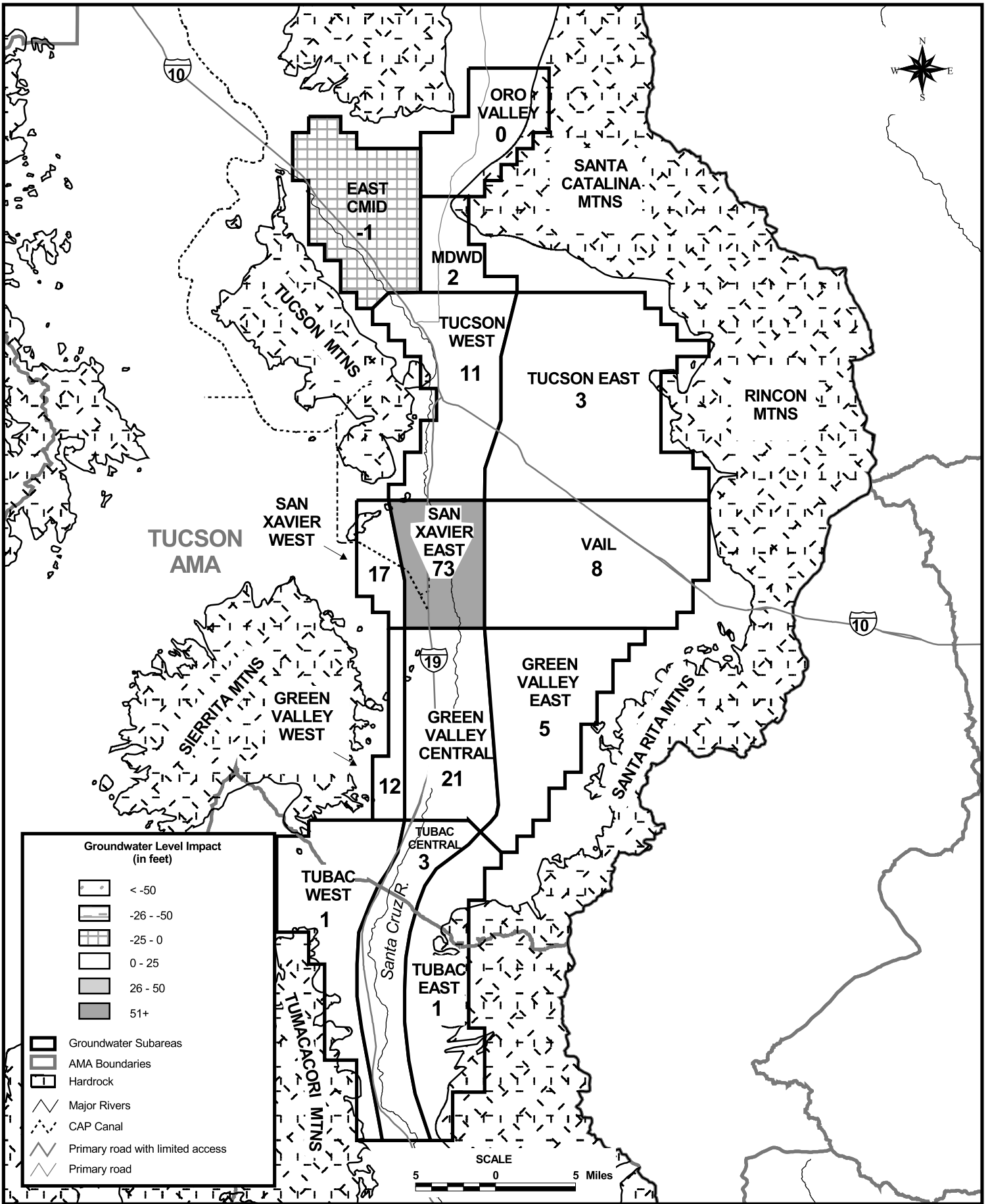

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Groundwater Level Impacts of Non - Settlement Alternative 3A for Year 2051 in the Tucson Area

June 2000

Figure I-23

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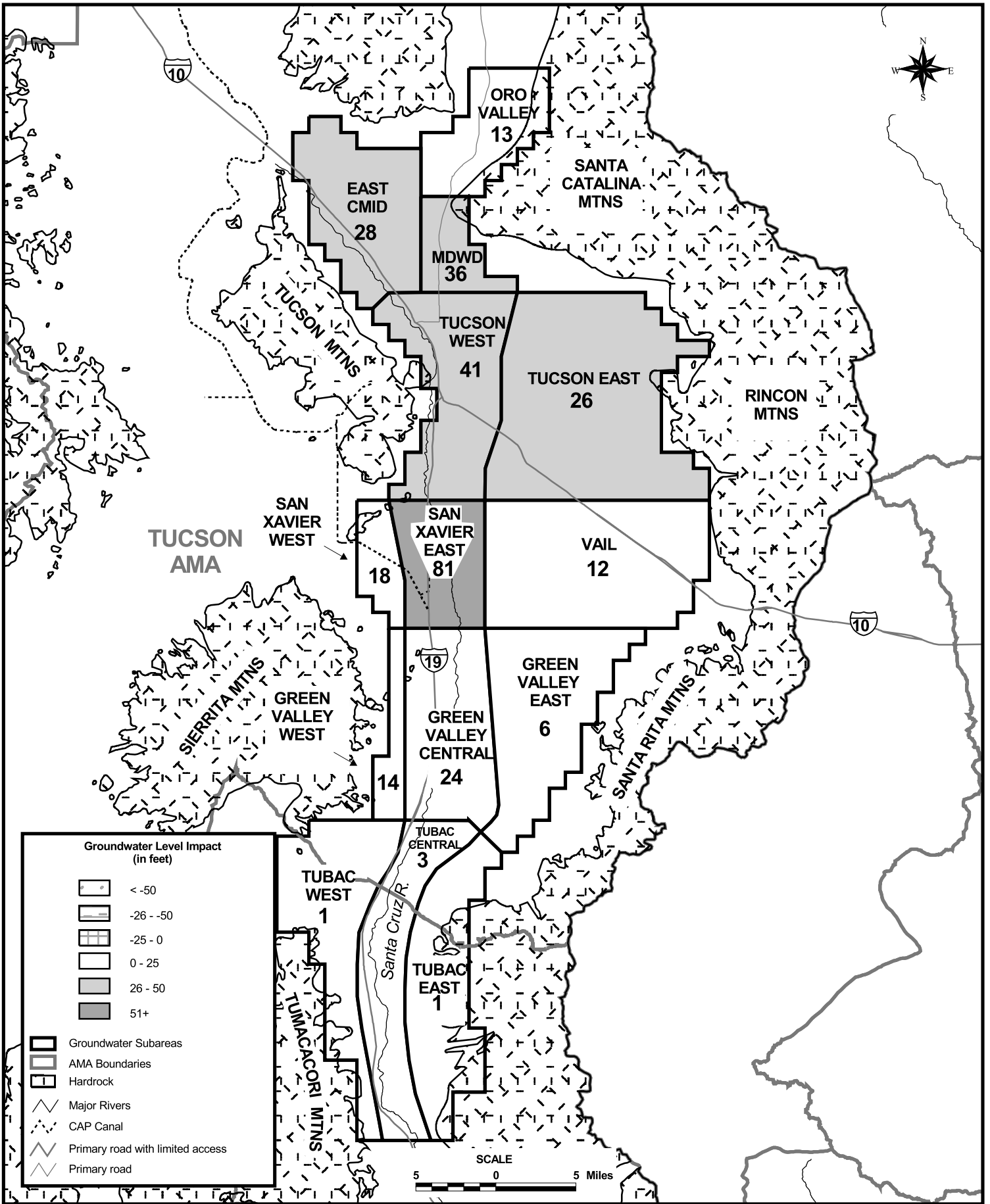

CAP Allocation Draft EIS

Groundwater Level Impacts of Non - Settlement Alternative 3B for Year 2051 in the Tucson Area

June 2000

Figure I-24

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Figure I-25
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in San Xavier East and Green Valley Central Sub-Areas to San Xavier District CAP Use

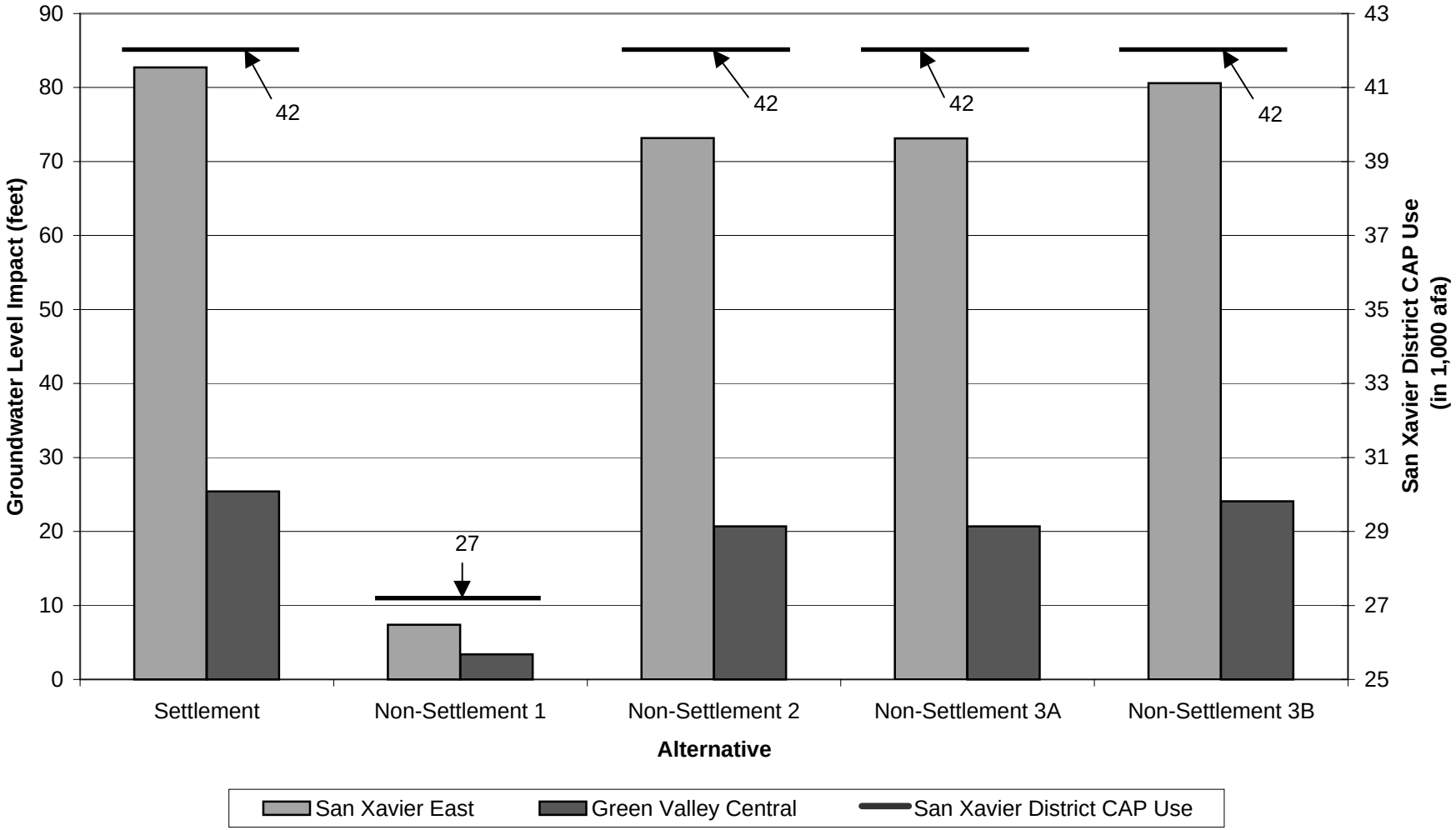
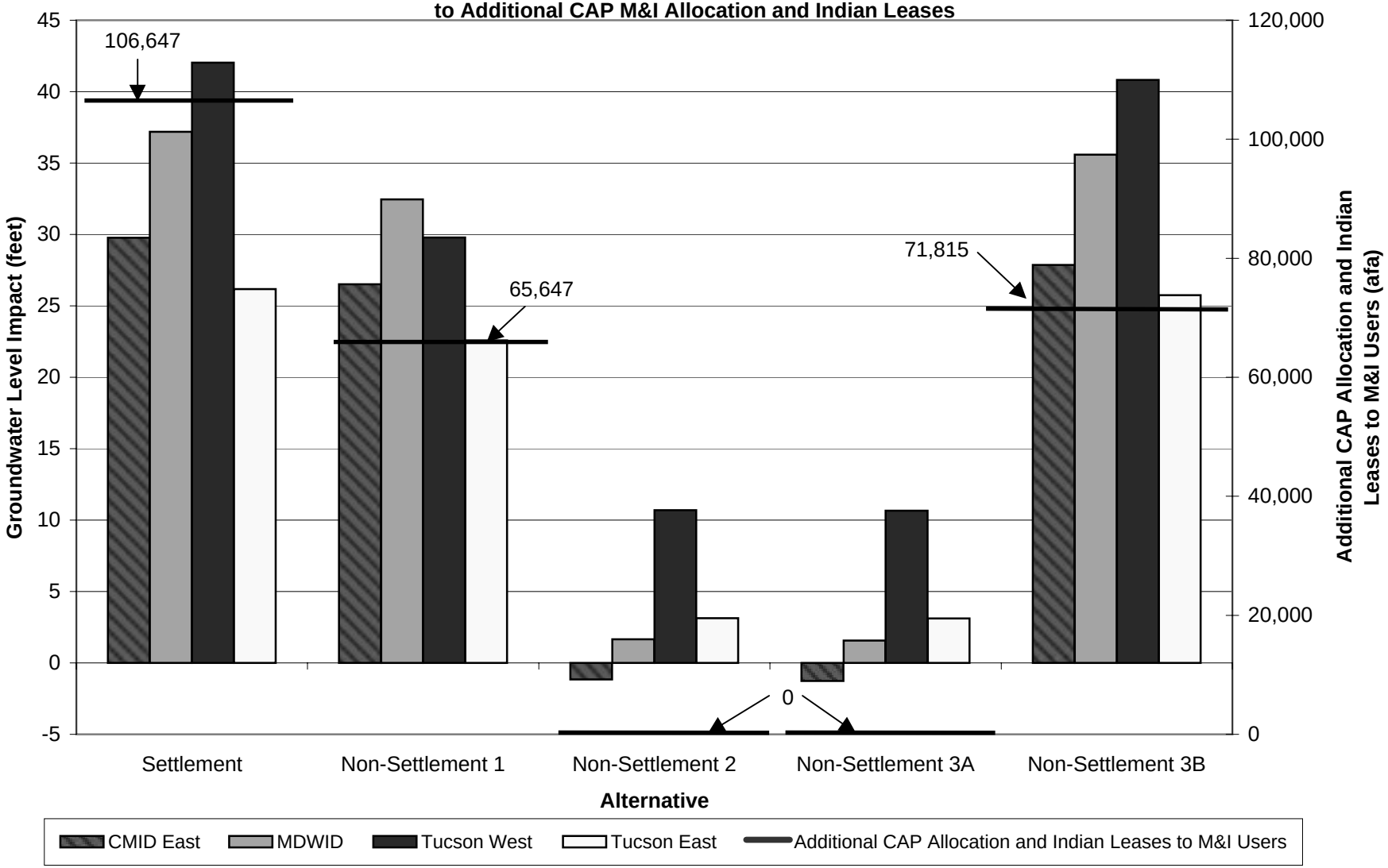
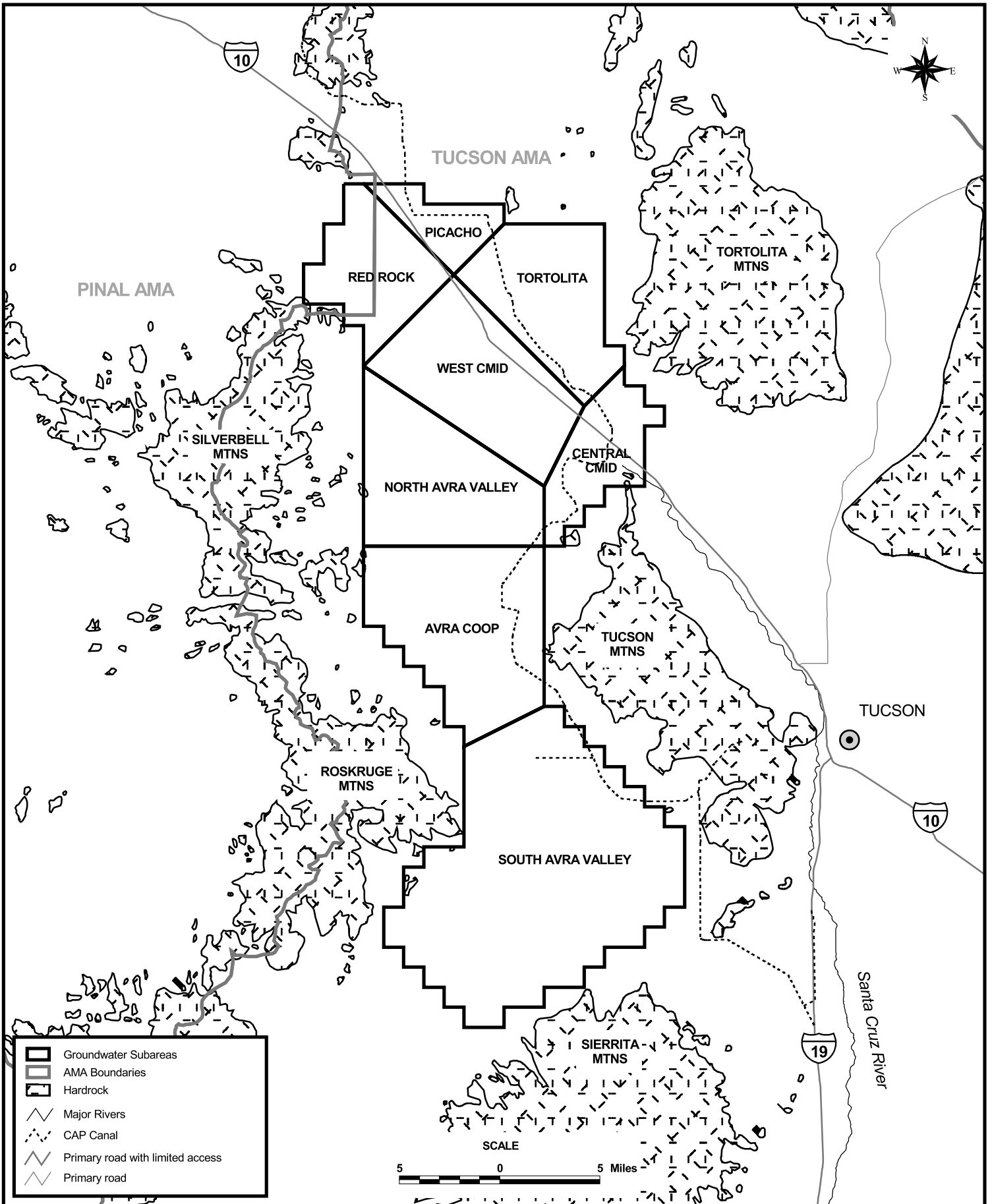


FIGURE I-26
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected Subareas in the Tucson Area to Additional CAP M&I Allocation and Indian Leases





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Groundwater Subareas - Avra Valley

Figure I-27

FIGURE I-28
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR PICACHO SUB-AREA

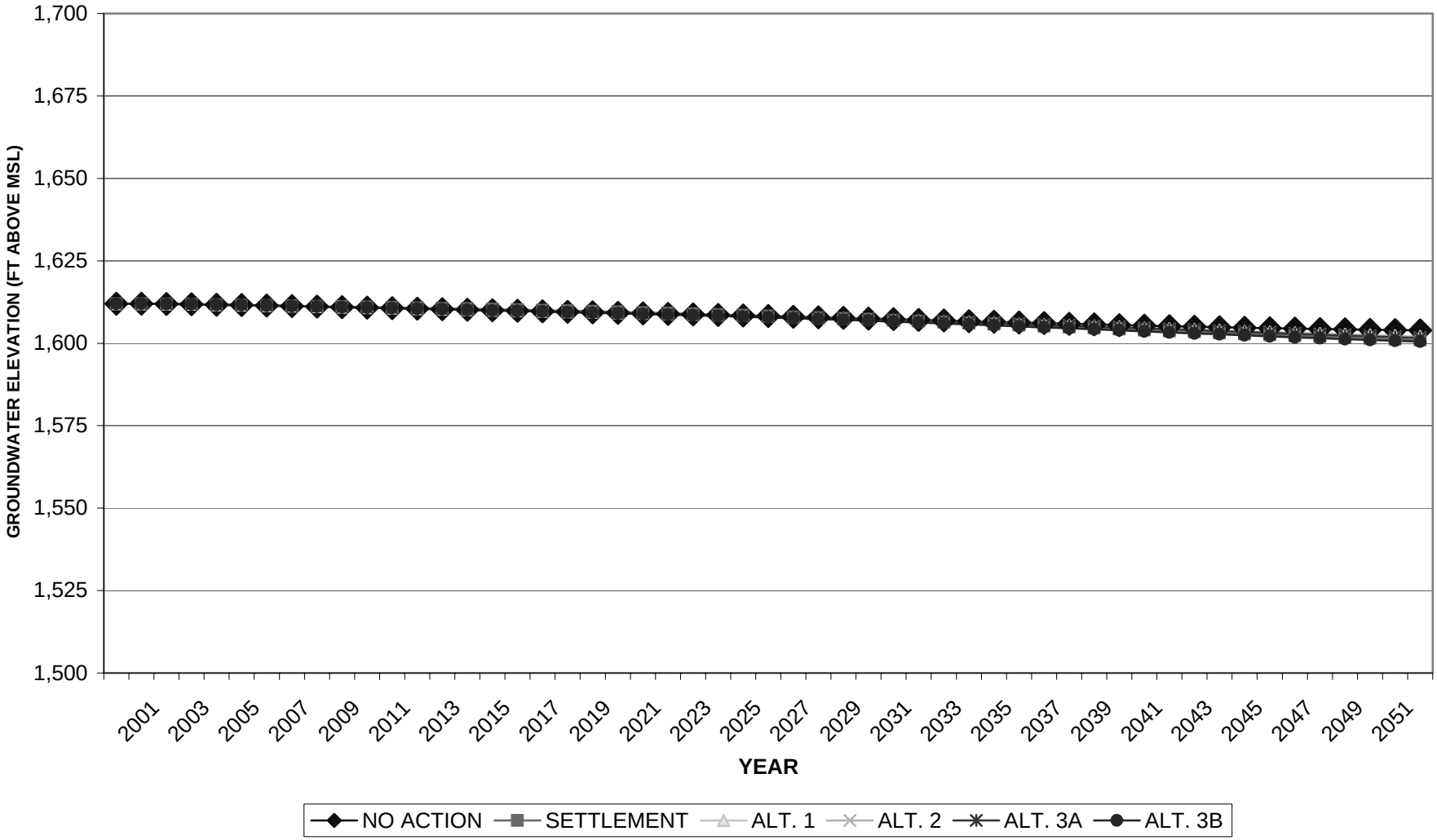


FIGURE I-29
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TORTOLITA SUB-AREA

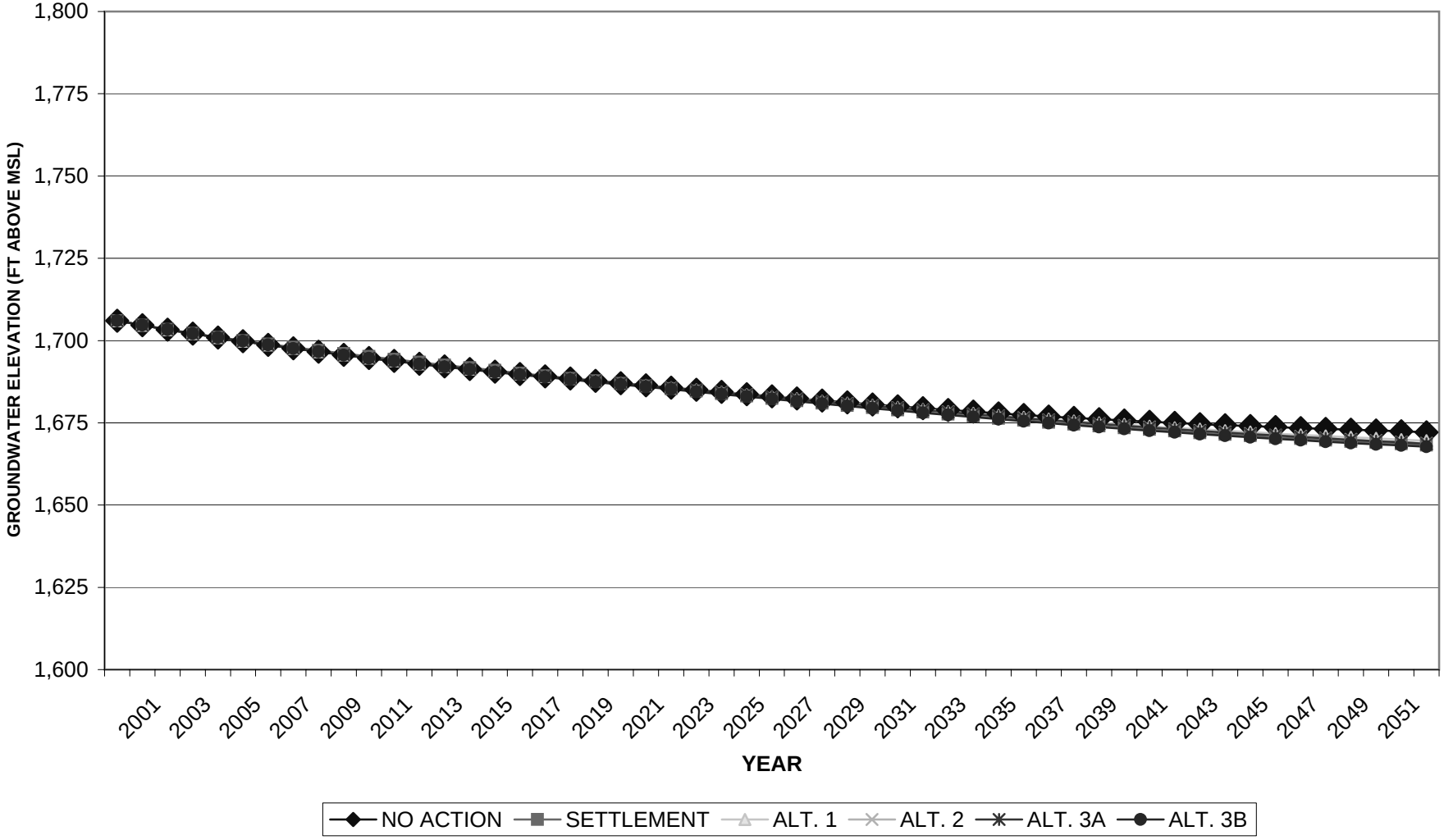


FIGURE I-30
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR RED ROCK SUB-AREA

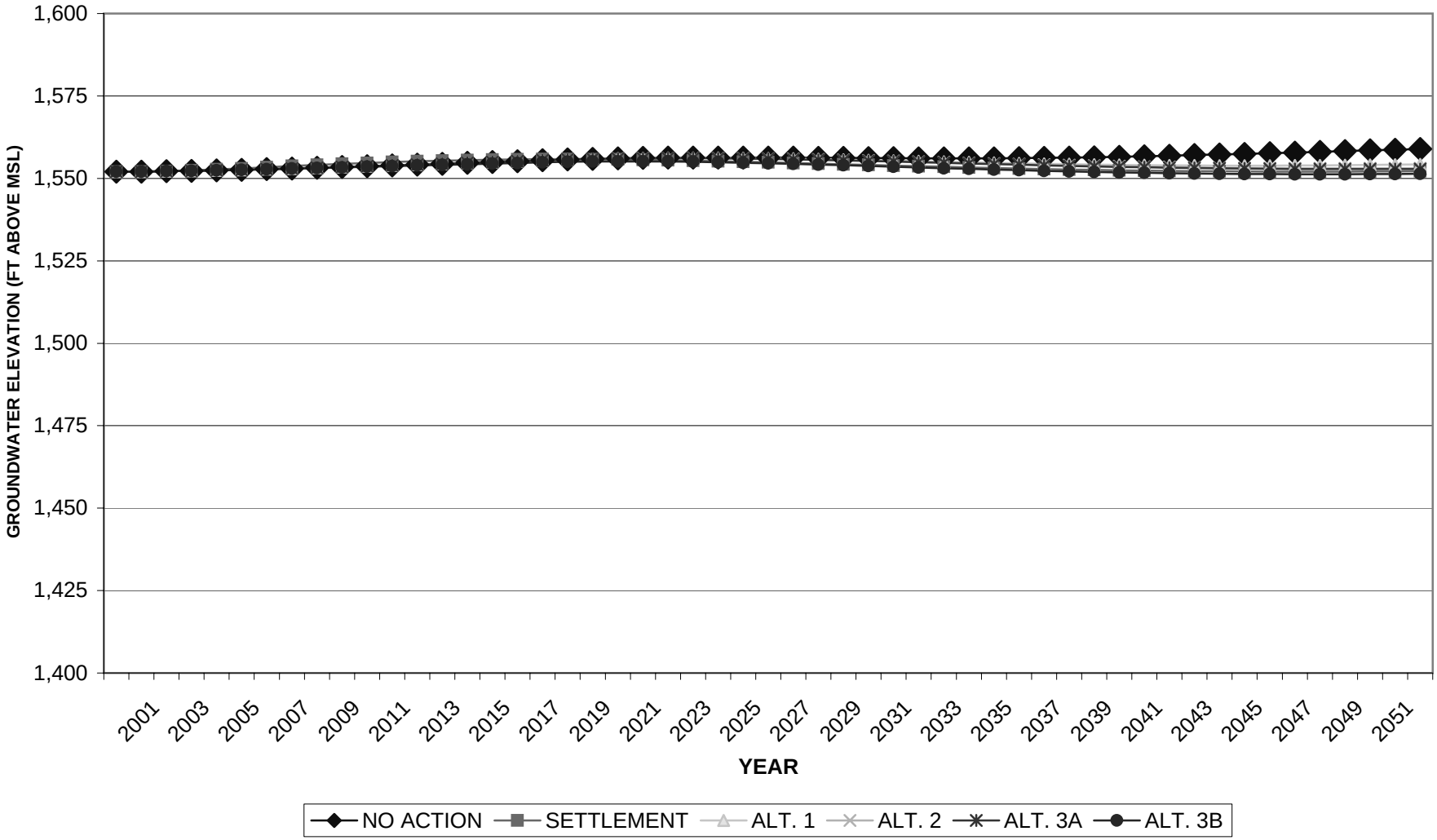


FIGURE I-31
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR WEST CMID SUB-AREA

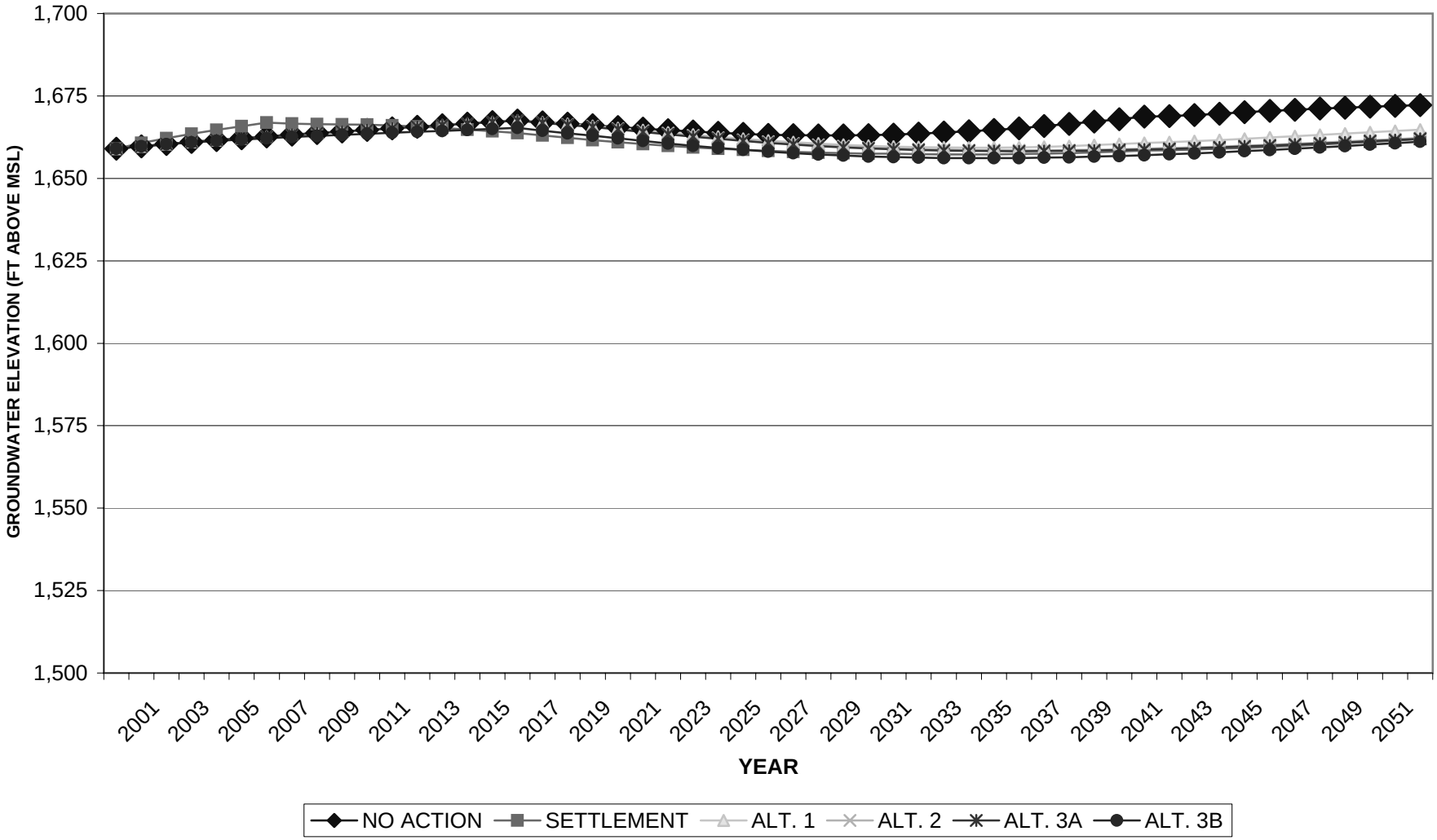


FIGURE I-32
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CENTRAL CMID SUB-AREA

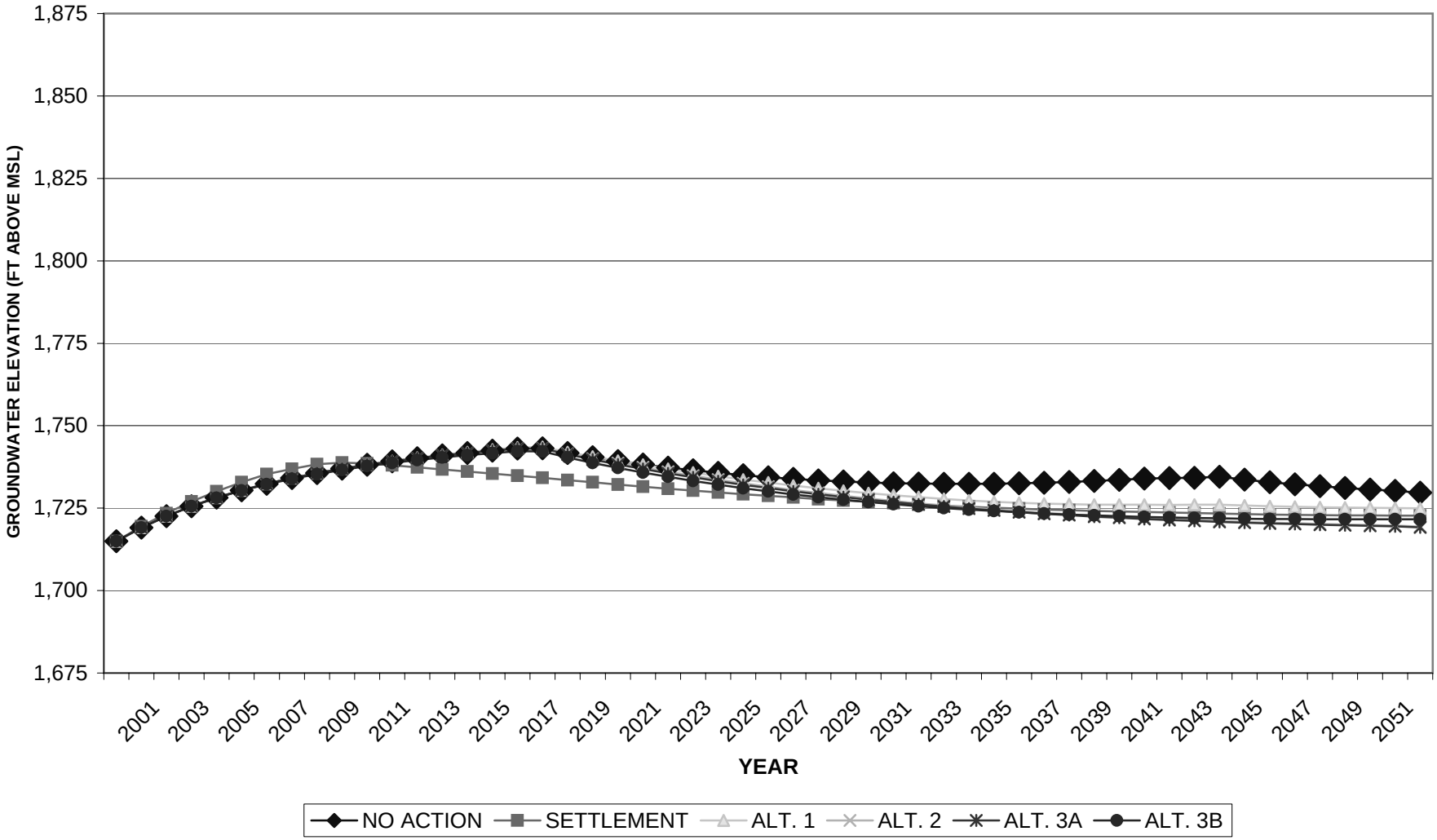


FIGURE I-33
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR NORTH AVRA VALLEY SUB-AREA

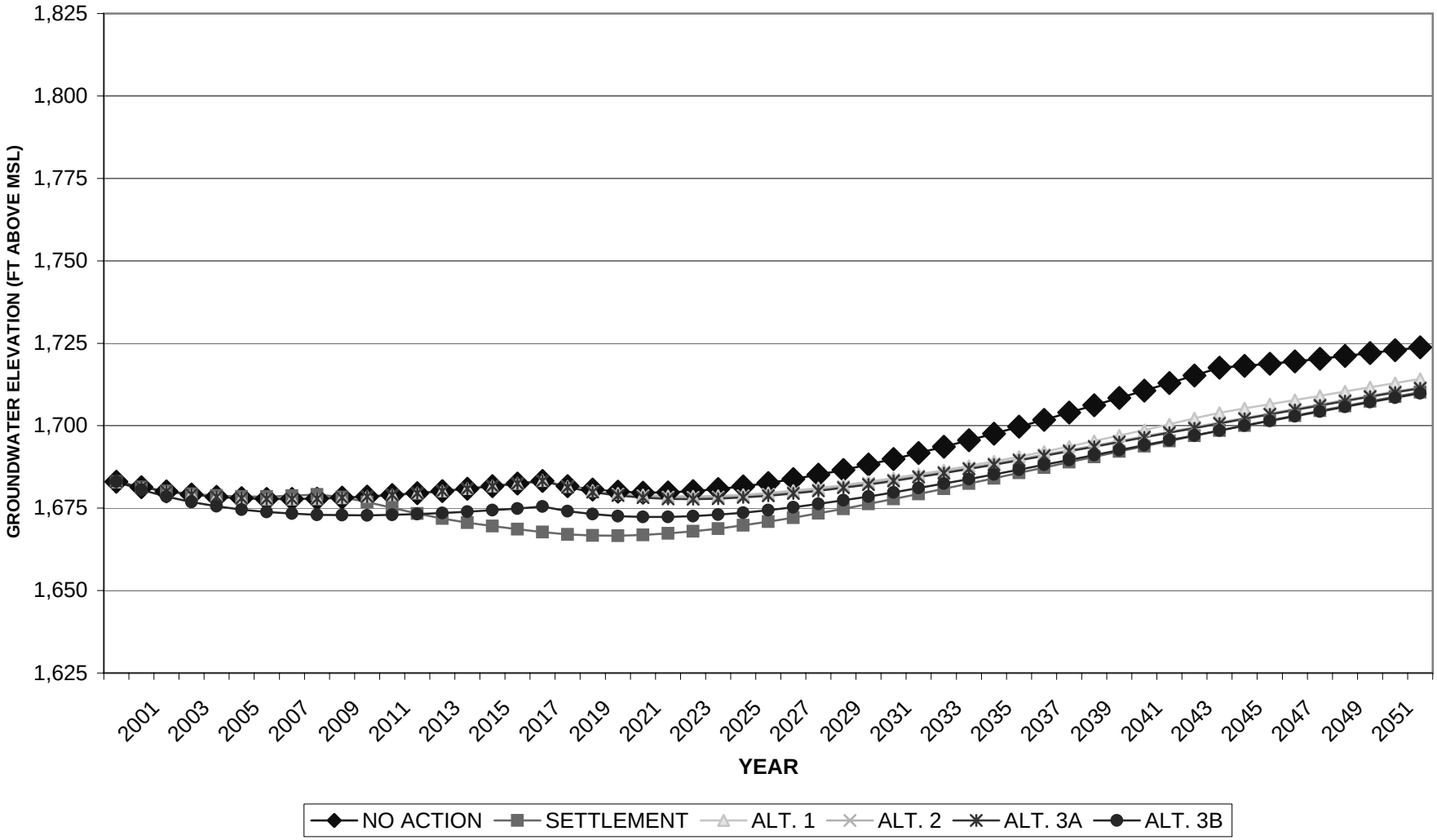
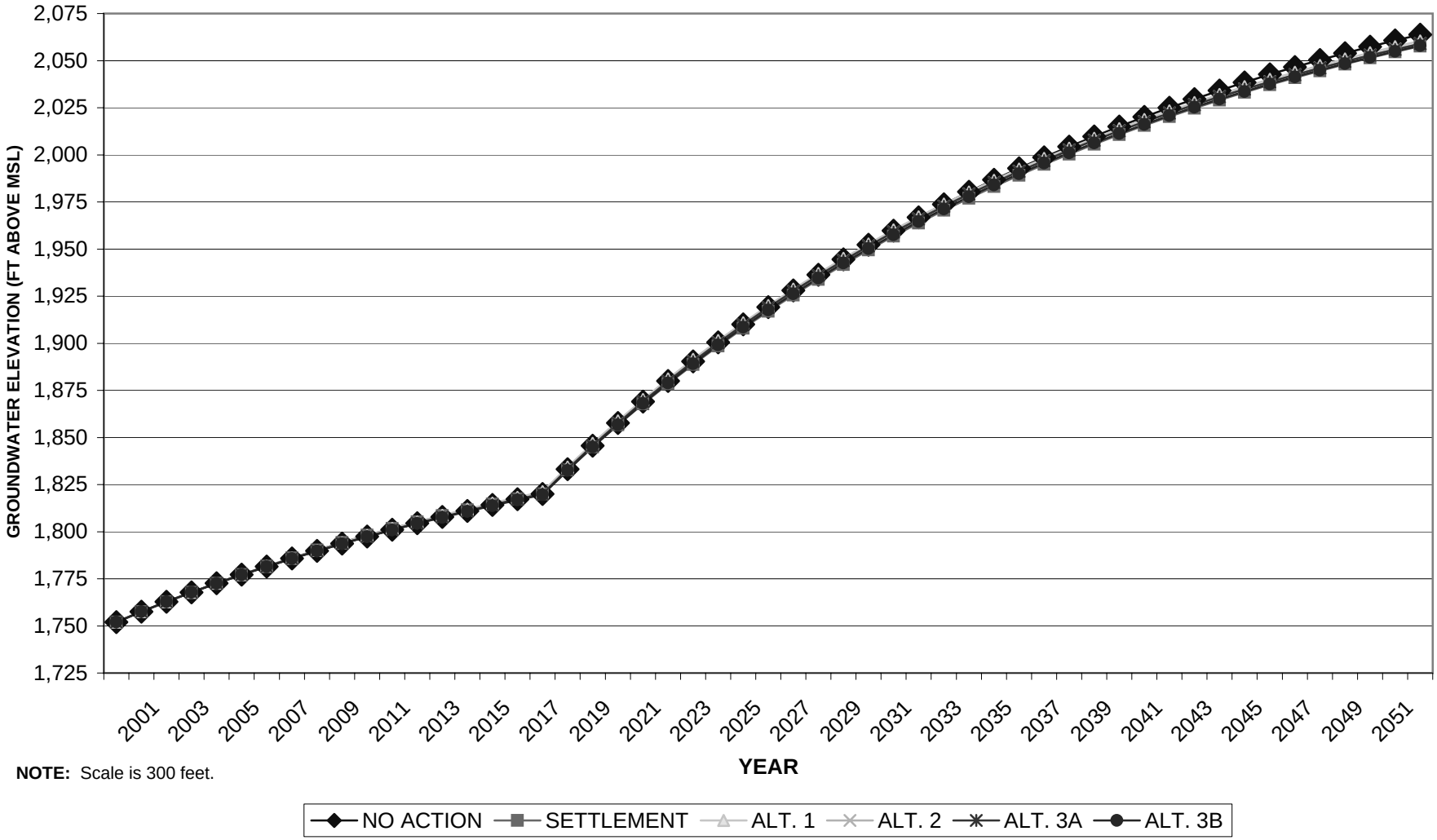
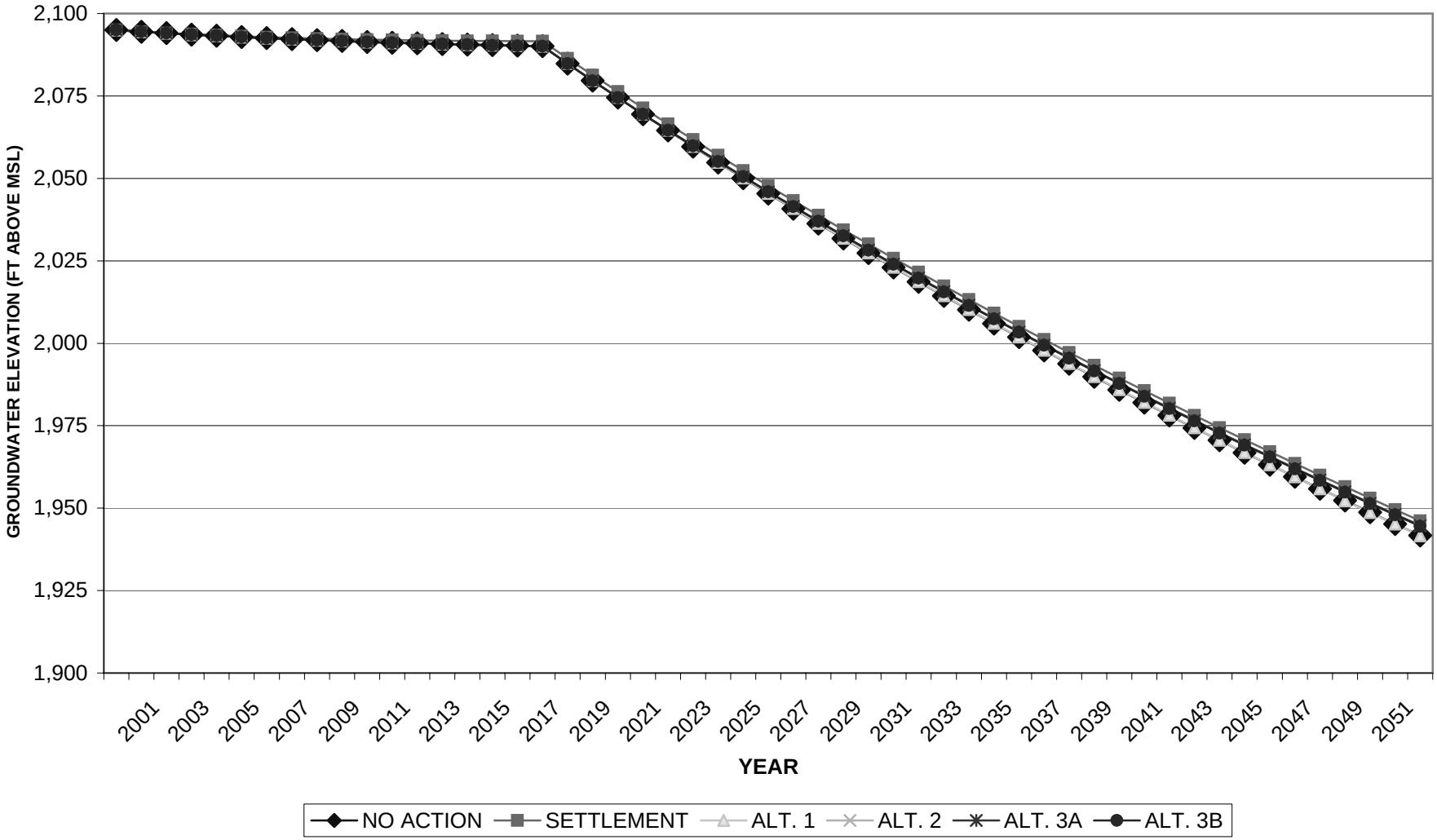


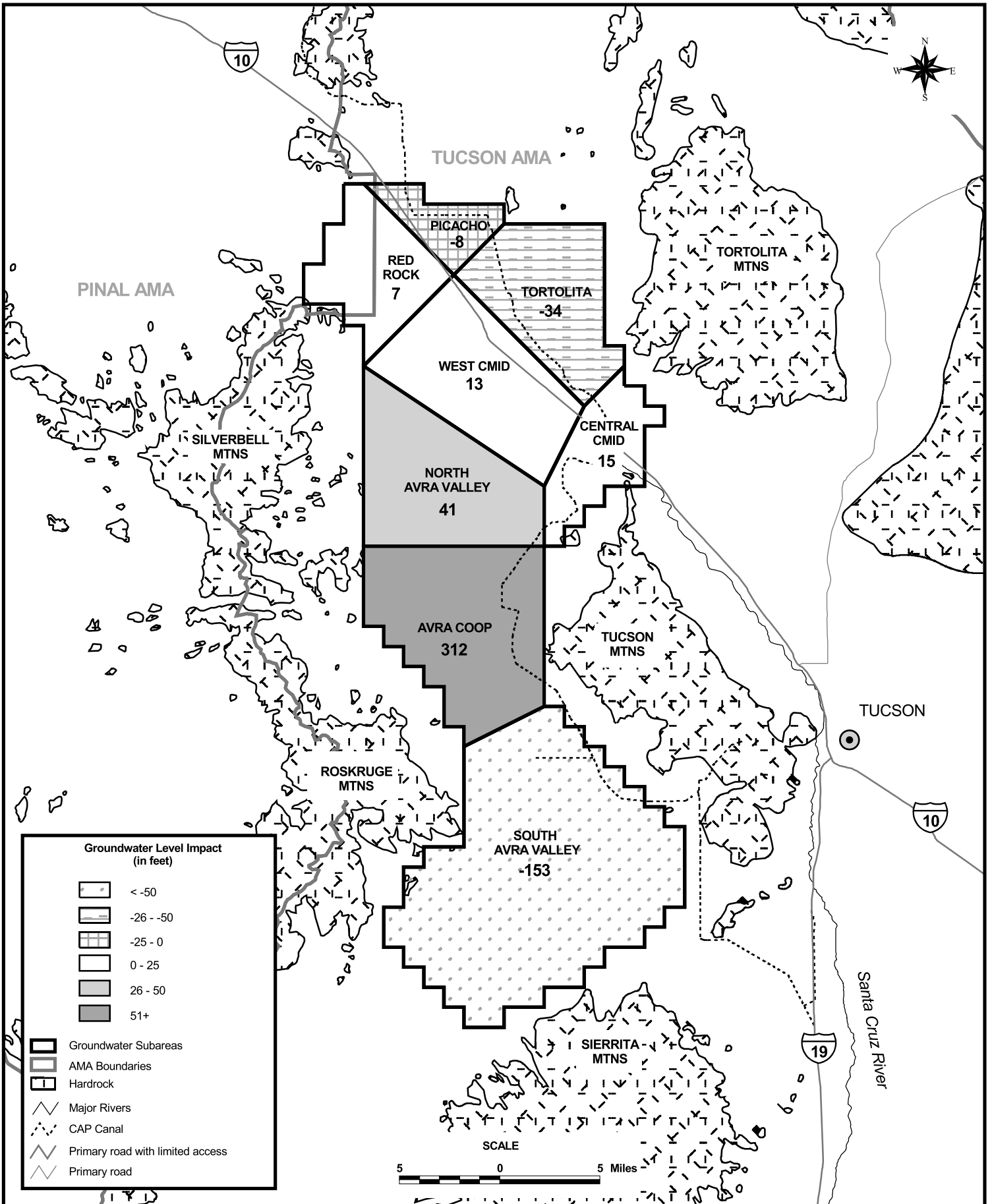
FIGURE I-34
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR FOR AVRA COOP SUB-AREA



NOTE: Scale is 300 feet.

FIGURE I-35
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SOUTH AVRA VALLEY SUB-AREA





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Change in Groundwater Levels in Avra Valley from 2001 to 2051 for the No Action Alternative

June 2000

Figure I-36

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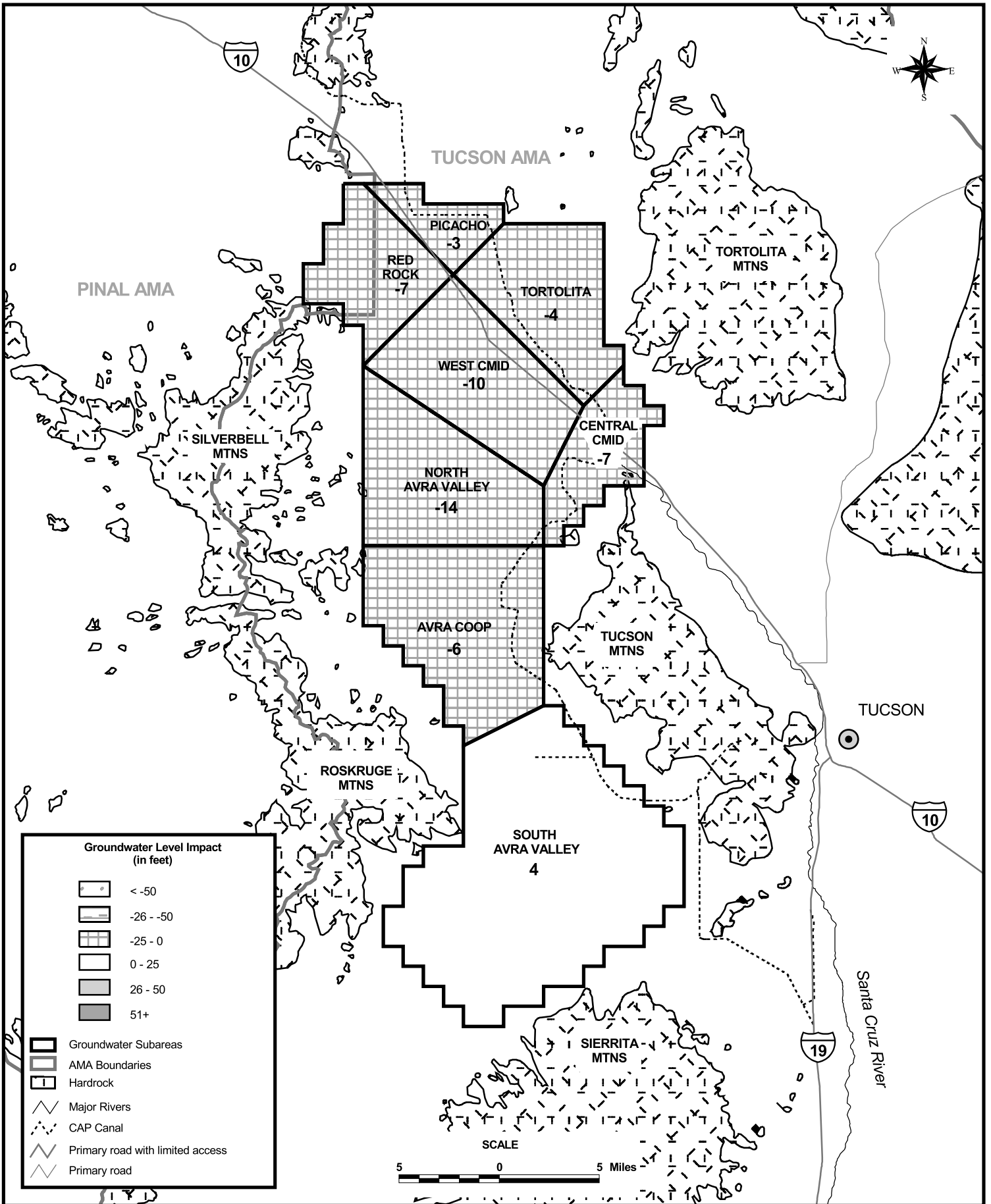

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Groundwater Level Impacts of Settlement Alternative for Year 2051 in Avra Valley

June 2000

Figure I-37

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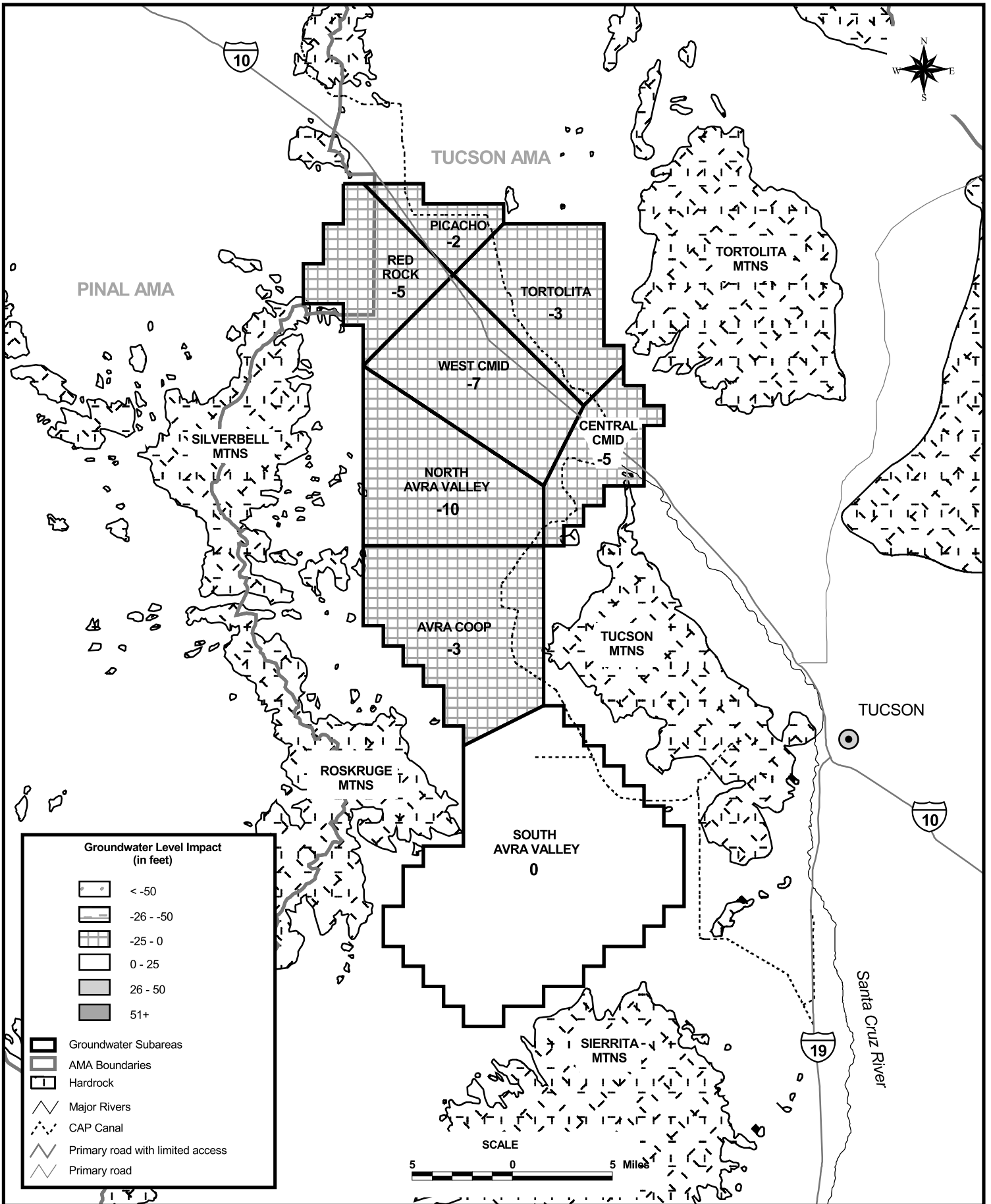

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Groundwater Level Impacts of Non - Settlement Alternative 1 for Year 2051 in Avra Valley

June 2000

Figure I-38

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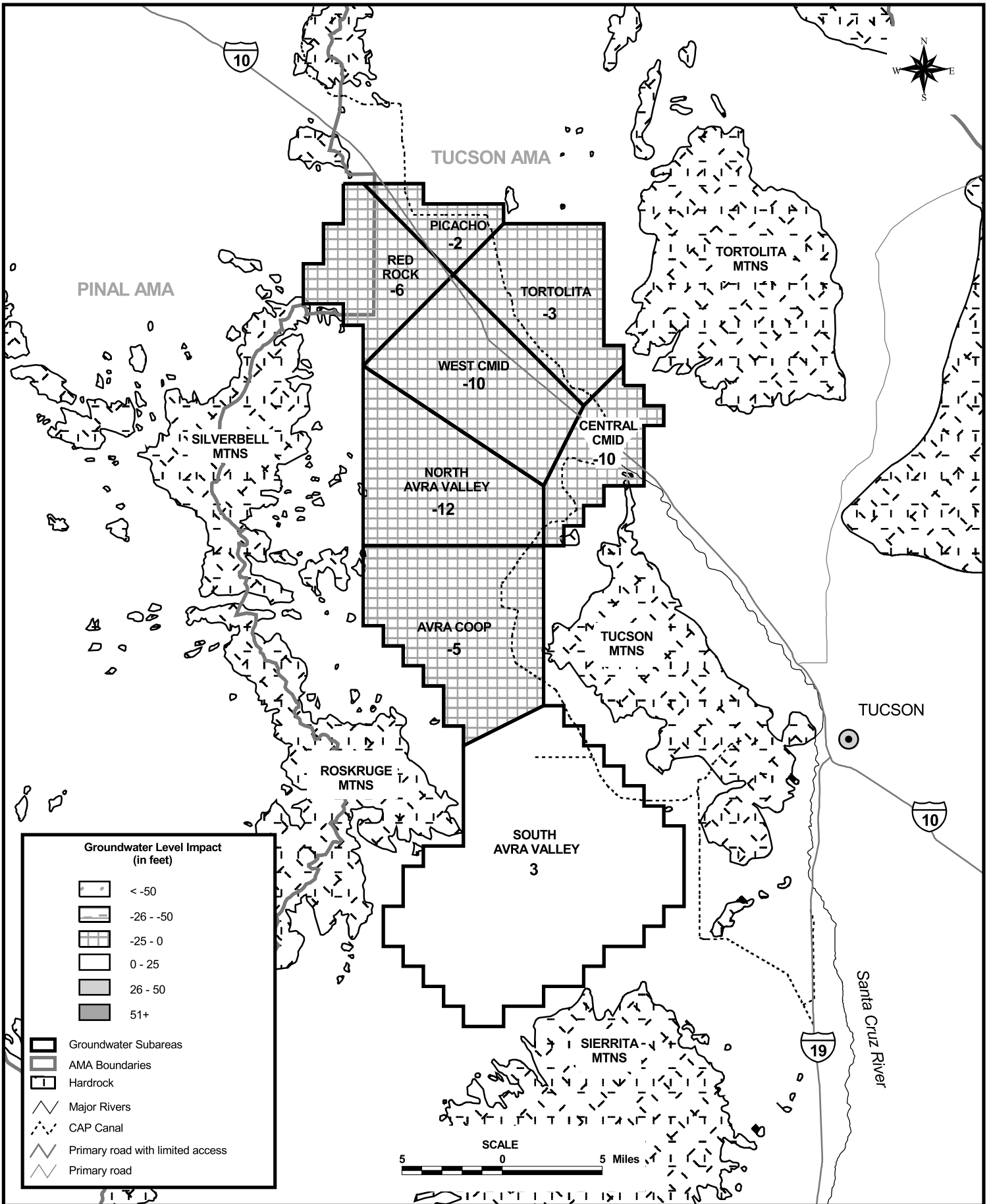

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Groundwater Level Impacts of Non - Settlement Alternative 2 for Year 2051 in Avra Valley

June 2000

Figure

I-39

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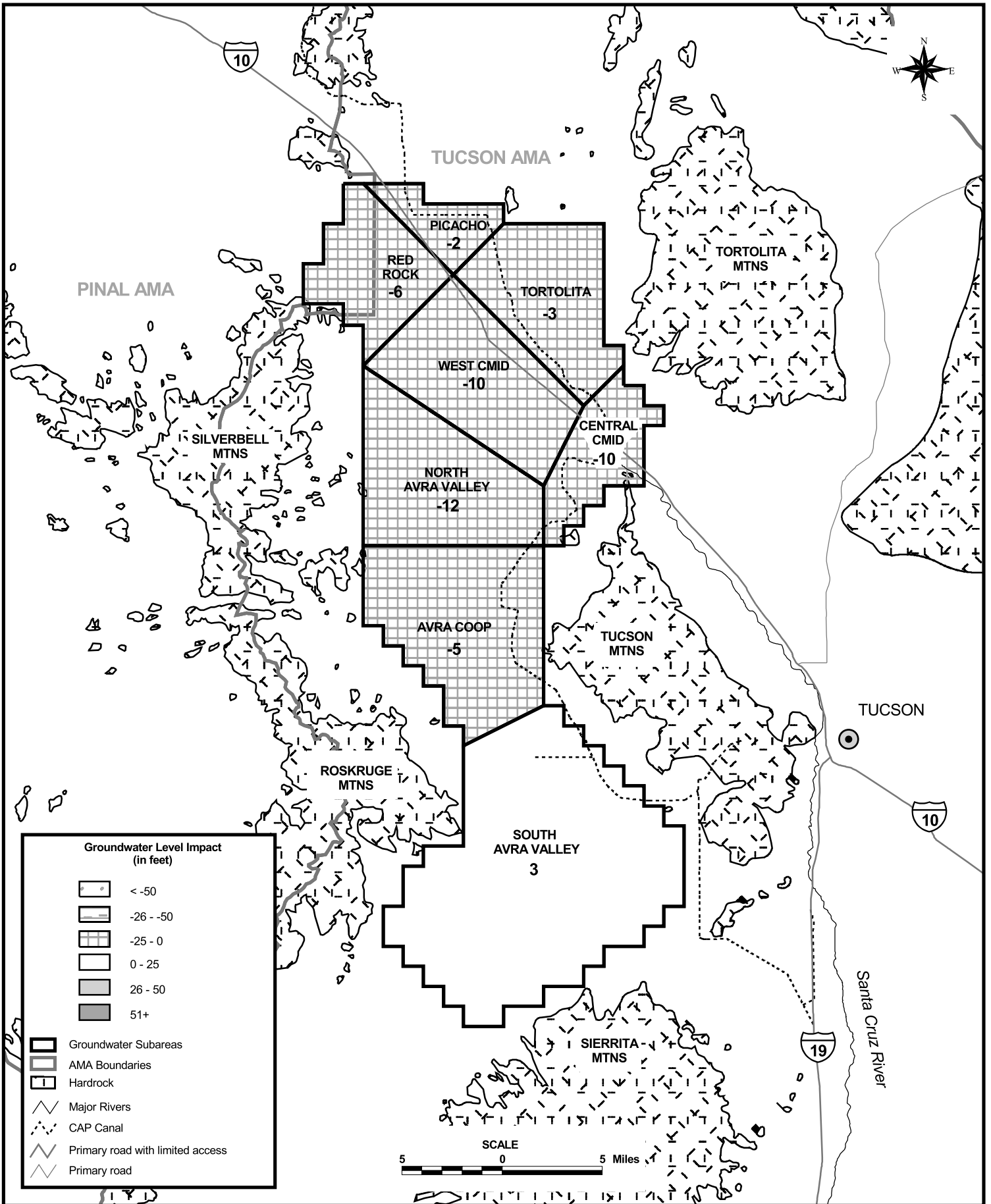

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Groundwater Level Impacts of Non - Settlement Alternative 3A for Year 2051 in Avra Valley

Figure I-40

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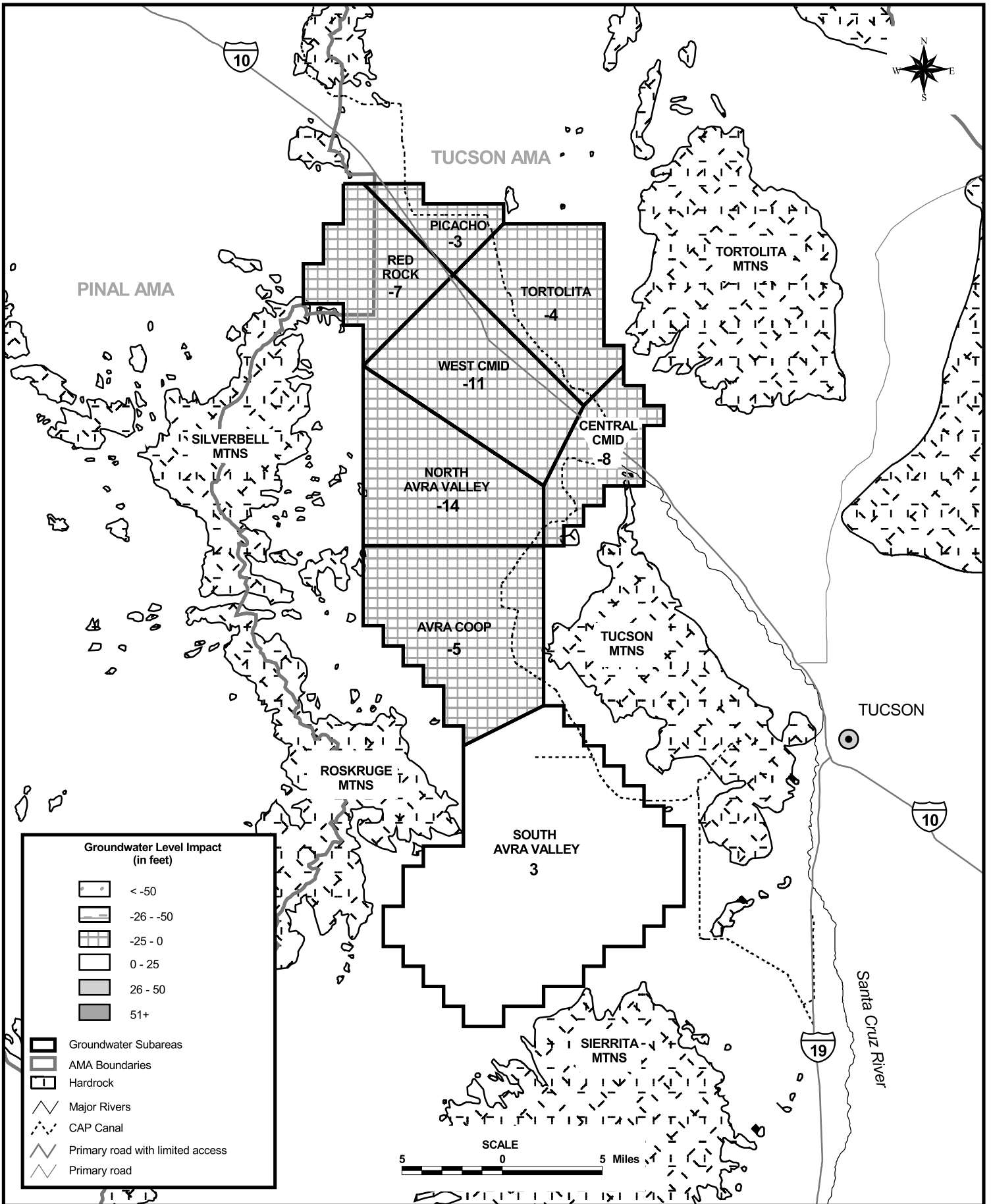

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Groundwater Level Impacts of Non - Settlement Alternative 3B for Year 2051 in Avra Valley

Figure I-41

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Figure I-42
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in 2051 for North Avra Valley and Avra Coop Sub-Areas

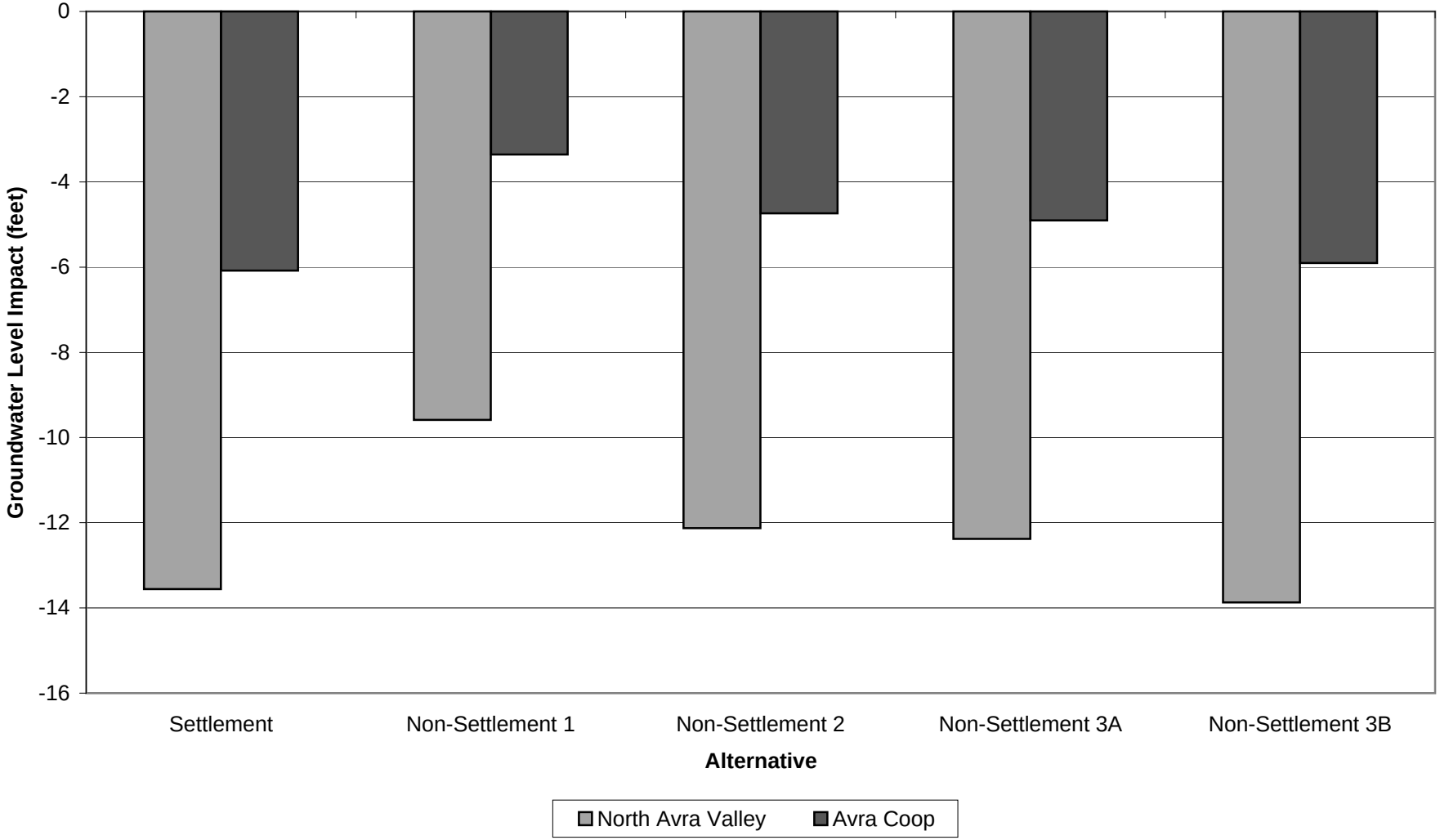
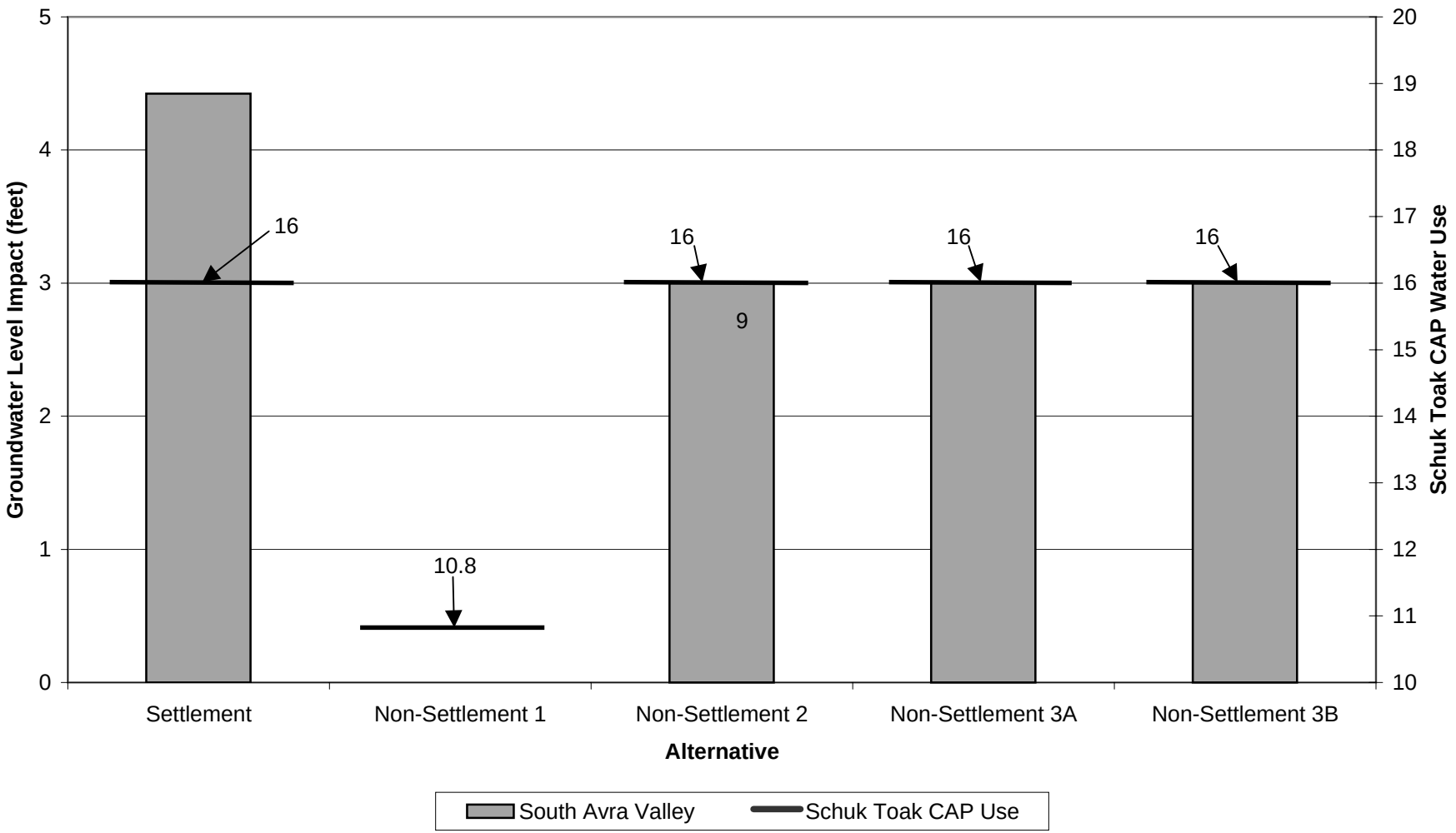
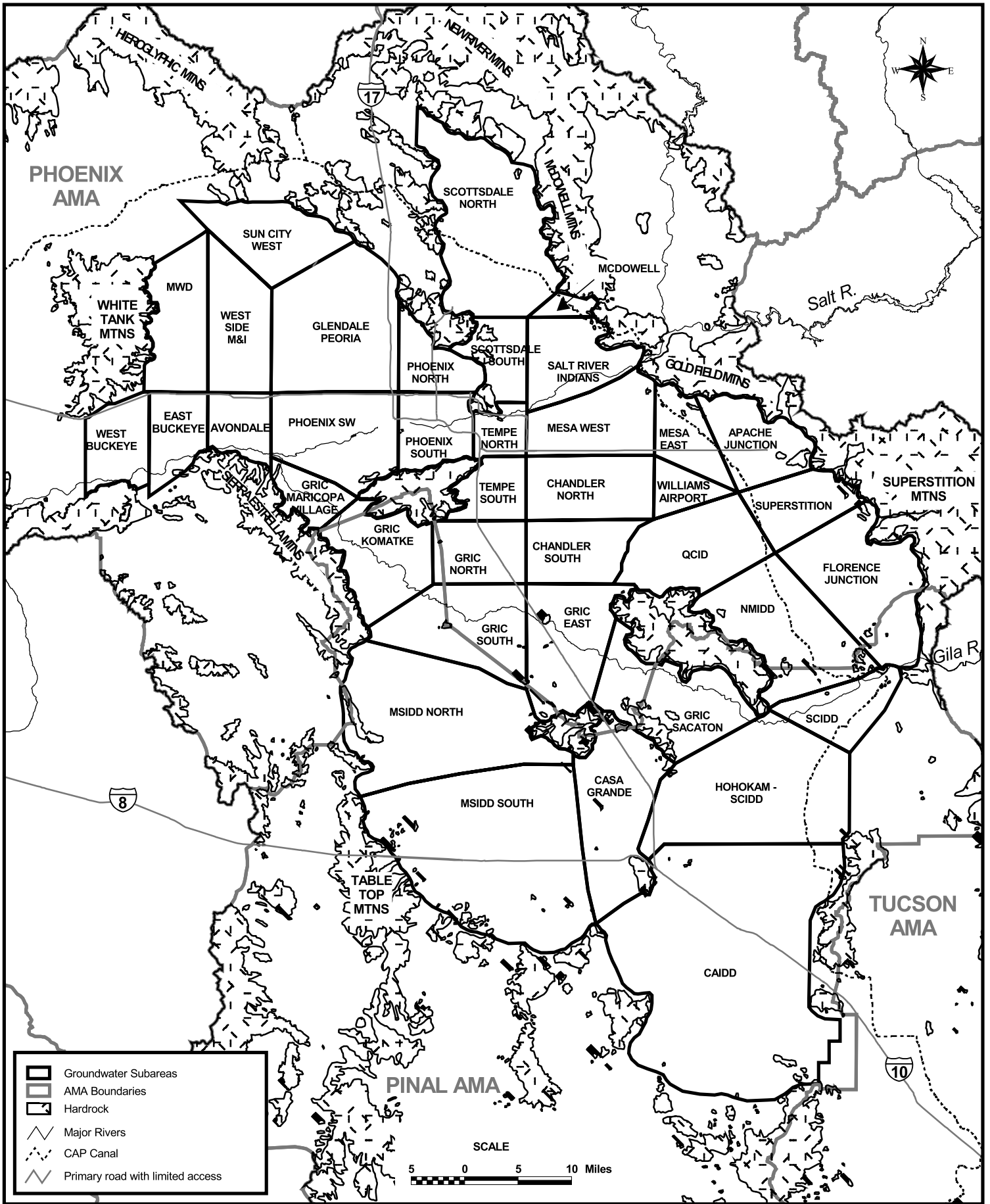


Figure I-43
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in South Avra Valley Sub-Area to Schuk Toak CAP Water Use





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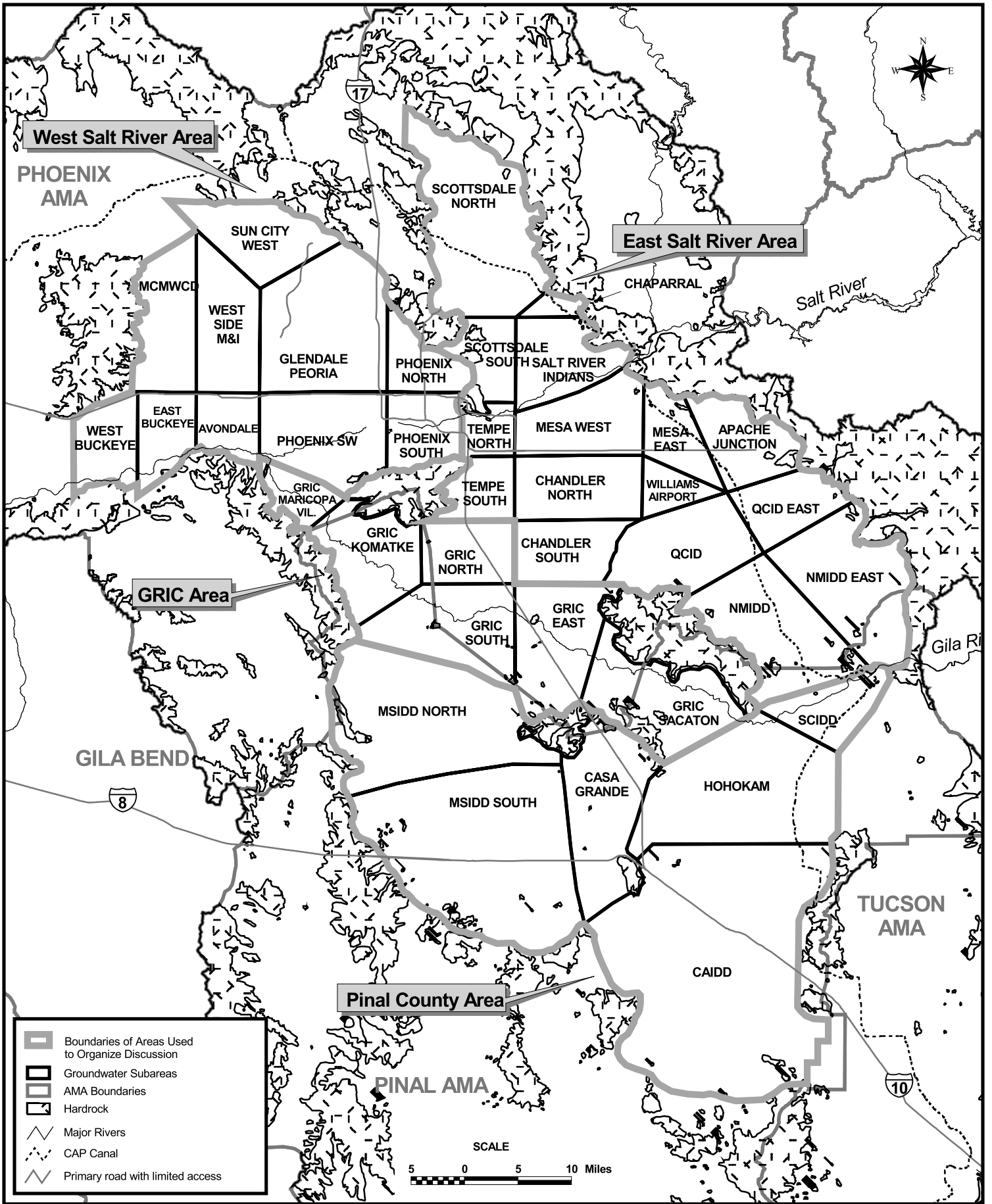
Groundwater Subareas - Pinal / Salt River Valley Area

Figure I-44



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CAP Allocation EIS

Location of Areas Used to Organize Discussion

Pinal / Salt River Valley Area

Figure

I-45

Figure I-46
CAP ALLOCATION DRAFT EIS
HISTORICAL GROUNDWATER LEVELS IN THE SCOTTSDALE SOUTH SUB-AREA

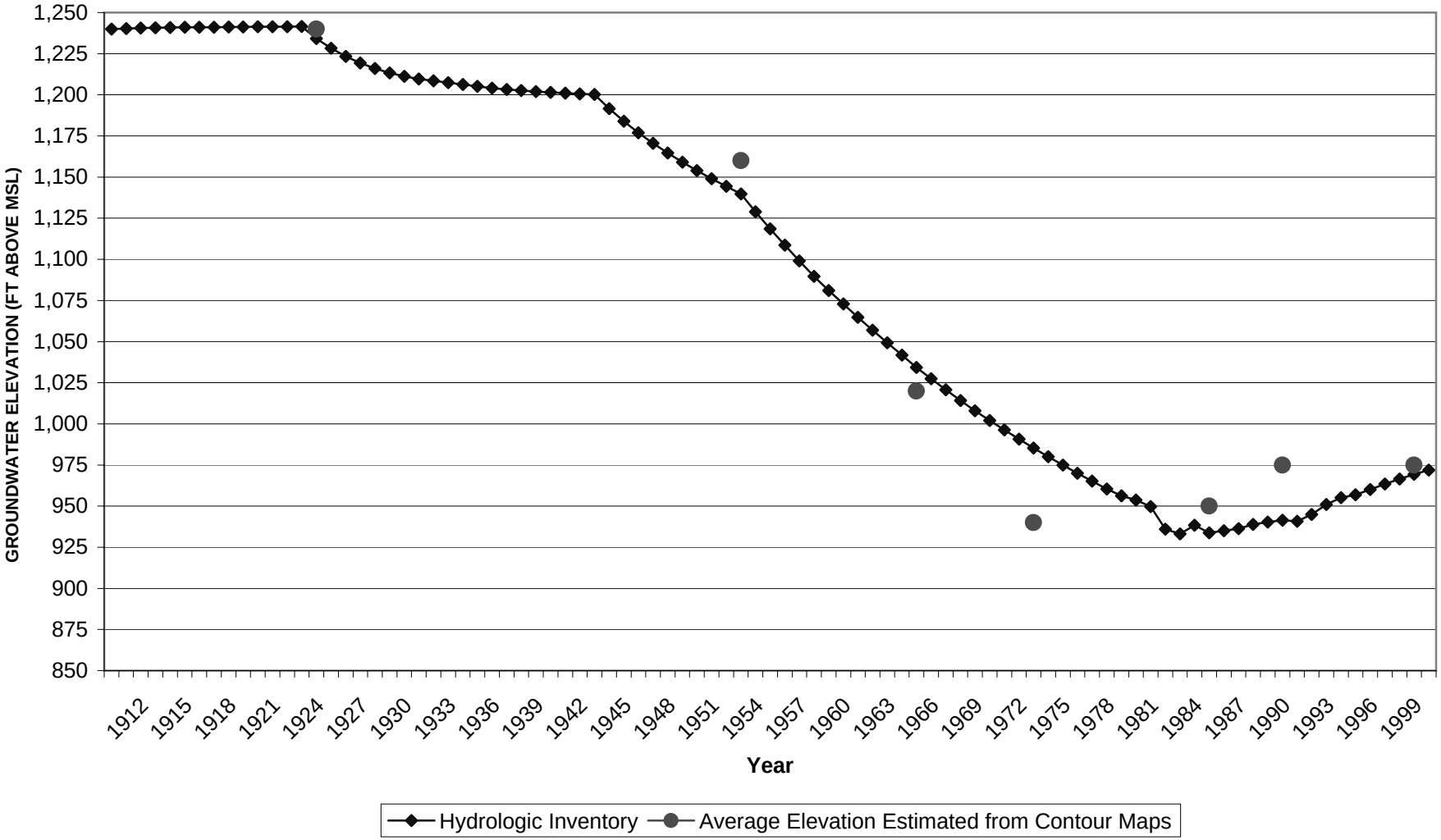


FIGURE I-47
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR MSIDD NORTH SUB-AREA

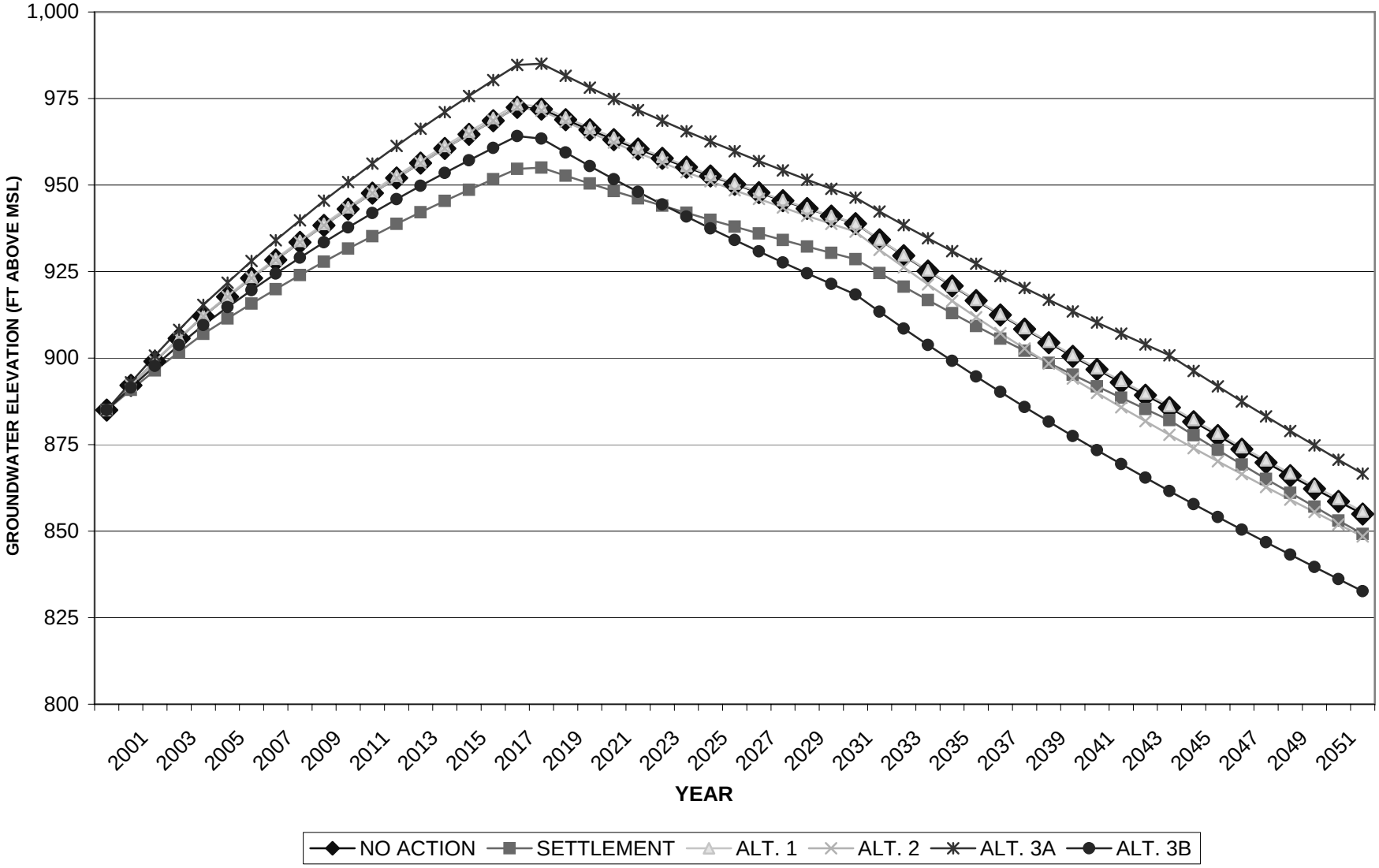


FIGURE I-48
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR MSIDD SOUTH SUB-AREA

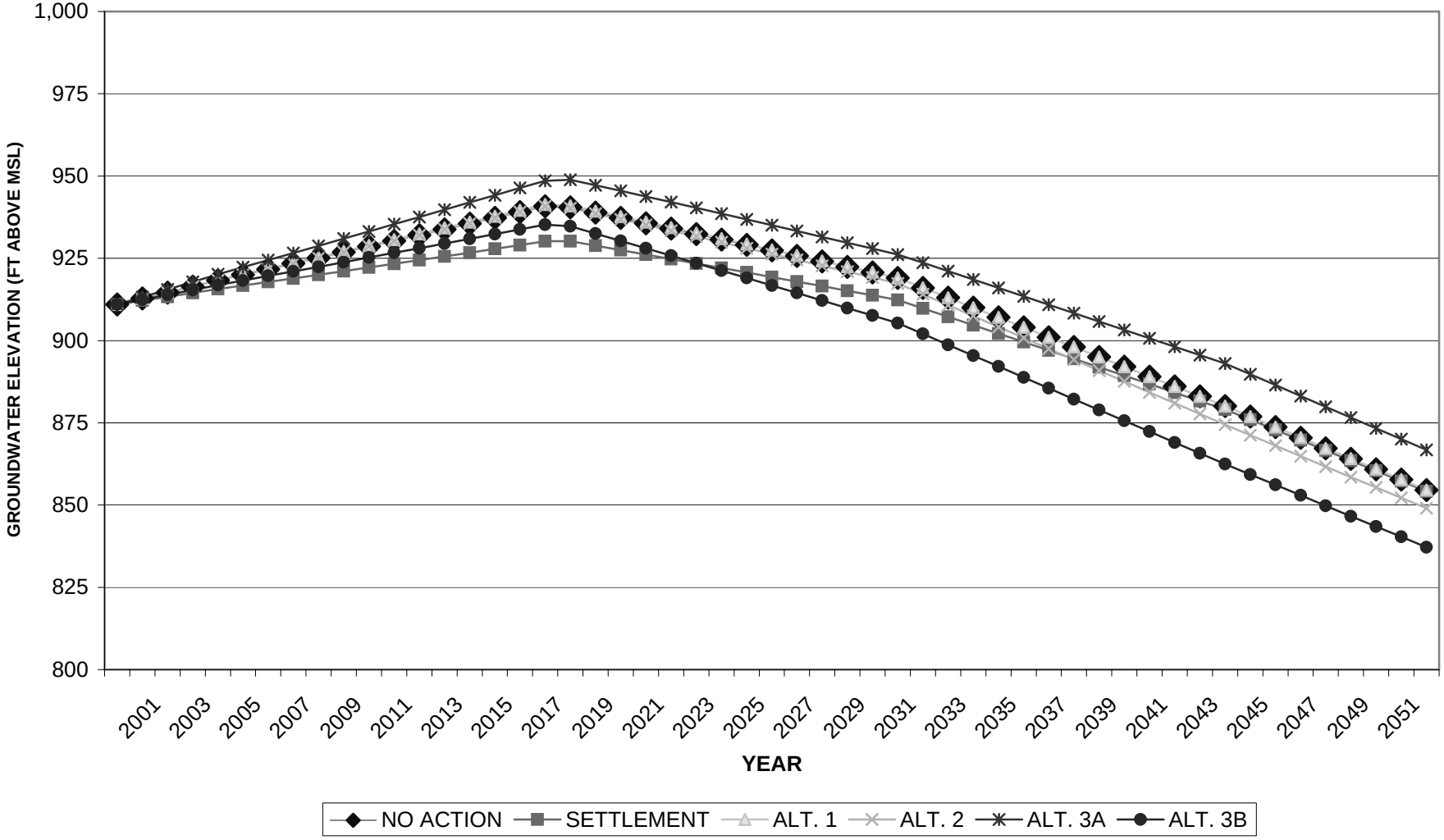


FIGURE I-49
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CASA GRANDE SUB-AREA

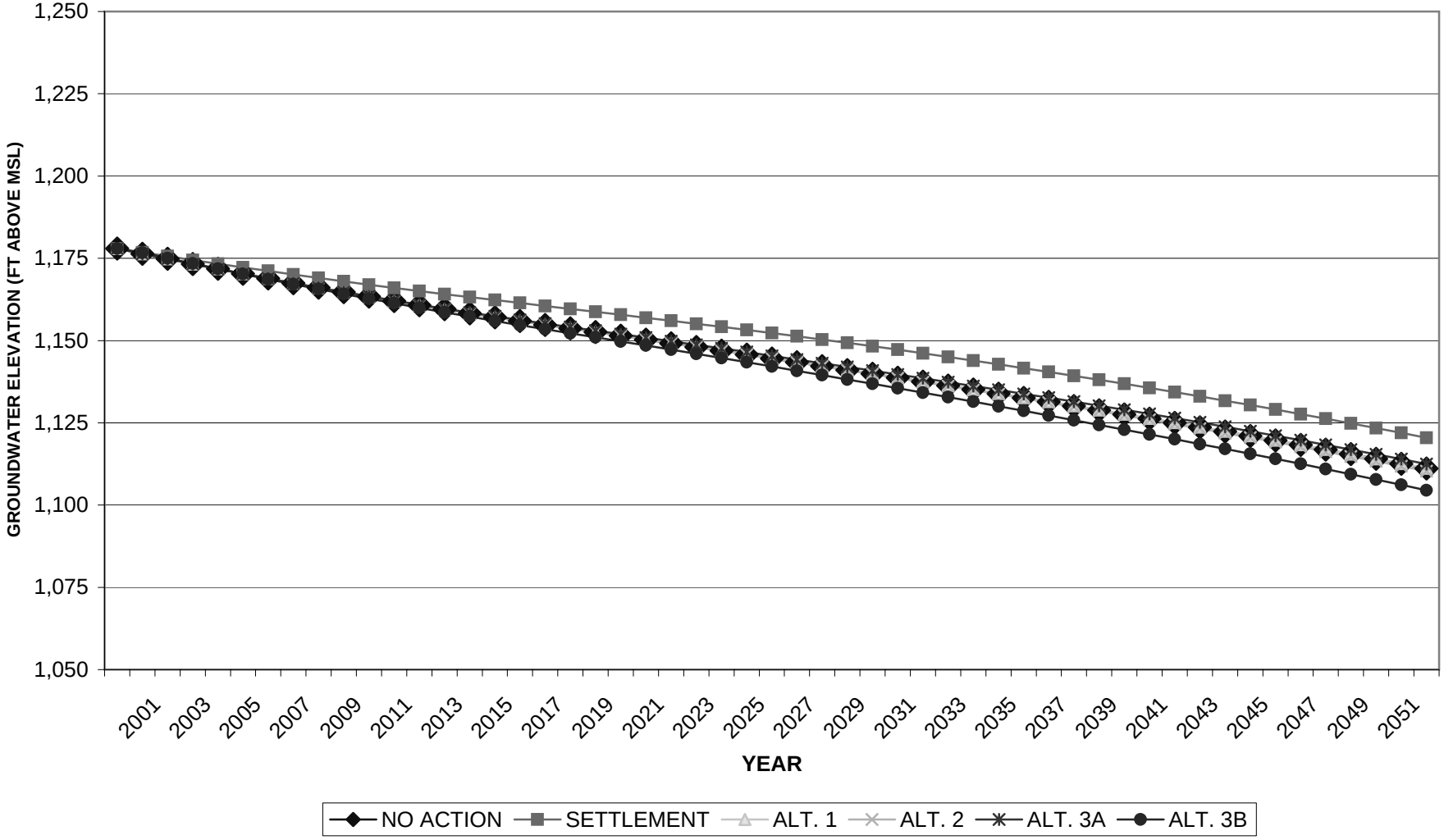


FIGURE I-50
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CAIDD SUB-AREA

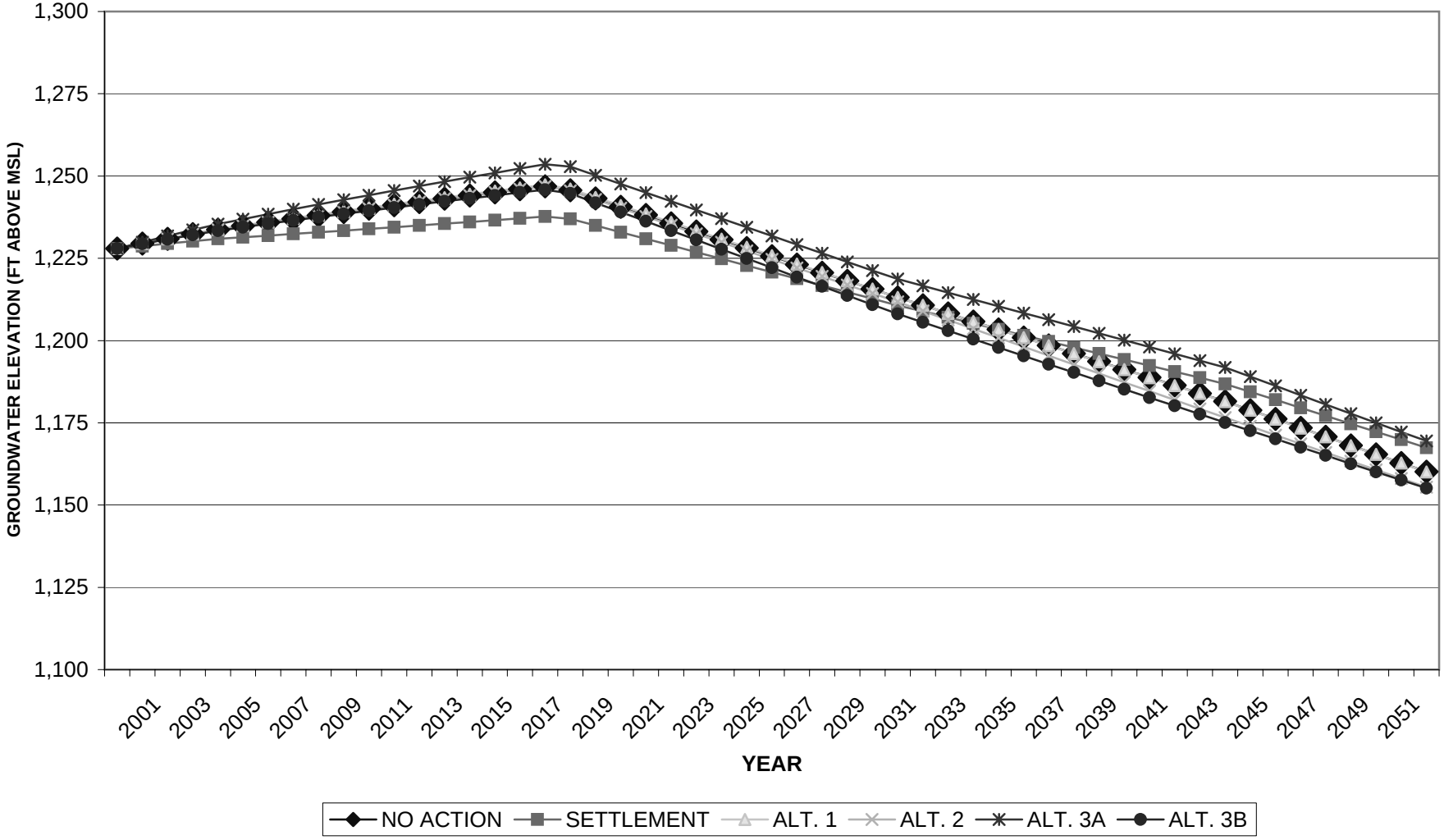


FIGURE I-51
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR HOHOKAM-SCIDD SUB-AREA

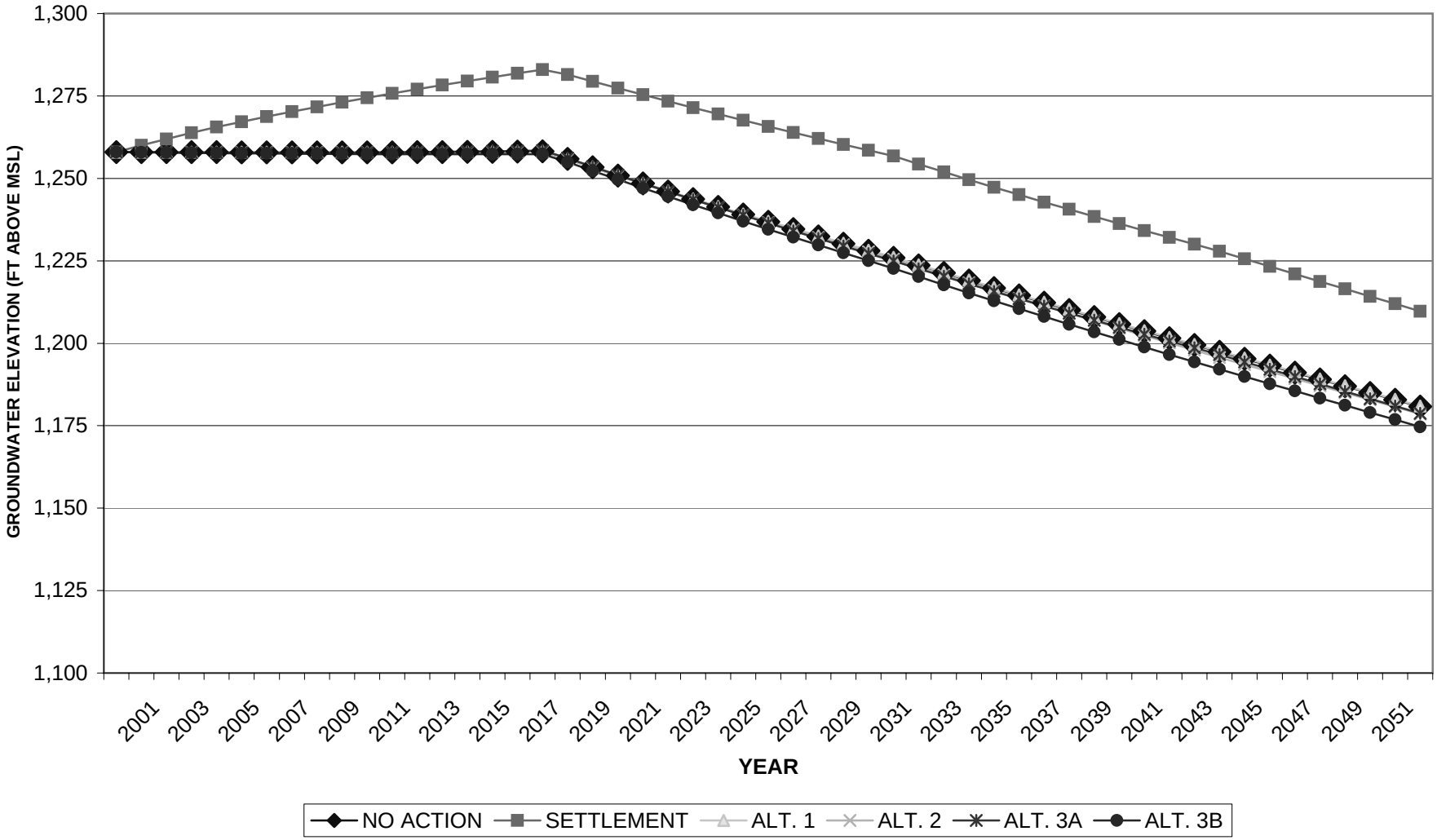
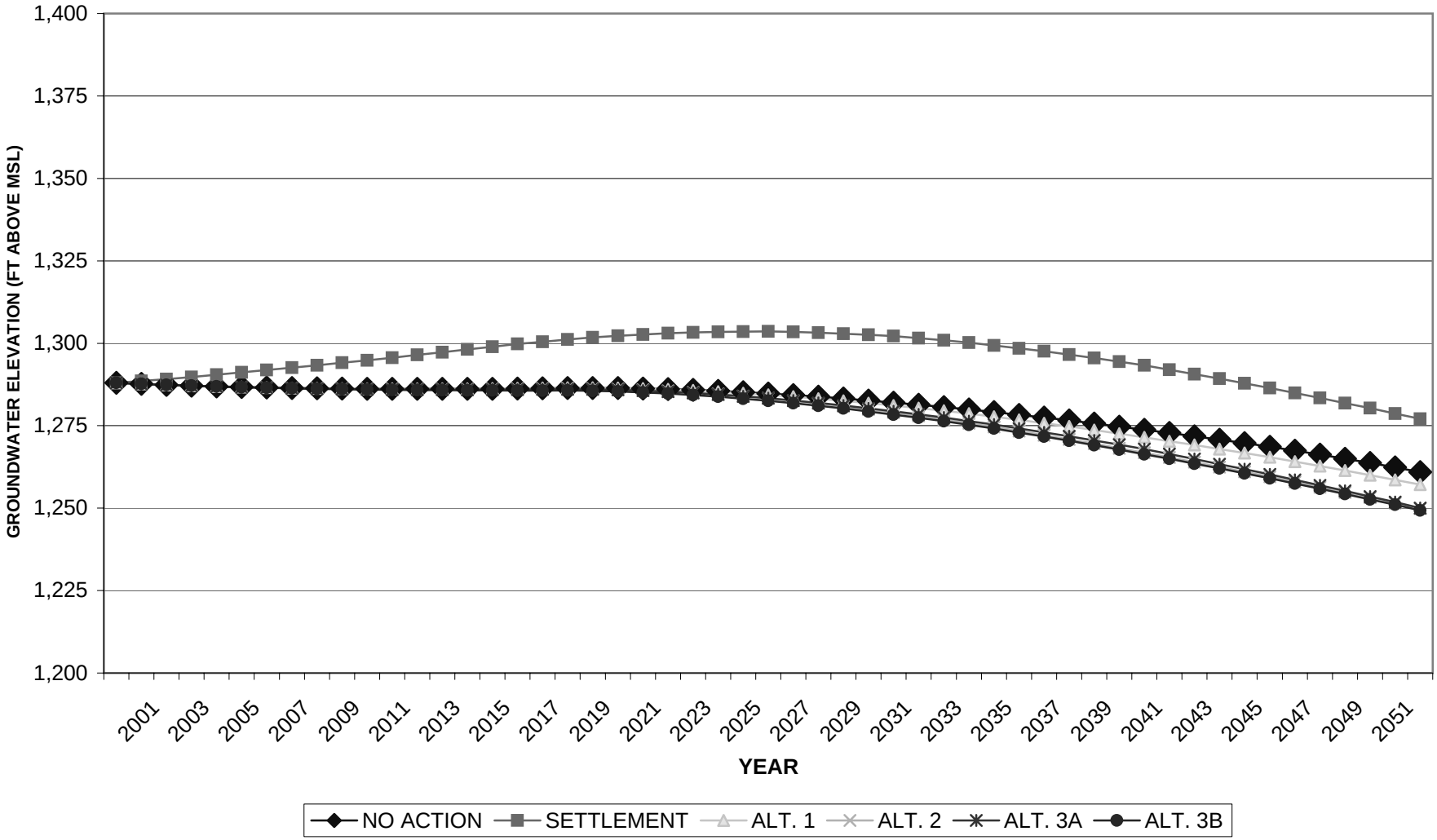
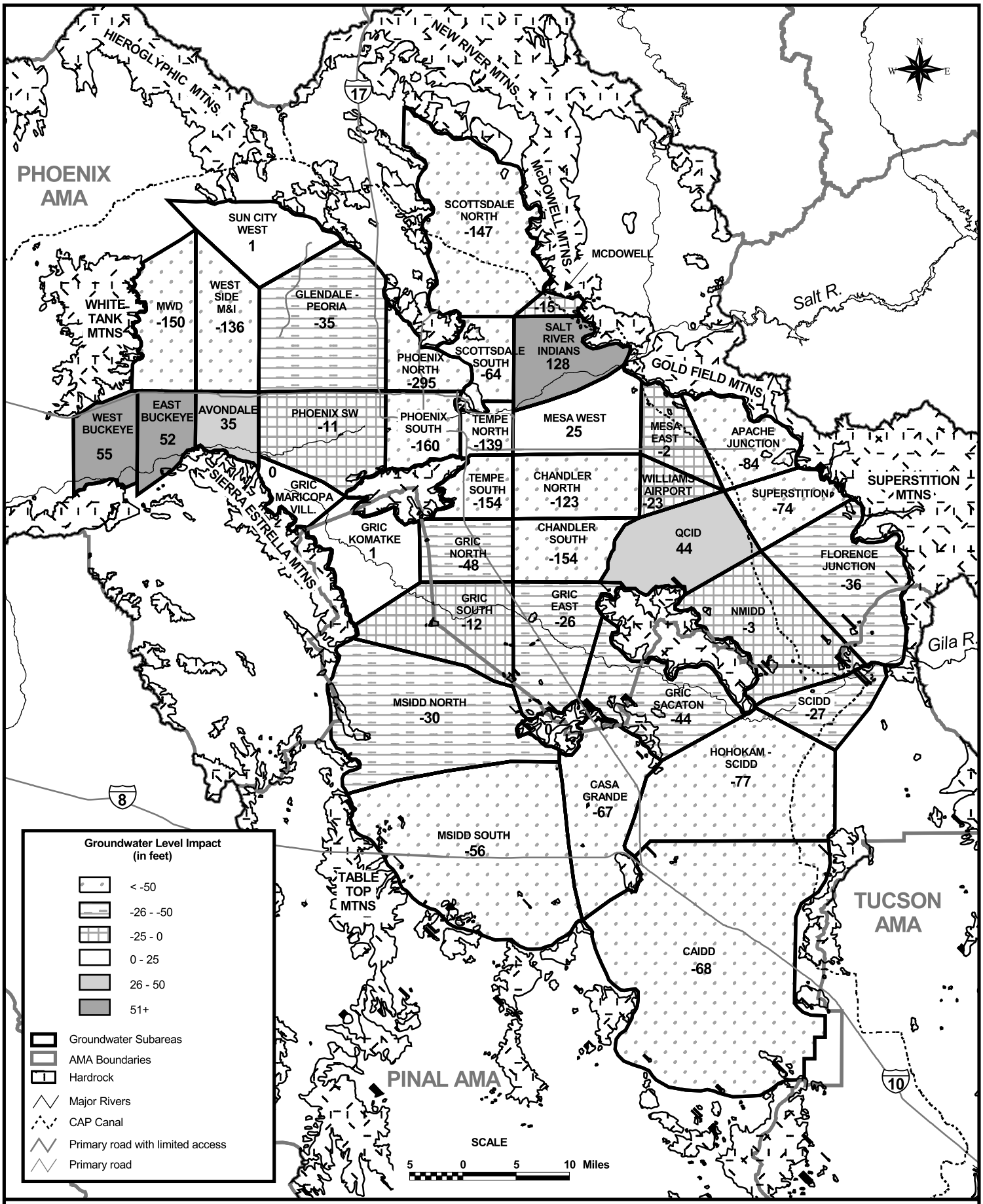


FIGURE I-52
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SCIDD SUB-AREA





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CAP Allocation Draft EIS
Change in Groundwater levels in the Pinal / Salt River Valley Area From 2001 - 2051 for the No Action Alternative

Figure I-53

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FIGURE I-54
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GRIC SACATON SUB-AREA

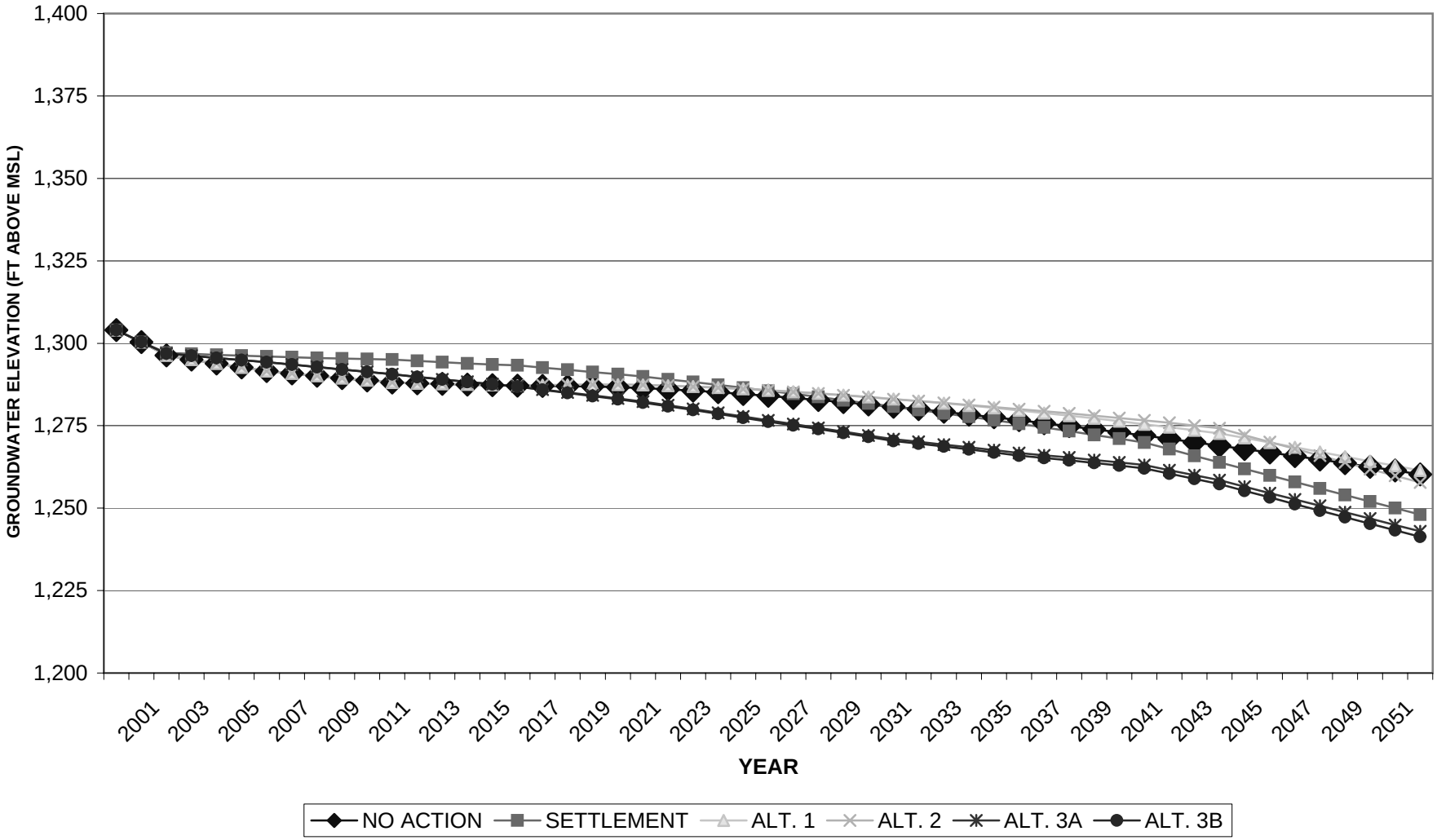

FIGURE I-55
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GRIC EAST SUB-AREA

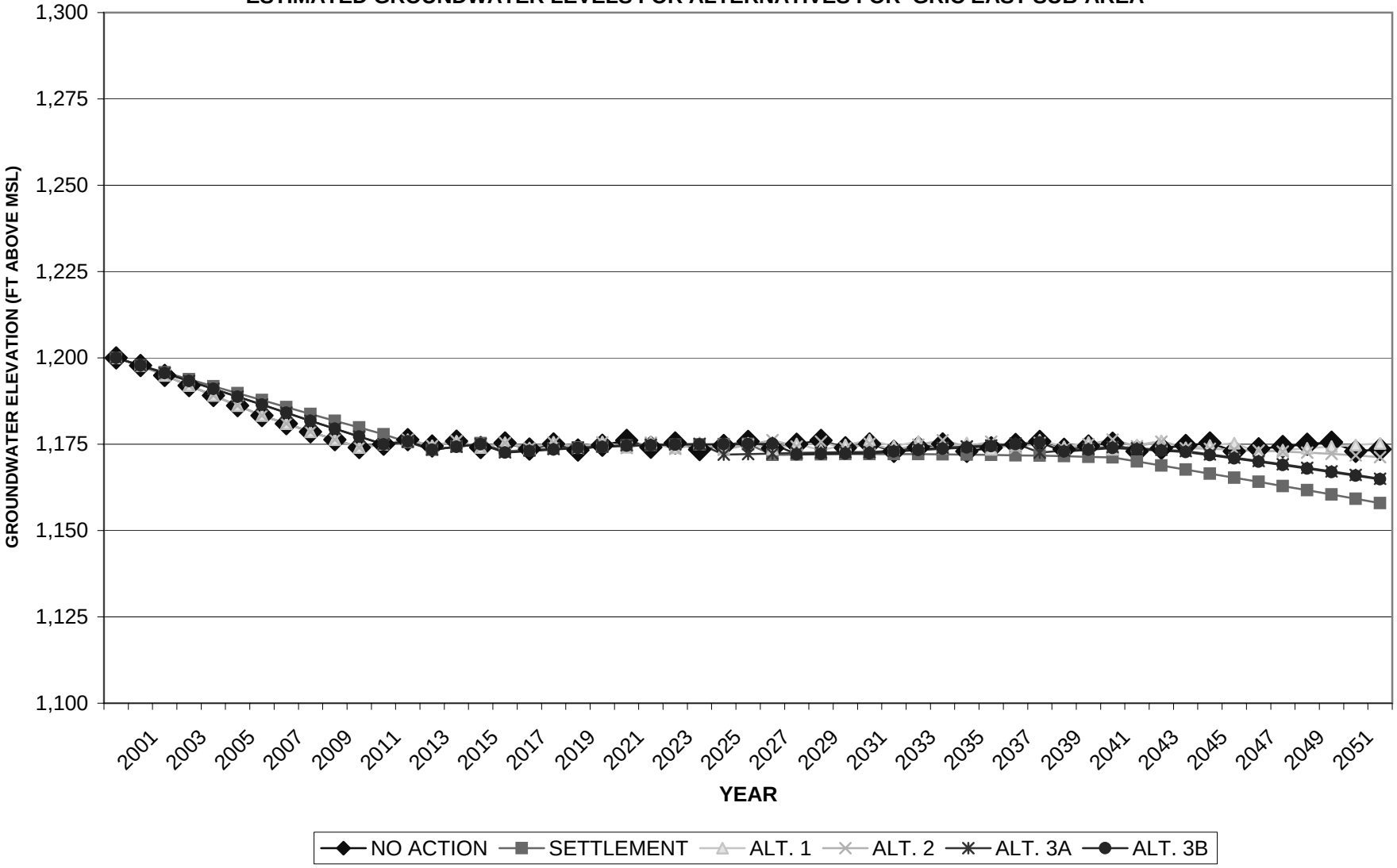

FIGURE I-56
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GRIC NORTH SUB-AREA

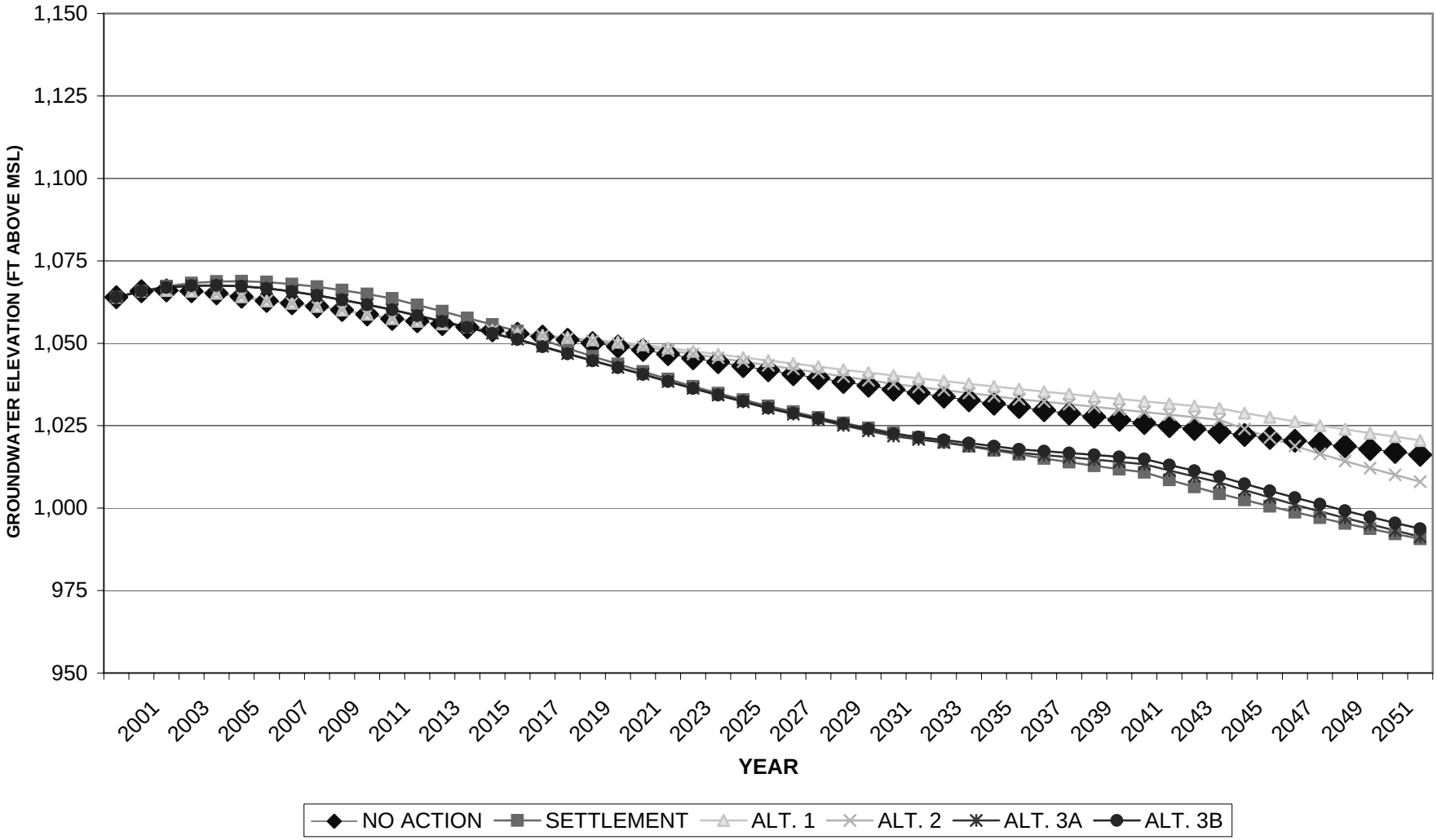

FIGURE I-57
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ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GRIC SOUTH SUB-AREA

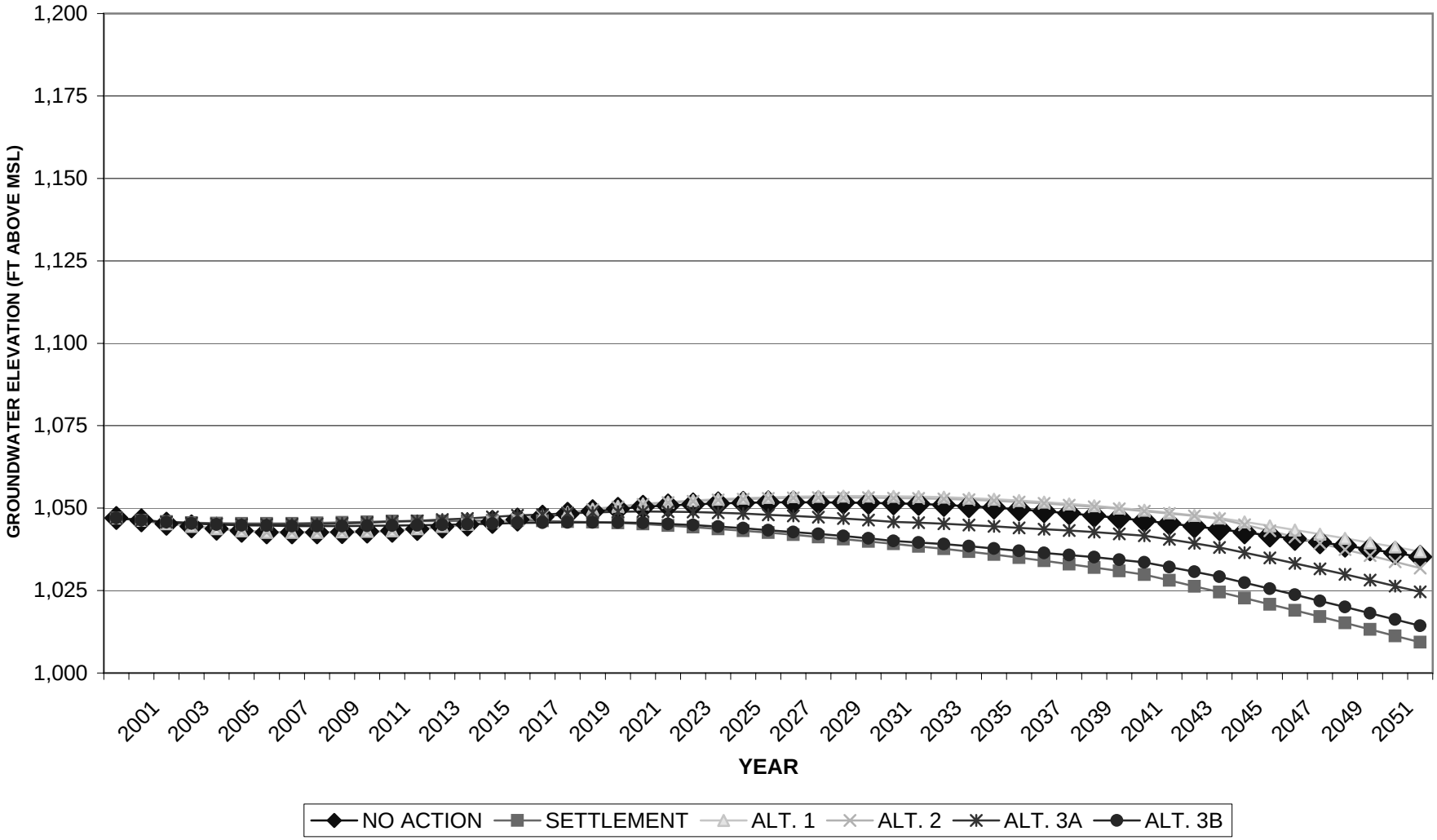

FIGURE I-58
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GRIC KOMATKE SUB-AREA

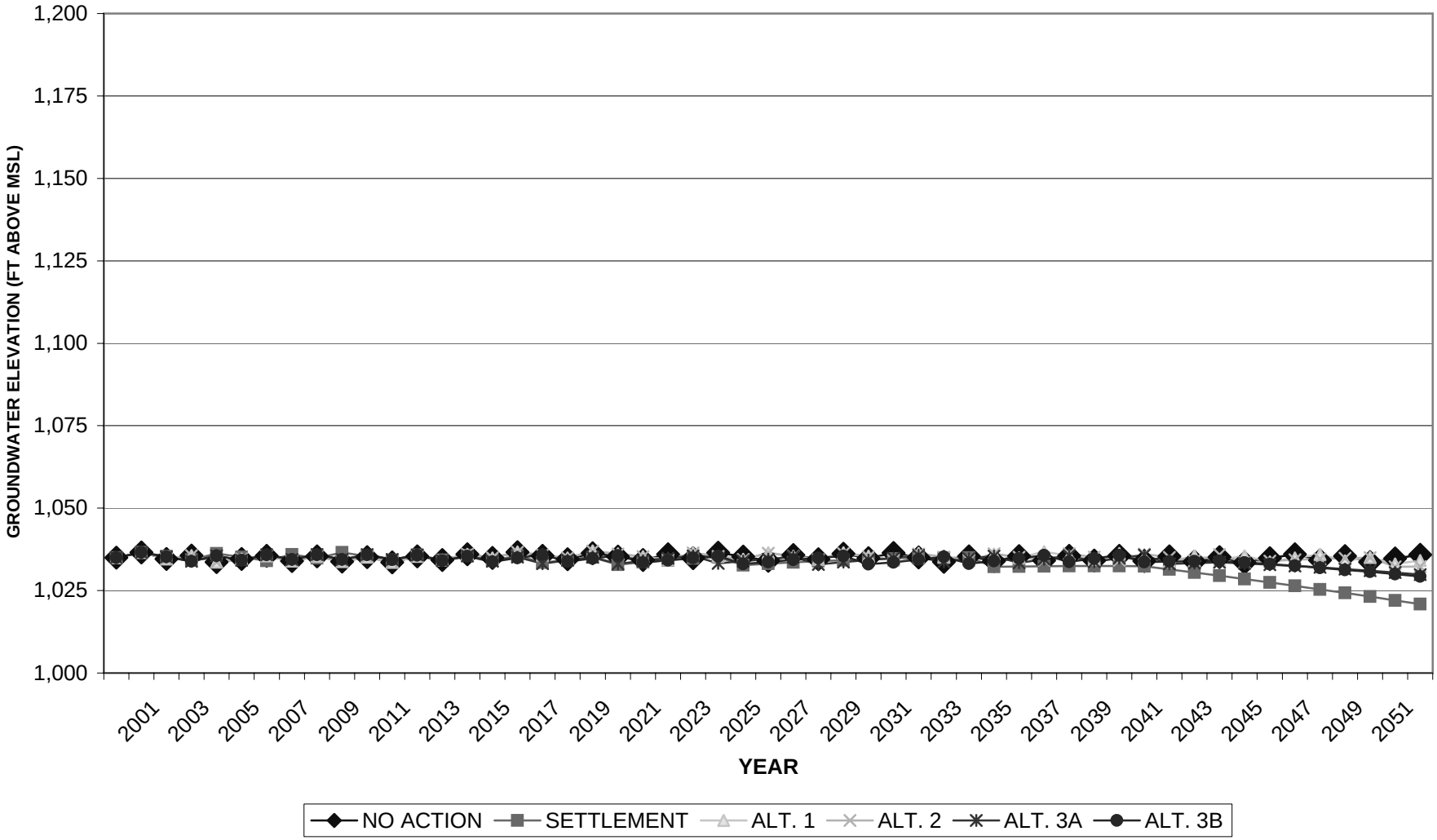

FIGURE I-59
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GRIC MARICOPA VILLAGE SUB-AREA

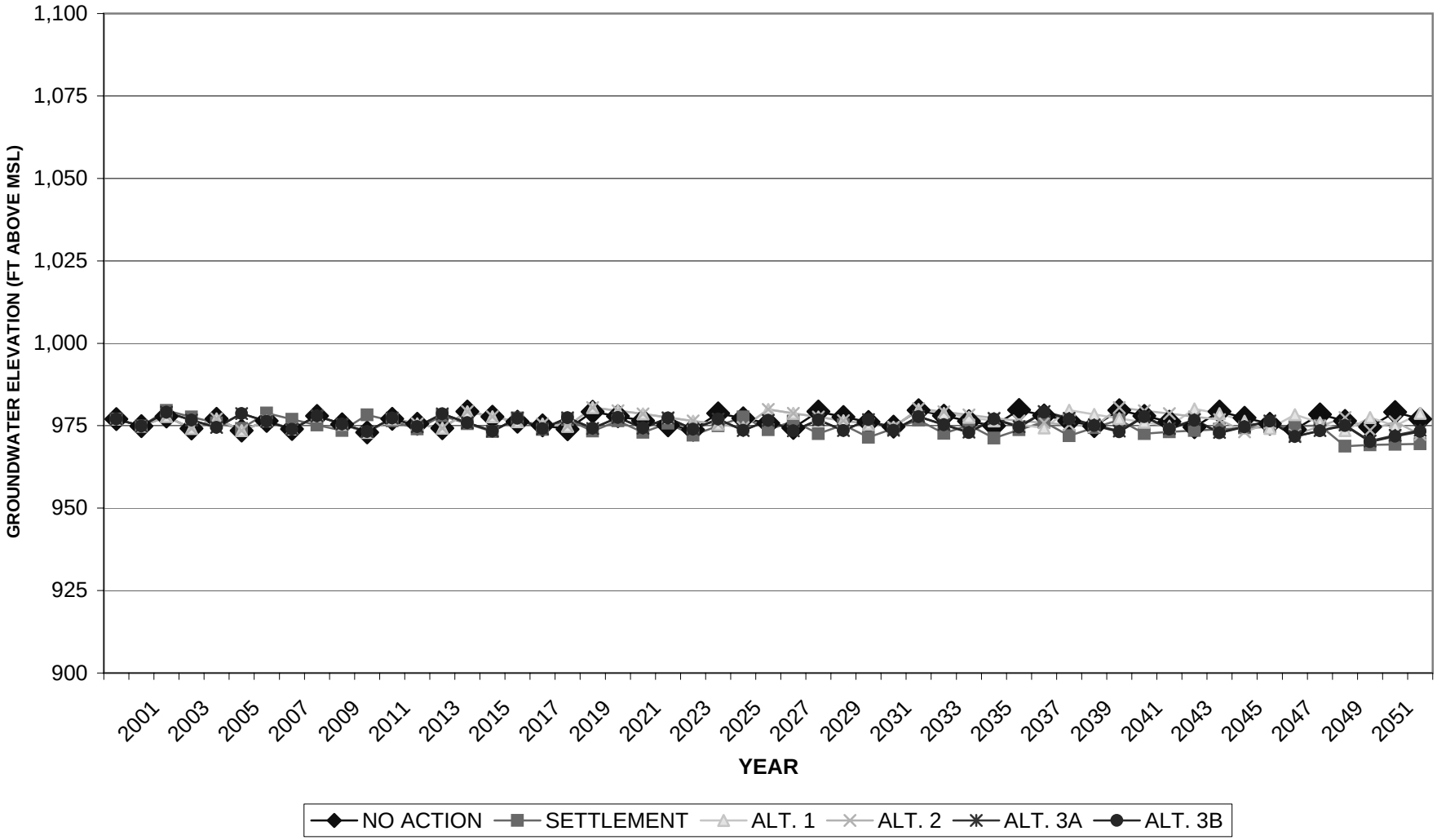

FIGURE I-60
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR NMIDD SUB-AREA

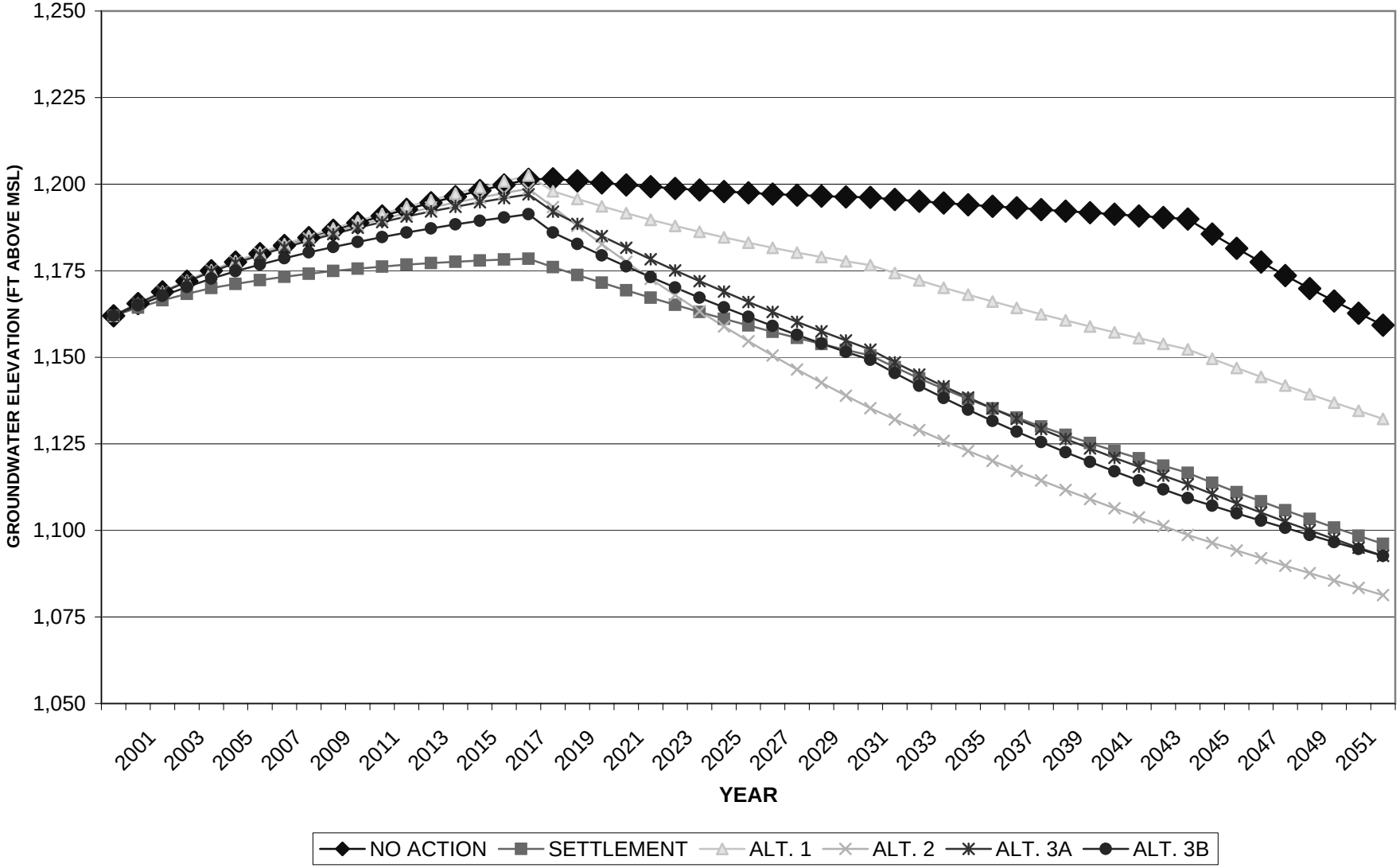

FIGURE I-61
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR FLORENCE JUNCTION SUB-AREA

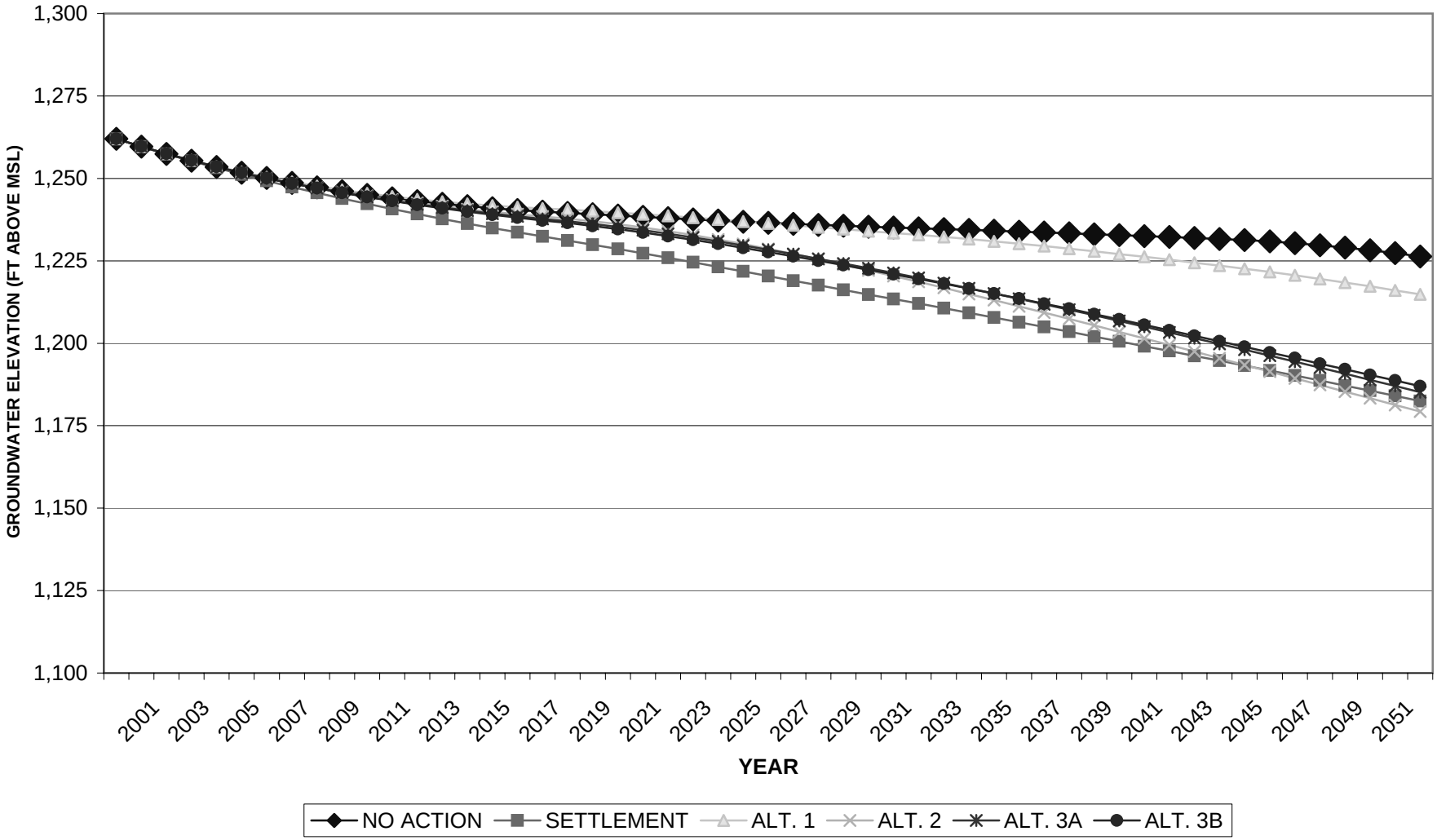

FIGURE I-62
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR QCID SUB-AREA

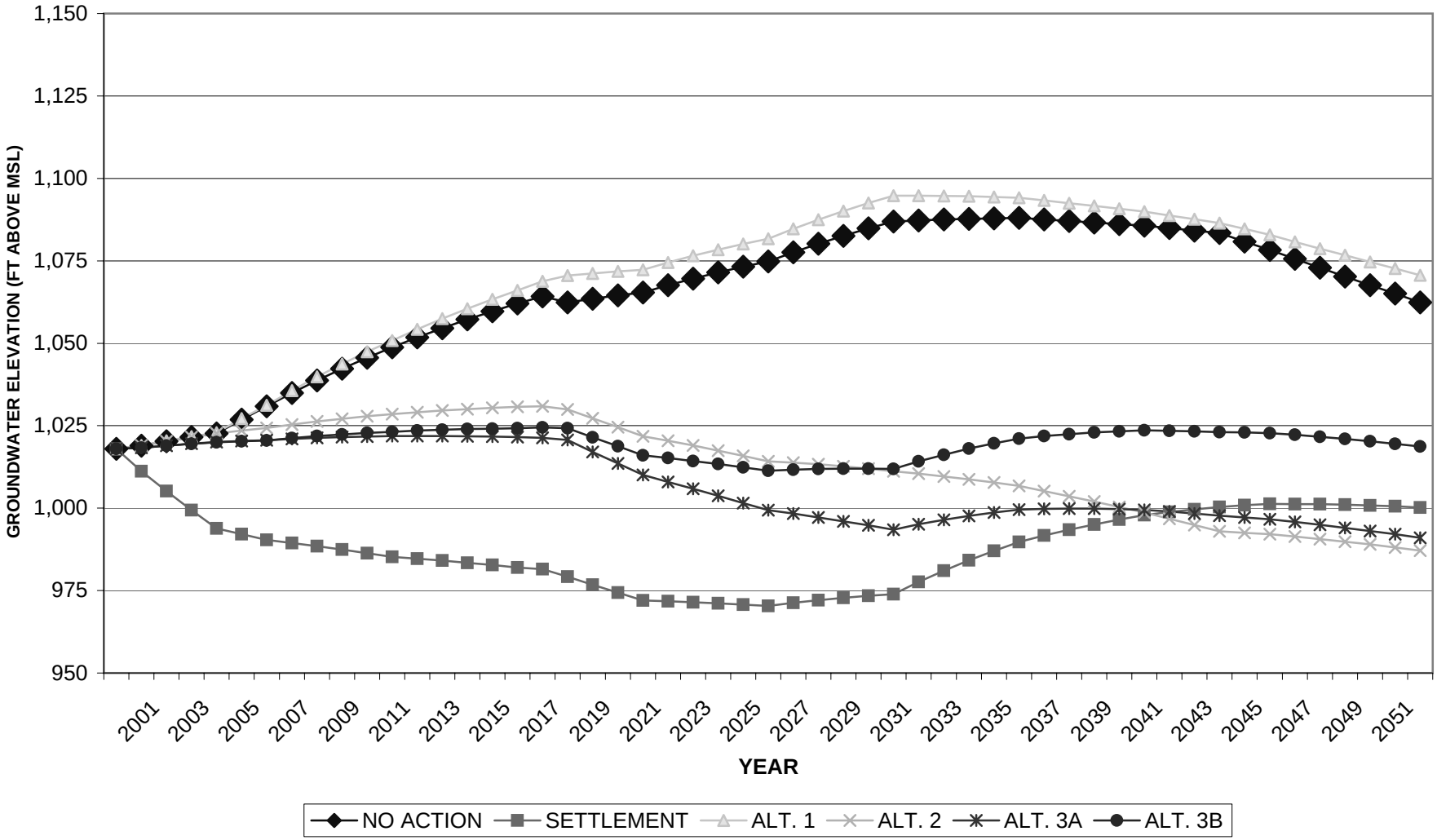

FIGURE I-63
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SUPERSTITION SUB-AREA

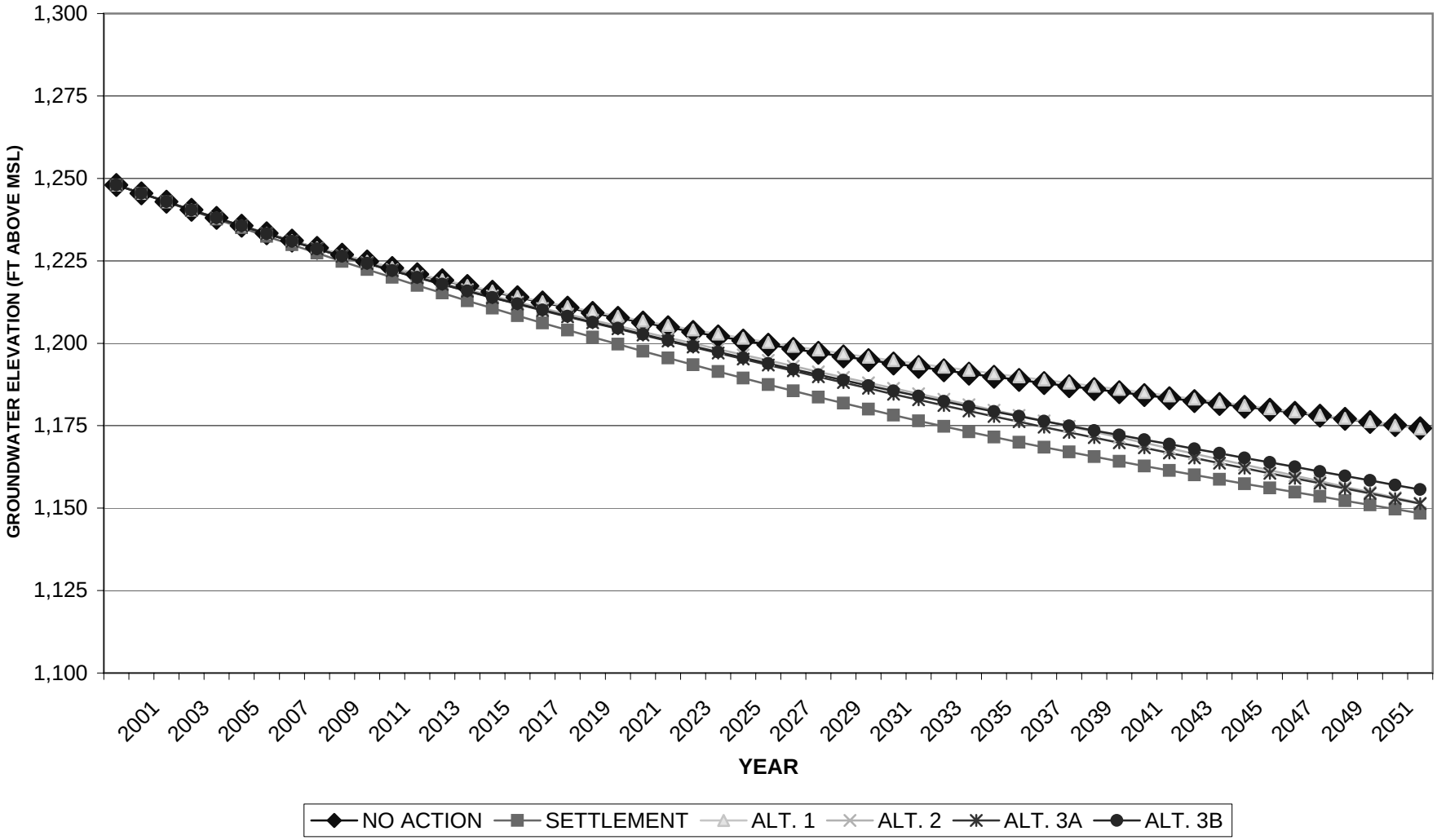

FIGURE I-64
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR APACHE JUNCTION SUB-AREA

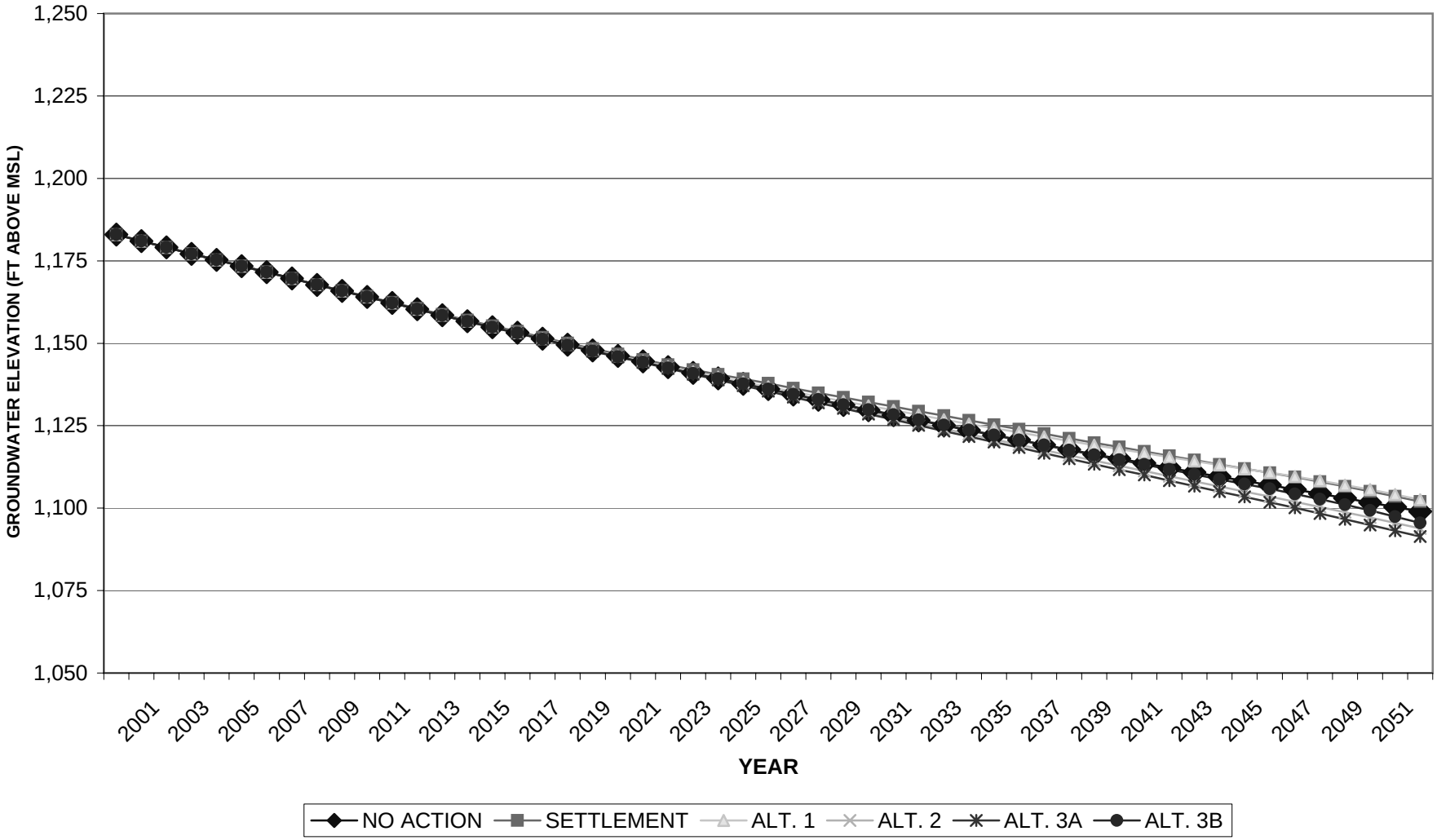

FIGURE I-65
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR MESA EAST SUB-AREA

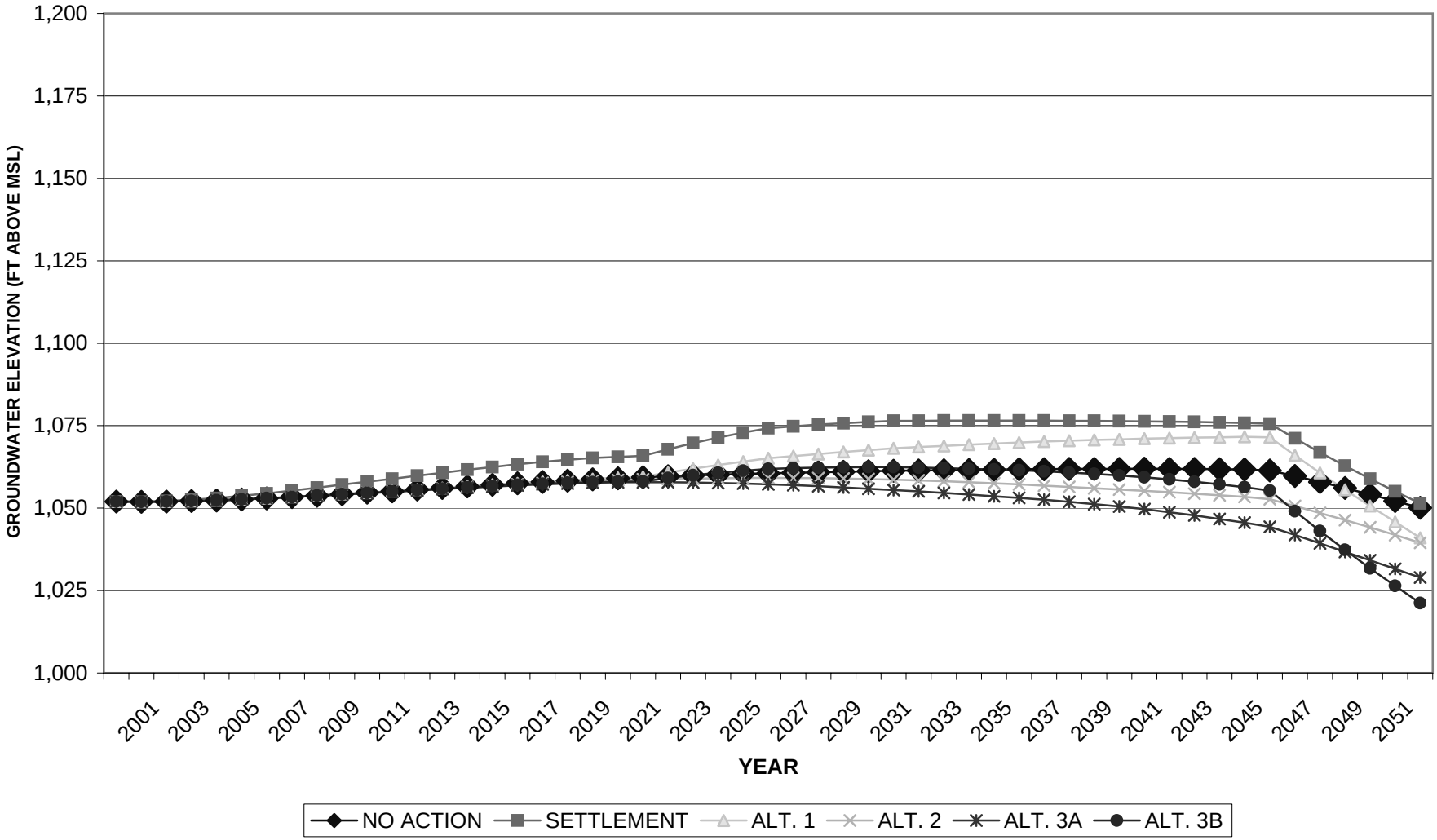

FIGURE I-66
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR WILLIAMS AIRPORT SUB-AREA

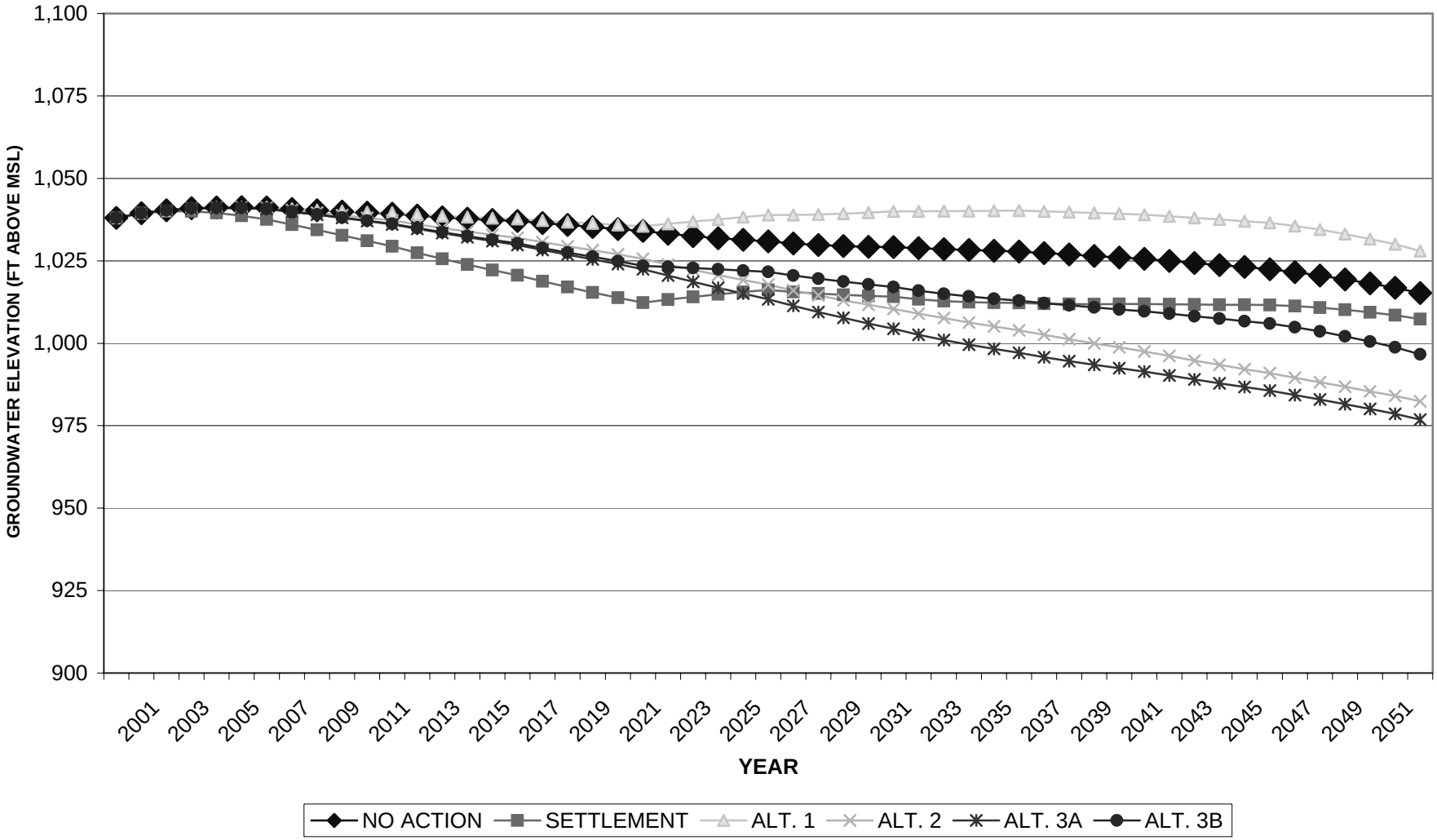

FIGURE I-67
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR MESA WEST SUB-AREA

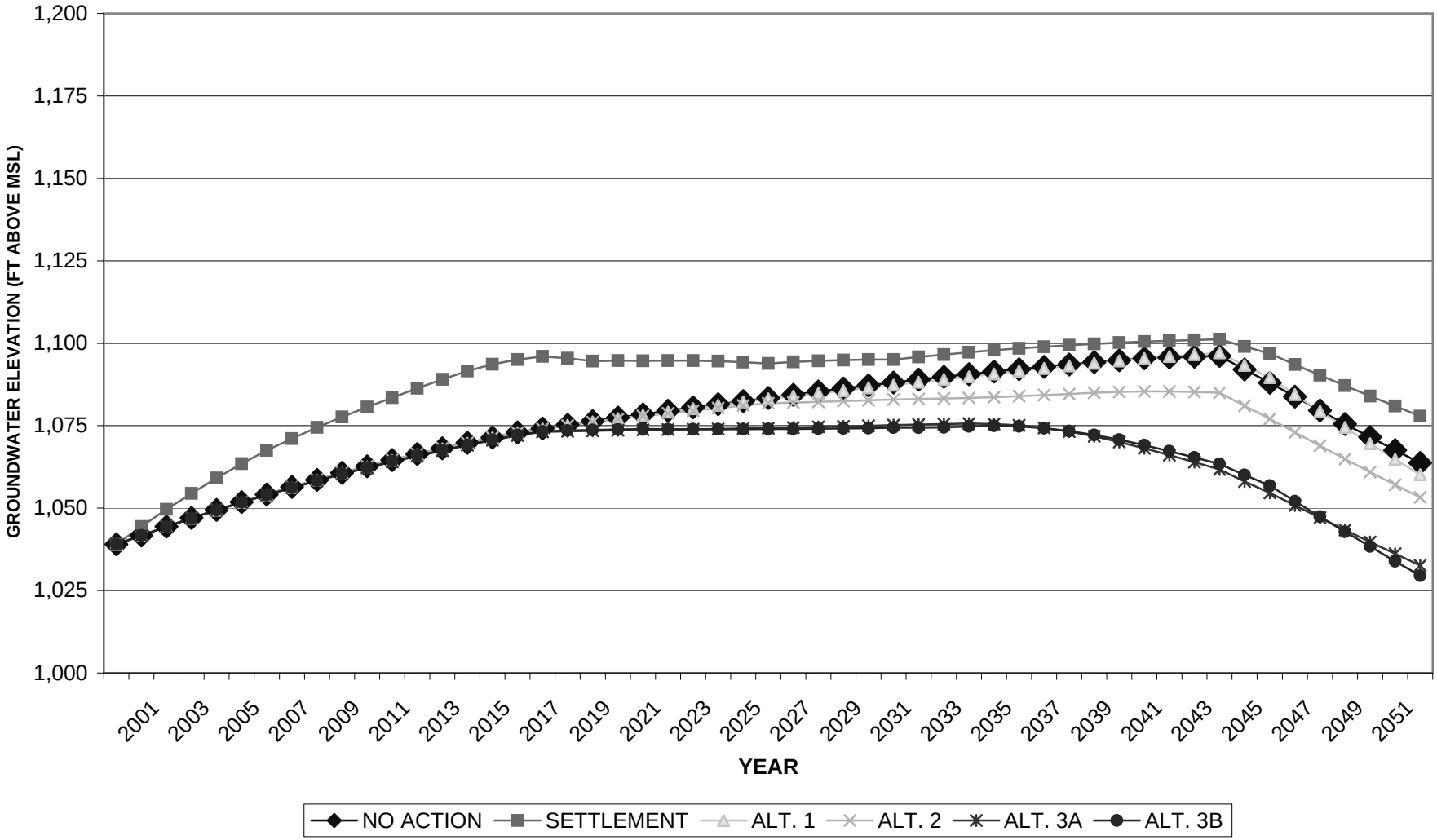

FIGURE I-68
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CHANDLER NORTH SUB-AREA

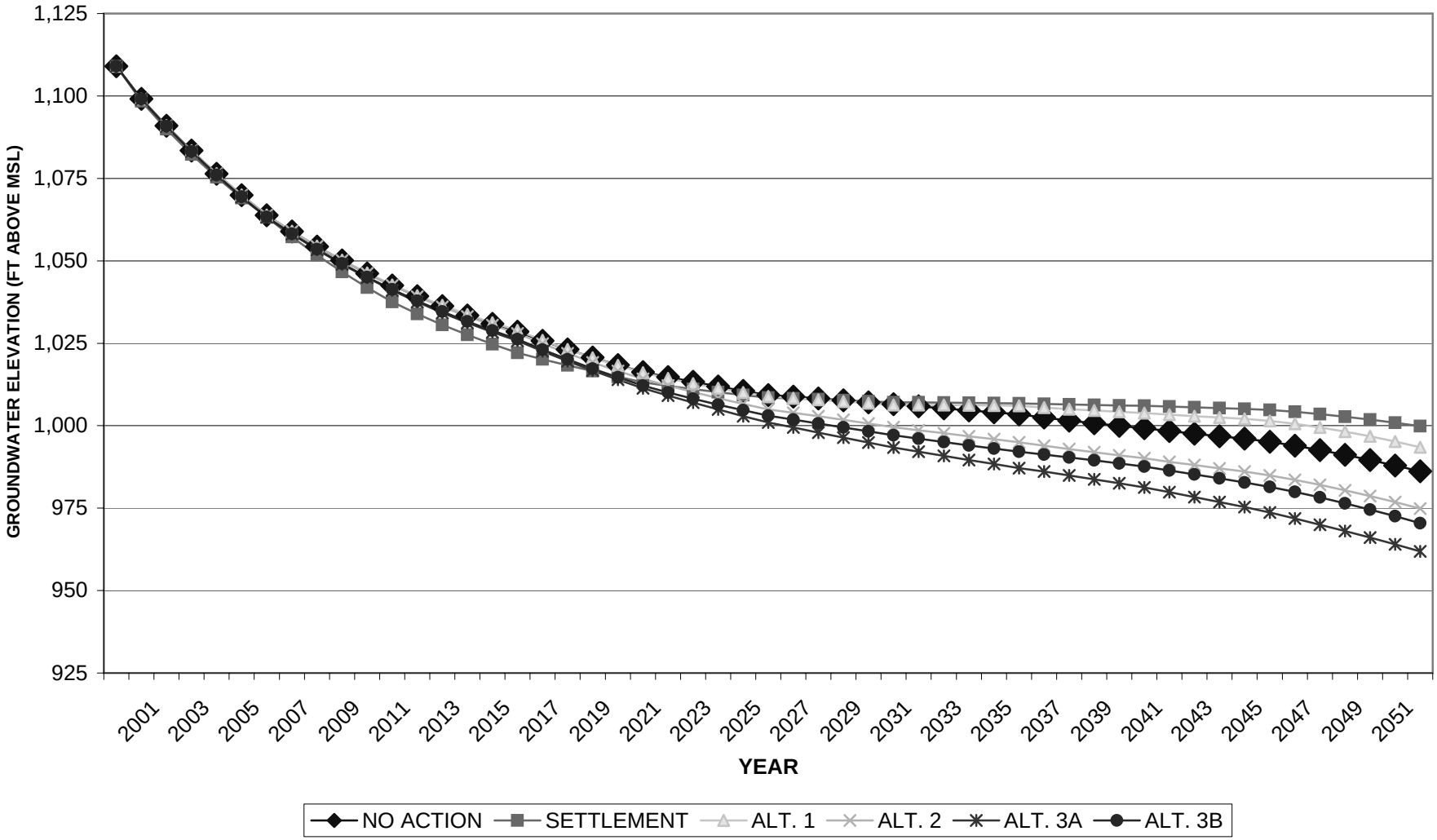

FIGURE I-69
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CHANDLER SOUTH SUB-AREA

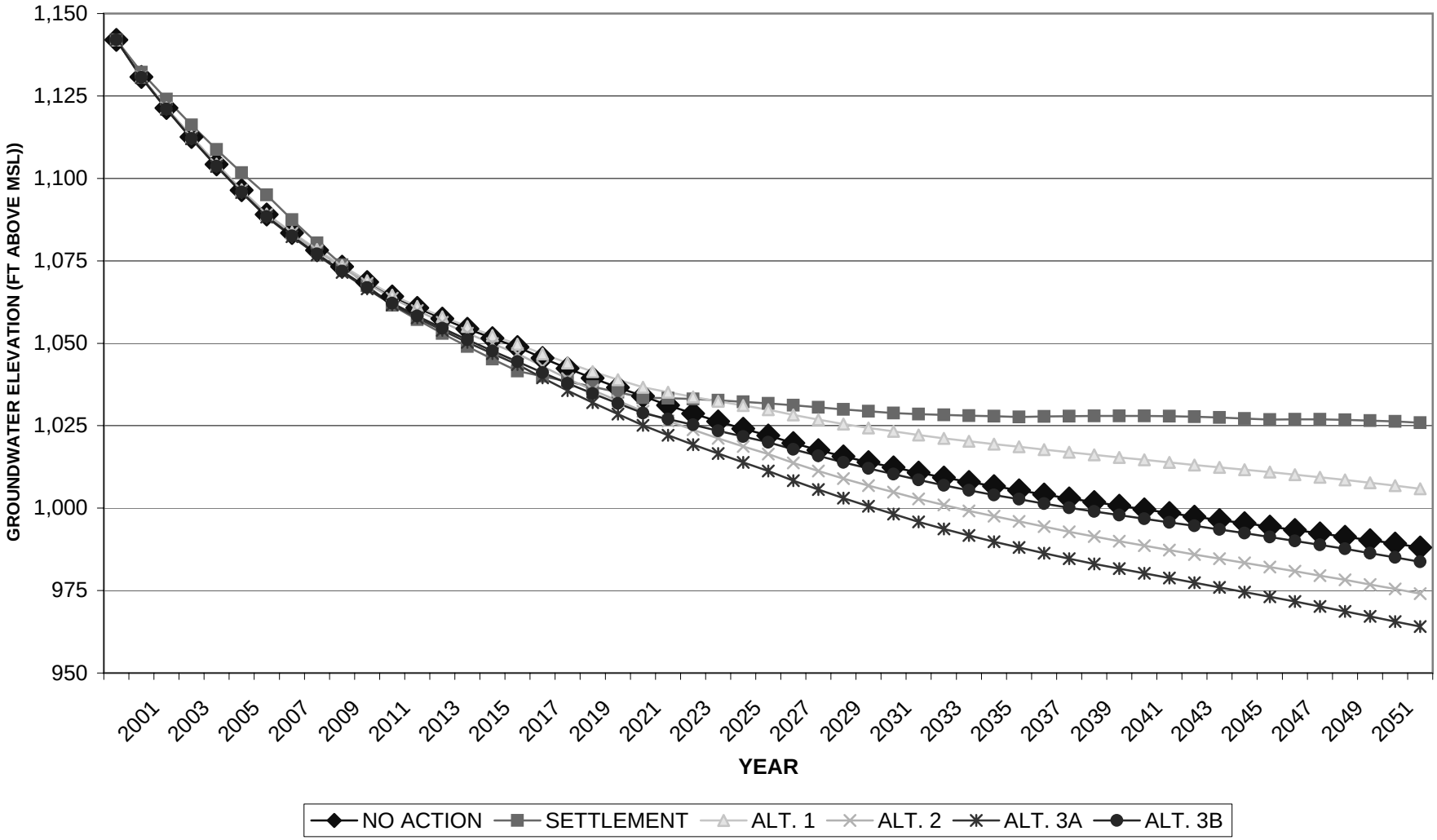

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FIGURE I-70
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TEMPE SOUTH SUB-AREA

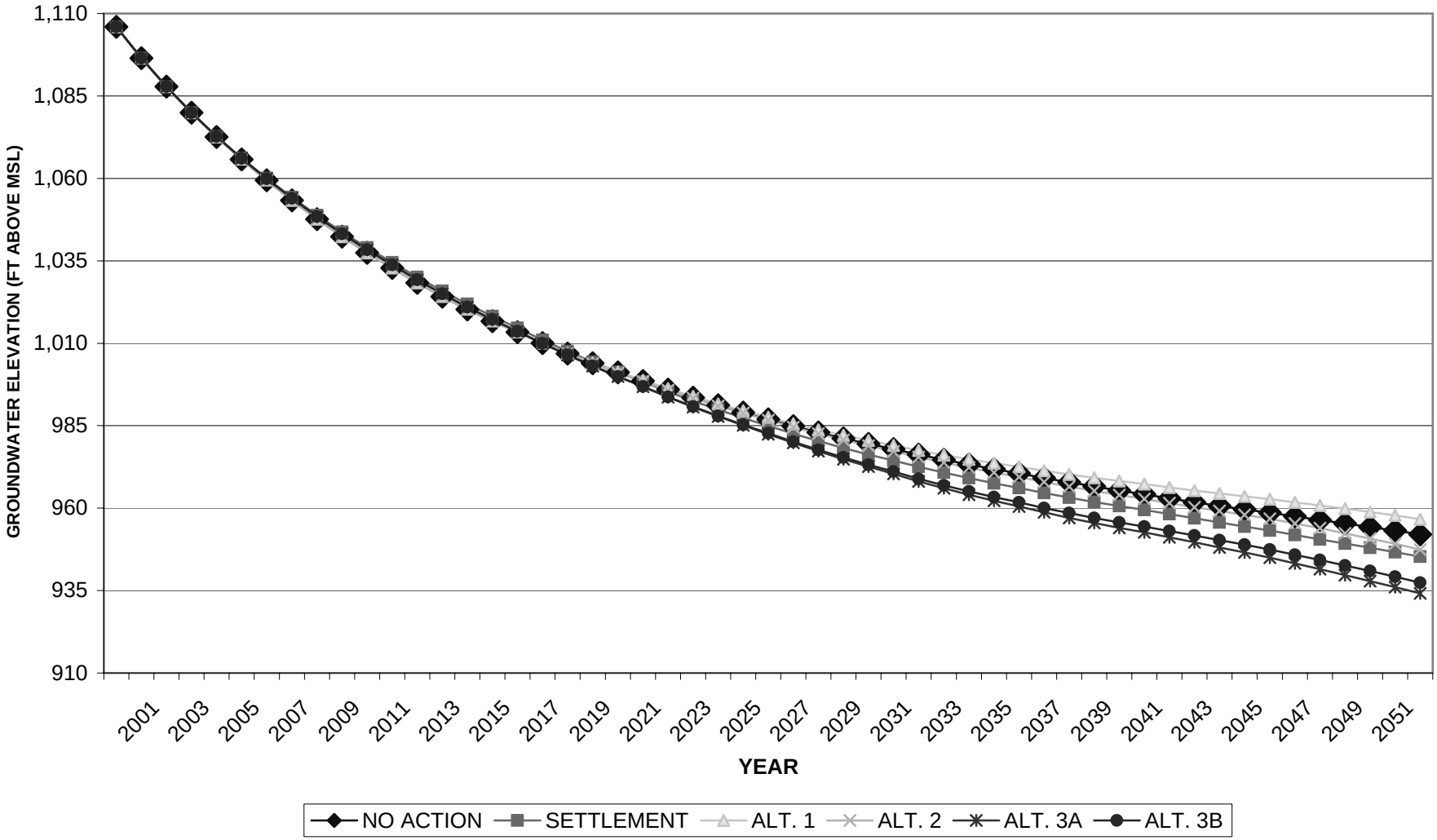


FIGURE I-71
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR TEMPE NORTH SUB-AREA

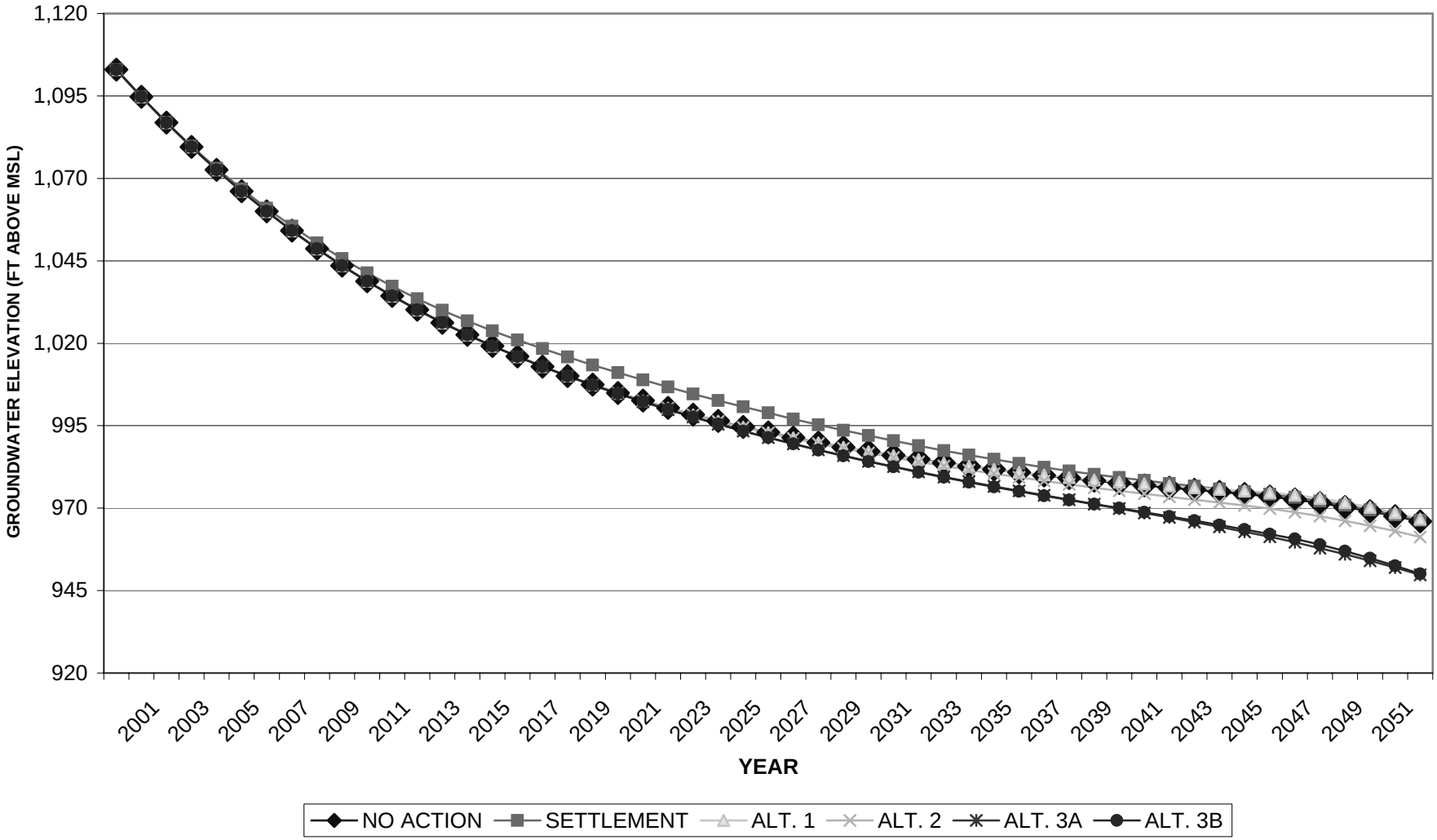


FIGURE I-72
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SALT RIVER INDIANS SUB-AREA

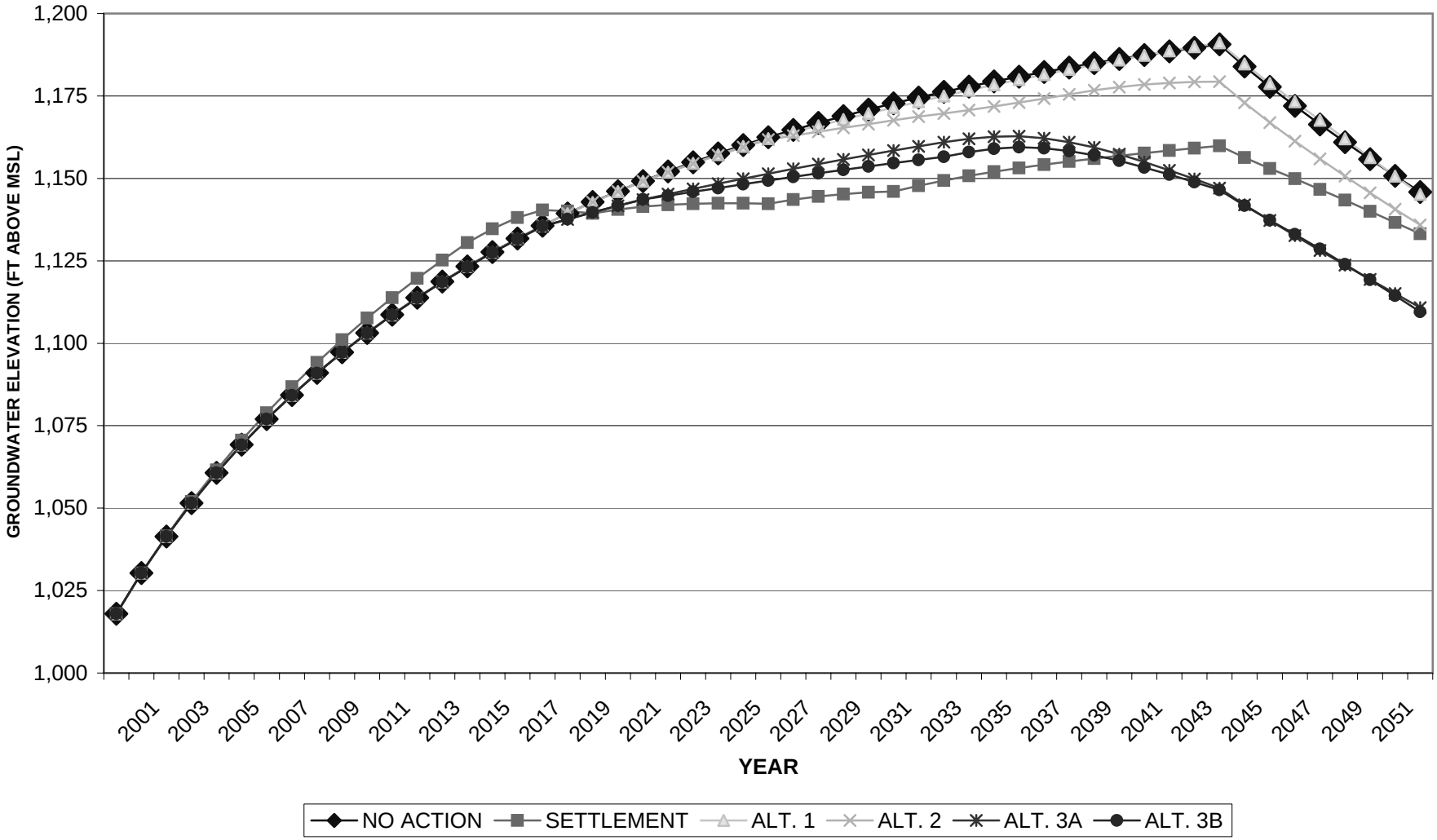


FIGURE I-73
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SCOTTSDALE SOUTH SUB-AREA

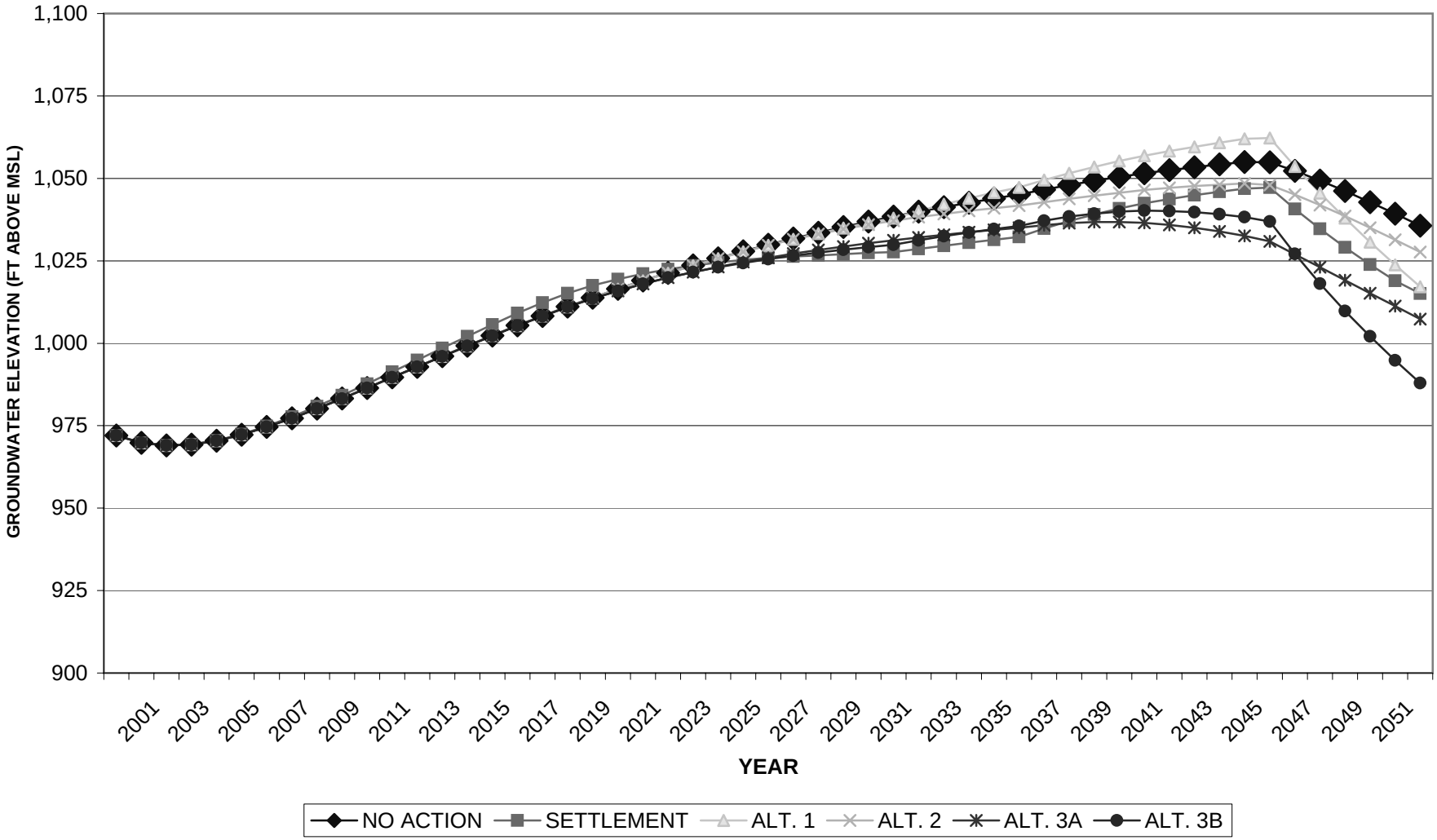


FIGURE I-74
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SCOTTSDALE NORTH SUB-AREA

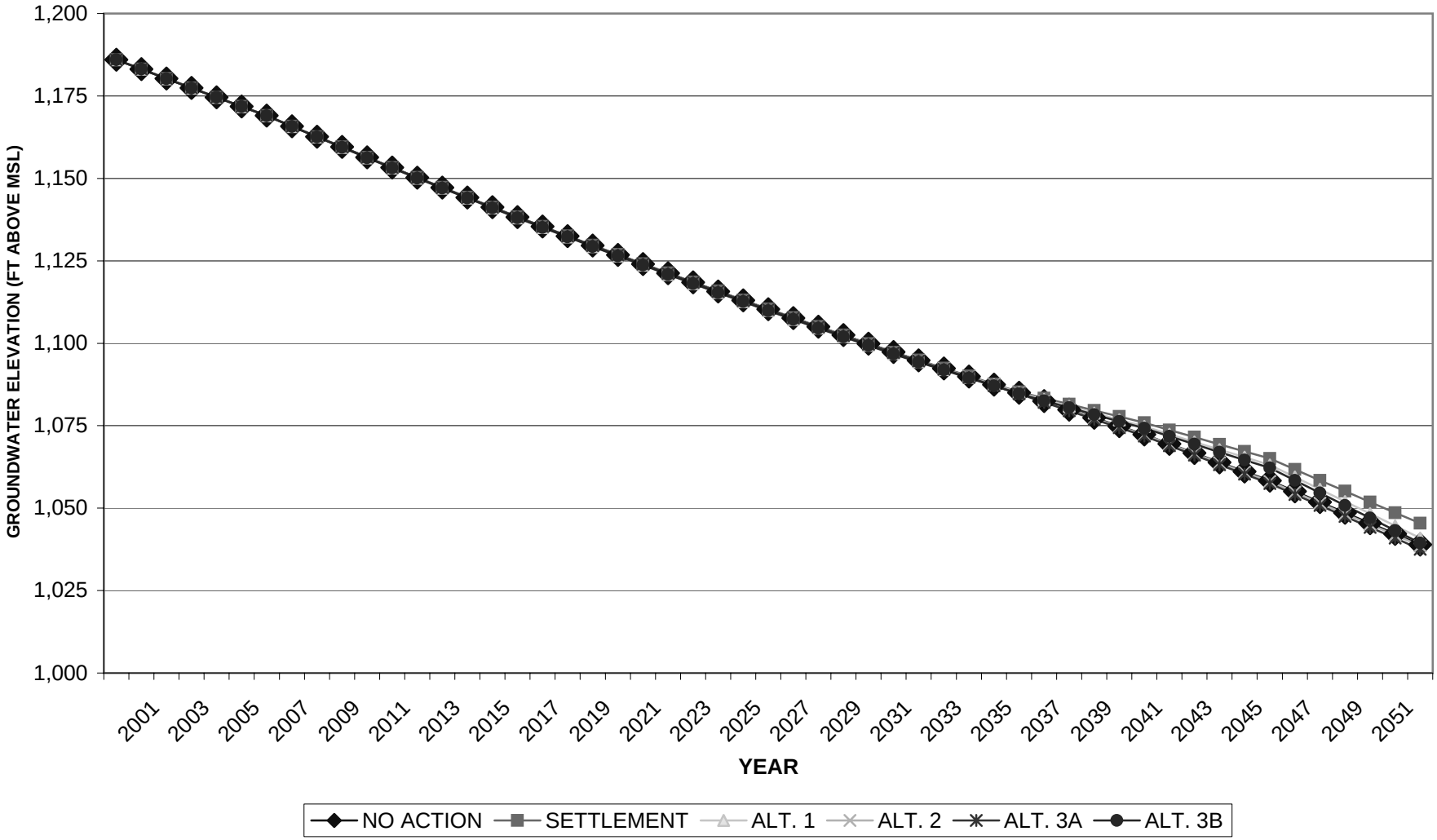


FIGURE I-75
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR McDOWELL SUB-AREA

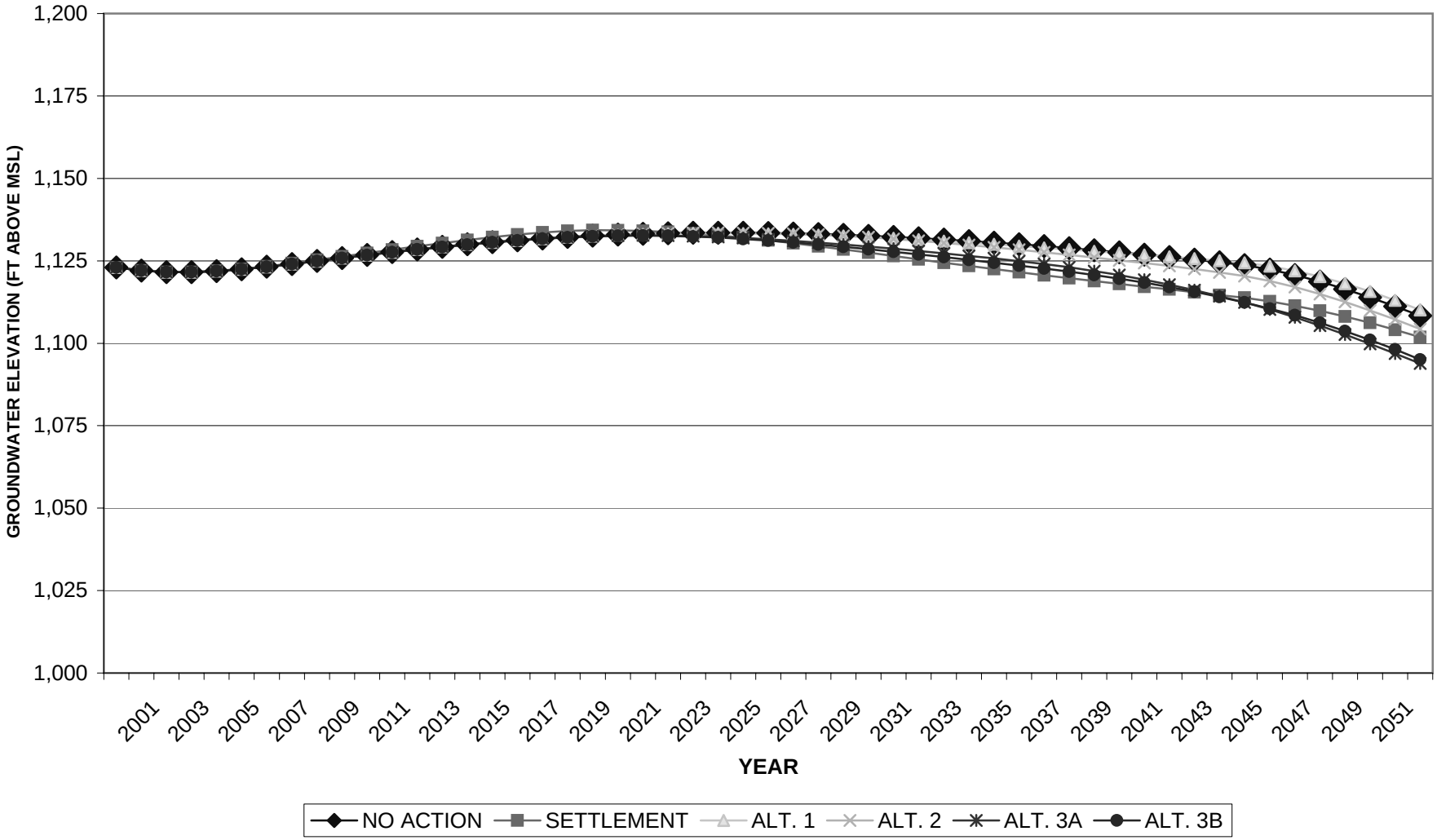


FIGURE I-76
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR PHOENIX SOUTH SUB-AREA

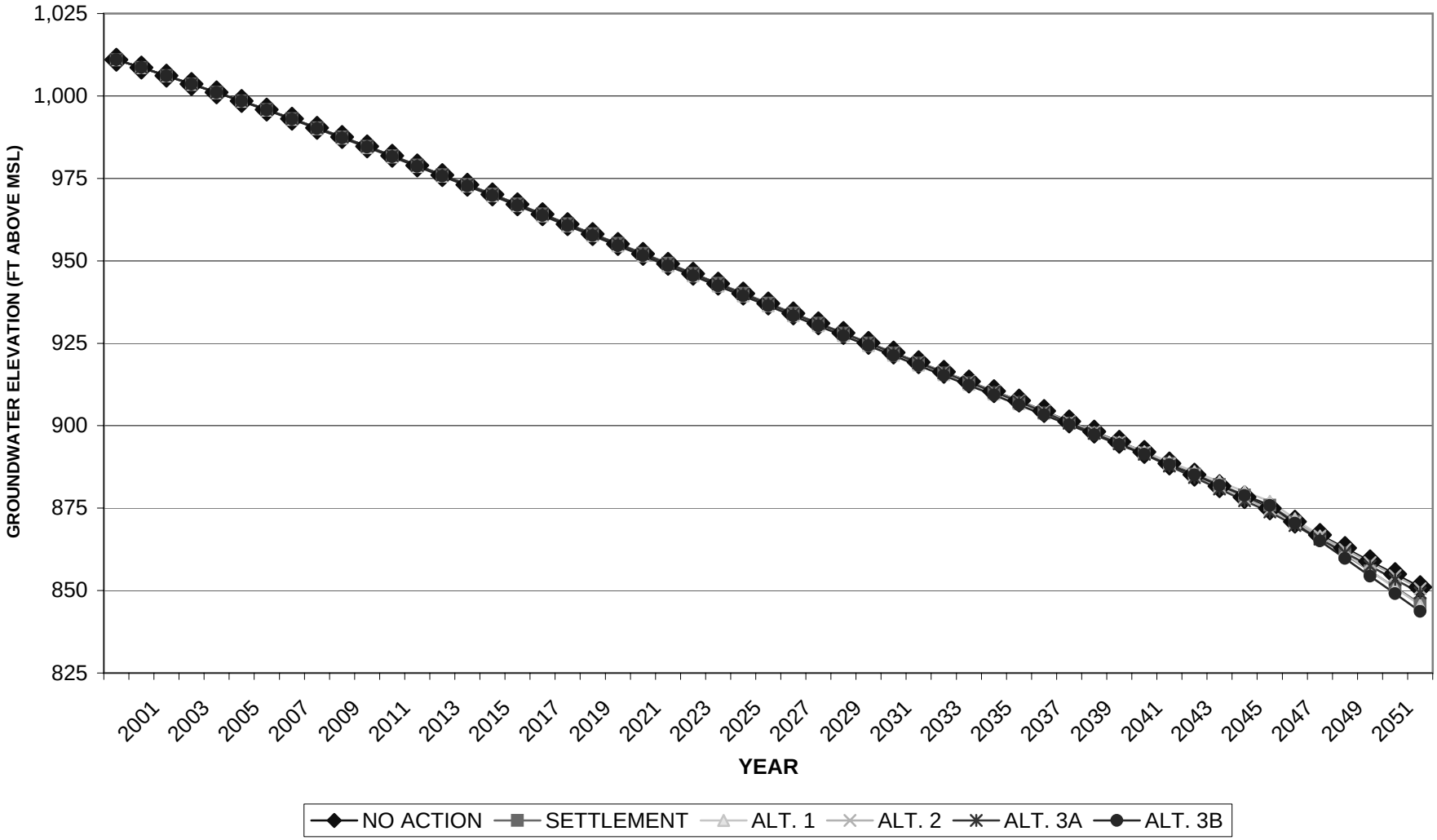
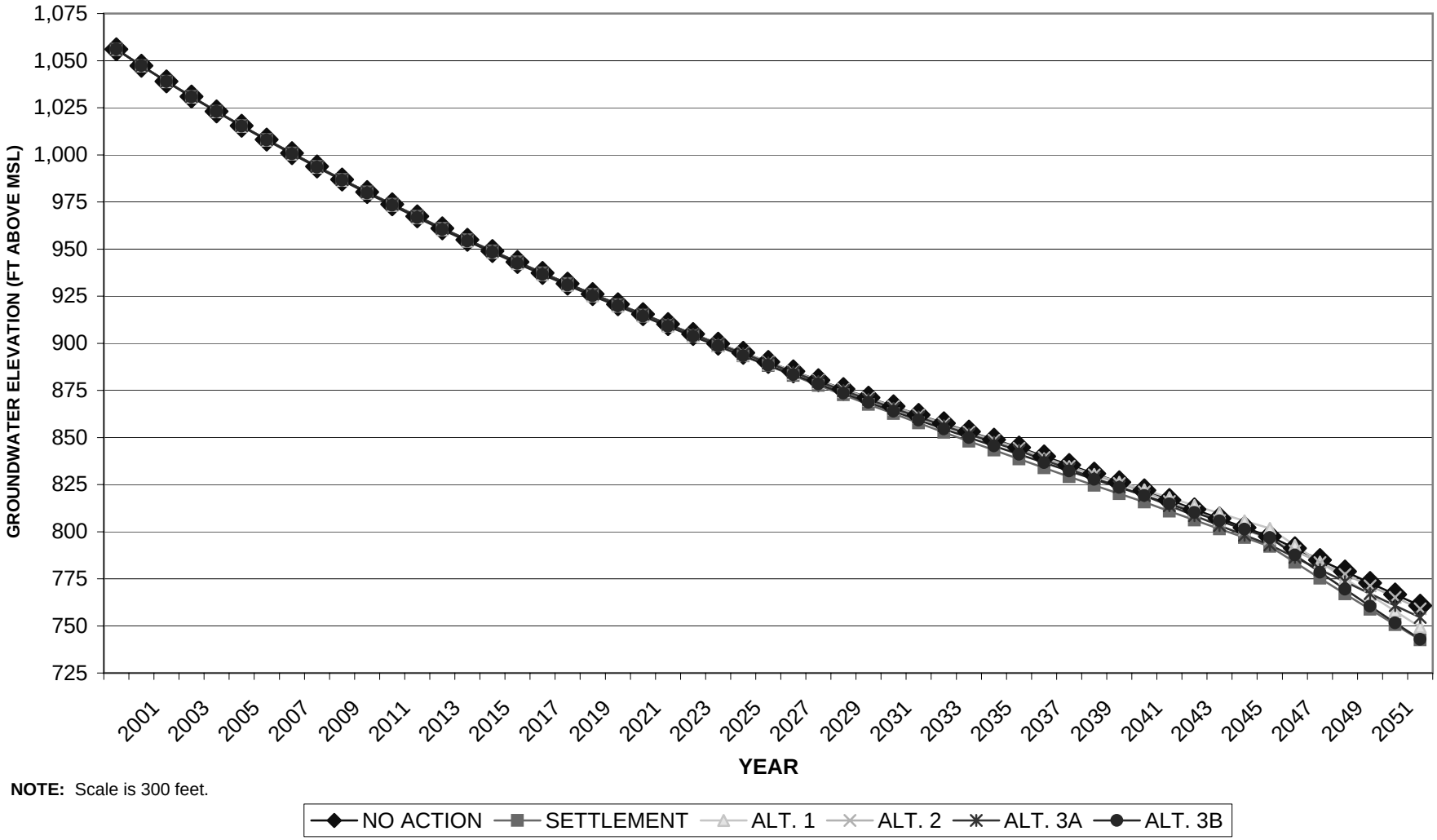


FIGURE I-77
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR PHOENIX NORTH SUB-AREA



NOTE: Scale is 300 feet.

FIGURE I-78
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR PHOENIX SW SUB-AREA

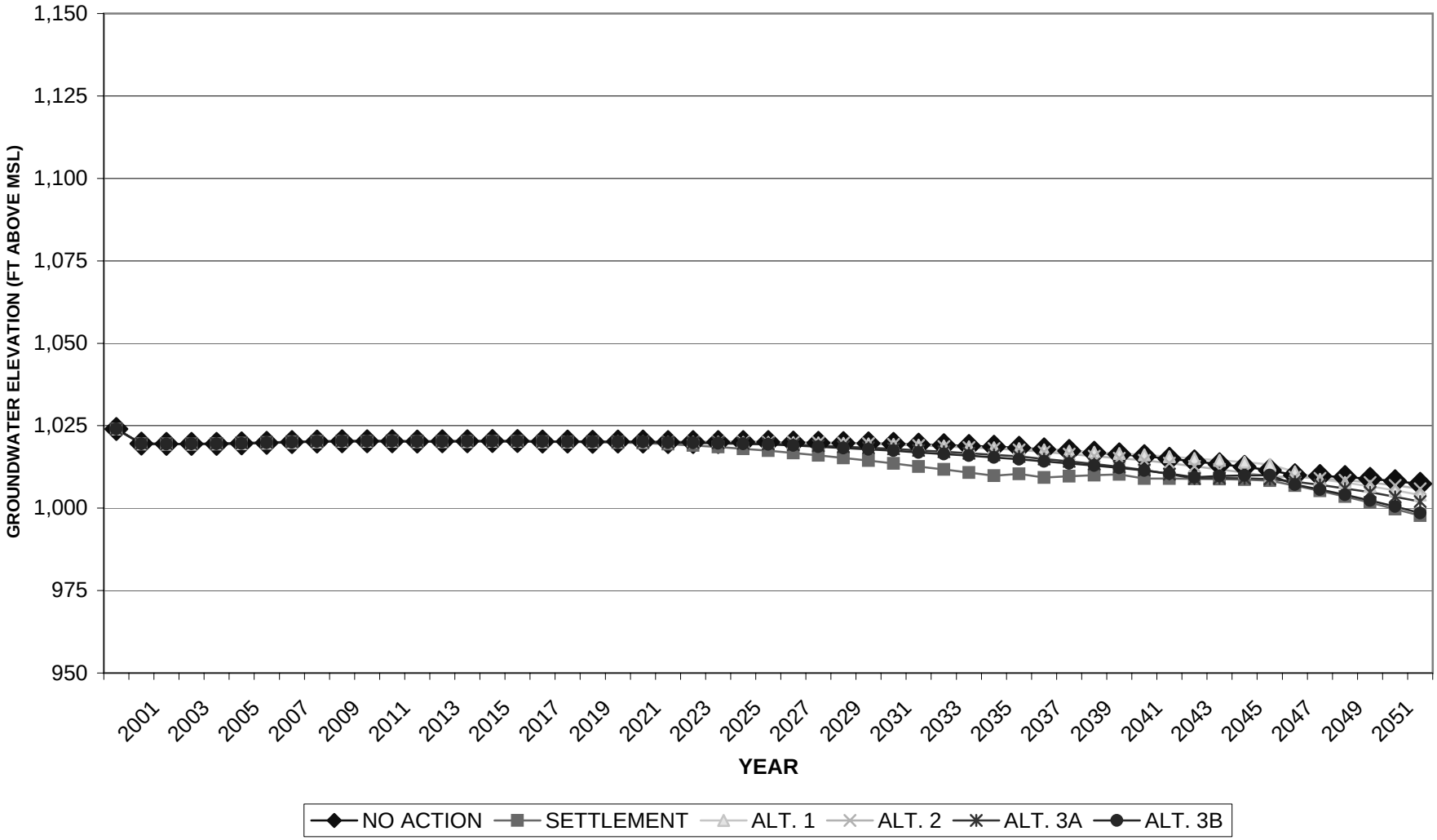


FIGURE I-79
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR GLENDALE-PEORIA SUB-AREA

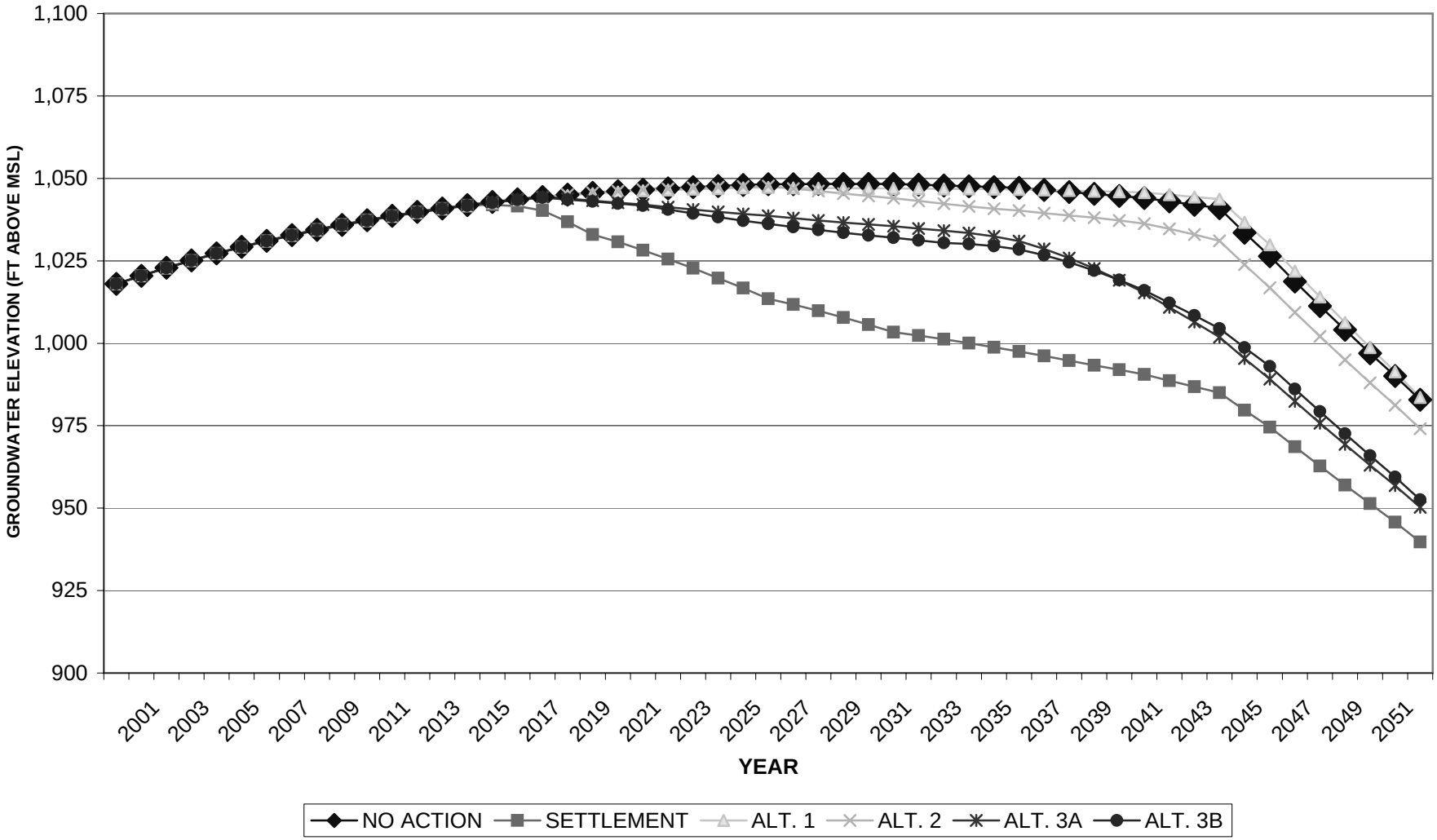


FIGURE I-80
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR SUN CITY WEST SUB-AREA

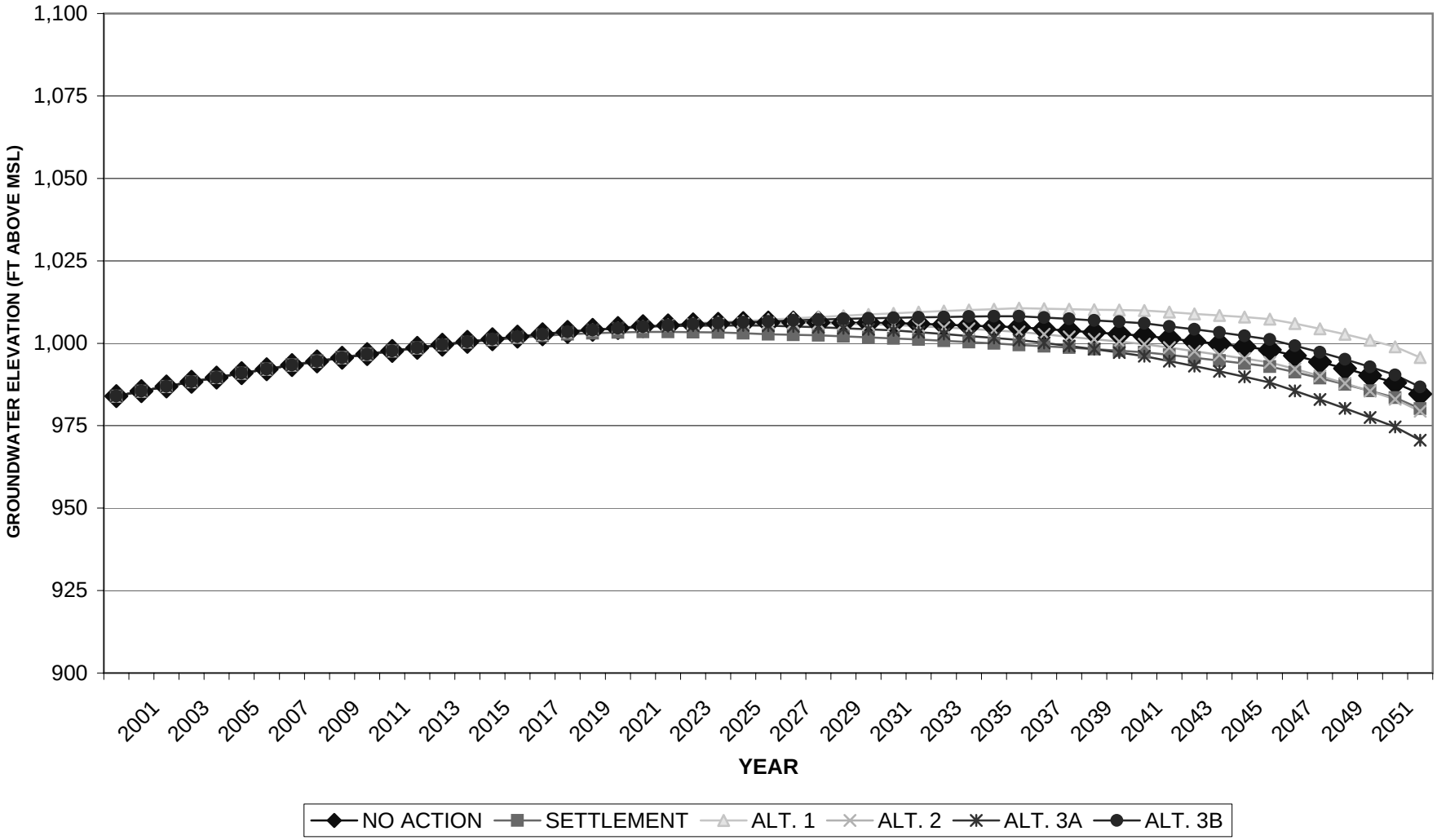
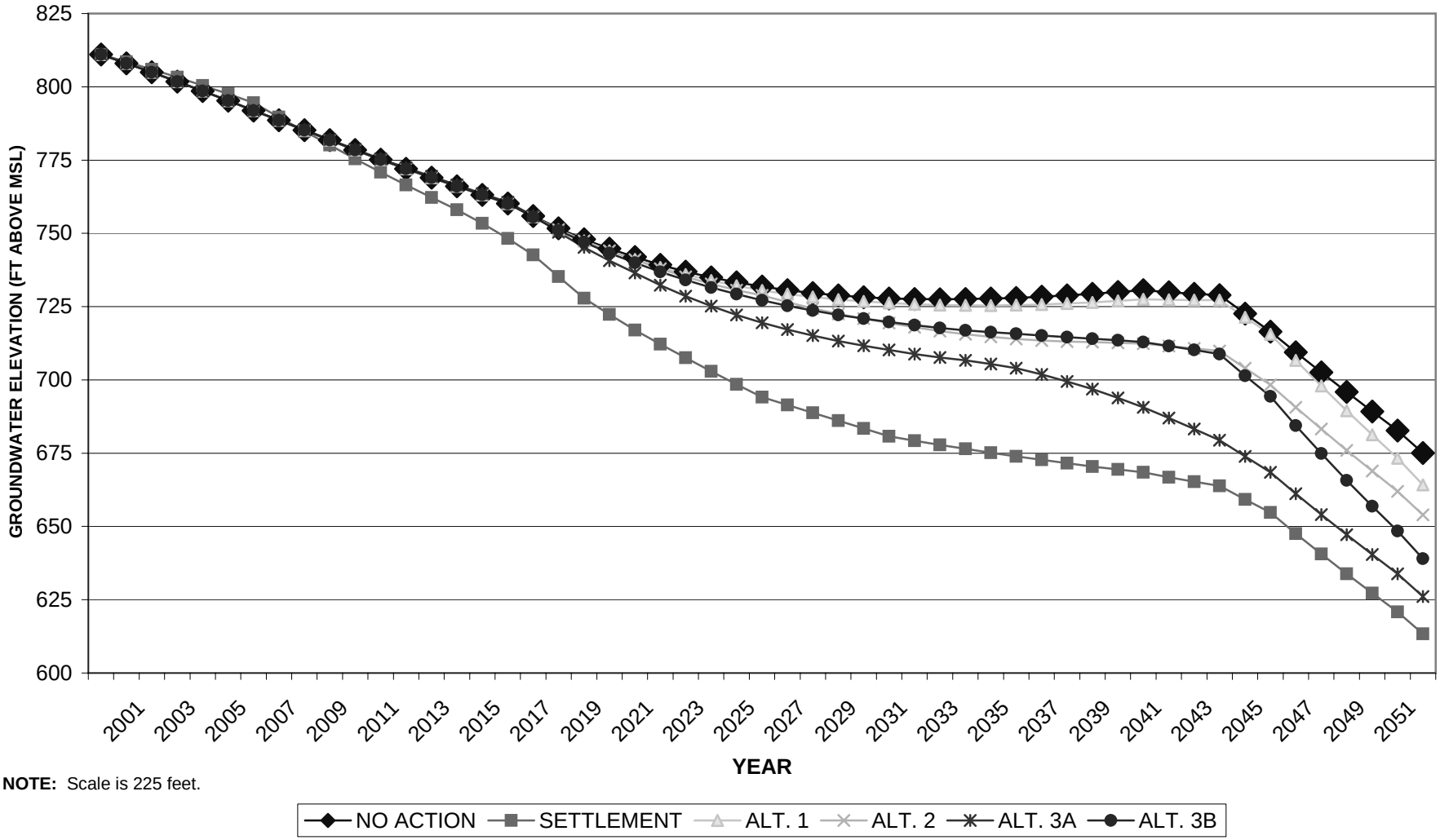
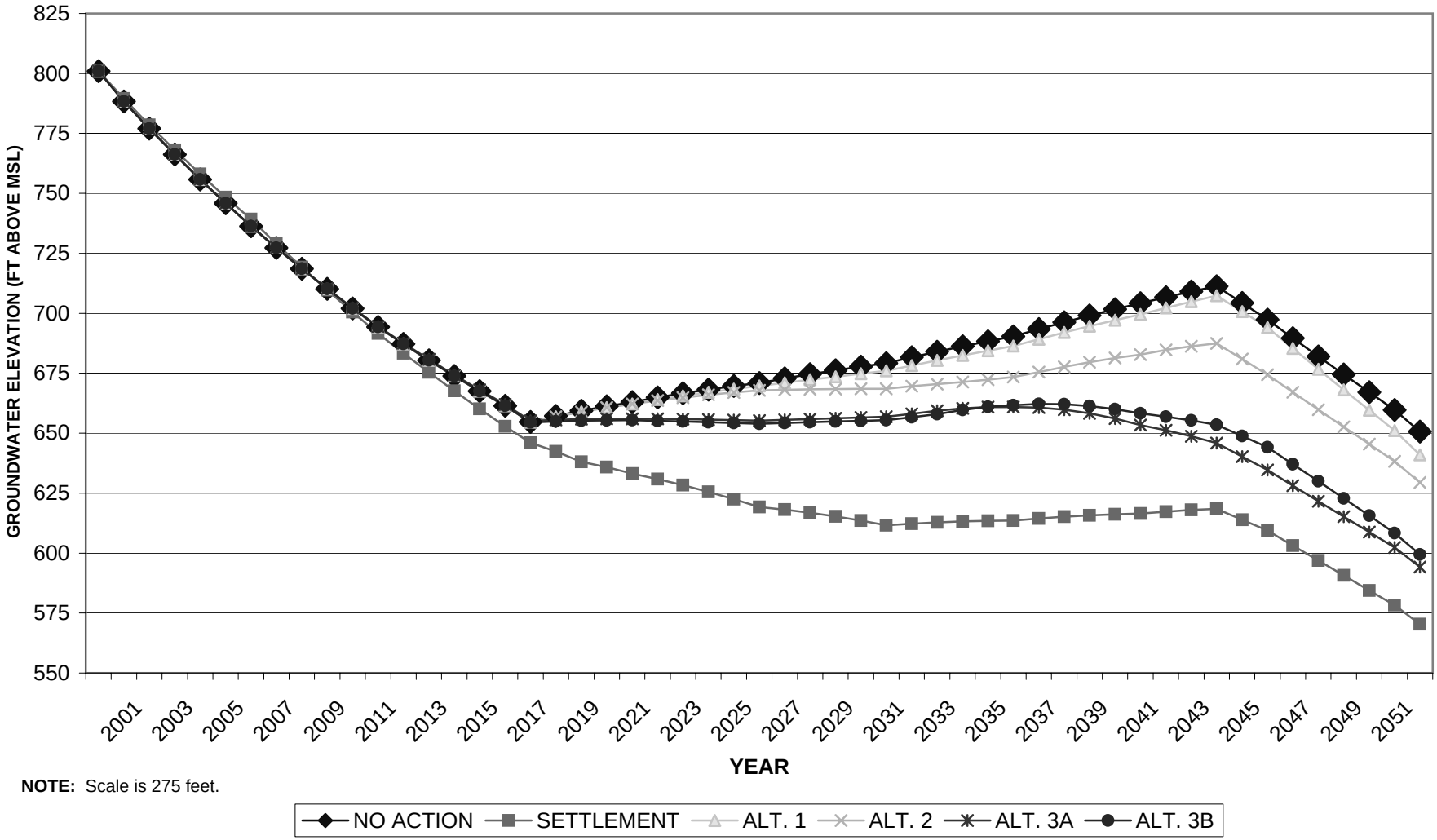


FIGURE I-81
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR WEST SIDE M&I SUB-AREA



NOTE: Scale is 225 feet.

FIGURE I-82
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR MWD SUB-AREA



NOTE: Scale is 275 feet.

FIGURE I-83
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR AVONDALE SUB-AREA

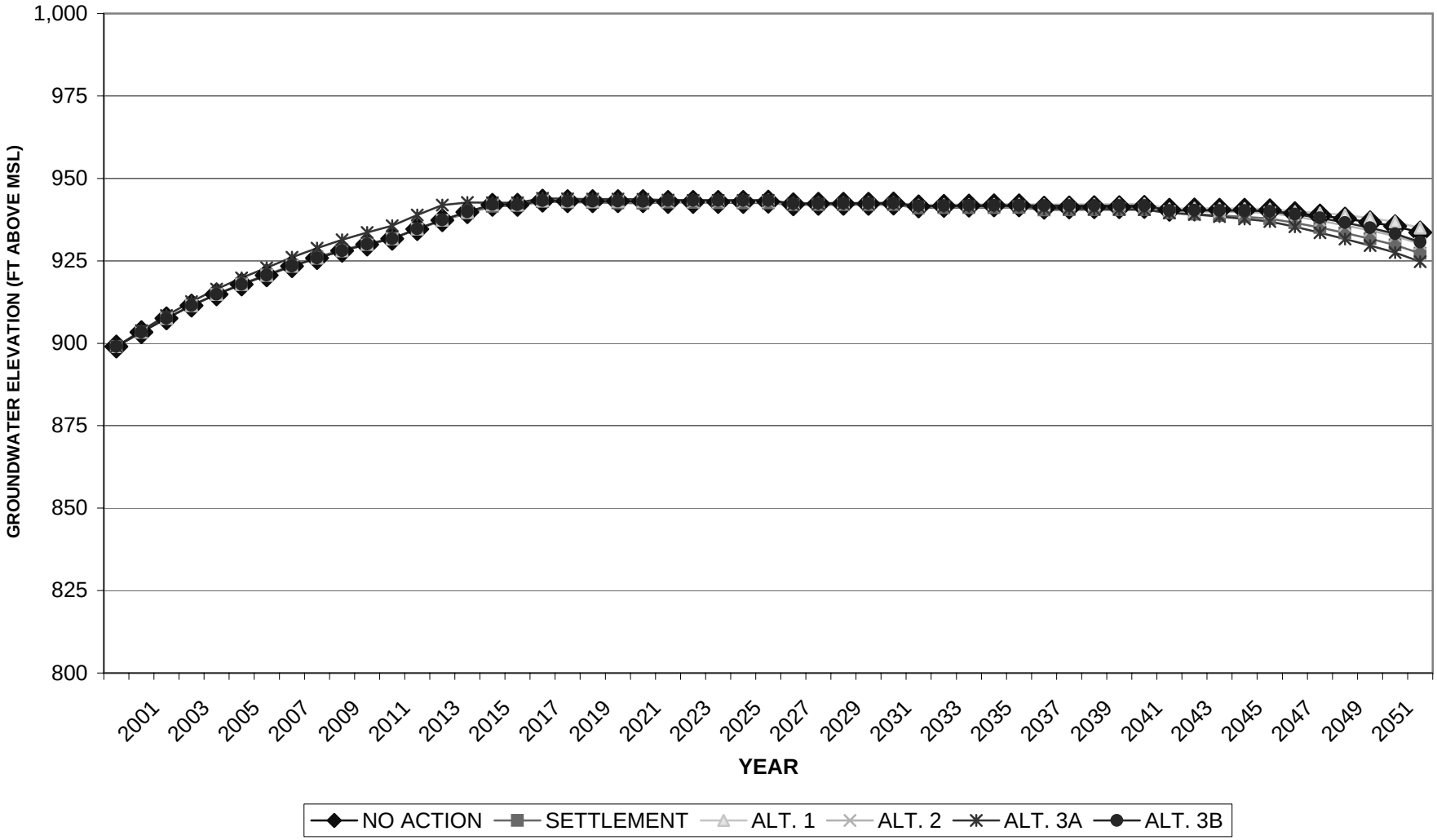


FIGURE I-84
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR EAST BUCKEYE SUB-AREA

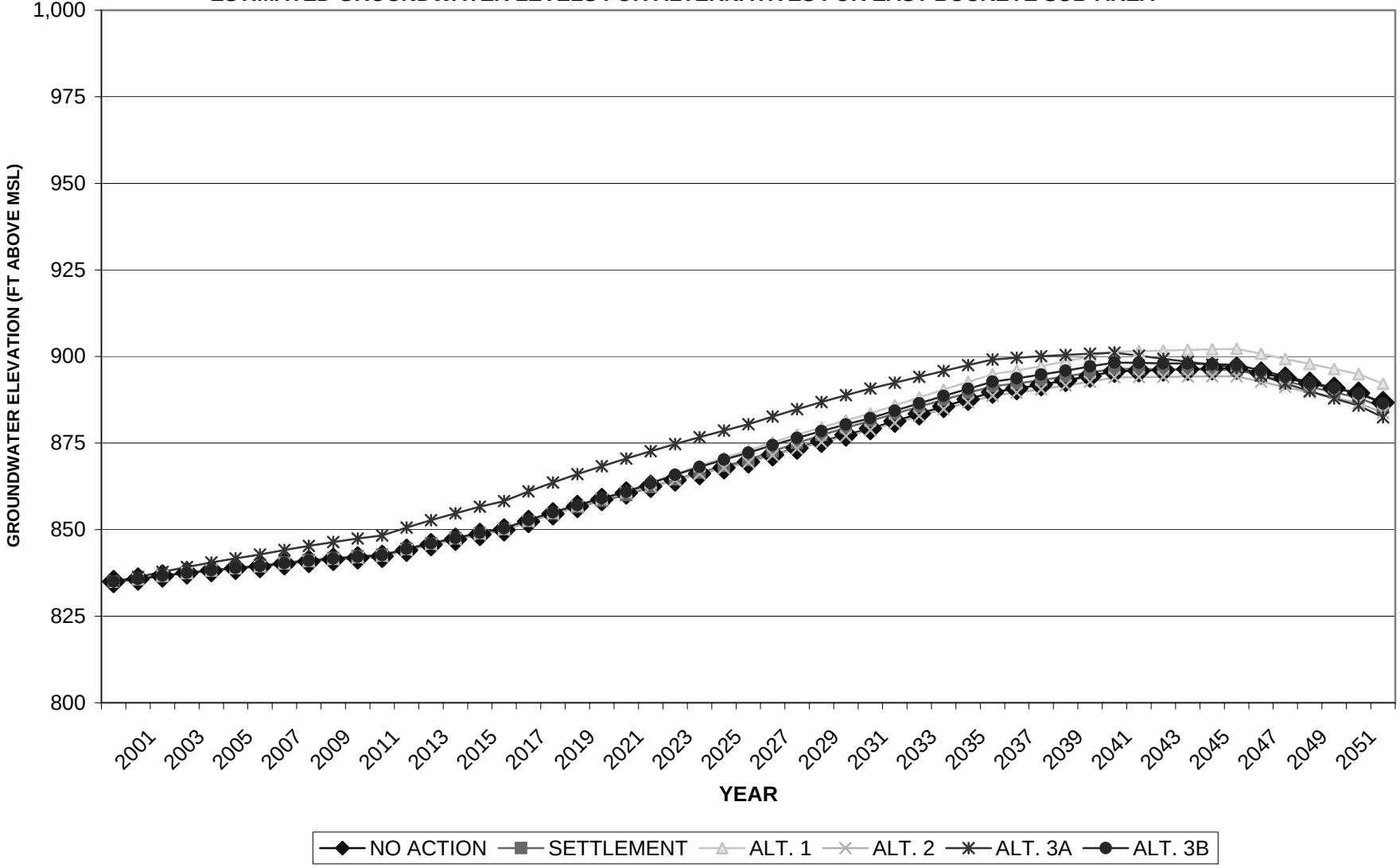
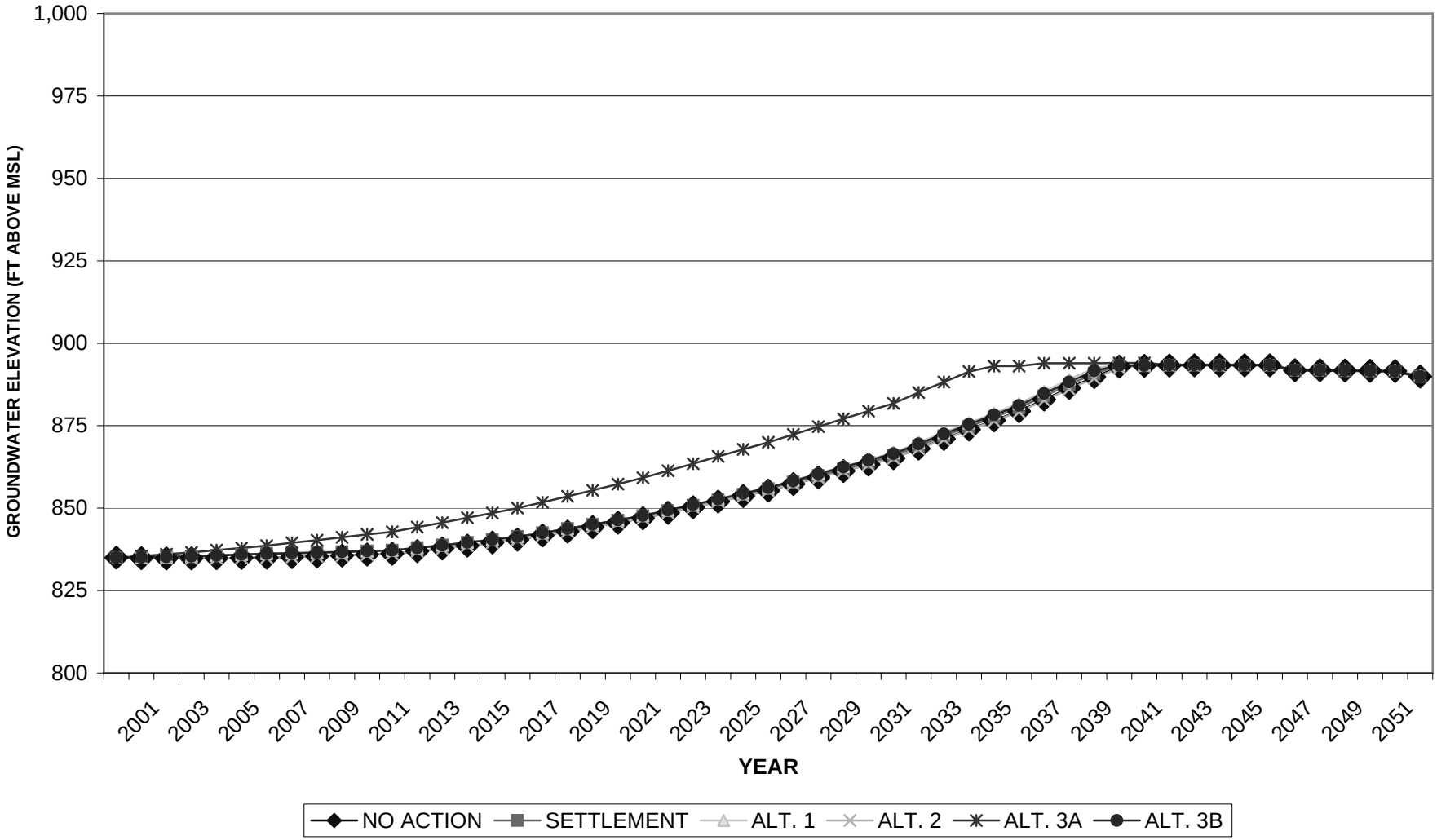
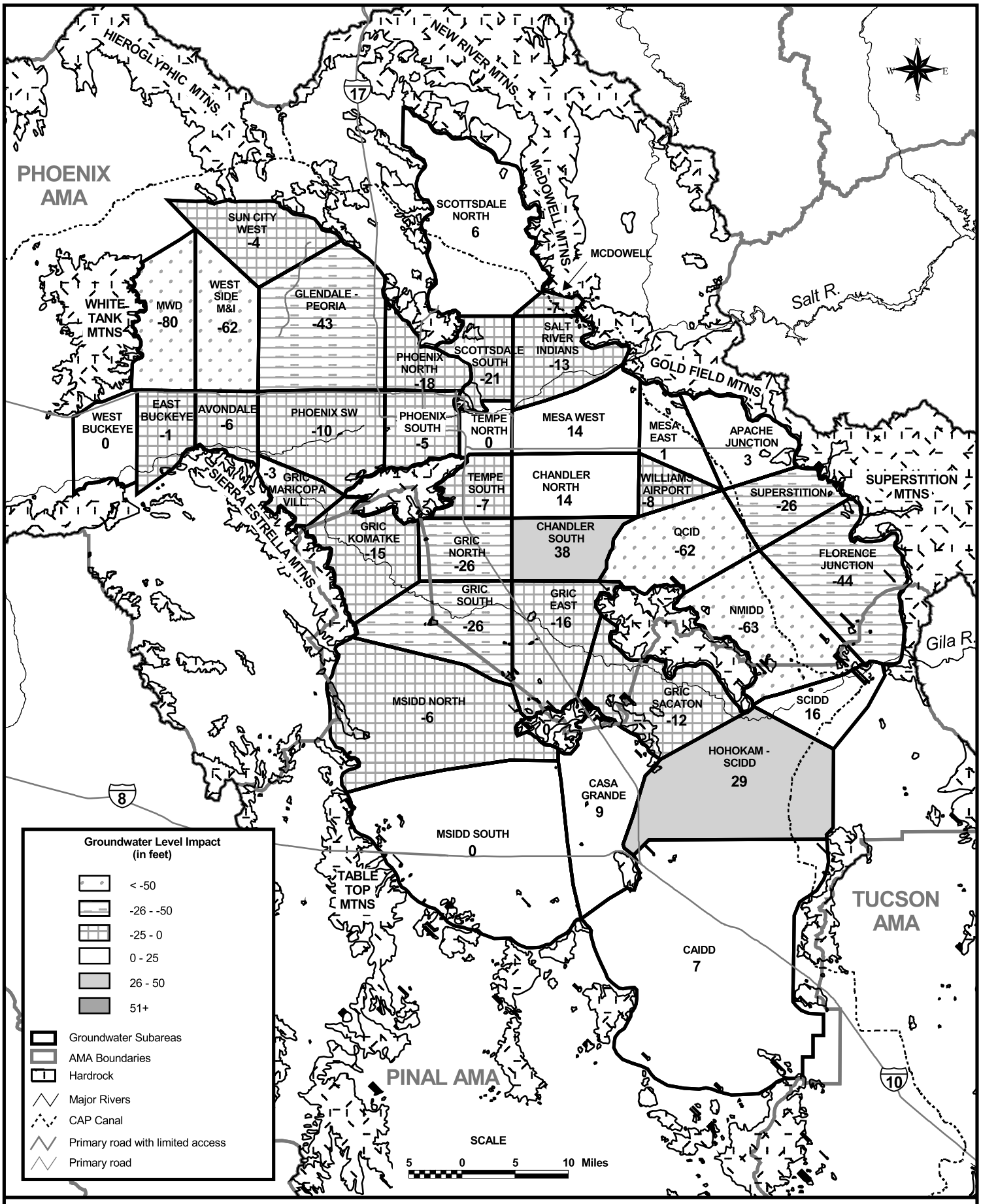


FIGURE I-85
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR WEST BUCKEYE SUB-AREA





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Groundwater Level Impacts of Settlement Alternative for Year 2051 in the Pinal / Salt River Valley Area

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Figure I-86

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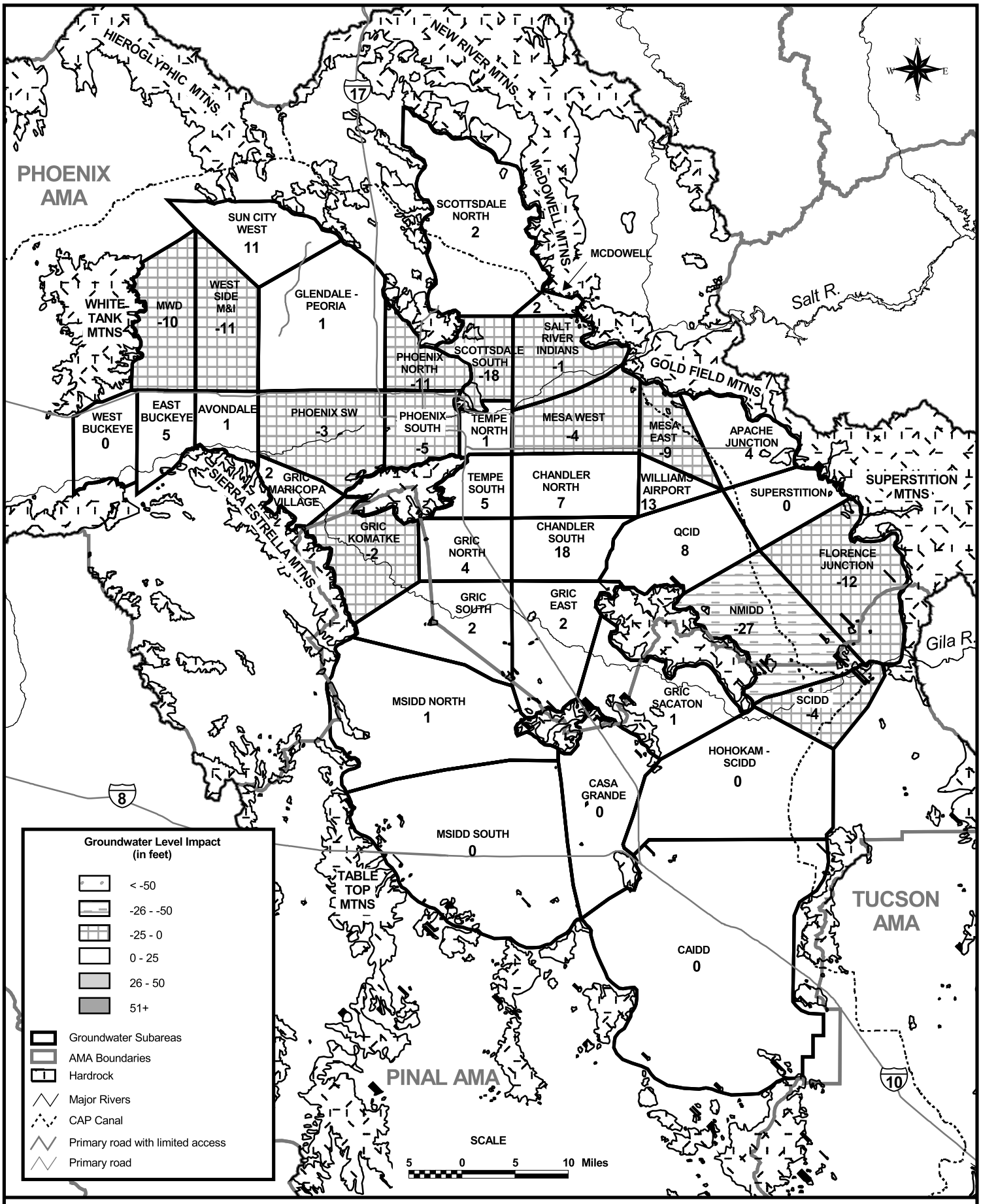

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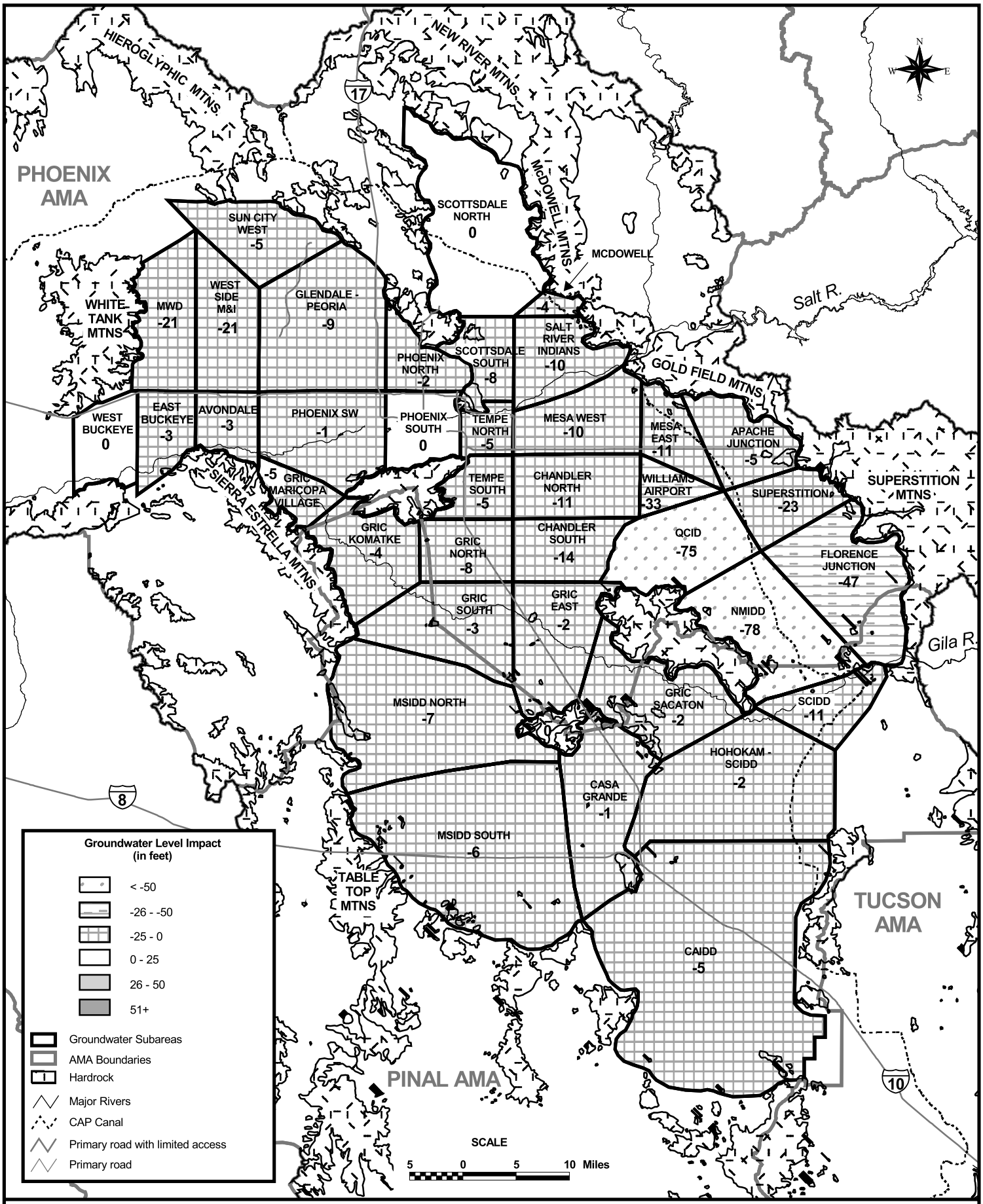
Groundwater Level Impacts of Non-Settlement Alternative 1 for Year 2051 in the Pinal / Salt River Valley Area

Figure I-87



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June 2000

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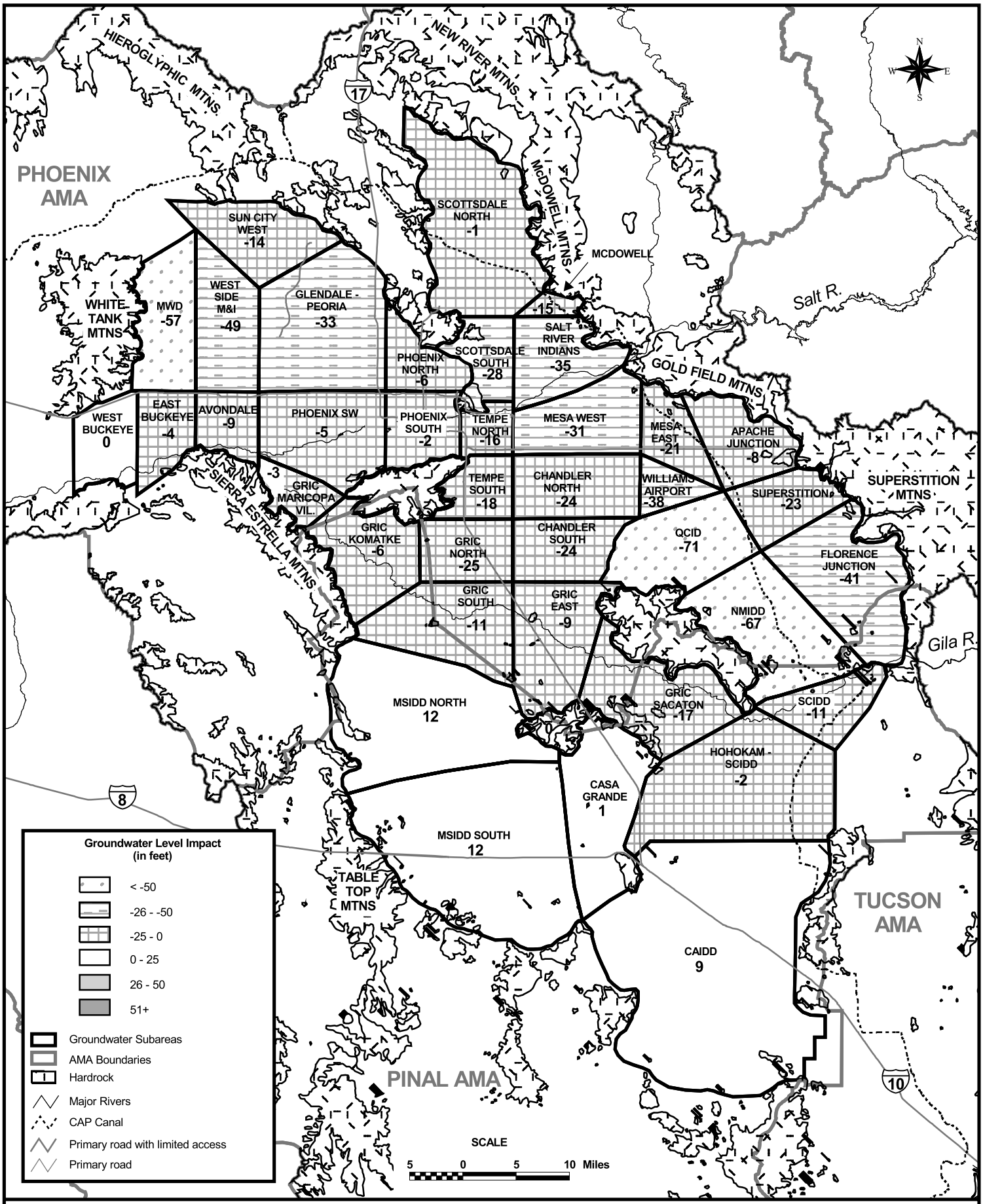
Groundwater Level Impacts of Non-Settlement Alternative 2 for Year 2051 in the Pinal / Salt River Valley Area

Figure I-88



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Groundwater Level Impacts of Non-Settlement Alternative 3A for Year 2051 in the Pinal / Salt River Valley Area

Figure I-89

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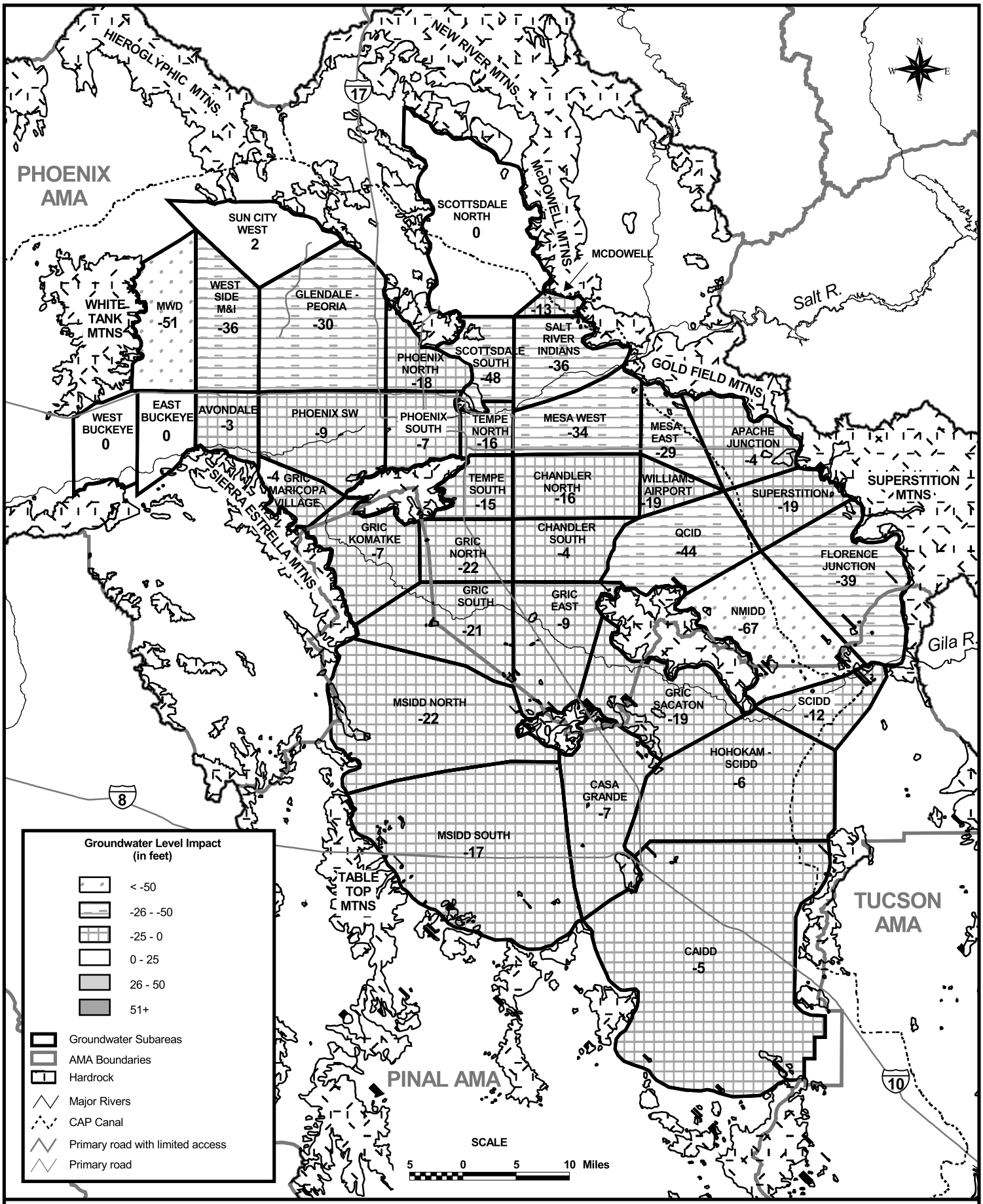

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Groundwater Level Impacts of Non-Settlement Alternative 3B for Year 2051 in the Pinal / Salt River Valley Area

Figure I-90

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FIGURE I-91
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Pinal Subareas to Changes in Ag Pool Volume and NIA Allocations

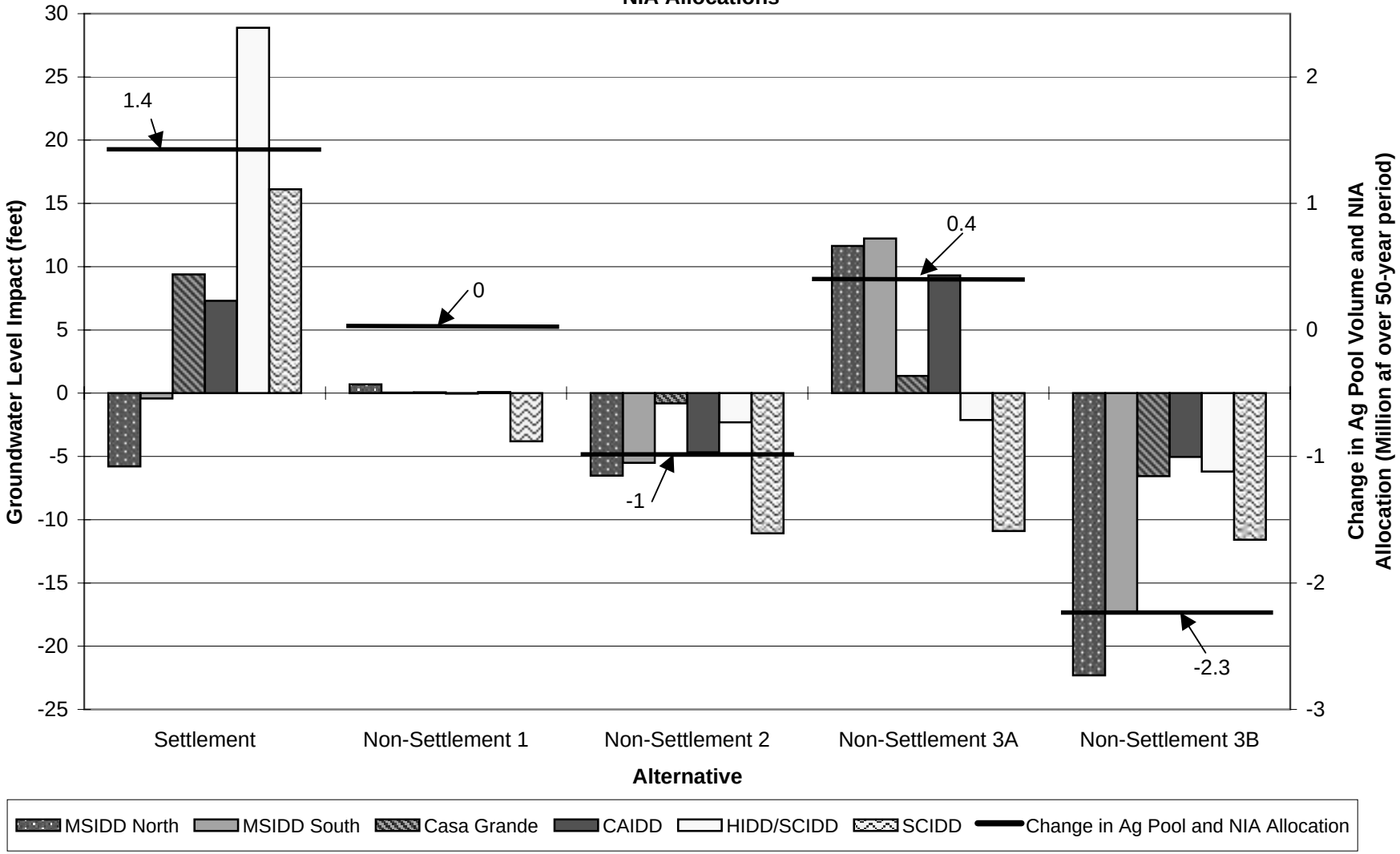


FIGURE I-92
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected Subareas in GRIC to Net Pumping on GRIC

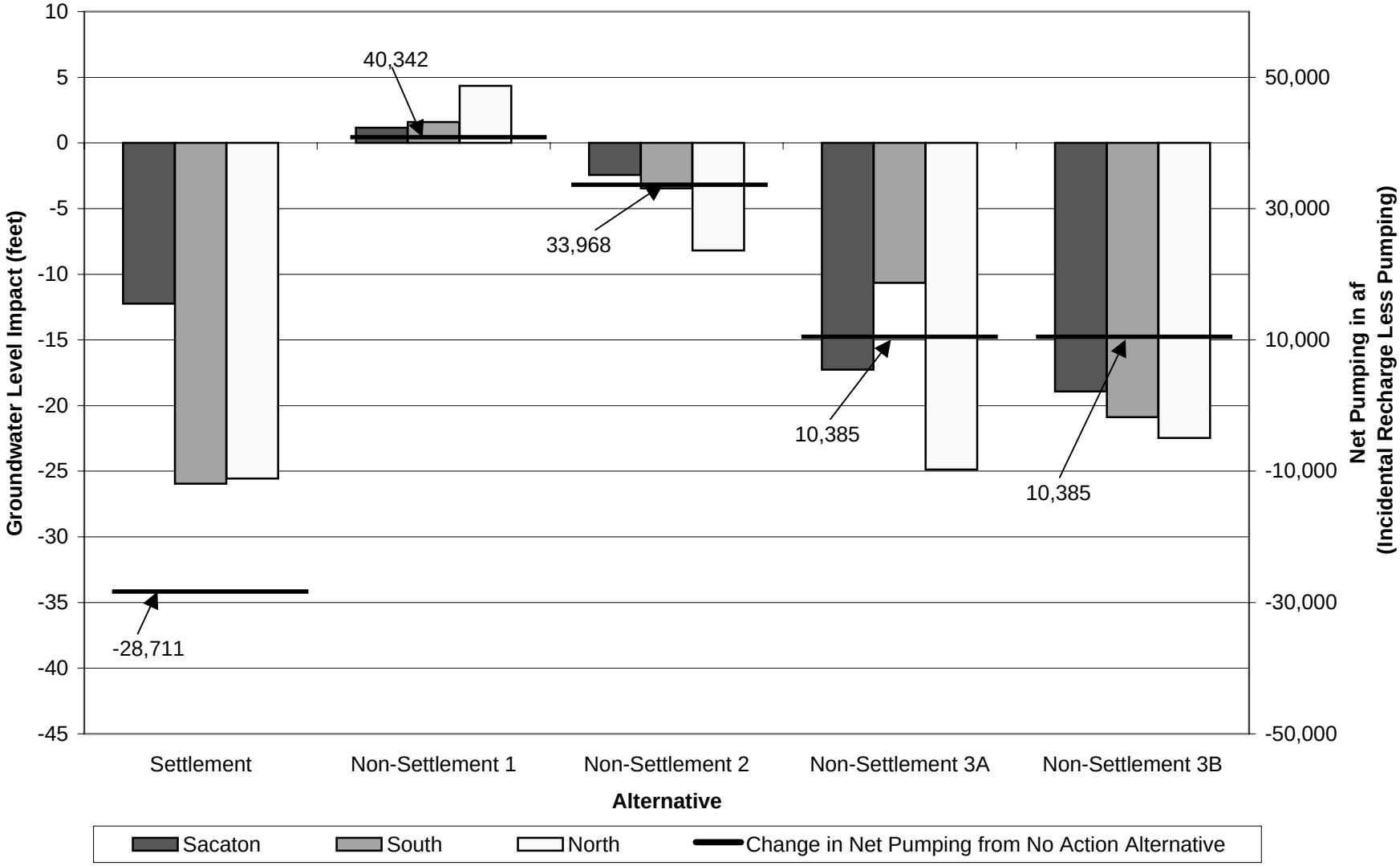


FIGURE I-93
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected East Salt River Valley Subareas to Reductions in Recharge Pool

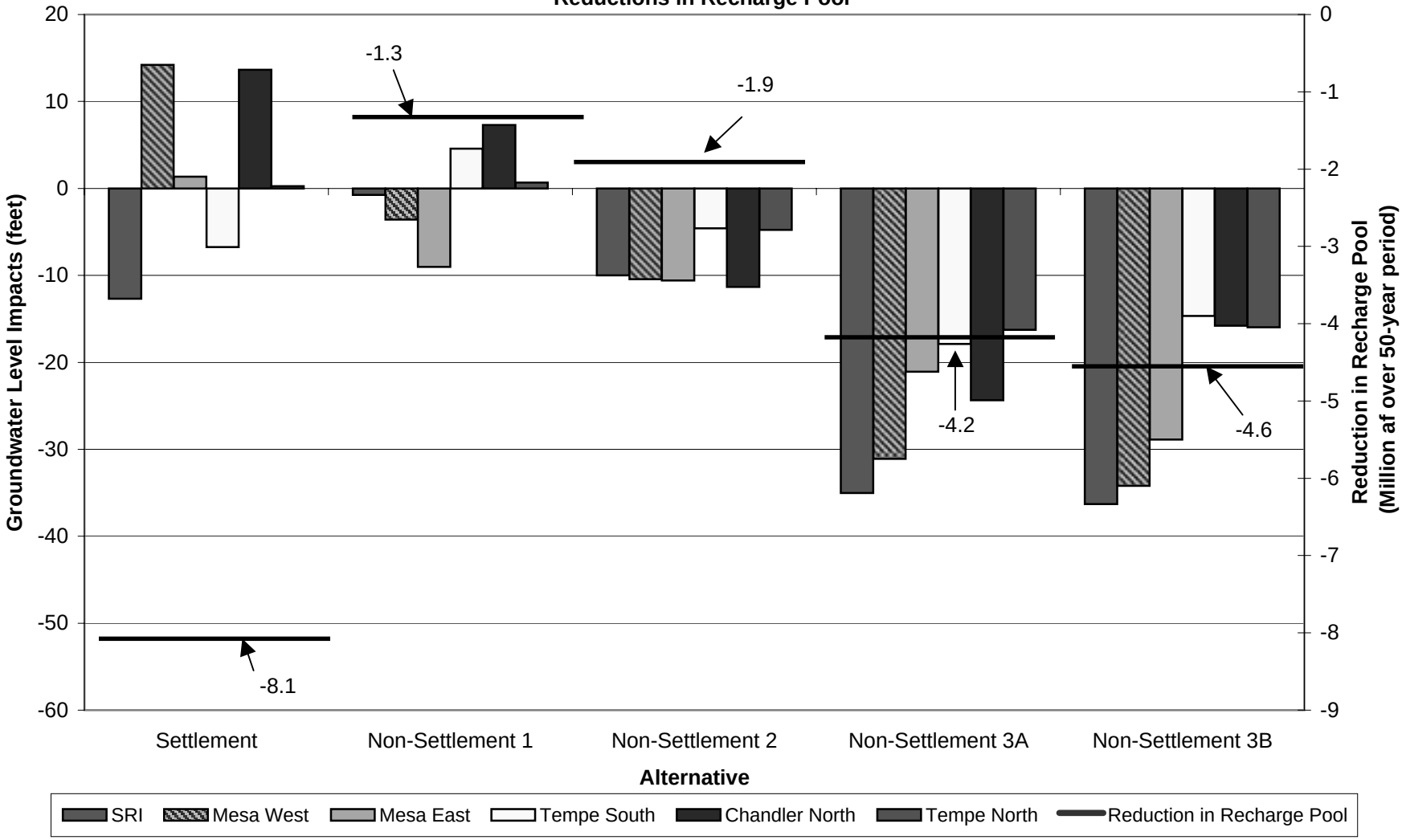


FIGURE I-94
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Agricultural Dominated Areas of ESRV

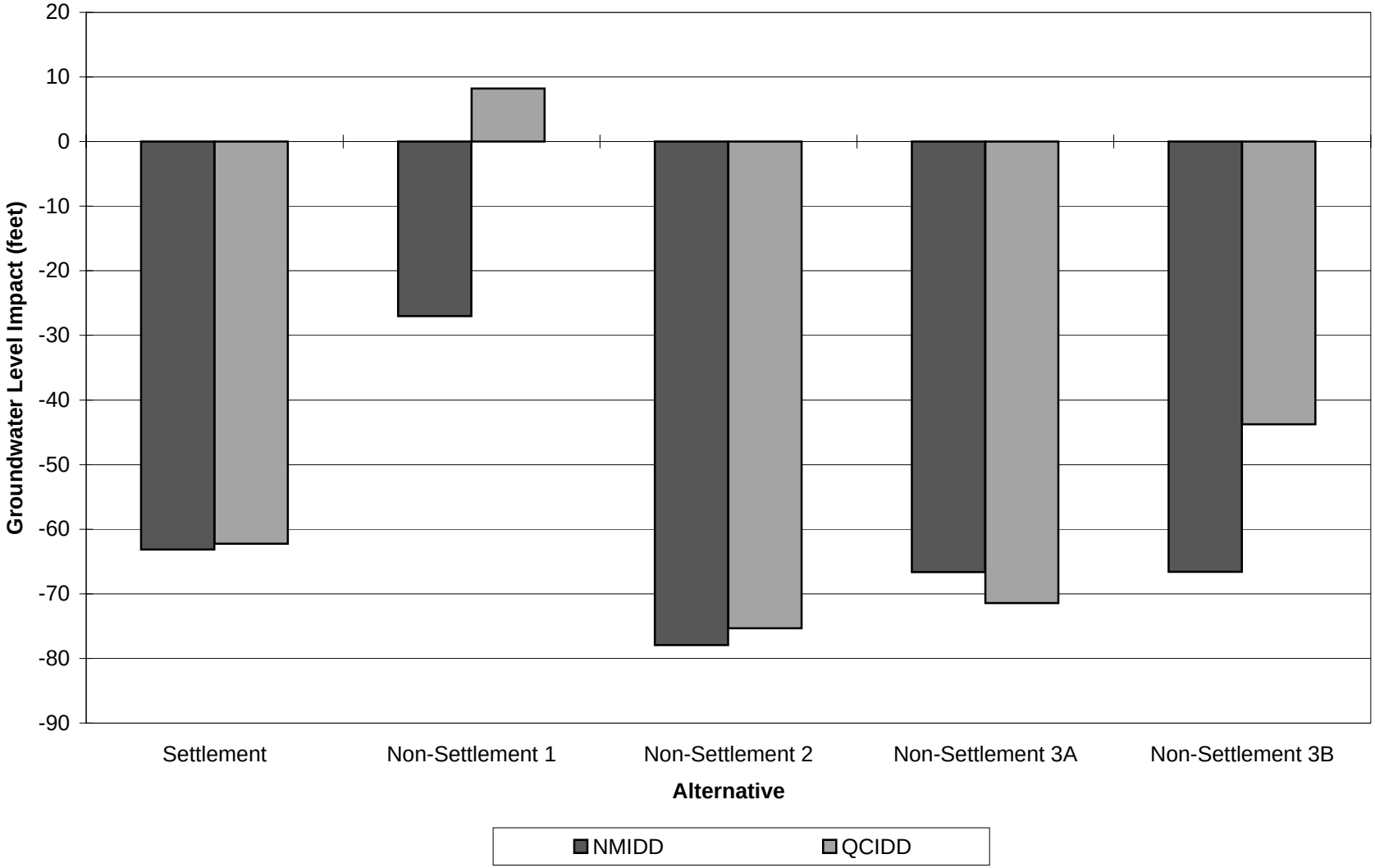
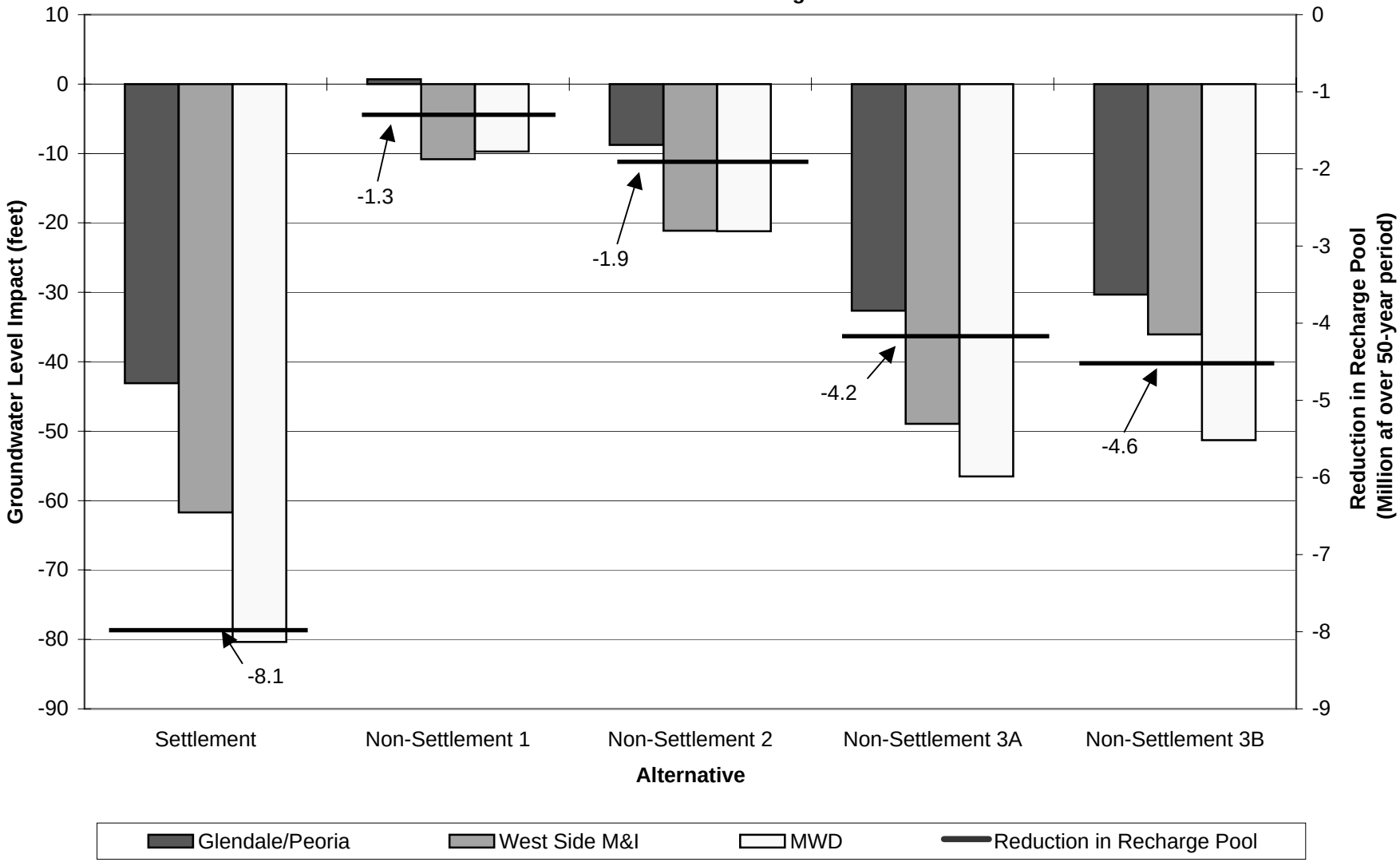
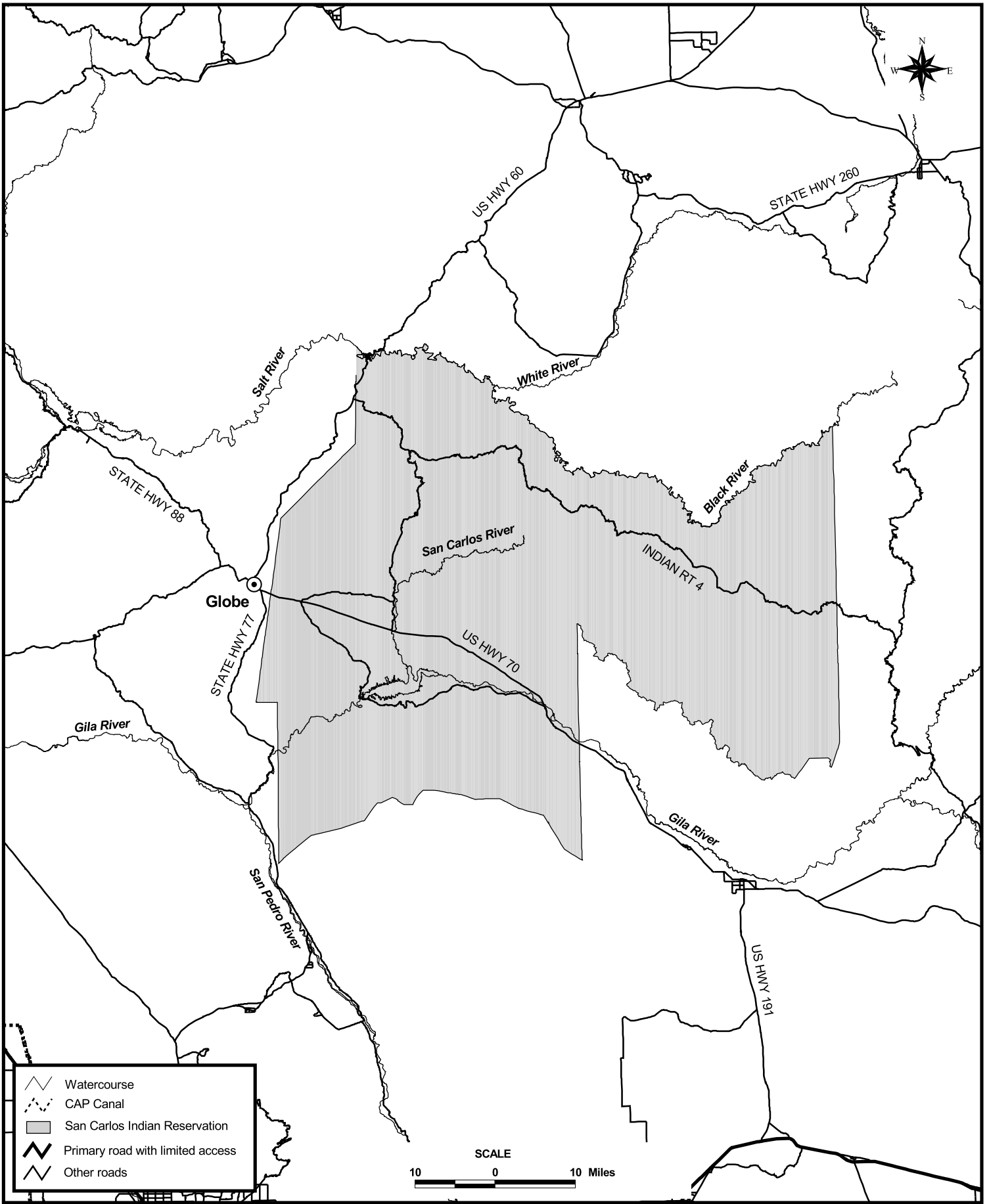


FIGURE I-95
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected Subareas in the West Salt River Valley to Reductions in CAP Recharge Pool





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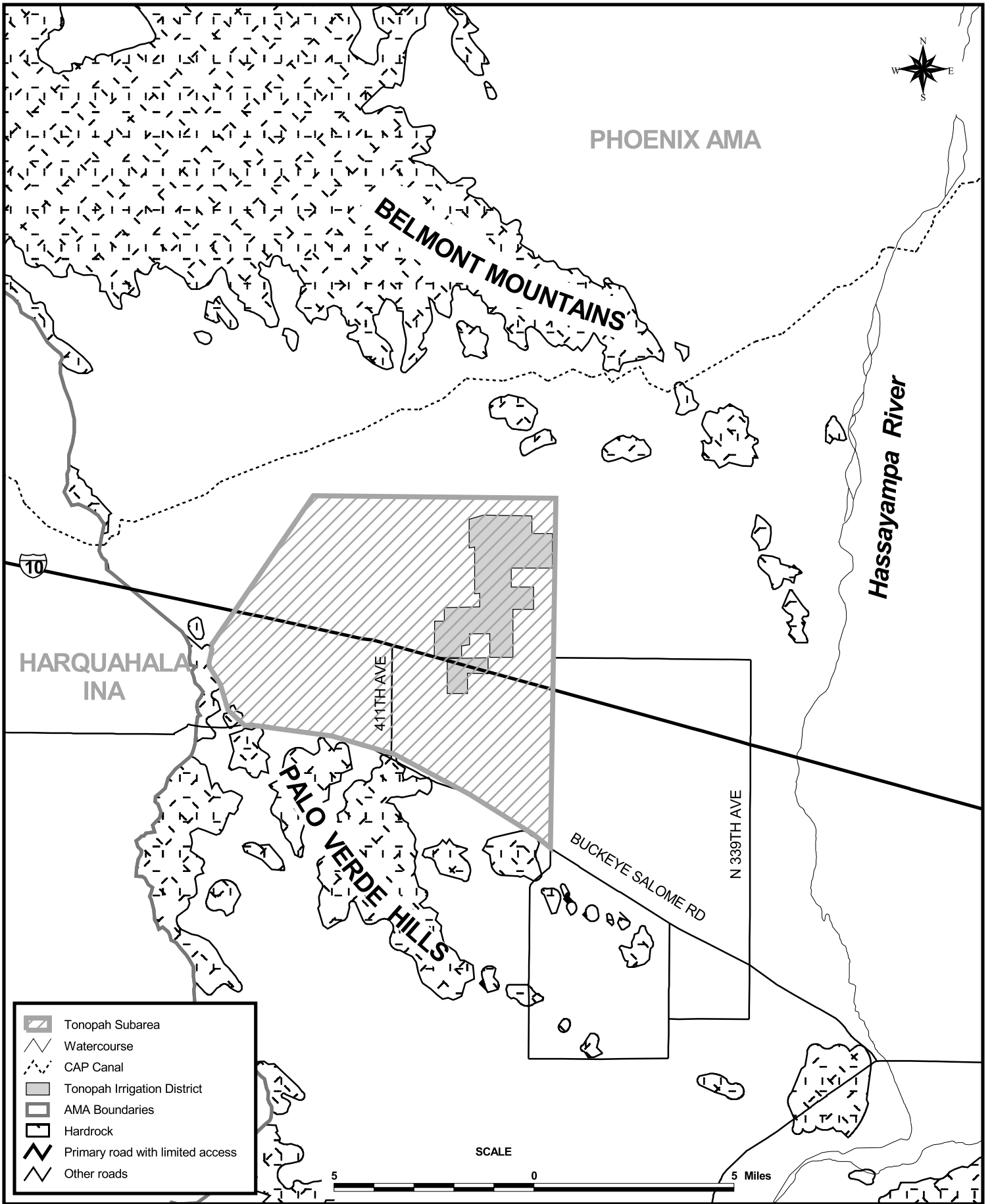
CAP Allocation EIS

San Carlos Indian Reservation

Figure

I-96

June 2000



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Tonopah Irrigation District Area

Figure

I-97

June 2000

FIGURE I-98
CAP ALLOCATION DRAFT EIS
HISTORICAL GROUNDWATER LEVELS IN TONOPAH IRRIGATION DISTRICT AREA

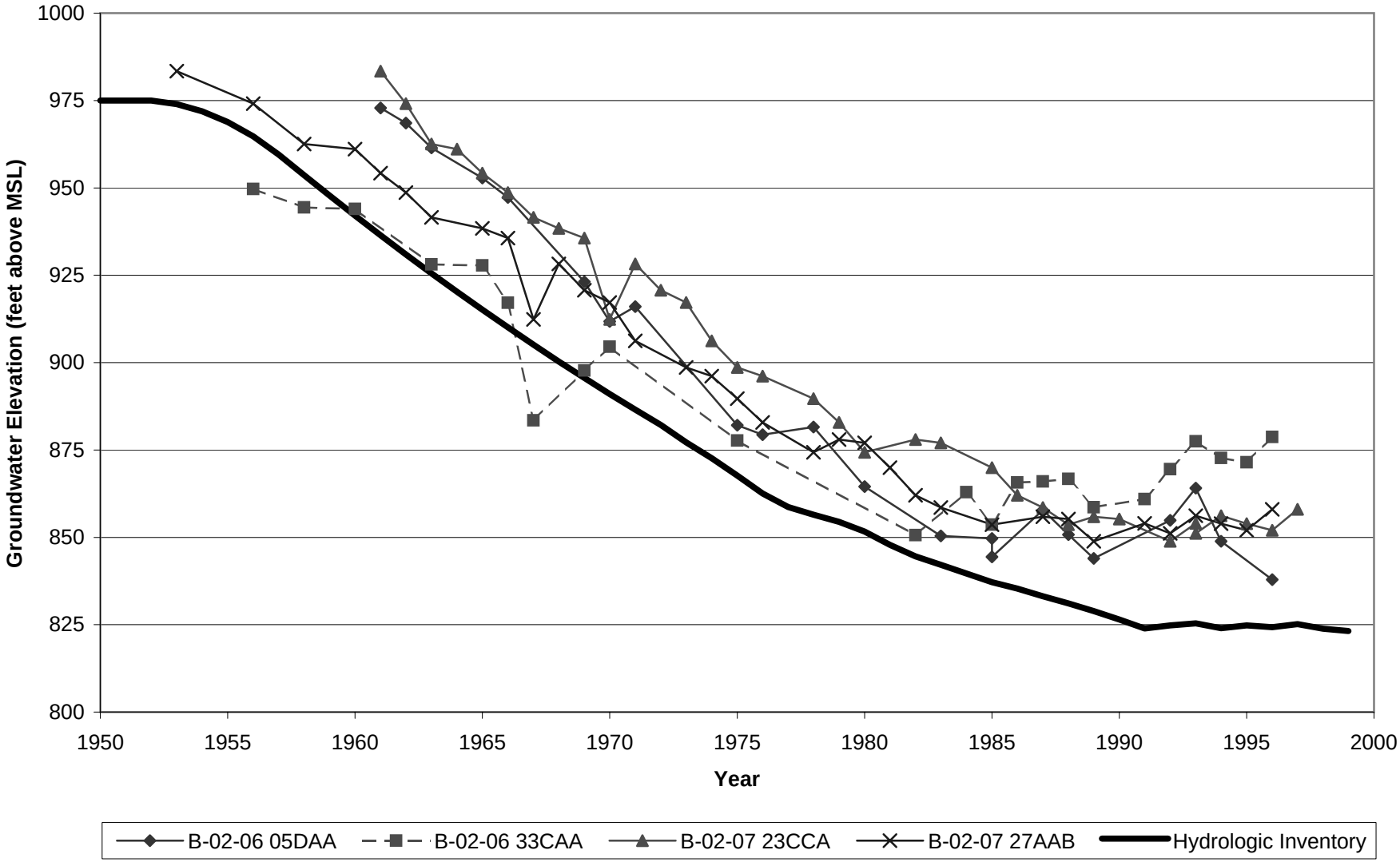


FIGURE I-99
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR THE TONOPAH IRRIGATION DISTRICT

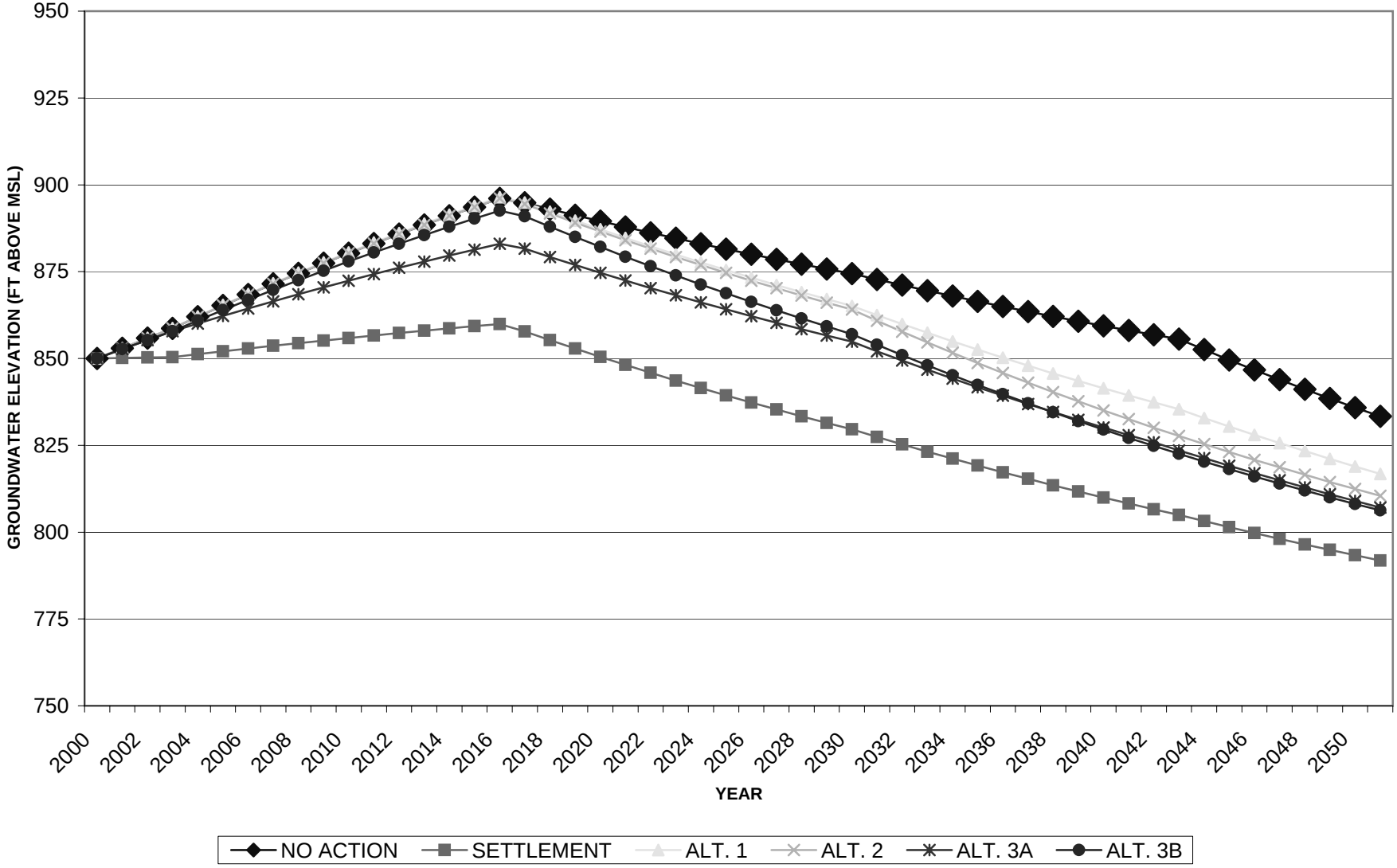
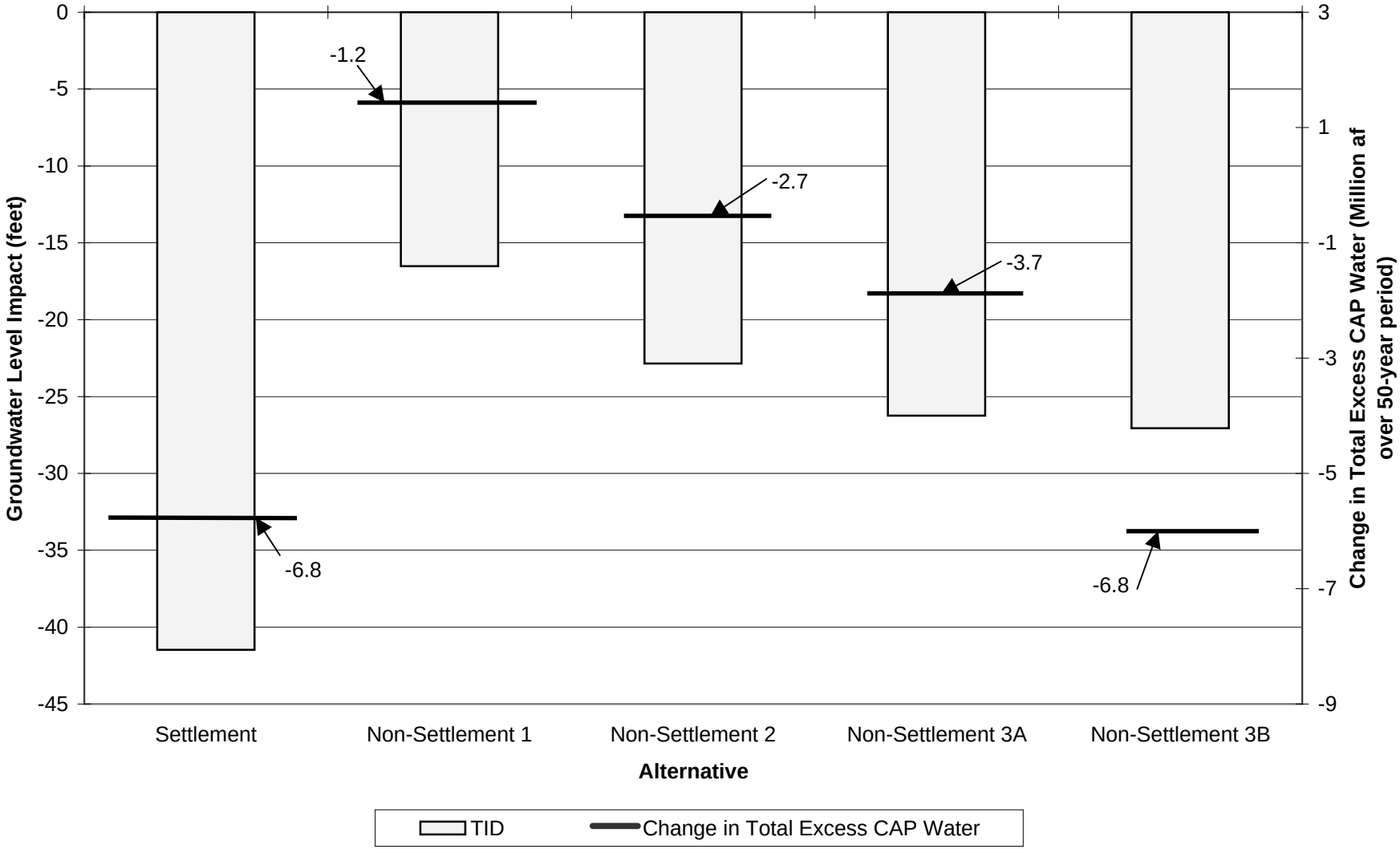
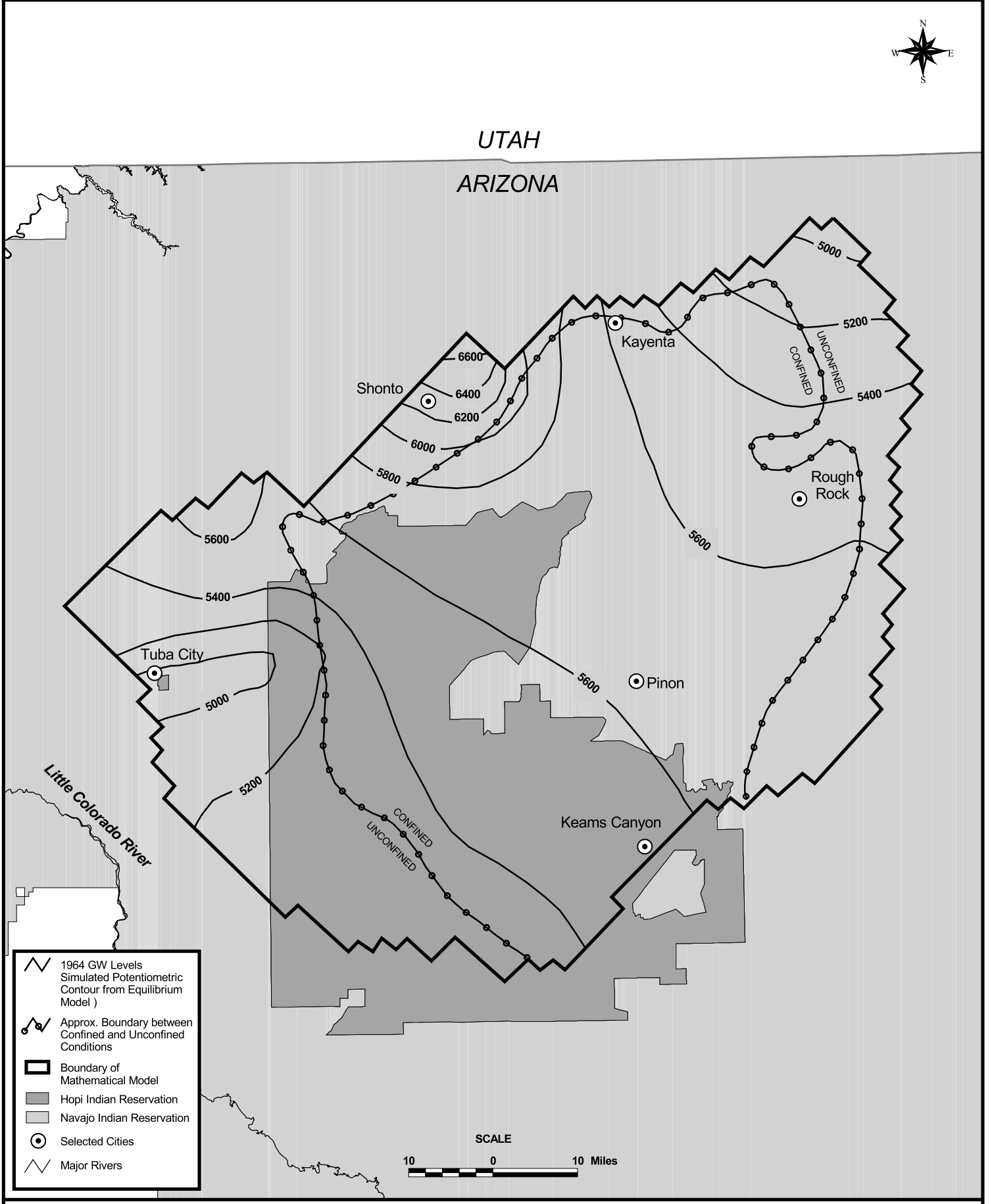


FIGURE I-100
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 in TID to Change in Total Excess CAP Water





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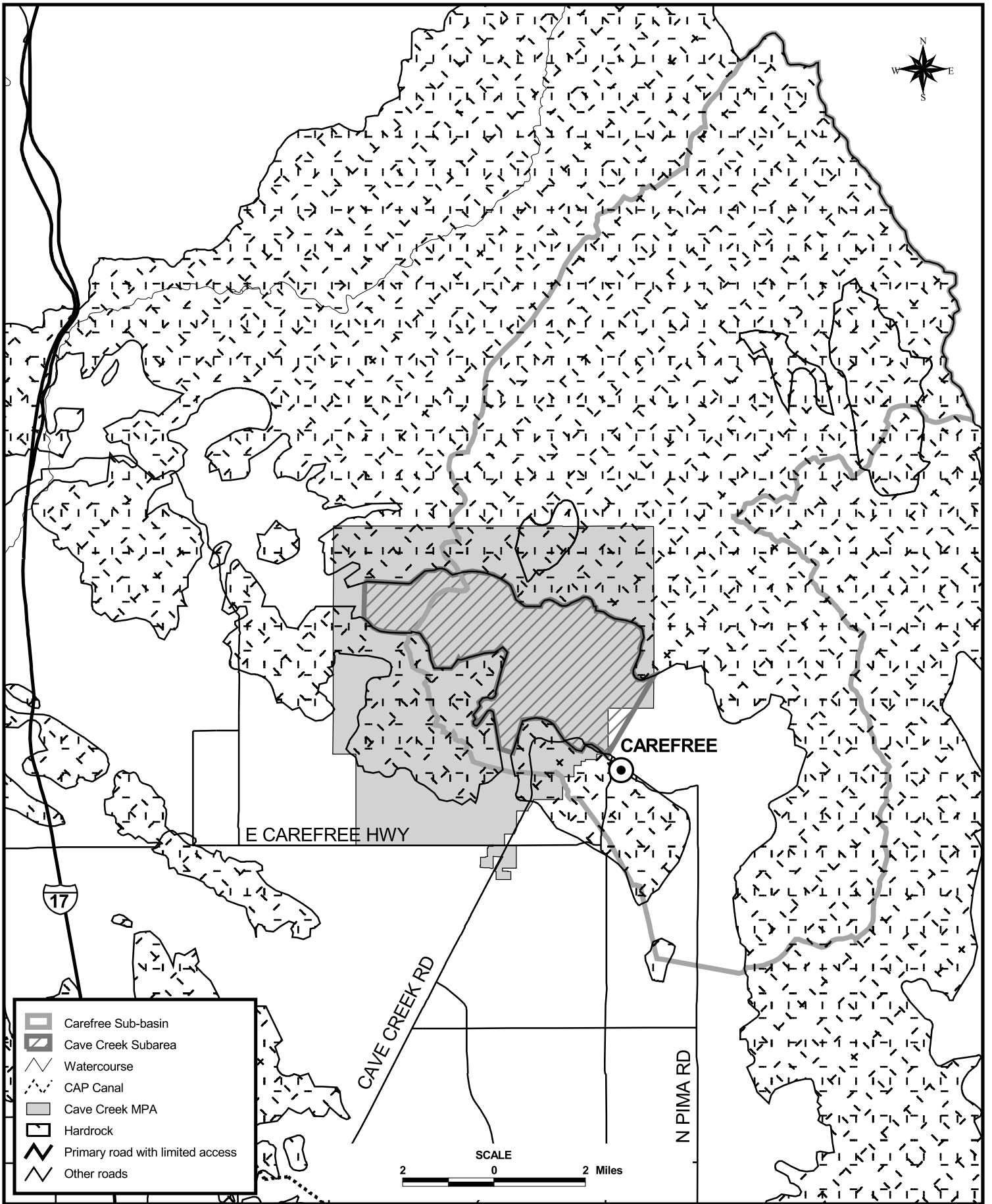
CAP Allocation EIS

1964 Groundwater Levels in the Area of Analysis for the Navajo and Hopi Indian Reservations

June 2000

Figure I-101



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CAP Allocation EIS

Location of Carefree Basin

Figure

I-102

June 2000

FIGURE I-103
CAP ALLOCATION DRAFT EIS
HISTORICAL AVERAGE GROUNDWATER ELEVATIONS FOR CAVE CREEK AREA

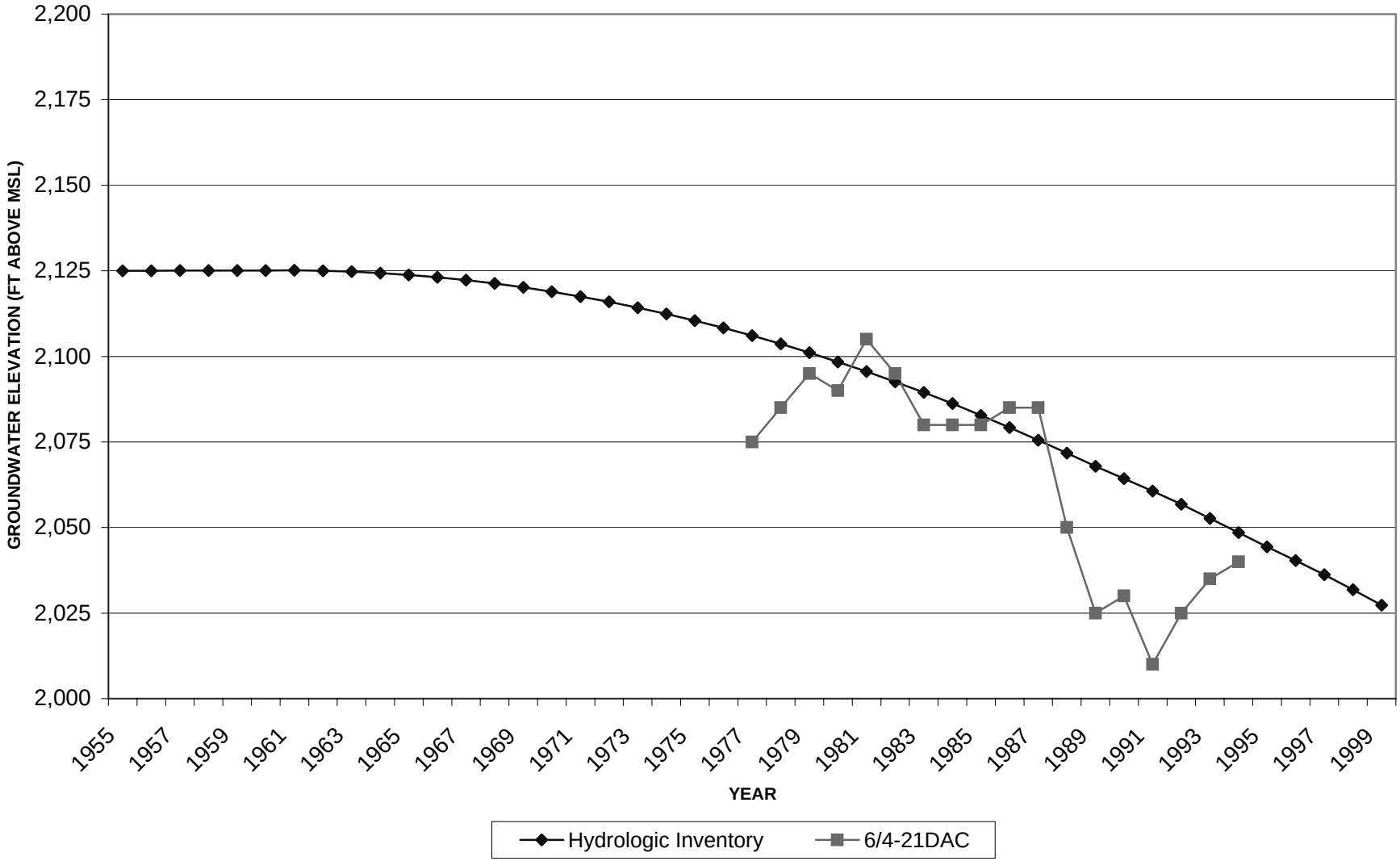
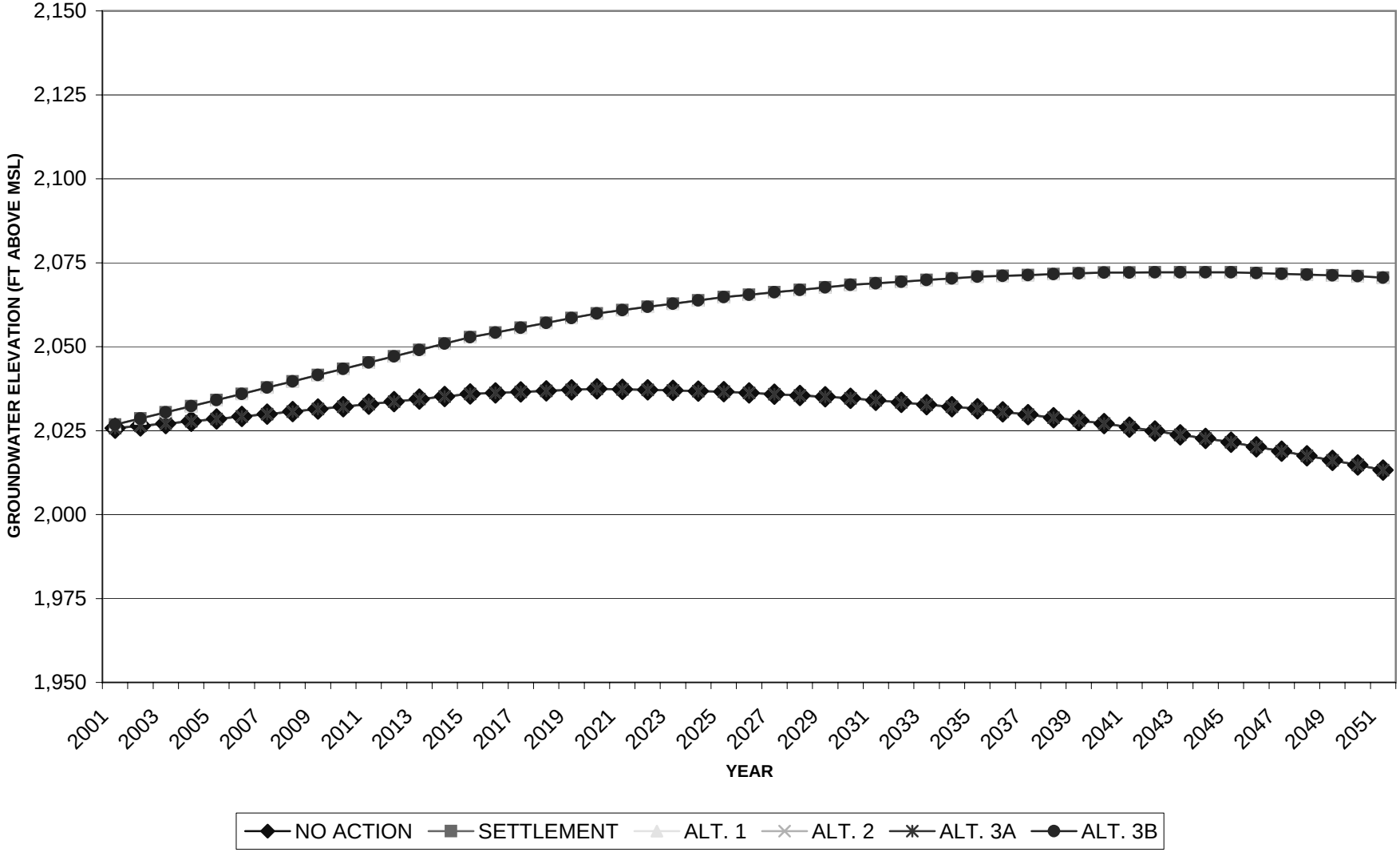
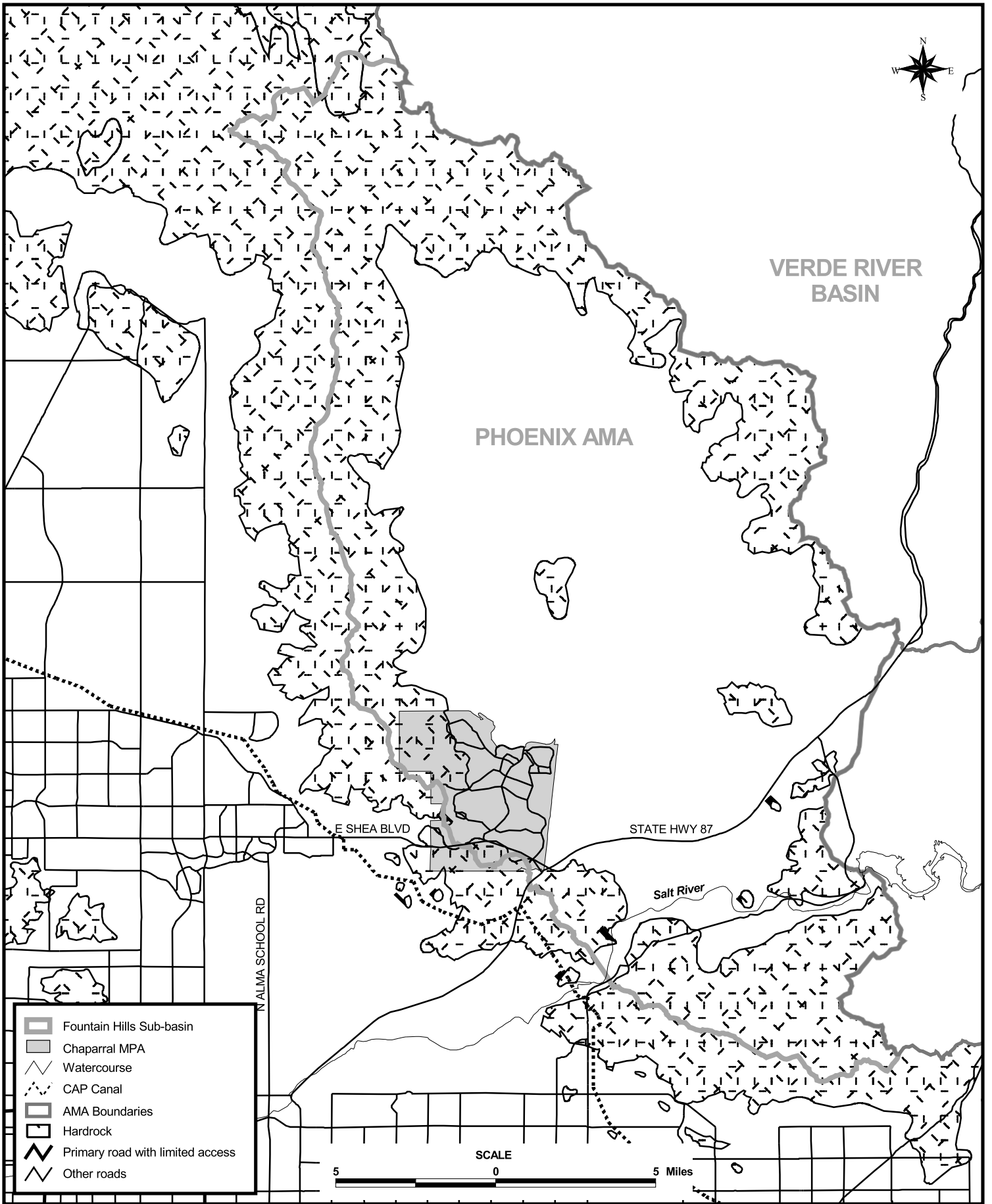


FIGURE I-104
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CAVE CREEK SUB-AREA





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CAP Allocation EIS

Location of Fountain Hills Sub-basin

June 2000

Figure

I-105

FIGURE I-106
CAP ALLOCATION DRAFT EIS
ESTIMATED HISTORICAL GROUNDWATER LEVELS IN CHAPARRAL AREA
COMPARED TO SELECTED WELL HYDROGRAPHS

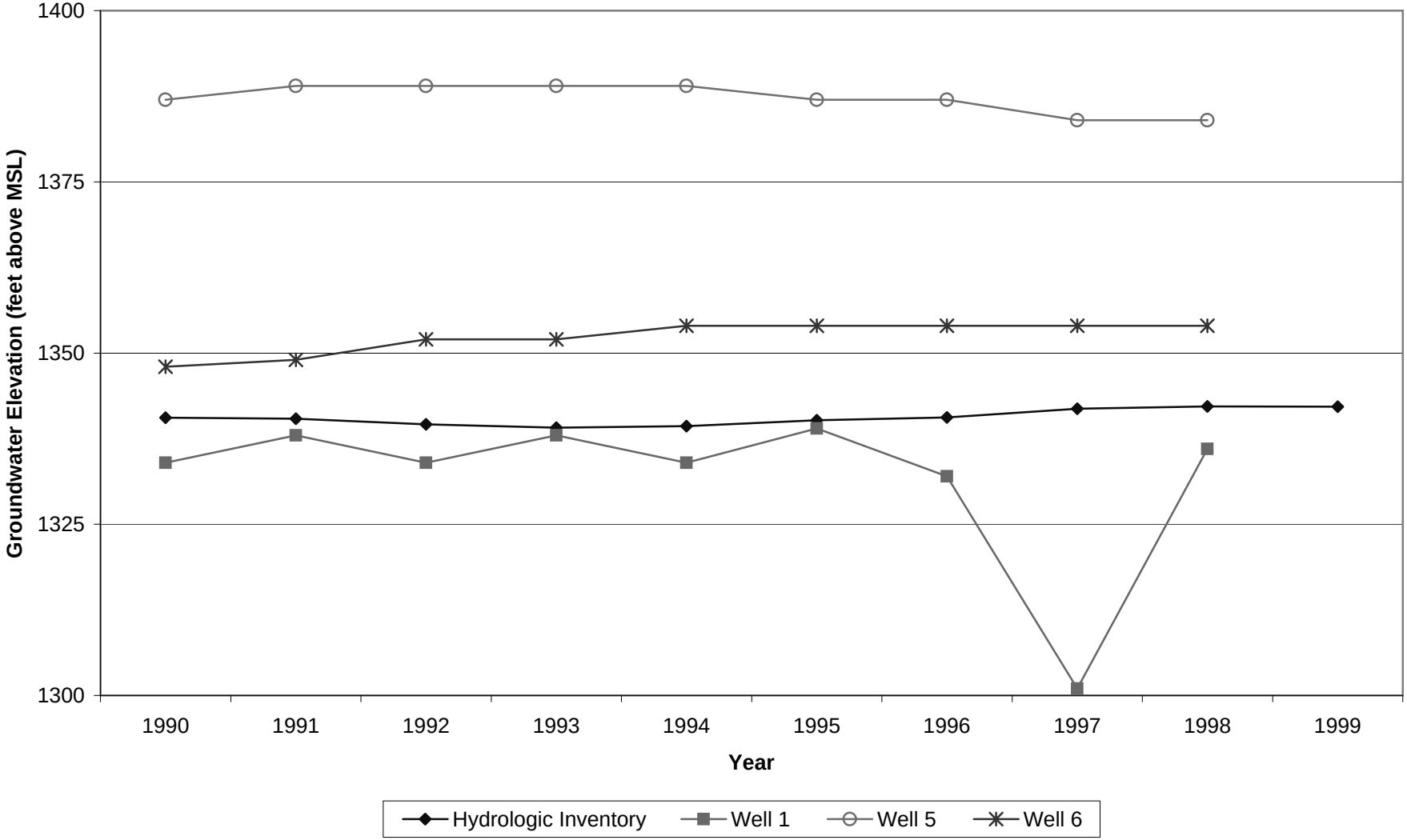


FIGURE I-107
CAP ALLOCATION DRAFT EIS
ESTIMATED GROUNDWATER LEVELS FOR ALTERNATIVES FOR CHAPARRAL SUB-AREA

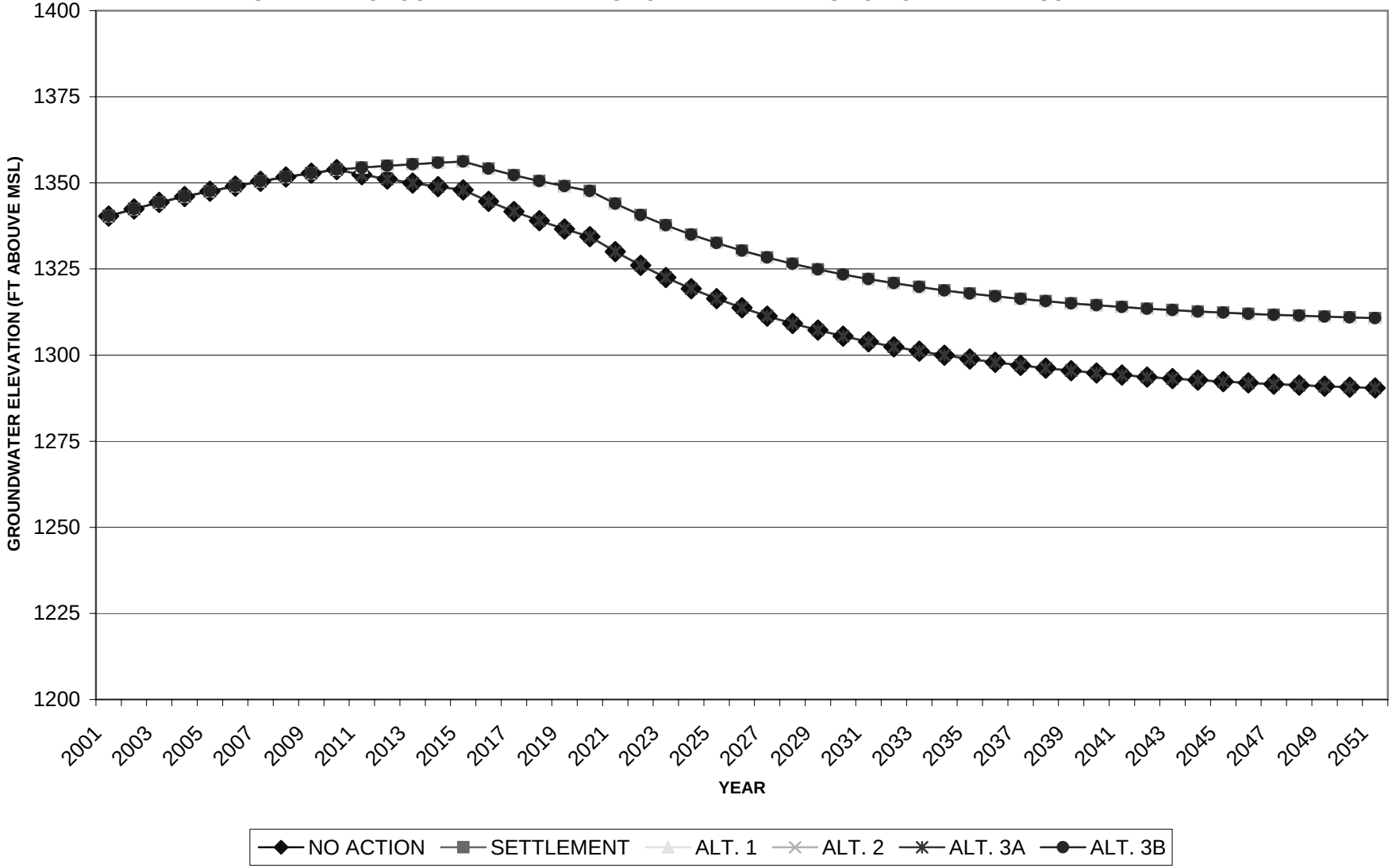


Table I-1
CAP Allocation Draft EIS
M&I DEMANDS AND USES

AVONDALE SUB-AREA

Settlement Alternative

	2001	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
SUB-AREA DEMAND ON PROJECT	761	967	1,236	1,852	3,085	4,036	5,191	6,410	7,868	8,122	8,434
SUB-AREA DEMAND OFF PROJECT	1,501	1,770	2,116	2,988	4,825	5,732	6,680	7,578	8,598	9,615	10,584
OUTSIDE SUB-AREA DEMAND	1,096	1,462	1,880	2,765	4,356	5,731	7,305	8,770	10,375	11,552	12,279
SUBTOTAL MUNICIPAL DEMANDS	3,358	4,199	5,231	7,606	12,267	15,499	19,176	22,758	26,841	29,289	31,298
URBAN IRRIGATION DEMAND	0	0	0	0	0	0	0	0	0	0	0
INDUSTRIAL DEMAND	336	420	523	761	1,227	1,550	1,918	2,276	2,684	2,929	3,130
DIRECT RECHARGE	0	0	0	0	0	0	0	0	0	0	0
TOTAL DEMAND	3,694	4,618	5,754	8,366	13,493	17,049	21,093	25,034	29,525	32,218	34,428
SUB-AREA DELIVERED SUPPLIES											
CAP	1,947	2,407	2,920	3,011	4,773	5,608	5,608	5,608	5,608	5,608	5,608
MUNI GW	182	182	182	182	182	182	182	182	182	182	182
IND. GW	285	285	285	285	285	285	285	285	285	285	285
IND. EFFLUENT	50	134	238	475	941	1,264	1,632	1,990	2,399	2,643	2,844
MUNI EFFLUENT	0	0	0	944	944	944	944	944	944	944	944
GRD	469	644	894	1,617	3,282	4,729	7,251	9,614	12,239	14,433	16,130
OTHER SW	0	0	0	0	0	0	0	0	0	0	0
SRP GW	228	290	371	556	926	1,211	1,557	1,923	2,360	2,437	2,530
SRP SW	533	677	865	1,297	2,160	2,825	3,634	4,487	5,507	5,685	5,904
TOTAL SUPPLIES	3,694	4,618	5,754	8,366	13,493	17,049	21,093	25,034	29,525	32,218	34,428
TOTAL GROUNDWATER PUMPED	1,164	1,401	1,732	2,639	4,675	6,407	9,275	12,004	15,067	17,337	19,127
TOTAL EFFLUENT USED	50	134	238	1,419	1,885	2,208	2,576	2,934	3,343	3,587	3,788
TOTAL SURFACE WATER DELIVERE	2,479	3,083	3,785	4,308	6,933	8,434	9,242	10,095	11,116	11,294	11,512
TOTAL DIRECT RECHARGE	0	0	0	0	0	0	0	0	0	0	0
GROUNDWATER PUMPED	1,164	1,401	1,732	2,639	4,675	6,407	9,275	12,004	15,067	17,337	19,127
RECHARGE	175	218	272	395	638	806	997	1,183	1,396	1,523	1,627

Table I-14
CAP Allocation Draft EIS
Characteristics of Agricultural Districts

District	Pumping Estimated in Socio-Economic Analysis?	Located in AMA	Estimated Consumpt. Use	Estimated Irrigation Efficiency	Non-CAP Surface Water		CAP Surface Water		
					Source	Average Annual Amount	Ag Pool	Recharge Pool	Effluent Use
CAIDD	Yes	Pinal	(b)	(b)			Yes	Yes	
NMIDD	Yes	Pinal/Phoenix	(b)	(b)			Yes	Yes	
HIDD	Yes	Pinal	(b)	(b)			Yes	Yes	
MSIDD	Yes	Pinal	(b)	(b)			Yes	Yes	
QCID	Yes	Phoenix	(b)	(b)			Yes	Yes	
Roosevelt ID	No	Phoenix	3.43	76%	Gila River	15,000	No	No	
St John's ID	No	Phoenix	3.43	76%	Gila/Salt River	9400	No	No	
RWCD	No	Phoenix	3.43	76%	Salt/Verde	10,279	Yes	Yes	
SRP	No	Phoenix	3.43	76%	Gila/Salt River	70% of su	No	No	
San Tan ID	No	Phoenix	3.43	76%			Yes	No	
Buckeye WCDD	No	Phoenix	3.43	76%	Gila River	151,900	No	No	30,000
MWD	No	Phoenix	3.43	76%	Agua Fria?	40,000	Yes	Yes	
Orangewood Farms	No	Phoenix	3.43	76%			No	No	
Sunburst Farms	No	Phoenix	3.43	76%			No	No	
Western Meadow	No	Phoenix	3.43	76%			No	No	
Citrus Heights Ranch	No	Phoenix	3.43	76%			No	No	
Arcadia Water Company	No	Phoenix	3.43	76%			No	No	
Peninsula Ditch Co.	No	Phoenix	3.43	76%	Salt River	4526			
					RID	3300	No	No	
CHID	No	Phoenix	3.43	76%			Yes	No	
County Farms I&M Co.	No	Phoenix	3.43	76%			No	No	
QCIWDD	For purpose of analysis, acreage included with QCIDD								
QC suburban	For purpose of analysis, acreage included with QCIDD								
Ranchos Jardine IDD	No	Phoenix	3.43	76%			No	No	
Suburban ID	No	Phoenix	3.43	76%			No	No	
Sun Valley Farms (a)	No	Phoenix	3.43	76%			No	No	
Arabian Farms Assoc.	No	Phoenix	3.43	76%			No	No	
SCIDD	No	Pinal	3.43	76%	Gila River	159,641	Yes	No	
AVID	No	Tucson	3.43	76%			No	No	
CMID	No	Tucson	3.43	76%	Santa Cruz R.	29,100	Yes	Yes	3,000
Tonopah ID	Yes	Phoenix	(b)	(b)			Yes	Yes	

(a) Includes Sun Valley Farm Units II, III, IV, and VII.
(b) Developed in the Socio-Economic Analysis.

Table I-15
CAP Allocation Draft EIS
Projected NIA Ag Pools Distribution by District for 2001-2003, No Action Alternative
All Quantities in Acre-Feet

NIA ENTITIES	Non-Settlement Percentages	2001			2002			2003		
		Ag Pool 1	Ag Pool 2	Ag Pool 3	Ag Pool 1	Ag Pool 2	Ag Pool 3	Ag Pool 1	Ag Pool 2	Ag Pool 3
CAIDD[a]	33.10%	66,200	66,200	43,027	66,200	66,200	36,663	66,200	66,200	34,350
CHCID [a]	0.50%	1,000	1,000	650	1,000	1,000	554	1,000	1,000	519
CMID		-	-	-	-	-	-	-	-	-
HIDD	4.50%	9,000	9,000	5,850	9,000	9,000	4,984	9,000	9,000	4,670
HVID	5.30%	10,600	10,600	6,889	10,600	10,600	5,870	10,600	10,600	5,500
MSIDD[a]	32.40%	64,800	64,800	42,117	64,800	64,800	35,888	64,800	64,800	33,624
MWD		-	-	-	-	-	-	-	-	-
NMIDD[a]	10.30%	20,600	20,600	13,389	20,600	20,600	11,409	20,600	20,600	10,689
QCID[a]	7.80%	15,600	15,600	10,139	15,600	15,600	8,640	15,600	15,600	8,095
RID[a]		-	-	-	-	-	-	-	-	-
RWCD	3.80%	7,600	7,600	4,940	7,600	7,600	4,209	7,600	7,600	3,944
SCIDD[a]		-	-	-	-	-	-	-	-	-
STID [a]	1.10%	2,200	2,200	1,430	2,200	2,200	1,218	2,200	2,200	1,142
TID [a]	1.30%	2,600	2,600	1,690	2,600	2,600	1,440	2,600	2,600	1,349
TOTAL CAP AG DELIVERIES:	100.10%	200,000	200,000	129,989	200,000	200,000	110,764	200,000	200,000	103,778

[a] Included in the EIS impact analyses
NIA = NON-INDIAN AGRICULTURE

TABLE I-16
CAP Allocation Draft EIS
Projected NIA Ag Pools Distribution by District for 2001-2003, No Action Alternative
All Quantities in Acre-Feet

NIA ENTITIES	Settlement Percentages	2001			2002			2003		
		Ag Pool 1	Ag Pool 2	Ag Pool 3	Ag Pool 1	Ag Pool 2	Ag Pool 3	Ag Pool 1	Ag Pool 2	Ag Pool 3
CAIDD[a]	27.02%	54,040	54,040	40,530	54,040	54,040	39,719	54,040	54,040	35,126
CHCID [a]	0.14%	280	280	210	280	280	206	280	280	182
CMID	1.39%	2,780	2,780	2,085	2,780	2,780	2,043	2,780	2,780	1,807
HIDD	8.28%	16,560	16,560	12,420	16,560	16,560	12,172	16,560	16,560	10,764
HVID	7.98%	15,960	15,960	11,970	15,960	15,960	11,731	15,960	15,960	10,374
MSIDD[a]	27.02%	54,040	54,040	40,530	54,040	54,040	39,719	54,040	54,040	35,126
MWD	0.97%	1,940	1,940	1,455	1,940	1,940	1,426	1,940	1,940	1,261
NMIDD[a]	8.58%	17,160	17,160	12,870	17,160	17,160	12,613	17,160	17,160	11,154
QCID[a]	2.19%	4,380	4,380	3,285	4,380	4,380	3,219	4,380	4,380	2,847
RID[a]	2.31%	4,620	4,620	3,465	4,620	4,620	3,396	4,620	4,620	3,003
RWCD	2.18%	4,360	4,360	3,270	4,360	4,360	3,205	4,360	4,360	2,834
SCIDD[a]	8.13%	16,260	16,260	12,195	16,260	16,260	11,951	16,260	16,260	10,569
STID [a]	0.34%	680	680	510	680	680	500	680	680	442
TID [a]	0.42%	840	840	630	840	840	617	840	840	546
TOTAL CAP AG DELIVERIES:	96.95%	200,000	200,000	150,000	200,000	200,000	147,000	200,000	200,000	130,000

[a] Included in the EIS impact analyses
NIA = NON-INDIAN AGRICULTURE

TABLE I-17
CAP Allocation Draft EIS
Projected NIA Ag Pool Distribution by District for 2004-2051
No Action Alternative

YEAR	NIA POOL	CAIDD	CHCID	CMID	HIDD	HVID	MSIDD	MWD	NMIDD	QCID	RID	RWCD	SCIDD	STID	TID
2004	498,433	164,981	2,492	0	22,429	26,417	161,492	0	51,339	38,878	0	18,940	0	5,483	6,480
2005	493,054	163,201	2,465	0	22,187	26,132	159,750	0	50,785	38,458	0	18,736	0	5,424	6,410
2006	473,076	156,588	2,365	0	21,288	25,073	153,277	0	48,727	36,900	0	17,977	0	5,204	6,150
2007	457,754	151,517	2,289	0	20,599	24,261	148,312	0	47,149	35,705	0	17,395	0	5,035	5,951
2008	441,381	146,097	2,207	0	19,862	23,393	143,007	0	45,462	34,428	0	16,772	0	4,855	5,738
2009	420,793	139,282	2,104	0	18,936	22,302	136,337	0	43,342	32,822	0	15,990	0	4,629	5,470
2010	404,019	133,730	2,020	0	18,181	21,413	130,902	0	41,614	31,513	0	15,353	0	4,444	5,252
2011	376,082	124,483	1,880	0	16,924	19,932	121,850	0	38,736	29,334	0	14,291	0	4,137	4,889
2012	344,866	114,151	1,724	0	15,519	18,278	111,737	0	35,521	26,900	0	13,105	0	3,794	4,483
2013	315,148	104,314	1,576	0	14,182	16,703	102,108	0	32,460	24,582	0	11,976	0	3,467	4,097
2014	286,430	94,808	1,432	0	12,889	15,181	92,803	0	29,502	22,342	0	10,884	0	3,151	3,724
2015	259,712	85,965	1,299	0	11,687	13,765	84,147	0	26,750	20,258	0	9,869	0	2,857	3,376
2016	232,995	77,121	1,165	0	10,485	12,349	75,490	0	23,998	18,174	0	8,854	0	2,563	3,029
2017	310,768	102,864	1,554	0	13,985	16,471	100,689	0	32,009	24,240	0	11,809	0	3,418	4,040
2018	300,052	99,317	1,500	0	13,502	15,903	97,217	0	30,905	23,404	0	11,402	0	3,301	3,901
2019	289,336	95,770	1,447	0	13,020	15,335	93,745	0	29,802	22,568	0	10,995	0	3,183	3,761
2020	278,620	92,223	1,393	0	12,538	14,767	90,273	0	28,698	21,732	0	10,588	0	3,065	3,622
2021	267,904	88,676	1,340	0	12,056	14,199	86,801	0	27,594	20,896	0	10,180	0	2,947	3,483
2022	257,188	85,129	1,286	0	11,573	13,631	83,329	0	26,490	20,061	0	9,773	0	2,829	3,343
2023	246,471	81,582	1,232	0	11,091	13,063	79,857	0	25,387	19,225	0	9,366	0	2,711	3,204
2024	235,755	78,035	1,179	0	10,609	12,495	76,385	0	24,283	18,389	0	8,959	0	2,593	3,065
2025	225,039	74,488	1,125	0	10,127	11,927	72,913	0	23,179	17,553	0	8,551	0	2,475	2,926
2026	214,323	70,941	1,072	0	9,645	11,359	69,441	0	22,075	16,717	0	8,144	0	2,358	2,786
2027	203,607	67,394	1,018	0	9,162	10,791	65,969	0	20,972	15,881	0	7,737	0	2,240	2,647
2028	192,891	63,847	964	0	8,680	10,223	62,497	0	19,868	15,045	0	7,330	0	2,122	2,508
2029	182,175	60,300	911	0	8,198	9,655	59,025	0	18,764	14,210	0	6,923	0	2,004	2,368
2030	171,458	56,753	857	0	7,716	9,087	55,553	0	17,660	13,374	0	6,515	0	1,886	2,229
2031	160,742	53,206	804	0	7,233	8,519	52,080	0	16,556	12,538	0	6,108	0	1,768	2,090
2032	150,026	49,659	750	0	6,751	7,951	48,608	0	15,453	11,702	0	5,701	0	1,650	1,950
2033	139,310	46,112	697	0	6,269	7,383	45,136	0	14,349	10,866	0	5,294	0	1,532	1,811
2034	128,594	42,565	643	0	5,787	6,815	41,664	0	13,245	10,030	0	4,887	0	1,415	1,672
2035	117,878	39,018	589	0	5,304	6,248	38,192	0	12,141	9,194	0	4,479	0	1,297	1,532
2036	107,162	35,470	536	0	4,822	5,680	34,720	0	11,038	8,359	0	4,072	0	1,179	1,393
2037	96,445	31,923	482	0	4,340	5,112	31,248	0	9,934	7,523	0	3,665	0	1,061	1,254
2038	85,729	28,376	429	0	3,858	4,544	27,776	0	8,830	6,687	0	3,258	0	943	1,114
2039	75,013	24,829	375	0	3,376	3,976	24,304	0	7,726	5,851	0	2,850	0	825	975
2040	64,297	21,282	321	0	2,893	3,408	20,832	0	6,623	5,015	0	2,443	0	707	836
2041	53,581	17,735	268	0	2,411	2,840	17,360	0	5,519	4,179	0	2,036	0	589	697
2042	42,865	14,188	214	0	1,929	2,272	13,888	0	4,415	3,343	0	1,629	0	472	557
2043	32,148	10,641	161	0	1,447	1,704	10,416	0	3,311	2,508	0	1,222	0	354	418
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE I-18
Projected NIA Ag Pool Distribution by District for 2004-2051
Settlment Alternative

YEAR	NIA POOL	CAIDD	CHCID	CMID	HIDD	HVID	MSIDD	MWD	NMIDD	QCID	RID	RWCD	SCIDD	STID	TID
2004	513,000	138,613	718	7,131	42,476	40,937	138,613	4,976	44,015	11,235	11,850	11,183	41,707	1,744	2,155
2005	497,000	134,289	696	6,908	41,152	39,661	134,289	4,821	42,643	10,884	11,481	10,835	40,406	1,690	2,087
2006	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2007	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2008	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2009	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2010	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2011	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2012	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2013	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2014	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2015	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2016	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2017	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2018	400,000	108,080	560	5,560	33,120	31,920	108,080	3,880	34,320	8,760	9,240	8,720	32,520	1,360	1,680
2019	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2020	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2021	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2022	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2023	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2024	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2025	300,000	81,060	420	4,170	24,840	23,940	81,060	2,910	25,740	6,570	6,930	6,540	24,390	1,020	1,260
2026	225,000	60,795	315	3,128	18,630	17,955	60,795	2,183	19,305	4,928	5,198	4,905	18,293	765	945
2027	225,000	60,795	315	3,128	18,630	17,955	60,795	2,183	19,305	4,928	5,198	4,905	18,293	765	945
2028	225,000	60,795	315	3,128	18,630	17,955	60,795	2,183	19,305	4,928	5,198	4,905	18,293	765	945
2029	225,000	60,795	315	3,128	18,630	17,955	60,795	2,183	19,305	4,928	5,198	4,905	18,293	765	945
2030	225,000	60,795	315	3,128	18,630	17,955	60,795	2,183	19,305	4,928	5,198	4,905	18,293	765	945
2031	149,323	40,347	209	2,076	12,364	11,916	40,347	1,448	12,812	3,270	3,449	3,255	12,140	508	627
2032	144,207	38,965	202	2,004	11,940	11,508	38,965	1,399	12,373	3,158	3,331	3,144	11,724	490	606
2033	139,090	37,582	195	1,933	11,517	11,099	37,582	1,349	11,934	3,046	3,213	3,032	11,308	473	584
2034	133,974	36,200	188	1,862	11,093	10,691	36,200	1,300	11,495	2,934	3,095	2,921	10,892	456	563
2035	128,858	34,817	180	1,791	10,669	10,283	34,817	1,250	11,056	2,822	2,977	2,809	10,476	438	541
2036	123,741	33,435	173	1,720	10,246	9,875	33,435	1,200	10,617	2,710	2,858	2,698	10,060	421	520
2037	118,565	32,036	166	1,648	9,817	9,462	32,036	1,150	10,173	2,597	2,739	2,585	9,639	403	498
2038	113,212	30,590	158	1,574	9,374	9,034	30,590	1,098	9,714	2,479	2,615	2,468	9,204	385	475
2039	106,756	28,845	149	1,484	8,839	8,519	28,845	1,036	9,160	2,338	2,466	2,327	8,679	363	448
2040	100,050	27,033	140	1,391	8,284	7,984	27,033	970	8,584	2,191	2,311	2,181	8,134	340	420
2041	93,210	25,185	130	1,296	7,718	7,438	25,185	904	7,997	2,041	2,153	2,032	7,578	317	391
2042	85,955	23,225	120	1,195	7,117	6,859	23,225	834	7,375	1,882	1,986	1,874	6,988	292	361
2043	77,286	20,883	108	1,074	6,399	6,167	20,883	750	6,631	1,693	1,785	1,685	6,283	263	325
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table I-22
CAP Allocation Draft EIS
Analysis of Groundwater Impacts of Alternatives on Apache Tribe Lands

1	2	3	4	5	6	7	8	9	10	11
			San Carlos River Stream Alluvium				Gila River Stream Alluvium			
Alternative	CAP Supply for Irrigation Use (AF)	Total Irrigated Acres	Total Stream Alluvium Acres	Assumed Irrigated Acres	Available Storage (AF)	Years to Fill Available Storage	Total Stream Alluvium Acres	Assumed Irrigated Acres	Available Storage (AF)	Years to Fill Available Storage
No Action	37665	7333	8,599	2,867	19,348	2.7	13,399	4,466	100,493	9.0
Proposed Action	31665	6300	8,600	2,463	19,350	3.1	13,400	3,837	100,500	10.5
Alt. 1	31665	6300	8,600	2,463	19,350	3.1	13,400	3,837	100,500	10.5
Alt. 2	50000	10000	8,600	3,909	19,350	2.0	13,400	6,091	100,500	6.6
Alt. 3	50000	10000	8,600	3,909	19,350	2.0	13,400	6,091	100,500	6.6

Notes:

2 From "Plans to Take and Use CAP Water San Carlos Apache Tribe"
3 CAP irrigation supply divided by assumed 5 AF/acre application rate, rounded to nearest 100 acres
4 Estimated to be 8,600 acres
5 Estimated to be proportional to stream alluvium along San Carlos River versus total stream alluvium
6 Estimated by multiplying total stream alluvium acres (column (4)) by depth to water of 15 feet and specific yield of 0.15
7 Estimated by dividing available storage (column (6)) by return flows (irrigated acres (column (5)) multiplied by annual return flow of 2.5 acre-feet per acre)
8 Estimated to be 13,400 acres
9 Total acres to be irrigated (column (3)) minus acres irrigated along San Carlos River (column (5)).
10 Estimated by multiplying total stream alluvium acres (column (8)) by depth to water of 50 feet and specific yield of 0.15
11 Estimated by dividing available storage (column (10)) by return flows (irrigated acres (column (9)) multiplied by annual return flow of 2.5 acre-feet per acre)

APPENDIX L

INDIVIDUAL ENTITY DESCRIPTIONS

MUNICIPAL AND INDUSTRIAL

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

M&I ENTITIES

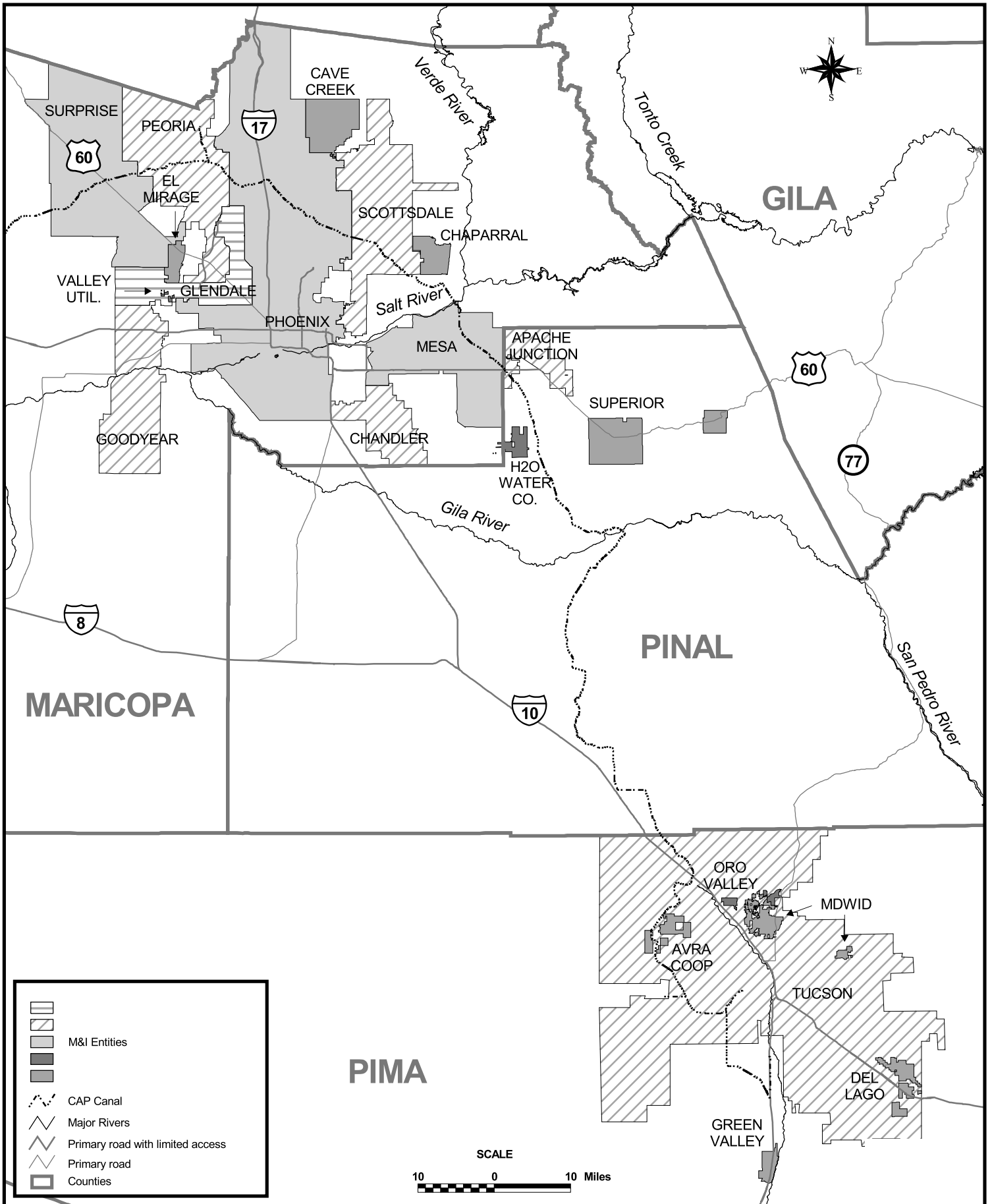
There are 21 municipal water providers and private water companies that were recommended, by the Arizona Department of Water Resources (ADWR), to receive an allocation of CAP water (see Table L-M&I-1). These entities, which comprise the M&I water users that are considered in the draft EIS, are located in Maricopa, Pinal and Pima Counties, Arizona. The entities are shown on Figure L-M&I-1. Under the Settlement Alternative and Non-Settlement Alternative 1, each of these entities would receive a portion of the currently unallocated 65,647 acre-feet annually (afa) of M&I priority CAP water. Under Non-Settlement Alternative 3B, each of these 21 entities would receive a portion of an estimated 71,815 afa of NIA priority water, based upon ADWR's recommendations. Of the 21 M&I entities, 15 currently have an existing CAP water allocation and would receive an additional allocation, and six would receive a new allocation. Under the remaining alternatives, these M&I entities would not receive an allocation.

In order to assess the potential impacts from the proposed allocation of CAP water to these 21 M&I entities, total long-term water deliveries for each water user were estimated. Population projections for future conditions under each allocation alternative were developed. Water demand and available water supply projections, including CAP water made available under each alternative, were also estimated (details on the methodology and projections are found in Appendices A and C). Land use changes within each entity's service area or MPA through time were also projected. These projections and estimates are totaled for all 21 entities and summarized on Table L-M&I-2. It should be noted that an analysis of current and potential future water resources compared to projected future water demands indicates all M&I entities evaluated in the draft EIS could meet their projected demands without receiving additional CAP water through this proposed allocation (see Appendix C); therefore, the amount of acreage urbanized would be the same for each alternative, including the No Action Alternative. The following summaries include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a brief description of the impacts to biological and cultural resources that would result from this conversion of desert and agricultural lands to urban uses.

Projected plans to take and use CAP water are described below for each M&I user. These plans are based upon a review of water use plans (where available) and telephone interviews with entity representatives.

The individual descriptions of land use include an identification of land use designations based on 1995 land use data received from either Maricopa Association of Governments (MAG) or as surveyed as part of the habitat zone delineation. The land use categories for MAG include agriculture, developed, rural, vacant, and water. The developed land use category is comprised of a number of individual land use categories including various residential, commercial, industrial and open space categories.

For the purpose of converting the 1995 MAG data to current and future anticipated land



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June 2000

CAP Allocation EIS

M&I Sector Location Map

Figure
L-M&I-1

usage, three land use categories were developed. The categories include agriculture, desert and urban. The agriculture category is the same as the 1995 MAG category and was adjusted based on 1999 aerial photography. The desert category includes that area defined as vacant in the 1995 MAG data and was adjusted based on the habitat mapping performed for the draft EIS. The urban category includes the 1995 MAG categories of developed, rural and water.

Table L-M&I-1
CAP Allocation Draft EIS
Summary of Entities in the M&I Sector

M&I Entity	Location
Arizona Water Company - Apache Junction	Pinal County
AVRA Water Cooperative	Pima County
Cave Creek Water Company	Maricopa County
City of Chandler	Maricopa County
Chaparral City Water Company	Maricopa County
Community Water Company of Green Valley	Pinal County
City of El Mirage	Maricopa County
City of Glendale	Maricopa County
City of Goodyear	Maricopa County
H2O Water Company	Maricopa County
City of Mesa	Maricopa County
Metropolitan Domestic Water Improvement District	Pima County
Town of Oro Valley	Pima County
City of Peoria	Maricopa County
City of Phoenix	Maricopa County
City of Scottsdale	Maricopa County
Town of Superior / Arizona Water Company-Superior	Pinal County
City of Surprise	Maricopa County
City of Tucson	Pima County
Vail Water Company	Pima County
Valley Utilities Water Company	Maricopa County

Table L-/M&I-2
CAP Allocation Draft EIS
Summary of Significant Data to M&I Sector

	Settlement Alternative	**Non-Settlement Alternative 1**	**Non-Settlement Alternative 2**	**Non-Settlement Alternative 3A**	**Non-Settlement Alternative 3B**	**No Action**
CAP Deliveries in 2051 (af)	552,422	523,610	458,366	458,366	523,610	458,366
Groundwater Pumped in 2051 (af)	123,583	123,583	123,722	123,722	123,583	123,722
Desert Urbanized (acres)	240,000	240,000	240,000	240,000	240,000	240,000
Estimated Population 2001 2051	 3,253,734 6,682,615	 3,253,734 6,682,615	 3,253,734 6,682,615	 253,734 6,682,615	 3,253,734 6,682,615	 3,253,734 6,682,615
CAGRD* Replenishment Obligation (af)	126,168	149,003	199,174	199,174	149,003	199,174

CAGRD = Central Arizona Groundwater Replenishment District

1. Arizona Water Company-Apache Junction

The City of Apache Junction is a rural community located in Pinal County on the eastern rim of the Phoenix metropolitan area. A variety of lifestyles are offered in Apache Junction, ranging from western rural acreage to more urban single-family residential neighborhoods. The economy of Apache Junction is based almost exclusively on recreation and retirement. Most commercial services in the area cater to tourists and recreation seekers on their way to Arizona's central lakes and forests. Extensive developments and accommodations in the area serve many retired persons as well as a large influx of winter visitors. The Arizona Water Company-Apache Junction service area is located approximately east of Butte Road, west of Mountain Road, north of Baseline Road, and south of McKellips Road.

The Arizona Water Company-Apache Junction serves 14,000 customers in the Apache Junction area. The other water provider in the area, the Arizona Water Company-Apache Junction Water District, serves 2,500 customers. This water provider is currently utilizing its existing CAP allocation of 6,000 afa.

A. Plans to Take and Use CAP Water

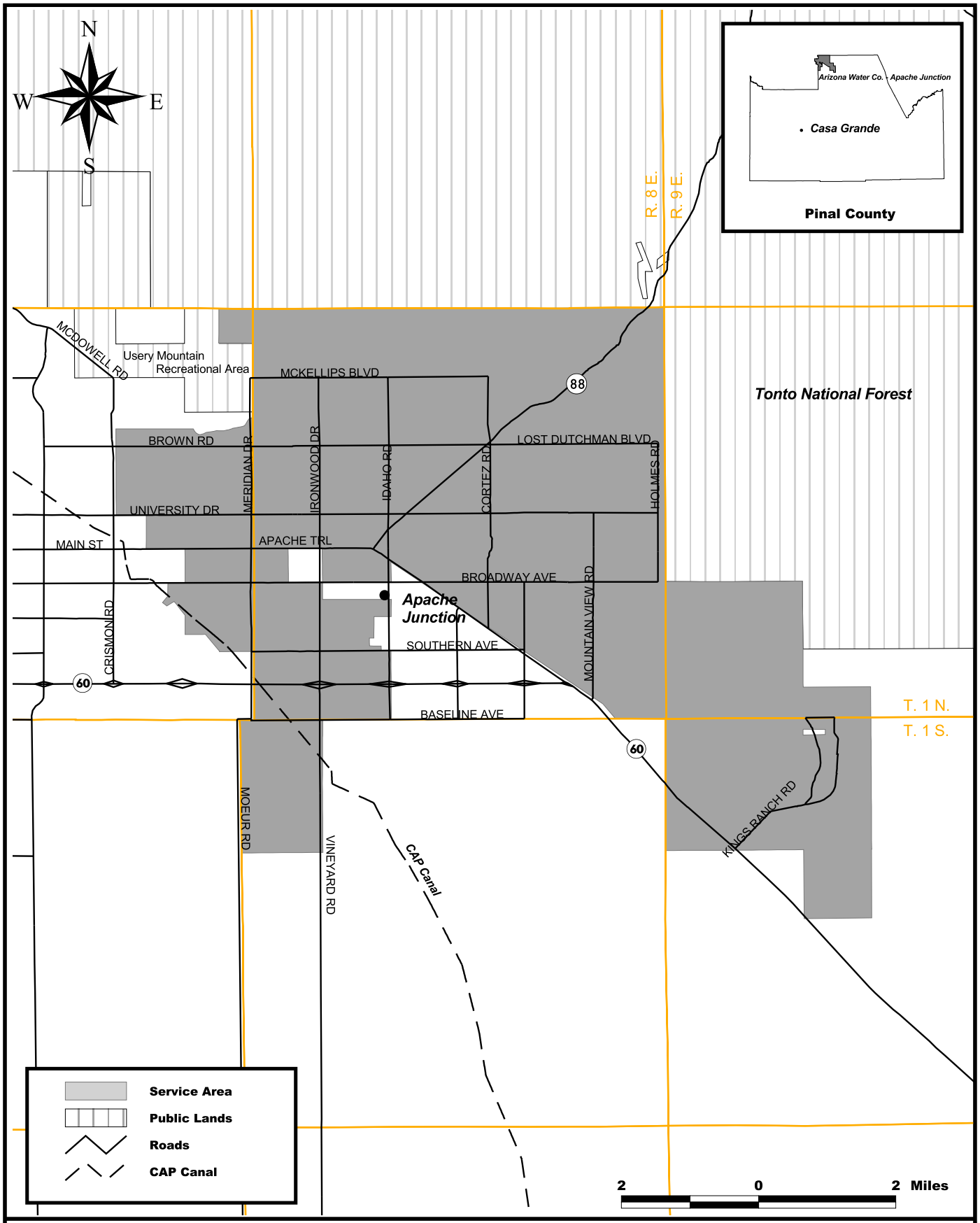
The Arizona Water Company-Apache Junction currently has a subcontract for 6,000 afa. Under the Settlement Alternative, Apache Junction would receive 285 afa of CAP water. Arizona Water Company-Apache Junction would only receive the additional allocation if the Town of Superior declines its allocation. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-3 outlines the proposed allocations by alternative.

Table L-M&I-3
CAP Allocation Draft EIS
Arizona Water Company-Apache Junction – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	285*	M&I
No Action	0	-
Non-Settlement Alternative 1	285*	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	312*	NIA
Existing CAP Allocation	6,000	

* If the allocation is not accepted, the 285 af (or 312 af) from Apache Junction would be recommended for the Arizona Water Company for use in Superior or Apache Junction.

Figure L-M&I-2 shows the service area for the Arizona Water Company-Apache Junction. The service area covers approximately 48 square miles. The Arizona Water Company-Apache Junction is currently taking and using their full CAP allocation through a



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CAP Allocation Draft EIS
General Location Map
Arizona Water Company - Apache Junction

June 2000

Figure No. L-M&I-2

connection to the CAP distribution system and a pipeline located along Brown Road. The CAP water is being treated at the City of Mesa water treatment plant that is also located along Brown Road. They would take and use their additional allocation in the same manner. No additional facilities would be required to take and treat the additional CAP allocation (Garfield 2000).

B. Population Projection

The population in 1985 for Arizona Water Company-Apache Junction was 9,645. The estimated 2001 population level for Arizona Water Company-Apache Junction is 22,621, and the estimated 2051 population level is 33,738.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the Arizona Water Company-Apache Junction would increase from 6,695 af in year 2001 to 11,114 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-4. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 4.3 percent and 2.6 percent of the estimated water supply required for the Arizona Water Company-Apache Junction for the years 2001 and 2051, respectively.

Table L-M&I-4
CAP Allocation Draft EIS
Arizona Water Company-Apache Junction – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	6,285	6,285	410	4,829	0	0	6,695	11,114
No Action Alternative	6,000	6,000	410	4,829	285	285	6,695	11,114
Non-Settlement Alternative 1	6,285	6,285	410	4,829	0	0	6,695	11,114
Non-Settlement Alternative 2	6,000	6,000	410	4,829	285	285	6,695	11,114
Non-Settlement Alternative 3A	6,000	6,000	410	4,829	285	285	6,695	11,114
Non-Settlement Alternative 3B	6,285	6,285	410	4,829	0	0	6,695	11,114

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 11,114 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1, and Non-Settlement Alternative 3B, 285 afa of demand are met by the additional CAP allocation. Alternatively, this 285 afa of demand are met by CAGRD membership under the No Action Alternative, Non-Settlement Alternative 2, and Non-Settlement Alternative 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Table L-M&I-5 provides the existing acres of land within the Arizona Water Company-Apache Junction service area, based on review of aerial photographs and field surveys and habitat mapping completed as part of the biological resources assessment of this draft EIS.

Table L-M&I-5
CAP Allocation Draft EIS
Arizona Water Company-Apache Junction – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	0	-	10,725	-	19,941	-
	2051	0	0	8,872	1,853	21,794	1,853
No Action	2001	0	-	10,725	-	19,941	-
	2051	0	0	8,872	1,853	21,794	1,853
Non-Settlement Alternative 1	2001	0	-	10,725	-	19,941	-
	2051	0	0	8,872	1,853	21,794	1,853
Non-Settlement Alternative 2	2001	0	-	10,725	-	19,941	-
	2051	0	0	8,872	1,853	21,794	1,853
Non-Settlement Alternative 3A	2001	0	-	10,725	-	19,941	-
	2051	0	0	8,872	1,853	21,794	1,853
Non-Settlement Alternative 3B	2001	0	-	10,725	-	19,941	-
	2051	0	0	8,872	1,853	21,794	1,853

2. Archaeological Resources

Survey coverage in the Arizona Water Company-Apache Junction service area is generally characterized by long, linear projects and small (averaging 40 to 160 acres) noncontiguous block surveys. Exceptions include the Queen Creek portion of Reclamation's extensive Salt-Gila Aqueduct–CAP survey (e.g., Stein 1979; Teague and Crown 1984), and Archaeological

Consulting Services, Ltd. (ACS's) survey for the Superstition Mountain Development (Moreno and Macnider 1996). These projects yielded numerous prehistoric sites, including villages, artifact scatters, roasting pits, fire-cracked rock concentrations, bedrock mortars, petroglyphs, and lithic quarries. The majority of sites are affiliated with Archaic, Hohokam, and Salado occupations; protohistoric Yavapai sites also have been documented. Other significant cultural resources—including the Hieroglyphic Canyon Site, a National Register property—have been recorded in the Tonto National Forest, Hieroglyphic Mountains, and other adjacent areas. Arizona Water Company-Apache Junction does not have a historic preservation program.

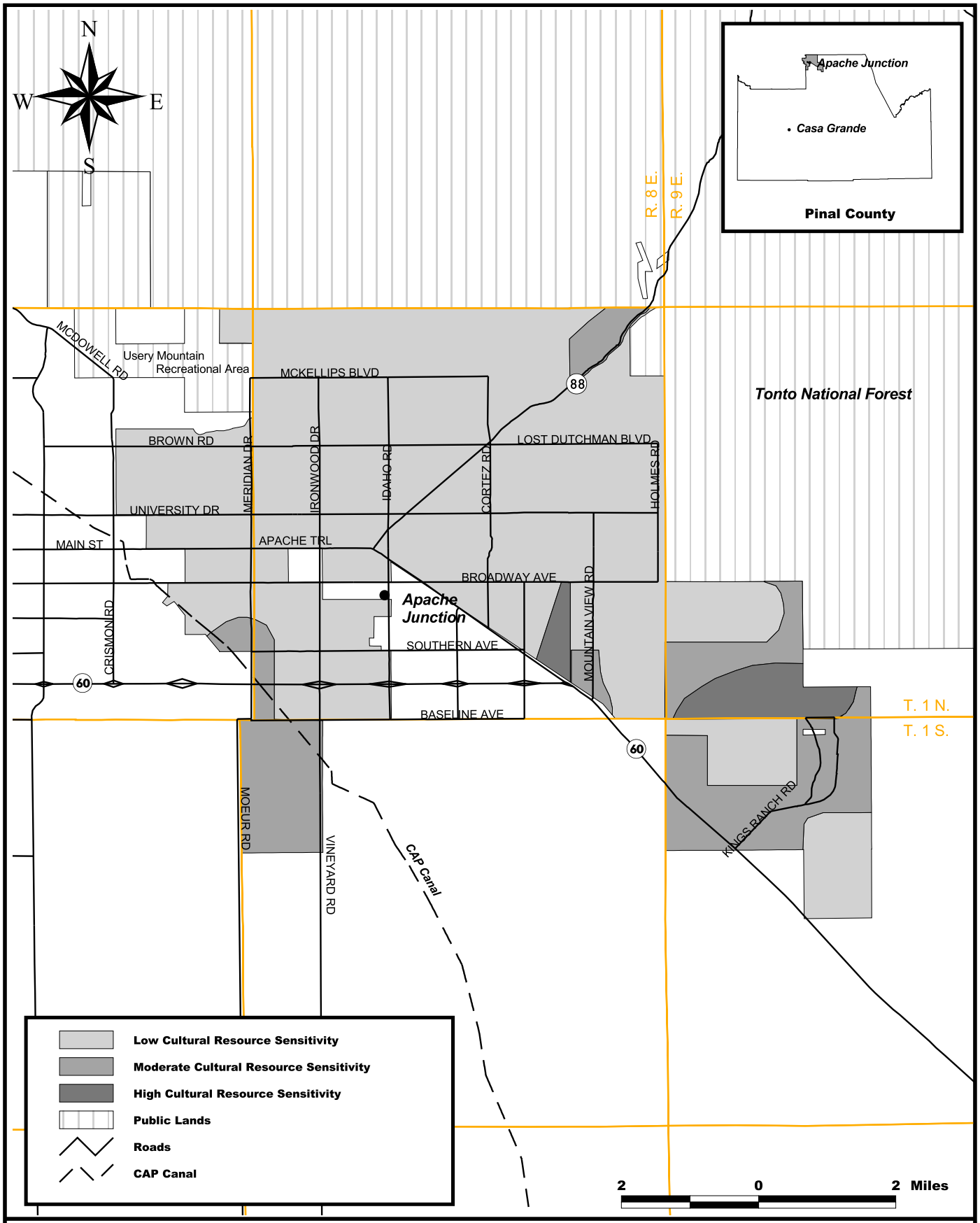
Cultural resource sensitivity areas in the service area are shown in Figure L-M&I-3. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Arizona Water Company-Apache Junction service area is low to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions, and development of applicable permit requirements (such as the Clean Water Act (CWA) Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. There would be no cultural resources impacts from construction of CAP water delivery facilities, since no new facilities would be required.

3. Biological Resources

Existing Habitats

The Arizona Water Company-Apache Junction service area is located at the western base of the Superstition Mountains at an elevation of 2200 feet. Some north-and east-facing slopes in the northeastern section are represented by Jojoba Mixed Scrub Association where the frequency of jojoba is high and co-dominants include wild buckwheat, Berlandier's wolfberry, teddybear cholla, and ephedra. Saguaro density is moderate. Most other slopes and coarser soils support Bursage/Foothill Paloverde Association where co-dominants include creosote-bush, jojoba, staghorn cholla, Gray's krameria, and little-leaf krameria. Other common trees include velvet mesquite, desert ironwood, blue-paloverde, and saguaro. Saguaro density is moderate to high. Creosote-Bush Scrub Association dominates the silty plains to the south where the cover is very low and dominated almost entirely by creosote-bush and bursage. Trees, such as foothill paloverde and desert ironwood, are widely-spaced. Blue-Paloverde Desert Ironwood Association habitat occurs along major washes and is characterized by ironwood, blue-paloverde, and velvet mesquite. The habitat zones located in the Arizona Water Company-Apache Junction service area are shown on Figure L-M&I-4.

Table L-M&I-6 provides the habitat acreages in the Arizona Water Company-Apache Junction service area for the habitat zones described above.



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CAP Allocation Draft EIS
Cultural Resources
Arizona Water Company - Apache Junction

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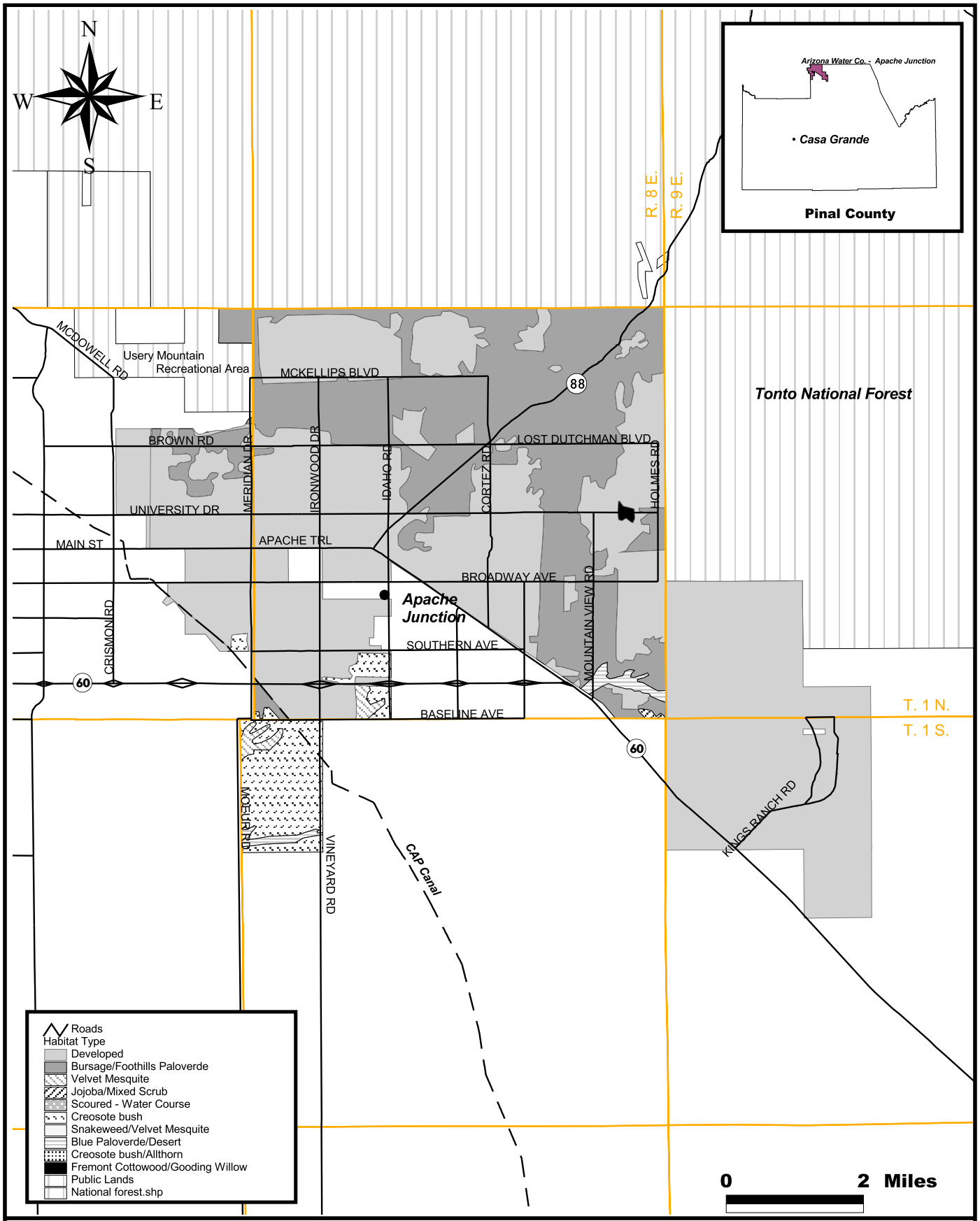
Figure No. L-M&I-3



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CAP Allocation Draft EIS
Habitat Zones
Arizona Water Company - Apache Junction

June 2000

Figure No. L-M&I-4

Table L-M&I-6
CAP Allocation Draft EIS
Arizona Water Company-Apache Junction – Habitat Acreages

Vegetation Name	Acres
Developed	19,941
Bursage / Foothills Paloverde	8,778
Velvet Mesquite	167
Jojoba / Mixed Scrub	18
Creosote-Bush	1,512
Blue Paloverde / Desert	219
Fremont Cottonwood / Goodding Willow	31
Total	**30,666**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Arizona Water Company-Apache Junction service area over the 50-year study period would result in loss of estimated 20,870 acres of Sonoran Desertscrub and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. No new CAP water delivery facilities are required, so no additional construction-related impacts to biological resources would occur.

Potential Threatened and Endangered (T&E) Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. Arizona Water Company-Apache Junction would be responsible for complying with the relevant provisions of the Endangered Species Act (ESA) as it permits and approves future urban growth. The Arizona Water Company-Apache Junction service area is located within Pinal County for which there are 13 T&E species listed by the United States Fish and Wildlife Service (USFWS). However, potential habitat only exists for cactus ferruginous pygmy-owl. Approximately 9,164 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the service area.

4. Water Resources

Groundwater in the Arizona Water Company-Apache Junction service area is obtained from the alluvium in the eastern part of the Salt River Valley. Before CAP water became available, demands on Arizona Water Company-Apache Junction were met entirely with pumped groundwater. Groundwater levels historically declined due to that groundwater pumping, and there has been some associated subsidence. The concentration of TDS in the underlying groundwater is generally less than 500 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-7 which shows the estimated groundwater level change for the period from 2001-2051 for each alternative as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative.

Under the No Action Alternative, groundwater levels would decline by about 84 feet from 2001 to 2051. While CAP water available to Apache Junction would be used to meet demands and offset groundwater pumping, increased demands over time would be met through increased local groundwater pumping. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels.

Groundwater levels would also decline for all of the action alternatives. These declines would be similar to the No Action Alternative. Substantial changes in groundwater quality would not be anticipated, although there would be the potential for subsidence due to the lower groundwater levels.

Table L-M&I-7
CAP Allocation Draft EIS
Arizona Water Company-Apache Junction – Groundwater Data Table

Alternative	**Apache Junction***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action Alternative	-84	--
Settlement Alternative	-81	3
Non-Settlement Alternative 1	-80	4
Non-Settlement Alternative 2	-89	-5
Non-Settlement Alternative 3A	-92	-8
Non-Settlement Alternative 3B	-88	-4

*Values correspond to Apache Junction sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small

increment of Apache Junction's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 2.6 percent of the total year 2051 demand for Arizona Water Company-Apache Junction.

Table L-M&I-8
CAP Allocation Draft EIS
Arizona Water Company-Apache Junction–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	286-291 [b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	286-291[b]	CAGRD
Non-Settlement Alternative 3A	286-291[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

3. Cave Creek Water Company

The Cave Creek Water Company has approximately 9.6 square miles in its franchise areas and currently uses 490 water meters to serve its population. The service area is located about 25 miles northeast of downtown Phoenix, and includes the town of Cave Creek. The Cave Creek Water Company service area is located north of Carefree Highway, west of Sections 23 and 27 of T6N, R4E, east of 24th Street, and south of the Tonto National Forest Boundary.

According to the ADWR Annual Water Withdrawal and Use Report, in the Cave Creek Water Company area in 1998, a total of 877 af of water were produced. Of that total, 322 af were from pumped groundwater and the remaining 555 af were CAP water. From the 877 af of water produced, 208 af of potable and raw CAP water were delivered to other municipal and individual users, leaving a balance of 669 af to be delivered for use.

A. Plans to Take and Use CAP Water

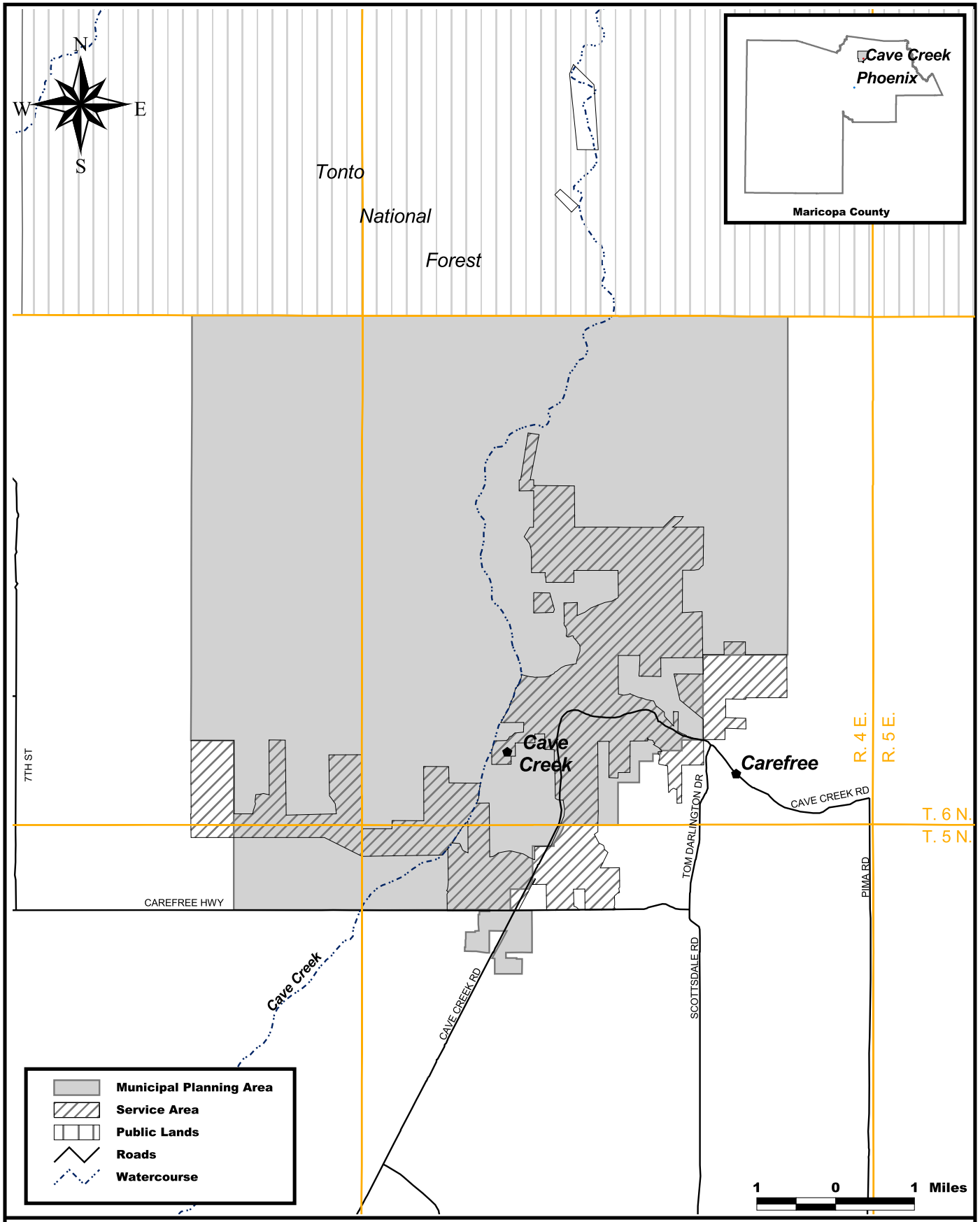
The Cave Creek Water Company currently has a subcontract for 1,600 afa and is currently using 1,010 af of the allocation. Under the Settlement Alternative, Cave Creek Water Company would receive an additional 806 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I -15 outlines the proposed allocations by alternative.

Table L-M&I-15
CAP Allocation Draft EIS
Cave Creek Water Company – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	806	M&I
No Action	0	-
Non-Settlement Alternative 1	806	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	882	NIA
Existing CAP Allocation	1,600	

Figure L-M&I-8 shows the service area and MPA for the Cave Creek Water Company. The service area covers approximately 6,171 acres and the MPA covers approximately 27,246 acres. CAP water can be delivered anywhere within the designated service area.

Cave Creek currently receives their CAP allocation through a CAP connection and pipeline at Cave Creek and Payson Roads. There is also an existing 16-inch pipeline at Deer Valley and Cave Creek Roads. The Cave Creek Water Company currently has a water treatment facility with a capacity of 1,100 afa. They are in the process of upgrading and increasing capacity at the facility. At the time of this writing, the engineering work had been completed and the necessary approvals from Maricopa County are expected in the short-term. The water treatment capacity would be upgraded to 2,200 afa, with an ultimate capacity of 3,300 afa



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
General Location Map
Cave Creek Water Company

Figure #L-M&I-8

annually. With the completion of improvements, no additional facilities would be required for the additional CAP allocation (George 2000).

B. Population Projection

The population in 1985 for the Cave Creek Water Company was 1,900. The estimated 2001 population level for the Cave Creek Water Company MPA is 4,181 and the estimated 2051 population level is 16,615.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the Cave Creek Water Company MPA would increase from 3,538 af in year 2001 to 6,030 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-16. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 23 percent and 13 percent of the current estimated water supply required for the Cave Creek Water Company MPA for the years 2001 and 2051, respectively.

Table L-M&I-16
CAP Allocation Draft EIS
Cave Creek Water Company– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	2,406	2,406	65	65	1,067	2,973	0	968	3,538	6,411
No Action	1,600	1,600	65	65	1,873	2,973	0	1,774	3,538	6,411
Non-Settlement Alternative 1	2,406	2,406	65	65	1,067	2,973	0	968	3,538	6,411
Non-Settlement Alternative 2	1,600	1,600	65	65	1,873	2,973	0	1,774	3,538	6,411
Non-Settlement Alternative 3A	1,600	1,600	65	65	1,873	2,973	0	1,774	3,538	6,411
Non-Settlement Alternative 3B	2,406	2,406	65	65	1,067	2,973	0	968	3,538	6,411
Note: A more detailed breakdown of supplies may be found in Appendix C.										

It is estimated that the demand for water at the end of the CAP contract period would be approximately 6,030 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and Non-Settlement Alternative 3B, 806 afa of demand is met by the additional CAP allocation. Alternatively, this 806 afa of demand is met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the Cave Creek Water Company MPA in 1995 consisted of approximately 4,105 acres of developed land, 3,122 acres of rural land, 13,488 acres of vacant land, and 6,531 acres of water, including lake, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e., agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-17 provides the projected acres of land within the Cave Creek Water Company MPA which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

Table L-M&I-17
CAP Allocation Draft EIS
Cave Creek Water Company– Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	0	-	25,604	-	1,642	-
	2051	0	0	19,683	5,921	7,563	5,921
No Action	2001	0	-	25,604	-	1,642	-
	2051	0	0	19,683	5,921	7,563	5,921
Non-Settlement Alternative 1	2001	0	-	25,604	-	1,642	-
	2051	0	0	19,683	5,921	7,563	5,921
Non-Settlement Alternative 2	2001	0	-	25,604	-	1,642	-
	2051	0	0	19,683	5,921	7,563	5,921
Non-Settlement Alternative 3A	2001	0	-	25,604	-	1,642	-
	2051	0	0	19,683	5,921	7,563	5,921
Non-Settlement Alternative 3B	2001	0	-	25,604	-	1,642	-
	2051	0	0	19,683	5,921	7,563	5,921

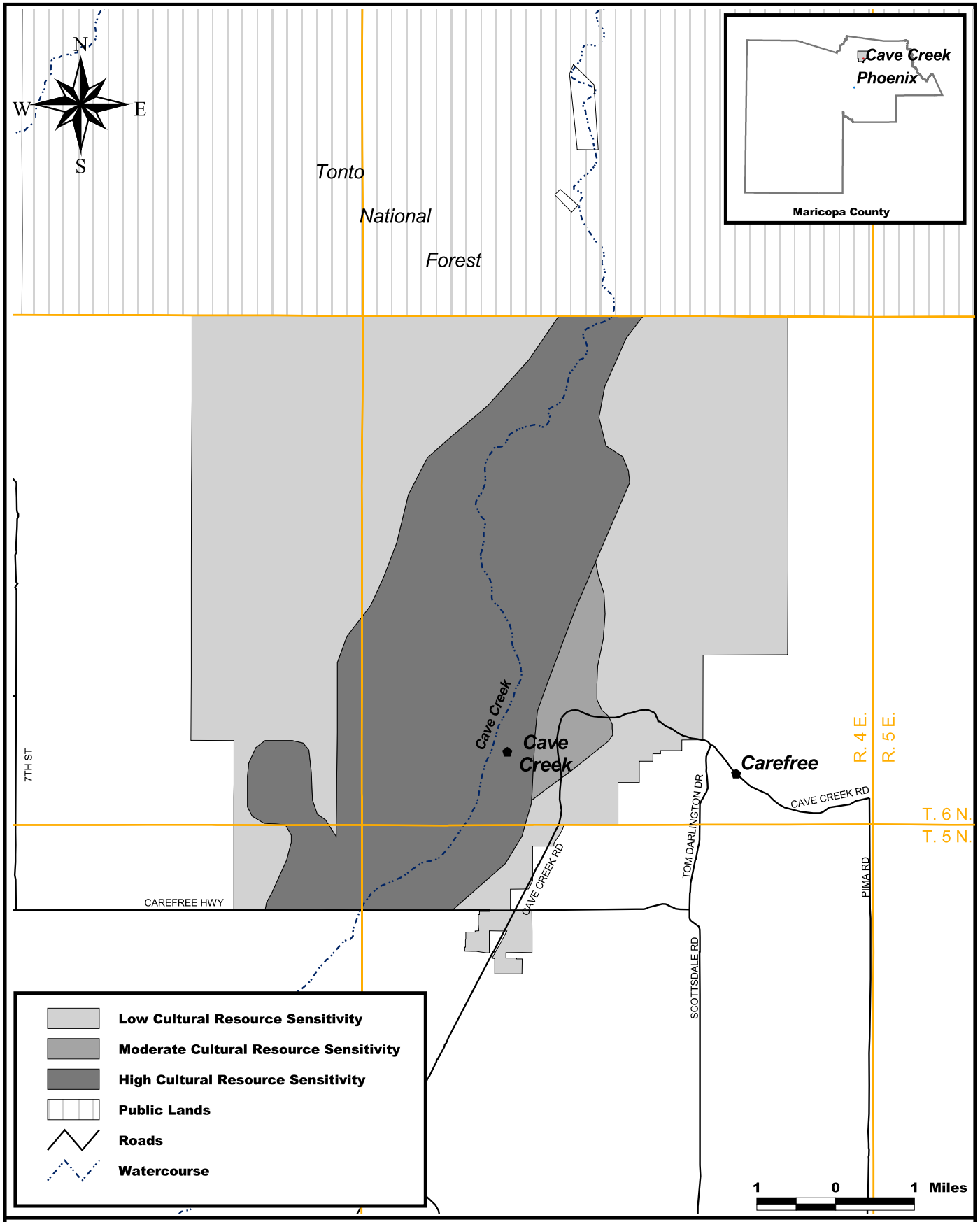
2. Archaeological Resources

A representative sample of the Cave Creek Water Company MPA has been surveyed (e.g., DeMaagd and Punzmann 1996; Holliday 1974; Madsen 1981; Wright 1993) and numerous sites have been documented, particularly along the banks of Cave Creek and adjacent terraces. The southern boundary of the service area extends onto the Cave Creek Archaeological District, a National Register property. Prehistorically, the area was utilized for agriculture. Within areas of high and moderate cultural resource sensitivity, sites range from compound villages with multiple structures (e.g., Spur Cross Ranch) to small, isolated field houses and limited-activity artifact scatters; features include burials, middens, roasting pits, check dams, rock piles and alignments, and "waffle gardens." Other known prehistoric resources include petroglyphs, trails, and shrines. Historic sites are associated primarily with mining. The Cave Creek Mining District was formed in 1874 to represent not only the area's large mines—such as the Golden Star Mine and the Phoenix Mine—but also the hundreds of smaller placer mines in the vicinity that were exploited for a year or two before they were abandoned (RECON 1987). Resources associated with ranching, agriculture and water management (e.g., canals), transportation, and the military also are present. Because of the nature of the depositional environment and the intensity of human occupation in the area through time, the potential for encountering additional surface and buried sites within this entity is very high. Cultural resource sensitivity areas in the Cave Creek Water Company MPA are shown on Figure L-M&I-9. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Cave Creek Water Company MPA is high. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions, and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. There would be no cultural resources impacts from construction of CAP water delivery facilities, since no new facilities would be required.

3. Biological Resources

Existing Habitats

The northern portion of the Cave Creek MPA is interspersed with low mountains under 4,500 feet in elevation. The steeper, mainly north- and east-facing slopes support a Jojoba/Mixed Scrub Association where co-dominants include barrel cactus, brittlebush, teddybear cholla, white-thorn acacia, wild-buckwheat, and turpentine-bush. Foothill paloverde, allthorn, desert ironwood, and saguaro are the common trees. Remaining slopes (mostly below 2,500 feet in elevation) and coarser soils support Bursage/Foothill Paloverde Association. Co-dominants include jojoba and staghorn cholla and, in addition to the foothill paloverde, other common trees include velvet mesquite, desert ironwood, blue-paloverde, allthorn, and saguaro. The density of saguaros is generally moderate but sometimes high. Rather small areas of the Creosote-Bush Association occur on silty plains to the south. The cover is low and trees are widely-spaced. Blue-Paloverde/Desert Ironwood Association habitat occurs along major washes. The habitat zones located in the Cave Creek Water Company MPA are shown on



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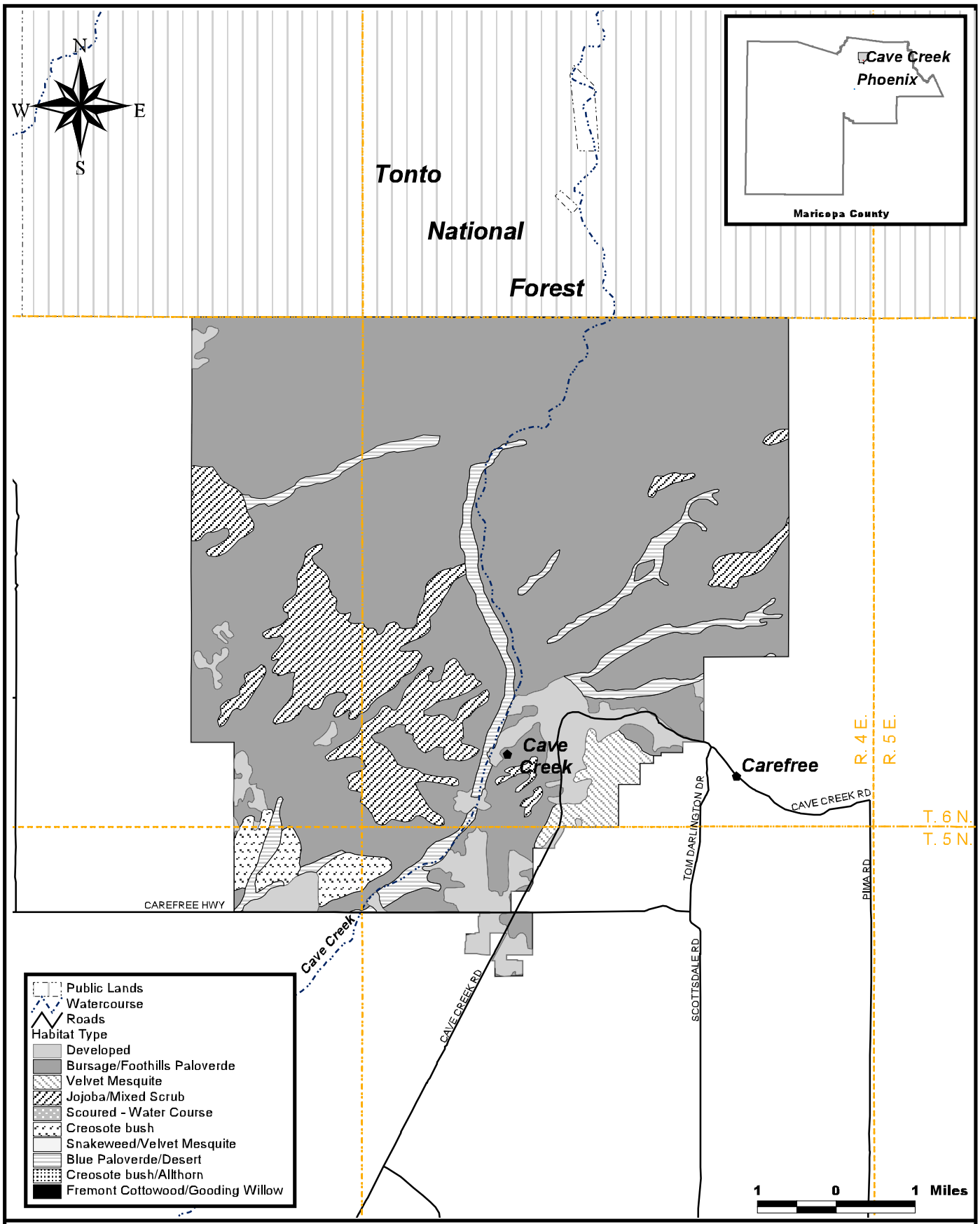
June 2000

CAP Allocation Draft EIS
Cultural Resources
Cave Creek Water Company

Figure #L-M&I-9



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Habitat Zones
Cave Creek Water Company

Figure No. L-M&I-10

Figure L-M&I-10. Table L-M&I-18 provides the habitat acreages in the Cave Creek Water Company MPA for the habitat zones described above.

Table L-M&I-18
CAP Allocation Draft EIS
Cave Creek Water Company – Habitat Acreages

Vegetation Name	Acres
Developed	1,642
Bursage / Foothills Paloverde	20,596
Velvet Mesquite	443
Jojoba / Mixed Scrub	2,731
Creosote-Bush	589
Blue Paloverde / Desert	1,245
Total	**27,246**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Cave Creek MPA over the 50-year study period would result in loss of estimated 5,921 acres of Sonoran Desertscrub and associated wildlife resources. There may be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. Under the action alternatives, there is no difference in impacts from the No Action Baseline. No new CAP water delivery facilities are required, so no additional construction–related impacts to biological resources would occur.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The Town of Cave Creek would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The Cave Creek MPA is located within Maricopa County for which there are 14 T&E species listed by the USFWS. Potential habitat only exists for cactus ferruginous pygmy-owl, southwestern willow flycatcher and Arizona agave. Approximately 22,284 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the Cave Creek MPA. Approximately 364 acres above 3,000 feet of potential suitable habitat for Arizona agave were identified in the Cave Creek MPA. Potential suitable habitat for southwestern willow flycatcher may occur in isolated pockets in the Cave Creek MPA. However, construction within the riparian corridor would require issuance of CWA Section 404 permits by the U.S. Army Corps of Engineers (Corps). As part of the permitting process, the Corps would have to comply with Section 7 of the ESA, and detailed surveys for threatened and endangered species would be carried out as necessary.

4. Water Resources

Demands in the Cave Creek Water Company have historically been met by pumping groundwater from the underlying basin fill. In more recent years, CAP water has been used to

meet a portion of the demands. This reliance on groundwater has resulted in declining groundwater levels over time. The concentration of TDS in the underlying groundwater is generally from about 200 to 700 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-19, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative.

Under the No Action Alternative, groundwater levels would decline by about 13 feet from 2001 to 2051. While CAP water available to Cave Creek Water Company would be used to meet demands and offset groundwater pumping, increased demands over time would be met through increased groundwater pumping. Substantial changes in groundwater quality would not be anticipated. Also, subsidence would not be anticipated in this area. Non-Settlement Alternatives 2 and 3A would have the same amount of CAP water available to the Cave Creek Water Company as the No Action Alternative, and therefore, would have the same changes in groundwater levels, groundwater quality, and subsidence.

Groundwater levels under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B would rise by about 45 feet over the 2001 to 2051 period. This rise reflects the additional CAP water that would be available under these alternatives and the corresponding reduction in groundwater pumping. Substantial changes in groundwater quality would not be anticipated for these alternatives. Also, subsidence would not be anticipated.

Table L-M&I-19
CAP Allocation Draft EIS
Cave Creek Water Company–Groundwater Data Table

Alternative	**Cave Creek***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-13	--
Settlement Alternative	45	58
Non-Settlement Alternative 1	45	58
Non-Settlement Alternative 2	-13	0
Non-Settlement Alternative 3A	-13	0
Non-Settlement Alternative 3B	45	58

***Values correspond to analysis of the Carefree sub-basin, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence,

alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of Cave Creek's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 13.4 percent of the total year 2051 demand for Cave Creek Water Company.

Table L-M&I-20
CAP Allocation Draft EIS
Cave Creek Water Company –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	238 – 239[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	238 – 239[b]	CAGRD
Non-Settlement Alternative 3A	238 – 239[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

5. Chaparral City Water Company

The Chaparral City Water Company service area contains approximately 20 square miles of land and includes the City of Fountain Hills and the foothills and bajadas of the McDowell Mountains. Chaparral City Water Company service area is located northwest of Beeline Highway and south of McDowell Mountain Regional Park. The City of Fountain Hills is an exclusive residential community, with local economic activities consisting of service-related businesses for its residents. The area's economic base stems mainly from the off-site employment of its residents.

According to the ADWR Annual Water Withdrawal and Use Report, in the Chaparral City Water Company service area in 1998, a total of 5,239 af of water were produced and delivered. Of that total, 1,083 af were pumped groundwater, and 4,156 af were CAP water.

A. Plans to Take and Use CAP Water

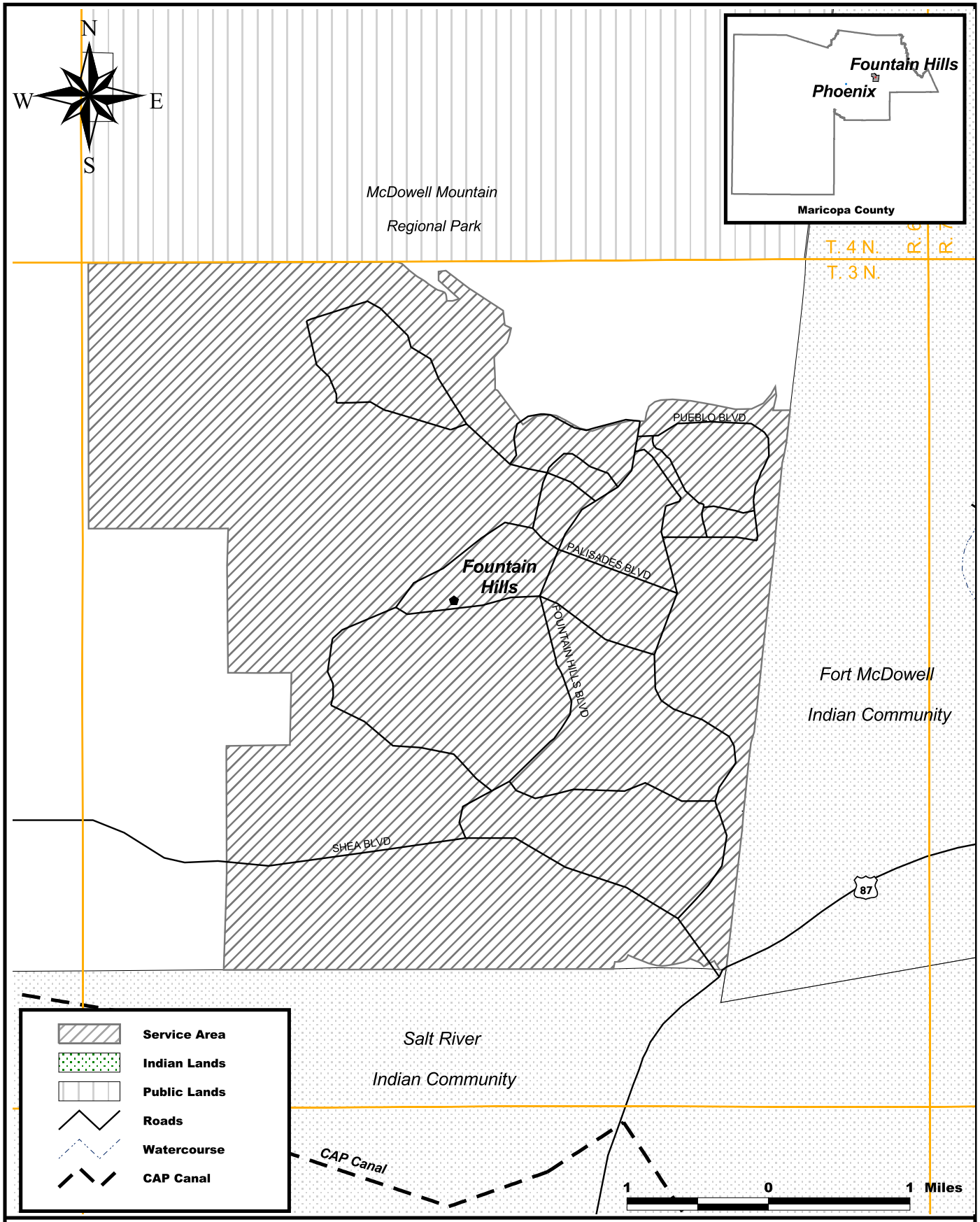
The Chaparral City Water Company service area currently has a subcontract for 6,978 af of water. Under the Settlement Alternative would receive an additional 1,931 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) and would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-27 outlines the proposed allocations by alternative.

Table L-M&I-27
CAP Allocation Draft EIS
Chaparral City Water Company – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	1,931	M&I
No Action	0	-
Non-Settlement Alternative 1	1,931	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	2,112	NIA
Existing CAP Allocation	6,978	-

Figure L-M&I-14 shows the service area for Chaparral City Water Company, which covers approximately 12,994 acres. CAP water can be delivered anywhere within the designated service area.

The Chaparral City Water Company currently has a turnout on the CAP system at 124th Street and Shea Boulevard. The water is processed at their treatment plant at Shea and Fountain Hills Boulevards. The existing system has capacity to treat and deliver their existing and additional CAP allocations (Laak 2000).



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June 2000

CAP Allocation Draft EIS
General Location Map
Chaparral City Water Company

Figure #L-M&I--14

B. Population Projection

The 1985 population of the Chaparral City Water Company service area was 9,000. The estimated 2001 population level is 22,138, and the estimated 2051 population level is 55,096.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the Chaparral City Water Company service area would increase from 6,687 af in year 2001 to 16,641 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-28. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 29 percent and 12 percent of the current estimated water supply required for the Chaparral City Water Company service area for the years 2001 and 2051, respectively.

Table L-M&I-28
CAP Allocation Draft EIS
Chaparral City Water Company – Projected Water Use

Alternative	Total CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	6,141	8,909	546	546	0	1,686	0	5,500	6,687	16,641
No Action	6,141	6,987	546	546	0	1,686	0	7,431	6,687	16,641
Non-Settlement Alternative 1	6,141	8,909	546	546	0	1,686	0	5,500	6,687	16,641
Non-Settlement Alternative 2	6,141	6,987	546	546	0	1,686	0	7,431	6,687	16,641
Non-Settlement Alternative 3A	6,141	6,987	546	546	0	1,686	0	7,431	6,687	16,641
Non-Settlement Alternative 3B	6,141	8,909	546	546	0	1,686	0	5,500	6,687	16,641

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 16,641 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 1,931 afa of demand are met by the additional CAP allocation. Alternatively, this 1,931 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the Chaparral City Water Company were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-29 provides the projected acres of land within the Chaparral City Water Company service area which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-29
CAP Allocation Draft EIS Appendix L
Chaparral City Water Company – Projected Land Use Changes
Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	0	-	5,643	-	7,351	-
	2051	0	0	0	5,643	12,994	5,643
No Action	2001	0	-	5,643	-	7,351	-
	2051	0	0	0	5,643	12,994	5,643
Non-Settlement Alternative 1	2001	0	-	5,643	-	7,351	-
	2051	0	0	0	5,643	12,994	5,643
Non-Settlement Alternative 2	2001	0	-	5,643	-	7,351	-
	2051	0	0	0	5,643	12,994	5,643
Non-Settlement Alternative 3A	2001	0	-	5,643	-	7,351	-
	2051	0	0	0	5,643	12,994	5,643
Non-Settlement Alternative 3B	2001	0	-	5,643	-	7,351	-
	2051	0	0	0	5,643	12,994	5,643

2. Archaeological Resources

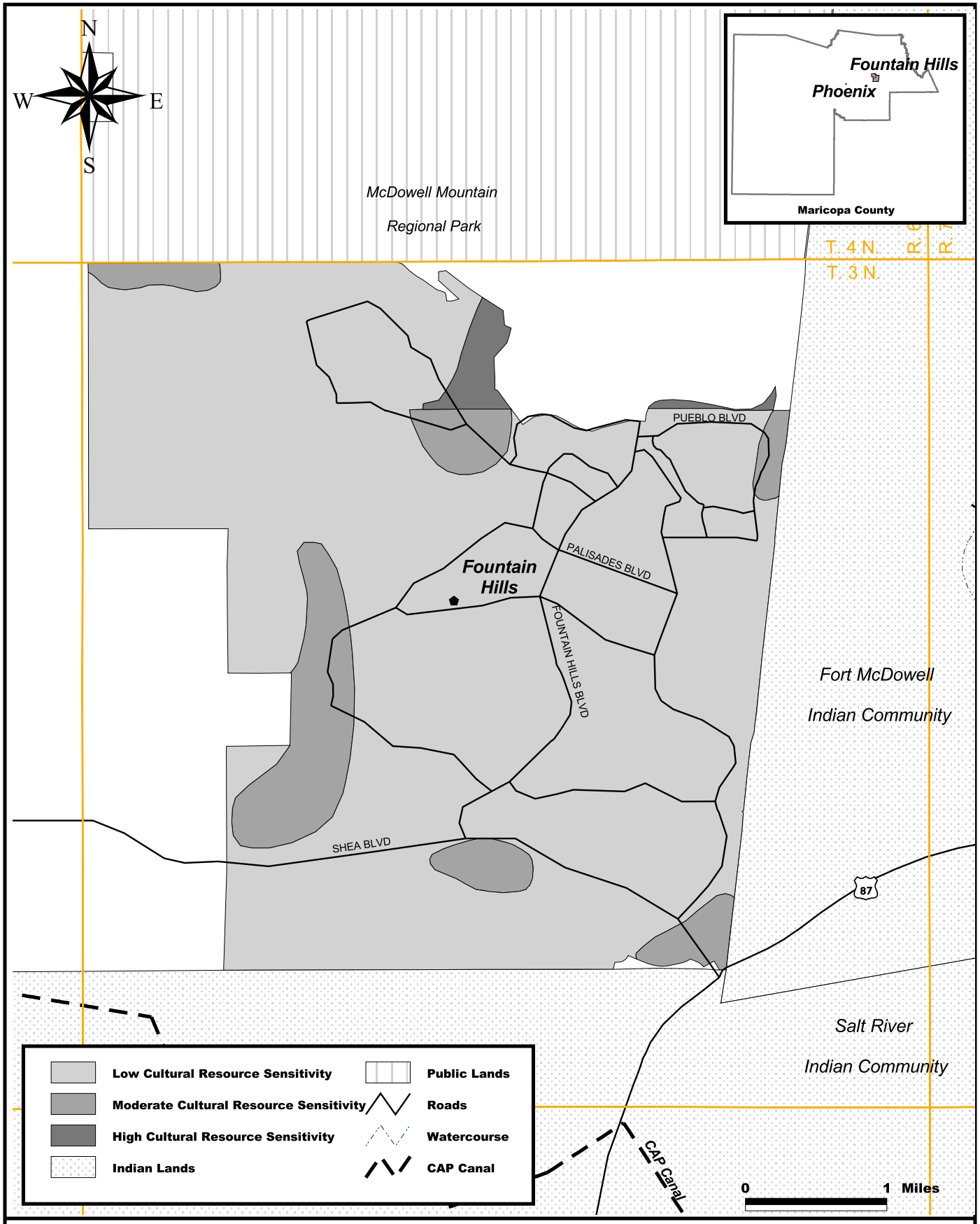
Approximately one-third of the Chaparral City Water Company service area has been surveyed. Surveyed areas range from small (<40 acres) to large (>640 acres) noncontiguous blocks, principally for urban development projects, and linear surveys, primarily for road and utility rights-of-way. Sites ranging from Archaic lithic scatters to Hohokam villages have been documented in the Chaparral service area's high and moderate cultural sensitivity areas. Other prehistoric site types known to occur within the service area include resource procurement loci (e.g., AZ U:5:177(Arizona State Museum [ASM])), cleared circles, rock alignments, canals, and small habitation sites. The entity's proximity to the Salt River Pima-Maricopa Indian Community (SRPMIC) on the south and the Fort McDowell Indian Community (FMIC) on the north suggests protohistoric sites might be present. Known historic site types include settlements (e.g., Maryville), homesteads, roads (e.g., Phoenix to McDowell Road), isolated graves, trash dumps, and water-control features. Sites related to mining and ranching also could be present. A Mormon settlement is known to have been located to the west of the service area boundaries; related deposits, possibly including traditional cultural places, might be expected near the southwest portion of the service area.

Cultural resource sensitivity areas in the service area are shown on Figure L-M&I-15. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Chaparral service area is low to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions, and development of applicable permit requirements (such as the CWA Section 404 permit). Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. There would be no cultural resource impacts from construction of CAP water delivery facilities, since no new facilities would be required.

3. Biological Resources

Existing Habitat

The Chaparral City Water Company service area occurs within the eastern portion of the McDowell Mountains up to an elevation of approximately 3,000 feet. The area is composed mainly of a complex of long ridges. Bursage/Foothill Paloverde Association is the only natural habitat recorded where co-dominants include creosote-bush, barrel cactus, little-leaf krameria, and staghorn cholla. Other common trees include velvet mesquite, desert ironwood, and saguaro. Saguaro density is high. The habitat zones located in the service area are shown on Figure L-M&I-16. Table L-M&I-30 provides the habitat acreages in the service area for the habitat zones described above.



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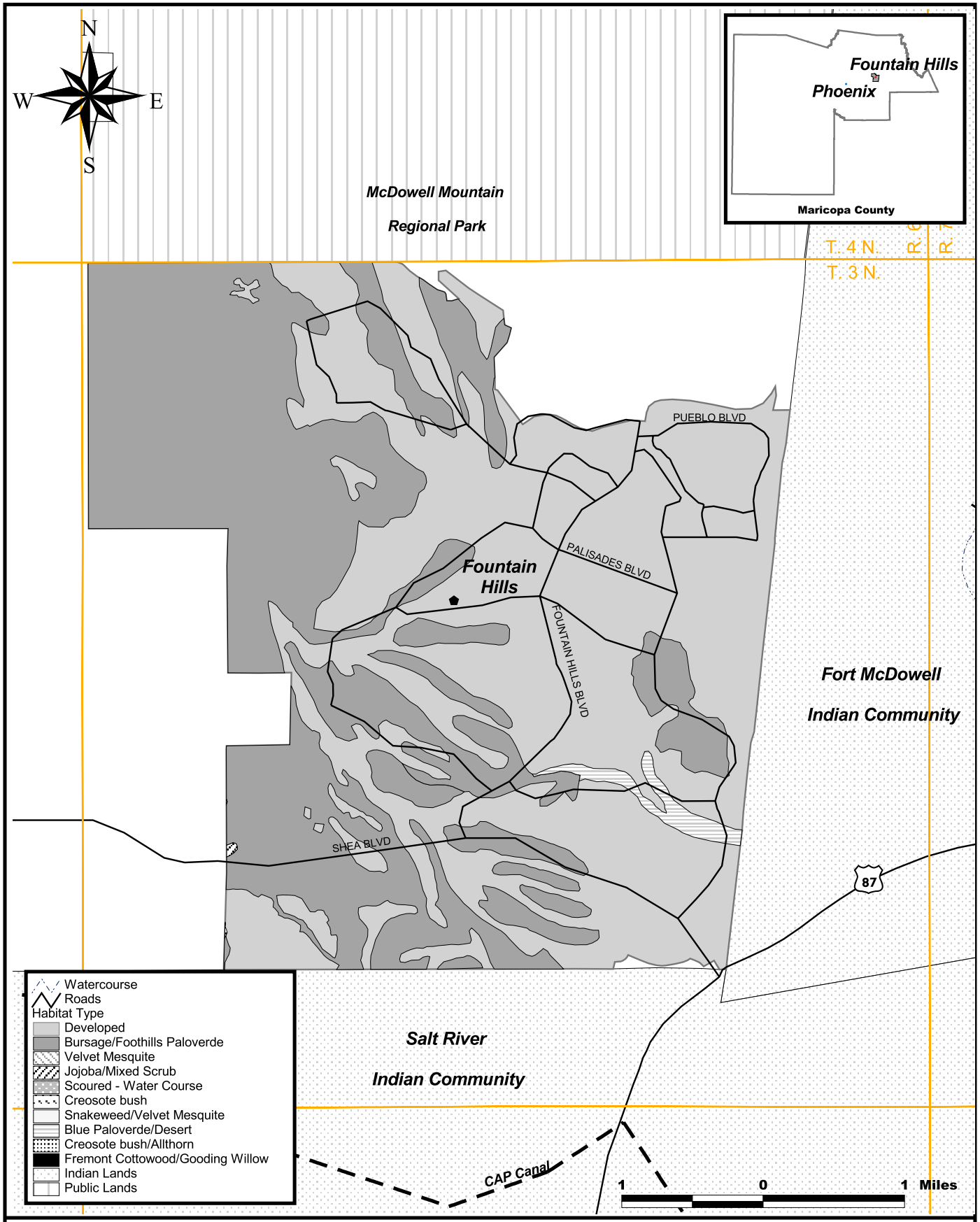
CAP Allocation Draft EIS
Cultural Resources
Chaparral City Water Company

Figure #L-M&I--15



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June 2000

CAP Allocation Draft EIS
Habitat Zones
Chaparral City Water Company

Figure No. L-M&I-16

Table L-M&I-30
CAP Allocation Draft EIS
Chaparral City Water Company– Habitat Acreages

Vegetation Name	Acres
Developed	7,351
Bursage / Foothills Paloverde	5,516
Jojoba / Mixed Scrub	4
Blue Paloverde / Desert	123
Total	**12,994**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Chaparral City Water Company service area over the 50-year study period would result in the loss of an estimated 5,643 acres of Sonoran Desertscrub and associated wildlife resources. There may be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. Under the action alternatives, there is no difference in impacts from the No Action baseline. No new CAP water delivery facilities are required, so no additional construction–related impacts to biological resources would occur.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The appropriate municipal or local governmental jurisdiction would be responsible for complying with the relevant provisions of the ESA, as it permits and approves future urban growth.

The Chaparral City Water Company service area is located within Maricopa County for which there are 14 T&E species listed by the USFWS. However, potential habitat only exists for cactus ferruginous pygmy-owl. Approximately 5,639 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the service area.

4. Water Resources

Demands in the Chaparral City Water Company have historically been met by pumping groundwater from the underlying basin fill. In more recent years, CAP water has been used to meet a portion of the demands. While groundwater has been used to meet demands, there have not been substantial drops in groundwater levels historically in this area. The concentration of TDS in the underlying groundwater is generally from about 300 to 850 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-31, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative, relative to the change for the No Action Alternative.

Under the No Action Alternative, groundwater levels would decline by about 48 feet from 2001 to 2051. While CAP water available to the Chaparral City Water Company would be used to meet demands and offset groundwater pumping, increased demands over time would be met through increased groundwater pumping. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence in this area. Non-Settlement Alternatives 2 and 3A would have the same amount of CAP water available as the No Action Alternative, and therefore would have the same changes in groundwater levels, groundwater quality, and subsidence.

Groundwater levels under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B would decline by about 27 feet over the 2001 to 2051 period. This smaller decline relative to the No Action Alternative reflects that additional CAP water would be available under these alternatives, resulting in a corresponding reduction in groundwater pumping. Substantial changes in groundwater quality would not be anticipated for these alternatives. Also, subsidence would not be anticipated.

Table L-M&I-31
CAP Allocation Draft EIS
Chaparral City Water Company –Groundwater Data Table

Alternative	**Chaparral***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-48	--
Settlement Alternative	-27	20
Non-Settlement Alternative 1	-27	20
Non-Settlement Alternative 2	-48	0
Non-Settlement Alternative 3A	-48	0
Non-Settlement Alternative 3B	-27	20

***Values correspond to analysis of Chaparral area of Fountain Hills sub-basin, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence,

alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of Chaparral City Water Company's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 11.6 percent of the total year 2051 demand for Chaparral City Water Company.

Table L-M&I-32
CAP Allocation Draft EIS
Chaparral City Water Company –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	289 – 293[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	289 – 293[b]	CAGRD
Non-Settlement Alternative 3A	289 – 293[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

4. City of Chandler

The City of Chandler is located in Maricopa County approximately 20 miles southeast of downtown Phoenix. It is bordered on the south by the Gila River Indian Community (GRIC). Once a quiet farm town centered around a tree-lined plaza, the City of Chandler has become one of the fastest growing cities in the nation. In recent years, the City of Chandler has experienced a successful diversification process. Its agricultural base of cotton and dairy products is still important, but the city is now a center for high-tech industry. More than 75 percent of Chandler's manufacturing employees are in high-tech fields compared to the national average of 15 percent. The City of Chandler MPA is located north of Hunt Highway, west of Lindsay Road, east of Price Road and 56th Street, and south of Pecos Road.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Chandler area in 1998, a total of 41,406 af of water were produced. Of that total, 704 af were from pumped groundwater, and the remaining 40,702 af were received from other rights including 36,828 af from surface water and 3,874 af from CAP. From the 41,406 af of water produced, 598 af of water were delivered to other users, leaving a balance of 40,808 af that were delivered for use.

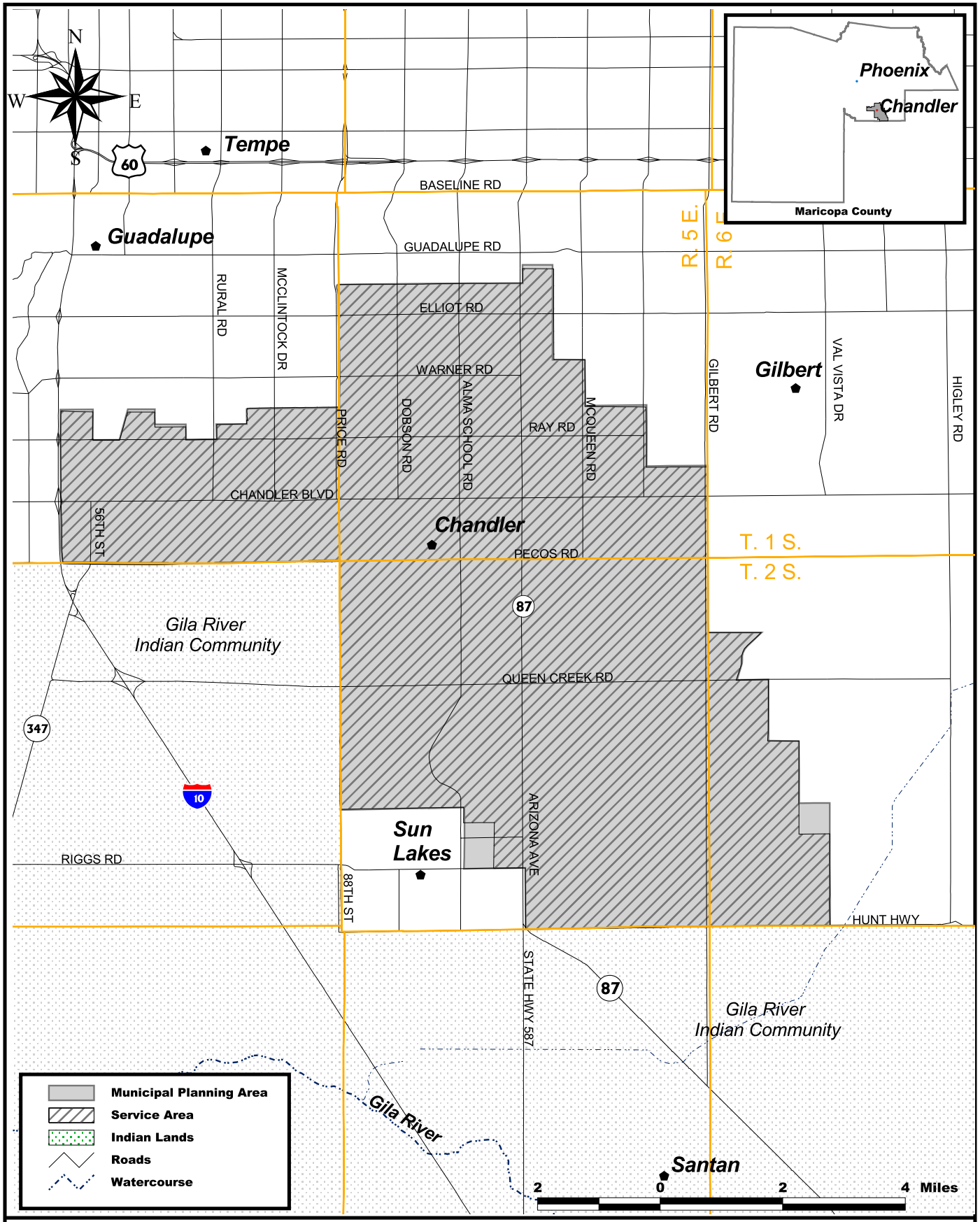
A. Plans to Take and Use CAP Water

The City of Chandler currently has a subcontract for 3,668 afa. Under the Settlement Alternative, the City of Chandler would receive an additional 4,986 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-21 outlines the proposed allocations by alternative.

Table L-M&I-21
CAP Allocation Draft EIS
City of Chandler – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	4,986	M&I
No Action	0	-
Non-Settlement Alternative 1	4,986	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	5,454	NIA
Existing CAP Allocation	3,668	

Figure L-M&I-11 shows both the service area and MPA for the City of Chandler. The service area covers approximately 44,596 acres and the MPA is estimated at 45,021 acres.



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June 2000

CAP Allocation Draft EIS
General Location Map
City of Chandler

Figure #L-M&I-11

The Chandler Water Treatment Plant (CWTP) treats CAP water and has a current capacity of 45 million gallons per day (mgd) with a build-out capacity of 90 mgd. The CWTP is located on Pecos Road just east of McQueen Road in the City of Chandler. Chandler also has a contract with the City of Mesa to use 3.27 mgd or 3,669 afa of treatment capacity at Mesa's Brown Road Water Treatment Plant. No new delivery facilities would be required for the City of Chandler to take and use the additional CAP allocation (Barfoot 2000).

The City of Chandler is entitled to 20 percent of Granite Reef's Underground Storage Project's (GRUSP's) capacity. Additionally, they have water storage permits for 13,158 afa and 20,000 afa with the Roosevelt Water Conservation District (RWCD) and Salt River Project (SRP) groundwater savings facilities, respectively.

B. Population Projection

The 1985 population for the City of Chandler was 5,020. The estimated 2001 population level for the City of Chandler MPA is 169,395, and the estimated 2051 population level is 322,164.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses; it is estimated that water demand in the City of Chandler would increase from 43,915 af in year 2001 to 75,483 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-22. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 11 percent and seven percent of the current estimated water supply required for the City of Chandler for the years 2001 and 2051, respectively.

Table L-M&I-22
CAP Allocation Draft EIS
City of Chandler – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		Other Surface Water		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	998	20,484	6,136	6,136	0	0	36,781	48,863	43,915	75,483
No Action	998	9,641	6,136	6,136	0	10,834	36,781	48,863	43,915	75,483
Non-Settlement Alternative 1	998	14,627	6,136	6,136	0	5,857	36,781	48,863	43,915	75,483
Non-Settlement Alternative 2	998	9,641	6,136	6,136	0	10,834	36,781	48,863	43,915	75,483
Non-Settlement Alternative 3A	998	9,641	6,136	6,136	0	10,834	36,781	48,863	43,915	75,483
Non-Settlement Alternative 3B	998	14,627	6,136	6,136	0	5,857	36,781	48,863	43,915	75,483

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 75,483 af. For all alternatives, there is estimated to be no unmet demand with or without the additional CAP allocation.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from the construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Chandler MPA in 1995 consisted of approximately 20,506 acres of agriculture, 19,212 acres of developed land, 893 acres of rural land, 3,757 acres of vacant land, and 653 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e., agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-23 provides the projected acres of land within the City of Chandler MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-23
CAP Allocation Draft EIS
City of Chandler – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	6,400	-	327	-	38,294	-
	2051	266	6,134	327	0	44,428	6,134
No Action	2001	6,400	-	327	-	38,294	-
	2051	266	6,134	327	0	44,428	6,134
Non-Settlement Alternative 1	2001	6,400	-	327	-	38,294	-
	2051	266	6,134	327	0	44,428	6,134
Non-Settlement Alternative 2	2001	6,400	-	327	-	38,294	-
	2051	266	6,134	327	0	44,428	6,134
Non-Settlement Alternative 3A	2001	6,400	-	327	-	38,294	-
	2051	266	6,134	327	0	44,428	6,134
Non-Settlement Alternative 3B	2001	6,400	-	327	-	38,294	-
	2051	266	6,134	327	0	44,428	6,134

2. Archaeological Resources

Most of the projects that have taken place within the City of Chandler MPA have been linear projects and related to construction of local roads and utilities (e.g., Woodall 1994). The majority of the western portion of the MPA was occupied prehistorically by the site complex known as Los Muertos, a series of Hohokam villages (e.g., Los Guanacos, Las Estufas) associated with an extensive irrigation system (Haury 1945; Howard and Huckleberry 1991; Midvale 1966; Turney 1929). Known and expected prehistoric resources in this area include artifact scatters, architectural features, canals, and burials. Protohistoric Pima and early historic Yaqui remains also are possible. Historic resources in this area include sites associated with agriculture, transportation, and the early Mexican settlement of Guadalupe (e.g., Corona Village). In the City of Chandler vicinity, known historic properties include the San Marcos Hotel, Chandler Park, and the Plaza Historic District. Water-control features significant to the development of modern irrigated agriculture (e.g., the Eastern, Consolidated, and Western Canals and laterals) also are present. Several historic roads (e.g., the wagon road from Sacaton to Tempe, ca. 1892) cross through the central portion of the MPA; however, because of the area's urban development, surface evidence of these features is unlikely. The City of Chandler does not have a historic preservation program.

Cultural resource sensitivity areas within the City of Chandler MPA are shown in Figure L-M&I-12. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the City of Chandler MPA is low to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions, and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. There would be no cultural resource impacts from construction of CAP water delivery facilities, since no new facilities would be required.

3. Biological Resources

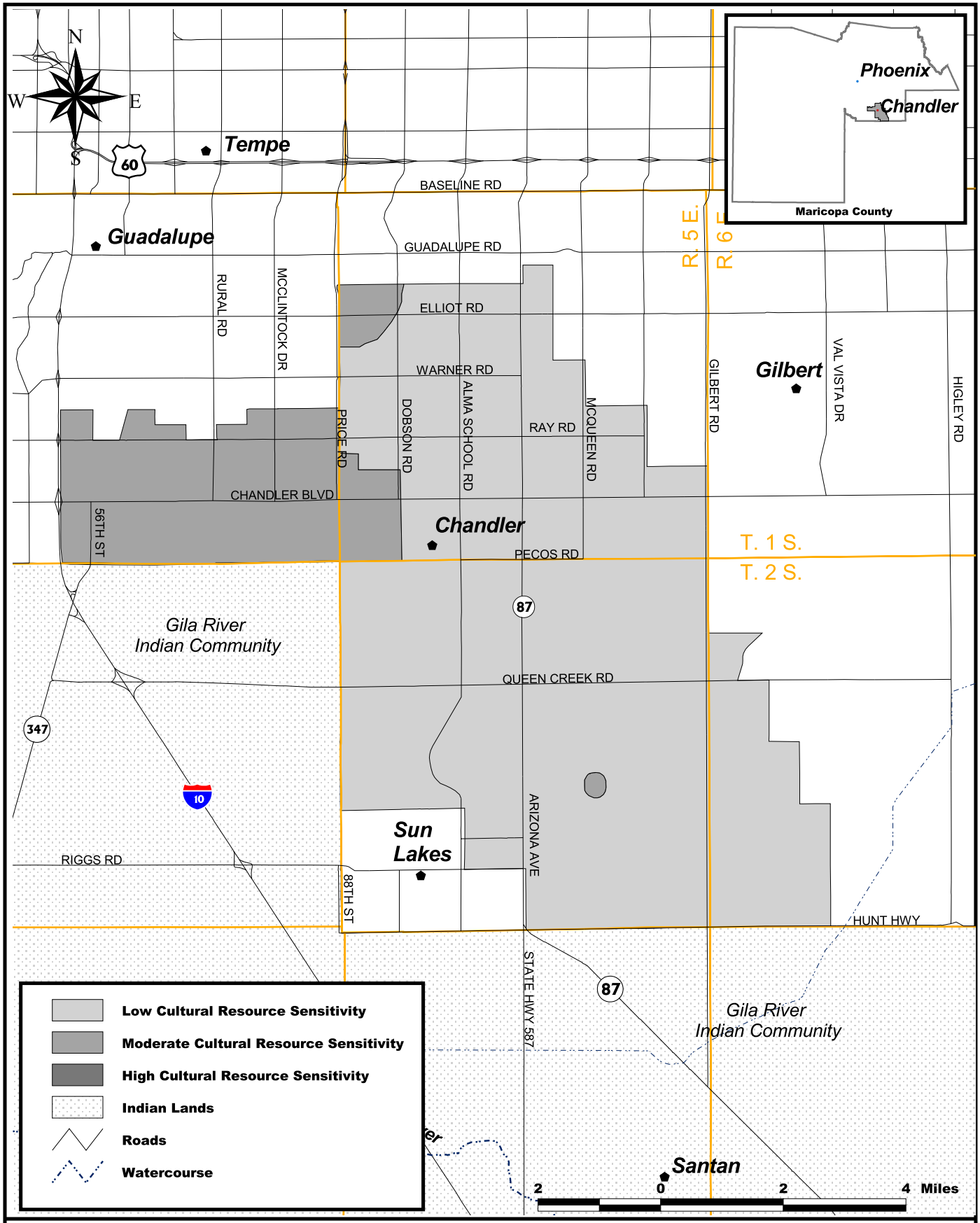
Existing Habitats

Little, if any, natural habitat remains within the City of Chandler MPA. Nearly all of the area has been developed for agriculture or urban use. Fallow fields in various stages of succession support small scrublands of velvet mesquite, desert-broom, four-wing saltbush, Frémont wolfberry, gray-thorn and creosote bush.

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Chandler MPA over the 50-year study period would result in no additional loss of natural habitat. However, an estimated 6,134 acres of farmland would be urbanized. This would result in the creation of fallow fields for some undetermined length of time. Fallow agricultural fields may be used by burrowing owls, a species protected under the Migratory Bird Treaty Act (MBTA). Individual developers who convert fallow lands for urban uses would be responsible for ensuring burrowing owls are removed prior to development. Failure to do so would be considered a violation of the MBTA. Under the action alternative, there is no difference in impacts from the No Action baseline. No new CAP water delivery facilities are required, so no additional construction-related impacts to biological resources would occur.

The habitat zones located in the City of Chandler service area are shown on Figure L-M&I-13. Table L-M&I-24 provides the habitat acreages in the City of Chandler MPA for the habitat zones described above.



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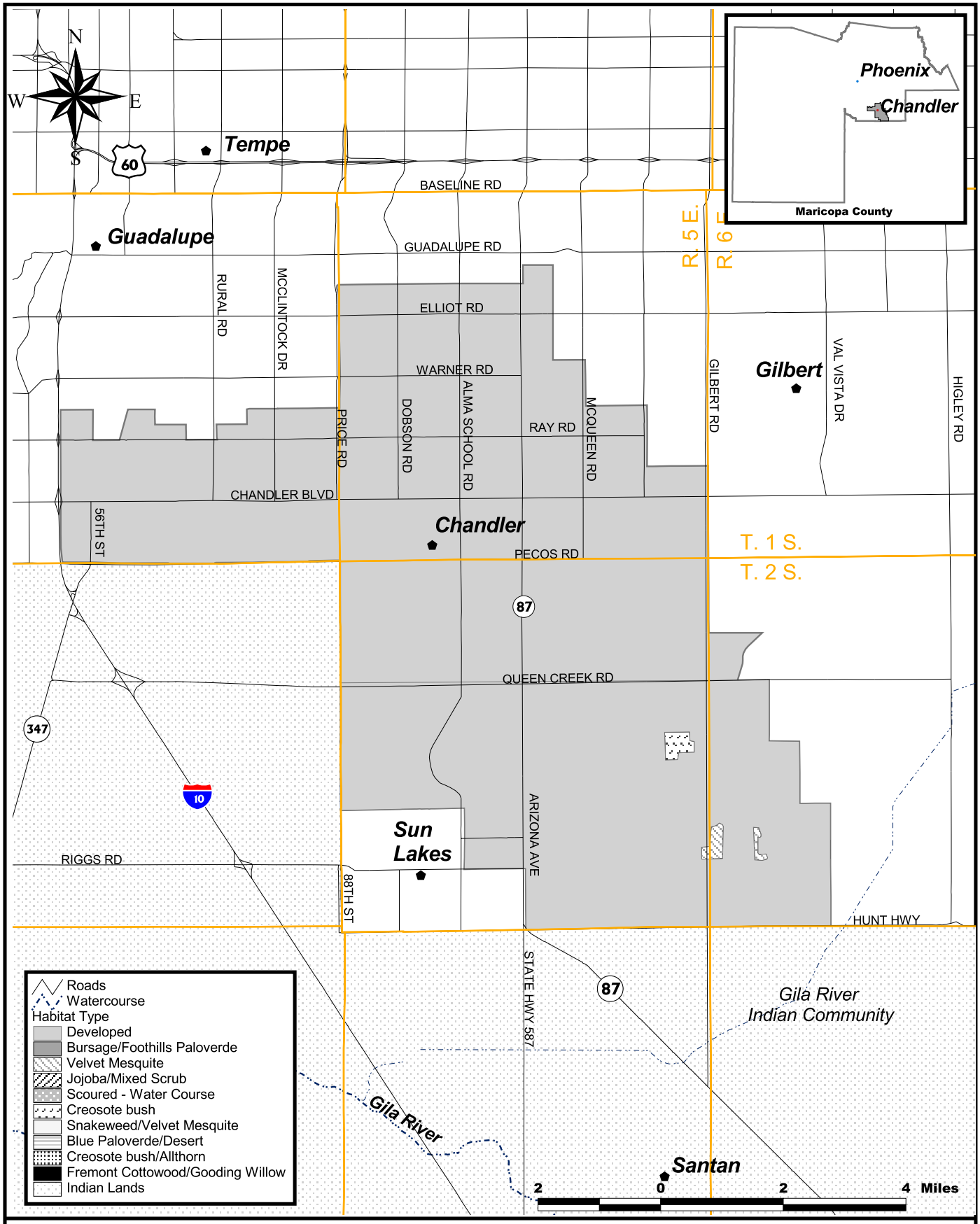
CAP Allocation Draft EIS
Cultural Resources
City of Chandler

Figure #L-M&I-12



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June 2000

CAP Allocation Draft EIS
Habitat Zones
City of Chandler

Figure No. L-M&I-13

TableL-M&I-24 CAP Allocation Draft EIS City of Chandler– Habitat Acreages	
Vegetation Name	**Acres**
Developed	44,694
Velvet Mesquite	215
Creosote Bush	112
Total	**45,021**

Potential T&E Species and Acres of Potential T&E Species Habitat
There is no potential suitable habitat for T&E species within the City of Chandler MPA.

4. Water Resources

Demands in the City of Chandler have historically been met with water provided by SRP and groundwater pumped from the underlying sedimentary rocks. Groundwater levels have declined in response to this pumping, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally from about 1,000 to 3,000 ppm..

Estimated groundwater level impacts are summarized in Table L-M&I-25, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Most of the City of Chandler falls within two groundwater sub-areas used for the analysis. Table L-M&I-25 shows groundwater conditions estimated for areas which include the northern and southern part of the City of Chandler (values for the northern part are presented first). Groundwater levels decline for all alternatives in both of these areas, with the larger declines for each alternative occurring in the southern part of Chandler.

Under the No Action Alternative, groundwater levels would decline by about 123 to 154 feet. These declines reflect, in part, continued reliance on groundwater to meet demands, both in the City of Chandler and in adjacent areas. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels.

Groundwater levels would also decline in the City of Chandler under the Settlement Alternative and all Non-Settlement Alternatives. The groundwater level impacts (changes from the No Action Alternative) appear to be most strongly influenced by changes in groundwater flows from adjacent areas, impacted by groundwater level changes beneath GRIC to the south and in the vicinity of GRUSP to the north. Also, for the Settlement Alternative, groundwater levels in Chandler also reflect additional CAP water obtained

from GRIC in exchange for effluent.

Substantial changes in groundwater quality would not be anticipated for any of the alternatives. There would be the potential for subsidence under all alternatives.

Table L-M&I-25
CAP Allocation Draft EIS
City of Chandler–Groundwater Data Table

Alternative		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-123 / -154	--
Settlement Alternative	-109 / -116	14 / 38
Non-Settlement Alternative 1	-116 / -136	7 / 18
Non-Settlement Alternative 2	-134 / -168	-11 / -14
Non-Settlement Alternative 3A	-147 / -178	-24 / -24
Non-Settlement Alternative 3B	-139 / -158	-16 / -4

*Values correspond to the Chandler North and Chandler South sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of the City of Chandler's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 6.6 percent of the total year 2051 demand for the City of Chandler.

Table L-M&I-26
CAP Allocation Draft EIS
City of Chandler–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a,b]	CAP Allocation
No Action	237[a]	Reclaimed Water
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	237[a]	Reclaimed Water
Non-Settlement Alternative 3A	237[a]	Reclaimed Water
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost expressed in year 2000 dollars.
b. Does not include monetary contribution to the GRIC Settlement.

7. City of El Mirage

The City of El Mirage is a residential community 16 miles northwest of Phoenix in Maricopa County. Although traditionally a farm community, currently El Mirage is developing its economic potential while maintaining a pleasant small town environment. Agriculture continues to employ many El Mirage residents, but considerable employment is also found in the construction and service sectors. The City of El Mirage MPA is located north of Northern Avenue, west of the Agua Fria River, east of Dysart Road, and south of Greenway Road.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of El Mirage in 1997, a total of 2534 af of groundwater were pumped and delivered. Of that total, 109 af has been delivered to other users; leaving 2425 af of water to be delivered to the City of El Mirage.

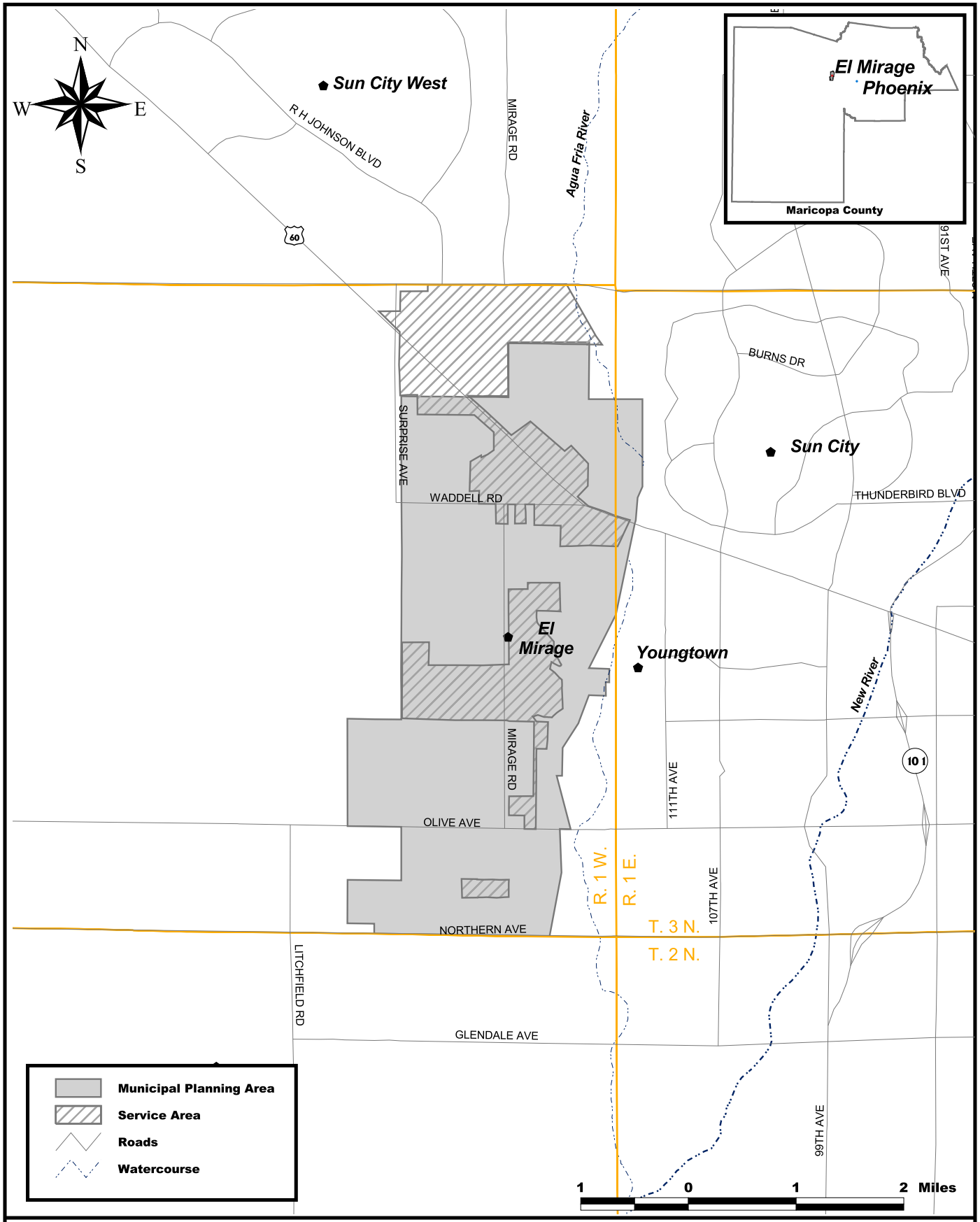
A. Plans to Take and Use CAP Water

The City of El Mirage currently has no subcontract for CAP water. Under the Settlement Alternative, El Mirage would receive 508 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-39 outlines the proposed allocations by alternative.

Table L-M&I-39
CAP Allocation Draft EIS
City of El Mirage – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	508	M&I
No Action	0	-
Non-Settlement Alternative 1	508	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	556	NIA
Existing CAP Allocation	-	-

Figure L-M&I-20 shows the service area and MPA for the City of El Mirage. The service area covers approximately 2,381 acres and the MPA covers approximately 6,556 acres. The City of El Mirage is considering wheeling its CAP water through the City of Peoria system. Specific plans and alignments are unknown at this time (Manna 2000).



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June 2000

CAP Allocation Draft EIS
General Location Map
City of El Mirage

Figure #L-M&I-20

B. Population Projection

The population in 1985 for the City of El Mirage area was 9,000. The estimated 2001 population level is 5,846, and the estimated 2051 population level is 24,026.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the City of El Mirage MPA would increase from 1,020 af in year 2001 to 4,003 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-40. Based on anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 50 percent and 13 percent of the current estimated water supply required for the City of El Mirage for the years 2001 and 2051, respectively.

Table L-M&I-40
CAP Allocation Draft EIS
City of El Mirage – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	508	460	460	560	560	0	2,475	1,020	4,003
No Action	0	0	460	460	560	560	0	2,983	1,020	4,003
Non-Settlement Alternative 1	0	508	460	460	560	560	0	2,475	1,020	4,003
Non-Settlement Alternative 2	0	0	460	460	560	560	0	2,983	1,020	4,003
Non-Settlement Alternative 3A	0	0	460	460	560	560	0	2,983	1,020	4,003
Non-Settlement Alternative 3B	0	508	460	460	560	560	0	2,475	1,020	4,003

It is estimated that the demand for water at the end of the CAP contract period would be approximately 4,003 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 508 afa of demand is met by the additional CAP allocation. Alternatively, this 508 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery

facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of El Mirage MPA in 1995 consisted of approximately 3,378 acres of agriculture, 1,076 acres of developed land, 1,460 acres of vacant land and 642 acres of water, including lake, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e. agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-41 provides the projected acres of land within the City of El Mirage MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

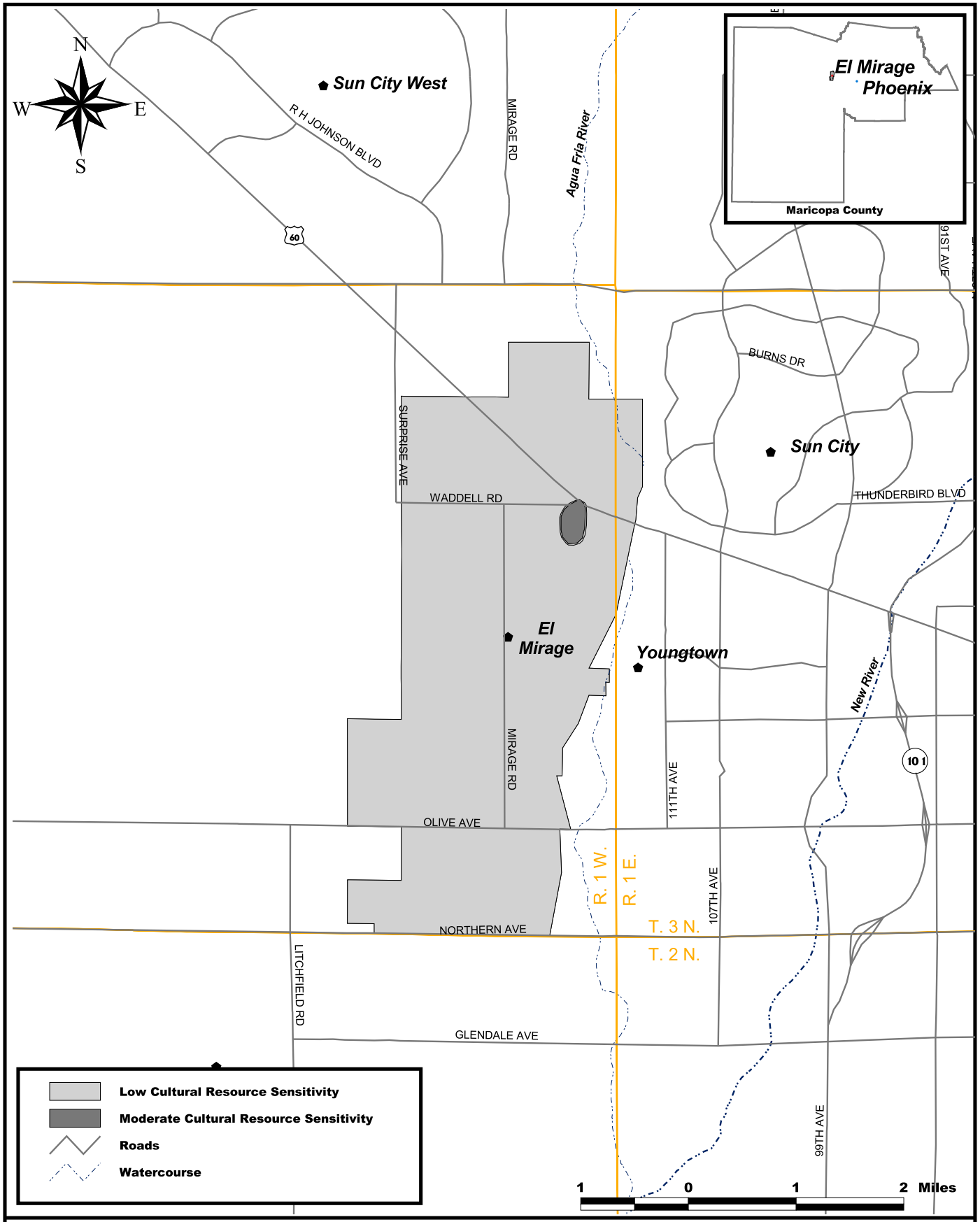
Table L-M&I-41
CAP Allocation Draft EIS
City of El Mirage– Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	2,800	--	0	--	3,756	-
	2051	1,515	1,285	0	0	5,041	1,285
No Action	2001	2,800	--	0	--	3,756	-
	2051	1,515	1,285	0	0	5,041	1,285
Non-Settlement Alternative 1	2001	2,800	--	0	--	3,756	-
	2051	1,515	1,285	0	0	5,041	1,285
Non-Settlement Alternative 2	2001	2,800	--	0	--	3,756	-
	2051	1,515	1,285	0	0	5,041	1,285
Non-Settlement Alternative 3A	2001	2,800	--	0	--	3,756	-
	2051	1,515	1,285	0	0	5,041	1,285
Non-Settlement Alternative 3B	2001	2,800	--	0	--	3,756	-
	2051	1,515	1,285	0	0	5,041	1,285

2. Archaeological Resources

Only a few surveys, mostly linear, have taken place within the City of El Mirage MPA. Two sites were identified northwest of Youngtown; no other cultural resources are known. However, prehistoric cultural deposits are likely in the Agua Fria River floodplain. Historic sites related to transportation, commerce, homesteading, agriculture, and ranching also might be expected.

Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-21. Based on the limited data used to generate the cultural sensitivity designations, the potential for



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Cultural Resources
City of El Mirage

Figure #L-M&I-21

cultural resource impacts in the City of El Mirage MPA is low. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Once El Mirage's plans for taking delivery of CAP water are finalized, Reclamation would carry out additional cultural resources compliance as appropriate, prior to water delivery.

3. Biological Resources

Existing Habitats

Almost no natural habitat remains within the City of El Mirage MPA (elevation approximately 1,200 feet). Some Blue Paloverde/Desert Ironwood Association habitat, dominated by burrobush, creosote-bush, brittle-bush, bursage, and foothill paloverde, occurs along the banks of the Agua Fria River. However, the Agua Fria River has been channelized and is no longer perennial. The habitat zones located in the El Mirage MPA are shown on Figure L-M&I-22. Table L-M&I-42 provides the habitat acreages in the City of El Mirage MPA for the habitat zones described above.

TableL-M&I-42
CAP Allocation Draft EIS
City of El Mirage – Habitat Acreages

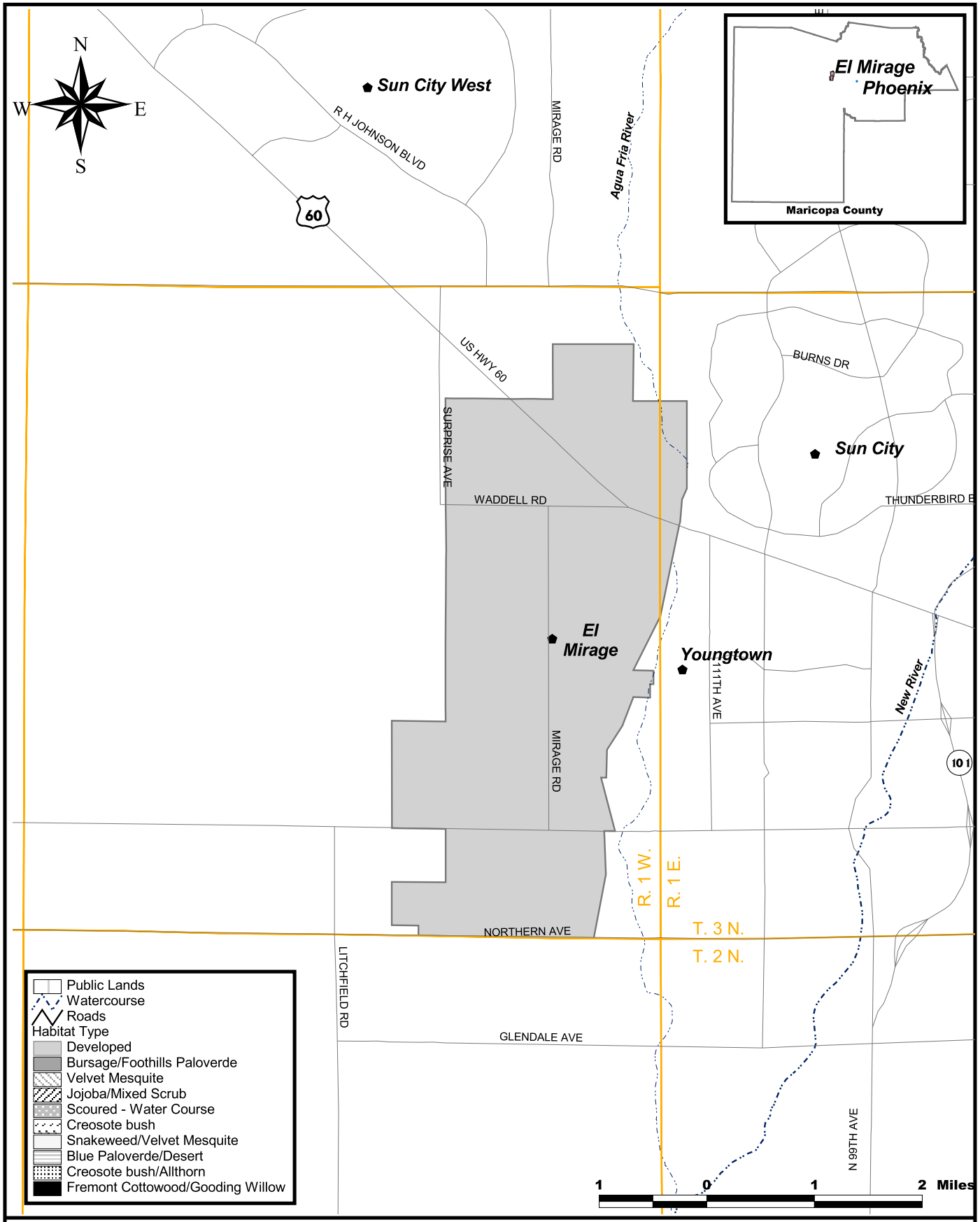
Vegetation Name	Acres
Developed	6,556
Scoured, Washes and Creekbeds	0
Total	**6,556**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of El Mirage MPA over the 50-year study period would result in no additional loss of natural habitat. However, approximately 1,285 acres of farmland would be urbanized. Any urbanization of the farmland would result in the creation of fallow fields for some undetermined length of time. Fallow agricultural fields in the area may be used by burrowing owls, a species protected under the MBTA. Individual developers who convert fallow lands for urban uses would be responsible for ensuring burrowing owls are removed prior to development. Failure to do so would be considered a violation of the MBTA. Under the action alternative, there is no difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities, Reclamation would carry out additional environmental review once plans are developed. At this time, significant impacts to biological resources are not anticipated, due to the probable use of the City of Peoria's system.

Potential T&E Species and Acres of Potential T&E Species Habitat

There is no potentially suitable habitat for T&E species within the City of El Mirage MPA.



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Habitat Zones
City of El Mirage

Figure No. L-M&I-22

4. Water Resources

Demands in the City of El Mirage have historically been met by pumping groundwater from the underlying basin fill. In more recent years, CAP water has been used to meet a portion of the demands. The City of El Mirage is in an area of relatively intensive groundwater development, and substantial declines in groundwater levels have been experienced that have formed the Luke Cone groundwater level depression. These declines have resulted in subsidence in this area. The concentration of TDS in the underlying groundwater is generally below 500 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-43, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative.

Under the No Action Alternative, groundwater levels would decline by about 136 feet from 2001 to 2051. This decline reflects the continued reliance on groundwater supplies in the vicinity of El Mirage. However, that decline is moderated by the influence of direct recharge of CAP water which would occur in the nearby Agua Fria Recharge Project and in future west-side recharge facilities. Increases in TDS concentrations could occur due to both the northward movement of poorer quality water from the south and due to lowering of groundwater levels in the vicinity of the Luke salt dome. The lower groundwater levels could also result in continued subsidence.

Groundwater levels under the Settlement and Non-Settlement Alternatives would also decline over the 2001 to 2051 period. These declines would be greater than the declines under the No Action Alternative, and could result in greater declines in groundwater quality and in additional subsidence relative to the No Action Alternative. The larger declines in groundwater levels primarily occur due to reduced direct recharge of CAP water under the Settlement and Non-Settlement Alternatives relative to the No Action Alternative.

Table L-M&I-43
CAP Allocation Draft EIS
City of El Mirage–Groundwater Data Table

Alternative	West-side M&I *	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	Groundwater Level Impact** (in Feet)
No Action	-136	--
Settlement Alternative	-198	-62
Non-Settlement Alternative 1	-147	-11
Non-Settlement Alternative 2	-157	-21
Non-Settlement Alternative 3A	-185	-49
Non-Settlement Alternative 3B	-172	-36

*Values correspond to the West-side sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of the City of El Mirage's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 12.7 percent of the total year 2051 demand for the City of El Mirage.

Table L-M&I-44
CAP Allocation Draft EIS
City of El Mirage –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water (per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	272 – 280[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	272 – 280[b]	CAGRD
Non-Settlement Alternative 3A	272 – 280[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

8. City of Glendale

The City of Glendale is located in the western part of the SRV, east of the White Tank Mountains and Agua Fria River. Glendale, which is located in Maricopa County, is Arizona's fourth largest city, and is the commercial, educational and industrial hub of the Phoenix area. Glendale has a dynamic market with fast and cost-efficient travel, which makes it a prime location for Arizona business. The City of Glendale enjoys a widely diversified economic base that includes manufacturing, service sector, aerospace, communications, precision metal working and casting, chemicals, electronics and warehousing industries. The Glendale MPA is located north of Camelback Road, west of 43rd Avenue, east of Perryville Road, and south of Northern Avenue and Pinnacle Peak Road.

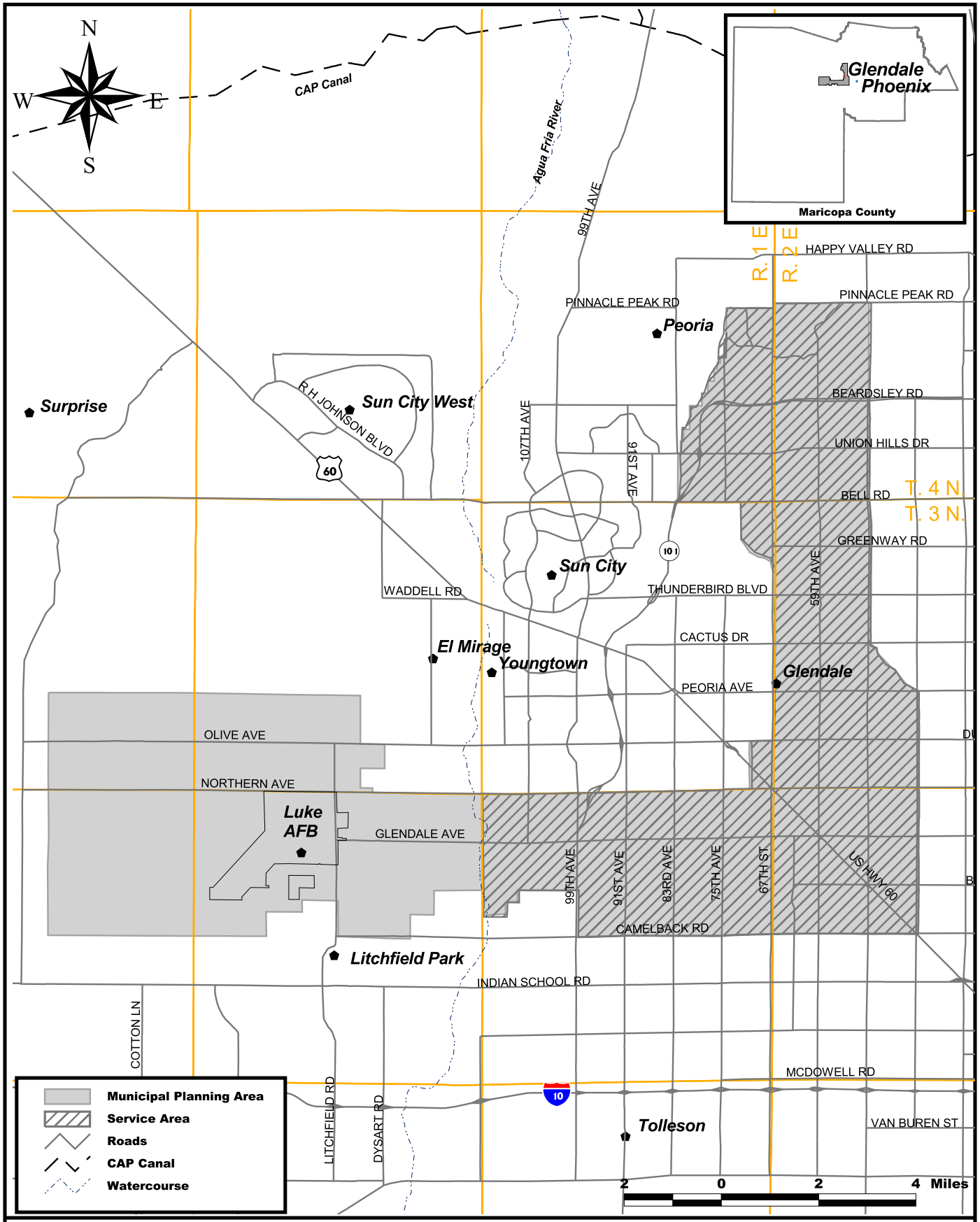
According to the ADWR Annual Water Withdrawal and Use Report, in the City of Glendale in 1998, a total of 41,372 af of water were produced and delivered. Of that total, 2,345 af were pumped from groundwater; 13,805 af were received from CAWCD (including 3682 af from the SRPMIC Settlement, i.e. 3,000 af from Wellton-Mohawk Irrigation and Drainage District (WMIDD) and 682 af from RWCD); and 25,223 af were surface water received from the SRP. Approximately 62 af of water were delivered to other users leaving 41,311 af of water to be used by the City of Glendale.

A. Plans to Take and Use CAP Water

The City of Glendale currently has a contract for 14,183 af of CAP water. The allocation includes a transfer of 100 af from the New River Utility Company. Under the Settlement Alternative, the City of Glendale would receive an additional 3,053 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-45 outlines the proposed allocations by alternative.

Table L-M&I-45
CAP Allocation Draft EIS
City of Glendale – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	3,053	M&I
No Action	0	-
Non-Settlement Alternative 1	3,053	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	3,340	NIA
Existing CAP Allocation	14,183	-



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
General Location Map
City of Glendale

Figure #L-M&I-23

Figure L-M&I-23 show both the service area and MPA for the City of Glendale. The service area covers approximately 34,893 acres, and the MPA is approximately 58,949 acres. The City of Glendale has three water treatment plants. The Pyramid Peak Water Treatment Plant currently treats CAP water and has a capacity of 16,800 afa. The Cholla Water Treatment Plant treats SRP water and has a capacity of 33,600 afa. CAP water could be wheeled through the SRP system to this water treatment plant. Long-term plans to expand the facilities include adding 12,300 afa of capacity to the Pyramid Peak Plant and adding 13,400 afa of capacity to the Cholla Plant. Once these additional expansions are completed, no additional facilities would be required for taking and treating the additional CAP allocation (Kukino 2000).

B. Population Projection

The population in 1985 for the City of Glendale was 23,895. The estimated 2001 population level is 216,843 and the estimated 2051 population level is 341,189.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the City of Glendale would increase from 44,182 af in year 2001 to 69,518 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-46. Based on anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide seven percent and four percent of the current estimated water supply required for the City of Glendale for the years 2001 and 2051, respectively.

Table L-M&I-46
CAP Allocation Draft EIS
City of Glendale – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		Other Surface Water*		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	7,138	16,626	5,545	5,545	0	278	31,498	47,069	44,182	69,518
No Action	7,138	15,997	5,545	5,545	0	906	31,498	47,069	44,182	69,518
Non-Settlement Alternative 1	7,138	16,626	5,545	5,545	0	278	31,498	47,069	44,182	69,518
Non-Settlement Alternative 2	7,138	15,997	5,545	5,545	0	906	31,498	47,069	44,182	69,518
Non-Settlement Alternative 3A	7,138	15,997	5,545	5,545	0	906	31,498	47,069	44,182	69,518
Non-Settlement Alternative 3B	7,138	16,626	5,545	5,545	0	278	31,498	47,069	44,182	69,518

* SRP and other ID water
Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 69,519 af. For all alternatives, there is estimated to be no unmet demand with or without the CAP allocation.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from the construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Glendale MPA in 1995 consisted of approximately 19,532 acres of agriculture, 25,702 acres of developed land, 3,332 acres of rural land, 9,524 acres of vacant land and 859 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e. agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-47 provides the projected acres of land within the City of Glendale MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

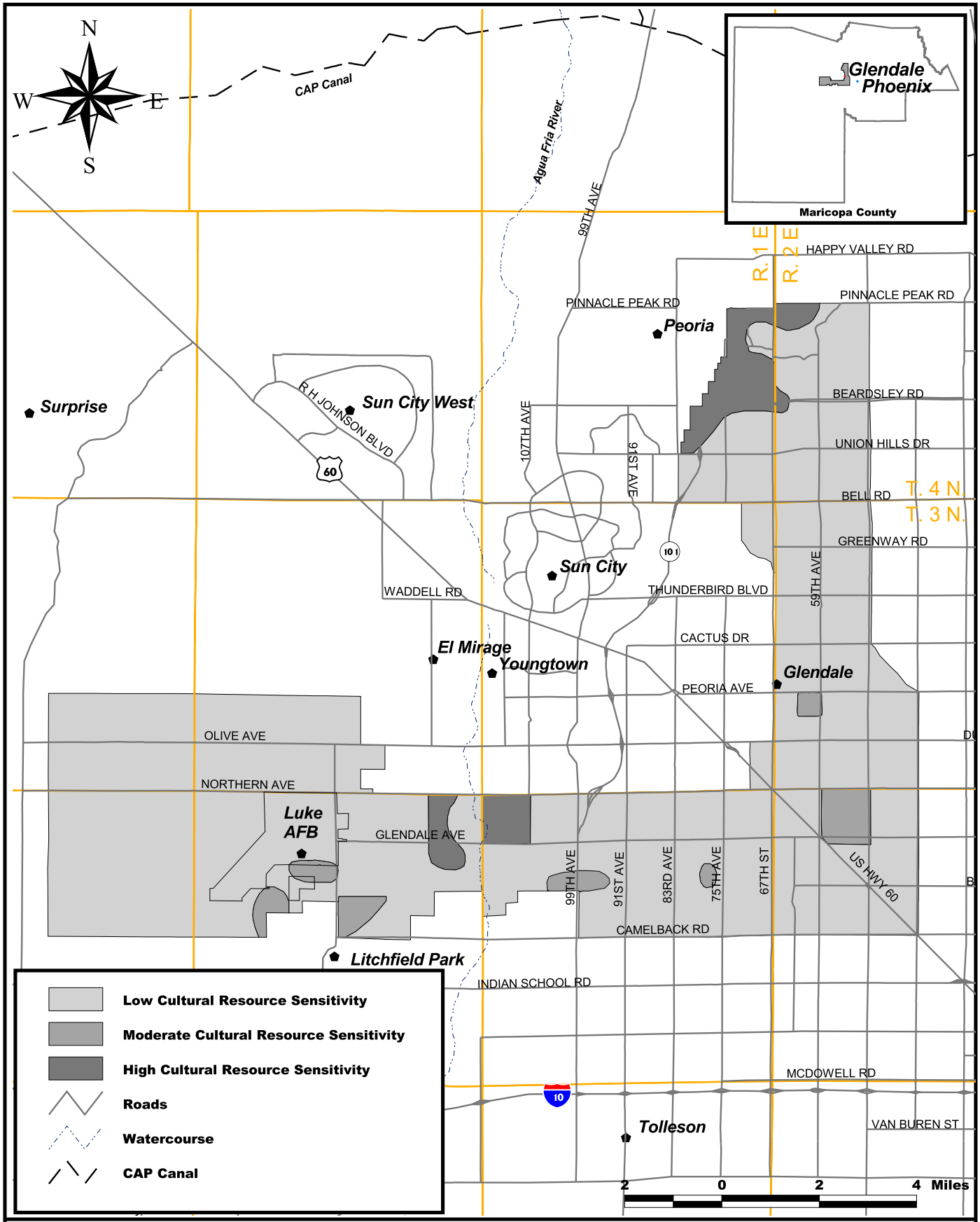
Table L-M&I-47
CAP Allocation Draft EIS Appendix L
City of Glendale – Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	11,520	--	4,632	--	42,797	--
	2051	1,879	9,641	4,632	0	52,438	9,641
No Action	2001	11,520	--	4,632	--	42,797	--
	2051	1,879	9,641	4,632	0	52,438	9,641
Non-Settlement Alternative 1	2001	11,520	--	4,632	--	42,797	--
	2051	1,879	9,641	4,632	0	52,438	9,641
Non-Settlement Alternative 2	2001	11,520	--	4,632	--	42,797	--
	2051	1,879	9,641	4,632	0	52,438	9,641
Non-Settlement Alternative 3A	2001	11,520	--	4,632	--	42,797	--
	2051	1,879	9,641	4,632	0	52,438	9,641
Non-Settlement Alternative 3B	2001	11,520	--	4,632	--	42,797	--
	2051	1,879	9,641	4,632	0	52,438	9,641

2. Archaeological Resources

Most of the surveys that have occurred within the City of Glendale MPA have been linear; very few moderate-sized (<640 acres) block surveys have taken place. Only one survey is recorded for the southwestern portion of the MPA; although this area is currently being used for agriculture, intact subsurface remains are still possible, as suggested by the areas of moderate cultural resource sensitivity that have been identified in the vicinity (e.g., AZ T:7:68(ASM)). In the northeast portion of the City of Glendale MPA is an area of high cultural resource sensitivity; numerous prehistoric sites ranging from Archaic lithic scatters to Classic period Hohokam settlements have been documented here, and might be expected to occur in the surrounding areas. The Glendale Townsite/Catlin Court Historic District has been listed on the National Register since 1992 (Graham, Kupel, and Keeling 1997). Other historic resources include roads, commercial and residential structures, farmsteads, and water control features (e.g., the Airline Canal). The City of Glendale has a Historic Preservation Commission.

Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-24. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the City of Glendale MPA is low to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Cultural Resources
City of Glendale

Figure #L-M&I-24

on the requirements of the local jurisdiction. No new delivery facilities would be required for the additional CAP allocation, although future expansions of existing wastewater treatment plants are planned. Reclamation would determine the need for additional cultural resources compliance prior to water deliveries.

3. Biological Resources

Existing Habitats

Little natural habitat remains within the City of Glendale MPA (elevation approximately 1,200 feet). Most of the area has been developed for agriculture or urbanized. Some Creosote-bush Association remains where trees are sparse and saguaro density is low. Small patches of Blue Paloverde/Desert Ironwood Association and Velvet Mesquite Associations occur along drainages and areas where runoff collects. The habitat zones located in the service area are shown on Figure L-M&I-25. Table L-M&I-48 provides the habitat acreages for the habitat zones described above.

TableL-M&I-48
CAP Allocation Draft EIS
City of Glendale– Habitat Acreages

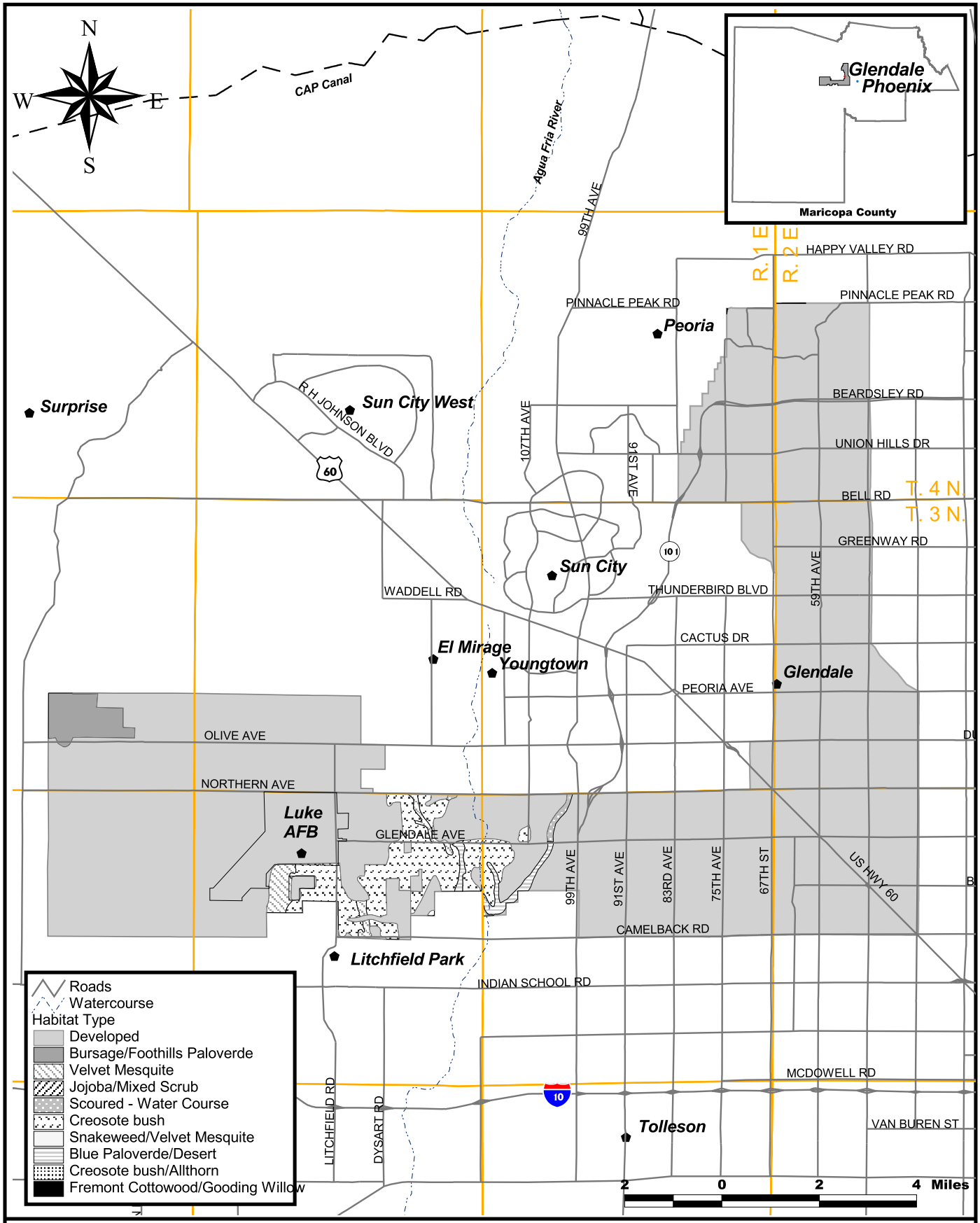
Vegetation Name	Acres
Developed	54,317
Bursage/Foothills Paloverde	860
Velvet Mesquite	465
Scoured, Washes and Creekbeds	104
Creosote-Bush	2,898
Blue Paloverde/Desert	305
Total	**58,949**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Glendale MPA over the 50-year study period would result in additional loss of natural habitat. However, an estimated 9,641 acres of farmland would be urbanized. This urbanization of the farmland would result in the creation of fallow fields for some undetermined length of time. Fallow agricultural fields in the area may be used by burrowing owls, a species protected under the MBTA. Individual developers who convert fallow lands for urban uses would be responsible for ensuring burrowing owls are removed prior to development. Failure to do so would be considered a violation of the MBTA. Under the action alternatives, there is no difference in impacts from the No Action baseline. No new CAP delivery facilities would be required for the additional allocation. No significant impacts from wastewater treatment plant expansions are anticipated based on the small acreage required.

Potential T&E Species and Acres of Potential T&E Species Habitat

There is no potential suitable habitat for T&E species within the City of Glendale MPA.



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BUREAU OF RECLAMATION

CAP Allocation Draft EIS
Habitat Zones
City of Glendale

June 2000

Figure No. L-M&I-25

4. Water Resources

Demands in the City of Glendale have historically been met by pumping groundwater from the underlying basin fill and with SRP water. In more recent years, CAP water has been used to meet a portion of the demands. The City of Glendale is in an area of relatively intensive groundwater development, and substantial declines in groundwater levels have been experienced. These declines have resulted in subsidence in this area. The concentration of TDS in the underlying groundwater can be as much as about 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-49, which shows the estimated groundwater level change for the period from 2001 to 2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. The City of Glendale falls within three groundwater sub-areas used for the analysis. Table L-M&I-25 shows estimated groundwater conditions in the city from east to west. In general, groundwater level changes for the three areas considered are similar.

Groundwater levels would decline during the 2001 to 2051 period under the No Action Alternative, with the declines increasing from about 35 feet in the eastern part of the City of Glendale to about 150 feet in the western part. These declines reflect the continued reliance on groundwater to meet demands, both in the City of Glendale and in adjacent areas. The declines have been moderated by the impact of direct recharge of CAP water in the Agua Fria recharge facilities and in future west-side recharge facilities. Increases in TDS concentrations could occur due to both the northward movement of poorer quality water from the south and due to lowering of groundwater levels in the vicinity of the Luke salt dome. The lower groundwater levels could also result in continued subsidence, particularly in the more westerly parts of the City of Glendale.

Groundwater levels under the Settlement and all Non-Settlement Alternatives would also decline over the 2001 to 2051 period. These declines would generally be greater than the declines under the No Action Alternative and could result in additional subsidence relative to the No Action Alternative. The larger declines in groundwater levels are primarily a result of reduced direct recharge of CAP water in the Agua Fria River and future west side recharge facilities under the Settlement and Non-Settlement Alternatives relative to the No Action Alternative.

Table L-M&I-49 CAP Allocation Draft EIS City of Glendale–Groundwater Data Table		
Alternatives		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-35 / -136 / -150	--
Settlement Alternative	-78 / -198 / -231	-43 / -62 / -80
Non-Settlement Alternative 1	-34 / -147 / -160	1 / -11 / -10
Non-Settlement Alternative 2	-44 / -157 / -172	-9 / -21 / -21
Non-Settlement Alternative 3A	-68 / -185 / -207	-33 / -49 / -57
Non-Settlement Alternative 3B	-65 / -172 / -202	-30 / -36 / -51

*Values correspond to the Glendale / Peoria, West-side M&I, and MWD sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimate, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and if needed, treating and reusing effluent. The difference in cost for this small increment of the City of Glendale's total water supply if considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 4.4 percent of the total year 2051 demand for the City of Glendale.

Table L-M&I-50
CAP Allocation Draft EIS
City of Glendale –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water (per af)	Water Source
Settlement Alternative	154[a,b]	CAP Allocation
No Action	237[a]	Reclaimed Water
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	237[a]	Reclaimed Water
Non-Settlement Alternative 3A	237[a]	Reclaimed Water
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost expressed in year 2000 dollars.
b. Does not include monetary contribution to the GRIC Settlement.

9. City of Goodyear

The City of Goodyear is a suburban community located near the City of Phoenix in the Southwest Valley. The City of Goodyear is located in the SRV, west of Phoenix, north of the Gila and Salt Rivers and southeast of the White Tank Mountains. The City of Goodyear MPA is located north of Rainbow Valley, west of Litchfield Road, east of Perryville Road, and south of Camelback Road. Goodyear's strong economic base and access to transportation and proximity to the metropolitan area have led to the city's rapid growth. According to the ADWR Annual Water Withdrawal and Use Report, in the City of Goodyear in 1998, a total of 2,326 af of groundwater were pumped and delivered.

A. Plans to Take and Use CAP Water

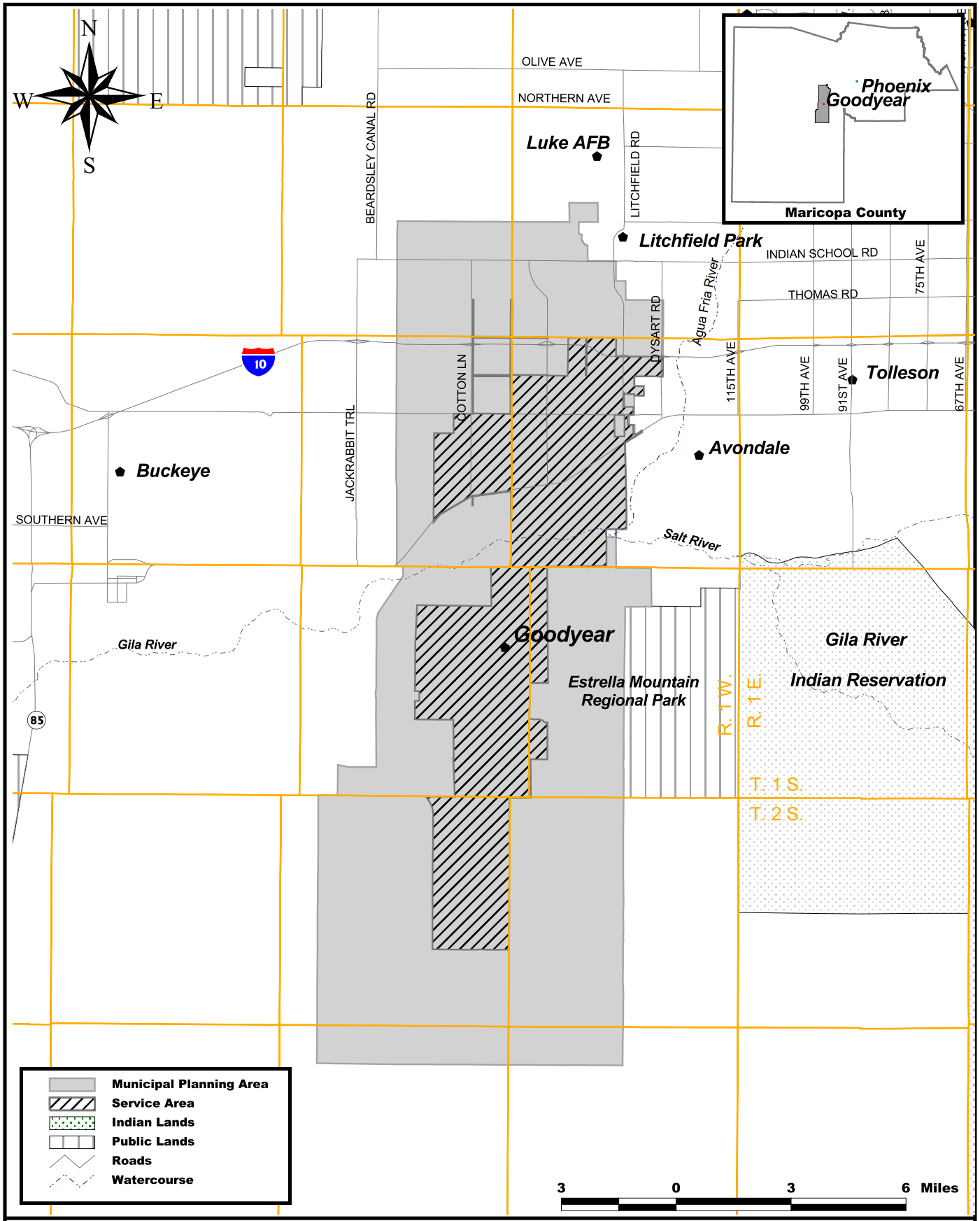
The City of Goodyear currently has a contract for 3,381 af of CAP water. The allocation includes 1,007 af of water which were transferred from McMicken Water District. Under the Settlement Alternative, the City of Goodyear would receive 7,211 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-51 outlines the proposed allocations by alternative.

Table L-M&I-51
CAP Allocation Draft EIS
City of Goodyear – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	7,211	M&I
No Action	0	-
Non-Settlement Alternative 1	7,211	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	7,889	NIA
Existing CAP Allocation	3,381	-

Figure L-M&I-26 shows the service area and MPA for the City of Goodyear. The service area covers approximately 28,659 acres and the MPA is estimated at approximately 96,430 acres.

The City of Goodyear plans to take and use their current and proposed CAP allocations through the White Tanks recharge facility. The CAP water would be wheeled through the MWD Beardsley Canal to the proposed recharge site east of the canal at Bethany Home Road. The White Tanks recharge facility would consist of spreading basins on previously irrigated lands. At full scale, the site would encompass approximately 80 acres and have a recharge capacity of 13,000 afa. The permit application for the pilot scale facility



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
General Location Map
City of Goodyear

Figure #L-M&I-26

(consisting of approximately 8.5 acres of spreading basins) has been filed with ADWR. The City of Goodyear intends to recover the water with wells on-site and convey the water in a proposed pipeline heading south with an alignment approximately one-half mile east of the Beardsley Canal. The recovered water would be blended with additional well water at a storage facility south of Interstate 10 and delivered to the city's water distribution system. Construction of the four-mile long pipeline from Bethany Home Road to Interstate 10 would disturb approximately 50 acres, assuming a 100-foot wide construction easement (Allen 2000).

B. Population Projection

The population in 1985 for the City of Goodyear was 3,530. The estimated 2001 population level is 19,640, and the estimated 2051 population level is 293,050.

C. Water Demand and Supply Quantities

As previously shown in Appendix C– M&I Sector Water Uses, it is estimated that water demand in the City of Goodyear would increase from 5,108 af in year 2001 to 76,218 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-52. Based on anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide over 100 percent and 14 percent of the current estimated water supply required for the City of Goodyear for the years 2001 and 2051, respectively.

Table L-M&I-52
CAP Allocation Draft EIS
City of Goodyear – Projected Water Use

Alternative	Total CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Others Surface Water*		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	3,378	16,449	648	648	0	3,360	0	32,753	1,082	23,008	5,108	76,218
No Action	3,378	3,381	648	648	0	3,360	0	45,821	1,082	23,008	5,108	76,218
Non-Settlement Alternative 1	3,378	10,592	648	648	0	3,360	0	38,610	1,082	23,008	5,108	76,218
Non-Settlement Alternative 2	3,378	3,381	648	648	0	3,360	0	45,821	1,082	23,008	5,108	76,218
Non-Settlement Alternative 3A	3,378	3,381	648	648	0	3,360	0	45,821	1,082	23,008	5,108	76,218
Non-Settlement Alternative 3B	3,378	10,592	648	648	0	3,360	0	38,610	1,082	23,008	5,108	76,218

*SRP and other ID water
Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 76,218 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 7,211 afa of demand are

met by the additional CAP allocation. Alternatively, this 7,211 afa of demand are met CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Goodyear MPA in 1995 consisted of approximately 39,694 acres of agriculture, 15,717 acres of developed land, 594 acres of rural land, 37,610 acres of vacant land and 2,815 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e. agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-53 provides the projected acres of land within the City of Goodyear MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

Table L-M&I-53
CAP Allocation Draft EIS Appendix L
City of Goodyear – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	25,600	--	46,129	--	24,701	--
	2051	8,683	16,917	33,001	13,128	54,746	30,045
No Action	2001	25,600	--	46,129	--	24,701	--
	2051	8,683	16,917	33,001	13,128	54,746	30,045
Non-Settlement Alternative 1	2001	25,600	--	46,129	--	24,701	--
	2051	8,683	16,917	33,001	13,128	54,746	30,045
Non-Settlement Alternative 2	2001	25,600	--	46,129	--	24,701	--
	2051	8,683	16,917	33,001	13,128	54,746	30,045
Non-Settlement Alternative 3A	2001	25,600	--	46,129	--	24,701	--
	2051	8,683	16,917	33,001	13,128	54,746	30,045
Non-Settlement Alternative 3B	2001	25,600	--	46,129	--	24,701	--
	2051	8,683	16,917	33,001	13,128	54,746	30,045

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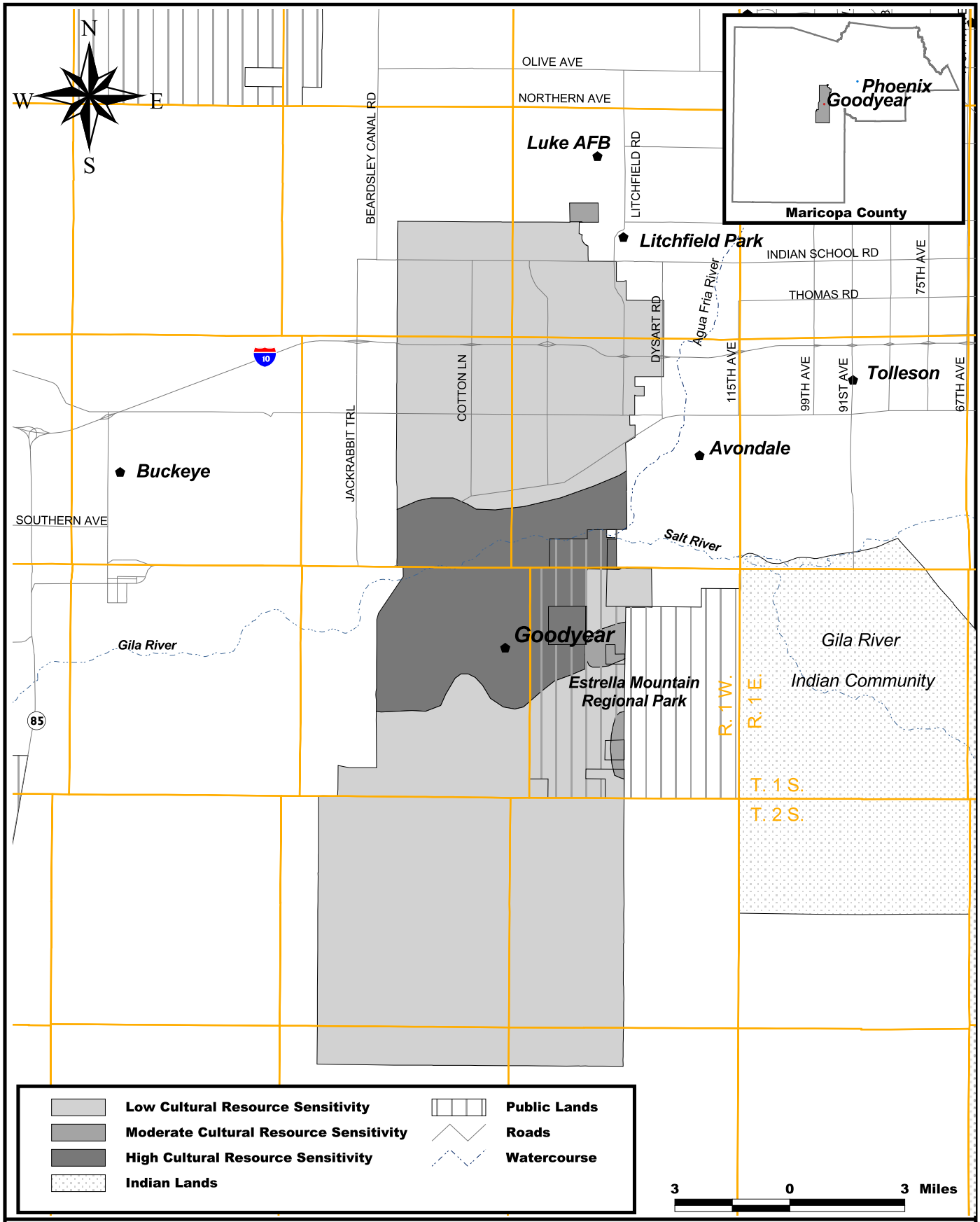
2. Archaeological Resources

Only two small surveys are documented for the southernmost portion of the City of Goodyear MPA; linear (e.g., Tucson Gas & Electric's El Sol-Vail transmission line) and small block surveys characterize coverage of the remainder of the MPA. Many sites have been found in the central portion of the MPA between the Gila River and the Estrella Mountain Regional Park. This area of high cultural resource sensitivity has yielded evidence of human occupation from the Archaic to the Late Historic periods. Prehistoric site types include large Hohokam villages (e.g., Coldwater Ruin, Cashion Site, Alkali Ruin), small habitations, artifact scatters, resource procurement loci, bedrock mortars, trails, petroglyphs, and agricultural features. Protohistoric Pima deposits might also be present. Historic resource types include trash deposits, campsites, farmsteads, water-control features, transportation-related sites, and features associated with ranching. The nature of the depositional environment indicates the potential for buried sites is high.

Cultural resource sensitivity areas in the City of Goodyear MPA are shown on Figure L-M&I-27. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the City of Goodyear MPA is low to high. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Based on Goodyear's plans to construct a direct recharge facility and recovery pipeline, there is the potential for impacts



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Cultural Resources
City of Goodyear

Figure #L-M&I-27

to previously unidentified cultural resources. Reclamation would carry out cultural resource compliance on Goodyear's final plans, prior to construction.

3. Biological Resources

Existing Habitats

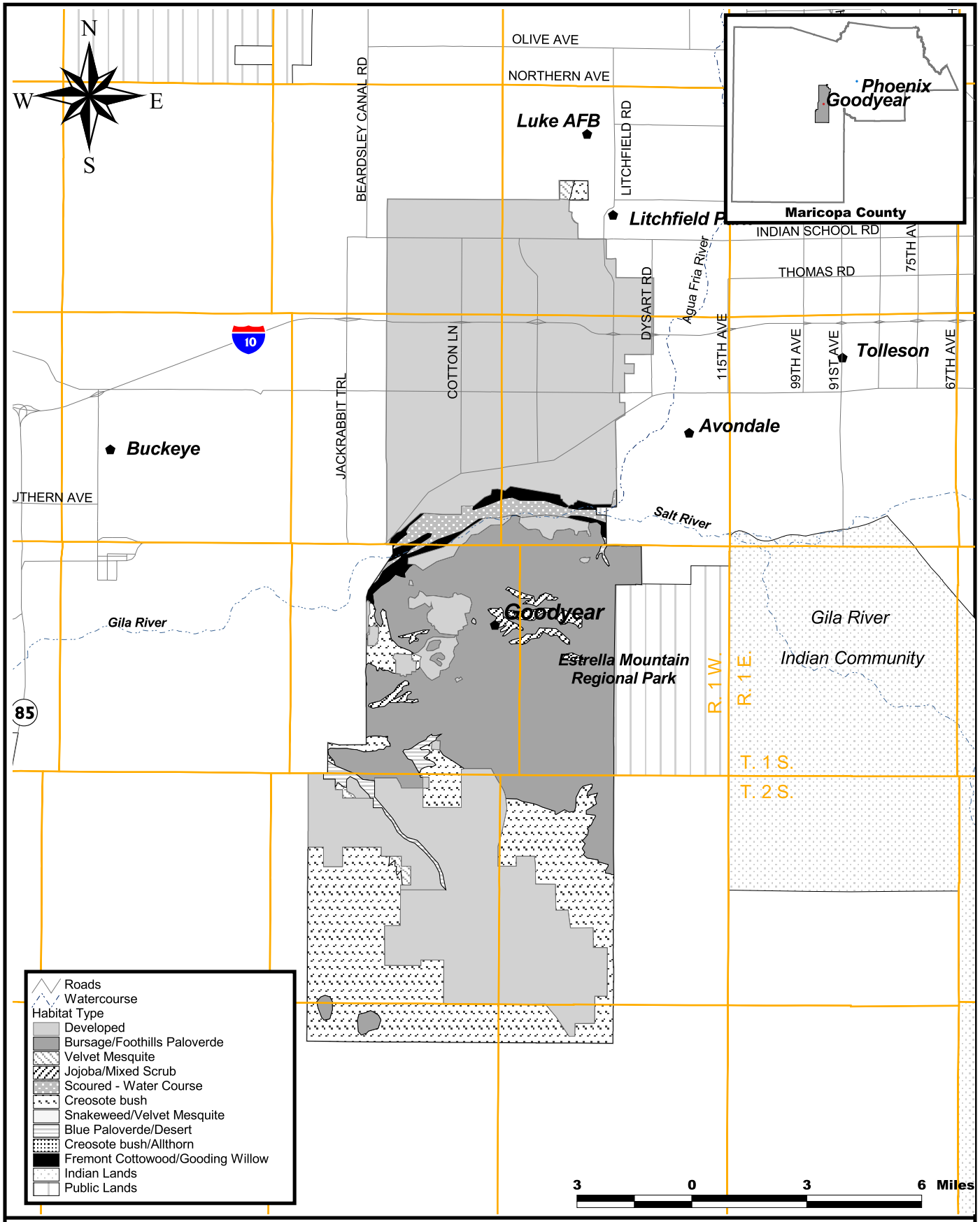
Most of the remaining natural habitat occurs in the southern portion of the City of Goodyear MPA. Bursage-Foothill Paloverde Association dominates the upper bajadas (to approximately 1,700 feet in elevation) of the Estrella Mountains, and Creosote-bush Association dominates the lower bajadas and floodplains. Co-dominants of the Bursage-Foothill Association include creosote-bush and brittlebush. The saguaro density is moderate. The density of saguaros and other trees within the Creosote-bush Association is low. Frémont Cottonwood/Goodding Willow Association occurs along the Gila River. Flows in the Gila River are maintained by effluent from the 91st Avenue Treatment Plant. No T&E fish species have been recorded from this portion of the Gila River. Blue Paloverde/Desert Ironwood Association occurs along Gila River tributaries. The habitat zones are shown on Figure L-M&I-28. Table L-M&I-54 provides the habitat acreages for the habitat zones described above.

TableL-M&I-54
CAP Allocation Draft EIS
City of Goodyear– Habitat Acreages

Vegetation Name	Acres
Developed	50,301
Bursage/Foothills Paloverde	24,218
Velvet Mesquite	291
Jojoba/Mixed Scrub	954
Scoured, Washes and Creekbeds	1,512
Creosote-Bush	17,253
Blue Paloverde/Desert	702
Fremont Cottonwood/Goodding Willow	1,199
Total	**96,430**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Goodyear MPA over the 50-year study period would result in loss of estimated 13,128 acres of Sonoran Desertscrub, and associated wildlife resources. There may be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. An estimated 16,917 acres of farmland would be urbanized, resulting in the creation of fallow fields for some undetermined length of time. Fallow agricultural fields in the area may be used by burrowing owls, a species protected under the MBTA. Individual developers who convert fallow lands for urban uses would be responsible for ensuring burrowing owls are removed prior to development. Failure to do so would be considered a violation of the MBTA. Under the action alternatives, there is no difference in impacts from the No Action baseline. Goodyear's plans to construct a recharge facility and recovery pipeline are not expected to have significant impacts to biological resources, since the recharge facility would be located on retired farmlands.



U.S. DEPARTMENT OF THE INTERIOR
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June 2000

CAP Allocation Draft EIS
Habitat Zones
City of Goodyear

Figure No. L-M&I-28

Additional environmental review would be carried out by Reclamation prior to construction.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect in urban growth, there would be no effect on T&E species from the CAP allocation. The City of Goodyear would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth. The City of Goodyear MPA is located within Maricopa County for which there are 14 T&E species listed by the USFWS. Potential habitat may exist for cactus ferruginous pygmy-owl, southwestern willow flycatcher and Yuma clapper rail. Approximately 26,410 acres of potentially suitable habitat for the cactus ferruginous pygmy owl were identified within the City of Goodyear MPA. Potentially suitable habitat for southwestern willow flycatcher and Yuma clapper rail may also occur along the Gila River. However, construction within the riparian corridor would require issuance of CWA Section 404 permits by the Corps. As part of the permitting process, the Corps would have to comply with Section 7 of the ESA, and detailed surveys for T&E species would be carried out as necessary.

4. Water Resources

Demands in the City of Goodyear have historically been met by pumping groundwater from the underlying basin fill. In more recent years, CAP water has been used to meet a portion of the demands. The City of Goodyear includes lands in the West SRV (which have been included in the analysis) and lands in the Rainbow Valley located south of the West SRV. For the purpose of this analysis, groundwater from the West SRV was assumed to be used to meet demands in excess of CAP water supplies, and the discussion presented herein focuses on the portions of the City of Goodyear within the West SRV. However, it is noted that some groundwater production would likely occur in the Rainbow Valley.

Groundwater levels in the northerly part of the City of Goodyear have experienced significant declines, while groundwater in the southerly areas (in the vicinity of the Gila River) has been more stable over time. The substantial groundwater level declines in the northern part of the City of Goodyear have resulted in subsidence in this area. The concentration of TDS in the underlying groundwater can exceed 3,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-55, which shows the estimated groundwater level change for the period from 2001-2051 as well as groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. The City of Goodyear falls within four groundwater sub-areas used for the analysis. Table L-M&I-55 shows (in order) estimated groundwater conditions in the northeastern, northwestern, southeastern, and southwestern part of the City of Goodyear in the West SRV area. In general, groundwater level changes in the northeastern and northwestern areas are similar to one another, as are the groundwater level changes in the southeastern and southwestern area.

Under the No Action Alternative, groundwater levels would decline by about 136 to 150

feet during the 2001 to 2051 period in the northern part of the City of Goodyear, and would rise by about 35 to 52 feet in the southern part. The declines in the northern part reflect the continued reliance on groundwater to meet demands, both in the City of Goodyear and in adjacent areas, and the declines have been moderated by the impact of direct recharge of CAP water in the Agua Fria recharge facilities and in future West-side recharge facilities. The rise in groundwater levels in the southern part of the City of Goodyear reflects the impact of recharge from the Gila River. Increases in TDS concentrations could occur in the northern part of the City of Goodyear due to both the northward movement of poorer quality water from the south, and due to lowering of groundwater levels in the vicinity of the Luke salt dome. The lower groundwater levels could also result in continued subsidence in the northerly areas.

Under the Settlement and all Non-Settlement Alternatives, groundwater levels would decline in the northern part of the City of Goodyear over the 2001 to 2051 period. These declines would be greater than the declines under the No Action Alternative and could result in additional subsidence relative to the No Action Alternative. The larger declines in groundwater levels are primarily a result of reduced direct recharge of CAP water in the Agua Fria and future West-side recharge facilities under the Settlement and Non-Settlement Alternatives relative to the No Action Alternative. The declines could also result in greater movement of poor quality water beneath the Gila River northward.

For areas of the City of Goodyear in the southern part of the West SRV, groundwater levels under the Settlement Alternative and all Non-Settlement Alternatives would be similar (within 10 feet) to the groundwater levels under the No Action Alternative. Groundwater quality and subsidence impacts would not be expected in this area.

Table L-M&I-55 CAP Allocation Draft EIS City of Goodyear –Groundwater Data Table		
Alternatives		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-136 / -150 / 35 / 52	--
Settlement Alternative	-198 / -231 / 28 / 50	-62 / -80 / -6 / -1
Non-Settlement Alternative 1	-147 / -160 / 36 / 57	-11 / -10 / 1 / 5
Non-Settlement Alternative 2	-157 / -172 / 31 / 49	-21 / -21 / -3 / -3
Non-Settlement Alternative 3A	-185 / -207 / 26 / 47	-49 / -57 / -9 / -4
Non-Settlement Alternative 3B	-172 / -202 / 32 / 51	-36 / -51 / -3 / 0

*Values correspond to the West-side M&I, MWD, Avondale, and East Buckeye sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of Goodyear's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 13.6 percent of the total year 2051 demand for the City of Goodyear.

Table L-M&I-56
CAP Allocation Draft EIS
City of Goodyear –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a,c]	CAP Allocation
No Action	277 – 280[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	277 – 280[b]	CAGRD
Non-Settlement Alternative 3A	277 – 280[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.
c. Does not include monetary contribution to the GRIC Settlement.

11. City of Mesa

The City of Mesa is located 12 miles southeast of Phoenix and covers more than 132 square miles. Mesa is Arizona's third largest city and is among the fastest growing communities in the state. The City of Mesa service area is located in the SRV, south of the Salt River, north of the Gila River and the San Tan Mountains, and west of the Goldfield Mountains. The Mesa MPA is located north of Germann Road, west of Meridian Road, east of Mesa City limits, and south of the SRPMIC. The local economy of Mesa is based primarily on retail and wholesale trade, services, and contract construction, plus some light manufacturing. The City of Mesa also boasts a strong economy and is the retail center of eastern Maricopa County.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Mesa in 1998, a total of 6,385 af of groundwater were pumped and delivered. Also, 78,936 af of water were received from other rights including 49,241 af of SRP water; 1,988 af of groundwater from other IDs; 22,782 af of CAP water; 2,655 af of RWCD water; 794 af of effluent; and 1,476 af of tailwater. Of that total of 78,936 af of water received from other rights, 2,309 af were used for treatment plant backwash leaving a total of 76,627 af received from other rights. Of the total 83,462 af of water received (i.e. 6,385 + 76,617), approximately 3,664 af were delivered to other rights leaving a total of 79,798 af to be used and delivered in the Mesa area.

A. Plans to Take and Use CAP Water

The City of Mesa currently has a contract for 36,388 af of CAP water. This includes 20,129 af received under the 1983 allocation and 16,259 af of transfers. The transfers included 5,933 af from Desert Sage; 768 af from Desert Sands; 2,697 af from Crescent Valley Utility; 3,932 af from Turner Ranches; 833 af from Williams Air Force Base; 596 af from QCID; and 1,500 af from the Arizona State Land Department (ASLD). Under the Settlement Alternative, the City of Mesa would receive an additional 7,115 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-63 outlines the proposed allocations by alternative.

Table L-M&I-63 CAP Allocation Draft EIS City of Mesa – Proposed CAP Allocation		
Alternative	**Allocation (in afa)**	**Priority**
Settlement Alternative	7,115	M&I
No Action	0	-
Non-Settlement Alternative 1	7,115	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	7,784	NIA
Existing CAP Allocation	36,388	-

Figure L-M&I-32 shows the service area and MPA for the City of Mesa. The service area covers approximately 84,278 acres, and the MPA covers approximately 109,108 acres. The City of Mesa has two water treatment plants. These include the Mesa CAP Water Treatment Plant, which is located at Brown Road and currently treats CAP water. It has a total capacity of 53,850 afa. After leases to Arizona Water Company for 1.4 mgd and to the City of Chandler for 3.27 mgd, the City of Mesa's capacity is 48,500 afa. The Val Vista Water Treatment Plant currently treats 100,800 afa of SRP water. CAP water could be wheeled through the SRP system for treatment at the Val Vista Water Treatment Plant.

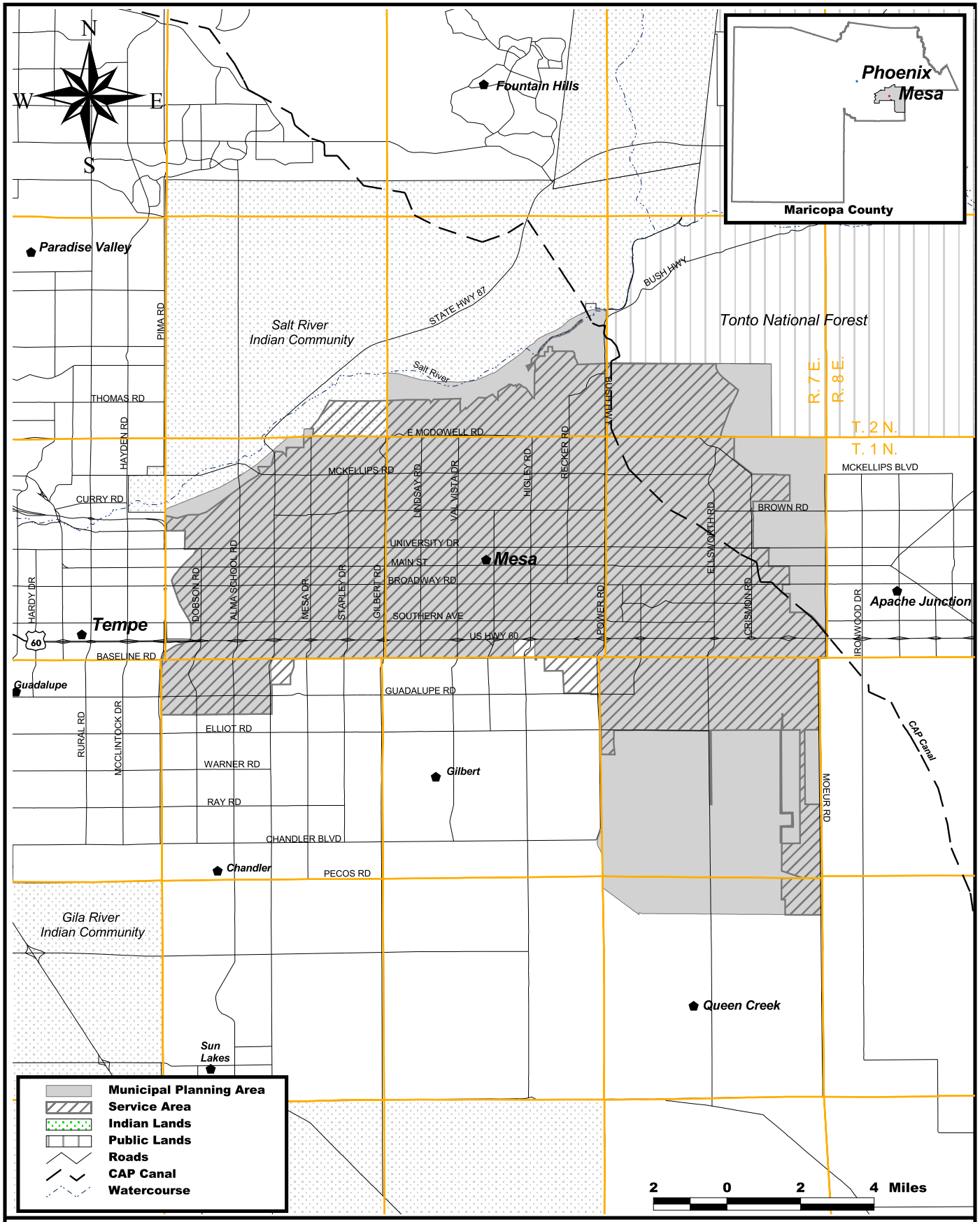
The City of Mesa also utilizes the following recharge facilities. Mesa is entitled to 24.86 percent of the GRUSP capacity. GRUSP currently has permits to handle 44,000 afa of CAP water; 30,000 afa of effluent; and 85,869 afa of Salt River/Verde River water. If GRUSP recharged 100,000 afa, Mesa could store up to 24,860 afa of CAP water. The Red Mountain recharge facility currently handles 2,000 afa of CAP water. No additional facilities would be required to take and treat the additional CAP allocation (Plumb 2000).

B. Population Projection

The population in 1985 for the City of Mesa area was 38,530. The estimated 2001 population level is 425,238, and the estimated 2051 population level is 664,700.

C. Water Demand and Supply Quantities

As previously shown in Appendix C – M&I Sector Water Uses, it is estimated that water demand in the City of Mesa would increase from 78,490 af in year 2001 to 122,689 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-64. Based on anticipated water demands, CAP water which would be allocated under the Settlement Alternative would provide nine percent and six percent of the current estimated water supply required for the City of Mesa for the years 2001 and 2051, respectively.



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CAP Allocation Draft EIS
General Location Map
City of Mesa

June 2000

Figure #L-M&I 32

Table L-M&I-64
CAP Allocation Draft EIS
City of Mesa – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		Other Surface Water*		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	19,067	51,103	10,587	10,587	959	959	47,877	60,040	78,490	122,689
No Action	19,067	40,599	10,587	10,587	959	11,463	47,877	60,040	78,490	122,689
Non-Settlement Alternative 1	19,067	47,532	10,587	10,587	959	4,530	47,877	60,040	78,490	122,689
Non-Settlement Alternative 2	19,067	40,599	10,587	10,587	959	11,463	47,877	60,040	78,490	122,689
Non-Settlement Alternative 3A	19,067	40,599	10,587	10,587	959	11,463	47,877	60,040	78,490	122,689
Non-Settlement Alternative 3B	19,067	47,532	10,587	10,587	959	4,530	47,877	60,040	78,490	122,689

*SRP and other ID water
Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 122,689 af. For all alternatives, there is estimated to be no unmet demand with or without the additional CAP allocation.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Mesa MPA in 1995 consisted of approximately 9,795 acres of agriculture, 62,060 acres of developed land, 870 acres of rural land, 34,133 acres of vacant land, and 2,250 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e., agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-65 provides the projected acres of land within the City of Mesa MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-65
CAP Allocation Draft EIS
City of Mesa – Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	1,420	--	12,435	--	95,253	--
	2051	401	1,019	0	12,435	108,707	13,454
No Action	2001	1,420	--	12,435	--	95,253	--
	2051	401	1,019	0	12,435	108,707	13,454
Non-Settlement Alternative 1	2001	1,420	--	12,435	--	95,253	--
	2051	401	1,019	0	12,435	108,707	13,454
Non-Settlement Alternative 2	2001	1,420	--	12,435	--	95,253	--
	2051	401	1,019	0	12,435	108,707	13,454
Non-Settlement Alternative 3A	2001	1,420	--	12,435	--	95,253	--
	2051	401	1,019	0	12,435	108,707	13,454
Non-Settlement Alternative 3B	2001	1,420	--	12,435	--	95,253	--
	2051	401	1,019	0	12,435	108,707	13,454

2. Archaeological Resources

Most of the previous survey coverage within the City of Mesa MPA has been linear (e.g., Macnider et al. 1999), although many small block surveys have also occurred, primarily for urban development. The MPA contains two major areas of high cultural resource sensitivity. The northernmost area, encompassing the banks and lower terraces of the Salt River, is characterized by many significant Hohokam remains, including Pueblo Ultimo, Mesa Grande, Crismon Pueblo, Casa del Omni, Pueblo Moroni, and Las Piedras. Many of these sites, which are associated with major irrigation systems, were documented during the late 1800s and early 1900s (e.g., Turney 1929). Although most have been completely obliterated by urban development, surface remains of these once-extensive sites can still be found; intact subsurface remains, including canals, also might be present (e.g., Dennis 1989). Numerous previously recorded sites also are known to have been present in the southeastern portion of the City of Mesa MPA, including Rittenhouse Ruins, the Midvale Site, the Ordinance Site, and El Horno Grande. Prehistoric cultural resource types that might be expected in these areas include artifact scatters, agricultural features, burials, and canals. Protohistoric and early historic Pima farmsteads and artifact scatters also might be present. Areas of moderate cultural resource sensitivity elsewhere within the MPA include prehistoric as well as historic sites. Known historic resources include trash scatters, roads, canals, orchards, and buildings associated with the early history of Mesa and the surrounding areas.

Cultural resource sensitivity areas in the MPA are shown on Figure L-M&I-33. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the City of Mesa MPA is high to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. There would be no cultural resource impacts from construction of CAP water delivery facilities, since no new facilities would be required.

3. Biological Resources

Existing Habitats

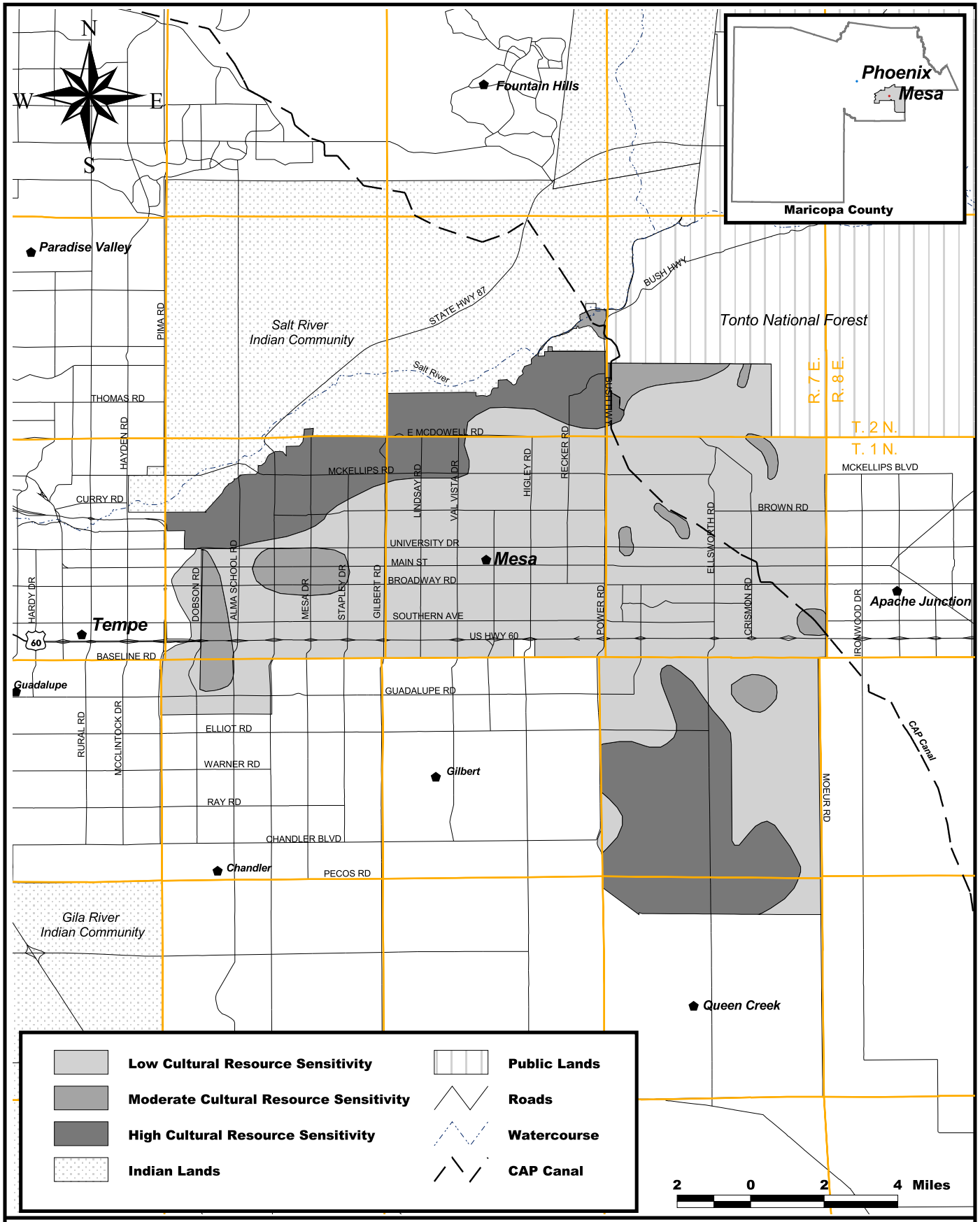
Little natural habitat remains within the gravelly and silty plains of the City of Mesa MPA. Most of the area has been developed for agriculture or urban use. On courser soils of higher ground (to approximately 2,000-foot elevation), there are fragments of Bursage-Foothills Paloverde Association where saguaro density is moderate. Silty soils support Creosote-bush Association where saguaros and other trees are sparsely distributed. Blue Paloverde/Desert Ironwood Association occurs along drainages and is characterized by desert ironwood, blue paloverde, and mesquite. The habitat zones are shown on Figure L-M&I-34. Table L-M&I-66 provides the habitat acreages for the habitat zones described above.

Table L-M&I-66
CAP Allocation Draft EIS
City of Mesa– Habitat Acreages

Vegetation Name	Acres
Developed	96,673
Bursage/Foothills Paloverde	1,892
Velvet Mesquite	3,064
Creosote-Bush	7,307
Blue Paloverde/Desert	171
Total	**109,108**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Mesa MPA over the 50-year study period would result in loss of an estimated 12,461 acres of Sonoran Desert Scrub Associations and wildlife resources. There may also be indirect impacts to undeveloped habitat and wildlife occurring in adjacent undeveloped habitat. Under the action alternatives, there is no difference from the No Action baseline. No new CAP water delivery facilities are required, so no additional construction–related impacts to biological resources would occur.



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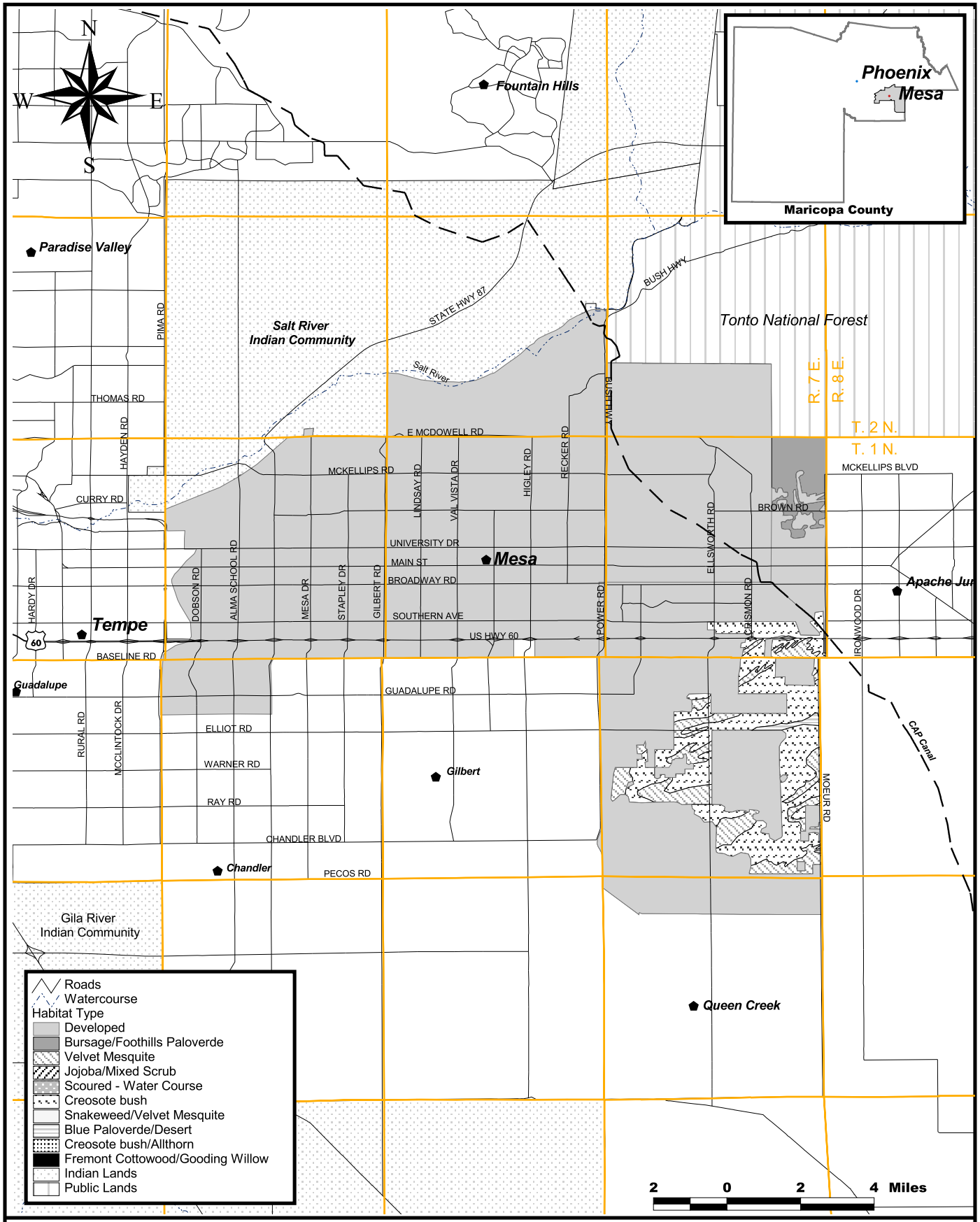
June 2000

CAP Allocation Draft EIS
Cultural Resources
City of Mesa

Figure #L-M&I 33



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CAP Allocation Draft EIS
Habitat Zones
City of Mesa

June 2000

Figure No. L-M&I-34

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Mesa would be responsible for complying with the relevant provisions of the ESA, as it permits and approves future growth. The City of Mesa MPA is located within Maricopa County for which there are 14 T&E species listed by the USFWS. No acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the Mesa MPA.

4. Water Resources

Demands in the City of Mesa have historically been met with water provided by SRP (in the western part of Mesa) and groundwater pumped from the underlying sedimentary rocks. Groundwater levels have declined in response to this pumping, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater ranges from less than 500 to over 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-67, which shows the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Most of the City of Mesa falls within two groundwater sub-areas used for the analysis. Table L-M&I-67 shows groundwater conditions estimated for areas which include the western part of the City of Mesa (in the SRP service area), the northeastern part, and the southeastern part (in the vicinity of the Williams Field Airport).

Under the No Action Alternative, over the 2001 to 2051 period, groundwater levels in the western part of Mesa would rise by about 25 feet, while groundwater levels would decline in the eastern part of Mesa by about two to 23 feet. These groundwater level changes reflect, in part, continued reliance on groundwater to meet demands, both in the City of Mesa and in adjacent areas. Offsetting this is the recharge of CAP water in the GRUSP facilities. Substantial changes in groundwater quality would not be anticipated under the No Action Alternative. There would be the potential for subsidence due to the lower groundwater levels in the vicinity of the Williams Field Airport.

For the Settlement Alternative, groundwater levels would be higher in year 2051 in the western and northeastern part of the City of Mesa. Those higher groundwater levels reflect that additional CAP water received through an exchange of effluent with GRIC would have a greater impact on groundwater levels than the reduction in recharge of CAP water in the GRUSP facilities. For the other alternatives, groundwater levels would be lower than under the No Action Alternative, primarily due to the reduction in CAP water recharged in GRUSP. Substantial changes in groundwater quality would not be anticipated for any of the alternatives. There would be the potential for subsidence in the eastern parts of the City of Mesa.

Table L-M&I-67 CAP Allocation Draft EIS City of Mesa–Groundwater Data Table		
Alternatives	**Mesa East***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	25 / -2 / -23	--
Settlement Alternative	39 / -1 / -31	14 / 1 / -8
Non-Settlement Alternative 1	21 / -11 / -10	-4 / -9 / 13
Non-Settlement Alternative 2	14 / -13 / -56	-10 / -11 / -33
Non-Settlement Alternative 3A	-6 / -23 / -61	-31 / -21 / -38
Non-Settlement Alternative 3B	-9 / -31 / -41	-34 / -29 / -19

*Values correspond to the Mesa West, Mesa East, and Williams Field Airport sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimates, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, as needed, treating and reusing effluent. The difference in cost for this small increment of the City of Mesa's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 5.8 percent of the total year 2051 demand for the City of Mesa.

Table L-M&I-68
CAP Allocation Draft EIS
City of Mesa–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a,b]	CAP Allocation
No Action	237[a]	Reclaimed Water
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	237[a]	Reclaimed Water
Non-Settlement Alternative 3A	237[a]	Reclaimed Water
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost expressed in year 2000 dollars.
b. Does not include monetary contribution to the GRIC Settlement.

14. City of Peoria

The City of Peoria is a rapidly growing suburban community located in Maricopa County, in the northwest portion of the Valley of the Sun. Formerly an agricultural town, Peoria is today a business and medical hub for the northwest valley. The City of Peoria encompasses approximately 117 square miles. The economy of Peoria has shifted from agriculture to commercial, light industrial and retail development. Peoria's MPA is located north of Beardsley Road, west of 67th Avenue, east of 171st Avenue, and south of the Maricopa County line.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Peoria in 1998, a total of 15,828 af of groundwater were pumped and delivered. Additional deliveries included 594 af of SRP water; 458 af of groundwater from Citizen's Resources and 467 af of CAP water from Pyramid Peak. A total of 17,347 af of water were delivered for use in the City of Peoria MPA.

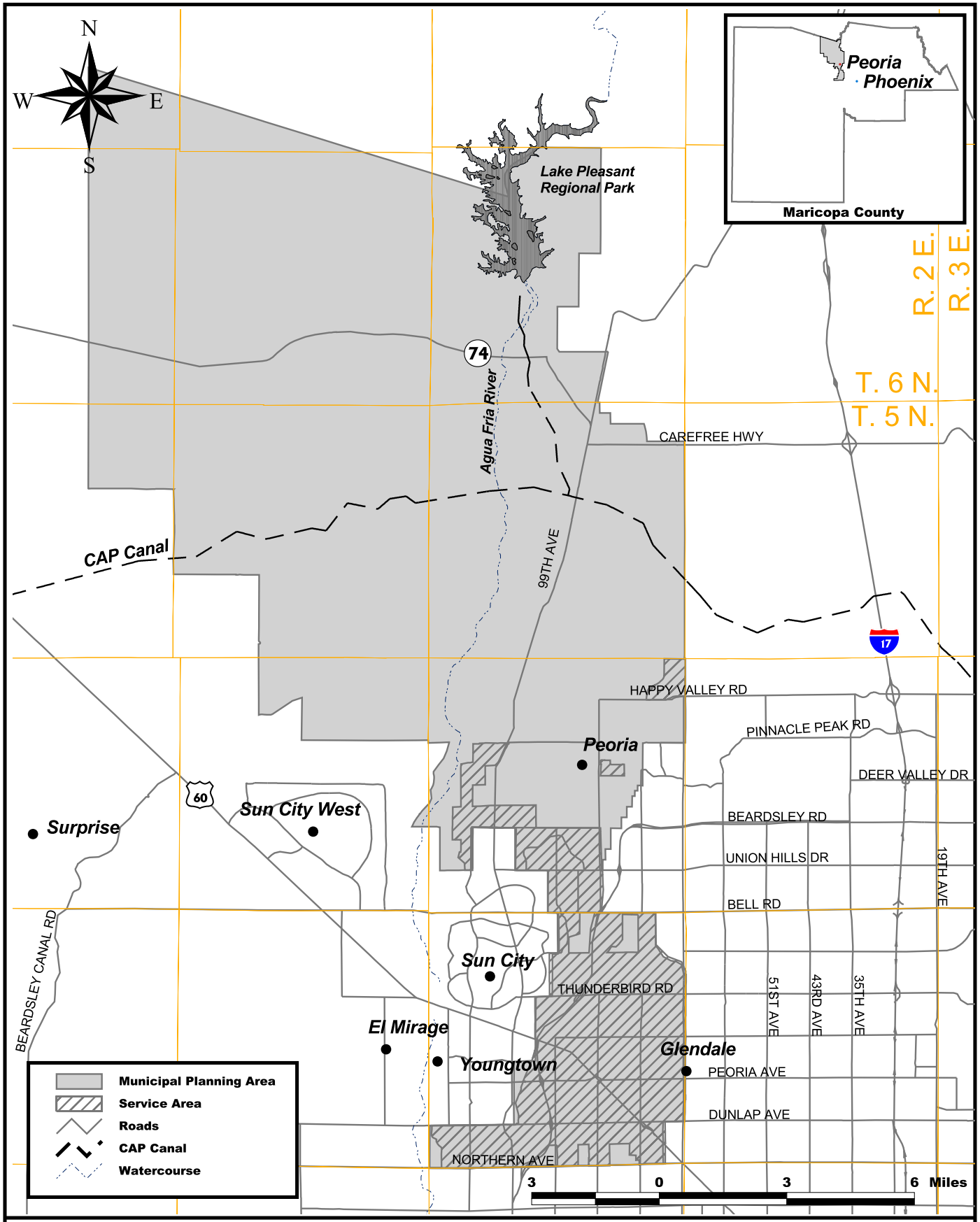
A. Plans to Take and Use CAP Water

The City of Peoria currently has a subcontract for 18,709 af of CAP water. This allocation includes 15,000 af received under the 1983 allocation; 2,849 af transferred from Clearwater Company; 374 af transferred from New River Utility Company; and 486 af transferred from McMicken ID. Under the Settlement Alternative, the City of Peoria would receive an additional 5,527 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-81 outlines the proposed CAP allocation by alternative.

Table L-M&I-81
CAP Allocation Draft EIS
City of Peoria – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	5,527	M&I
No Action	0	-
Non-Settlement Alternative 1	5,527	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	6,046	NIA
Existing CAP Allocation	18,709	-

Figure L-M&I-41 shows the service area and MPA for the City of Peoria. The service area covers approximately 16,957 acres, and the MPA covers approximately 127,716 acres. The City of Peoria is currently constructing the Greenway Water Treatment Plant. This plant would have a capacity of 17,900 afa for SRP and CAP water. The plant is expected to be



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
General Location Map
City of Peoria

Figure #L-M&I-41

operational in 2001. Peoria also has an agreement with the City of Glendale for approximately 6,700 afa of additional capacity to treat CAP water at the Pyramid Peak Water Treatment Plant. Recharge facilities utilized by Peoria include in-lieu with SRP, which has a capacity of 40,000 afa, and the GRUSP, which has capacity of 20,000 afa for Peoria (Kadlec 2000).

B. Population Projection

In 1985, the population in the City of Peoria was 16,100. The estimated 2001 population is 93,675, and the estimated 2051 population level is 358,317.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the City of Peoria would increase from 16,505 af in year 2001 to 63,132 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-82. Based on anticipated water demands, CAP water which would be allocated under the Settlement Alternative would provide 33 percent and 8.8 percent of the current estimated water supply required for the City of Peoria for the years 2001 and 2051, respectively.

Table L-M&I-82
CAP Allocation Draft EIS
City of Peoria– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Others Surface Water*		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	4,613	30,093	2,423	2,423	0	0	0	17,835	9,469	12,780	16,505	63,132
No Action	4,613	18,709	2,423	2,423	0	0	0	29,219	9,469	12,780	16,505	63,132
Non-Settlement Alternative 1	4,613	24,236	2,423	2,423	0	0	0	23,692	9,469	12,780	16,505	63,132
Non-Settlement Alternative 2	4,613	18,709	2,423	2,423	0	0	0	29,219	9,469	12,780	16,505	63,132
Non-Settlement Alternative 3A	4,613	18,709	2,423	2,423	0	0	0	29,219	9,469	12,780	16,505	63,132
Non-Settlement Alternative 3B	4,613	24,236	2,423	2,423	0	0	0	23,692	9,469	12,780	16,505	63,132

*SRP and other ID water.
Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 63,132 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 5,527 afa of demand are met by the additional CAP allocation. Alternatively, this 5,527 afa of demand are met by

CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Peoria MPA in 1995 consisted of approximately 4,330 acres of agriculture, 17,662 acres of developed land, 1,286 acres of rural land, 98,058 acres of vacant land and 6,380 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e., agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-83 provides the projected acres of land within the City of Peoria MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

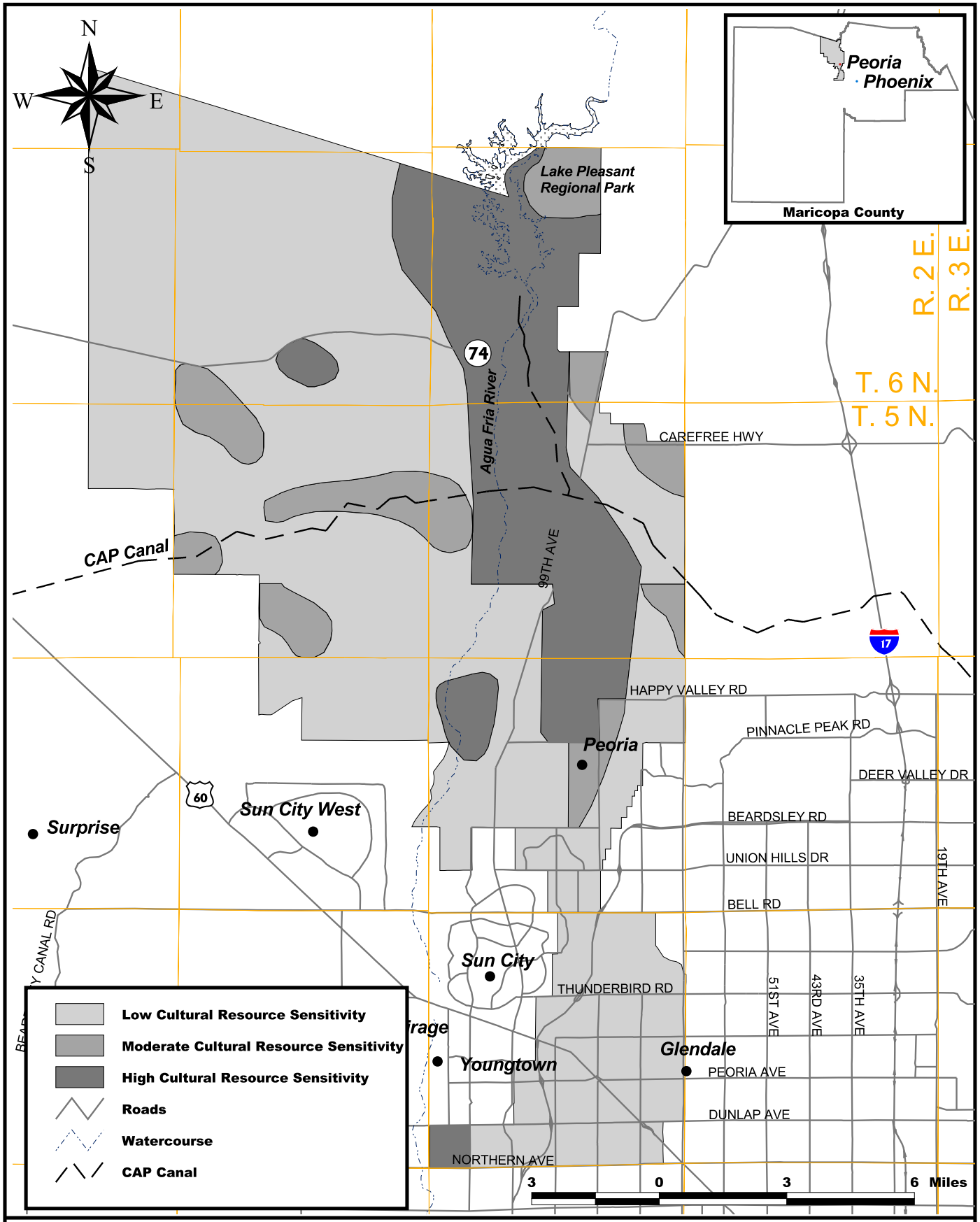
TableL-M&I-83
CAP Allocation Draft EIS Appendix L
City of Peoria - Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	1,920	--	101,044	--	24,752	--
	2051	1,920	0	70,908	30,136	54,888	30,136
No Action	2001	1,920	--	101,044	--	24,752	--
	2051	1,920	0	70,908	30,136	54,888	30,136
Non-Settlement Alternative 1	2001	1,920	--	101,044	--	24,752	--
	2051	1,920	0	70,908	30,136	54,888	30,136
Non-Settlement Alternative 2	2001	1,920	--	101,044	--	24,752	--
	2051	1,920	0	70,908	30,136	54,888	30,136
Non-Settlement Alternative 3A	2001	1,920	--	101,044	--	24,752	--
	2051	1,920	0	70,908	30,136	54,888	30,136
Non-Settlement Alternative 3B	2001	1,920	--	101,044	--	24,752	--
	2051	1,920	0	70,908	30,136	54,888	30,136

2. Archaeological Resources

Few surveys have occurred in the northwest portion of the City of Peoria MPA; elsewhere, survey coverage has been moderate, including both linear (e.g., Green 1984; Hoffman and Green 1988) and large block surveys (e.g., Green 1989; Greenwald and Keller 1988). Numerous sites have been documented along the Lake Pleasant–Agua Fria River portion of the MPA, making this an area of high to moderate cultural resource sensitivity. High site density is also identified in a small area between State Route 74 and Saddleback Mountain. The east-central portion of the City of Peoria MPA extends onto the New River Dam Archaeological District and the Calderwood Butte Archaeological District, both National Register properties. Documented prehistoric site types include artifact scatters of Hohokam and Sinagua affiliation, resource procurement and processing loci, field houses, petroglyphs, and rock features. Historic resources include water-control features (e.g., the Beardsley Canal), residential properties, transportation-related sites, and camps associated with sheep herding and other ranching activities. The City of Peoria has implemented a comprehensive master plan for future development that includes policies for conserving archaeological resources.

Cultural resource sensitivity areas in the City of Peoria MPA are shown on Figure L-M&I-42. Based on the limited data used to generate the cultural sensitivity designations, the



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Cultural Resources
City of Peoria

Figure #L-M&I-42

potential for cultural resource impacts in the City of Peoria MPA is moderate to high. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Significant impacts to cultural resources from new CAP delivery and treatment facilities are not expected, since most facilities are already in place. Reclamation would continue to work with the City of Peoria regarding any additional cultural resource clearances from CAP delivery facilities.

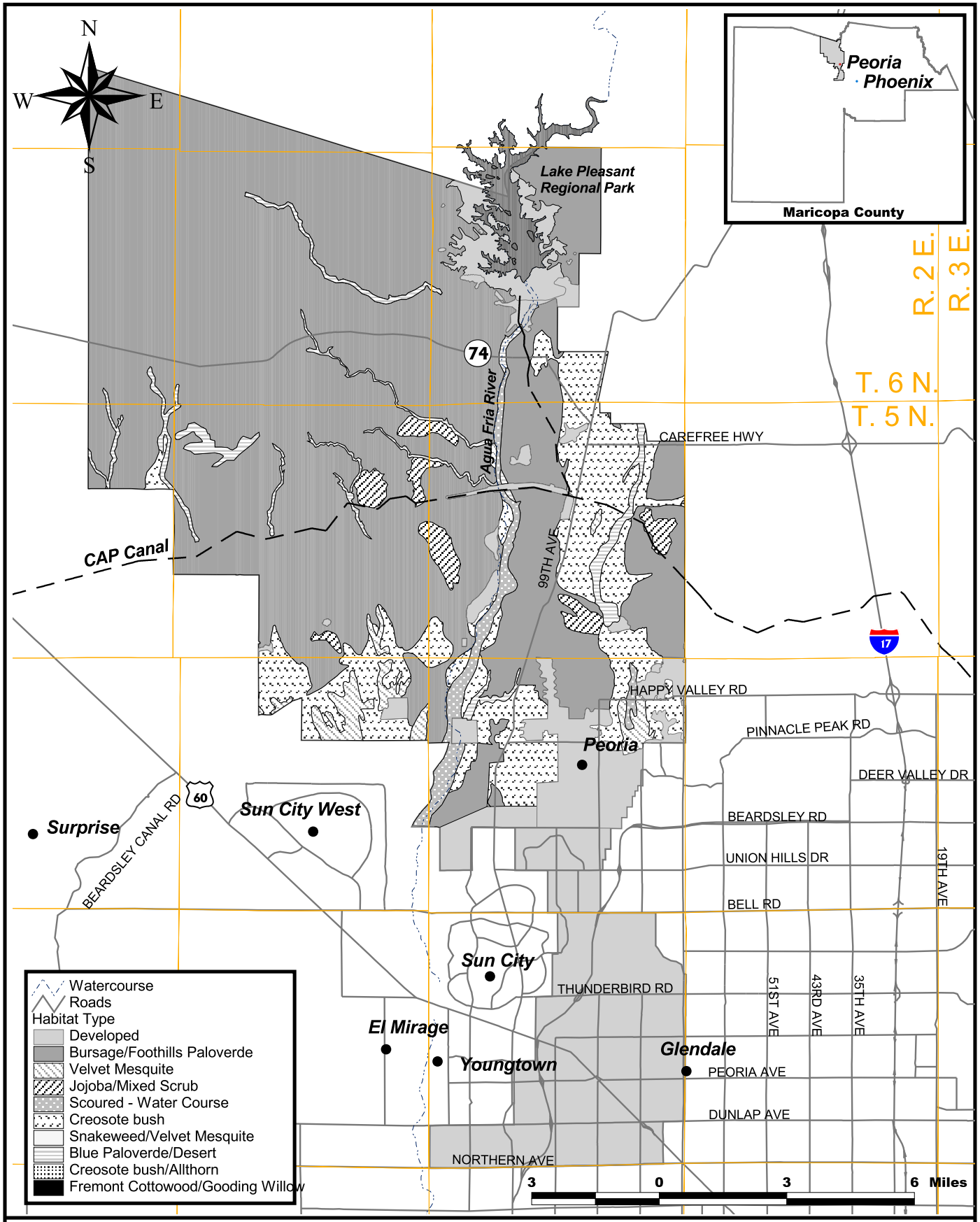
3. Biological Resources

Existing Habitats

The northern portion of the City of Peoria MPA is composed of rocky hills and ridges known as the Hieroglyphic Mountains. Numerous washes drain though alluvial fans and then onto silty plains to the south. The lower half of Lake Pleasant occurs in the northeast corner of the MPA. Jojoba/Mixed Scrub Association occurs on north-facing slopes of the highest elevations (to 3200 feet), much of which is dominated by wild buckwheat, while Bursage/Foothill Paloverde Association is most common in most of the remaining undeveloped portions. Co-dominants include creosote-bush, staghorn cholla, and teddybear cholla with buckwheat brush dominating the north facing slope. Other common trees include velvet mesquite, desert ironwood, blue-paloverde, and saguaro. The density of saguaros is generally moderate. Creosote-Bush Association is the main plant association on silty plains where cover is very low and dominated almost entirely by creosote-bush. Trees, such as foothill paloverde, desert ironwood, and saguaro are widely-spaced. Blue-Paloverde/Desert Ironwood Association habitat occurs along major ephemeral washes where conspicuous species include burrobush, desert-broom, blue-paloverde, desert ironwood, and desert-willow. The habitat zones are shown on Figure L-M&I-43. Table L-M&I-84 provides the habitat acreages for the habitat zones described above.

Table L-M&I-84
CAP Allocation Draft EIS
City of Peoria– Habitat Acreages

Vegetation Name	Acres
Developed	26,671
Bursage/Foothills Paloverde	78,562
Velvet Mesquite	1,788
Jojoba/Mixed Scrub	2,110
Scoured, Washes and Creekbeds	1,838
Creosote-Bush	13,917
Blue Paloverde/Desert	2,830
Total	**127,716**



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CAP Allocation Draft EIS
Habitat Zones
City of Peoria

June 2000

Figure No. L-M&I-43

Impacts to Biological Resources

Under the No Action Alternatives, urban growth within the MPA over the 50-year study period would result in loss of an estimated 30,136 acres of Sonoran desertscrub and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. Significant impacts to biological resources from new CAP delivery and treatment facilities are not expected, since most facilities are already in place. Reclamation would continue to work with the City of Peoria regarding any additional biological resource clearances from CAP delivery facilities.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Peoria would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

This City of Peoria MPA is located within Maricopa County for which there are 14 T&E species listed by the USFWS. Potentially suitable habitat only exists for cactus ferruginous pygmy-owl, southwestern willow flycatcher and bald eagle. Approximately 83,181 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the City of Peoria MPA. A nesting pair of bald eagles is known in the upper part of Lake Pleasant within the park boundaries. The foraging area is primarily on the Lake and Agua Fria River upstream from the nest, outside the Peoria MPA. The potential suitable habitat for southwestern willow flycatcher is just below the Waddell Dam within the park boundaries.

4. Water Resources

Demands in the City of Peoria have historically been met by pumping groundwater from the underlying basin fill. In more recent years, CAP water has been used to meet a portion of the demands. Groundwater level declines have been experienced in response to the groundwater development. The concentration of TDS in the underlying groundwater is generally less than 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-85, which shows the estimated groundwater level change for the period of 2001–2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. The City of Peoria falls within two groundwater sub-areas used for the analysis. Table L-M&I-85 shows estimated groundwater conditions in the southeasterly portion of the City of Peoria (adjacent to the City of Glendale) and the northwesterly area (in the vicinity of Sun City West).

Under the No Action Alternative, groundwater levels would decline by about 35 feet during the 2001 to 2051 period in the southeastern part of the city, and groundwater levels

would be essentially unchanged over that period in the northwestern part. Substantial changes in groundwater quality would not be expected under the No Action Alternative. There would be some potential for subsidence in the southeasterly portion of the City of Peoria.

Groundwater levels in the southeastern part of the City of Peoria would also decline under the Settlement and all Non-Settlement Alternatives. The greatest declines occur under the Settlement Alternative and Non-Settlement Alternatives 3A and 3B, which have the smallest amount of direct recharge. There would be potential subsidence in this area under all alternatives.

In the northwesterly part of the City of Peoria, groundwater levels are generally similar to the No Action Alternative (within 14 feet). These groundwater levels are influenced both by the amount of direct recharge of CAP water in adjacent areas, and by changes in the amount of CAP water available to the City of Peoria.

Table L-M&I-85
CAP Allocation Draft EIS Appendix L
City of Peoria–Groundwater Data Table

Alternatives		
	Estimated Groundwater Level Change from 2001-2051 (in feet)	**Groundwater Level Impact**(in feet)**
No Action	-35 / 1	--
Settlement Alternative	-78 / 4	-43 / -4
Non-Settlement Alternative 1	-34 / 12	1 / 11
Non-Settlement Alternative 2	-44 / -5	-9 / -5
Non-Settlement Alternative 3A	-68 / -13	-13 / -14
Non-Settlement Alternative 3B	-65 / 3	-30 / 2

* Values correspond to the Glendale / Peoria and Sun City West sub-areas, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of the City of Peoria's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 8.8 percent of the total year 2051 demand for the City of Peoria.

Table L-M&I-86
CAP Allocation Draft EIS Appendix L
City of Peoria–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a, c]	CAP Allocation
No Action	275 – 280[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	275 – 280[b]	CAGRD
Non-Settlement Alternative 3A	275 – 280[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.
c. Does not include monetary contribution to the GRIC Settlement.

15. City of Phoenix

The City of Phoenix is also known as the Valley of the Sun and is the sixth largest city in the nation. Phoenix, also the center of the rapidly growing Southwest, is the capital of Arizona and the Maricopa County seat. The City of Phoenix has a diversified economic base with manufacturing as a lead employer. The local economy of Phoenix also includes retail trade, electronics, tourism, and the service sector. Climate has been a major factor in economic development as the area experiences sunshine nearly every day of the year. The City of Phoenix MPA is located north of Pecos Road, west of Scottsdale Road, east of 107th Avenue in the southern part and 67th Avenue in the northern part, and south of Carefree Highway.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Phoenix in 1998, 13,398 af of groundwater were pumped and delivered. Water received from other sources included 175,559 af of SRP water and 157,708 af of groundwater from other IDs. Of the total 333,267 af from other sources, 11,138 af were used as backwash to Phoenix canals, leaving a total of 322, 128 af received from other sources. Of the total 335,527 af of water available for use (13,398 + 175,559), 57,858 af were delivered to other users, leaving 277,689 af of water for use in the City of Phoenix MPA.

A. Plans to Take and Use CAP Water

The City of Phoenix currently has a contract for 113,914 af of CAP water. The allocation includes 113,882 af received under the 1983 allocation and an additional 32 af that was transferred from the Berneil Water Company. Under the Settlement Alternative the City of Phoenix would receive an additional 8,206 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-87 outlines the proposed allocations by alternative.

Table L-M&I-87 CAP Allocation Draft EIS City of Phoenix – Proposed CAP Allocation		
Alternative	**Allocation (in afa)**	**Priority**
Settlement Alternative	8,206	M&I
No Action	0	-
Non-Settlement Alternative 1	8,206	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	8,977	NIA
Existing CAP Allocation	113,914	-

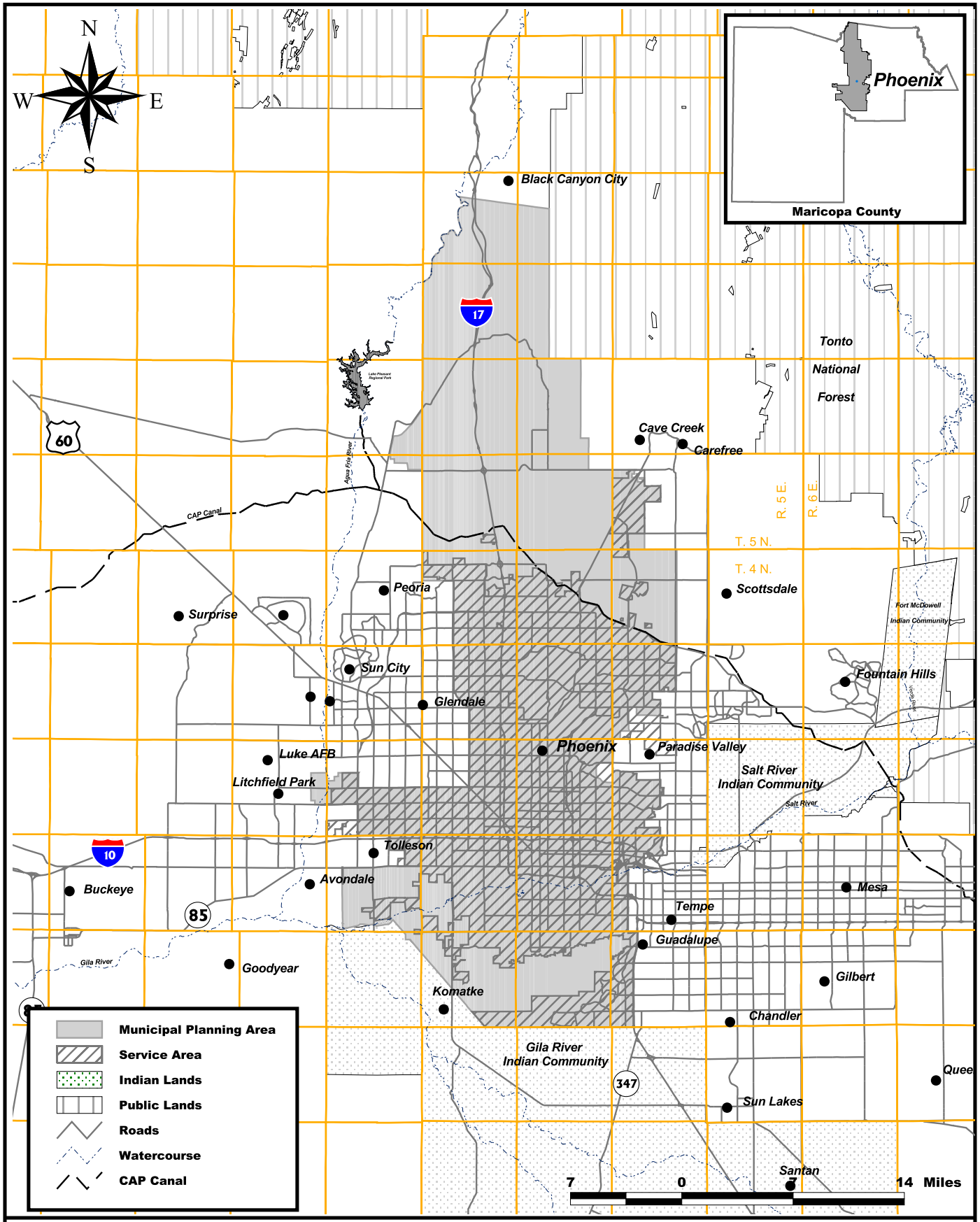
Figure L-M&I-44 shows the service area and planning area for the City of Phoenix. The service area covers approximately 219,714 acres, and the MPA covers approximately 412,750 acres. The City of Phoenix currently has five water treatment plants. The Union Hills plant has a capacity of 179,200 afa and currently receives CAP water. The Val Vista plant has the capacity of 145,600 afa, and currently receives both SRP and CAP water. The Verde plant has the capacity of 56,000 afa, and currently receives SRP water. The Deer Valley plant has the capacity of 168,000 afa, and currently receives both SRP and CAP water. The Squaw Peak plant has a capacity of 156,800 afa and currently receives both SRP and CAP water. Phoenix also is planning to construct the Lake Pleasant Water Treatment Plant, sited on the east side of the Waddell Canal. This plant would treat CAP water and is planned to deliver 89,760 afa, with an ultimate capacity of 359,000 af. While the City of Phoenix could take their existing and proposed CAP allocations through any combination of these water treatment plants, it is most likely that the CAP water would be treated at the Union Hills and Lake Pleasant water treatment plants. The City of Phoenix also is entitled to 80,000 afa of capacity in the GRUSP recharge facility (Larson 2000).

B. Population Projection

In 1985, the population in the City of Phoenix was 307,412. The estimated 2001 population is 1,288,409 and the estimated 2051 population level is 2,548,666.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the City of Phoenix would increase from 291,861 af in year 2001 to 498,722 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-88. Based on anticipated water demands, CAP water which would



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June 2000

CAP Allocation Draft EIS
General Location Map
City of Phoenix

Figure #L-M&I-44

be allocated under the Settlement Alternative would provide three percent and two percent of the current estimated water supply required for the City of Phoenix for the years 2001 and 2051, respectively.

Table L – M&I-88
CAP Allocation Draft EIS Appendix L
City of Phoenix – Projected Water Use

Alternative	Annual CAP Deliveries		Ground-water		Effluent		CAGRD Ground-Water		Other Surface Water		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	101,262	149,345	34,822	34,822	0	41,541	0	16,362	155,776	335,271	291,861	577,341
No Action	101,262	135,282	34,822	34,822	0	41,541	0	30,425	155,776	335,271	291,861	577,341
Non-Settlement Alternative 1	101,262	143,488	34,822	34,822	0	41,541	0	22,219	155,776	335,271	291,861	577,341
Non-Settlement Alternative 2	101,262	135,282	34,822	34,822	0	41,541	0	30,425	155,776	335,271	291,861	577,341
Non-Settlement Alternative 3A	101,262	135,282	34,822	34,822	0	41,541	0	30,425	155,776	335,271	291,861	577,341
Non-Settlement Alternative 3B	101,262	143,488	34,822	34,822	0	41,541	0	22,219	155,776	335,271	291,861	577,341

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 577,341 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 3B, 8,206 afa of demand are met by the additional CAP allocation. Alternatively, this 8,206 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Phoenix MPA in 1995 consisted of approximately 20,928 acres of agriculture, 182,017 acres of developed land, 10,024 acres of rural land, 188,456 acres of vacant land, and 11,325 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e., agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-89 provides the projected acres of land within the City of Phoenix MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-89
CAP Allocation Draft EIS
City of Phoenix – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	22,400	--	148,144	--	242,206	--
	2051	7,948	14,452	72,156	75,988	332,646	90,440
No Action	2001	22,400	--	148,144	--	242,206	--
	2051	7,948	14,452	72,156	75,988	332,646	90,440
Non-Settlement Alternative 1	2001	22,400	--	148,144	--	242,206	--
	2051	7,948	14,452	72,156	75,988	332,646	90,440
Non-Settlement Alternative 2	2001	22,400	--	148,144	--	242,206	--
	2051	7,948	14,452	72,156	75,988	332,646	90,440
Non-Settlement Alternative 3A	2001	22,400	--	148,144	--	242,206	--
	2051	7,948	14,452	72,156	75,988	332,646	90,440
Non-Settlement Alternative 3B	2001	22,400	--	148,144	--	242,206	--
	2051	7,948	14,452	72,156	75,988	332,646	90,440

2. Archaeological Resources

Numerous surveys have occurred within the City of Phoenix MPA; however, much remains unexamined. Prehistorically, it was part of the Hohokam “core” area; identified loci of high and moderate cultural resource sensitivity—which extend onto the Cave Creek and the New River Dam Archaeological Districts, among others—reflect only a fraction of the City of Phoenix MPA’s prehistoric occupation density. Many of the large agricultural village sites located in the MPA (e.g., Pueblo Grande, Pueblo del Rio, Villa Buena, Las

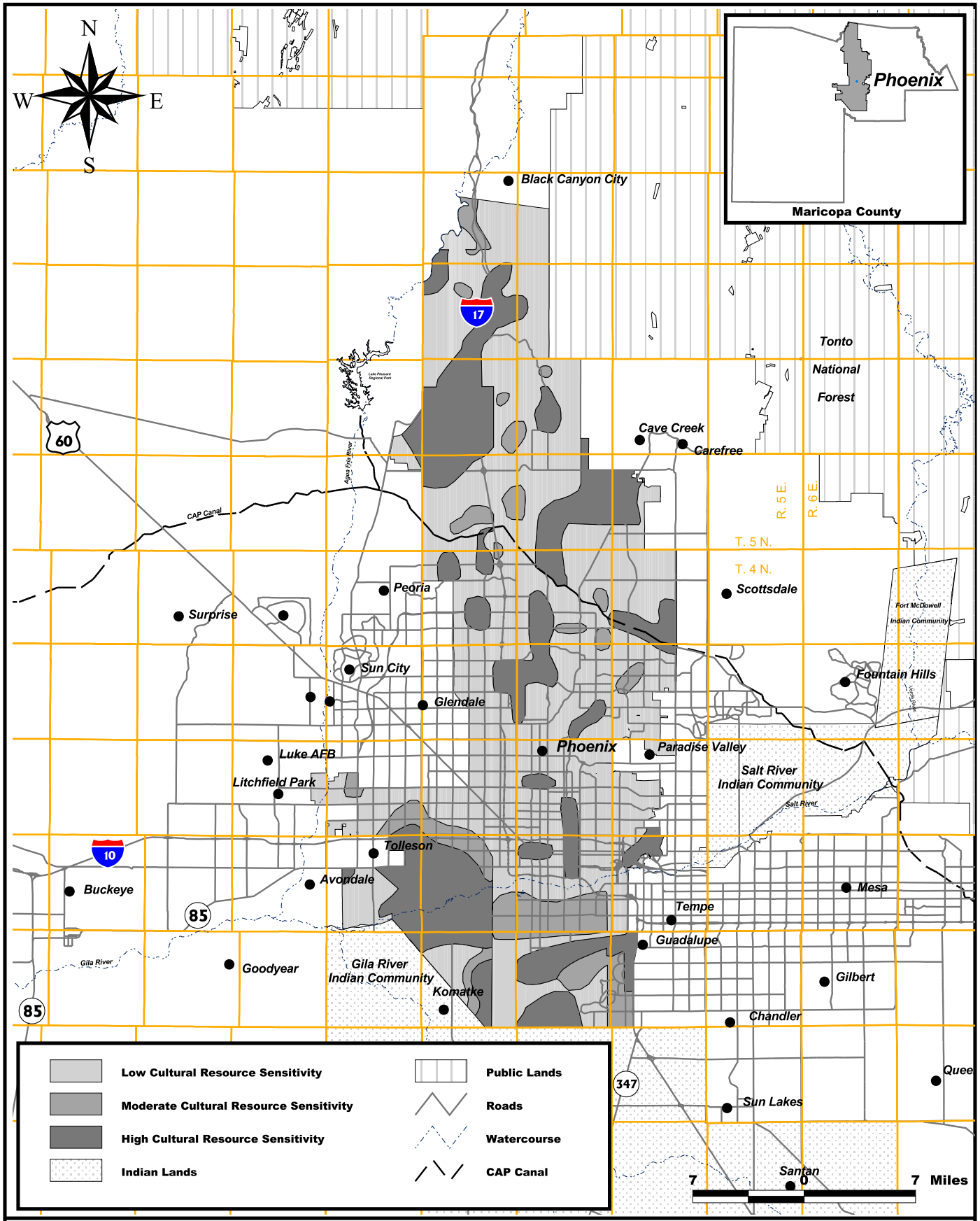
Canopas, Pueblo del Alamo, the Patrick Site, Dutch Canal Ruins, La Ciudad, Tres Aguas) were originally recorded in the late 1800s and the early 1900s by pioneers of Arizona archaeology such as Frank Cushing and Omar Turney; few surface remains are extant today. However, because the boundaries were carefully mapped and the material remains meticulously described the projected location of buried features can be estimated. Significant, intact subsurface cultural deposits are possible even in areas where all surface integrity has been destroyed by agriculture, urbanization, or other ground-disturbing activities (e.g., Aguila et al. 1999). As might be expected, the area's known prehistoric site types include material remains associated with a primarily agricultural economy (e.g., canals, rock features, ground stone artifacts, and specialized items such as tabular knives). Other items, including shell, turquoise, obsidian, and artifacts of Mesoamerican influence—such as palettes and copper bells—reflect the core area's participation in the Hohokam exchange system. Human remains both inhumations and cremations, are likely in the vicinity of the major sites. Protohistoric Pima sites also might be expected, although some deposits, particularly agricultural sites and features, might be indistinguishable from those of the Hohokam. Historic resources reflect the area's rich and complex heritage, and include sites associated with early Mexican, Anglo, and Mormon settlements, irrigated agriculture, transportation, and commerce.

Cultural resource sensitivity areas in the City of Phoenix MPA are shown on Figure L-M&I-45. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the City of Phoenix MPA is high to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. The construction of the new Lake Pleasant Water Treatment Plant could impact previously unidentified cultural resources. If cultural resource surveys have not been carried out by the City of Phoenix, Reclamation would require such clearances as part of the CAP contracting process.

3. Biological Resources

Existing Habitats

The northern portion of the City of Phoenix MPA is a mosaic of soil types on a complex of hills, mesas, low mountain slopes, and associated drainages (below 3,300-foot elevation). Jojoba/mixed Scrub Association occurs in the higher hills, especially on north-facing slopes. Co-dominants include foothill paloverde, barrel cactus, brittlebush, wild-buckwheat, and turpentine-bush. Allthorn-Creosote Bush Association occurs on white sedimentary soil in this area where co-dominants include staghorn cholla and little-leaved krameria, and with soil indicator species such as tiquilia and Arizona buckwheat. Bursage-Foothill Paloverde Association occurs on igneous soils of the gentler, more south-facing



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Cultural Resources
City of Phoenix

Figure #L-M&I-45

slopes and on gravelly soils of the lower plains. Co-dominants include creosote-bush and staghorn cholla. Other common trees include velvet mesquite, desert ironwood, blue paloverde, and saguaro. Saguaro density is moderate. Silty plains within the southern portions of the MPA are dominated by Creosote-bush Association. Blue Paloverde/Desert Ironwood Association habitat occurs along major ephemeral washes. The habitat zones are shown on Figure L-M&I-46. Table L-M&I-90 provides the habitat acreages for the habitat zones described above.

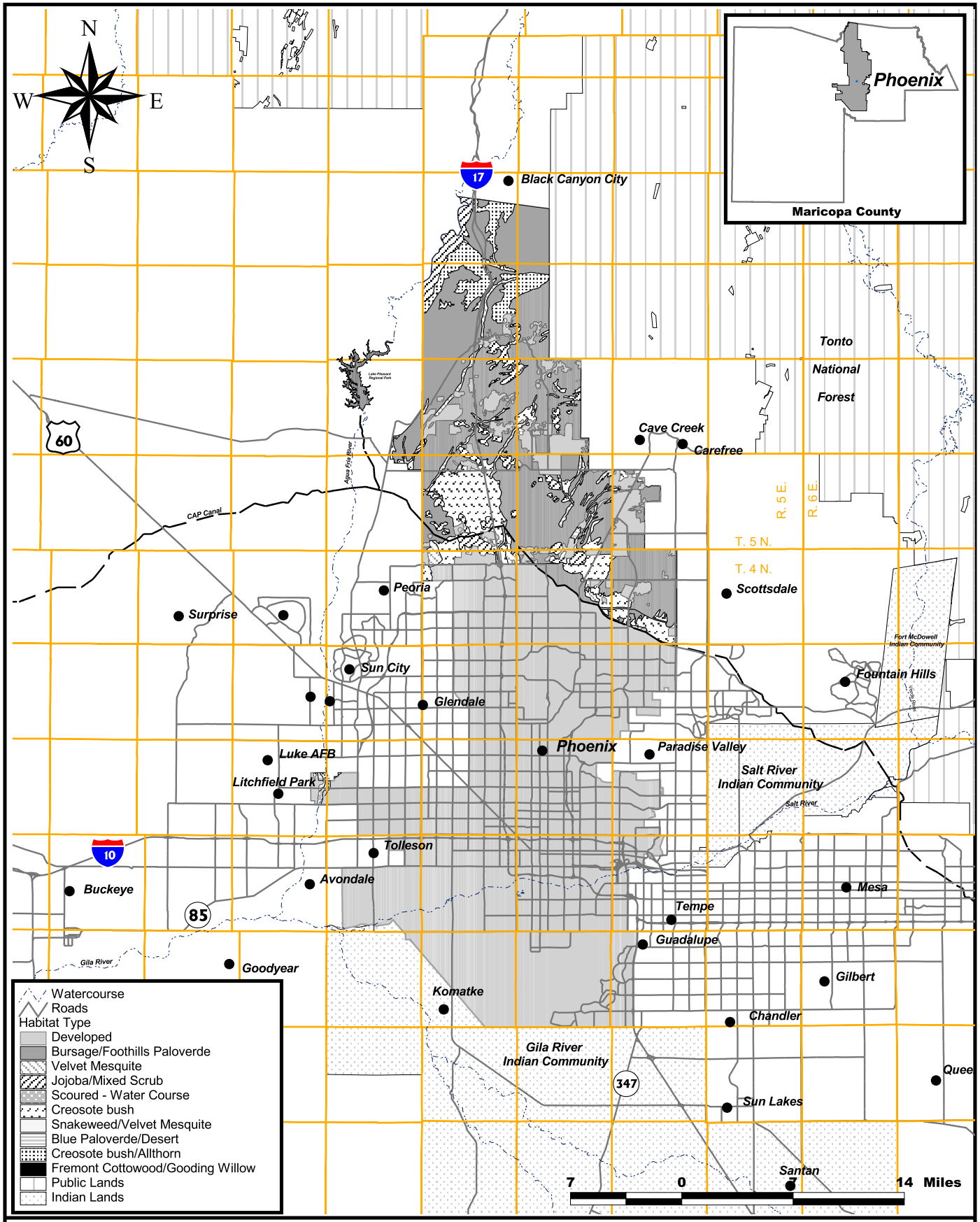
Table L-M&I-90
CAP Allocation Draft EIS
City of Phoenix– Habitat Acreages

Vegetation Name	Acres
Developed	264,606
Bursage/Foothills Paloverde	100,202
Velvet Mesquite	3,023
Jojoba/Mixed Scrub	11,181
Scoured, Washes and Creekbeds	321
Creosote Bush	19,260
Blue Paloverde/Desert	4,435
Creosote Bush	9,722
Total	**412,750**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Phoenix MPA over the 50-year study period would result in loss of an estimated 75,988 acres of Sonoran desertscrub and associated wildlife resources. There may be indirect impacts on wildlife occurring in adjacent undeveloped habitat. An estimated 14,452 acres of farmland would be urbanized. This urbanization of the farmland would result in the creation of fallow fields for some undetermined length of time. Fallow agricultural fields in the area may be used by burrowing owls, a species protected under the MBTA. Individual developers who convert fallow lands for urban uses would be responsible for ensuring burrowing owls are removed prior to development. Failure to do so would be considered a violation of the MBTA. With regard to biological resources, there is no difference in impacts among the five alternatives. Under the action alternatives, there is no difference in impacts from the No Action baseline. With regard to new facilities to take or treat the additional CAP allocation, the City of Phoenix is planning to construct a new treatment plant for CAP water on the east side of Waddell Canal, near Lake Pleasant. The construction of this facility could impact approximately 50 acres of desert habitat. Reclamation would carry out additional environmental review based upon specific plans prior to construction.

Potential T&E Species and Acres of Potential T&E Species Habitat



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Habitat Zones
City of Phoenix

Figure No. L-M&I-46

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Phoenix would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The City of Phoenix MPA is located within Maricopa County for which there are 14 T&E species listed by the USFWS. Potentially suitable habitat only exists for cactus ferruginous pygmy-owl, southwestern willow flycatcher, Arizona cliffrose and Arizona agave. Approximately 107,660 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the Phoenix MPA. Also, approximately 207 acres above 3,000 feet of potentially suitable habitat for Arizona agave and approximately 4,435 acres of potentially suitable habitat for Arizona cliffrose were identified. Potential suitable habitat for southwestern willow flycatcher may occur in isolated pockets along the New River or Aqua Fria River. However, construction within riparian corridors would require issuance of CWA Section 404 permits by the Corps. As part of the permitting process, the Corps would have to comply with Section 7 of the ESA, and detailed surveys for T&E species would be carried out as necessary.

4. Water Resources

Demands in the City of Phoenix have historically been met with groundwater and with Salt River water for areas within the SRP service area. The city covers an extensive geographic area, and groundwater conditions can vary significantly between those areas. In some areas, groundwater levels have dropped substantially in response to groundwater pumping, while in other areas groundwater levels have remained relatively stable. Subsidence has been experienced in those areas with substantial drops in groundwater levels. Similarly, groundwater quality can vary substantially, with concentrations of TDS ranging from less than 500 to more than 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-91, which shows the estimated groundwater level change for the period from 2001 to 2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. The City of Phoenix falls within five groundwater sub-areas used for the analysis. Table L-M&I-91 shows estimated groundwater conditions first in the northern part of the East SRV, and then in the northeastern, northwestern, southeastern, and southwestern parts of the West SRV.

Under the No Action Alternative, groundwater levels would decline in all of the areas of Phoenix considered over the 2001 to 2051 period. These declines result from continued reliance on groundwater to meet demands, both in the City of Phoenix and in adjacent entities. These declines are relatively large (more than 100 feet) in the East SRV and in the

portion of the city in the eastern part of the West SRV. Smaller declines (less than 100 feet) occur in the portion of the city in the western part of the West SRV. The smaller decline in these areas reflects the impacts of recharge in the Salt and Gila Rivers and recharge of CAP water in the Agua Fria Recharge Project. Under the No Action Alternative, there could be reduction in the quality of groundwater due to the northerly movement of relatively poor quality water beneath the Salt and Gila Rivers to the north. There would also be the potential for subsidence throughout the city.

Groundwater levels would also decline over the 2001 to 2051 period throughout the City of Phoenix under the Settlement Alternative and all Non-Settlement Alternatives. In general, the groundwater levels would be similar to (within 10 feet) the groundwater levels under the No Action Alternative. The exception would be for those parts of Phoenix in the more northerly parts of the West SRV. Groundwater levels in those areas would be deeper than under the No Action Alternative (particularly for the Settlement Alternative and Non-Settlement Alternatives 3A and 3B) in large part due to reductions in the volume of direct recharge of CAP water in the Agua Fria Recharge Project. Water quality and subsidence for the Settlement and Non-Settlement Alternatives would be similar to the No Action Alternative.

Table L-M&I-91
CAP Allocation Draft EIS
City of Phoenix–Groundwater Data Table

Alternative		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-147 / -295 / -35 / -160 / -11	--
Settlement Alternative	-141 / -313 / -78 / -165 / -20	6 / -18 / -43 / -5 / -10
Non-Settlement Alternative 1	-145 / -307 / -34 / -165 / -14	2 / -11 / 1 / -51 / -3
Non-Settlement Alternative 2	-147 / -297 / -44 / -160 / -12	0 / -2 / -9 / 0 / -1
Non-Settlement Alternative 3A	-148 / -302 / -68 / -162 / -16	-1 / -6 / -33 / -2 / -5
Non-Settlement Alternative 3B	-147 / -313 / -65 / -167 / -19	0 / -18 / -30 / -7 / -9

*****Values correspond to the Scottsdale North, Phoenix North, Glendale / Peoria, Phoenix South, and Phoenix Southwest sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of the City of Phoenix's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 1.6 percent of the total year 2051 demand for the City of Phoenix.

Table L-M&I-92
CAP Allocation Draft EIS
City of Phoenix –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a,c]	CAP Allocation
No Action	295 – 301[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	295 – 301[b]	CAGRD
Non-Settlement Alternative 3A	295 – 301[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.
c. Does not include monetary contribution to the GRIC Settlement.

19. City of Tucson

The City of Tucson is Arizona's oldest city with a unique blend of Indian, Spanish, Mexican and Anglo heritages. The city is the second largest in the state and is also the Pima County seat. Tucson is a modern city with high-tech industries and world-class cultural events, yet it retains the charm of its desert frontier roots. The main components of Tucson's employment base include the government service sector (i.e., Federal, State and local governments) and the University of Arizona. Manufacturing also plays a major role in the economy, as manufacturing employment has more than doubled in the last 10 years. The Tucson MPA is located throughout the greater Tucson area and includes large areas south and west of downtown Tucson.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Tucson in 1998, 83,766 af of groundwater were pumped and delivered. In addition, 27,490 af of groundwater were from other sources and 202 af of CAP water were received. From the total 111,459 af of water received, 455 af were delivered to other users. The remaining 111,004 af were delivered for use within the City of Tucson.

A. Plans to Take and Use CAP Water

The City of Tucson currently has a subcontract for 138,920 af of CAP water. In 1983, Tucson received an allocation of 151,064 af, 2,644 af of that allocation were transferred to Ranch Lands (then Spanish Trails) before the contract was offered. Also, 642 af were transferred to Oro Valley and 8,858 af were transferred to MDWID. Under the Settlement Alternative, the City of Tucson would receive an additional 8,206 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-111 outlines the proposed CAP allocation by alternative.

Table L-M&I-111
CAP Allocation Draft EIS
City of Tucson– Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	8,206	M&I
No Action	0	--
Non-Settlement Alternative 1	8,206	M&I
Non-Settlement Alternative 2	0	--
Non-Settlement Alternative 3A	0	--
Non-Settlement Alternative 3B	8,977	NIA
Existing CAP Allocation	138,920	--

Figure L-M&I-56 shows the service area and MPA for the City of Tucson. The MPA covers approximately 779,846 acres. The City of Tucson's plans to take and use CAP water are constrained by Proposition 200 Water Consumer Protection Act (WCPA), which passed in 1995 and restricts direct deliveries of CAP water. Currently, Tucson is participating in several recharge facilities including the Central Avra Valley Storage and Recovery Project (CAVSRP), the Pima Mine Road Recharge Facility, and indirect facilities (CMID, Bing K. Wong Farms, and Kai Farms). The City of Tucson constructed the CAP Treatment plant, which has a capacity of 168,300 afa; however the WCPA precludes the use of this treatment plant.

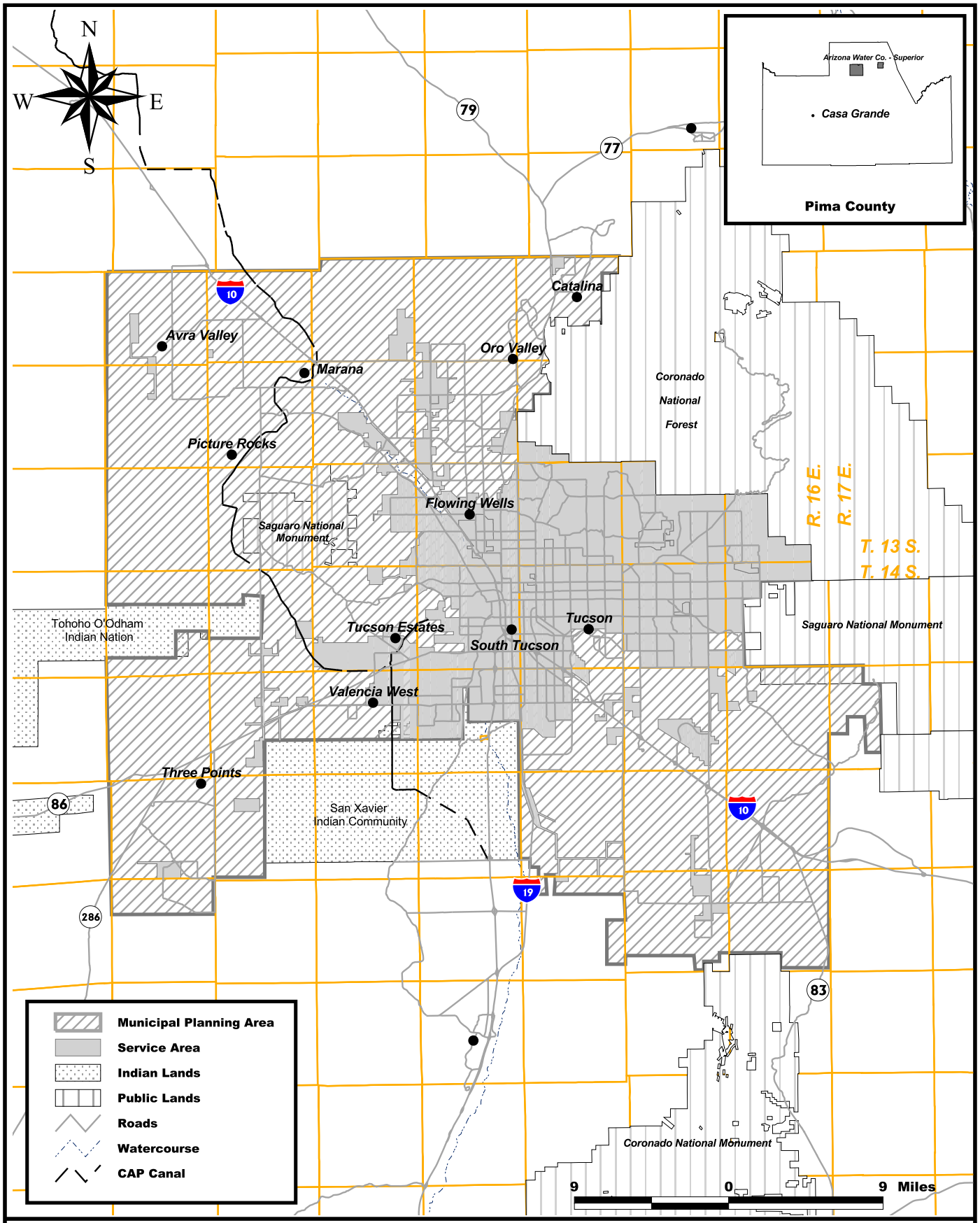
The City of Tucson is using an increasing amount of its CAP allocation for recharge and recovery as a short-term solution. Tucson has not determined how it would ultimately use its full allotment in the long term. Tucson continues to explore options for direct delivery, including a recent pilot study in cooperation with Reclamation on membrane filtration. In November 1999, voters defeated a proposition, which would have increased restrictions on CAP water use originally established by the WCPA. The majority of the restrictions from the 1995 Act would expire in November 2000. The CAVSRP, currently under construction (recharge basins and recovery facilities, wells and pipeline), would begin delivery of CAP water in early 2001 (Johnson 2000).

B. Population Projection

The population in the City of Tucson in 1985 was 531,230. The estimated 2001 population is 644,223, and the estimated 2051 population level is 1,128,535.

C. Water Demand and Supply Quantities

As previously shown in Appendix C – M&I Sector Water Uses, it is estimated that water demand in the City of Tucson would increase from 110,415af in year 2001 to 193,423af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-112. Based on anticipated water demands, water which would be allocated under the Settlement Alternative, would provide seven percent and four percent of the current estimated water supply required for the City of Tucson for the years 2001 and 2051, respectively.



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CAP Allocation Draft EIS
General Location Map
City of Tucson

June 2000

Figure #L-M&I-56

Table L-M&I-112
CAP Allocation Draft EIS
City of Tucson– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	147,126	110,415	44,733	0	0	0	1,564	110,415	193,423
No Action	0	138,920	110,415	44,733	0	0	0	9,770	110,415	193,423
Non-Settlement Alternative 1	0	147,126	110,415	44,733	0	0	0	1,564	110,415	193,423
Non-Settlement Alternative 2	0	138,920	110,415	44,733	0	0	0	9,770	110,415	193,423
Non-Settlement Alternative 3A	0	138,920	110,415	44,733	0	0	0	9,770	110,415	193,423
Non-Settlement Alternative 3B	0	147,126	110,415	44,733	0	0	0	1,564	110,415	193,423

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 193,423 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 8,206 afa of demand are met by the additional CAP allocation. Alternatively, this 8,206 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the City of Tucson were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-113 provides the projected acres of land within the City of Tucson MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

Table L-M&I-113
CAP Allocation Draft EIS
City of Tucson – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
No Action	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 1	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 2	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 3A	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990
Non-Settlement Alternative 3B	2001	11,000	--	535,313	--	233,533	--
	2051	4,464	6,536	486,859	48,454	288,523	54,990

2. Archaeological Resources

Both linear (e.g., Hammack 1983; Rieder and Myers 1996; Slawson 1993; Stephen 1988) and block (e.g., Rozen 1985; Simpson and Wells 1984; Slawson 1994) surveys have yielded sites within this entity's boundaries. Areas of high and moderate cultural resource sensitivity are located primarily at lower elevations along the area's major drainages (e.g., the Santa Cruz Riverpark Archaeological District, a National Register property). Known prehistoric resource types include numerous aceramic artifact and fire-cracked rock concentrations of possible Archaic affiliation, as well as Hohokam sites ranging from small sherd and lithic scatters, to extensive agricultural systems (e.g., AZ BB:14:32(ASM)), to large villages with multiple house clusters, (e.g., the West Branch site, the Valencia Site, Julian Wash, St. Mary's, Punta de Agua, Los Morteros). At higher elevations, camp sites, trails, petroglyphs, and resource procurement and processing sites are common. Although no sites have been reported in the southwesternmost portion of this entity, this area borders the Gunsight Mountain Archaeological District, a National Register property which includes more than 40 sites; similar site types might be expected. Likewise, areas of low cultural resource sensitivity in the east and northeast portions of the entity are surrounded by areas of high site density (e.g., the Saguaro Wilderness area, Colossal Cave County Park, the Sutherland Wash Archaeological District, and the Rincon Foothills Archaeological District, all National Register properties). Protohistoric Pima, Papago, and Yaqui sites also are known; the entity's proximity to the Tohono O'odham (TON) and Pascua Yaqui Reservations suggests similar sites might be expected to occur in unsurveyed areas.

Historic resources include properties from the area's early Native American, Spanish, Mexican, and Anglo occupations (e.g., San Xavier Mission, Agua Caliente Ranch) and represent every identified historic context, including farming, ranching, mining, commerce, and transportation. The nature of the depositional environment, particularly along the Santa Cruz River floodplain and lower terraces, indicates the potential for buried cultural deposits is high; finds in the nearby Schuk Toak Archaeological District include paleontological remains dating to the Pleistocene, raising the possibility that Paleoindian sites might be present within the entity.

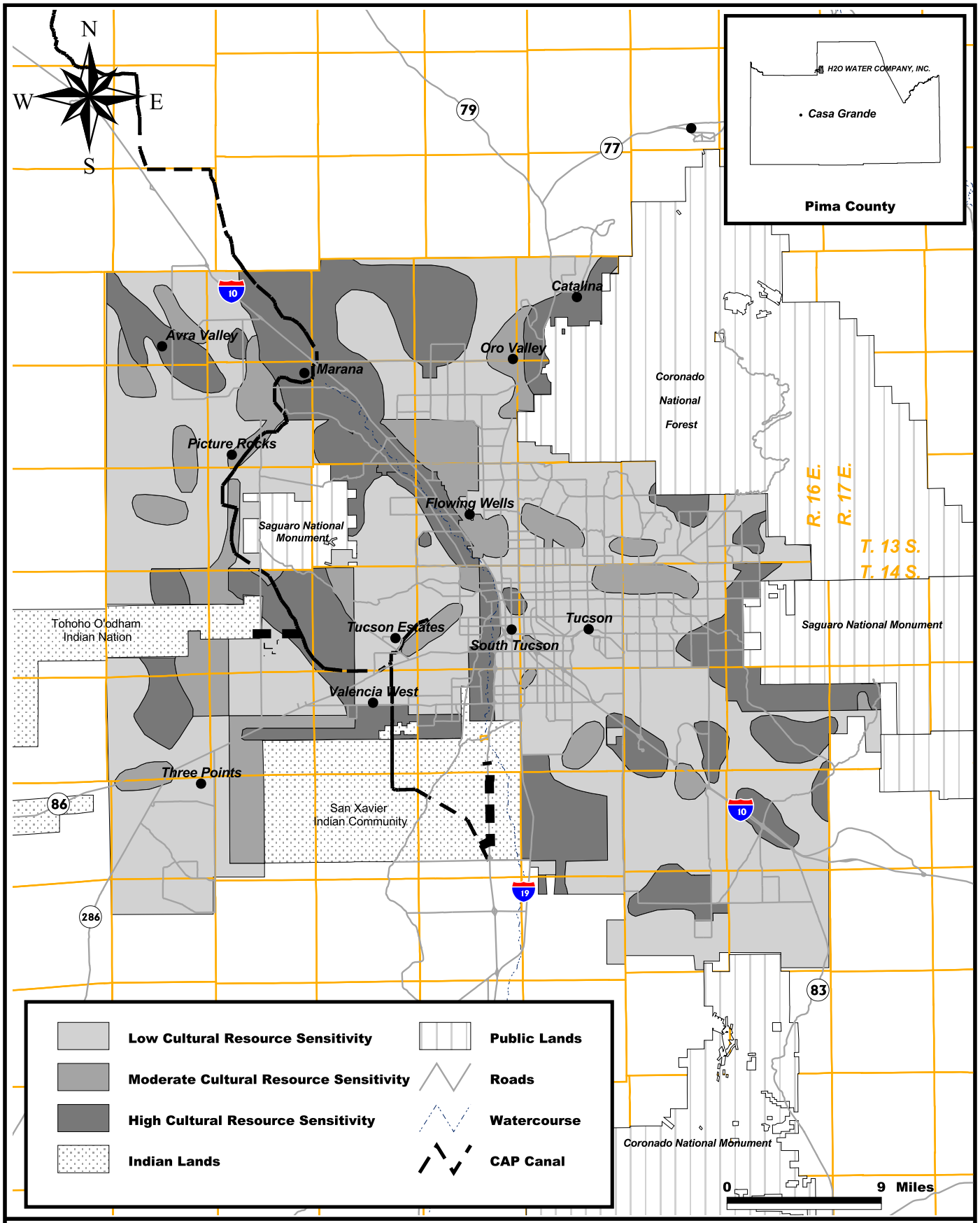
Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-57. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. It does not appear that Tucson would require additional CAP delivery or treatment facilities to handle the additional allocation. Thus no additional impacts to cultural resources are expected from the construction of such facilities. However, Tucson's long-term plans are uncertain, as described above. Once Tucson determines its final plans for taking the additional CAP allocation, Reclamation would determine whether additional cultural resource compliance is required.

3. Biological Resources

Existing Habitats

The large area within the boundaries of the City of Tucson MPA includes portions of the Tortolita Mountains (to 4,000-foot elevation) and the Tucson Mountains. Alluvial fans spread outward from rocky ridges and hillsides and onto silty plains. Jojoba/Mixed Scrub Association occurs on steeper slopes and varies greatly in its composition of species. Overall it is dominated by wormwood, slender janusia, jojoba, bedstraw, and Wright's lippia. Trees include blue-paloverde, foothill paloverde, and velvet mesquite. Saguaro density varies from sparse on north-facing slopes to dense on south-facing slopes.

Bursage/Foothill Paloverde Association occurs on more gentle slopes and represents most of the natural habitat recorded for the City of Tucson MPA. Co-dominants include creosote-bush, buckhorn cholla, brown-spined prickly pear, chain-fruit cholla, and Engelmann prickly pear. Other common trees include blue-paloverde, desert ironwood, and velvet mesquite. For the most part, the density of saguaros is high. Creosote-Bush Association composes a large portion of the silty alluvial soils. The frequency of creosote-bush is very high with co-dominants including bursage, burrobush, and whitestem paperflower. Trees present are foothill paloverde, desert ironwood and velvet mesquite. The density of saguaros is low. Disclimax Grassland Association occurs mainly in the



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CAP Allocation Draft EIS
Cultural Resources
City of Tucson

June 2000

Figure #L-M&I-57

southeastern portion of the planning area and is dominated by brown-spined prickly pear and several grass species. Co-dominants include velvet mesquite, soaptree yucca, whitestem paperflower, chain-fruit cholla, white-thorn acacia, and buckhorn cholla. Blue-paloverde and foothill paloverde are also present. Saguaro density is low. Velvet Mesquite Association occurs along broad drainages and within some flood plains where the frequency of velvet mesquite is very high. Co-dominants are Fremont wolfberry and creosote-bush. Saguaro density is low. The habitat zones are shown on Figure L-M&I-58. Table L-M&I-114 provides the habitat acreages for the habitat zones described above.

TableL-M&I-114
CAP Allocation Draft EIS
City of Tucson MPA– Habitat Acreages

Vegetation Name	Acres
Developed	244,533
Bursage / Foothills Paloverde	213,308
Velvet Mesquite	20,250
Jojoba / Mixed Scrub	14,466
Scoured, Washes, and Creeks	11,306
Creosote-Bush	207,314
Snakeweed / Velvet Mesquite	68,669
Total	**779,846**

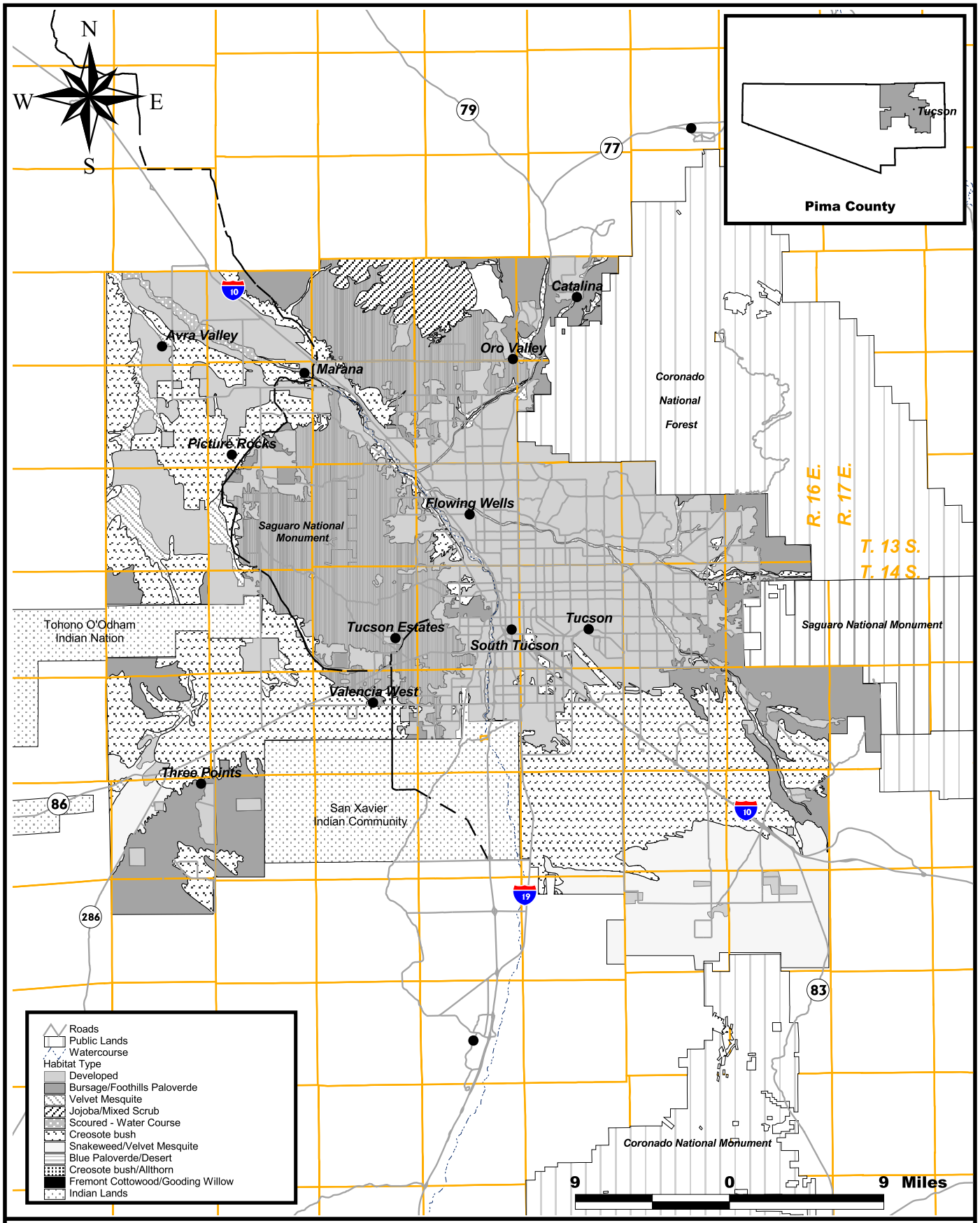
Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Tucson MPA over the 50-year study period would result in loss of an estimated 48,454 acres of Sonoran desertscrub and associated wildlife resources. There may also be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. Under the action alternatives, there is no difference in impacts from the No Action baseline. Construction of additional CAP treatment or delivery facilities does not appear likely at this time. Based on Tucson's final plans for taking the additional allocation, Reclamation would determine if additional environmental review is needed.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Tucson would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The City of Tucson MPA is located within Pima County for which there are 16 T&E species listed by USFWS. Potentially suitable habitat only exists for cactus ferruginous pygmy-owl and the Pima pineapple cactus. There is no designated critical habitat for the Pima pineapple cactus and approximately 441 acres of potentially suitable habitat were identified. Also, approximately 233,558 acres of potentially suitable habitat for the cactus



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CAP Allocation Draft EIS
Habitat Zones
City of Tucson

June 2000

Figure No. L-M&I-58

ferruginous pygmy-owl were identified within the Tucson MPA. While there is no designated critical habitat for the Nichol's Turk's Head cactus, 100 acres of potentially suitable habitat were identified.

4. Water Resources

While the City has an extensive service area, most of the historical demands and groundwater pumping have occurred in a much more limited metropolitan area, generally located between the Tucson and Rincon Mountains. The demands in that metropolitan area have historically been met primarily by pumping groundwater from the underlying sedimentary rocks. This reliance on groundwater has resulted in declining groundwater levels over time, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally less than 1,000 ppm, although there are pockets of groundwater with TDS in the range of 1,000 to 3,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-115, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Groundwater conditions were estimated in the analysis for both the eastern and western part of the Tucson metropolitan area. Another area of particular interest for the City of Tucson is the well field in the southern part of Avra Valley. Three values are presented in Table L-M&I-109 for each alternative, representing groundwater levels for (in order) the western part of the Tucson metropolitan area, the eastern part of the Tucson metropolitan area, and the southern part of Avra Valley.

Under the No Action Alternative, groundwater levels would rise about 10 feet in the western metropolitan area and decline about 53 feet in the eastern metropolitan area. Those changes reflect both the direct use of a portion of Tucson's CAP water and the direct recharge of a portion of the available CAP water in the Santa Cruz Managed Recharge Project in the western metropolitan area. Groundwater levels would decline by about 153 feet in South Avra Valley, primarily in response to groundwater pumping by the City of Tucson well field in South Avra Valley. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels in the eastern metropolitan area and particularly in the South Avra Valley.

Groundwater levels would be improved relative to the No Action Alternative in the Tucson metropolitan area under all of the action alternatives. Those improvements are largest for the Settlement Alternative and Non-Settlement Alternatives 1 and 3B, in which the City of Tucson would receive an additional allocation of CAP water. For Non-Settlement Alternatives 2 and 3A, the City of Tucson would not receive an additional

allocation of CAP water, and the groundwater levels would be similar to the No Action Alternative. The slight improvement in groundwater levels under those alternatives primarily results from changes in underflow due to higher groundwater levels south of the Tucson metropolitan area due to direct recharge.

In the South Avra Valley area, groundwater levels would only be slightly higher than under the No Action Alternative. The small improvements in groundwater levels would reflect impacts related to delivery of CAP water to the nearby Schuk Toak District of the Tohono O'odham Nation.

Substantial changes in groundwater quality would not be anticipated for any of the alternatives. There would be some potential for improvement of groundwater quality along the Santa Cruz River in the metropolitan Tucson area, due to direct recharge of CAP water which has better quality than some of the underlying groundwater. There would be the potential for subsidence under all alternatives in the eastern metropolitan area, and particularly in the South Avra Valley area.

Table L-M&I-115
CAP Allocation Draft EIS
City of Tucson –Groundwater Data Table

Alternative	**Tucson East***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	10 / -53 / -153	--
Settlement Alternative	52 / -27 / -149	42 / 26 / 4
Non-Settlement Alternative 1	39 / -30 / -153	30 / 23 / 0
Non-Settlement Alternative 2	20 / -50 / -150	11 / 3 / 3
Non-Settlement Alternative 3A	20 / -50 / -150	11 / 3 / 3
Non-Settlement Alternative 3B	50 / -27 / -150	41 / 26 / 3

***Values correspond to the Tucson West, Tucson East, and South Avra Valley sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. It should be noted that the increment of demand

met by the proposed CAP allocation is approximately 4.2 percent of the total year 2051 demand for the City of Tucson.

Table L-M&I-116
CAP Allocation Draft EIS
City of Tucson –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	234[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	234[b]	CAGRD
Non-Settlement Alternative 3A	234[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

6. Community Water Company of Green Valley

The Community Water Company of Green Valley provides water for the service area designated as Green Valley South, which includes a service area of approximately eight square miles. The service area is located in the Santa Cruz River Valley approximately 25 miles south of the City of Tucson. According to the ADWR Annual Water Withdrawal and Use Report, in the Community Water Company of Green Valley service area in 1998, a total of 2,243 af of groundwater were pumped and delivered.

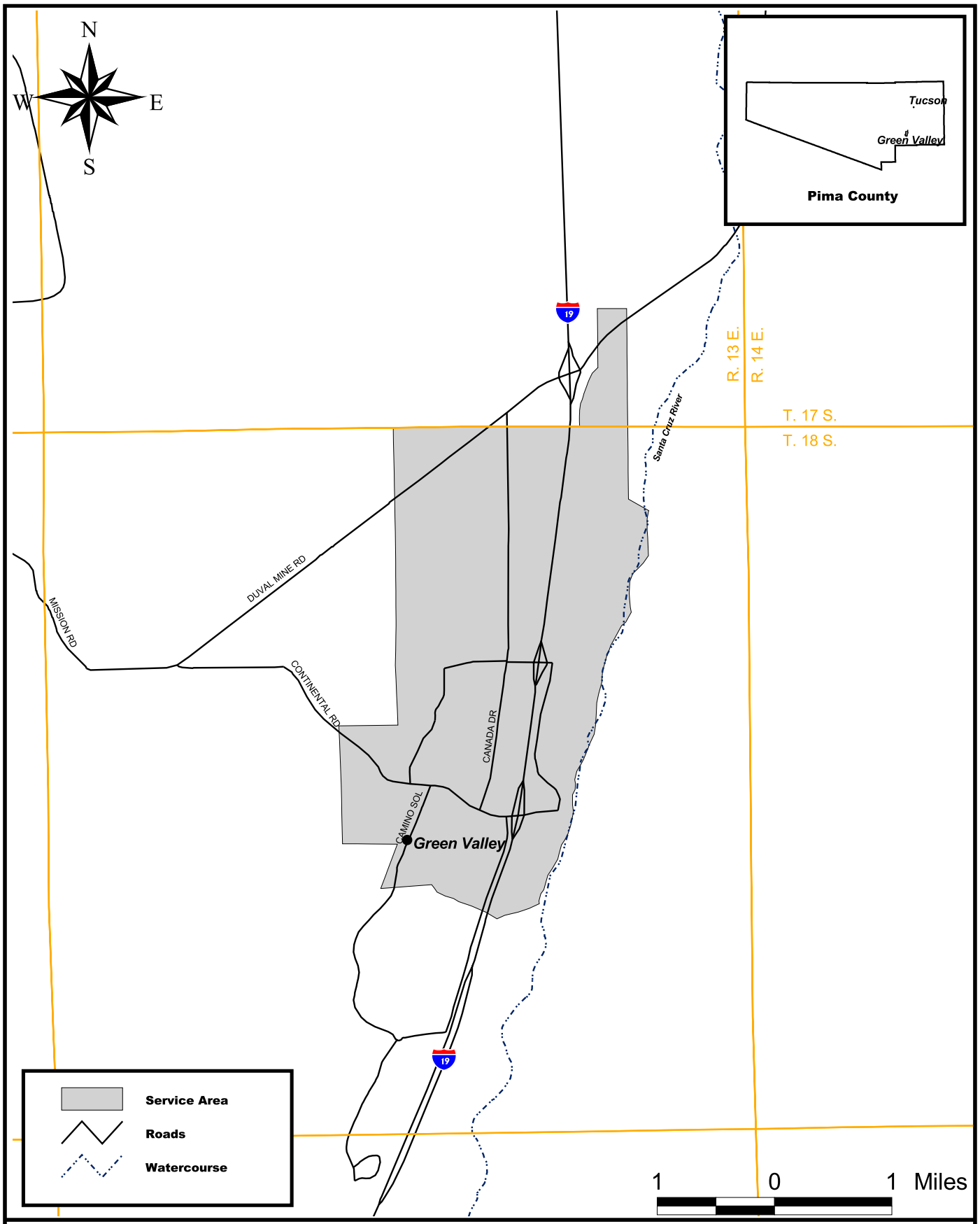
A. Plans to Take and Use CAP Water

The Community Water Company of Green Valley currently has a subcontract for 1,337 af of CAP water. This total includes 1,100 af allocated as part of the 1983 ROD and 237 af that were transferred from the New Pueblo Water Company. Green Valley is not currently taking and using its allocation. Under the Settlement Alternative, the Community Water Company of Green Valley would receive an additional 1,512 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-33 outlines the proposed allocations by alternative.

Table L-M&I-33
CAP Allocation Draft EIS
Community Water Company of Green Valley – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	1,512	M&I
No Action	0	-
Non-Settlement Alternative 1	1,512	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	1,664	NIA
Existing CAP Allocation	1,337	-

Figure L-M&I-17 shows the service area for the Community Water Company of Green Valley, which covers approximately 5,113 acres. The Community of Green Valley is located approximately nine miles from the CAP terminus, and currently has no connection to the CAP system. Green Valley is working with other entities to extend the CAP system down to the Green Valley area, but do not currently have the funding in place to do so. Agricultural users in the area have also expressed an interest in extending the CAP system into the area. The Community of Green Valley anticipates using the CAP allocation for direct or in-lieu recharge and would continue to pump groundwater to meet its municipal demands. Direct recharge could occur at the Pima Mine Road recharge facility (Forrest 2000).



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CAP Allocation Draft EIS
General Location Map
Community Water Company of Green Valley

June 2000

Figure #L-M&I-17

B. Population Projection

The population in 1985 for the Community Water Company of Green Valley service area was 1,637. The estimated 2001 population level is 14,290 and the estimated 2051 population level is 28,275.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the service area of the Community Water Company of Green Valley would increase from 2,244 af in year 2001 to 4,439 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-34. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative, would provide 67 percent and 34 percent of the current estimated water supply required for the Community Water Company of Green Valley service area for the years 2001 and 2051, respectively.

Table L-M&I-34
CAP Allocation Draft EIS
Community Water Company of Green Valley– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	2,858	2,244	0	0	0	0	1,581	2,244	4,439
No Action	0	1,337	1,337	0	0	0	907	3,102	2,244	4,439
Non-Settlement Alternative 1	0	2,858	2,244	0	0	0	0	1,581	2,244	4,439
Non-Settlement Alternative 2	0	1,337	1,337	0	0	0	907	3,102	2,244	4,439
Non-Settlement Alternative 3A	0	1,337	1,337	0	0	0	907	3,102	2,244	4,439
Non-Settlement Alternative 3B	0	2,858	2,244	0	0	0	0	1,581	2,244	4,439

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 4,439 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 1,512 afa of demand is met by the additional CAP allocation. Alternatively, this 1,512 afa of demand is met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from the construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the Community Water Company of Green Valley were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-35 provides the projected acres of land within the Community Water Company of Green Valley service area which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-35
CAP Allocation Draft EIS Community Water Company of Green Valley– Projected Land Use Changes Within the Service Area
(in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	0	--	1,130	--	3,983	--
	2051	0	0	0	1,130	5,113	1,130
No Action	2001	0	--	1,130	--	3,983	--
	2051	0	0	0	1,130	5,113	1,130
Non-Settlement Alternative 1	2001	0	--	1,130	--	3,983	--
	2051	0	0	0	1,130	5,113	1,130
Non-Settlement Alternative 2	2001	0	--	1,130	--	3,983	--
	2051	0	0	0	1,130	5,113	1,130
Non-Settlement Alternative 3A	2001	0	--	1,130	--	3,983	--
	2051	0	0	0	1,130	5,113	1,130
Non-Settlement Alternative 3B	2001	0	--	1,130	--	3,983	--
	2051	0	0	0	1,130	5,113	1,130

2. Archaeological Resources

A few block surveys have occurred within the northern half of the service area; the remainder of the service area was sparsely surveyed, primarily by linear projects along

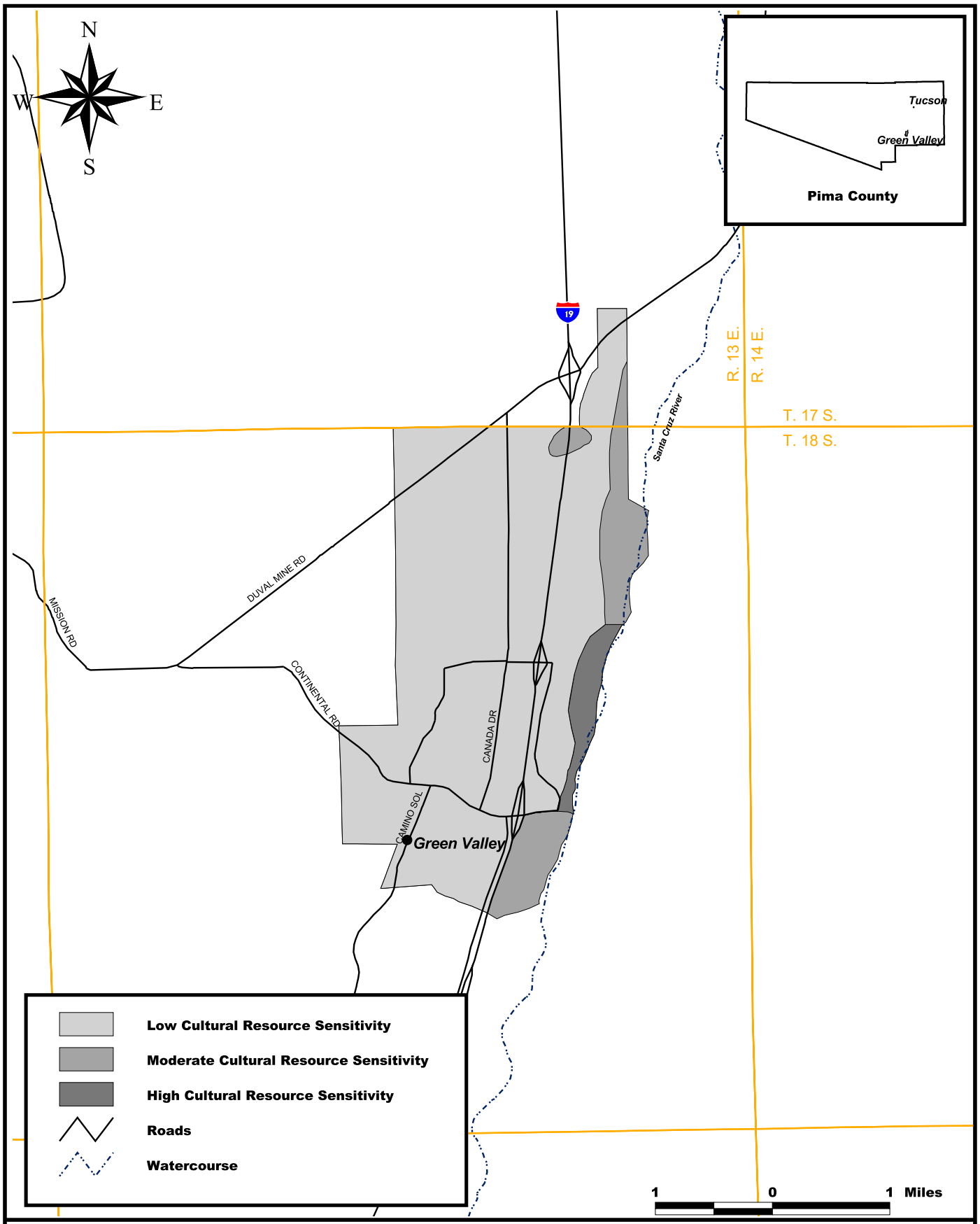
road, railroad, and pipeline rights-of-way. Cultural resources in high to moderate densities occur along the banks of the Santa Cruz River near the eastern boundary of the service area. Site types documented in this area include sherd and lithic scatters, and rock piles. Known historic sites include wells, roads, and early settlements such as Continental (AZ EE:1:82(ASM)), founded in 1914 by the Continental Rubber Company. No other sites are known in the vicinity, although historic sites associated with early commerce, farming, and/or mining are likely throughout the service area. Additionally, because of the nature of the depositional environment, the potential for buried sites is high.

Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-18. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Community Water Company of Green Valley service area is low to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. The Community Water Company of Green Valley's plans for taking delivery of CAP water is not complete. If construction of a pipeline to the service area is proposed, impacts to cultural resources are possible. If all existing facilities are used, such as the Pima Mine Road recharge facility, then no additional construction-related impacts to cultural resources would occur. Reclamation would review the final plans for taking CAP water, and carry out additional cultural resource compliance as appropriate, prior to water deliveries.

3. Biological Resources

Existing Habitats

Little natural habitat remains within the Community Water Company of Green Valley service area (elevation between 2,850 and 3,050 feet). Most of the area has been developed for agricultural and urban use. The remaining native vegetation is mostly disclimax grassland with snakeweed, turpentine-bush, and velvet mesquite. Other common perennials include chainfruit cholla, staghorn cholla, netleaf hackberry, brittlebush, foothills paloverde, ocotillo, whitethorn acacia, fluffgrass, brown-spined prickly-pear, paperflower, and bush muhly. Trees with a diameter breast height (dbh) greater than siz inches were rather closely-spaced and saguaros were not present. The habitat zones located in the service area are shown on Figure L-M&I-19. Table L-M&I-36 provides the habitat acreages in the service area for the habitat zones described above.



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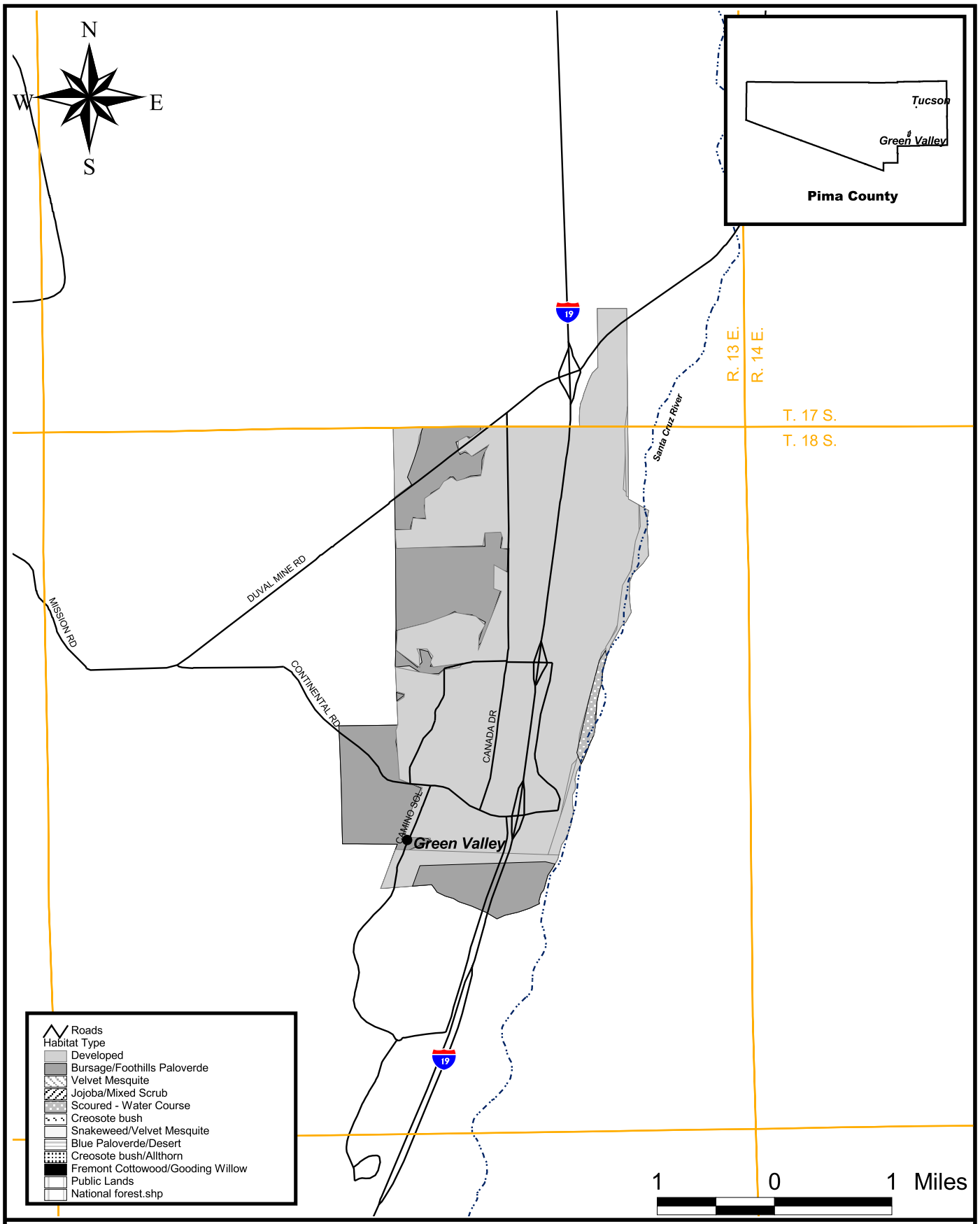
CAP Allocation Draft EIS
Cultural Resources
Community Water Company of Green Valley

June 2000

Figure #L-M&I-18



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CAP Allocation Draft EIS
Habitat Zones
Community Water Company of Green Valley

June 2000

Figure No. L-M&I-19

Table L-M&I-36
CAP Allocation Draft EIS
Community Water Company of Green Valley– Habitat Acreages

Vegetation Name	Acres
Developed	3,983
Bursage/Foothills Paloverde	1,090
Velvet Mesquite	0
Jojoba/Mixed Scrub	0
Creosote-Bush	0
Blue Paloverde/Desert	0
Creekbeds	39
Total	**5,113**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Community Water Company of Green Valley service area would result in loss of an estimated 1,131 acres of Bursage/Foothills Paloverde Association and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. The Community Water Company of Green Valley plans for taking delivery of CAP water are uncertain at this time. Based on final plans, Reclamation would carry out additional environmental review of specific facilities. In addition to the above concerns, there is a specific issue regarding water deliveries to the Community of Green Valley with respect to the endangered Gila topminnow. On June 11, 1999, USFWS submitted a draft Biological Opinion (BO) to Reclamation, which concluded that the CAP water deliveries to Pima County users would jeopardize the continue existence of the Gila topminnow. The BO stated that jeopardy could be avoided by the construction of two fish barriers in the Santa Cruz River to prevent upstream movement of CAP-source non-native aquatic species. The BO further states that any proposed CAP water deliveries upstream (south) of the proposed fish barriers would require additional consultation under the ESA. At this time, the preferred location for the fish barriers are downstream of the Community of Green Valley Water Company service area, so it appears specific consultation on this potential impact would be requested, based on the Community of Green Valley Water Company final plans for taking CAP water.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation as it pertains to urban growth. The appropriate municipal or local governmental jurisdiction would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth. The Community Water Company of Green Valley service area is located within Pima County for which there are 16 T&E species listed by USFWS. However, potential habitat exists only for cactus ferruginous pygmy-owl and the Pima pineapple cactus. There is no designated critical habitat for the Pima pineapple cactus and approximately

1,091 acres of potential suitable habitat were identified. Approximately 1,091 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were also identified within the service area.

4. Water Resources

Demands in the Community Water Company of Green Valley have historically been met by pumping groundwater from the underlying sedimentary rocks. This reliance on groundwater has resulted in declining groundwater levels over time, and there has been some subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally from about 500 to 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-37, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative.

Under the No Action Alternative, groundwater levels would decline by more than 110 feet from 2001 to 2051. This decline would primarily result from increased demands over time which would be met through increased local groundwater pumping. CAP water available to the Community Water Company of Green Valley would be recharged at other locations, which would limit the benefit of that recharge on the local groundwater levels. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels.

Groundwater levels would also decline for all of the action alternatives. However, the declines would be smaller for all of the action alternatives than for the No Action Alternative. The smaller groundwater level declines are primarily a reflection of changes in groundwater underflows that result from higher groundwater levels to the north of the Community Water Company of Green Valley due to greater amounts of direct recharge by the San Xavier District of the Tohono O'odham Nation and in the Pima Mine Road facilities.

The estimated groundwater levels for all of the action alternatives indicate that a groundwater level depression would develop in the vicinity of the Community Water Company of Green Valley. This could result in the development of an adverse salt balance for this area. Also, the groundwater level declines from 2001 to 2051 for all alternatives could result in subsidence in this area.

Table L-M&I-37 CAP Allocation Draft EIS Community Water Company of Green Valley –Groundwater Data Table		
Alternative	**Green Valley Central***	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	**Groundwater Level Impact** (in feet)**
No Action	-111	--
Settlement Alternative	-85	+25
Non-Settlement Alternative 1	-107	+3
Non-Settlement Alternative 2	-90	21
Non-Settlement Alternative 3A	-90	21
Non-Settlement Alternative 3B	-87	+24

*Values correspond to the Green Valley Central sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be greater than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of the Community Water Company of Green Valley's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 34.3 percent of the total year 2051 demand for Community Water Company of Green Valley.

Table L-M&I-38
CAP Allocation Draft EIS
Community Water Company of Green Valley–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water (per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	229 – 236[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	229 – 236[b]	CAGRD
Non-Settlement Alternative 3A	229 – 236[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

10. H20 Water Company

The H2O Water Company service area is located north of Combs Road, west of Schnepf Road, east of Maricopa County line and south of Germann Road. According to the ADWR Annual Water Withdrawal and Use Report, in the H2O Water Company service area in 1998, a total of 396 af of groundwater were pumped and delivered. Of that total, 102 af were delivered to other users. The remaining 294 af were delivered in the H2O Water Company service area.

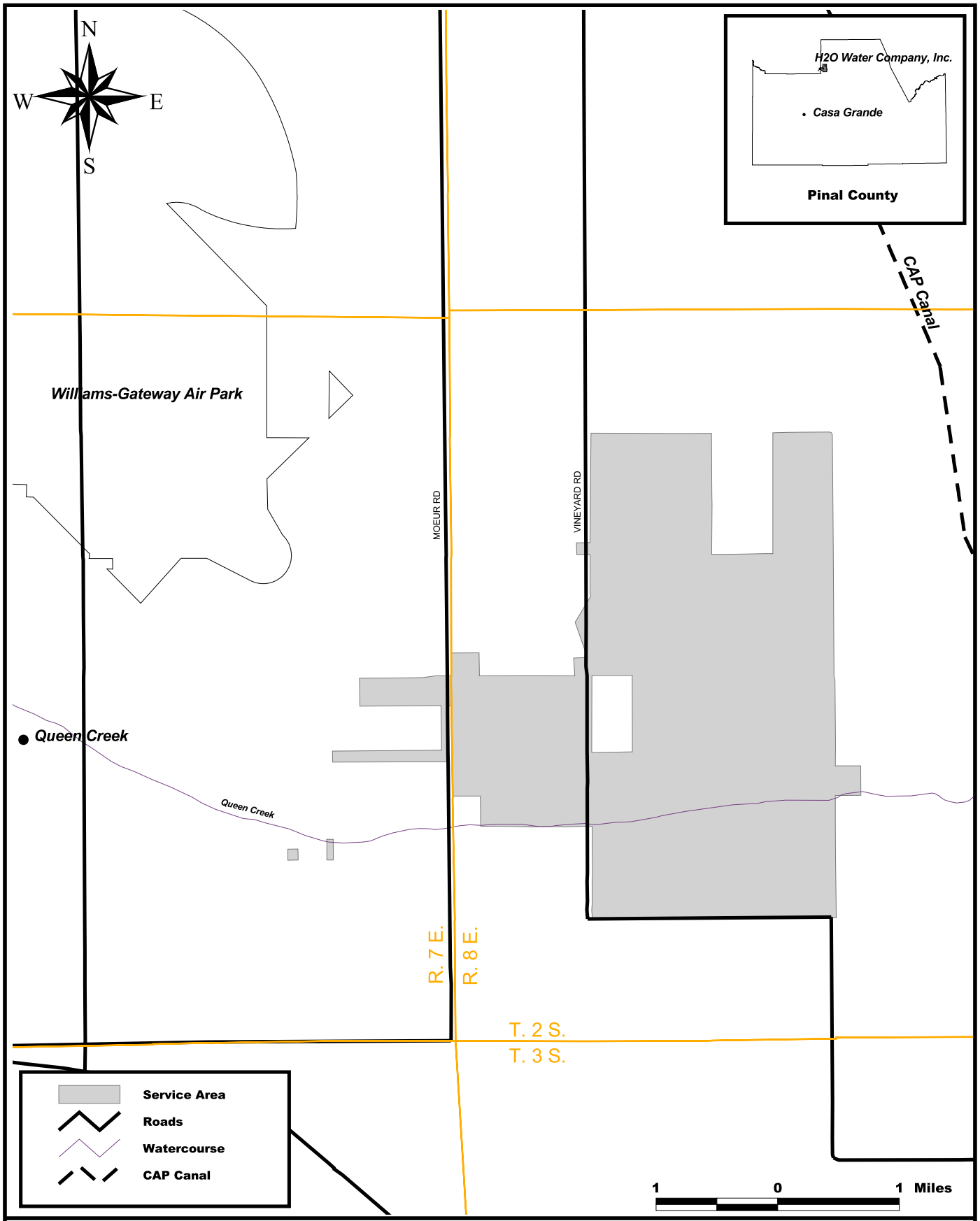
A. Plans to Take and Use CAP Water

The H2O Water Company currently has no contract for CAP water. Under the Settlement Alternative, the H2O Water Company would receive 147 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-57 outlines the proposed allocations by alternative.

Table L-M&I-57
CAP Allocation Draft EIS
H2O Water Company – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	147	M&I
No Action	0	-
Non-Settlement Alternative 1	147	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	161	NIA
Existing CAP Allocation	-	

Figure L-M&I-29 shows the service area for the H2O Water Company, which covers approximately 5,821 acres. The H2O Water Company is currently purchasing excess CAP water and wheeling it through the Queen Creek Irrigation District (QCID) system for delivery. This water is not treated and is used for non-potable industrial demands. The H2O Water Company could continue this arrangement or could use the City of Mesa's existing system to treat and wheel their CAP water. To connect to Mesa's system, the H2O Water Company would construct an eight-inch diameter pipeline in the Germann Road corridor one-mile long, from Vinyard to Meridian Roads. Assuming a 100-foot wide construction easement, this proposed pipeline would disturb approximately 15 acres (Schnepf 2000).



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CAP Allocation Draft EIS
General Location Map
H2O Water Company

June 2000

Figure #L-M&I-29

B. Population Projection

The estimated 2001 population level for the H2O Water Company service area is 793 and the estimated 2051 population level is 1,861.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the H2O Water Company service area would increase from 157 af in year 2001 to 368 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-58. Based on anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 94 percent and 40 percent of the current estimated water supply required for the H2O Water Company service area for the years 2001 and 2051, respectively.

Table L-M&I-58
CAP Allocation Draft EIS Appendix L
H2O Water Company– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
Settlement Alternative	147	147	0	0	0	0	10	221	157	368
No Action	0	0	0	0	0	0	157	368	157	368
Non-Settlement Alternative 1	147	147	0	0	0	0	10	221	157	368
Non-Settlement Alternative 2	0	0	0	0	0	0	157	368	157	368
Non-Settlement Alternative 3A	0	0	0	0	0	0	157	368	157	368
Non-Settlement Alternative 3B	147	147	0	0	0	0	10	221	157	368

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 368 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 147 afa of demand are met by the additional CAP allocation. Alternatively, this 147afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to

biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the H2O Water Company were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-59 provides the projected acres of land within the H2O Water Company service area, which are agriculture, desert, or urban, and the number of acres expected to change from the existing category for the years 2001 and 2051.

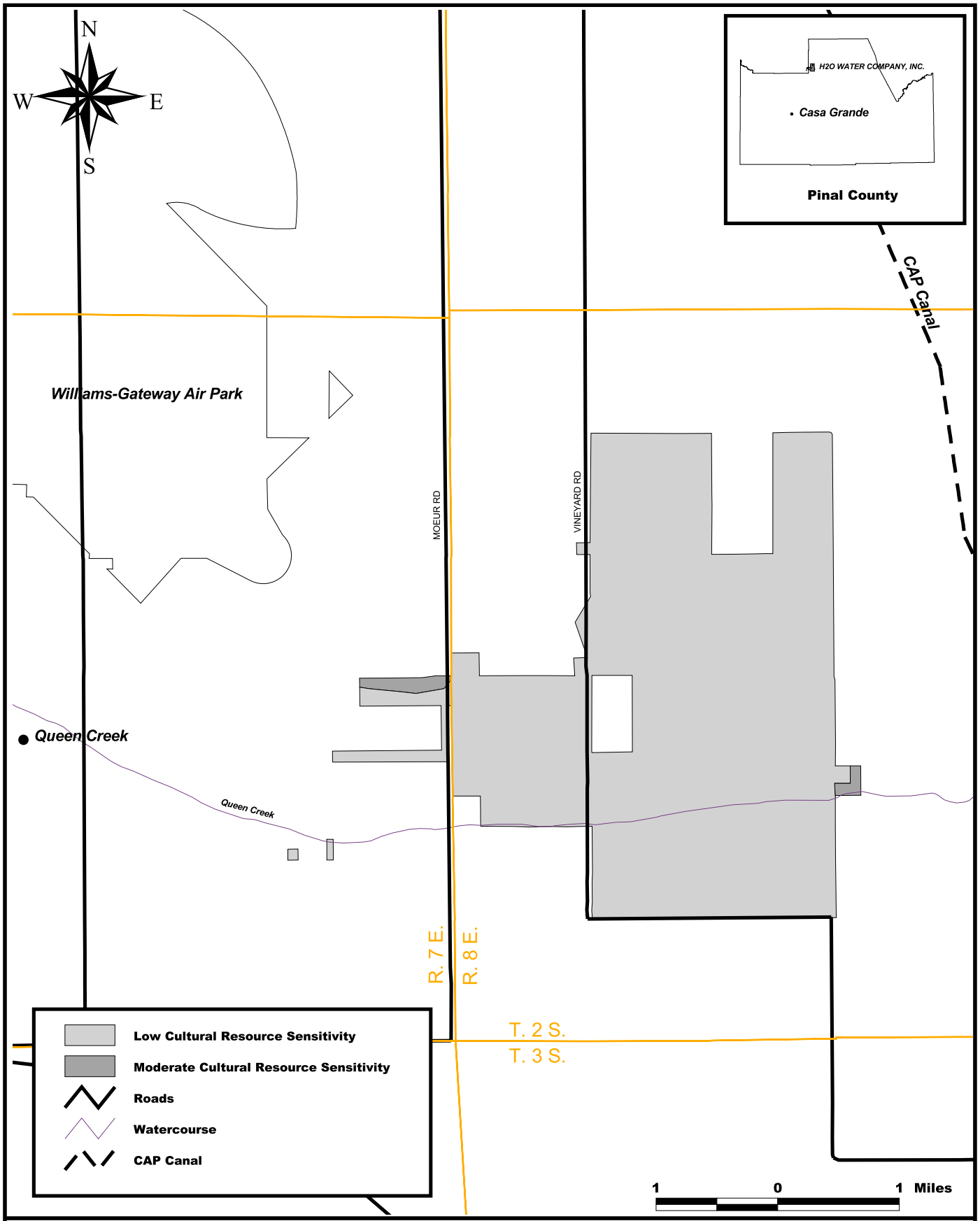
TableL-M&I-59
CAP Allocation Draft EIS
H2O Water Company– Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert*	Desert Urbanized**	Urban	Changes to Urban Acreage
Settlement Alternative	2001	0	--	0	--	5821	--
	2051	0	0	0	0	5821	0
No Action	2001	0	--	0	--	5821	--
	2051	0	0	0	0	5821	0
Non-Settlement Alternative 1	2001	0	--	0	--	5821	--
	2051	0	0	0	0	5821	0
Non-Settlement Alternative 2	2001	0	--	0	--	5821	--
	2051	0	0	0	0	5821	0
Non-Settlement Alternative 3A	2001	0	--	0	--	5821	--
	2051	0	0	0	0	5821	0
Non-Settlement Alternative 3B	2001	0	--	0	--	5821	--
	2051	0	0	0	0	5821	0

* Includes agricultural lands fallowed primarily due to economics.
** Include agricultural lands retired and subsequently urbanized.

2. Archaeological Resources

Only two projects have taken place within the H2O Water Company service area. These include a linear survey of the Southern Pacific Railroad right-of-way and survey of various parcels for the New Magma Irrigation and Drainage District (NMIDD) portion of Reclamation's Salt-Gila Aqueduct, CAP (e.g., Bontrager 1986; Marmaduke et al. 1983; Stein 1979). No sites are recorded within the service area; however, the Massera Site, a large Hohokam village with multiple mounds and a probable ball court, was originally documented by Frank Midvale as extending onto the westernmost portion of the service area. Although most of this site has been obliterated by agricultural activities, it is possible



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CAP Allocation Draft EIS
Cultural Resources
H2O Water Company

June 2000

Figure #L-M&I-30

that intact subsurface remains might be present below the plow zone. A second small area to the east of the H2O Water Company service area is surrounded by previously recorded prehistoric sites; similar resources might be expected within the service area. Historic resources, particularly sites associated with farming and ranching, also are likely.

Cultural resource sensitivity areas in the H2O Water Company service area are shown in Figure L-M&I-30. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the H2O Water Company service area is low. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. If the additional CAP delivery pipeline is constructed as described above, no significant impacts to cultural resources are expected, since construction would be within a disturbed road corridor. Depending on the specific alignment and right-of-way required, Reclamation would determine whether additional cultural resources surveys are required.

3. Biological Resources

Existing Habitats

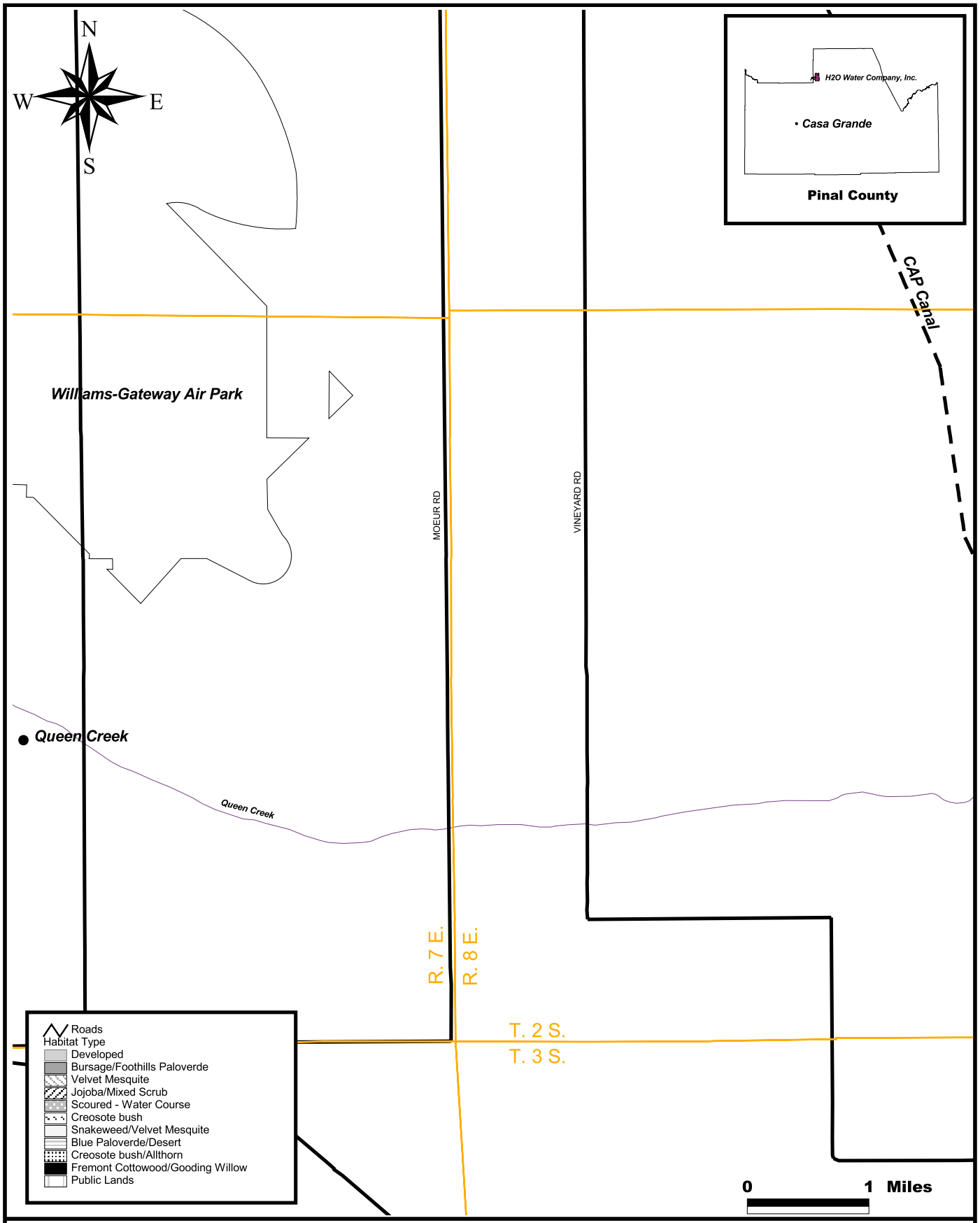
The H2O Water Company service area lies on silty plains below 1,500 feet in elevation that were probably once occupied by Creosote-bush Scrub Association. Today, the entire area outside of the Queen Creek channel has been developed for housing, agriculture, and industry. Vegetation along Queen Creek, which is ephemeral, is sparse with small stands of desert-broom, tamarisk, velvet mesquite, burrobush, and Frémont Cottonwood. The habitat zones located in the H2O Water Company service area are shown on Figure L-M&I-31. Table L-M&I-60 provides the habitat acreages in the H2O Water Company service area for the habitat zones described above.

Table L-M&I-60
CAP Allocation Draft EIS
H2O Water Company- Habitat Acreages

Vegetation Name	Acres
Developed	5,821
Total	**5,821**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the H2O Water Company service area over the 50-year study period would result in no additional loss of natural habitat. Under the action alternatives, there is no difference in the impacts from the No Action baseline. Biological impacts from CAP delivery facilities are expected to be minor, since the proposed pipeline construction would be along a road right-of-way and would only be



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CAP Allocation Draft EIS
Habitat Zones
H2O Water Company

June 2000

Figure No. L-M&I-31

one mile in length.

Potential T&E Species and Acres of Potential T&E Species Habitat

There is no potential suitable habitat for T&E species within the H2O Water Company service area.

4. Water Resources

Demands in the H2O Water Company have historically been met by pumping groundwater from the underlying basin fill. In more recent years, CAP water has been used to meet a portion of the demands. Groundwater levels have historically declined in this area in response to groundwater pumping, and a groundwater level depression is located in the general vicinity of the H2O Water Company. These declines have resulted in subsidence in this area. The concentration of TDS in the underlying groundwater is generally from about 500 to 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-61, which shows the estimated groundwater level change for the period from 2001-2051 for each alternative as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative.

Under the No Action Alternative, groundwater levels rise by about 44 feet through about 2051. Groundwater levels in the H2O Water Company are strongly influenced by activities in the QCID. The rise in groundwater levels reflects in part the interplay of a number of factors for QCID, including urbanization and changes in irrigated acreage due to economic considerations. The rise in groundwater levels would tend to eliminate subsidence. Also, the groundwater level rise in this area would eliminate the current local groundwater depression, which would tend to improve groundwater quality.

Groundwater levels in year 2051 under the Settlement Alternative and all Non-Settlement Alternatives would be lower than under the No Action Alternative, except for Alternative 1. As with the No Action Alternative, these groundwater levels reflect a number of different factors largely related to QCID, including urbanization and changes in irrigated acres due to economic considerations. There would be the potential for subsidence under the Settlement Alternative and Non-Settlement Alternatives 2 and 3A, due to the lower groundwater levels. There would also be the potential for adverse groundwater quality impacts under the Settlement Alternative, as a groundwater level depression would remain in the vicinity of the H2O Water Company.

Table L-M&I-61 CAP Allocation Draft EIS H2O Water Company–Groundwater Data Table		
Alternative	*	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	44	--
Settlement Alternative	-18	-62
Non-Settlement Alternative 1	53	8
Non-Settlement Alternative 2	-31	-75
Non-Settlement Alternative 3A	-27	-71
Non-Settlement Alternative 3B	1	-44

*Values correspond to the Queen Creek sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of H2O Water Company's water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 39.9 percent of the total year 2051 demand for the H2O Water Company.

Table L-M&I-62
CAP Allocation Draft EIS
H2O Water Company –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	221 – 225[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	221 – 225[b]	CAGRD
Non-Settlement Alternative 3A	221 – 225[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

12. Metropolitan Domestic Water Improvement District (MDWID)

The MDWID service area covers approximately 18 square miles. The population in 1998 was 44,952, with a water production of 8,735af. In general, the service area is bounded by Oracle Road and First Avenue on the east, Thornydale Road on the west, Sunset Road on the south, and Lambert Lane on the north. The existing MDWID water system is comprised of 21 relatively small service areas that are served by one or more wells and generally operate independently. MDWID currently pumps groundwater for its entire water supply from 29 active wells. The recovery capacity of the well system is approximately 18,000 gpm, or about 29,000 afa. The distribution system consists of over 292 miles of pipelines varying in size from two inches to 24 inches in diameter.

In 1998, more than 70 percent of the deliveries were to single family residences. About 13 percent of the deliveries were to apartments. The remaining deliveries were made to nonresidential customers which include schools, medical facilities, shopping areas, offices, restaurants, turf irrigation, and a park (ADWR 1999). According to the ADWR Annual Water Withdrawal and Use Report, in the MDWID service area in 1998, a total of 8,773 af of groundwater were pumped and delivered and 22 af of groundwater were received or diverted from other sources. Of the total 8,795 af of water produced and delivered, 58 af were delivered to other users, leaving a balance of 8,737 af to be delivered with the MDWID service area.

A. Plans to Take and Use CAP Water

The MDWID service area currently has a contract for 8,858 af of CAP water. Under the Settlement Alternative, the MDWID would receive 4,602 af of CAP water through the First Trust of Arizona, but has not yet taken delivery of any CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-69 outlines the proposed allocations by alternative.

Table L-M&I-69 CAP Allocation Draft EIS Appendix L MDWID – Proposed CAP Allocation		
Alternative	**Allocation (in afa)**	**Priority**
Settlement Alternative	4,602	M&I
No Action	0	-
Non-Settlement Alternative 1	4,602	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	5,034	NIA
Existing CAP Allocation	8,858	-

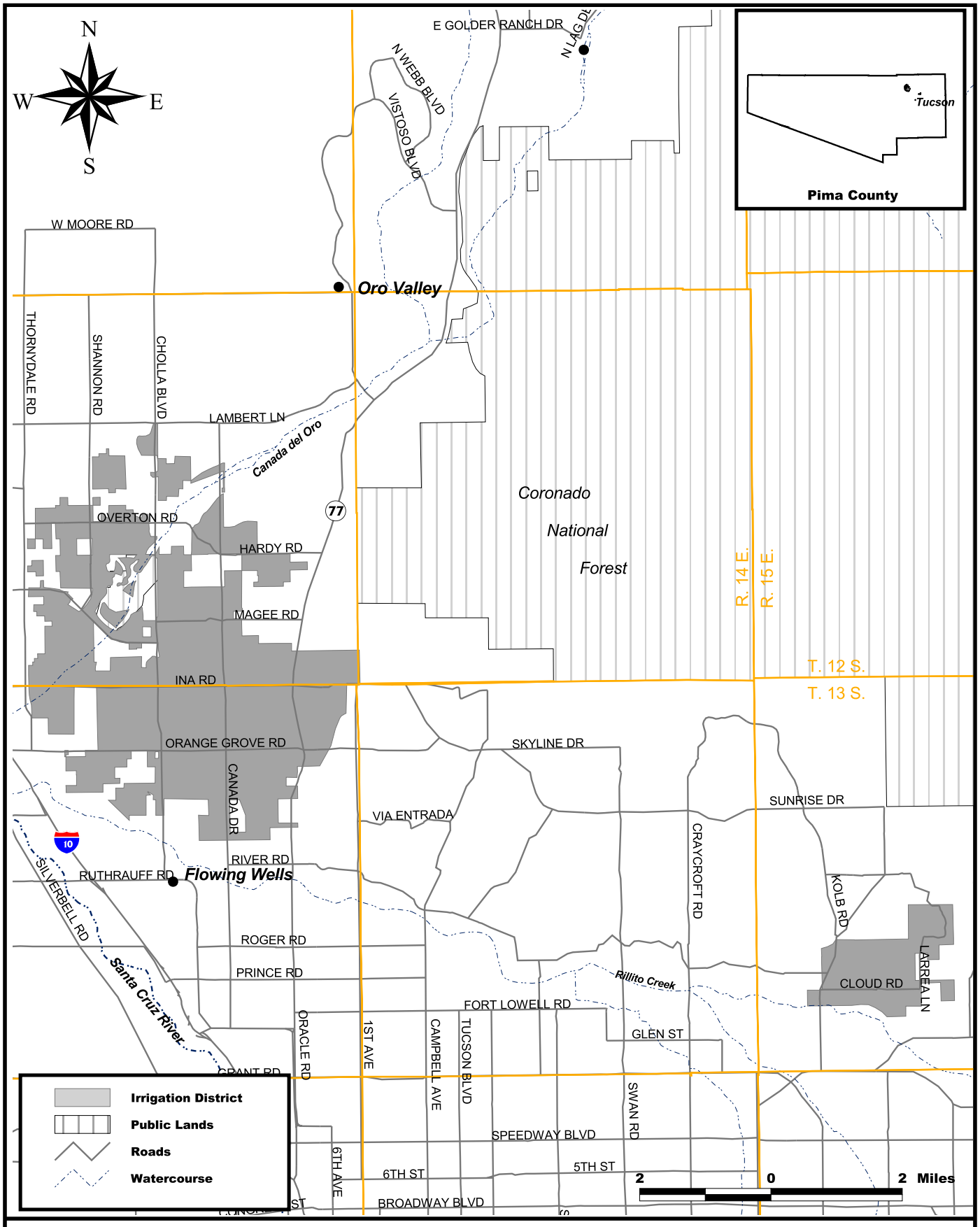
Figure L-M&I-35 shows the service area for the MDWID, which covers approximately 11,338 acres. The MDWID currently recharges a portion of its CAP allocation directly at the AVRA Valley recharge facility and indirectly with the Cortaro-Marana Irrigation District (CMID) and Kai Farms. Recovery is through existing wells within the MDWID service area. Future plans may include direct recharge in the Cañada del Oro Wash and/or treatment and direct delivery (Tenney 2000).

B. Population Projection

The estimated 2001 population level for the MDWID service area is 47,750 and the estimated 2051 population level is 103,451.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the MDWID service area would increase from 8,985 af in year 2001 to 19,467 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-70. Based on anticipated water demands, CAP water which would be allocated under the Settlement Alternative would provide 51 percent to 24 percent of the current estimated water supply required for the MDWID service area for the years 2001 and 2051, respectively.



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CAP Allocation Draft EIS
General Location Map
Metropolitan Domestic Water Improvement District

June 2000

Figure #L-M&I-35

Table L-M&I-70
CAP Allocation Draft EIS
MDWID– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	13,460	8,985	0	0	0	0	6,007	8,985	19,467
No Action	0	8,858	8,858	0	0	0	127	10,609	8,985	19,467
Non-Settlement Alternative 1	0	13,460	8,985	0	0	0	0	6,007	8,985	19,467
Non-Settlement Alternative 2	0	8,858	8,858	0	0	0	127	10,609	8,985	19,467
Non-Settlement Alternative 3A	0	8,858	8,858	0	0	0	127	10,609	8,985	19,467
Non-Settlement Alternative 3B	0	13,460	8,985	0	0	0	0	6,007	8,985	19,467

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 19,467 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 4,602 afa of demand are met by the additional CAP allocation. Alternatively, this 4,602 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the MDWID service area were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-71 provides the projected acres of land within the MDWID service area that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

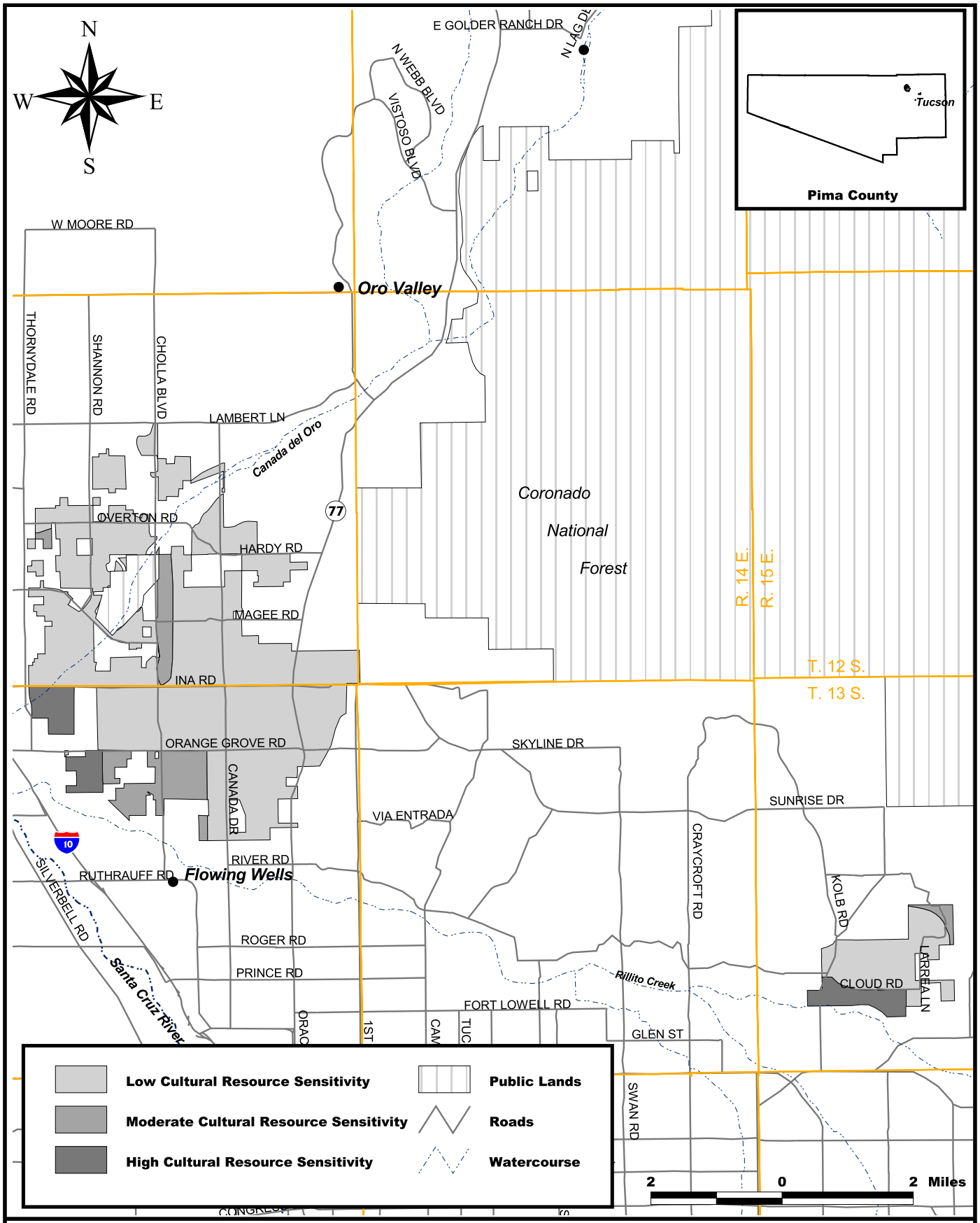
TableL-M&I-71
CAP Allocation Draft EIS Appendix L
MDWID– Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	0	--	833	--	10,505	--
	2051	0	0	0	833	11,338	833
No Action	2001	0	--	833	--	10,505	--
	2051	0	0	0	833	11,338	833
Non-Settlement Alternative 1	2001	0	--	833	--	10,505	--
	2051	0	0	0	833	11,338	833
Non-Settlement Alternative 2	2001	0	--	833	--	10,505	--
	2051	0	0	0	833	11,338	833
Non-Settlement Alternative 3A	2001	0	--	833	--	10,505	--
	2051	0	0	0	833	11,338	833
Non-Settlement Alternative 3B	2001	0	--	833	--	10,505	--
	2051	0	0	0	833	11,338	833

2. Archaeological Resources

Much of the MDWID service area has been block-surveyed; numerous linear surveys also have taken place, particularly along Interstate 10 and west of the Santa Cruz River. In the easternmost portion of the service area, sites have been recorded along the banks of Tanque Verde Creek, Sabino Creek, and Ventana Canyon Wash. Fewer surface manifestations have been recorded to the west, probably as a result of urban development. Significant cultural resources—including Archaic and Hohokam artifact scatters, Hohokam villages, and resource-processing loci—also have been documented in the southwest portion of the service area. This landscape, dissected by numerous washes that drain out of the Tortolita Mountains, has a high potential for containing prehistoric sites. Protohistoric Papago and Pima sites also might be expected. Historic trails, roads, railroads, and other transportation-related features are common throughout the service area, as are sites related to commerce, mining, farming, ranching, and other historic activities.

Cultural resource sensitivity areas in the MDWID service area are shown on Figure L-M&I-36. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the MDWID service area is low to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Once the plans for taking delivery



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CAP Allocation Draft EIS
Cultural Resources
Metropolitan Domestic Water Improvement District

June 2000

Figure #L-M&I-36

of CAP water are finalized, Reclamation would carry out additional cultural resources compliance as appropriate, prior to water delivery.

3. Biological Resources

Existing Habitats

Little natural habitat remains within the MDWID service area. Nearly all of the area has been developed for urban use. It is located in an area that was probably transitional between Bursage/Foothills Paloverde and Creosote-Bush Associations. The habitat zones are shown on Figure L-M&I-37. Table L-M&I-72 provides the habitat acreages for the habitat zones described above.

TableL-M&I-72
CAP Allocation Draft EIS
MDWID– Habitat Acreages

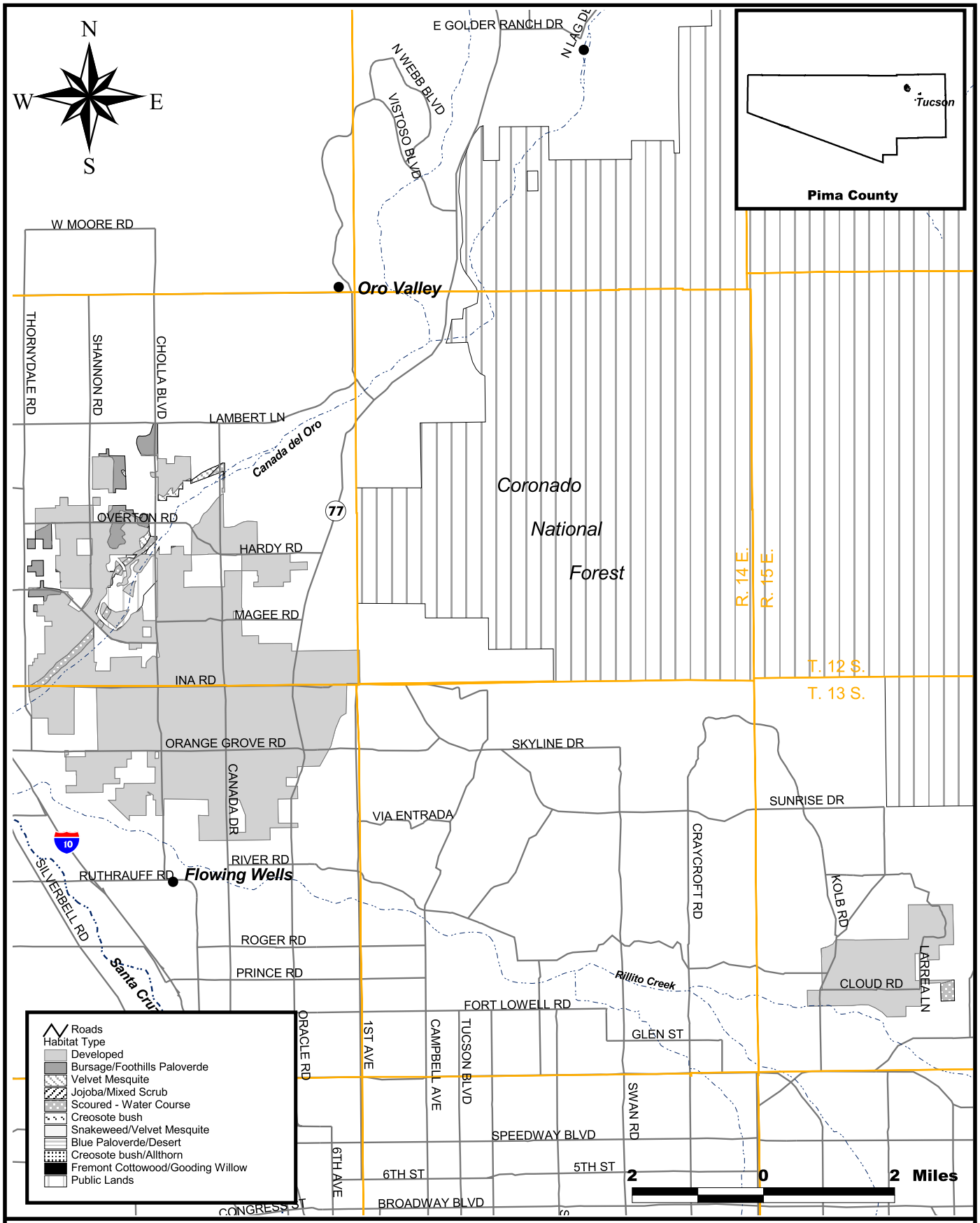
Vegetation Name	Acres
Developed	10,505
Bursage/Foothills Paloverde	584
Velvet Mesquite	62
Scoured, Washes and Creeks	187
Total	**11,338**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within this service area would result in loss of an estimated 833 acres of Sonoran Desertscrub and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities, Reclamation would carry out additional environmental review once plans are developed.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The appropriate municipal or local governmental jurisdiction would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth. This service area is located within Pima County for which there are 16 T&E species listed by USFWS. However, potential habitat exists only for cactus ferruginous pygmy-owl. Approximately 645 acres of potentially suitable habitat were identified for the cactus ferruginous pygmy-owl within the MDWID service area.



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BUREAU OF RECLAMATION

CAP Allocation Draft EIS
Habitat Zones
Metropolitan Domestic Water Improvement District

June 2000

Figure No. L-M&I-37

4. Water Resources

Demands in MDWID have historically been met primarily by pumping groundwater from the underlying sedimentary rocks. This reliance on groundwater has resulted in declining groundwater levels over time, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-73, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Most of MDWID was contained in two groundwater sub-areas. The first number shown in Table L-M&I-73 represents groundwater levels for the eastern part of MDWID, and the second number represents the western part of MDWID. Declines in groundwater levels and groundwater impacts are similar in both the eastern and western part of MDWID.

Under the No Action Alternative, groundwater levels would decline by as much as about 100 feet from 2001 to 2051. A portion of the CAP water available to MDWID would be directly delivered, while a portion would be recharged in direct recharge facilities. The CAP water (and particularly the water directly delivered) tends to improve groundwater levels, but the continued decline in groundwater levels results from increased demands over time that would be met by increased local groundwater pumping. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels.

Groundwater levels would also decline for all of the action alternatives. However, these declines would be substantially smaller than under the No Action Alternative for the Settlement Alternative and Non-Settlement Alternatives 1 and 3B, reflecting the additional allocation of CAP water received under those alternatives. For Non-Settlement Alternatives 2 and 3A, MDWID would not receive an additional allocation of CAP water, and the groundwater levels would be similar to the No Action Alternative.

Substantial changes in groundwater quality would not be anticipated for any of the alternatives. However, there would be the potential for subsidence under all alternatives.

Table L-M&I-73 CAP Allocation Draft EIS MDWID–Groundwater Data Table		
Alternatives	**MDWID***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact**(in Feet)**
No Action	-99 / -88	--
Settlement Alternative	-62 / -59	37 / 30
Non-Settlement Alternative 1	-67 / -62	32 / 27
Non-Settlement Alternative 2	-97 / -90	2 / -1
Non-Settlement Alternative 3A	-98 / -90	2 / -1
Non-Settlement Alternative 3B	-64 / -61	36 / 28

*Values correspond to MDWID and East CMID sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of MDWID's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 23.6 percent of the total year 2051 demand for the MDWID.

Table L-M&I-74
CAP Allocation Draft EIS
MDWID–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	226 – 231[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	226 – 231[b]	CAGRD
Non-Settlement Alternative 3A	226 – 231[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

16. City of Scottsdale

The City of Scottsdale is located northwest of Phoenix in Maricopa County. Scottsdale has grown from a tiny farming community of 2,000 persons occupying one square mile in 1951 to a vibrant community of more than 180,000 persons spreading over 185 square miles. The City of Scottsdale is characterized by a hospitality industry serving both the business and leisure sector. Scottsdale's quality of life includes well-planned living, working and shopping areas. The city is known for its architectural and landscape design excellence and rich cultural, business and recreational environments. The City of Scottsdale MPA is located north of McDowell Road, west of 136th Street, east of Scottsdale Road, and south of the Tonto National Forest boundary.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Scottsdale in 1998, 34,545 af of groundwater were pumped and delivered. Also, 7,457 af of water were received from other irrigation districts and 29258 af were received from CAWCD. Of the total 712,260 af of water produced and delivered, 154 af were delivered to other users, leaving 71,106 af of water to be used by the City of Scottsdale.

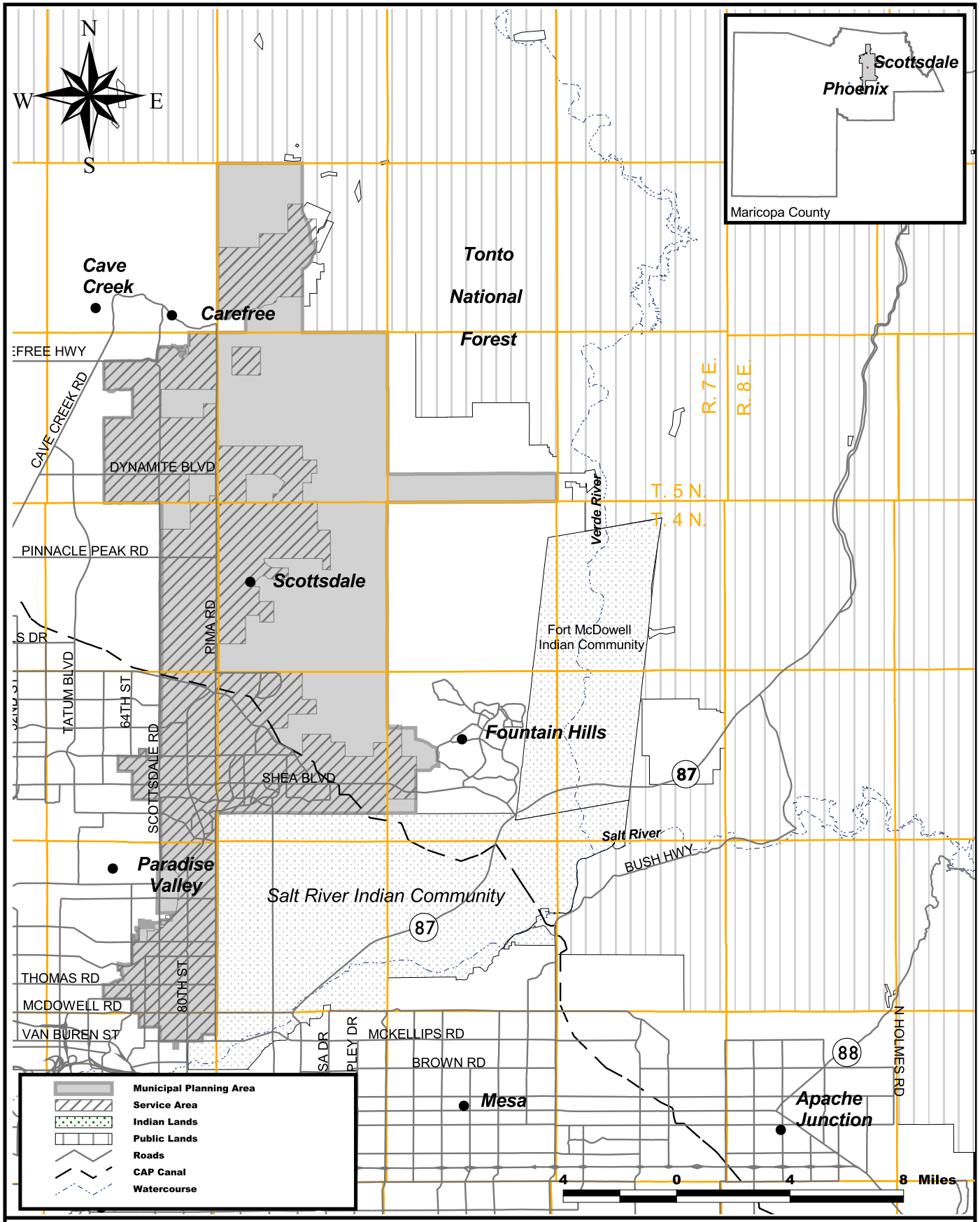
A. Plans to Take and Use CAP Water

The City of Scottsdale currently has a contract for 49,029 af of CAP water. This allocation includes 19,702 af received under the 1983 allocation and 29,327 af of transferred water. The transferred water was from North Valley Water (393 af), Ironwood Water (393 af), Carefree Ranch Water Company (954 af), Payson (4,995 af), Desert Ranch Water Company (139 af), Yavapai Prescott (500 af), City of Prescott (7,127), Rio Rico Citizens Utility (2,683 af), ASLD (530 af), Mayer Domestic Water Improvement District (332 af), Nogales (3,949 af), Berneil Water Company (200 af), ASLD (3,900 af)<, Cottonwood (1,789 af) and Camp Verde (1,443 af). Under the Settlement Alternative, the City of Scottsdale would receive 2,981 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-93 outlines the proposed CAP allocation by alternative.

Table L-M&I-93
CAP Allocation Draft EIS
City of Scottsdale – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	2,981	M&I
No Action	0	--
Non-Settlement Alternative 1	2,981	M&I
Non-Settlement Alternative 2	0	--
Non-Settlement Alternative 3A	0	--
Non-Settlement Alternative 3B	3,261	NIA
Existing CAP Allocation	49,029	--

Figure L-M&I-47 shows the service area and MPA for the City of Scottsdale. The service area covers approximately 70,337 acres and the MPA covers approximately 123,639 acres. The City



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June 2000

CAP Allocation Draft EIS
General Location Map
City of Scottsdale

Figure #L-M&I-47

of Scottsdale currently uses the CAP Water Treatment Plant (located at Union Hills and Pima). The capacity of the plant is 56,000 afa. The City of Scottsdale is entitled to 2.16 percent of GRUSP's recharge capacity and holds a water storage permit with SRP for 20,000 afa (Mansfield 2000).

B. Population Projection

In 1985, the population in the City of Scottsdale was 34,365. The estimated 2001 population is 204, 892, and the estimated 2051 population is 374,482.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the City of Scottsdale would increase from 56,903 af in year 2001 to 104,135 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-94. Based on anticipated demands, CAP water, which would be allocated under the Settlement Alternative, would provide five percent and three percent of the current estimated water supply required for the City of Scottsdale for the years 2001 and 2051, respectively.

Table L-M&I-94
CAP Allocation Draft EIS
City of Scottsdale– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD		Other Surface Water		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	25,171	66,847	12,157	12,157	0	1,000	0	0	19,574	24,131	56,903	104,135
No Action	25,171	61,315	12,157	12,157	0	6,532	0	0	19,574	24,131	56,903	104,135
Non-Settlement Alternative 1	25,171	65,599	12,157	12,157	0	2,247	0	0	19,574	24,131	56,903	104,135
Non-Settlement Alternative 2	25,171	61,315	12,157	12,157	0	6,532	0	0	19,574	24,131	56,903	104,135
Non-Settlement Alternative 3A	25,171	61,315	12,157	12,157	0	6,532	0	0	19,574	24,131	56,903	104,135
Non-Settlement Alternative 3B	25,171	65,599	12,157	12,157	0	2,247	0	0	19,574	24,131	56,903	104,135

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 104,135 af. For all alternatives, there is estimated to be no unmet demand with or without the additional CAP allocation.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Scottsdale MPA in 1995 consisted of approximately 62 acres of agriculture, 54,950 acres of developed land, 561 acres of rural land, 67,525 acres of vacant land and 541 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e. agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for this EIS. Table L-M&I-95 provides the projected acres of land within the City of Scottsdale MPA which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-95
CAP Allocation Draft EIS
City of Scottsdale – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	0	--	67,144	--	56,495	--
	2051	0	0	49,409	17,735	74,230	17,735
No Action	2001	0	--	67,144	--	56,495	--
	2051	0	0	49,409	17,735	74,230	17,735
Non-Settlement Alternative 1	2001	0	--	67,144	--	56,495	--
	2051	0	0	49,409	17,735	74,230	17,735
Non-Settlement Alternative 2	2001	0	--	67,144	--	56,495	--
	2051	0	0	49,409	17,735	74,230	17,735
Non-Settlement Alternative 3A	2001	0	--	67,144	--	56,495	--
	2051	0	0	49,409	17,735	74,230	17,735
Non-Settlement Alternative 3B	2001	0	--	67,144	--	56,495	--
	2051	0	0	49,409	17,735	74,230	17,735

2. Archaeological Resources

In general, the distribution of sites across the City of Scottsdale MPA reflects the extent of survey coverage; however, much remains unexamined or has been inadequately covered for purposes of Section 106 compliance (e.g., RECON 1987). Areas of high and moderate cultural resource sensitivity in the northern portion of the MPA consist primarily of prehistoric agricultural and habitation sites and historic mining sites such as are common along Cave Creek and surrounding areas. The central portion of the MPA is characterized by numerous sites ranging from small undifferentiated lithic scatters of possible Archaic affiliation to extensive Hohokam villages (e.g., Pinnacle Peak Village/the Herberger Site) associated with trash mounds, agricultural features, trails, and petroglyph loci. Rock shelters, quarries, special-use areas, bedrock mortars, and other isolated features also have been identified (e.g., Atwell 1992). In the southern portion of the MPA, from Taliesin West (AZ U:5:15(ASM)) to Gilbert Road are many prehistoric artifact scatters, some associated with surface features (e.g., Crownover 1996; Schroeder 1992). Protohistoric Pima sites, including camps and agricultural fields, are known to be present near the McDowell Mountains area; surface remains might be expected. Historic

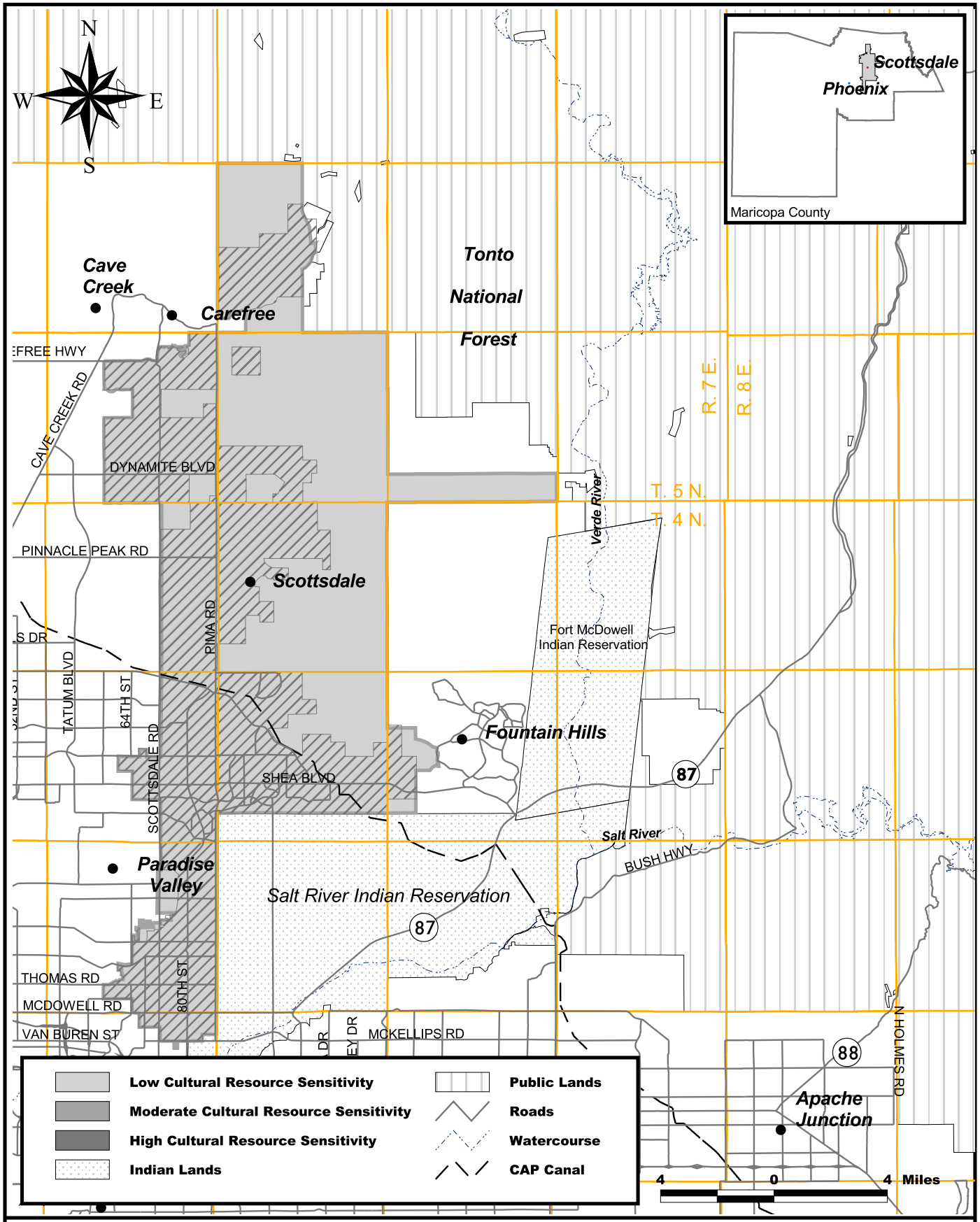
homesteads, wagon roads, corrals, camps, and related trash dumps also are present in this area (e.g., Crownover 1996; Schroeder 1992). Historic resources in urban areas include commercial and residential buildings, and transportation-related sites such as road and railroad features. The City of Scottsdale has a Historic Preservation Committee and has drafted its own Archaeological Resources Ordinance.

Cultural resource sensitivity areas in the City of Scottsdale MPA are shown on Figure L-M&I-48. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the City of Scottsdale MPA is moderate to high. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Once the plans for taking delivery of CAP water are finalized, Reclamation would carry out additional cultural resource compliance as appropriate, prior to water delivery.

3. Biological Resources

Existing Habitats

In the northwest portion of the City of Scottsdale MPA at higher elevations (to approximately 4,900 feet), occurs an approximation of the Jojoba/Mixed Scrub Association, which is dominated by turpentine-bush and co-dominated by foothills paloverde, catclaw acacia, staghorn cholla, fairy-duster, and hedgehog cactus. This association also occurs in the area of the McDowell Mountains. Bursage-Foothill Paloverde Association dominates most of the undeveloped portions of the Scottsdale MPA below 3,500 feet in elevation. Recent fires have affected much of this habitat. In unaffected areas, saguaro and other trees are fairly dense, while in the burned areas, they are sparse. In general, co-dominants of the Bursage-Foothill Paloverde Association include creosote-bush and staghorn cholla. Other common trees include velvet mesquite, desert ironwood, blue paloverde, and saguaro. In the lower, silty plains in the southwestern portion of the planning area, Creosote-bush Scrub Association is dominant where the cover is very low and trees are widely spaced. Blue Paloverde/Desert Ironwood Association occurs along major washes where conspicuous species include burrobush, desert-broom, blue-paloverde, desert ironwood, and desert-willow. The habitat zones are shown on Figure L-M&I-49. Table L-M&I-96 provides the habitat acreages for the habitat zones described above.



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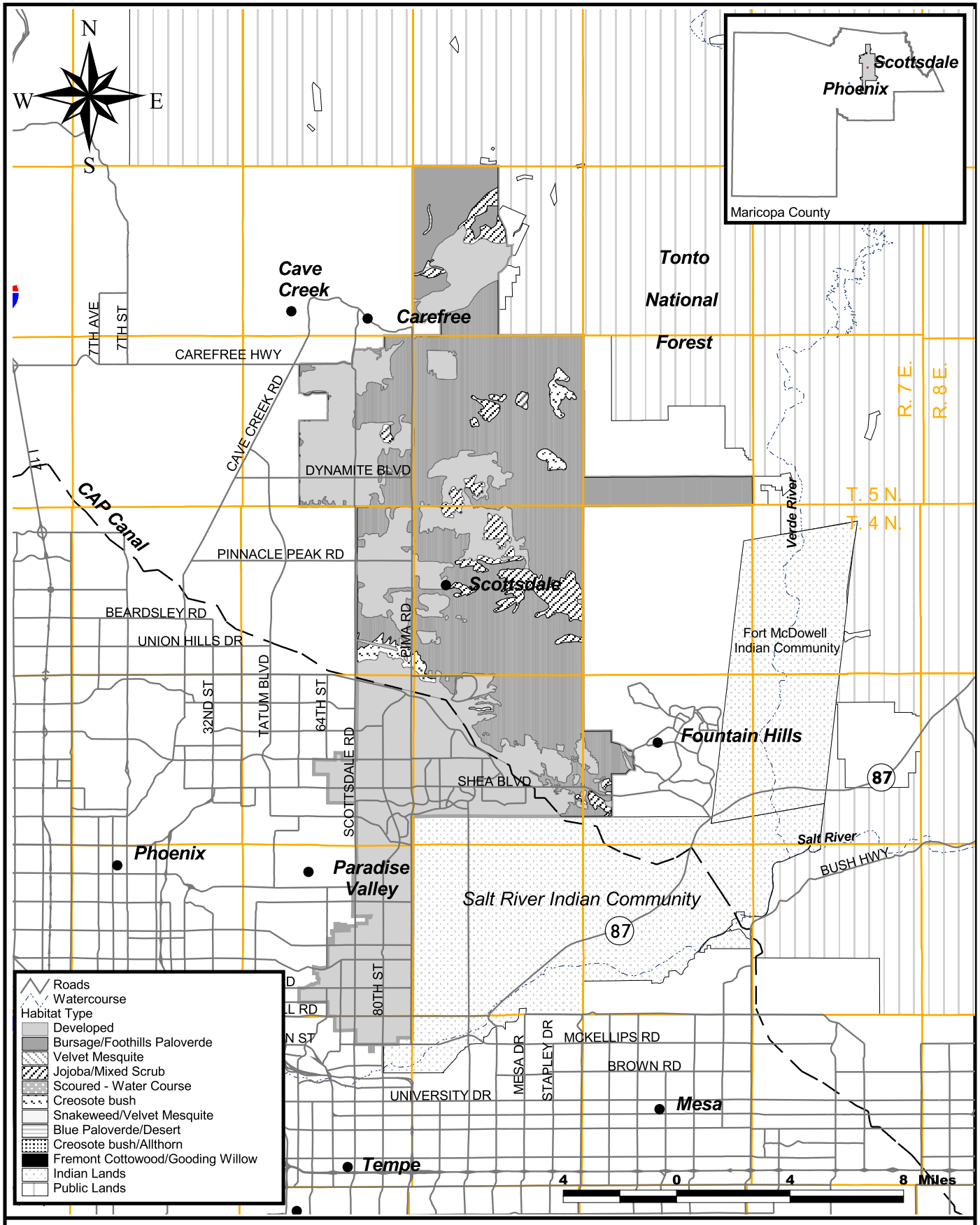
CAP Allocation Draft EIS
Cultural Resources
City of Scottsdale

Figure #L-M&I-48



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June 2000

CAP Allocation Draft EIS
Habitat Zones
City of Scottsdale

Figure No. L-M&I-49

TableL-M&I-96 CAP Allocation Draft EIS City of Scottsdale– Habitat Acreages	
Vegetation Name	**Acres**
Developed	56,495
Bursage / Foothills Paloverde	59,909
Jojoba / Mixed Scrub	5,450
Creosote Bush	1,622
Blue Paloverde / Desert	163
Total	**123,639**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Scottsdale MPA over the 50-year study period would result in loss of an estimated 17,735 acres of Sonoran Desertscrub and associated wildlife resources. There may also be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. Under the action alternatives, there is a difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities, Reclamation would carry out additional environmental review once plans are developed.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Scottsdale would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth. The City of Scottsdale MPA is located within Maricopa County for which there are 14 T&E species listed by the USFWS. Potentially suitable habitat only exists for cactus ferruginous pygmy-owl and Arizona agave. Approximately 60,072 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the Scottsdale MPA. Also, approximately 4,489 acres above 3,000 feet of potentially suitable habitat for Arizona agave were identified.

4. Water Resources

Demands in the City of Scottsdale have historically been met with water provided by SRP (available in the southern portion of the city) and groundwater pumped from the underlying sedimentary rocks. A groundwater depression has developed under the southern part of the City of Scottsdale in response to this pumping, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally below 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-97, which shows the estimated groundwater level change for the period from 2001–2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. As shown in Table L-M&I-97, groundwater conditions were estimated in the analysis for both the northern and southern part of the City of Scottsdale (values for the northern part are presented first).

Under the No Action Alternative, groundwater levels would rise about 64 feet in the southern part of Scottsdale and decline about 147 feet in the northern part. The decline in the northern part reflects the increased demands in that area and the heavy reliance on groundwater to meet these demands, as these demands are largely outside the SRP service area. In the southern part of Scottsdale, groundwater pumping is offset in part by both CAP and SRP water. Groundwater levels in the southern part of Scottsdale would also be influenced by recharge in GRUSP located to the east of Scottsdale. Those factors result in a rise in groundwater levels. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence in the northern part of Scottsdale due to the lower groundwater levels.

Under the Settlement Alternative and all Non-Settlement Alternatives, groundwater levels would decline in the northern portion of Scottsdale and rise in the southern portion. In the northern Scottsdale area, the declines are almost the same as for the No Action Alternative (ranging from one foot deeper to six feet higher in year 2051). Larger differences from the No Action Alternative occur in the southern Scottsdale area, where groundwater levels in 2051 would be from eight to 48 feet deeper than under the No Action Alternative. These differences reflect the differing availability of CAP water to the City of Scottsdale and the influence of changes in groundwater levels in adjacent areas that are influenced by recharge at GRUSP.

Substantial changes in groundwater quality would not be anticipated for any of the alternatives. There would be the potential for subsidence under all alternatives in the northern part of Scottsdale.

Table L-M&I-97
CAP Allocation Draft EIS
City of Scottsdale –Groundwater Data Table

Alternatives		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-147 / 64	--
Settlement Alternative	-141 / 43	6 / -21
Non-Settlement Alternative 1	-145 / 45	2 / -18
Non-Settlement Alternative 2	-147 / 56	0 / -8
Non-Settlement Alternative 3A	-148 / 35	-1 / -28
Non-Settlement Alternative 3B	-147 / 16	0 / -48

*Values correspond to the Scottsdale North and Scottsdale South sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and treating and reusing effluent. The difference in cost for this small increment of the City of Scottsdale's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately three percent of the total year 2051 demand for the City of Scottsdale.

Table L-M&I-98
CAP Allocation Draft EIS
City of Scottsdale –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a,b]	CAP Allocation
No Action	237[a]	Reclaimed Water
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	237[a]	Reclaimed Water
Non-Settlement Alternative 3A	237[a]	Reclaimed Water
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period.

13. Town of Oro Valley

The Town of Oro Valley is in northeastern Pima County, approximately six miles northeast of Tucson. Oro Valley is at an elevation of 2,260 feet and covers nearly 27 square miles. The Town of Oro Valley is home to a four-diamond resort hotel, and the largest employers include local country clubs, the local government and the local high school. The Town of Oro Valley service area is located north of Magee Road, west of Cañada Del Oro River, east of Thornydale Road, and south of Crown Ridge Way. Oro Valley was founded in 1974. Oro Valley Water Users (OVWU) currently serves over 13,500 homes and businesses in the fast-growing area within and around the Town of Oro Valley. More than half the deliveries are to residential customers, primarily single family residences. The remaining deliveries are to nonresidential users, including five golf courses. Deliveries to the golf courses constituted 29 percent of the total deliveries in the service area in 1998 (ADWR 1999). In 1998, OVWU used 5,911 af of groundwater, with a corresponding 215 gallons per capita per day (gpcd) usage rate. The utility has a current Assured Water Supply (AWS) designation from ADWR.

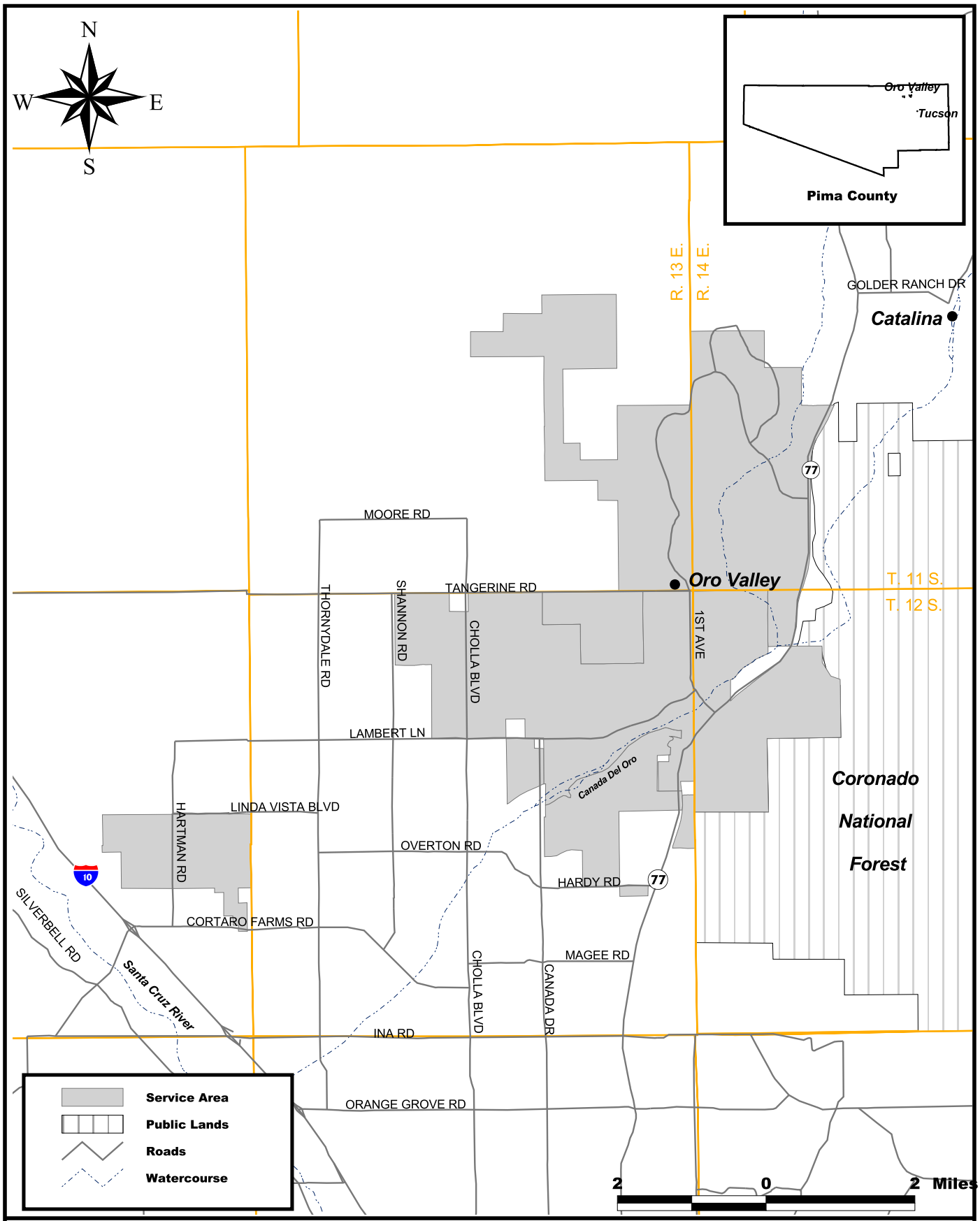
A. Plans to Take and Use CAP Water

The Town of Oro Valley currently has a contract for 2,294 af of CAP water. Under the Settlement Alternative, Oro Valley would receive 3,557 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-75 outlines the proposed allocations by alternative.

Table L-M&I-75
CAP Allocation Draft EIS
Town of Oro Valley– Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	3,557	M&I
No Action	0	-
Non-Settlement Alternative 1	3,557	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	3,891	NIA
Existing CAP Allocation	2,294	-

Figure L-M&I-38 shows the service area for the Town of Oro Valley. The Town of Oro Valley is currently taking their CAP allocation through an in-lieu recharge arrangement with Kai Farms. The water is recovered using existing wells within Oro Valley. The additional CAP allocation could also be taken in this manner or through other direct or indirect recharge facilities or through a water treatment plant. Entities in the north Tucson



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CAP Allocation Draft EIS
General Location Map
Town of Oro Valley

June 2000

Figure #L-M&I-38

area are developing a regional solution. Oro Valley is continuing to develop alternatives for a comprehensive water management plan. Potable water alternatives that are being analyzed are recharge, treatment for direct delivery, continuing mining of groundwater and buying water from the City of Tucson. Renewable supply (CAP and reclaimed effluent) alternatives are being analyzed for turf irrigation (Seng 2000).

The Town of Oro Valley Potable Water System Master Plan has recently been approved. This comprehensive master plan would upgrade the water system design criteria and develop the water system requirements to meet projected growth demands. The plan defines improvements to system build out, including improvements to be included in the next five year Capital Improvement Program. The master plan also incorporates a single-source infrastructure plan for a direct delivery option of CAP water.

The OVWU currently has 22 wells, with a total production capacity of approximately 11,639 gpm, or about 18,776 afa. The system also has approximately 19 booster stations and 11 high-zone reservoirs. The wells are generally located within the Big Wash and Cañada Del Oro Wash geologic flood plain.

B. Population Projection

The estimated 2001 population level for the Town of Oro Valley is 27,362, and the estimated 2051 population level is 91,435.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the Town of Oro Valley would increase from 5,509 af in year 2001 to 18,411 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-76. Based on anticipated water demands, CAP water allocated under the Settlement Alternative would provide 65 percent and 19 percent of the current estimated water supply required for the Town of Oro Valley for the years 2001 and 2051, respectively.

Table L-M&I-76
CAP Allocation Draft EIS
Town of Oro Valley– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	5,851	5,509	0	0	0	0	12,560	5,509	18,411
No Action	0	2,294	2,294	0	0	0	3,215	16,117	5,509	18,411
Non-Settlement Alternative 1	0	5,851	5,509	0	0	0	0	12,560	5,509	18,411
Non-Settlement Alternative 2	0	2,294	2,294	0	0	0	3,215	16,117	5,509	18,411
Non-Settlement Alternative 3A	0	2,294	2,294	0	0	0	3,215	16,117	5,509	18,411
Non-Settlement Alternative 3B	0	5,851	5,509	0	0	0	0	12,560	5,509	18,411

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 18,411 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 3,557 afa of demand are met by the additional CAP allocation. Alternatively, this 3,557 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the Town of Oro Valley were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-77 provides the projected acres of land within the Town of Oro Valley service area which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

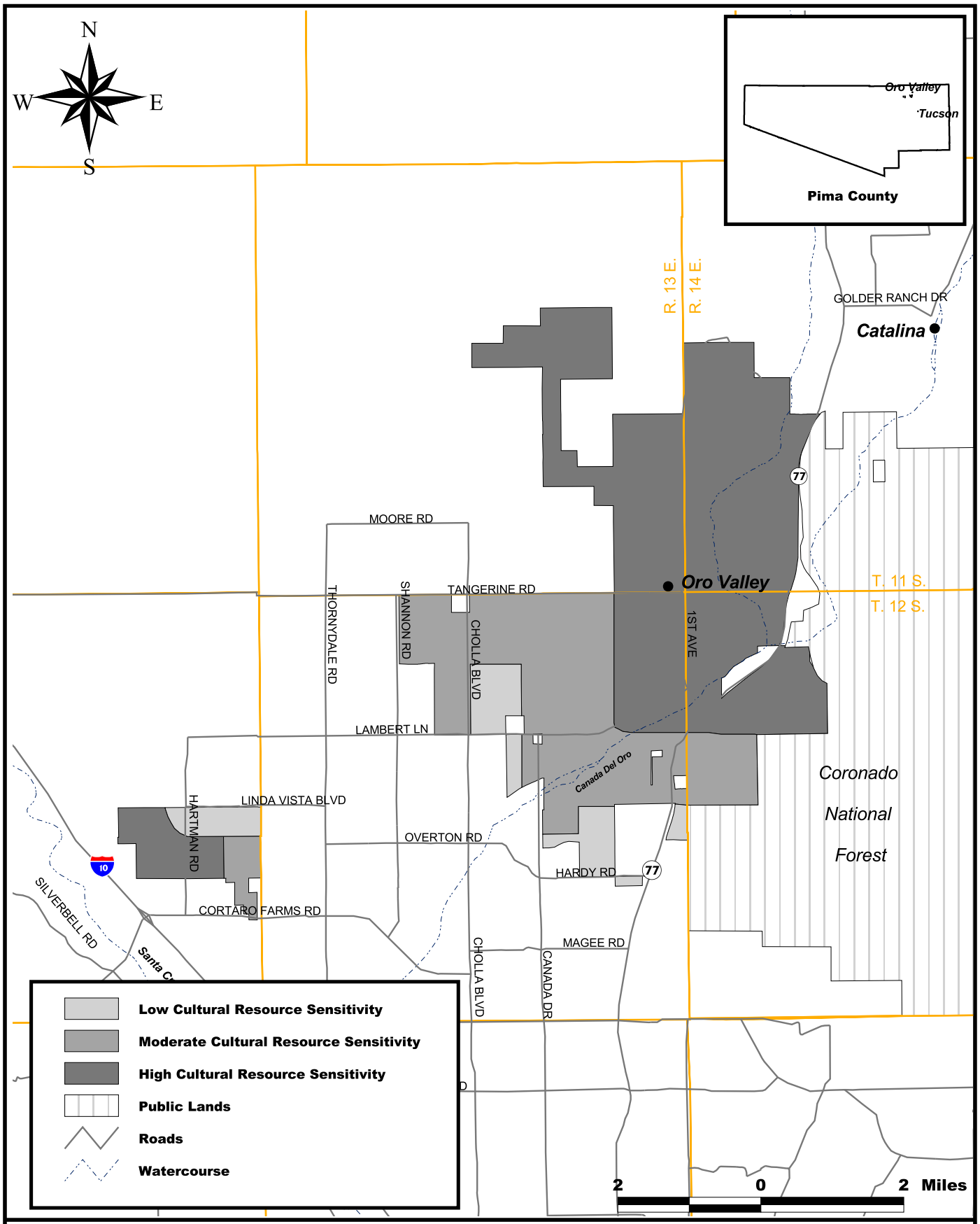
TableL-M&I-77
CAP Allocation Draft EIS Appendix L
Town of Oro Valley – Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert*	Desert Urbanized**	Urban	Changes in Urban Acreage
Settlement Alternative	2001	0	--	1,013	--	1,695	--
	2051	0	0	0	1,013	2,708	1,013
No Action	2001	0	--	1,013	--	1,695	--
	2051	0	0	0	1,013	2,708	1,013
Non-Settlement Alternative 1	2001	0	--	1,013	--	1,695	--
	2051	0	0	0	1,013	2,708	1,013
Non-Settlement Alternative 2	2001	0	--	1,013	--	1,695	--
	2051	0	0	0	1,013	2,708	1,013
Non-Settlement Alternative 3A	2001	0	--	1,013	--	1,695	--
	2051	0	0	0	1,013	2,708	1,013
Non-Settlement Alternative 3B	2001	0	--	1,013	--	1,695	--
	2051	0	0	0	1,013	2,708	1,013

2. Archaeological Resources

The Town of Oro Valley service area is of high-to-moderate cultural resource sensitivity and has been extensively surveyed. On the southeast, it borders the Sutherland Wash Archaeological District, a National Register property containing more than 40 sites. Prehistoric sites also abound along Cañada del Oro, Sutherland Wash, Big Wash, Chalk Creek, and the numerous other arroyos that drain the region. Protohistoric and historic trails, roads, and sites associated with farming, ranching, and prospecting might also be present within the Town of Oro Valley service area.

Cultural resource sensitivity areas in the Town of Oro Valley service area are shown on Figure L-M&I-39. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Town of Oro Valley service area is high. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Once the plans for taking delivery of CAP water are finalized, Reclamation would carry out additional cultural resource compliance as appropriate, prior to water delivery.



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CAP Allocation Draft EIS
Cultural Resources
Town of Oro Valley

June 2000

Figure #L-M&I-39

3. Biological Resources

Existing Habitats

Low rocky hills of granite dominate the northeastern portion of the Oro Valley service area where typical Bursage/Foothill Paloverde Association occurs. Common co-dominants include velvet mesquite, creosote-bush, and Engelmann prickly-pear. Other common trees include velvet mesquite, desert ironwood, blue-paloverde, netleaf hackberry, and saguaro. In the deeper soils of the lower alluvial plains and valleys occurs a phase of Bursage/Foothill Paloverde Association somewhat transitional to disclimax grassland. Saguaros are much less common in this area. Blue Paloverde/Desert Ironwood Association habitat occurs along major washes, which are ephemeral, where more dominant species include burro-bush, desert-broom, blue-paloverde, velvet mesquite, foothill paloverde and netleaf hackberry. The habitat zones are shown on Figure L-M&I-40. Table L-M&I-78 provides the habitat acreages for the habitat zones described above.

TableL-M&I-78
CAP Allocation Draft EIS
Town of Oro Valley - Habitat Acreages

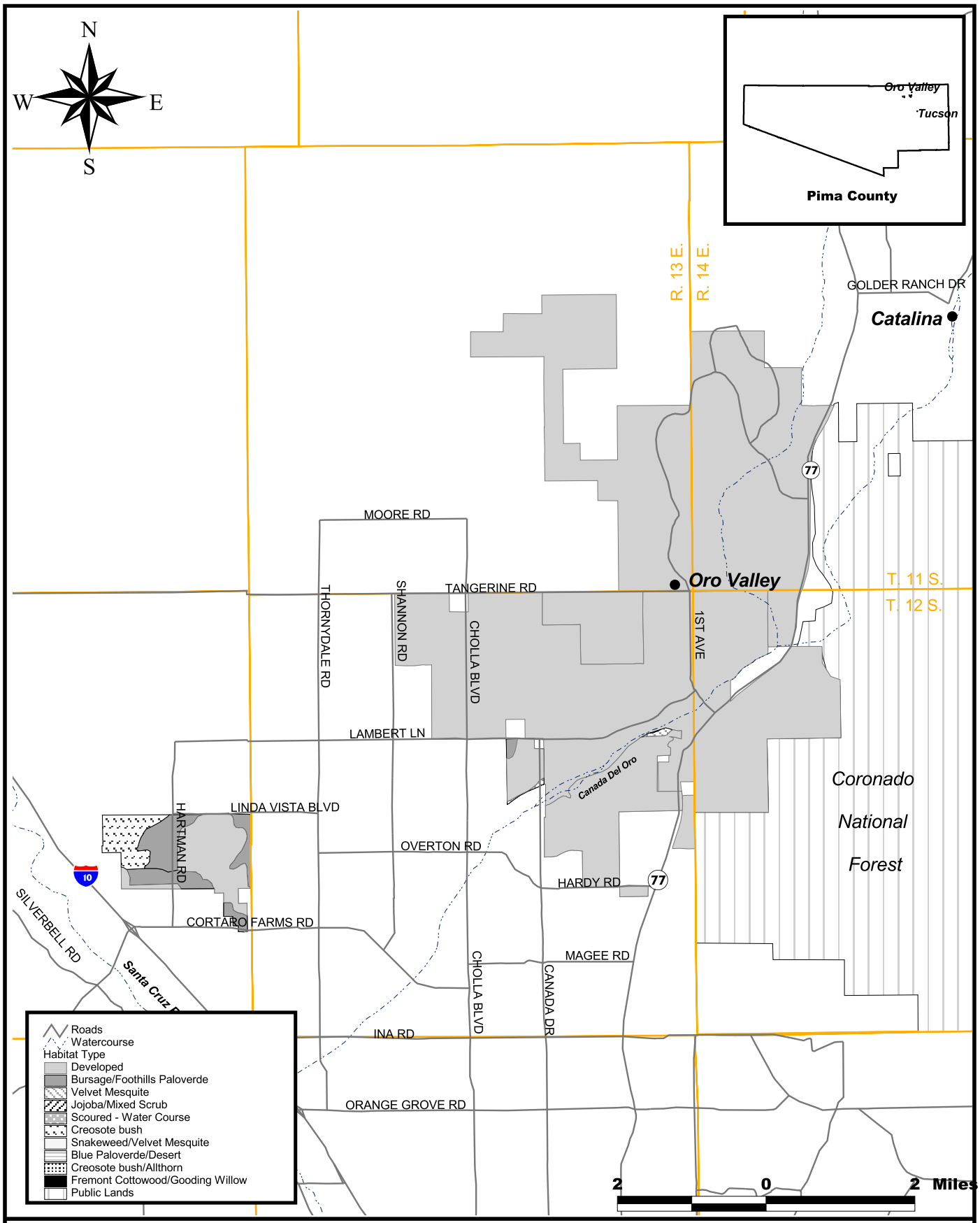
Vegetation Name	Acres
Developed	1,695
Bursage/Foothills Paloverde	774
Velvet Mesquite	21
Scoured, Washes and Creeks	1
Creosote-Bush	217
Total	**2,708**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Town of Oro Valley service area over the 50-year study period would result in loss of an estimated 1,157 acres of Sonoran Desertscrub and associated wildlife resources. There may also be indirect impacts on wildlife occurring in the adjacent undeveloped habitat. Under the action alternatives, there is no difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities, Reclamation would carry out additional environmental review once plans are developed.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The Town of Oro Valley would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.



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CAP Allocation Draft EIS
Habitat Zones
Town of Oro Valley

June 2000

Figure No. L-M&I-40

The Town of Oro Valley service area is located within Pima County for which there are 16 T&E species listed by USFWS. However, potential habitat only exists for cactus ferruginous pygmy-owl. Approximately 795 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the Town of Oro Valley service area.

4. Water Resources

Demands in the Town of Oro Valley have historically been met primarily by pumping groundwater from the underlying sedimentary rocks. This reliance on groundwater has resulted in declining groundwater levels over time, and there has been subsidence associated with these lower groundwater levels. The concentration of TDS in the underlying groundwater is generally less than 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-79, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Most of the Town of Oro Valley was contained in two groundwater sub-areas. The first number shown in Table L-M&I-73 represents groundwater levels for the eastern part of Oro Valley, and the second number represents the western part of Oro Valley. Declines in groundwater levels and groundwater impacts are similar in both the eastern and western part of Oro Valley.

Under the No Action Alternative, groundwater levels would decline by as much as about 88 feet from 2001 to 2051 in the western part of the town. A portion of the CAP water available to the Town of Oro Valley would be directly delivered, while a portion would be recharged in direct recharge facilities. The CAP water (and particularly the water directly delivered) tends to improve groundwater levels, but the continued decline in groundwater levels results from increased demands over time that would be met by increased local groundwater pumping. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels.

Groundwater levels would also decline for all of the action alternatives. However, the declines under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B would be substantially smaller than under the No Action Alternative, reflecting the additional allocation of CAP water received under those alternatives. For Non-Settlement Alternatives 2 and 3A, the Town of Oro Valley would not receive an additional allocation of CAP water, and the groundwater levels would be similar to the No Action Alternative.

Substantial changes in groundwater quality would not be anticipated for any of the alternatives. However, there would be the potential for subsidence under all alternatives.

Table L-M&I-79 CAP Allocation Draft EIS Town of Oro Valley –Groundwater Data Table		
Alternatives		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-88 / -74	--
Settlement Alternative	-59 / -61	30 / 14
Non-Settlement Alternative 1	-62 / -62	27 / 12
Non-Settlement Alternative 2	-90 / -74	-1 / 0
Non-Settlement Alternative 3A	-90 / -74	-1 / 0
Non-Settlement Alternative 3B	-61 / -61	28 / 13

*Values correspond to the East CMIDD and Oro Valley sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment Town of Oro Valley's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 19.3 percent of the total year 2051 demand for the Town of Oro Valley.

Table L-M&I-80
CAP Allocation Draft EIS
Oro Valley–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	214 – 218[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	214 – 218[b]	CAGRD
Non-Settlement Alternative 3A	214 – 218[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

17. Town of Superior/Arizona Water Company-Superior

The Town of Superior/Arizona Water Company-Superior is located 63 miles east of Phoenix in Pinal County. The town is in a mountainous setting at an elevation of 2,882 feet and is surrounded by peaks such as the Iron Mountain at 6,056 feet. Major employment in the Town of Superior/Arizona Water Company-Superior includes mining, trade and service. The community is improving its trade and service sector in order to expand the income from tourism. Agriculture is significant to the local economy and ranching is conducted in the surrounding areas. The Town of Superior/Arizona Water Company-Superior service area is located in two units, one surrounding Florence Junction and the other surrounding Superior itself.

A. Plans to Take and Use CAP Water

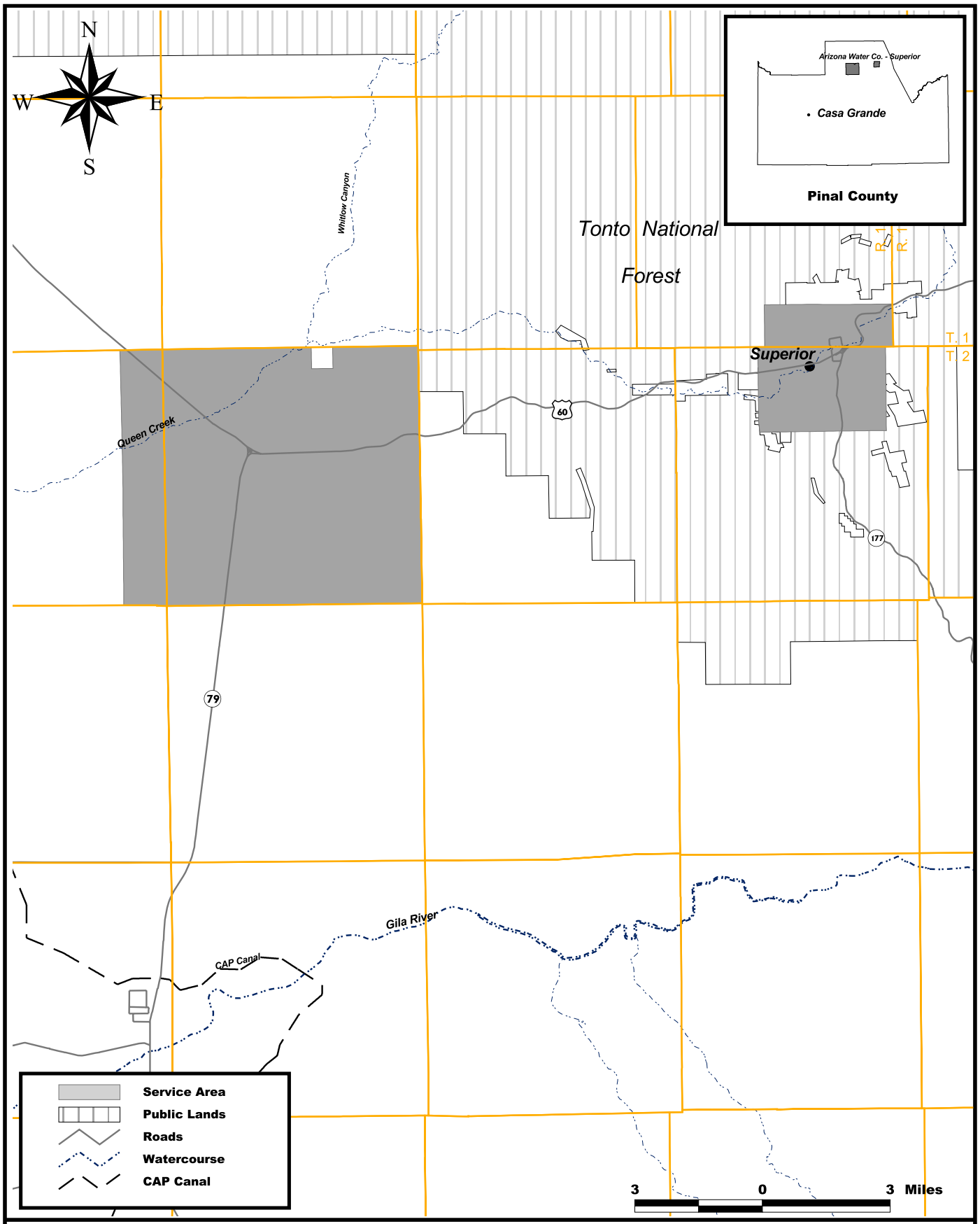
The Town of Superior/Arizona Water Company-Superior currently has no contract for CAP water. Under the Settlement Alternative, Superior would receive 285 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-99 outlines the proposed allocations by alternative.

Table L-M&I-99
CAP Allocation Draft EIS
Town of Superior/Arizona Water Company-Superior– Proposed CAP Allocation*

Alternative	Allocation (in afa)	Priority
Settlement Alternative	285	M&I
No Action	0	-
Non-Settlement Alternative 1	285	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	312	NIA
Existing CAP Allocation	-	-

* If the allocation is not accepted, then the 285 af (or 312 af) from the Town of Superior/Arizona Water Company-Superior would be recommended for the Arizona Water Company for use in Superior or Apache Junction.

Figure L-M&I-50 shows the service area for the Town of Superior/Arizona Water Company-Superior. The service area covers approximately 22,634 acres. The Town of Superior is located approximately 30 miles away from the closest connection to CAP water. Specific plans to convey the CAP water to Superior are not known at this time. Superior would use the CAP water for irrigation of greenbelt areas and possibly for potable uses. The Arizona Water Company is the current potable water supplier to the Town of Superior. No facilities currently exist to convey the water from the CAP system to the



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CAP Allocation Draft EIS
General Location Map
Town of Superior / Arizona Water Company - Superior

June 2000

Figure #L-M&I-50

Arizona Water Company's service area in the Town of Superior (Chavez 2000).

B. Population Projection

The estimated 2001 population level for the Town of Superior / Arizona Water Company-Superior is 3,483, and the estimated 2051 population level is 3,709.

C. Water Demand and Supply Quantities

As previously shown in Appendix C– M&I Sector Water Uses, it is estimated that water demand in the Town of Superior / Arizona Water Company-Superior would increase from 493 af in year 2001 to 525 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-100. Based on anticipated water demands, CAP water which would be allocated under the Settlement Alternative would provide 58 percent and 54 percent of the current estimated water supply required for the Town of Superior / Arizona Water Company-Superior for the years 2001 and 2051, respectively.

Table L-M&I-100
CAP Allocation Draft EIS
Town of Superior/Arizona Water Company-Superior– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	285	285	0	0	0	0	208	240	493	525
No Action	0	0	0	0	0	0	493	525	493	525
Non-Settlement Alternative 1	285	285	0	0	0	0	208	240	493	525
Non-Settlement Alternative 2	0	0	0	0	0	0	493	525	493	525
Non-Settlement Alternative 3A	0	0	0	0	0	0	493	525	493	525
Non-Settlement Alternative 3B	285	285	0	0	0	0	208	240	493	525

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 525 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and Non-Settlement Alternative 3B, 285 afa of demand is met by the additional CAP allocation. Alternatively, this 285 afa of demand is met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2, and Non-Settlement Alternative 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the Town of Superior / Arizona Water Company were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS Table L-M&I-101 provides the projected acres of land within the Town of Superior / Arizona Water Company-Superior service area, which are agriculture, desert or urban, and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-101
CAP Allocation Draft EIS
Town of Superior/Arizona Water Company-Superior –
Projected Land Use Changes Within the service area(in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	0	-	2,929	-	101	-
	2051	0	0	2,891	38	139	38
No Action	2001	0	-	2,929	-	101	-
	2051	0	0	2,891	38	139	38
Non-Settlement Alternative 1	2001	0	-	2,929	-	101	-
	2051	0	0	2,891	38	139	38
Non-Settlement Alternative 2	2001	0	-	2,929	-	101	-
	2051	0	0	2,891	38	139	38
Non-Settlement Alternative 3A	2001	0	-	2,929	-	101	-
	2051	0	0	2,891	38	139	38
Non-Settlement Alternative 3B	2001	0	-	2,929	-	101	-
	2051	0	0	2,891	38	139	38

2. Archaeological Resources

Survey coverage of the Town of Superior / Arizona Water Company-Superior service area is generally low. The easternmost parcel has been examined only via linear surveys; approximately 10 historic sites, including buildings, roads, trails, and sites related to

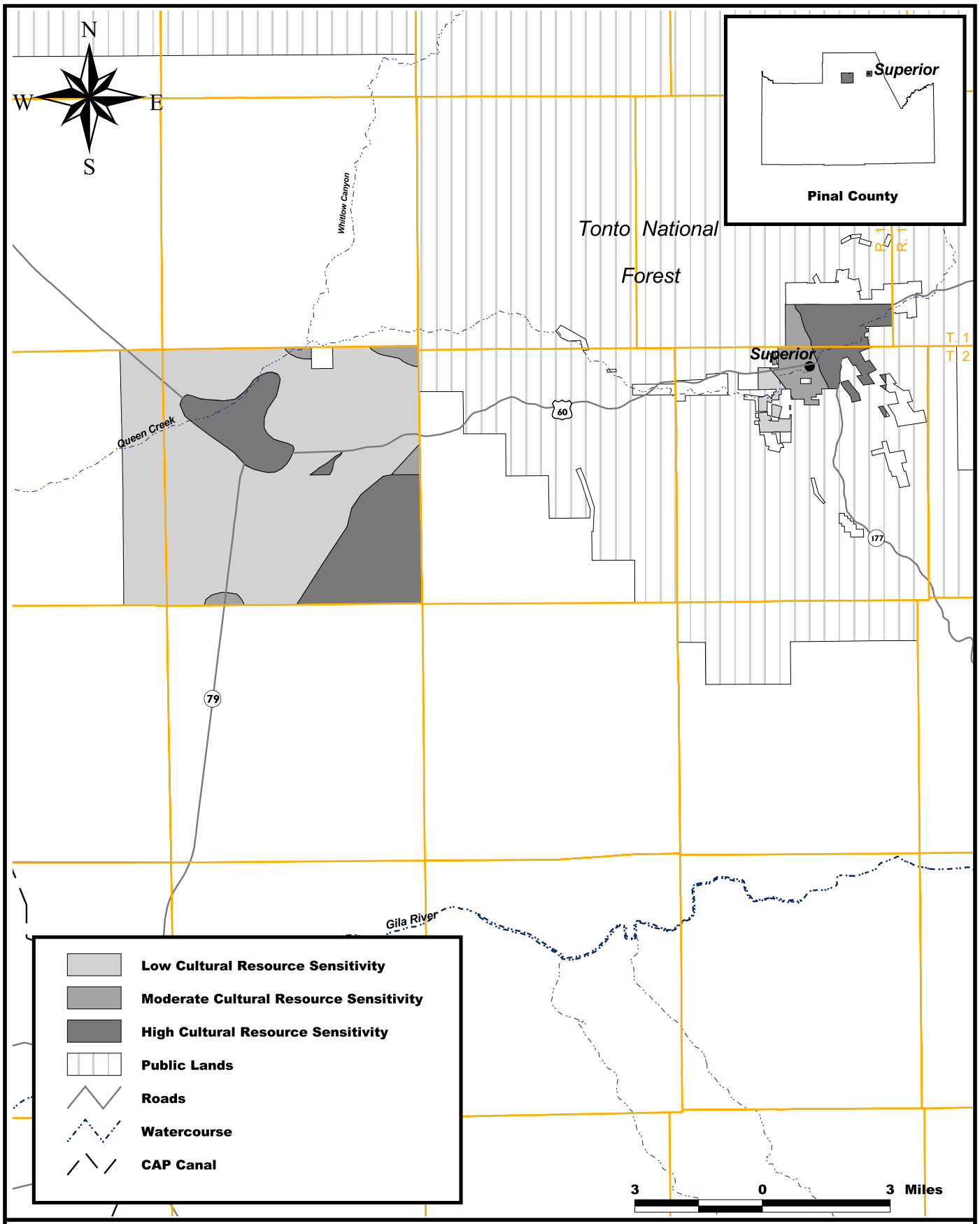
mining, have been documented near Superior City limits. Camps, prospecting loci, shafts, and other sites associated with the area's gold and silver mines (e.g., Queen Creek, Belmont, Grand Pacific) are abundant in this area. In the high cultural sensitivity areas in the north-central and southeastern portions of the westernmost parcel, linear surveys and small block surveys have identified numerous prehistoric sites, including large Hohokam villages (e.g., Los Montículos), prehistoric agricultural features (e.g., field houses, check dams, terraces), artifact scatters, and special-use sites (e.g., lithic quarries). Historic resources include roads (e.g., AZ U:11:70(ASM), historic U.S. 60/70/80/89), railroads, and associated transportation-related features.

Cultural resource sensitivity areas in the Town of Superior/Arizona Water Company-Superior MPA are shown on Figure L-M&I-51. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Town of Superior/Arizona Water Company-Superior service area is high to moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. Once the plans for taking delivery of CAP water are finalized, Reclamation would carry out additional cultural resource compliance as appropriate, prior to water delivery.

3. Biological Resource

Existing Habitats

Low mountains (to 3,350-foot elevation) dominate the north-central portion of the Florence Junction area of the Town of Superior/Arizona Water Company-Superior service area. The steeper slope and rocky ridges support Jojoba/Mixed Scrub Association. Alluvial fans spread from these rocky ridges and merge into broad plains in the southern portion. Bursage-Foothill Paloverde Association occurs on the alluvial fans and eastern plains where co-dominants include buckhorn cholla, Engelmann hedgehog, chain-fruit cholla, and creosote-bush. Other common trees include velvet mesquite, desert ironwood, and saguaro. The distribution of saguaros is moderately dense. Creosote-bush Association occurs in the deeper soils. Creosote-bush frequency is high and tree frequency is very low. Near Superior, most vegetation of steeper slopes (to 4,500-foot elevation) is Jojoba/Mixed Scrub Association. Co-dominants include snakeweed, fairy-duster, brittle-bush, and Engelmann prickly-pear. Tree species include foothill paloverde, crucifixion-thorn, blue-paloverde, velvet mesquite, mountain-laurel, and saguaro. The distribution of saguaros is moderately dense. Disclimax Grassland Association occurs on the deeper soils around Superior and is dominated by snakeweed and Engelmann prickly-pear. Common trees include saguaro, blue-paloverde, foothill paloverde, and velvet mesquite. Riparian woodland, with Fremont cottonwood and Goodding willow occurs along Queen Creek, which are perennial in certain locations. The habitat zones are shown on Figure L-M&I-52.



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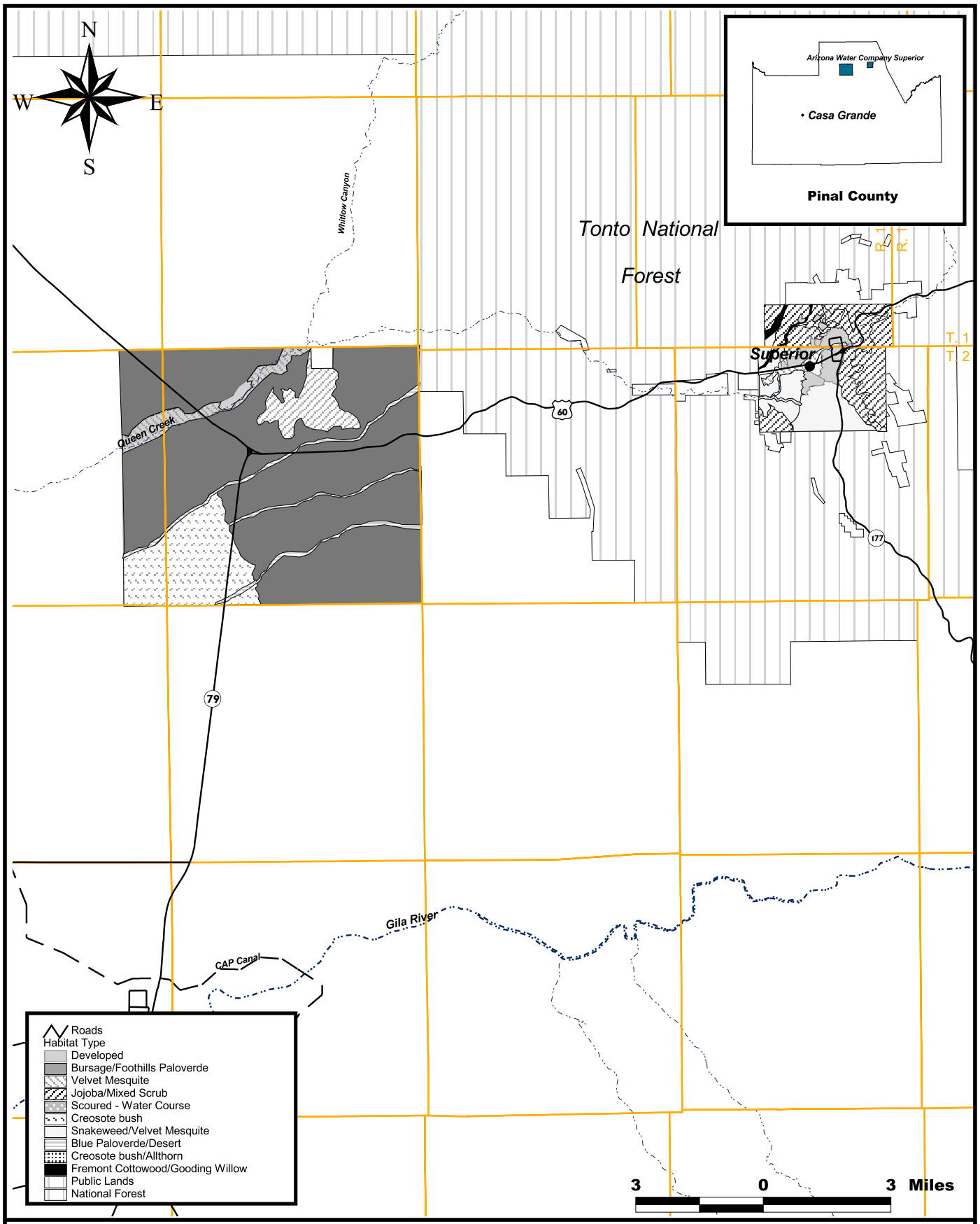
CAP Allocation Draft EIS
Cultural Resources
Town of Superior / Arizona Water Company - Superior

June 2000

Figure #L-M&I-51



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CAP Allocation Draft EIS
Habitat Zones
Town of Superior / Arizona Water Company - Superior

June 2000

Figure No. L-M&I-52

Table L-M&I-102 provides the habitat acreages for the habitat zones described above.

Table L-M&I-102
CAP Allocation Draft EIS
Town of Superior/Arizona Water Company-Superior– Habitat Acreages

Vegetation Name	Acres
Developed	101
Bursage / Foothills Paloverde	1,854
Velvet Mesquite	101
Jojoba / Mixed Scrub	402
Creosote-Bush	312
Snakeweed / Velvet Mesquite	141
Blue Paloverde / Desert	118
Fremont Cottonwood / Goodding Willow	2
Total	**3,031**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Town of Superior / Arizona Water Company-Superior service area would result in loss of an estimated 38 acres of Sonoran desertscrub and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities, Reclamation would carry out additional environmental review once plans are developed.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The Town of Superior / Arizona Water Company-Superior would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The Town of Superior / Arizona Water Company-Superior service area is located within Pinal County for which there are 13 T&E species listed by USFWS. Potential habitat only exists for cactus ferruginous pygmy-owl, southwestern willow flycatcher, Arizona hedgehog cactus, and Arizona agave. Approximately 2,073 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were identified within the Town of Superior / Arizona Water Company-Superior service area. Also, approximately 1,182 acres above 3,000 feet of potential suitable habitat for Arizona agave were identified. Potentially suitable habitat for Arizona hedgehog cactus exists on rocky, steep slopes, which are not likely to be developed. Potentially suitable habitat for southwestern willow flycatcher may occur in isolated pockets along Queen Creek. However, construction within the riparian

corridor would require issuance of CWA Section 404 permits by the Corps. As part of the permitting process, the Corps would have to comply with Section 7 of the ESA, and detailed surveys for T&E species would be carried out as necessary.

4. Water Resources

Demands in the Town of Superior have historically been met by pumping groundwater from the basin fill in the vicinity of Florence Junction (east of Superior) and piping that water to Superior. Limited data are available on groundwater level conditions and groundwater quality near those wells.

Estimated groundwater level impacts are summarized in Table L-M&I-103, which shows the estimated groundwater level changes for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Under the No Action Alternative, groundwater levels would decline by about 36 feet from 2001 to 2051. This decline primarily reflects the continued groundwater outflow toward NMIDD to the west. There would be the potential for subsidence in this area due to the declining groundwater levels.

Groundwater levels under the Settlement and Non-Settlement Alternatives would also decline over the 2001 to 2051 period. These declines would be greater than the declines under the No Action Alternative and could result in additional subsidence relative to the No Action Alternative. The larger declines in groundwater levels primarily occur due to greater groundwater level declines in NMIDD to the east, and the resulting increased groundwater flow to NMIDD.

Table L-M&I-103
CAP Allocation Draft EIS
Town of Superior/Arizona Water Company-Superior –Groundwater Data Table

Alternative	**Florence Junction**	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-36	--
Settlement Alternative	-80	-44
Non-Settlement Alternative 1	-47	-12
Non-Settlement Alternative 2	-83	-47
Non-Settlement Alternative 3A	-77	-41
Non-Settlement Alternative 3B	-75	-39

*****Values correspond to the Florence Junction sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of Town of Superior/Arizona Water Company-Superior's total water supply is considered insignificant.

Table L-M&I-104
CAP Allocation Draft EIS
Town of Superior/Arizona Water Company-Superior –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water (per af)*	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	259-261[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	259-261[b]	CAGRD
Non-Settlement Alternative 3A	259-261[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

18. City of Surprise

The City of Surprise is located in the fast-growing part of the Valley of the Sun, and to the northwest of Phoenix, in Maricopa County. The City of Surprise was originally founded to provide home sites for agricultural workers in the West Valley. The city is experiencing explosive growth in its residential, commercial and industrial sectors. The city also offers business and industry opportunities for growth and profit. The MPA is located north of Bell Road, west Dysart Road, Bullard Avenue, and 163rd Avenue, east of R4W, and south of the Maricopa County line.

According to the ADWR Annual Water Withdrawal and Use Report, in the City of Surprise in 1998, 89 af of groundwater were pumped and delivered, and 121 af of groundwater was also received from other IDs. Of the total 210 af of water, 54 af were delivered to other users leaving 156 af to be used in the City of Surprise.

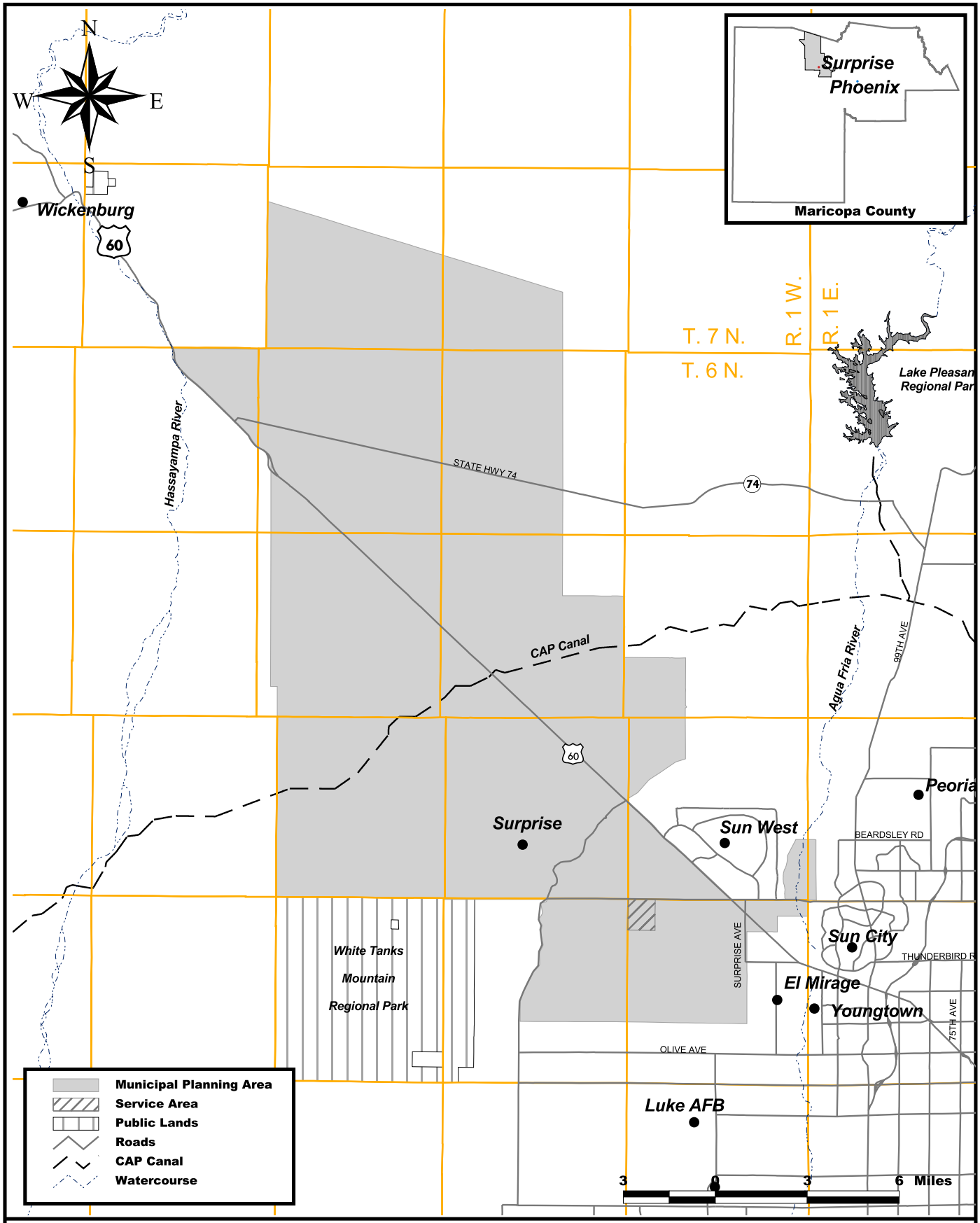
A. Plans to Take and Use CAP Water

The City of Surprise currently has a subcontract for 7,373 af of CAP water. Under the Settlement Alternative, the city would receive an additional 2,876 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-105 outlines the proposed CAP allocation by alternative.

Table L-M&I-105
CAP Allocation Draft EIS
City of Surprise - Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	2,876	M&I
No Action	0	-
Non-Settlement Alternative 1	2,876	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	3,146	NIA
Existing CAP Allocation	7,373	-

Figure L-M&I-53 shows the service area and MPA for the City of Surprise. The service area covers approximately 573 acres and the MPA covers approximately 174,396 acres. The City of Surprise's short-term plans to take and use their CAP water involve two planned recharge and recovery facilities: McMicken Dam and Surprise Park. The McMicken Dam Recharge Facility is proposed to be located west of McMicken Dam, between Grand Avenue and Bell Road. CAP water could either be wheeled through the Beardsley Canal or conveyed through a pipeline with an alignment along Grand Avenue to the recharge



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June 2000

CAP Allocation Draft EIS
General Location Map
City of Surprise

Figure #L-M&I-53

facility. The first phase of this project has a capacity of 10,000 afa and is scheduled for completion in 2000, with an ultimate capacity of 100,000 afa. If constructed, the pipeline from the CAP system to the McMicken Dam recharge facility would extend approximately six miles along the Grand Avenue alignment and would disturb approximately 75 acres, assuming a 100-foot wide construction easement.

The Surprise Park Recharge Facility is located near the Luke Auxiliary Airfield, west of Litchfield Road and south of Bell Road. It is planned to be operational within 2 years for effluent recharge and five years for CAP water recharge. Recovery from either facility would be through existing City of Surprise wells. CAP water could be supplied to this facility via an extension of the aforementioned potential pipeline along Grand Avenue. If constructed, this reach of the pipeline would also be approximately 6 miles long and would disturb another approximately 75 acres.

The City of Surprise is participating in the West Salt River Valley CAP Subcontractors (WESTCAPS) planning process for a regional long-term solution for taking and using CAP water. One option that is being considered by the WESTCAPS group is a regional water treatment plant sited on the Beardsley Canal at Bell Road or Grand Avenue (Swanson 2000).

B. Population Projection

The estimated 2001 population for the City of Surprise is 26,506 and, the estimated 2051 population is 235,977.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the City of Surprise would increase from 6,354 af in year 2001 to 56,566 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-106. Based on anticipated water demands, which are provided above, CAP water which would be allocated under the Settlement Alternative would provide 52 percent and six percent of the current estimated water supply required for the City of Surprise for the years 2001 and 2051, respectively.

Table L–M&I-106
CAP Allocation Draft EIS
City of Surprise – Projected Water Use

Alternative	Annual CAP		Groundwater		Effluent		CAGRD Ground Water		Other Surface Water*		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	2,812	10,987	791	791	0	3,584	0	21,381	2,751	19,823	6,354	56,566
No Action	2,812	7,373	791	791	0	3,584	0	24,257	2,751	19,823	6,354	56,566
Non-Settlement Alternative 1	2,812	10,249	791	791	0	3,584	0	21,381	2,751	19,823	6,354	56,566
Non-Settlement Alternative 2	2,812	7,373	791	791	0	3,584	0	24,257	2,751	19,823	6,354	56,566
Non-Settlement Alternative 3A	2,812	7,373	791	791	0	3,584	0	24,257	2,751	19,823	6,354	56,566
Non-Settlement Alternative 3B	2,812	10,249	791	791	0	3,584	0	21,381	2,751	19,823	6,354	56,566

*SRP and other districts.
Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 56,566 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 2,876 afa of are met by the additional CAP allocation. Alternatively, this 2,876 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

According to data from MAG, the land use designations in the City of Surprise MPA in 1995 consisted of approximately 18,181 acres of agriculture, 11,166 acres of developed land, 707 acres of rural land, 143,343 acres of vacant land, and 999 acres of water, including lakes, rivers and canals. As described in the introduction to this appendix, the 1995 MAG categories were redefined into three new categories (i.e., agriculture, desert and urban). These 1995 data were also updated and adjusted based on reviews of the 1998 aerial photography and the field surveys that were completed to assess biological resources for

this EIS. Table L-M&I-107 provides the projected acres of land within the City of Surprise MPA that are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

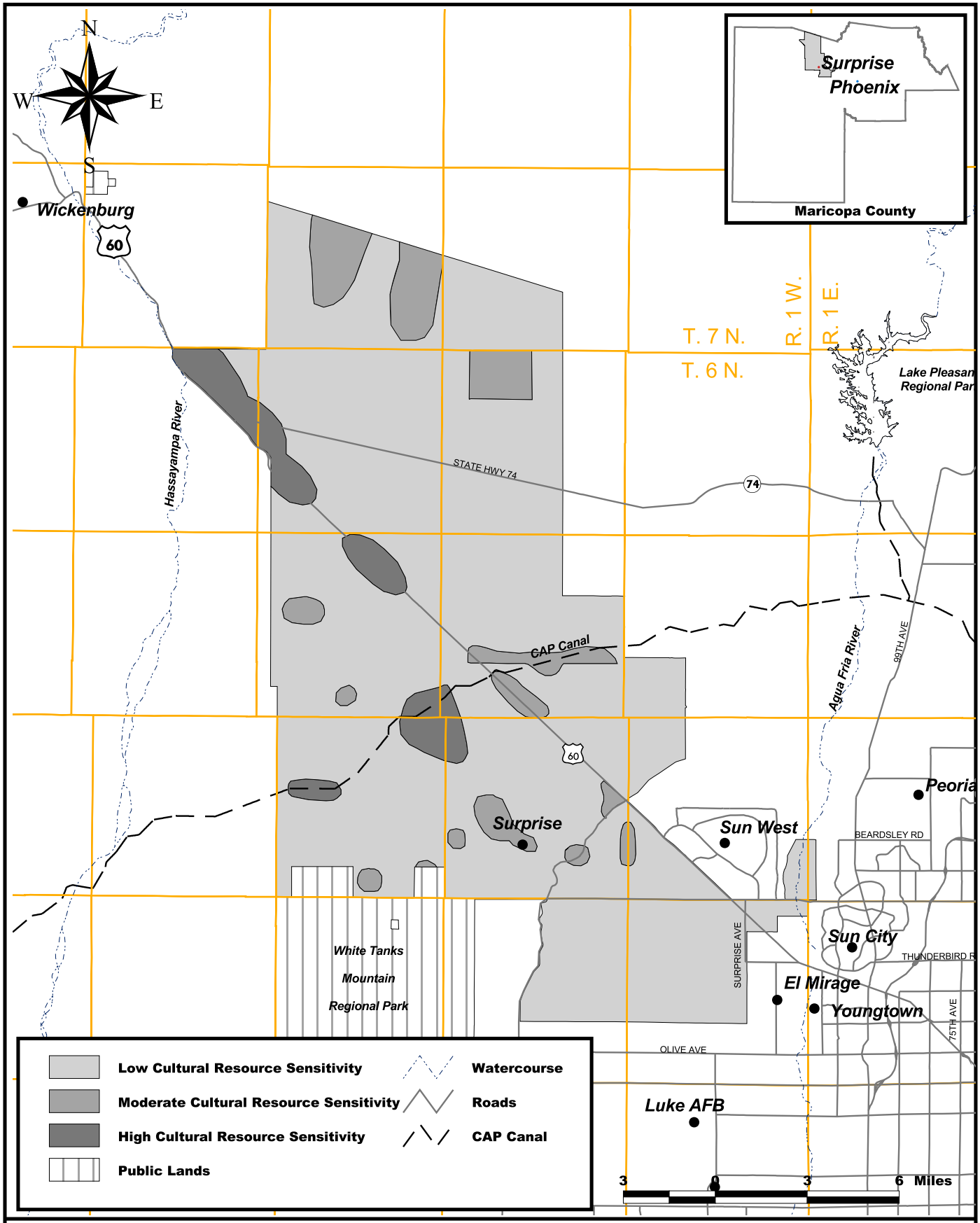
TableL-M&I-107
CAP Allocation Draft EIS
City of Surprise – Projected Land Use Changes Within the MPA (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	12,160	--	141,190	--	21,046	--
	2051	0	12,160	118,567	22,623	55,829	34,783
No Action	2001	12,160	--	141,190	--	21,046	--
	2051	0	12,160	118,567	22,623	55,829	34,783
Non-Settlement Alternative 1	2001	12,160	--	141,190	--	21,046	--
	2051	0	12,160	118,567	22,623	55,829	34,783
Non-Settlement Alternative 2	2001	12,160	--	141,190	--	21,046	--
	2051	0	12,160	118,567	22,623	55,829	34,783
Non-Settlement Alternative 3A	2001	12,160	--	141,190	--	21,046	--
	2051	0	12,160	118,567	22,623	55,829	34,783
Non-Settlement Alternative 3B	2001	12,160	--	141,190	--	21,046	--
	2051	0	12,160	118,567	22,623	55,829	34,783

2. Archaeological Resources

A few linear (e.g., Hathaway 1991; Jensen 1994; Kwiatkowski 1993) and block (e.g., Dosh 1988; Neily 1992b) surveys have taken place within the City of Surprise MPA; however, the majority of the MPA has not been examined. The vicinity of Morristown, in the northwest portion of the entity, is classified as an area of high cultural resource sensitivity. Numerous historic properties representing most identified historic contexts have been documented therein, including sites associated with homesteading, transportation, mining, ranching, and agriculture. Although the majority of the surface remains identified to date in this area have been historic, prehistoric and protohistoric resources also are known, including Archaic and Ceramic period artifact concentrations, agricultural features (e.g., AZ T:2:50(ASM)), roasting pits, cleared circles, and rock rings. Elsewhere within the entity, other small areas of high and moderate cultural resource sensitivity reflect the noncontiguous nature of the MPA's survey coverage. It should be noted that the surveyed areas have tended to yield cultural resources, therefore, the potential for additional resources in unexamined areas is high.

Cultural resource sensitivity areas in the City of Surprise MPA are shown on Figure L-M&I-54. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit).



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June 2000

CAP Allocation Draft EIS
Cultural Resources
City of Surprise

Figure #L-M&I-54

Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. With regard to new facilities taking and treating the additional CAP allocation, Reclamation would carry out additional cultural resource compliance as appropriate, based on final plans provided by Surprise. The McMicken Dam Recharge Facility was already subject of an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) prepared by Reclamation in 1996.

3. Biological Resources

Existing Habitats

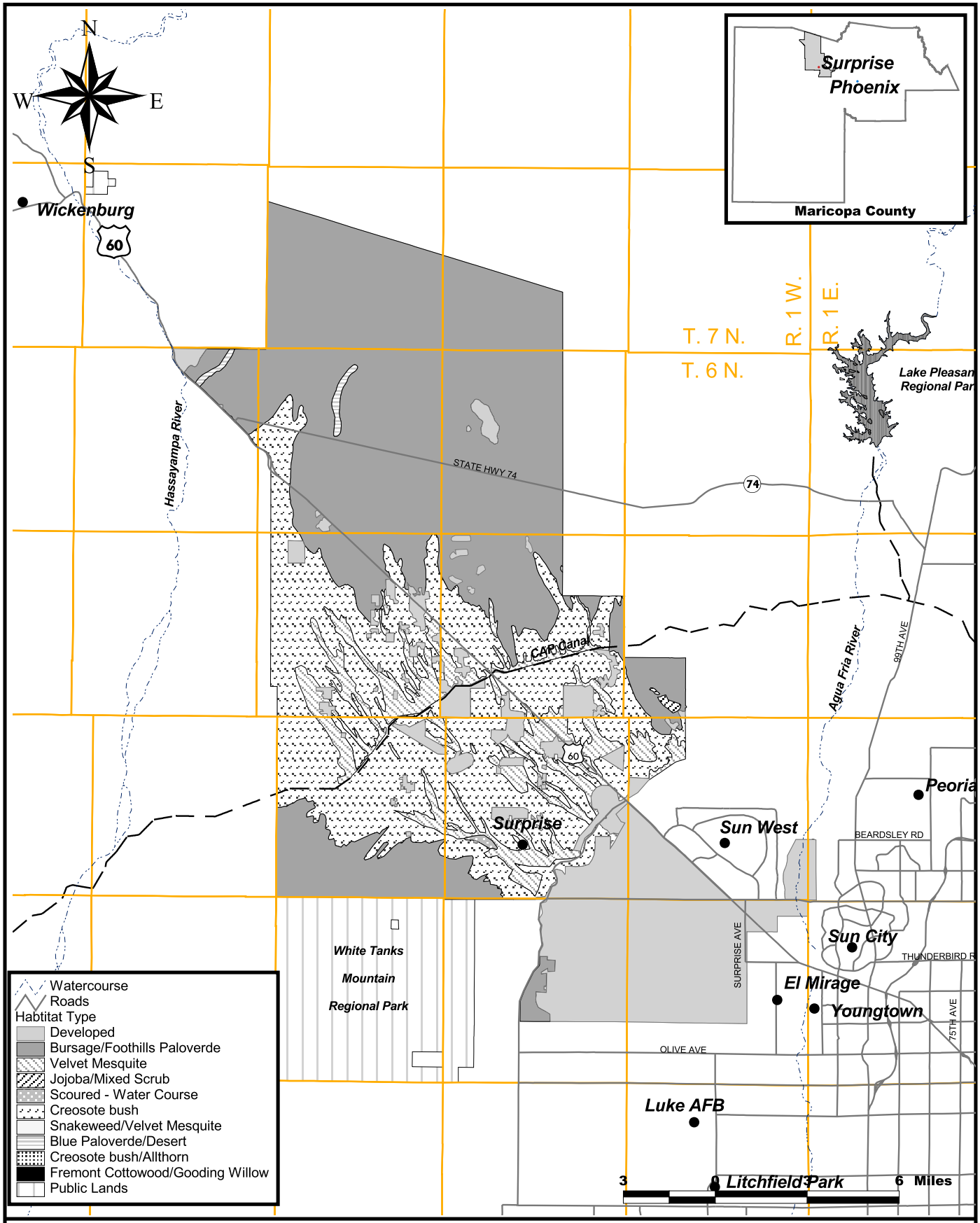
The northern portion of the City of Surprise MPA is composed of rocky hills and ridges below 3,500 feet in elevation within the Wickenburg Mountains. Jojoba/Mixed Scrub Association occurs mainly on the steeper, north-facing slopes. Co-dominants include *Parish viguiera,* white-thorn acacia, wild-buckwheat, and turpentine-bush. Bursage/Foothill Paloverde Association occurs on the remaining slopes, alluvial fans and bajadas. Co-dominants include creosote-bush and staghorn cholla. Other common trees include velvet mesquite, desert ironwood, blue-paloverde, allthorn, and saguaro. Saguaro density is generally moderate. The Creosote-Bush Association occurs in the southern portion of the water district on silty plains, often forming a mosaic with Velvet Mesquite Association. Blue-Paloverde/Desert Ironwood Association habitat occurs along major ephemeral washes. The habitat zones are shown on Figure L-M&I-55. Table L-M&I-108 provides the habitat acreages for the habitat zones described above.

TableL-M&I-108
CAP Allocation Draft EIS
City of Surprise MPA – Habitat Acreages

Vegetation Name	Acres
Developed	33,206
Bursage/Foothills Paloverde	79,493
Velvet Mesquite	12,175
Jojoba/Mixed Scrub	145
Scoured, Washes and Creekbeds	130
Creosote Bush	48,680
Blue Paloverde/Desert	567
Total	**174,396**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the City of Surprise MPA over the 50-year study period would result in the loss of an estimated 22,623 acres of Sonoran desertscrub and associated wildlife resources. There may be indirect impacts on wildlife occurring in the adjacent undeveloped habitat.



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Habitat Zones
City of Surprise

Figure No. L-M&I-55

An estimated 12,160 acres of farmland would be urbanized. This urbanization of the farmland would result in the creation of fallow fields for some undetermined length of time. Fallow agricultural fields in the area may be used by burrowing owls, a species protected under the MBTA. Individual developers who convert fallow lands for urban uses would be responsible for ensuring burrowing owls are removed prior to development. Failure to do so would be considered a violation of the MBTA. Under the action alternatives, there is no difference in impacts from the No Action baseline.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The City of Surprise would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The City of Surprise MPA is located within Maricopa County; there are 14 T&E species listed by the USFWS. Potentially suitable habitat only exists for cactus ferruginous pygmy owl, and Arizona agave. Approximately 92,235 acres of potentially suitable habitat for the cactus ferruginous pygmy owl were identified within the City of Surprise MPA. Also, approximately 155 acres above 3,000 feet of potentially suitable habitat for Arizona agave were identified.

4. Water Resources

Demands in the City of Suprise have historically been met by pumping groundwater from the basin fill. The City of Surprise covers an extensive geographic area. Much of the present development is in the southeastern part of the city, which is within the area analyzed. In the future, development may occur northwesterly, out of the West SRV and into the Hassayampa sub-basin. The analysis performed placed the demands for this population within the West SRV area.

Estimated groundwater level impacts are summarized in Table L-M&I-109, which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. The City of Surprise falls within three groundwater sub-areas used for the analysis. Table L-M&I-109 shows estimated groundwater conditions (in order of presentation in the table) in the vicinity of Sun City West, in the vicinity of the City of El Mirage, and north of the western part of the City of Glendale.

Under the No Action Alternative, groundwater levels would decline by about 136 to 150 feet during the 2001 to 2051 period east of the City of El Mirage and north of the City of Glendale. In the vicinity of Sun City West, groundwater levels would be essentially unchanged from the present levels. The declines reflect the continued reliance on groundwater to meet demands, both in the City of Surprise and in adjacent areas. The declines have been moderated by the impact of direct recharge of CAP water in the Agua Fria recharge facilities and in future west-side recharge facilities located south of the city. Substantial changes in TDS concentrations would not be anticipated under the No Action Alternative. The lower groundwater levels in the most southerly areas considered could result in subsidence.

Groundwater levels near the Cities of El Mirage and Glendale would also decline under the Settlement and all Non-Settlement Alternatives. The greatest declines occur under the Settlement Alternative and Non-Settlement Alternatives 3A and 3B, which have the smallest amount of direct recharge. There would be potential subsidence in this area under all alternatives.

Groundwater levels near Sun City West under the Settlement Alternative and Non-Settlement Alternatives would be similar to the levels under the No Action Alternative (within 14 feet). These groundwater levels are influenced both by the amount of direct recharge of CAP water in adjacent areas and by changes in the amount of CAP water available to the City of Surprise and adjacent M&I entities.

The impacts in the Settlement Alternative and Non-Settlement Alternatives primarily reflect the influence of direct recharge in the MWD sub-area. The magnitude of the decline in groundwater levels from No Action Alternative groundwater levels for each alternative generally reflects the reduction in CAP water available from the Recharge Pool.

Table L-M&I-109 CAP Allocation Draft EIS City of Surprise – Groundwater Data Table		
Alternatives		
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact**(in Feet)**
No Action	1 / -136 / -150	--
Settlement Alternative	-4 / -198 / -231	-4 / -62 / -80
Non-Settlement Alternative 1	12 / -147 / -160	11 / -11 / -10
Non-Settlement Alternative 2	-5 / -157 / -172	-5 / -21 / -21
Non-Settlement Alternative 3A	-13 / -185 / -207	-14 / -49 / -57
Non-Settlement Alternative 3B	3 / -172 / -202	2 / -36 / -51

*Values correspond to the Sun City West, West-side M&I, and MWD sub-areas, respectively, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of the City of Surprise's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 5.6 percent of the total year 2051 demand for the City of Surprise.

Table L-M&I-110
CAP Allocation Draft EIS Appendix L
City of Surprise –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	272 – 280[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	272 – 280[b]	CAGRD
Non-Settlement Alternative 3A	272 – 280[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

20. Vail Water Company

Vail Water Company is a subsidiary of Horizon Corporation, owner of Rancho Del Lago, an 1800+-acre ranch located near the City of Vail. It was formerly known as the Vail Water Company. The Vail Water Company service area is located north of Sahuarita Road, west of Range 17 East, east of Range 15 East, and south of the Saguaro National Park (east). According to the ADWR Annual Water Withdrawal and Use Report, in the Vail Water Company service area in 1998, a total of 208 af of groundwater were pumped and delivered.

A. Plans to Take and Use CAP Water

The Vail Water Company currently has a subcontract for 786 af of CAP water, but has never taken delivery of any CAP water. Under the Settlement Alternative, the Vail Water Company would receive 1,071 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-117 outlines the proposed allocations by alternative.

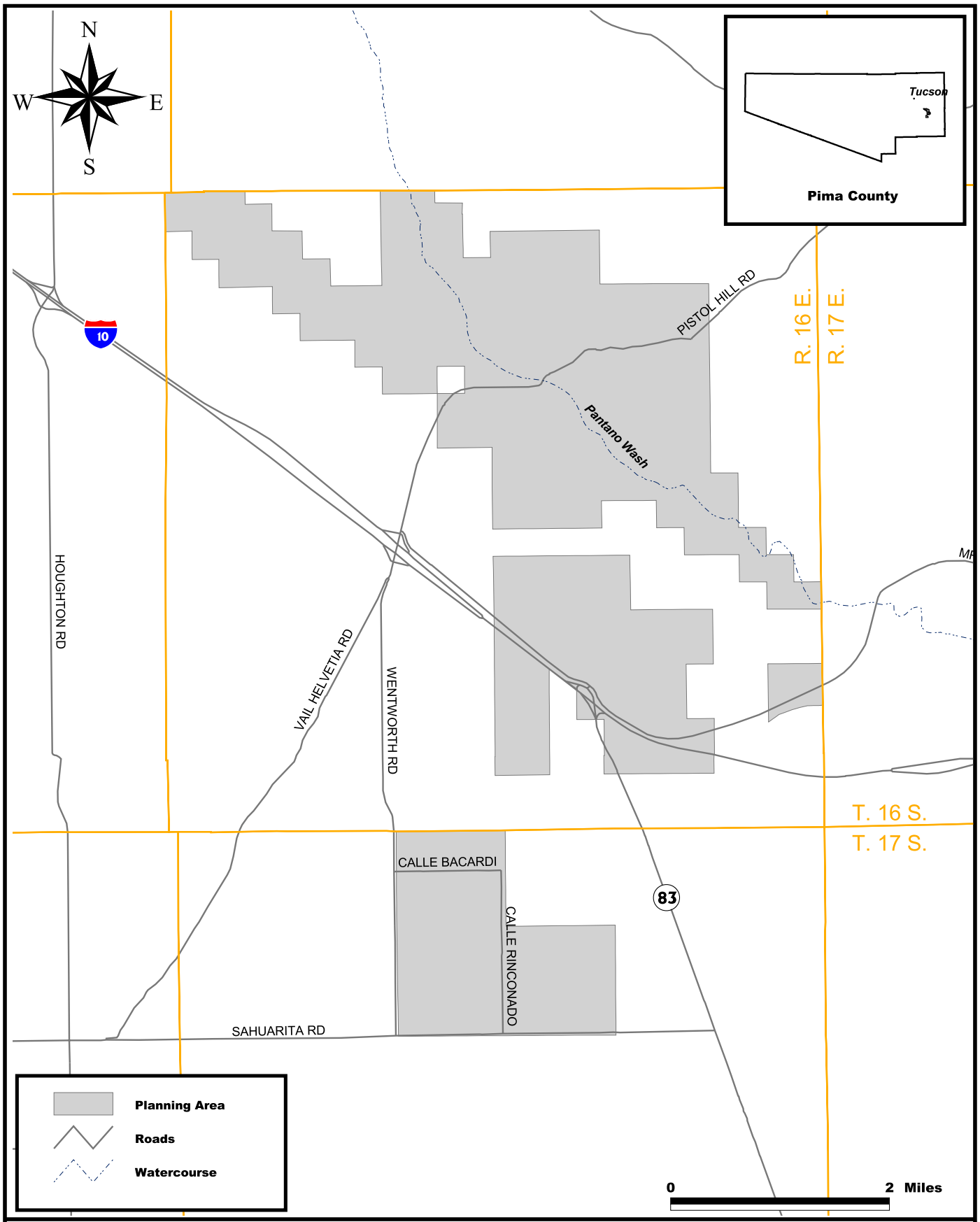
Table L-M&I-117
CAP Allocation Draft EIS
Vail Water Company – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	1,071	M&I
No Action	0	--
Non-Settlement Alternative 1	1,071	M&I
Non-Settlement Alternative 2	0	--
Non-Settlement Alternative 3A	0	--
Non-Settlement Alternative 3B	1,712	NIA
Existing CAP Allocation	786	

Figure L-M&I-59 shows the service area for the Vail Water Company, which covers approximately 9,480 acres. The Vail Water Company's plans to take and use CAP water involve in-lieu recharge with Kai Farms. Recovery would utilize existing wells within the Vail Water Company's service area (Noll 2000).

B. Population Projection

The population in 1985 for Vail Water Company service area was 500. The estimated 2001 population is 3,100 and, the estimated 2051 population level is 19,623.



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
General Location Map
Vail Water Company

Figure #L-M&I-59

C. Water Demand and Supply Quantities

As previously shown in Appendix C-M&I Sector Water Uses, it is estimated that water demand in the Vail Water Company service area would increase from 568 af in year 2001 to 3,958 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-118. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide over 100 percent and 27 percent of the current estimated water supply required for the Vail Water Company service area for the years 2001 and 2051, respectively.

Table L-M&I-118
CAP Allocation Draft EIS
Vail Water Company– Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	1,857	568	0	0	0	0	1,741	568	3,598
No Action	0	786	568	0	0	0	0	2,812	568	3,598
Non-Settlement Alternative 1	0	1,857	568	0	0	0	0	1,741	568	3,598
Non-Settlement Alternative 2	0	786	568	0	0	0	0	2,812	568	3,598
Non-Settlement Alternative 3A	0	786	568	0	0	0	0	2,812	568	3,598
Non-Settlement Alternative 3B	0	1,857	568	0	0	0	0	1,741	568	3,598

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 3,598 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 1,071 afa of demand are met by the additional CAP allocation. Alternatively, this 1,071 afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the Vail Water Company were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-119 provides the projected acres of land within the Vail Water Company service area, which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-119
CAP Allocation Draft EIS
Vail Water Company– Projected Land Use Changes Within the Service Area (in acres

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changed to Urban Acreage
Settlement Alternative	2001	0	--	8,161	--	1,319	--
	2051	0	0	7,230	931	2,250	931
No Action	2001	0	--	8,161	--	1,319	--
	2051	0	0	7,230	931	2,250	931
Non-Settlement Alternative 1	2001	0	--	8,161	--	1,319	--
	2051	0	0	7,230	931	2,250	931
Non-Settlement Alternative 2	2001	0	--	8,161	--	1,319	--
	2051	0	0	7,230	931	2,250	931
Non-Settlement Alternative 3A	2001	0	--	8,161	--	1,319	--
	2051	0	0	7,230	931	2,250	931
Non-Settlement Alternative 3B	2001	0	--	8,161	--	1,319	--
	2051	0	0	7,230	931	2,250	931

2. Archaeological Resources

Survey coverage of the Vail Water Company service area was primarily linear, although a few small block surveys have taken place in the northwest portion of the service area, where numerous sites have been found. The service area extends onto the Colossal Cave County Park, a National Register property consisting of more than 20 prehistoric, protohistoric, and historic activity loci; similar remains might be expected in adjacent, unsurveyed portions of the service area. Documented prehistoric resource types include undifferentiated lithic scatters, sherd scatters, and agricultural features (e.g., rock piles, clusters). The Vail Station (AZ BB:14:18(ASM)), a historic site associated with the Union Pacific/Southern Pacific Railroad is within the Vail Water Company service area boundaries. This site, which is characterized by artifacts and features of Anglo, Mexican, and Chinese affiliation, was the main depot for miners working in the Santa Rita Mountains; it is likely that other sites associated with mining and/or transportation might

present within the service area boundaries.

Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-60. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Vail Water Company service area is moderate. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. With regard to water delivery facilities, Reclamation would carry out additional cultural resource compliance as appropriate, prior to water delivery.

3. Biological Resources

Existing Habitats

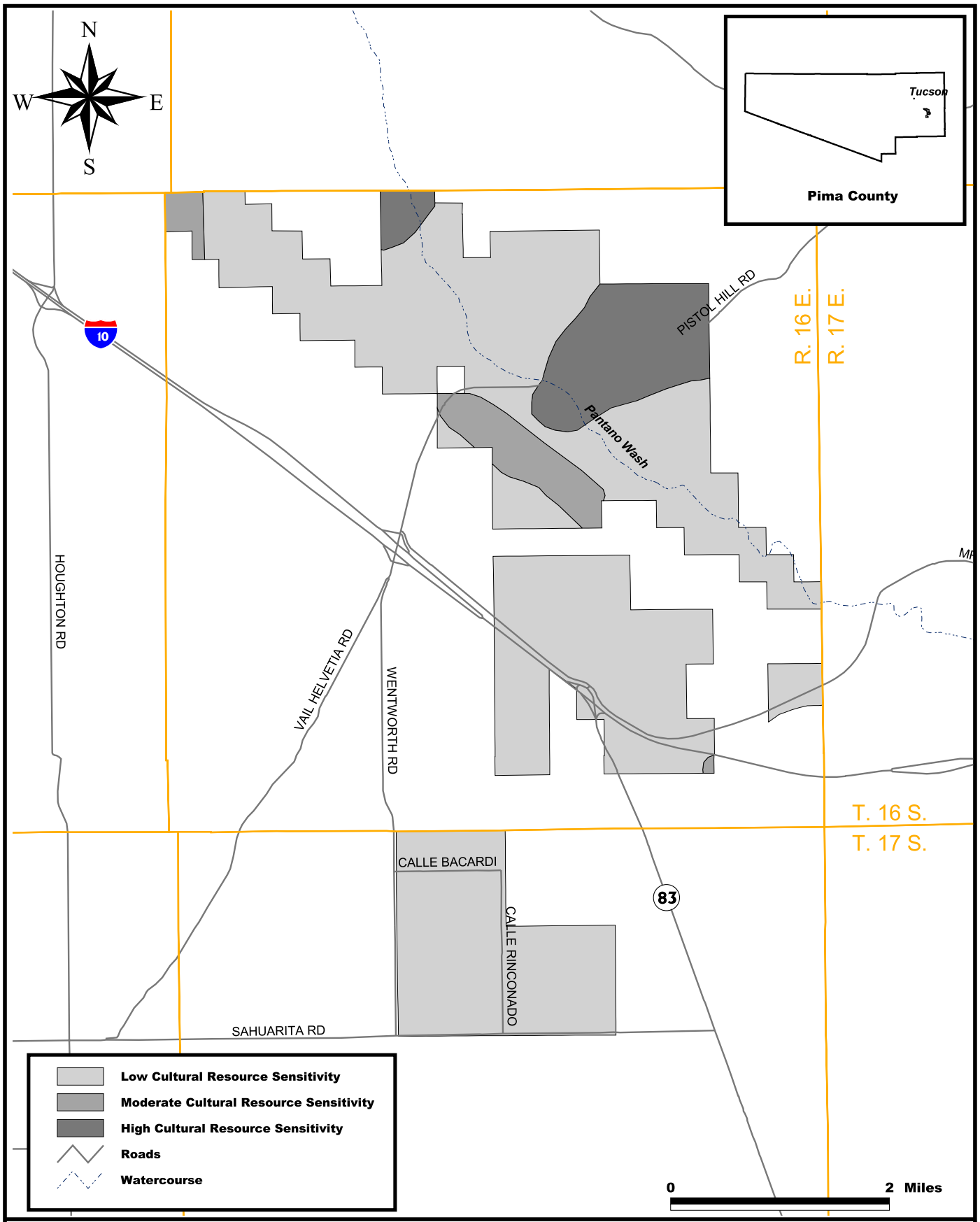
The Vail Water Company service area occurs on broad alluvial plains. The Bursage/Foothill Paloverde Association occurs on coarser soils where co-dominant trees include velvet mesquite and saguaro. Creosote-Bush Association and Disclimax Grassland Association occurs on the siltier soils, where saguaro density is low. Co-dominants include chain-fruit cholla, white-thorn acacia, and tiquilia. Common trees include foothill paloverde and velvet mesquite. Whitestem paperflower is unusually common within all communities. The habitat zones are shown on Figure L-M&I-61. Table L-M&I-120 provides the habitat acreages for the habitat zones described above.

Table L-M&I-120
CAP Allocation Draft EIS
Vail Water Company- Habitat Acreages

Vegetation Name	Acres
Developed	1,319
Bursage/Foothills Paloverde	1,647
Scoured, Washes and Creeks	225
Creosote-Bush	2,453
Snakeweed/Velvet Mesquite	3,836
Total	**9,480**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the Vail Water Company service area would result in loss of an estimated 931 acres of Sonoran Desertscrub and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities, Reclamation would carry out additional environmental review once plans are developed.



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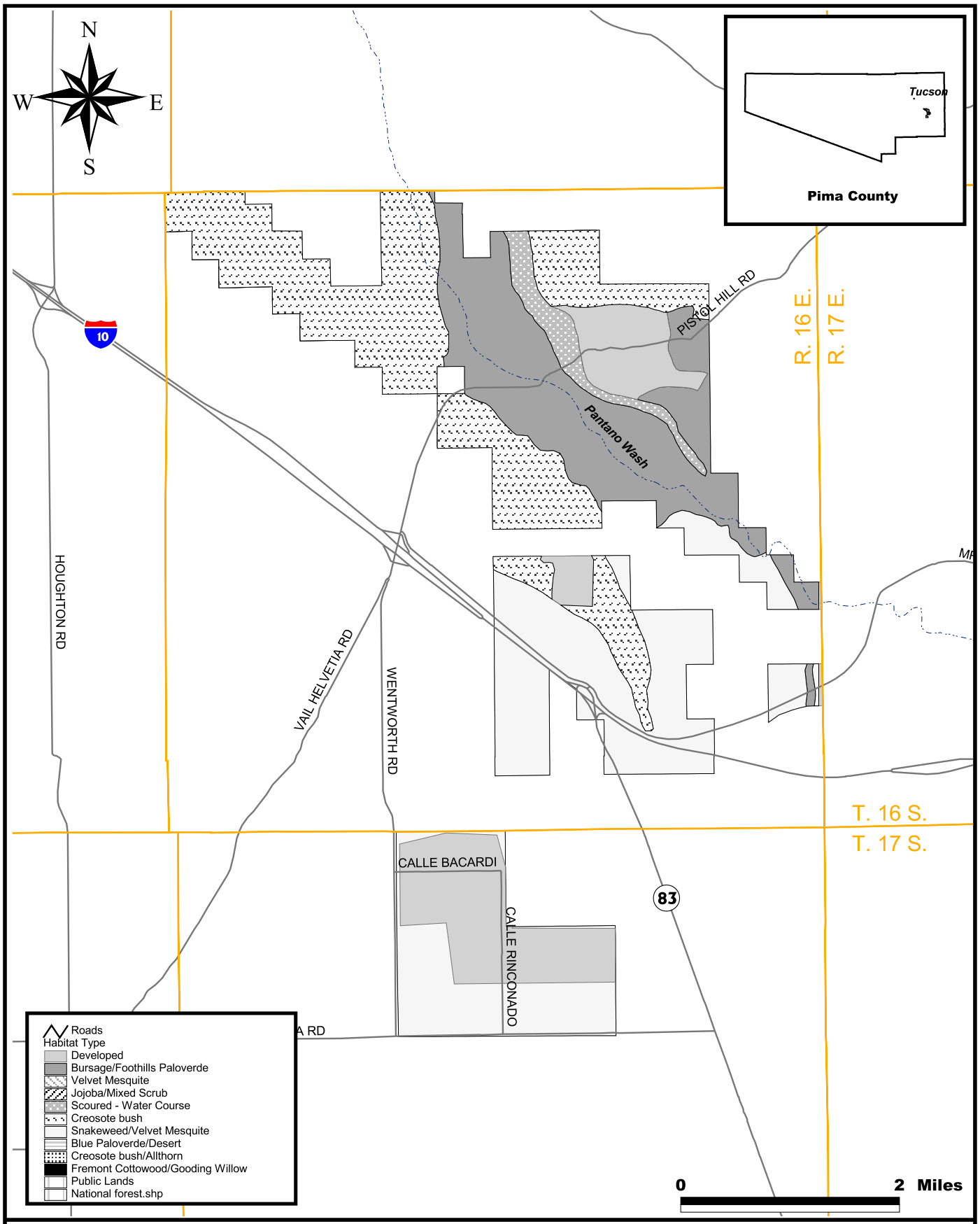
June 2000

CAP Allocation Draft EIS
Cultural Resources
Vail Water Company

Figure #L-M&I-60



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Habitat Zones
Vail Water Company

Figure No. L-M&I-61

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The appropriate municipal or local governmental jurisdiction would be responsible for complying with the provisions of the ESA as it permits and approves future urban growth.

The Vail Water Company service area is located within Pima County for which there are 16 T&E species listed by USFWS. However, potentially suitable habitat only exists for cactus ferruginous pygmy-owl and the Pima pineapple cactus. There is no designated critical habitat for the Pima pineapple cactus and approximately 5,209 acres of potentially suitable habitat have been identified. Also, approximately 1,647 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl have been identified within the Vail Water Company service area.

4. Water Resources

Demands in the Vail Water Company have historically been met by pumping groundwater from the underlying sedimentary rocks. This reliance on groundwater has resulted in declining groundwater levels over time. The concentration of TDS in the underlying groundwater is generally from 500 to 1,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-121, which shows the estimated groundwater level change for the period form 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Under the No Action Alternative, groundwater levels would decline by about 68 feet from 2001 to 2051. This decline would primarily result from increased demands over time that would be met through increased local groundwater pumping. This includes both Vail Water Company pumping and nearby pumping for the City of Tucson. CAP water available to the Vail Water Company would be both delivered directly and recharged in direct recharge facilities. The direct recharge facilities would be located away from the Vail Water Company wells, which would limit the benefit of that recharge on the local groundwater levels. Substantial changes in groundwater quality would not be anticipated. However, there would be the potential for subsidence due to the lower groundwater levels.

Groundwater levels would also decline for all of the action alternatives. However, the declines would be slightly smaller for all of the action alternatives than for the No Action Alternative (by four to 12 feet, depending on the alternative). The smaller declines are primarily a reflection of changes in groundwater underflows that result from higher groundwater levels to the west of the Vail Water Company due to greater amounts of direct recharge by the San Xavier District of the Tohono O'odham Nation and in the Pima Mine Road facilities.

The groundwater level declines estimated for all alternatives for the 2001 to 2051 period could result in subsidence in this area.

Table L-M&I-121
CAP Allocation Draft EIS
Vail Water Company–Groundwater Data Table

Alternative	**Vail***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-68	--
Settlement Alternative	-55	13
Non-Settlement Alternative 1	-63	4
Non-Settlement Alternative 2	-59	8
Non-Settlement Alternative 3A	-59	8
Non-Settlement Alternative 3B	-55	12

*Values correspond to the Vail sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of Vail Water Company's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 29.8 percent of the total year 2051 demand for Vail Water Company.

Table L-M&I-122
CAP Allocation Draft EIS
Vail Water Company–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	223 – 227[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	223 – 227[b]	CAGRD
Non-Settlement Alternative 3A	223 – 227[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

21. Valley Utilities Water Company

The Valley Utilities Water Company service area is located north of Camelback Road, west of El Mirage Road, east of Litchfield Road, and south of Glendale Avenue. According to the ADWR Annual Water Withdrawal and Use Report, in the Valley Utilities Water Company service area in 1998, a total of 490 af of groundwater was pumped and delivered. Approximately eight af were delivered to other users and the remaining 481 af were delivered for use in the area.

A. Plans to Take and Use CAP Water

The Valley Utilities Water Company service area currently has no contract for CAP water. Under the Settlement Alternative, the Valley Utilities Water Company would receive 250 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-123 outlines the proposed allocations by alternative.

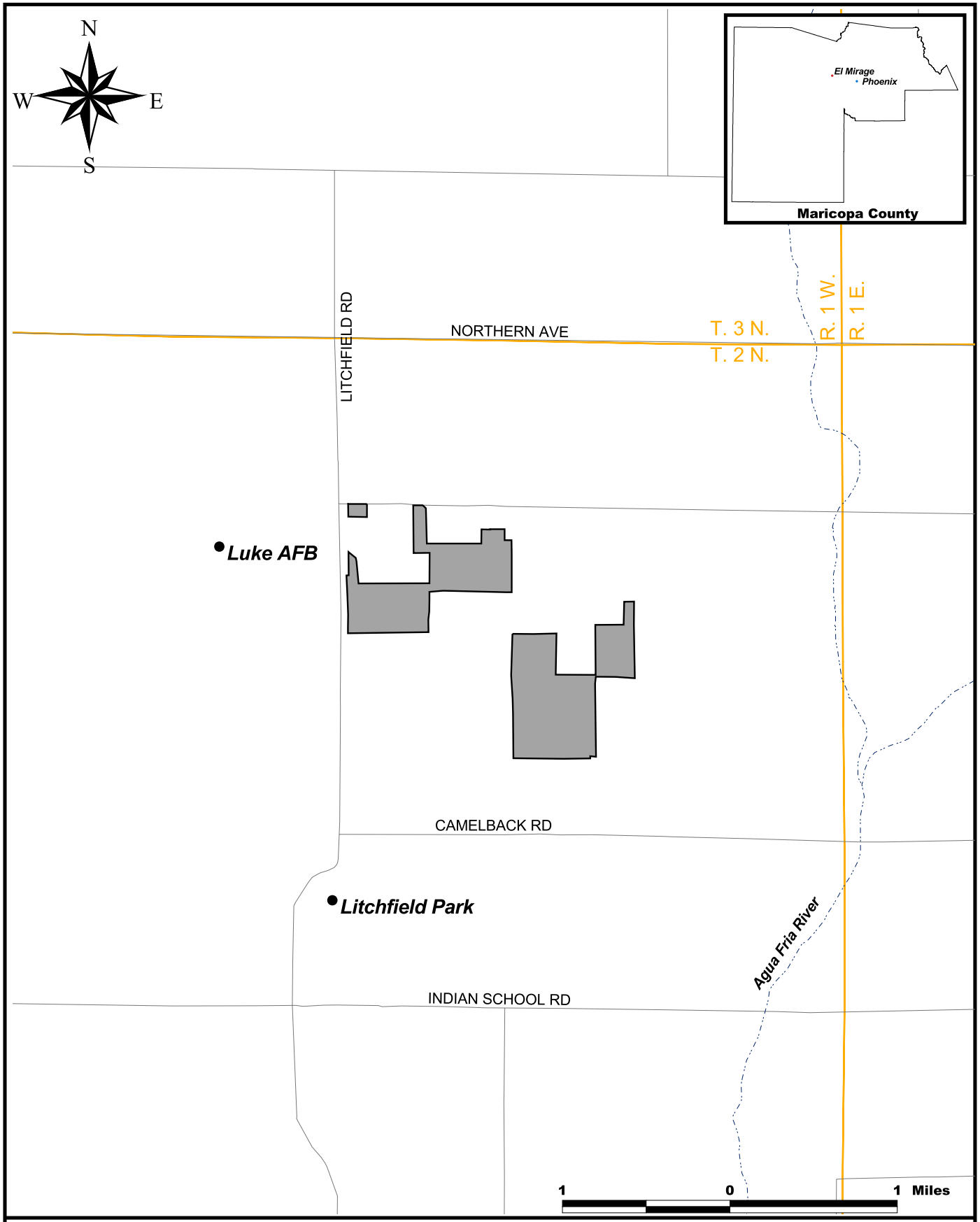
Table L-M&I-123
CAP Allocation Draft EIS
Valley Utilities Water Company – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	250	M&I
No Action	0	-
Non-Settlement Alternative 1	250	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	273	NIA
Existing CAP Allocation	-	-

Figure L-M&I-62 shows the service area for the Valley Utilities Water Company, which covers approximately 467 acres. The Valley Utilities Water Company is in the process of developing plans to take and use their proposed CAP allocation. Potential options include wheeling through the City of Glendale's system or assigning their proposed allocation to the CAGRD and continuing to pump existing wells (Prince 2000).

B. Population Projection

The estimated 2001 population level for the Valley Utilities Water Company service area is 7,726 and the estimated 2051 population level is 18,445.



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BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
General Location Map
Valley Utilities Water Company

Figure #L-M&I-62

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand in the Valley Utilities Water Company service area would increase from 1,093 af in year 2001 to 2,609 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-124. Based on these anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 23 percent and 10 percent of the current estimated water supply required for the Valley Utilities Water Company for the years 2001 and 2051, respectively.

Table L-M&I-124
CAP Allocation Draft EIS
Valley Utilities Water Company – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	250	250	0	0	0	0	843	2,359	1,093	2,609
No Action	0	0	0	0	0	0	1,093	2,609	1,093	2,609
Non-Settlement Alternative 1	250	250	0	0	0	0	843	2,359	1,093	2,609
Non-Settlement Alternative 2	0	0	0	0	0	0	1,093	2,609	1,093	2,609
Non-Settlement Alternative 3A	0	0	0	0	0	0	1,093	2,609	1,093	2,609
Non-Settlement Alternative 3B	250	250	0	0	0	0	843	2,359	1,093	2,609

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 2,609 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 250 afa of demand are met by the additional CAP allocation. Alternatively, this 250afa of demand are met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the Valley Utilities Water Company were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-125 provides the projected acres of land within the Valley Utilities Water Company service area which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

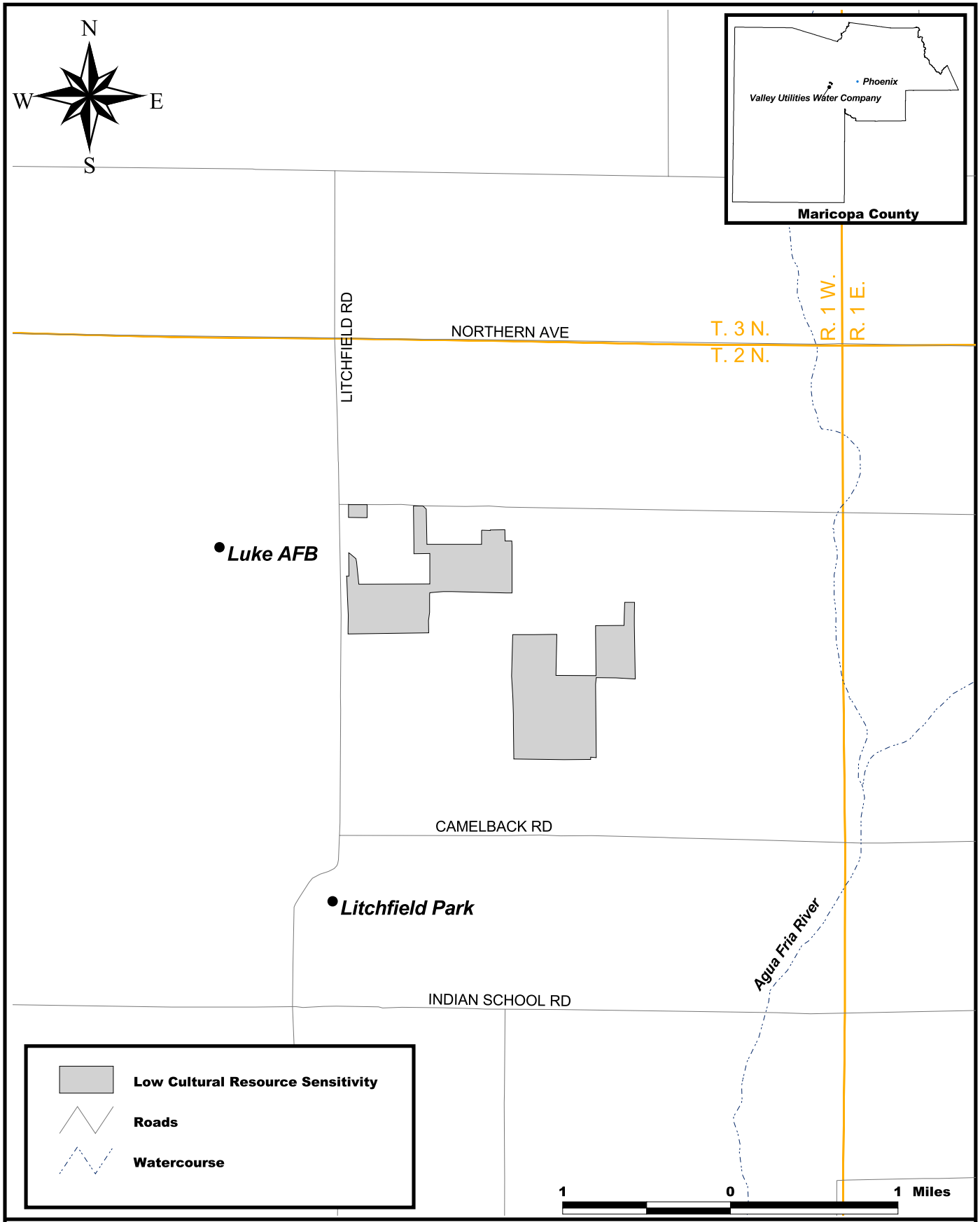
TableL-M&I-125
CAP Allocation Draft EIS
Valley Utilities Water Company – Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes in Urban Acreage
Settlement Alternative	2001	0	--	19	--	448	--
	2051	0	0	19	0	448	0
No Action	2001	0	--	19	--	448	--
	2051	0	0	19	0	448	0
Non-Settlement Alternative 1	2001	0	--	19	--	448	--
	2051	0	0	19	0	448	0
Non-Settlement Alternative 2	2001	0	--	19	--	448	--
	2051	0	0	19	0	448	0
Non-Settlement Alternative 3A	2001	0	--	19	--	448	--
	2051	0	0	19	0	448	0
Non-Settlement Alternative 3B	2001	0	--	19	--	448	--
	2051	0	0	19	0	448	0

2. Archaeological Resources

The southernmost parcel within the Valley Utilities Water Company service area was previously surveyed; no other projects have occurred within the area. Although several sites have been documented to the west, none was recorded within the service area. The Arizona Canal, a National Register-eligible property, borders the service area on the east (Aguila 1998). Historic sites associated with its construction might be expected.

Cultural resource sensitivity areas in the service area are shown on Figure L-M&I-63. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the Valley Utility Water Company service area is low. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be



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June 2000

CAP Allocation Draft EIS
Cultural Resources
Valley Utilities Water Company

Figure #L-M&I-63

dependent on the requirements of the local jurisdiction. Based on their potential options to use existing facilities, significant cultural resource impacts are not expected. Reclamation would carry out additional cultural resource compliance as appropriate, prior to water delivery.

3. Biological Resources

Existing Habitats

Almost no natural habitat remains within the Valley Utilities Water Company service area (elevation approximately 1,100 feet). Most of the area has been developed for urban use. Some Creosote-Bush Association remains in undeveloped lots within residential areas. The habitat zones located in the Valley Utilities Water Company service area are shown on Figure L-M&I-64. Table L-M&I-126 provides the habitat acreages in the Valley Utilities Water Company service area for the habitat zones described above.

TableL-M&I-126
CAP Allocation Draft EIS
Valley Utilities Water Company – Habitat Acreages

Vegetation Name	Acres
Developed	448
Creosote-Bush	19
Total	**467**

Impacts to Biological Resources

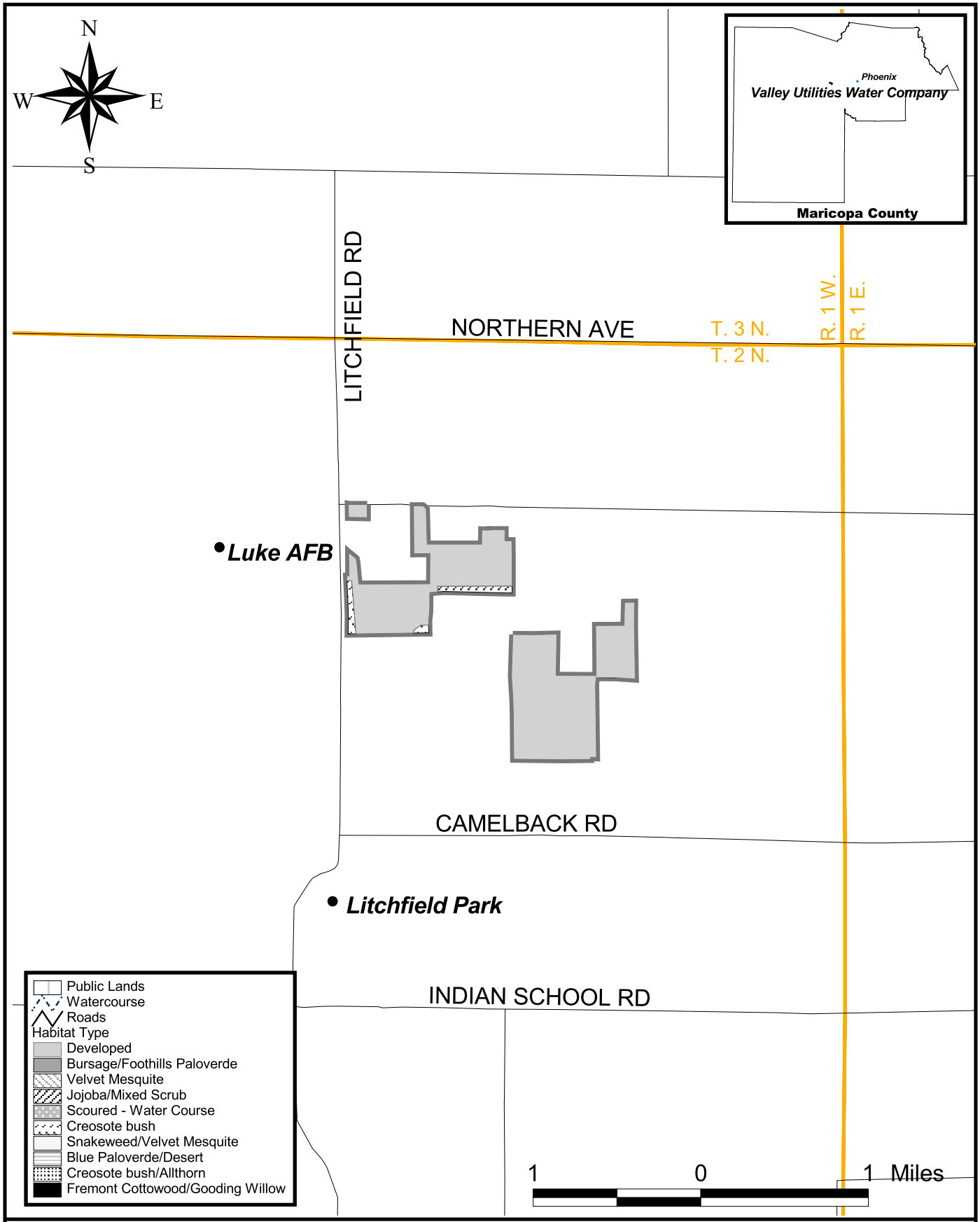
Under the No Action Alternative, urban growth within the Valley Utilities Water Company service area over the 50-year study period would result in no increased loss of natural habitat. Under the action alternatives, there is no difference in impacts from the No Action baseline. With regard to construction of CAP delivery facilities; Reclamation would carry out additional environmental review once plans are developed. However, based on the potential to use existing facilities, significant impacts are not expected.

Potential T&E Species and Acres of Potential T&E Species Habitat

There is no potentially suitable habitat for T&E species within the Valley Utilities Water Company service area.

4. Water Resources

Demands in the Valley Utilities Water Company have historically been met by pumping groundwater from the underlying basin fill. The Valley Utilities Water Company is in an area of relatively intensive groundwater development, and substantial declines in groundwater levels have been experienced that have formed the Luke Cone groundwater



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June 2000

CAP Allocation Draft EIS
Habitat Zones
Valley Utilities Water Company

Figure No. L-M&I-64

level depression. These declines have resulted in subsidence in this area. The concentration of TDS in the underlying groundwater can range from 1,000 to 3,000 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-127, which shows estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative. Under the No Action Alternative, groundwater levels would decline by about 136 feet from 2001 to 2051. This decline reflects the continued reliance on groundwater supplies in the vicinity of the Valley Utilities Water Company. However, that decline is moderated by the influence of direct recharge of CAP water which would occur in the nearby Agua Fria Recharge Project, and in future West-side recharge facilities. Increases in TDS concentrations could occur due to both the northward movement of poorer quality water from the south, and due to lowering of groundwater levels in the vicinity of the Luke salt dome. The lower groundwater levels could also result in continued subsidence.

Groundwater levels under the Settlement and Non-Settlement Alternatives would also decline over the 2001 to 2051 period. These declines would be greater than the declines under the No Action Alternative and could result in greater declines in groundwater quality and in additional subsidence relative to the No Action Alternative. The larger declines in groundwater levels primarily occur due to reduced direct recharge of CAP water under the Settlement and Non-Settlement Alternatives relative to the No Action Alternative.

Table L-M&I-127
CAP Allocation Draft EIS
Valley Utilities Water Company –Groundwater Data Table

Alternative	**West Side M&I ***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	-136	--
Settlement Alternative	-198	-62
Non-Settlement Alternative 1	-147	-11
Non-Settlement Alternative 2	-157	-21
Non-Settlement Alternative 3A	-185	-49
Non-Settlement Alternative 3B	-172	-36

*Values correspond to the West-side M&I sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, for providing the proposed allocations and, in their absence, alternative water supplies. The alternative water supplies include joining the CAGRD and, as needed, treating and reusing effluent. The difference in cost for this small increment of Valley Utility Water Company's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 9.6 percent of the total year 2051 demand for Valley Utility Water Company.

Table L-M&I-128
CAP Allocation Draft EIS
Valley Utilities Water Company–Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	229 – 238[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	229 – 238[b]	CAGRD
Non-Settlement Alternative 3A	229 – 238[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period.

APPENDIX L

INDIVIDUAL ENTITY DESCRIPTIONS

NON-INDIAN AGRICULTURE

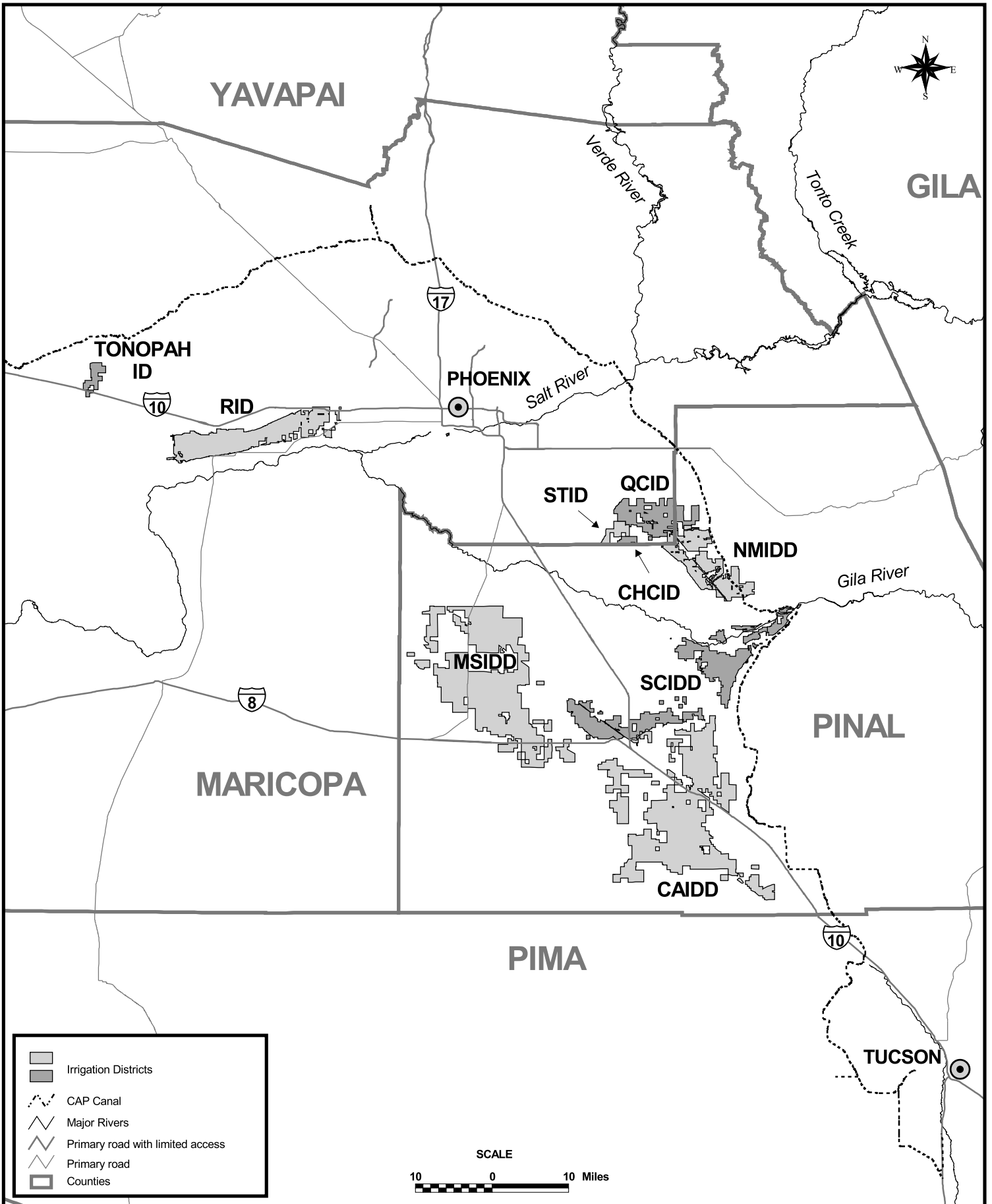
Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

APPENDIX L NON-INDIAN AGRICULTURAL DISTRICTS

NON-INDIAN AGRICULTURAL DISTRICTS

There are nine NIA districts that could be affected by the proposed allocation. These districts, which are located in Maricopa and Pinal Counties, Arizona, comprise the NIA water users that are considered in the draft EIS (see Figure L-NIA-1). Under the Settlement Alternative, these NIA districts would voluntarily relinquish their existing allocations, but would continue to have access to a pool of excess water at an affordable price through 2030. The amount of this pool of water, which is projected to be approximately 550,000 (acre-feet) af in 2001, would decline over time (see Appendix A). Also under the Settlement Alternative, some degree of Federal debt and RRA relief would be provided. Under Non-Settlement Alternative 1 and the No Action Alternative, there would be no change to the status quo. Under Non-Settlement Alternative 2, an estimated 38,999 af that are considered to be relinquished or declined would be used to facilitate Indian water rights claims. Under Non-Settlement Alternative 3, an estimated 184,449 af, originally contracted to six NIA districts which are currently receiving excess water through two-party letter agreements with CAWCD, would revert to the Secretary for use in facilitating Indian water rights claims. Also, under Non-Settlement Alternative 3, six of the nine NIA districts would be allocated a portion of an estimated 71,815 af of currently uncontracted NIA priority CAP water. These six districts were identified to be reallocated in the SRPMIC Indian Water Rights Settlement of 1988 and the Secretary's 1992 reallocation decision. In order to evaluate the range of impacts from this alternative, two potential outcomes are considered. Under option 3A, the draft EIS assumes the districts accept and enter into three-party contracts for the water. Under option 3B, the draft EIS assumes the districts decline those allocations.

In order to assess the potential impacts to the NIA districts from the proposed reallocation of NIA priority water, Reclamation analyzed current farming practices, water demand and supply quantities and projected CAP water availability. Land uses within each district service area were projected for each alternative. Analysis of anticipated changes to cropping patterns and cessation of farming due to water prices or water unavailability was conducted to estimate acreage fallowed over the study period (details on the methodology and projections are found in Appendices A and D). Future urbanization and the resultant decrease in farm acreage were estimated (details on the methodology and projections are found in Chapter III). No conversion of desert to agricultural land was assumed to occur within NIA districts as a result of any of the alternatives, due to Arizona's GMA prohibiting use of CAP water to expand agricultural production and because of the requirement that CAP water be used to replaced pumped groundwater for NIA users.



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CAP Allocation EIS

Irrigation District Sector Location Map

Figure
L-NIA-1

Table L-NIA-1
CAP Allocation Draft EIS
Summary of NIA Users

Entity	Location
Central Arizona IDD	Pinal County
Chandler Heights Citrus ID	Maricopa County
Maricopa-Stanfield IDD	Pinal County
New Magma IDD	Pinal County
Queen Creek IDD	Maricopa County
Roosevelt ID	Maricopa County
San Carlos IDD	Pinal County
STID	Maricopa County
Tonopah ID	Maricopa County

IDD – Irrigation and Drainage District
ID – Irrigation District

Table L-NIA-2
CAP Allocation Draft EIS
Summary of Significant Data to NIA Sector

	No Action	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B	Settlement Alternative
CAP Deliveries Ag Pool In-Lieu Total over 50 Yrs	1,704,905	1,309,709	1,263,334	1,253,120	1,253,120	713,715
Farmland Urbanized (acres)	46,900	46,900	46,900	46,900	46,900	46,900
Farmland Retired Due to Economic Reasons[(a)]	40,926	40,926	40,926	40,926	40,926	40,926

(a) Although the total farmland retired is the same for all alternatives, the intermediate timing differs by alternative.

I. CENTRAL ARIZONA IRRIGATION AND DRAINAGE DISTRICT

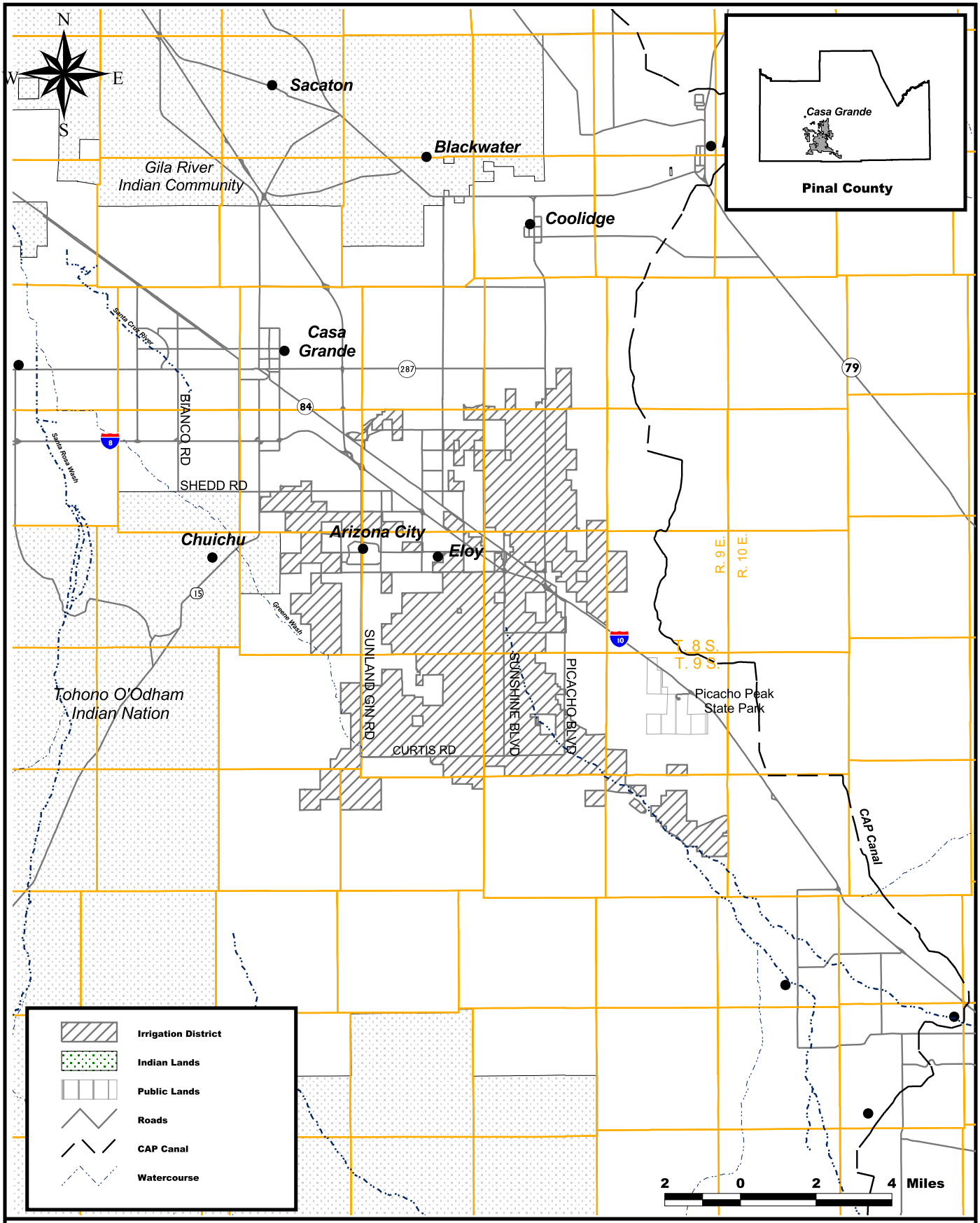
Central Arizona Irrigation and Drainage District (CAIDD) was organized in 1964 for the purpose of securing supplemental water from the Central Arizona Project (CAP). The district is located approximately four miles southeast of Casa Grande in Pinal County. CAIDD delivered a total of 207,879 af of water in 1998. Of that total, 74,193 af, or 36 percent, was from groundwater, and 133,686 af, or 64 percent, was CAP water. Figure L-NIA-2 shows the district boundaries for the CAIDD, which covers approximately 96,501 acres. CAP water can only be delivered to CAP-eligible lands within the district.

CAIDD receives CAP water from the Santa Rosa Canal and the East Main Canal, both of which have turnouts on the Fannin-MacFarland reach of the CAP Aqueduct. All of CAIDD's distribution facilities are concrete-lined.

I.A. CAP Water Allocation History

The CAIDD entered into a contract with the United States and Central Arizona Water Conservation District (CAWCD) for 18.01 percent of the available Non-Indian Agricultural (NIA) pool, effective October 1, 1993. In the 1992 NIA reallocation process, CAIDD's percentage of the available NIA pool was increased to 22.74. However, the existing subcontract has not been amended to include the 1992 reallocation. In late 1993, CAIDD entered into a two-party letter agreement with CAWCD under which CAIDD and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract." The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, CAIDD has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original requirements.

Under the Settlement Alternative, CAIDD would voluntarily relinquish its allocation of CAP water in exchange primarily for debt relief and access to affordably priced CAP Ag Pool water for the next 30 years (see Chapter II for full description of all alternatives). Under Non-Settlement Alternative 3A, CAIDD would be offered and would accept an allocation of a portion of the available NIA CAP water supply. For purposes of analysis only, this percentage amount has been estimated at 27,342 afa. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) on an as-available basis, with less water anticipated as being available later in time. The CAP water would be used to supplement water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Under all the other alternatives, CAIDD would not receive an additional allocation. It should be noted that, even without an allocation, CAP water would continue to be available to CAIDD from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative, CAIDD would receive 27.02 percent of the Ag Pool. Under all other alternatives, CAIDD would receive 33.1 percent of the Ag Pool. Table L-NIA-3 outlines the proposed CAP allocation by alternative.



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CAP Allocation Draft EIS
General Location Map
Central Arizona Irrigation and Drainage District

June 2000

Figure #L-NIA-2

Table L-NIA-3
CAP Allocation DEIS
CAIDD – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	27,342[b]	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	71,671[c]	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]This allocation is CAIDD's calculated percentage from the uncontracted NIA pool.
[c]Based on 18.01 percent of the available NIA CAP water supply. The status of this allocation is in dispute.

I.B. Water Demand and Supply Quantities

CAIDD contains 85,434 CAP-eligible acres and 11,067 acres of CAP excess land. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, CAIDD uses approximately 147,977 afa of CAP water, of which 15,913 afa are provided as in-lieu groundwater recharge. Additionally, CAIDD pumps 67,392 afa of groundwater. This water use pattern is based on a five-year average from 1998 to 1994. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next 50 years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not wheat will be grown based on the marginal costs of growing wheat, given the price and availability of water. The land and water uses projected by the economic model were incorporated into the hydrologic inventory model to project groundwater use. The ability of CAIDD to pump and afford the projected water supply was verified using the economic model and available data.

Acreage was also decreased based on urbanization due to population growth.

I.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one possible exception. Under the Settlement Alternative, RRA restrictions may be lifted, and CAIDD may desire to build new

facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

I.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to CAIDD would result from the availability of CAP water and its cost, under the different alternatives.

I.D.1. Land Use

Table L-NIA-4 shows the land use pattern for years 2001 to 2051 within the CAIDD area. Approximately 600 acres would be urbanized during the study period and an additional approximately 22,800 acres are estimated to be fallowed due to farming economics. For all alternatives, the 22,800 acres are fallowed in 2043, when the CAP Ag Pool volume goes to zero because of CAP shortage conditions.

Table L-NIA-4
CAP Allocation DEIS
CAIDD – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	59,723	0	0
	2004	59,540	183	0
	2017	59,387	153	0
	2030	59,269	118	0
	2043	36,362	84	22,823
	2051	36,287	75	0
No Action	2001	59,723	0	0
	2004	59,540	183	0
	2017	59,387	153	0
	2030	59,269	118	0
	2043	36,362	84	22,823
	2051	36,287	75	0
Non-Settlement Alternative 1	2001	59,723	0	0
	2004	59,540	183	0
	2017	59,387	153	0
	2030	59,269	118	0
	2043	36,362	84	22,823
	2051	36,287	75	0
Non-Settlement Alternative 2	2001	59,723	0	0
	2004	59,540	183	0
	2017	59,387	153	0
	2030	59,269	118	0
	2043	36,362	84	22,823
	2051	36,287	75	0
Non-Settlement Alternative 3A	2001	59,723	0	0
	2004	59,540	183	0
	2017	59,387	153	0
	2030	59,269	118	0
	2043	36,362	84	22,823
	2051	36,287	75	0
Non-Settlement Alternative 3B	2001	59,723	0	0
	2004	59,540	183	0
	2017	59,387	153	0
	2030	59,269	118	0
	2043	36,362	84	22,823
	2051	36,287	75	0

I.D.2. Archaeological Resources

Few block surveys have occurred in the project area, but linear surveys along major roads, railroads, and/or pipelines have yielded a few prehistoric sites ranging from small undifferentiated lithic scatters to extensive Hohokam villages dating to the Colonial and Sedentary periods. Protohistoric Pima and historic Anglo occupations also have been documented. South of the entity's boundaries lies the Los Robles Archaeological District, a National Historic Register property. The proximity of this area of high cultural resource sensitivity suggests similar site types might be present within the entity's unsurveyed areas. A series of Reclamation's CAP surveys identified numerous sites just east of the entity's boundaries (e.g., Qukillian 1987). Because some of these sites extend onto the entity's northeastern portion, this area's cultural resource sensitivity is classified as high. Additionally, because of the high potential for sediment deposition near the Santa Cruz River floodplain and adjacent terraces, the potential for buried sites in most of this entity is high. It is not known whether this entity has a local historic preservation program. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-3. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low to moderate.

I.D.3. Biological Resources

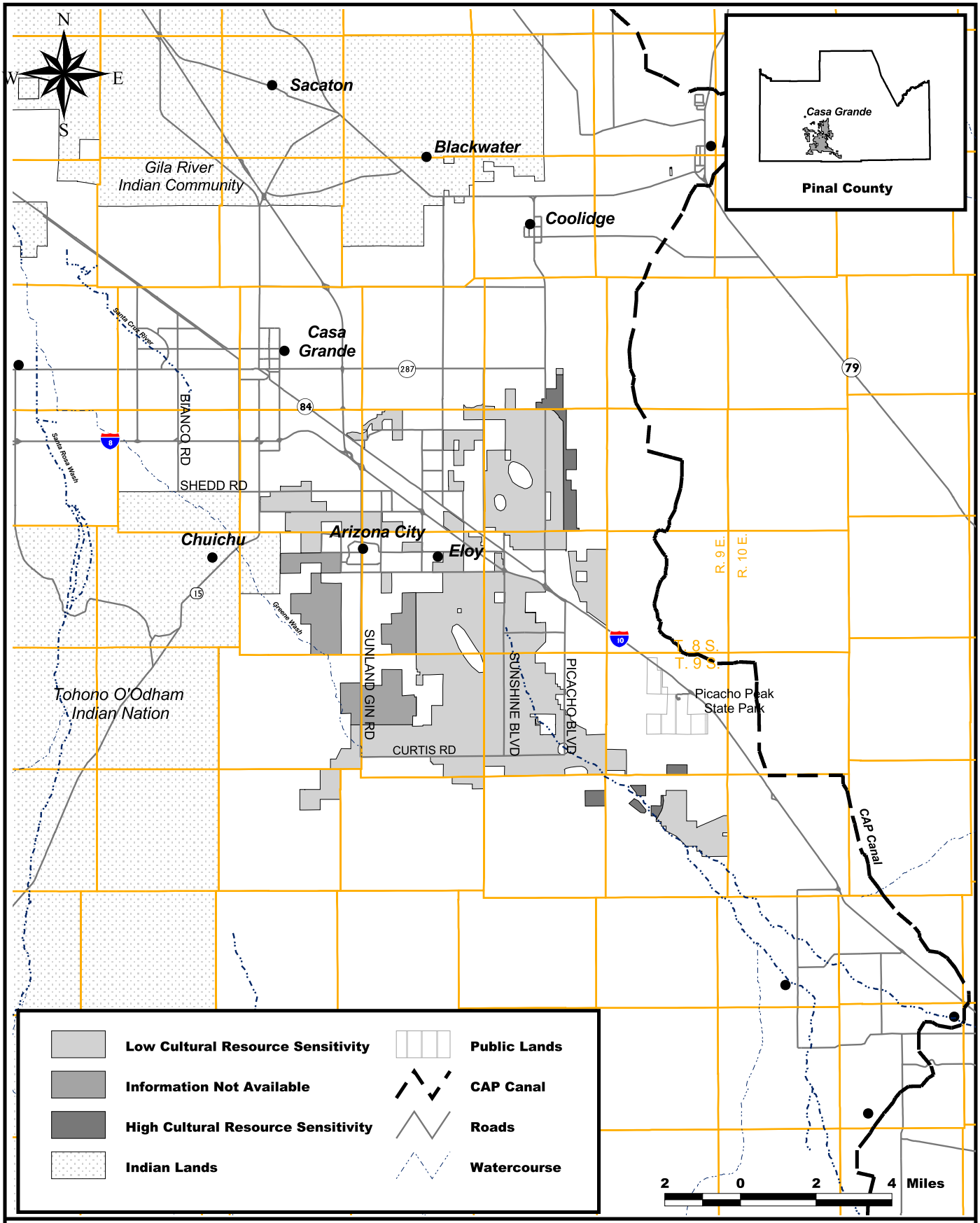
Table L-NIA-4 shows land use over the period of study by alternative. Land stays in agricultural production or is either converted to urban uses or fallowed. The change in land use will result in two possible effects on biological resources. If conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals. If conversion of agricultural lands to fallow fields occurs, the period of time the land is left fallow will vary. Through the natural revegetation process, these fallow fields can provide fair wildlife habitat in the long term. Reclamation with natural vegetation can enhance this process if these fields will not be developed in the future. Fallow fields often become areas of potential dispersal for noxious weeds.

I.D.4. Water Resources

CAIDD has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater levels have declined historically in response to the groundwater pumping. The TDS concentration of groundwater is generally from about 500 to 1,000 ppm. CAIDD has experienced subsidence historically, due to the groundwater level declines.

Presented in Table L-NIA-5 are estimated changes in groundwater levels from 2001 to 2051. Estimated groundwater level impacts for each alternative (changes from levels under the No Action Alternative) are also shown.

Under the No Action Alternative, groundwater levels would rise from 2001 to 2017, reflecting the availability of CAP water for in-lieu recharge during that period. After 2017, CAP water would only be available from the Ag Pool, which results in greater groundwater pumping and declining groundwater levels. Overall, groundwater levels under the No Action Alternative would decline by about 68 feet through 2051. The lower groundwater levels would cause an



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CAP Allocation Draft EIS
Cultural Resources
Central Arizona Irrigation and Drainage District

June 2000

Figure #L-NIA-3

increase in groundwater pumping costs and a continuation of the subsidence that has been historically experienced. Lower groundwater levels might also result in production of poorer quality groundwater at some wells in CAIDD, where there is poorer quality water at depth.

Groundwater levels under the Settlement Alternative and all Non-Settlement Alternatives would also decline by year 2051. The resulting estimated groundwater levels would be within 10 feet of the level estimated for the No Action Alternative. The relatively small differences in groundwater levels primarily reflect differences in the availability of CAP water to CAIDD from the Ag Pool.

Table L-NIA-5
CAP Allocation Draft EIS
CAIDD – Groundwater Data Table

Alternative	CAIDD*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	-68	--
Settlement Alternative	-61	7
Non-Settlement Alternative 1	-68	0
Non-Settlement Alternative 2	-73	-5
Non-Settlement Alternative 3A	-59	9
Non-Settlement Alternative 3B	-73	-5

* Values correspond to CAIDD, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

I.D.5. Socioeconomic

Table L-NIA-6 shows the estimated lost agricultural gross revenues over the 50-year study period resulting from the fallowing of approximately 22,800 acres in 2043, the timing of which varies by alternative. For more information regarding impacts of CAP water reallocation on NIA districts, refer to Appendix D of this publication.

Table L-NIA-6
CAP Allocation DEIS
CAIDD Estimated Lost Gross Agricultural Revenues 2001-2051 (dollars)

Alternative	Lost Gross Revenues 2001-2051 ($)
Settlement Alternative	176,136,513
No Action	176,136,513
Non-Settlement Alternative 1	176,136,513
Non-Settlement Alternative 2	176,136,513
Non-Settlement Alternative 3A	176,136,513
Non-Settlement Alternative 3B	293,560,855

II. CHANDLER HEIGHTS CITRUS IRRIGATION DISTRICT

Chandler Heights Citrus Irrigation District (CHCID) was organized in 1929 and is located in Maricopa County, about 10 miles southwest of Chandler as shown on Figure L-NIA-4. The CHCID has approximately 23 miles of underground pipeline.

Of the 1,290 acres in the District, approximately 1,250 are irrigated primarily for citrus, some grapes, and a little pasture. Well pumpage is measured in gallons per minute and farmers are charged by the af. This charge is currently $45. Deliveries are made on the basis of request and availability of water. From June 30, 1994 to June 30, 1995, 4,200 af of water were distributed within the district for irrigation. During the same period, approximately 37 million gallons of water were served to more than 250 domestic connections. A property tax of $50 per acre was assessed in 1995.

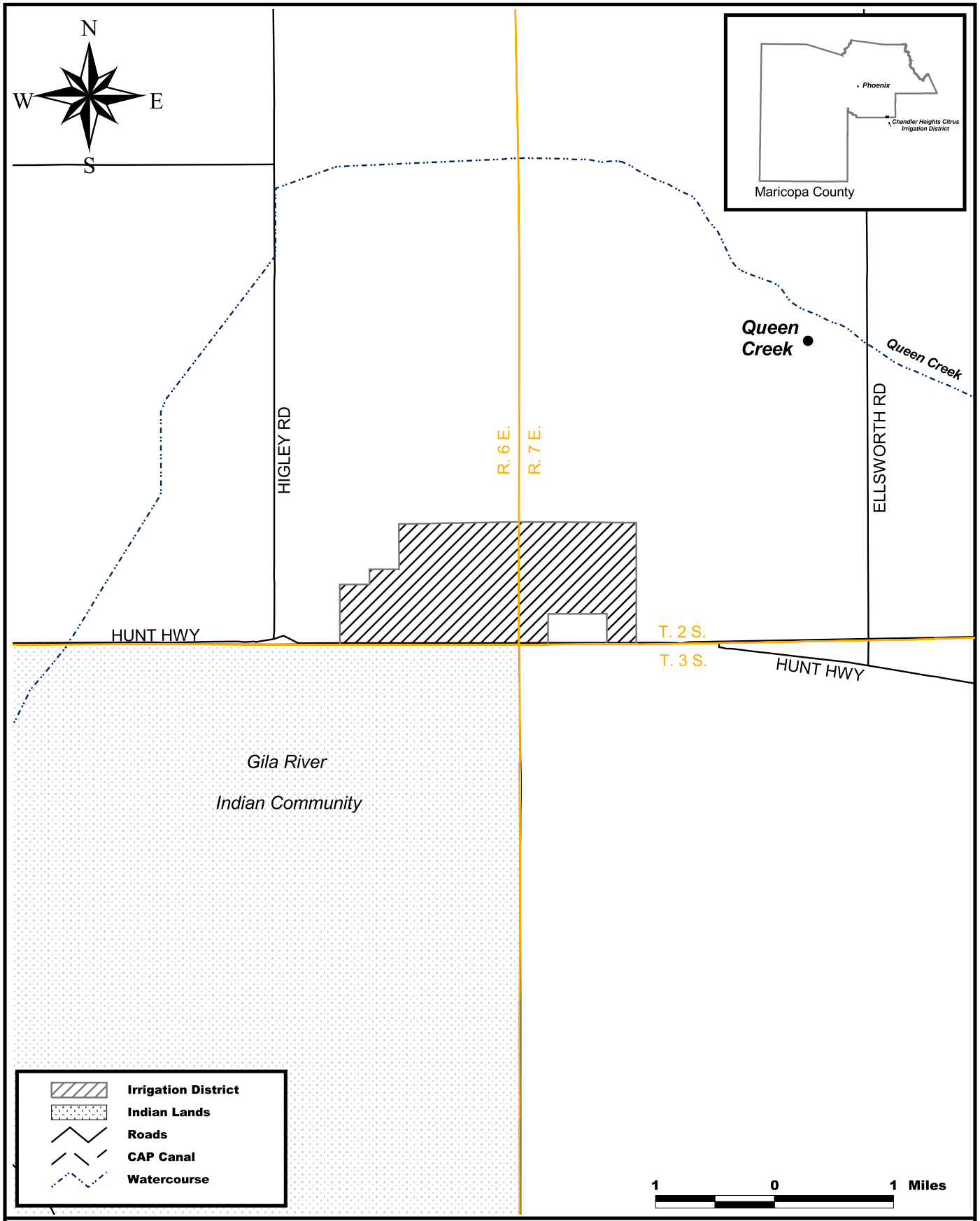
CHCID delivered a total of 3,686 af of water in 1998. Of that total, 1,784 af, or 48 percent, was from groundwater, and 1,902 af, or 52 percent, was from CAP.

II.A. CAP Water Allocation History

The CHCID entered into a contract with the United States and CAWCD for 0.28 percent of the available NIA pool, effective October 1, 1993. Had the 1992 NIA reallocation process been completed, CHCID's percentage of the available NIA pool would have increased to 0.3. In late 1993, CHCID entered into a two-party letter agreement with CAWCD under which CHCID and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract." The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, CHCID has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original contract requirements.

Under the Settlement Alternative, CHCID would voluntarily relinquish its allocation of CAP water in exchange primarily for debt relief and access to affordably priced CAP Ag Pool water for the next 30 years (see Chapter II for full description of all alternatives). Under Non-Settlement Alternative 3A, CHCID would be offered and would accept an allocation of the available NIA CAP water supply. For purposes of analysis only, this percentage amount has been converted to 173 afa. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) on an as-available basis, with less water anticipated as being available later in time. The CAP water would be used to supplement water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Under all the other alternatives, CHCID would not receive an additional allocation. It should be noted that, even without an allocation, CAP water will continue to be available to CHCID from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative, CHCID would receive 0.14 percent of the Ag Pool. Under all other alternatives, CHCID would receive 0.5 percent of the Ag Pool.

Table L-NIA-7 outlines the proposed CAP allocation by alternative.



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CAP Allocation Draft EIS
General Location Map
Chandler Heights Citrus Irrigation District

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Figure #L-NIA-4

Table L-NIA-7
CAP Allocation DEIS
CHCID – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	173[b]	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	1,114[c]	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]This allocation is CHCID's calculated percentage from the uncontracted NIA pool.
[c]Based on 0.28 percent of the available NIA CAP water supply. The status of this allocation is in dispute.

II.B. Water Demand and Supply Quantities

CHCID contains 542 CAP-eligible acres and 67 acres of CAP excess land. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, CHCID uses approximately 1,786 afa of CAP water, of which 53 afa are provided as in-lieu groundwater recharge. Additionally, CHCIDD pumps 12,215 afa of groundwater. This water use pattern is based on a five-year average from 1998 to 1994. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next 50 years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions.

CHCID was excluded in the economic analysis because predominantly high-value crops (i.e., citrus) are cultivated that are not sensitive to the range of water prices examined in this study. Acreage was also decreased based on urbanization due to population growth.

II.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one exception. Under the Settlement Alternative, RRA restrictions may be lifted and CHCID may desire to build new facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

II.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to CHCID would result from the availability of CAP water and its cost, under the different alternatives.

II.D.1. Land Use

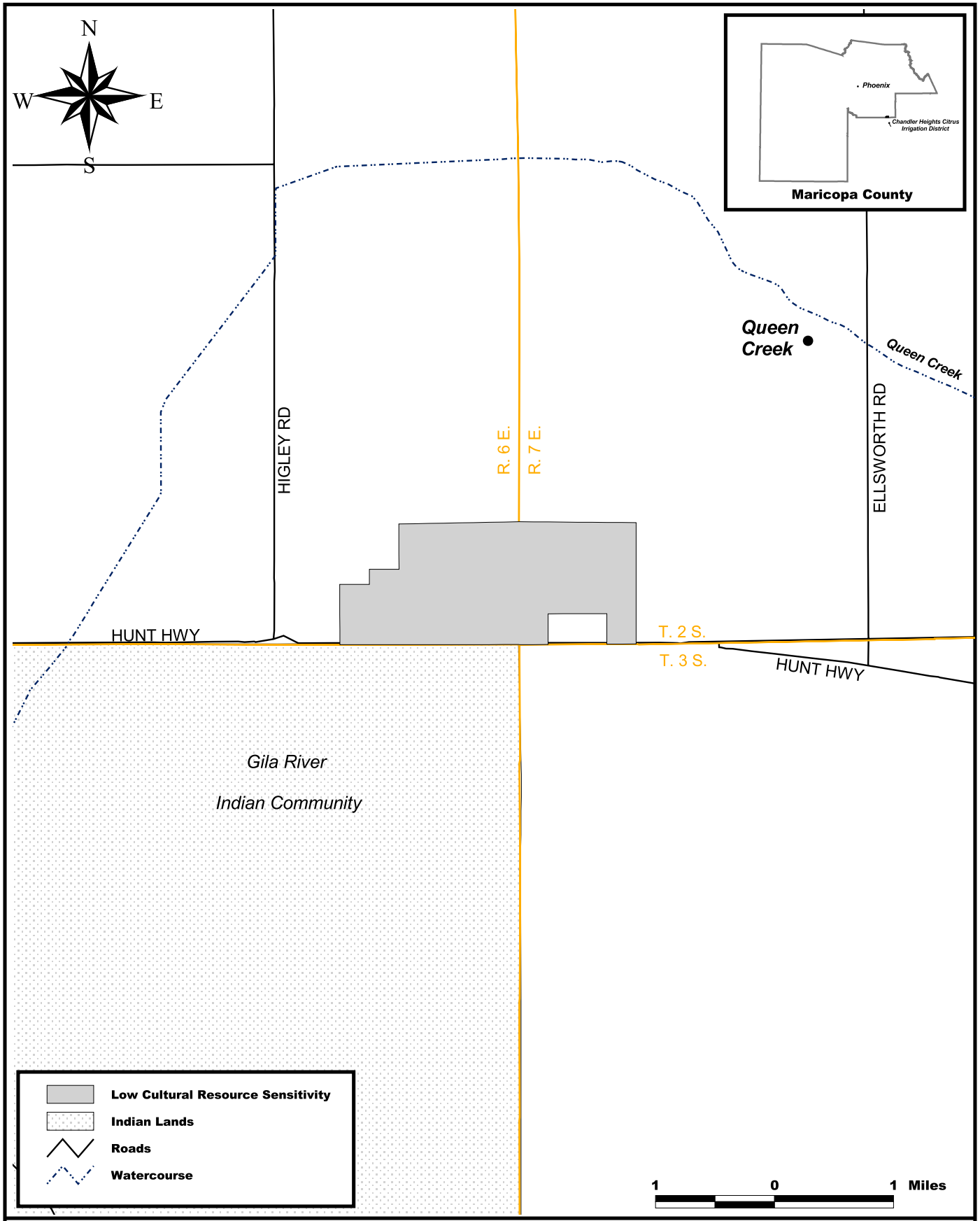
Table L-NIA-8 shows the land use pattern for years 2001 to 2051 within the CHCID area. No acreage is projected to be retired and fallowed, but the entire district is projected to be urbanized by 2030.

Table L-NIA-8
CAP Allocation DEIS
CHCID – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	1,406	0	0
	2004	1,122	284	0
	2017	848	274	0
	2030	89	759	0
	2043	0	89	0
	2051	0	0	0
No Action	2001	1,406	0	0
	2004	1,122	284	0
	2017	848	274	0
	2030	89	759	0
	2043	0	89	0
	2051	0	0	0
Non-Settlement Alternative 1	2001	1,406	0	0
	2004	1,122	284	0
	2017	848	274	0
	2030	89	759	0
	2043	0	89	0
	2051	0	0	0
Non-Settlement Alternative 2	2001	1,406	0	0
	2004	1,122	284	0
	2017	848	274	0
	2030	89	759	0
	2043	0	89	0
	2051	0	0	0
Non-Settlement Alternative 3A	2001	1,406	0	0
	2004	1,122	284	0
	2017	848	274	0
	2030	89	759	0
	2043	0	89	0
	2051	0	0	0
Non-Settlement Alternative 3B	2001	1,406	0	0
	2004	1,122	284	0
	2017	848	274	0
	2030	89	759	0
	2043	0	89	0
	2051	0	0	0

II.D.2. Archaeological Resources

Only one archaeological survey has taken place, and no previously recorded sites are located within this entity. Although herein classified as an area of low cultural resource sensitivity, it is



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CAP Allocation Draft EIS
Cultural Resources
Chandler Heights Citrus Irrigation District

June 2000

Figure #L-NIA-5

worth noting that archaeological sites are known to be present in the surrounding areas. Pozos de Sonoqui, a major Hohokam village complex with a ball court and platform mound, is located to the east, suggesting the possibility of additional associated cultural deposits—such as artifact scatters, isolated features, and agricultural fields—within the entity's boundaries. Protohistoric and/or historic Pima and Pi-Posh remains also might be present. It is not known whether this entity has a local historic preservation program. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-5. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low. Urbanization of farmlands could impact any intact cultural deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

II.D.3. Biological Resources

Table L-NIA-8 shows land use over the period of study by alternative. Land either stays in agricultural production or is converted to urban uses. When conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted, such as burrowing owls, nests of local birds, and habitat for small mammals.

II.D.4. Water Resources

CHCID has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater levels have declined historically in response to the groundwater pumping, and a groundwater level depression is located in the general vicinity of CHCID. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm. This area has experienced subsidence historically, due to the groundwater level declines.

Presented in Table L-NIA-9 are estimated changes in groundwater levels from 2001 to 2051 and estimated groundwater level impacts for each alternative. Under the No Action Alternative, groundwater levels rise by about 44 feet through about 2051. This rise in groundwater levels reflects the interplay of a number of factors, including urbanization and changes in irrigated acreage in QCID (located adjacent to CHCID) due to economic considerations. The rise in groundwater levels would likely cause a reduction in pumping costs. The rise in groundwater levels would tend to eliminate subsidence. Also, the groundwater level rise in this area would eliminate the current local groundwater depression, which would tend to improve groundwater quality.

Groundwater levels in year 2051 under the Settlement Alternative and all Non-Settlement Alternatives would be lower than under the No Action Alternative, except for Alternative 1. As with the No Action Alternative, these groundwater levels reflect a number of different factors, including urbanization and changes in irrigated acres in the adjacent QCID due to economic considerations. There would be the potential for subsidence under the Settlement Alternative and Non-Settlement Alternatives 2 and 3A, due to the lower groundwater levels. There would also be the potential for adverse groundwater quality impacts under the Settlement Alternative, as a groundwater level depression would remain in the vicinity of CHCID.

Table L-NIA-9
CAP Allocation Draft EIS
CHCID – Groundwater Data Table

Alternative	CHCID*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	44	--
Settlement Alternative	-18	-62
Non-Settlement Alternative 1	53	+8
Non-Settlement Alternative 2	-31	-75
Non-Settlement Alternative 3A	-27	-71
Non-Settlement Alternative 3B	1	-44

* Values correspond to the QCID sub-area.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

II.D.5. Socioeconomic

CHCID was excluded in the economic analysis because predominantly high-value crops are cultivated in CHCID that are not sensitive to the range of water prices examined in this study.

No crop acreage is projected to go out of production due to increases in water price. Therefore, no socioeconomic impacts associated with the CAP reallocation strategies in this EIS were analyzed for this irrigation district.

III. MARICOPA-STANFIELD IRRIGATION & DRAINAGE DISTRICT

Maricopa-Stanfield Irrigation & Drainage District (MSIDD) is located in northwestern Pinal County and contains an area of approximately 148,000 acres centered about 40 miles south of Phoenix and 12 miles northwest of Casa Grande, as shown on Figure L-NIA-6.

CAP water is the main source of surface water for the district. Irrigation wells acquired from district growers serve as the source of groundwater for the district.

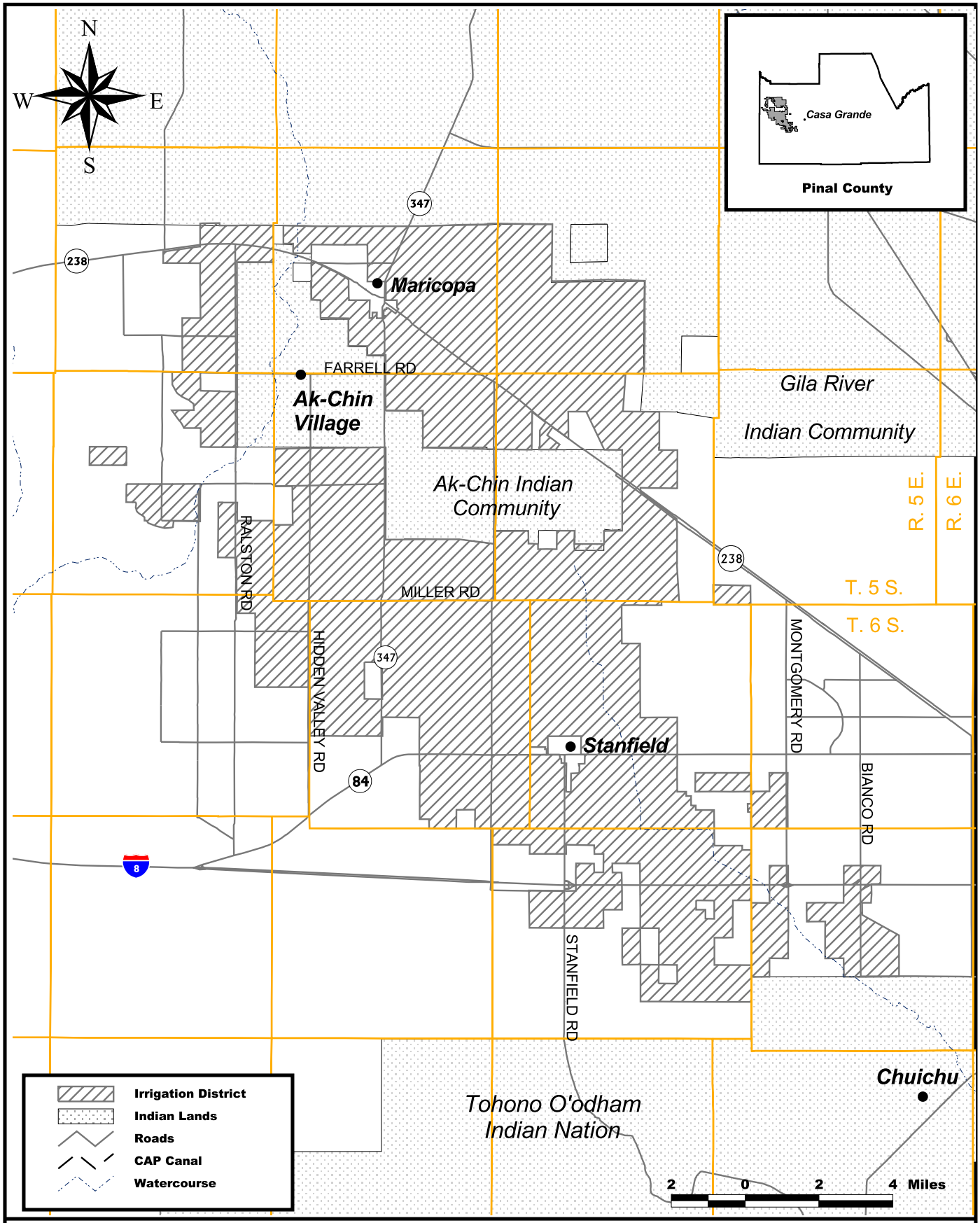
The district received its CAP water through one aqueduct turnout and operates 75 miles of main conveyance canals, 136 miles of lateral canals and pipelines, 186 farm turnouts and 396 irrigation wells. Construction of all federally funded CAP facilities in the district was completed in 1989. The Santa Rosa Canal, operated by the district, is currently used jointly by the district with the CAIDD and the Ak-Chin Indian Community. The district's annual water requirements range between 250,000 and 300,000 af with 1995 water deliveries totaling 281,047 af. The greater district area encompasses approximately 148,000 acres with 87,000 acres of irrigable land receiving water service from the district. In 1995, the district delivered water to approximately 66,000 acres. Cotton, small grains, pecans, grapes, and specialty crops are grown within the district. Approximately 12,000 connections are served.

In the MSIDD service area in 1998, a total of 232,908 af of water were produced and delivered. Of that total, 77,517 af, or 33 percent, was from groundwater and 155,391 af, or 67 percent, was from CAP.

III.A. CAP Water Allocation History

The MSIDD entered into a contract with the United States and CAWCD for 20.48 percent of the available NIA pool, effective October 1, 1993. Had the 1992 NIA reallocation process been completed, MSIDD's percentage of the available NIA pool would have increased to 22.75. In late 1993, MSIDD entered into a two-party letter agreement with CAWCD under which MSIDD and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract." The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, MSIDD has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original requirements.

Under the Settlement Alternative, MSIDD would voluntarily relinquish its allocation of CAP water in exchange primarily for debt relief and access to affordably priced CAP Ag Pool water for the next 30 years (see Chapter II for full description of all alternatives). Under Non-Settlement Alternative 3A, MSIDD would be offered and would accept an allocation of the available NIA CAP water supply. For purposes of analysis only, this percentage amount has been estimated at 26,497 afa. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) on an as-available basis, with less water anticipated as being available later in time. The CAP water would be used to supplement water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Under all the other alternatives, MSIDD would not receive an additional allocation. It should be noted that, even without an allocation, CAP water would continue to be available to MSIDD from the Ag Pool, which is comprised of excess water.



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CAP Allocation Draft EIS
General Location Map
Maricopa-Stanfield Irrigation & Drainage District

June 2000

Figure #L-NIA-6

Under the Settlement Alternative, MSIDD would receive 27.02 percent of the Ag Pool. Under all other alternatives, MSIDD would receive 32.4 percent of the Ag Pool. Table L-NIA-10 outlines the proposed CAP allocation by alternative.

Table L-NIA-10
CAP Allocation DEIS
MSIDD – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	26,497[b]	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	81,500[c]	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]This allocation is MSIDD's calculated percentage from the uncontracted NIA pool.
[c]Based on 20.48 percent of the available NIA CAP water supply. The status of this allocation is in dispute.

III.B. Water Demand and Supply Quantities

MSIDD contains 82,792 CAP-eligible acres and 10,200 acres of CAP excess land. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, MSIDD uses approximately 172,035 afa of CAP water, of which 26,130 afa are provided as in-lieu groundwater recharge. Additionally, MSIDD pumps 99,794 afa of groundwater. This water use pattern is based on a five-year average from 1998 to 1994. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next 50 years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not a certain wheat will be grown based on the marginal costs of growing wheat, given the price and availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify MSIDD's ability to pump and afford the projected groundwater use. Acreage was also decreased based on urbanization due to population growth.

III.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one exception. Under the Settlement Alternative, RRA restrictions may be lifted and MSIDD may desire to build new facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

III.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to MSIDD would result from the availability of CAP water and its cost, under the different alternatives.

III.D.1. Land Use

Table L-NIA-11 shows the land use pattern for years 2001 to 2051 within the MSIDD area. No acreage is projected to be retired and fallowed during the study period, but approximately 4,200 acres are projected to be urbanized.

Table L-NIA-11
CAP Allocation DEIS
MSIDD – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	61,719	0	0
	2004	60,453	1,266	0
	2017	59,405	1,048	0
	2030	58,591	814	0
	2043	58,014	577	0
	2051	57,499	515	0
No Action	2001	61,719	0	0
	2004	60,453	1,266	0
	2017	59,405	1,048	0
	2030	58,591	814	0
	2043	58,014	577	0
	2051	57,499	515	0
Non-Settlement Alternative 1	2001	61,719	0	0
	2004	60,453	1,266	0
	2017	59,405	1,048	0
	2030	58,591	814	0
	2043	58,014	577	0
	2051	57,499	515	0
Non-Settlement Alternative 2	2001	61,719	0	0
	2004	60,453	1,266	0
	2017	59,405	1,048	0
	2030	58,591	814	0
	2043	58,014	577	0
	2051	57,499	515	0
Non-Settlement Alternative 3A	2001	61,719	0	0
	2004	60,453	1,266	0
	2017	59,405	1,048	0
	2030	58,591	814	0
	2043	58,014	577	0
	2051	57,499	515	0
Non-Settlement Alternative 3B	2001	61,719	0	0
	2004	60,453	1,266	0
	2017	59,405	1,048	0
	2030	58,591	814	0
	2043		577	0
	2051		515	0

III.D.2. Archaeological Resources

Very few surveys, most of them linear (e.g., Neily 1991), have been performed within this entity's boundaries. Areas of high and moderate cultural resource sensitivity are primarily associated with various tasks pertaining to Reclamation's Salt-Gila Aqueduct-CAP surveys (e.g., Teague and Crown 1983). Prehistoric sites are mainly related to non-irrigation agriculture and resource processing, and include rock features, roasting pits, fire-cracked rock concentrations, artifact scatters, and small farmsteads. There is evidence that sites to the south (e.g., Shelltown, the Hind Site) were involved in the Hohokam shell exchange system (Marmaduke and Martynec 1993). Sites with evidence of shellcraft in this entity would be particularly important in answering questions about the nature of prehistoric trade networks. The entity's vicinity to the Ak-Chin Indian Community also suggests that protohistoric and historic Pima and Maricopa sites—including petroglyphs and pictographs—might be present (e.g., Berry and Marmaduke 1980; Marmaduke et al. 1983). Historic sites related to water control (e.g., canals) and transportation (e.g., roads, railroads, and associated features) also are likely. It is not known whether this entity has a local historic preservation program. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-7. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low to moderate. Urbanization of farmlands could impact any intact cultural/deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

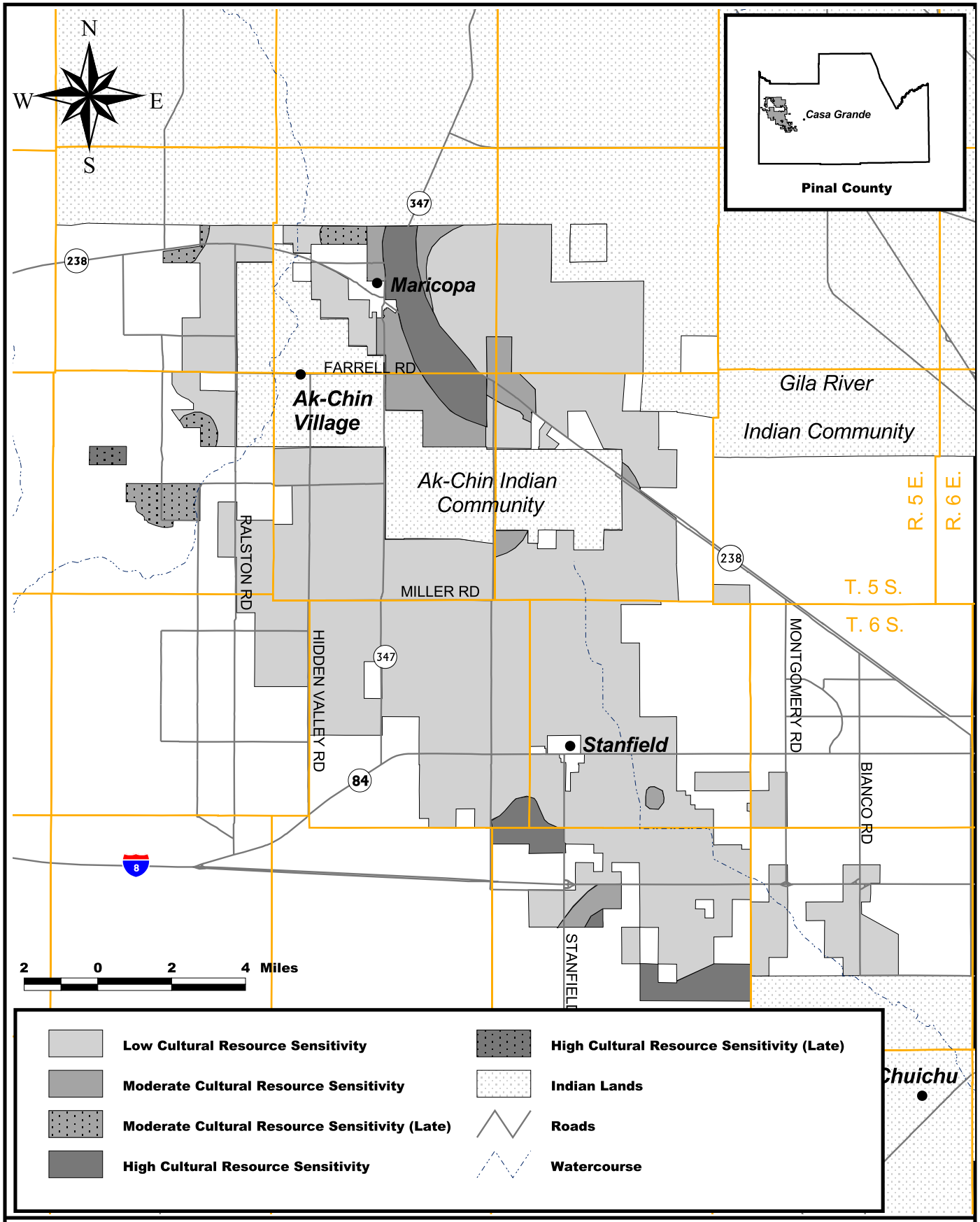
III.D.3. Biological Resources

Table L-NIA-11 shows land use over the period of study by alternative. Land stays in agricultural production or is converted to urban uses. When conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals.

III.D.4. Water Resources

MSIDD has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater levels have declined historically in response to the groundwater pumping. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm. MSIDD has experienced subsidence historically, due to the groundwater level declines.

Presented in Table L-NIA-12 are estimated changes in groundwater levels from 2001 to 2051. Estimated groundwater level impacts for each alternative (changes from levels under the No Action Alternative) are also shown. Groundwater conditions were estimated in the analysis for both the northern and southern part of MSIDD. Two values are presented in Table L-NIA-12 for each alternative, representing groundwater levels for (in order) the northern and southern part of MSIDD. Estimated groundwater level changes are larger in the southern part of MSIDD, although the changes relative to the No Action Alternative are similar in both the northern and southern areas.



U.S. DEPARTMENT OF THE INTERIOR
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CAP Allocation Draft EIS
Cultural Resources
Maricopa-Stanfield Irrigation & Drainage District

June 2000

Figure #L-NIA-7

Under the No Action Alternative, groundwater levels would rise from 2001 to 2017, reflecting the availability of CAP water for in-lieu recharge during that period. After 2017, CAP water would only be available from the Ag Pool, which results in greater groundwater pumping and declining groundwater levels. Overall, groundwater levels under the No Action Alternative would decline by about 30 to 56 feet through 2051. The lower groundwater levels would cause an increase in groundwater pumping costs and a continuation of the subsidence that has been historically experienced. Groundwater quality impacts would not be anticipated.

Groundwater levels under the Settlement Alternative and all Non-Settlement Alternatives would also decline by year 2051. The relatively small differences in groundwater levels primarily reflect differences in the availability of CAP water to MSIDD from the Ag Pool.

Table L-NIA-12
CAP Allocation Draft EIS
MSIDD – Groundwater Data Table

Alternative	MSIDD*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	-30 / –56	--
Settlement Alternative	-36 / –57	-6 / 0
Non-Settlement Alternative 1	-29 / –56	1 / 0
Non-Settlement Alternative 2	-37 / –62	-7 / –6
Non-Settlement Alternative 3A	-18 / -44	12 / 12
Non-Settlement Alternative 3B	-52 / -74	-22 / –17

* Values correspond to the MSIDD North and MSIDD South sub-areas, respectively.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated change in groundwater levels.

III.D.5. Socioeconomic

No land fallowing is expected to occur in MSIDD over the study period as a result of the reallocation of CAP water. Therefore, no loss of revenues is expected due to the reallocation of CAP water.

Table L-NIA-13
CAP Allocation Draft EIS
MSIDD Estimated Lost Gross Agricultural Revenues 2001-2051 ($)

Alternative	Lost Gross Revenues 2001-2051
Settlement Alternative	0
No Action	0
Non-Settlement Alternative 1	0
Non-Settlement Alternative 2	0
Non-Settlement Alternative 3A	0
Non-Settlement Alternative 3B	0

IV. NEW MAGMA IRRIGATION DISTRICT

The New Magma Irrigation and Drainage District (NMIDD) was formed in 1965 upon the dissolution of the New Magma Irrigation District. The new district was formed for the purpose of receiving CAP water. The NMIDD is located in Pinal County, approximately five miles northwest of Florence as shown on Figure L-NIA-8. The district owns no wells. In 1969, there were 103 private wells within district boundaries. The district has built a distribution system to deliver CAP water.

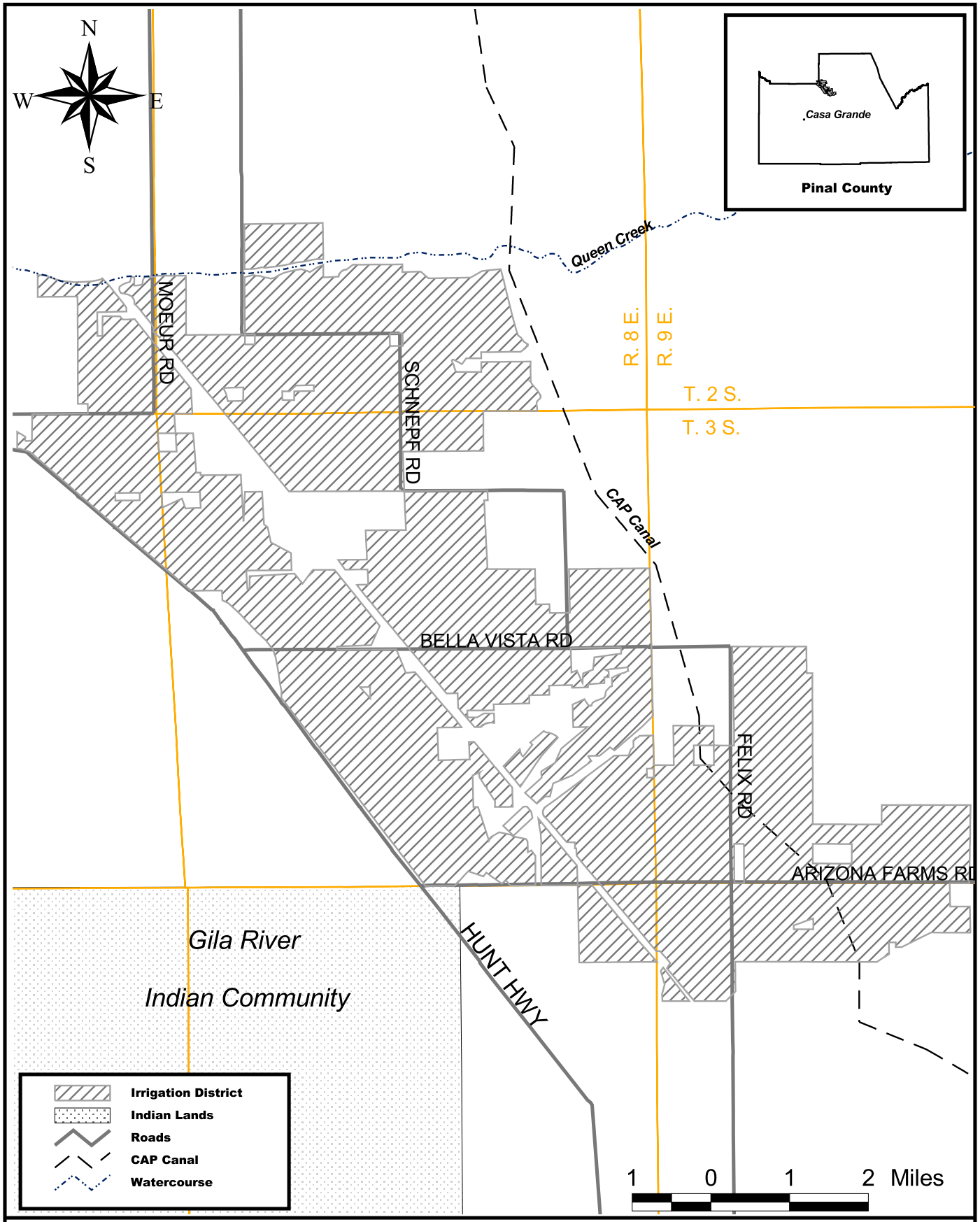
Water used within the district is a combination of groundwater and CAP water. Approximately 40,000 to 50,000 af of CAP water are used. Groundwater used within the district is privately pumped. The district is comprised of 26,900 acres.

In 1998, in the NMIDD service area, a total of 78,714 af of water was produced and delivered. Of that total, all was derived from CAP deliveries.

VI.A. CAP Water Allocation History

The NMIDD entered into a contract with the United States and CAWCD for 4.34 percent of the available NIA pool, effective October 1, 1993. Had the 1992 NIA reallocation process been completed, NMIDD's percentage of the available NIA pool would have increased to 7.23. In 1995, NMIDD declared bankruptcy and relinquished its CAP contract entitlement as part of the bankruptcy. In late 1993, NMIDD entered into a two-party letter agreement with CAWCD under which NMIDD and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract." The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, NMIDD has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original contract requirements.

Under the Settlement Alternative, NMIDD would voluntarily relinquish any claim to any additional water from the 1992 NIA reallocation process, in exchange for debt relief and access to affordably priced CAP Ag Pool water for the next thirty years (see Chapter 2 for full description of all Alternatives). Under Non-Settlement Alternative 3A, NMIDD would be offered and would accept an allocation of the available NIA CAP water supply. For purposes of analysis only, this percentage amount has been converted to 3,396 afa. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) on an as-available basis, with less water anticipated as being available later in time. The CAP water would be used to supplement water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Under all the other alternatives, NMIDD would not receive an additional allocation. It should be noted that, even without an allocation, CAP water will continue to be available to NMIDD from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative NMIDD would receive 8.58 percent of the Ag Pool. Under all other alternatives, NMIDD would receive 10.3 percent of the Ag Pool. Table L-NIA-14 outlines the proposed CAP allocation by alternative.



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CAP Allocation Draft EIS
General Location Map
New Magma Irrigation and Drainage District

June 2000

Figure #L-NIA-8

Table L-NIA-14
CAP Allocation Draft EIS
NMIDD – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	3,396[b]	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	0[c]	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]This allocation is NMIDD's calculated percentage from the uncontracted NIA pool.
[c]NMIDD relinquished their original CAP allocation during bankruptcy proceedings.

IV.B. Water Demand and Supply Quantities

NMIDD consists of 26,548 CAP-eligible acres and 2,439 acres of CAP excess land. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, NMIDD uses approximately 87,000 afa of CAP water, of which 26,865 afa are provided as in-lieu groundwater recharge. This water use pattern is based on a five-year average from 1999 to 1994. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access of CAP water.

In order to estimate impacts for the next fifty years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not a certain wheat will be grown based on the marginal costs of growing wheat given the prices and availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify NMIDD's ability to pump and afford the projected groundwater to be used.

IV.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one exception. Under the Settlement Alternative, RRA restrictions may be lifted and NMIDD may desire to build new facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

IV.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to NMIDD would result from the availability of CAP water, and its cost, under the different alternatives.

IV.D.1. Land Use

Table L-NIA-15 shows the land use pattern for years 2001 to 2051 within the NMIDD area. Approximately 3,900 acres are projected to be urbanized over the study period. Additionally, approximately 10,500 acres are estimated to be retired and fallowed due to farming economics. The timing of the land retirement and fallowing varies by alternative.

Table L-NIA-15
CAP Allocation Draft EIS
NMIDD – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	23,261	0	0
	2004	22,168	1,093	0
	2017	16,146	915	5,107
	2030	9,782	915	5,449
	2043	9,278	504	0
	2051	8,829	449	0
No Action	2001	23,261	0	0
	2004	22,168	1,093	0
	2017	16,146	915	5,107
	2030	9,782	915	5,449
	2043	9,278	504	0
	2051	8,829	449	0
Non-Settlement Alternative 1	2001	23,261	0	0
	2004	22,168	1,093	0
	2017	16,146	915	5,107
	2030	9,782	915	5,449
	2043	9,278	504	0
	2051	8,829	449	0
Non-Settlement Alternative 2	2001	23,261	0	0
	2004	22,168	1,093	0
	2017	16,146	915	5,107
	2030	9,782	915	5,449
	2043	9,278	504	0
	2051	8,829	449	0
Non-Settlement Alternative 3A	2001	23,261	0	0
	2004	22,168	1,093	0
	2017	16,146	915	5,107
	2030	9,782	915	5,449
	2043	9,278	504	0
	2051	8,829	449	0
Non-Settlement Alternative 3B	2001	23,261	0	0
	2004	22,168	1,093	0
	2017	16,146	915	5,107
	2030	9,782	915	5,449
	2043	9,278	504	0
	2051	8,829	449	0

IV.D.2. Archaeological Resources

Several projects have taken place in this entity's northern half, including most prominently Reclamation's CAP survey (Marmaduke et al. 1985); several isolated occurrences, mostly ceramic shards, were noted, but no sites were found. No projects or sites have been documented in the southern half; however, numerous sites, ranging from Archaic scatters to Hohokam villages (e.g., Escalante Ruin), have been recorded between the entity's southern boundary and the Gila River. Additional prehistoric sites have been recorded to the northwest, within the Queen Creek Archaeological District. It is likely that similar cultural resource types might be present within this entity, particularly intact buried deposits below the existing plow zone.

Historic resources, including National Historic Register properties (e.g., the Florence Townsite Historic District), transportation routes, and commercial as well as residential structures, also are known. Cultural resource sensitivity areas in this entity are shown in Figure L-IA-9. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low. Urbanization of farmlands could impact any intact/cultural deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

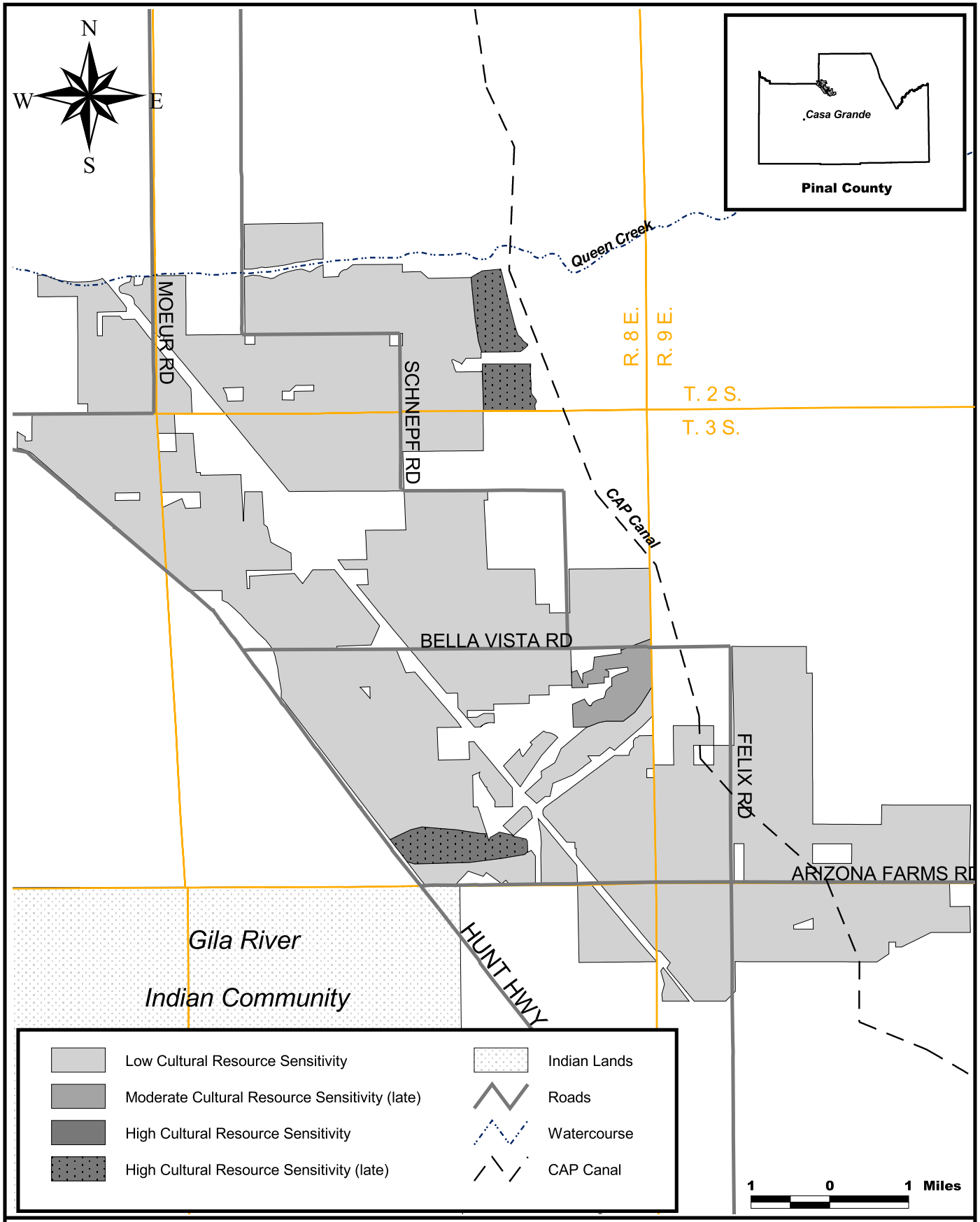
IV.D.3. Biological Resources

Table L-NIA-15 shows land use over the period of study by alternative. Land stays in agricultural production or is either converted to urban uses or is fallowed. The change in land use will result in two possible effects on biological resources. If conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals. If conversion of agricultural lands to fallow fields occurs, the period of time the land is left fallow will vary. Through natural revegetation processes, these fallow fields can provide fair wildlife habitat in the long term. Reclamation with natural vegetation can enhance this process if these fields will not be developed in the future. Fallow fields often become areas of potential dispersal for noxious weeds.

IV.D.4. Water Resources

NMIDD has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater levels have declined historically in response to the groundwater pumping. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm.

Presented in Table L-NIA-16 are estimated changes in groundwater levels from 2001 to 2051 and estimated groundwater level impacts for each alternative. Under the No Action Alternative, groundwater levels decline slightly by about three feet through 2051. Because the change in groundwater level is very small, it would not be anticipated that there would be substantial changes in the groundwater pumping cost, groundwater quality, or subsidence.



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CAP Allocation Draft EIS
Cultural Resources
New Magma Irrigation and Drainage District

June 2000

Figure #L-NIA-9

Groundwater levels in year 2051 under the Settlement Alternative and all Non-Settlement Alternatives would be lower than under the No Action Alternative. The lower groundwater levels relative to the No Action Alternative reflect the reduced availability of CAP water to NMIDD under these alternatives. The lower groundwater levels relative to the No Action Alternative would result in higher groundwater pumping costs and the potential for subsidence. Groundwater quality impacts would not be anticipated.

Table L-NIA-16
CAP Allocation Draft EIS
NMIDD – Groundwater Data Table

Alternative	NMIDD*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	-3	--
Settlement Alternative	-66	-63
Non-Settlement Alternative 1	-30	-27
Non-Settlement Alternative 2	-81	-78
Non-Settlement Alternative 3A	-69	-67
Non-Settlement Alternative 3B	-69	-67

* Values correspond to the NMIDD sub-area.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

IV.D.5. Socioeconomic

Table L-NIA-17 shows the estimated lost agricultural gross revenues over the 50-year study period resulting from the fallowing of approximately 10,500 acres, the timing of which varies by alternative. For more information regarding impacts of CAP water reallocation on NIA districts, refer to Appendix D of this publication.

Table L-NIA-17
CAP Allocation Draft EIS
NMIDD Estimated Lost Gross Agricultural Revenues 2001-2051 (dollars)

Alternative	Lost Gross Revenues 2001-2051 ($)
Settlement Alternative	232,724,946
No Action	48,046,416
Non-Settlement Alternative 1	174,919,240
Non-Settlement Alternative 2	232,724,946
Non-Settlement Alternative 3A	232,724,946
Non-Settlement Alternative 3B	232,724,946

V. QUEEN CREEK IRRIGATION DISTRICT

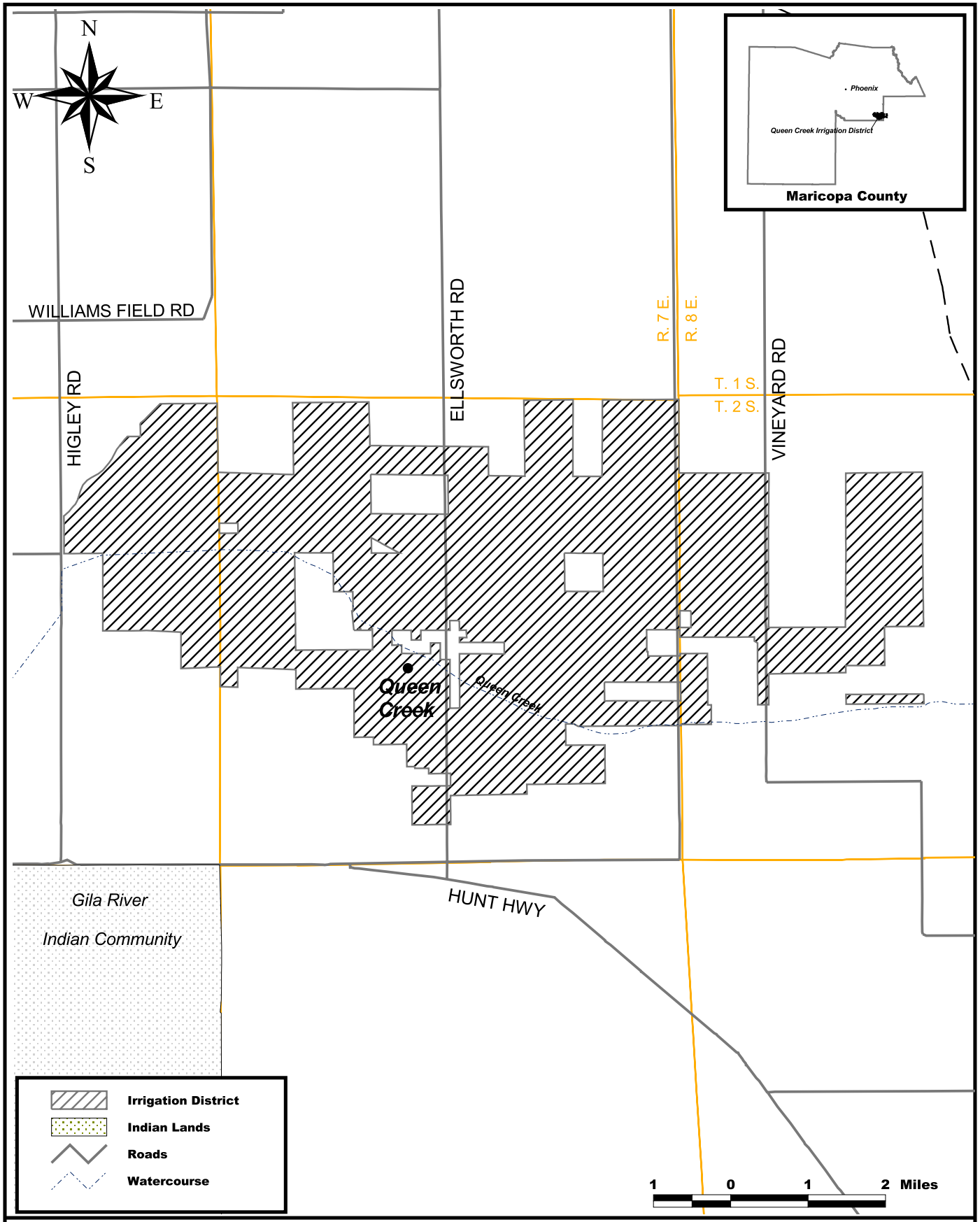
The Queen Creek Irrigation District (QCID) was organized in 1923 and is located in southwestern Maricopa County approximately 12 miles southeast of Mesa, as shown on Figure L-NIA-10. It was originally organized to obtain electrical power to operate pumps, which it continues to do through a contract with the Salt River Project. The district distribution system was completed in August 1989.

In the QCID service area in 1998, a total of 43,180 af of water was produced and delivered. Of that total, 43,180 af were derived from CAP deliveries.

V.A. CAP Water Allocation History

The QCID entered into a contract with the United States and CAWCD for 4.83 percent of the available NIA pool, effective October 1, 1993. Had the 1992 NIA reallocation process been completed, QCID's percentage of the available NIA pool would not have increased. In late 1993, QCID entered into a two-party letter agreement with CAWCD under which QCID and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract." The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, NMIDD has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original contract requirements.

Under the Settlement Alternative, QCID would voluntarily relinquish its allocation of CAP water in exchange primarily for debt relief and access to affordably priced CAP Ag Pool water for the next 30 years (see Chapter II for full description of all alternatives). Under all of the alternatives, QCID would not receive an additional allocation. It should be noted that, even without an allocation, CAP water will continue to be available to QCID from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative, QCID would receive 2.91 percent of the Ag Pool; under all other alternatives, QCID would receive 7.8 percent of the Ag Pool. Table L-NIA-18 outlines the proposed CAP allocation by alternative.



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CAP Allocation Draft EIS
General Location Map
Queen Creek Irrigation District

June 2000

Figure #L-NIA-10

Table L-NIA-18
CAP Allocation Draft EIS
QCID – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	3,396[b]	NIA
Non-Settlement Alternative 3B	19,221[(b)]	-
Existing CAP Allocation	0[c]	NIA

Notes:
[(a)]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[(b)]Based on 4.83 percent of the available NIA CAP water supply. The status of this allocation is in dispute.

V.B. Water Demand and Supply Quantities

QCID consists of 19,161 CAP-eligible acres and 585 acres of CAP excess land. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, QCID uses approximately 45,614 afa of CAP water, of which 10,307 afa are provided as in-lieu groundwater recharge. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access of CAP water.

In order to estimate impacts for the next 50 years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not a certain wheat will be grown based on the marginal costs of growing wheat given the prices and availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify QCID's ability to pump and afford the projected groundwater to be used. Acreage was also decreased based on urbanization due to population growth.

V.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one exception. Under the Settlement Alternative, RRA restrictions may be lifted and QCID may desire to build new facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

V.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to QCID would result from the availability of CAP water and its cost, under the different alternatives.

V.D.1. Land Use

Table L-NIA-19 shows the land use pattern for years 2001 to 2051 within the QCID area. Approximately 3,900 acres are projected to be urbanized over the study period. Additionally, approximately 7,000 acres are fallowed due to farming economics. The timing of the acreage fallowed varies by alternative and is tied to the size of the retired acreage and the CAP Ag Pool.

Table L-NIA-19
CAP Allocation Draft EIS
QCID– Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	15,259	0	0
	2004	11,012	1,093	3,154
	2017	10,097	915	0
	2030	9,182	915	0
	2043	4,831	504	3,847
	2051	4,382	449	0
No Action	2001	15,259	0	0
	2004	11,012	1,093	3,154
	2017	10,097	915	0
	2030	9,182	915	3,847
	2043	4,831	504	0
	2051	4,382	449	0
Non-Settlement Alternative 1	2001	15,259	0	0
	2004	11,012	1,093	3,154
	2017	10,097	915	3,847
	2030	9,182	915	0
	2043	4,831	504	0
	2051	4,382	449	0
Non-Settlement Alternative 2	2001	15,259	0	0
	2004	11,012	1,093	0
	2017	10,097	915	3,154
	2030	9,182	915	5,449
	2043	4,831	504	0
	2051	4,382	449	3,847
Non-Settlement Alternative 3A	2001	15,259	0	0
	2004	11,012	1,093	0
	2017	10,097	915	3,154
	2030	9,182	915	0
	2043	4,831	504	3,847
	2051	4,382	449	0
Non-Settlement Alternative 3B	2001	15,259	0	0
	2004	11,012	1,093	0
	2017	10,097	915	3,154
	2030	9,182	915	0
	2043	4,831	504	3,847
	2051	4,382	449	0

V.D.2. Archaeological Resources

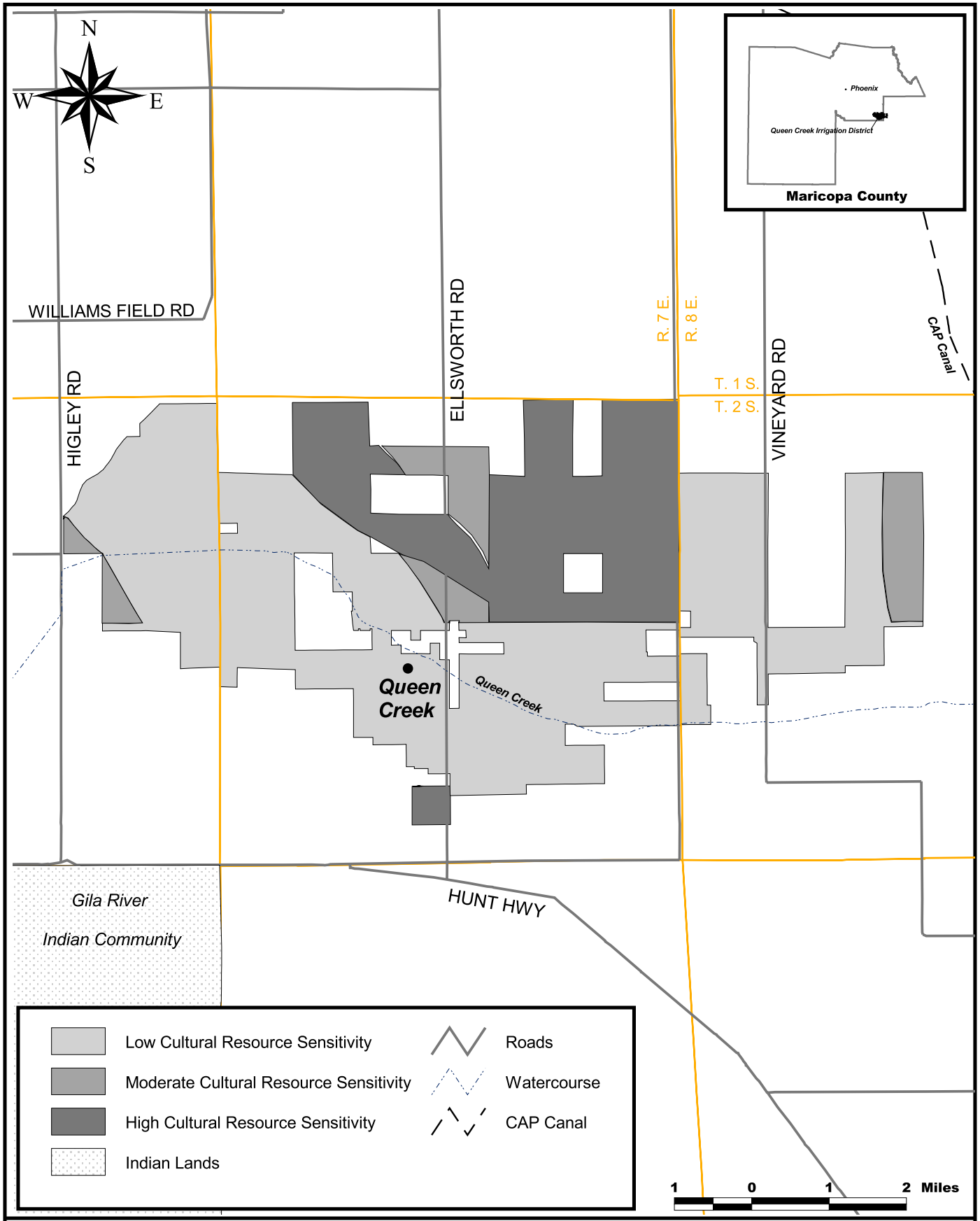
Less than one-third of this entity has been surveyed, with linear surveys comprising approximately 75 percent of the area examined. Most surveys have been negative, although numerous sites were documented in the northern half of the entity by various surveys associated with Reclamation's Salt-Gila Aqueduct – CAP (e.g., Stein 1979; Marmaduke et al. 1985). This area of high cultural resource sensitivity includes Hohokam artifact scatters—some including mounds, ranging from the Sedentary to the Classic periods (e.g., the Southwest Germann Site; Las Ollas Oriente), as well as architectural sites recorded by Omar Turney, Frank Midvale, and others (e.g., Rittenhouse Ruins) during the 1930s and 1940s. Given the rate of development that has occurred in this area since then, it is likely that some of these sites are no longer visible; however, intact subsurface deposits are still possible below the plow zone. It is also likely that surface remains—such as field houses, canals, and other agricultural features—associated with some of the larger sites might be present in the surrounding areas. A second, smaller parcel in the south half of the entity also is classified as an area of high cultural resource sensitivity, as it encompasses two large Hohokam architectural sites, Sonoquit Pueblo and Pozps de Sonoqui. Areas of moderate sensitivity contain small, dispersed artifact scatters or border areas of high sensitivity, such as the archaeology-rich landscape around the CAP canal. Historic resources that might be present throughout the entity include homesteads, orchards, roads, canals, and railroad features. It is not known whether this entity has a local historic preservation program. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-11. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high to moderate. Urbanization of farmlands could impact any intact cultural/deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

V.D.3. Biological Resources

Table L-NIA-19 shows land use over the period of study by alternative. Land stays in agricultural production or is converted to urban uses or fallowed. The change in land use will result in two possible effects on biological resources. If conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals. If conversion of agricultural lands to fallow fields occurs, the period of time the land is left fallow will vary. Through natural revegetation processes, these fallow fields can provide fair wildlife habitat in the long term. Reclamation with natural vegetation can enhance this process if these fields will not be developed in the future. Fallow fields often become areas of potential dispersal for noxious weeds.

V.D.4. Water Resources

QCID has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater levels have declined historically in response to the groundwater pumping, and a groundwater level depression is located in the vicinity of QCID. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm. This area has experienced subsidence historically, due to the groundwater level declines.



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CAP Allocation Draft EIS
Cultural Resources
Queen Creek Irrigation District

June 2000

Figure #L-NIA-11

Presented in Table L-NIA-20 are estimated changes in groundwater levels from 2001 to 2051, and estimated groundwater level impacts for each alternative. Under the No Action Alternative, groundwater levels rise by about 44 feet through about 2051. This rise in groundwater levels reflects the interplay of a number of factors, including urbanization and changes in irrigated acreage in QCID due to economic considerations. The rise in groundwater levels would likely cause a reduction in pumping costs. The rise in groundwater levels would tend to eliminate subsidence. Also, the groundwater level rise in this area would eliminate the current local groundwater depression, which would tend to improve groundwater quality.

Groundwater levels in year 2051 under the Settlement Alternative and all Non-Settlement Alternatives would be lower than under the No Action Alternative, except for Alternative 1. As with the No Action Alternative, these groundwater levels reflect a number of different factors in the vicinity of QCID, including urbanization and changes in irrigated acres due to economic considerations. There would be the potential for subsidence under the Settlement Alternative and Non-Settlement Alternatives 2 and 3A, due to the lower groundwater levels. There would also be the potential for adverse groundwater quality impacts under the Settlement Alternative, as a groundwater level depression would remain in the vicinity of QCID.

Table L-NIA-20
CAP Allocation Draft EIS
QCID– Groundwater Data Table

Alternative	QCID*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	44	--
Settlement Alternative	-18	-62
Non-Settlement Alternative 1	53	8
Non-Settlement Alternative 2	-31	-75
Non-Settlement Alternative 3A	-27	-71
Non-Settlement Alternative 3B	+1	-44

* Values correspond to the QCID sub-area.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

V.D.5. Socioeconomic

Table L-NIA-21 shows the estimated lost agricultural gross revenues over the 50-year study period resulting from the fallowing of approximately 17,000 acres, the timing of which varies by alternative. For more information regarding impacts of CAP water reallocation on NIA districts, refer to Appendix D of this publication.

Table L-NIA-21
CAP Allocation Draft EIS
QCIDD Estimated Lost Gross Agricultural Revenues 2001-2051 ($)

Alternative	Lost Gross Revenues 2001-2051
Settlement Alternative	238,999,360
No Action	61,724,600
Non-Settlement Alternative 1	85,397,690
Non-Settlement Alternative 2	148,607,438
Non-Settlement Alternative 3A	171,227,798
Non-Settlement Alternative 3B	148,607,438

VI. ROOSEVELT IRRIGATION DISTRICT

The Roosevelt Irrigation District (RID) was formed in 1923. The District is served by 50 miles of main canals and 136 miles of laterals, mostly concrete-lined. The collector canals in the Tolleson area are connected to the District main canal by a 108-inch diameter inverted siphon under the Agua Fria River. Water is pumped from 104 operating wells, of which 54 are located in the Tolleson or Salt River Project area, and 50 are located in the District. Figure L-NIA-12 shows the general location of the RID.

In 1998 the RID service area, a total of 140,615 af of water was produced and delivered. Of that total, 110,598 af, or 79 percent, was from groundwater, and 30,018 af, or 21 percent, was from spillwater.

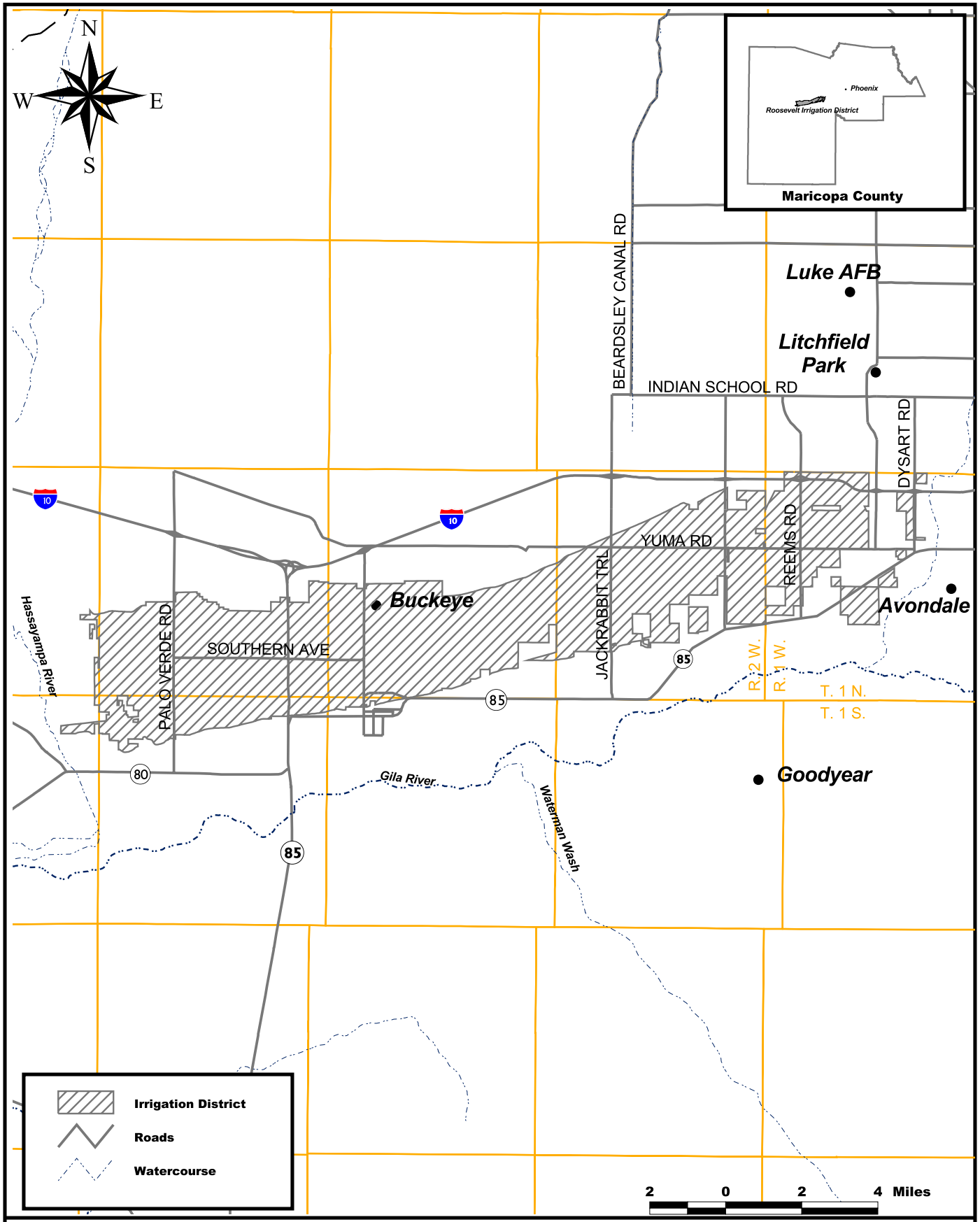
VI.A. CAP Water Allocation History

RID was originally allocated 2.61 percent of the available NIA pool in the 1983 CAP allocations. RID was to be offered an increased allocation of 5.06 percent of the NIA pool. This reallocation process was never completed. Under Non-Settlement Alternative 3A, RID would be offered and would accept an allocation of the available NIA CAP water supply. For purposes of analysis only, this percentage amount has been converted to 6,122 afa. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) on an as-available basis, with less water anticipated as being available later in time. The CAP water would be used to supplement water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Under all the other alternatives, RID would not receive an additional allocation. It should be noted that, even without an allocation, CAP water will continue to be available to RID from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative, RID would receive 2.31 percent of the Ag Pool. Under all other alternatives, RID would not receive a percent of the Ag Pool. Table L-NIA-22 outlines the proposed CAP allocation by alternative.

Table L-NIA-22
CAP Allocation Draft EIS
Roosevelt ID – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	6,122 [(b)]	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	0	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]This allocation is Roosevelt ID's calculated percentage from the uncontracted NIA pool.



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CAP Allocation Draft EIS
General Location Map
Roosevelt Irrigation District

June 2000

Figure #L-NIA-12

VI.B. Water Demand and Supply Quantities

RID contains 38,000 CAP-eligible acres. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, RID uses CAP water. RID pumps 139,165 afa of groundwater. This water use pattern is based on a five-year average from 1998 to 1995. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next fifty years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not wheat will be grown based on the marginal costs of growing wheat given the prices and the availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify RID's ability to pump and afford the projected groundwater to be used. Acreage was also decrease based on urbanization due to population growth.

VI.C. Specific Construction-Related Impacts

No new water delivery facilities would be required. CAP water can be delivered to RID lands through existing SRP or MWD facilities.

VI.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to RID would result from the availability of CAP water and its costs under the different alternatives.

VI.D.1. Land Use

Table L-NIA-23 shows the land use pattern for years 2001 to 2051 within the RID area. Approximately 28,300 acres are projected to be urbanized during the study period. No land is projected to be retired and fallowed due to farm economics.

Table L-NIA-23
CAP Allocation Draft EIS
Roosevelt ID – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	26,065	0	0
	2004	24,232	1,833	0
	2017	20,073	4,159	0
	2030	9,718	10,355	0
	2043	3,190	6,528	0
	2051	0	5,431	0
No Action	2001	26,065	0	0
	2004	24,232	1,833	0
	2017	20,073	4,159	0
	2030	9,718	10,355	0
	2043	3,190	6,528	0
	2051	0	5,431	0
Non-Settlement Alternative 1	2001	26,065	0	0
	2004	24,232	1,833	0
	2017	20,073	4,159	0
	2030	9,718	10,355	0
	2043	3,190	6,528	0
	2051	0	5,431	0
Non-Settlement Alternative 2	2001	26,065	0	0
	2004	24,232	1,833	0
	2017	20,073	4,159	0
	2030	9,718	10,355	0
	2043	3,190	6,528	0
	2051	0	5,431	0
Non-Settlement Alternative 3A	2001	26,065	0	0
	2004	24,232	1,833	0
	2017	20,073	4,159	0
	2030	9,718	10,355	0
	2043	3,190	6,528	0
	2051	0	5,431	0
Non-Settlement Alternative 3B	2001	26,065	0	0
	2004	24,232	1,833	0
	2017	20,073	4,159	0
	2030	9,718	10,355	0
	2043	3,190	6,528	0
	2051	0	5,431	0

VI.D.2. Archaeological Resources

No large block surveys have taken place, and very few sites have been recorded within the project area. Given the sparse survey coverage, it is possible that undocumented sites could be present within the entity's boundaries. Site types known to occur within the surrounding White Tanks-Hassayampa region range from small lithic scatters of unknown affiliations to large Hohokam villages associated with canal systems (Gladwin and Gladwin 1929, 1930; Johnson 1963; Midvale 1920-1971; Turney 1929). Other possible site types include Patayan and Yavapai shard scatters, rock rings, petroglyphs, and rockshelters. Historic roads, canals, and sites associated with mining also are possible. It is not known whether this entity has a local historical preservation program. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-13. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low. Urbanization of farmlands could impact cultural/deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

VI.D.3. Biological Resources

Table L-NIA-23 shows land use over the period of study by alternative. Land stays in agricultural production or is converted to urban use. When conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals.

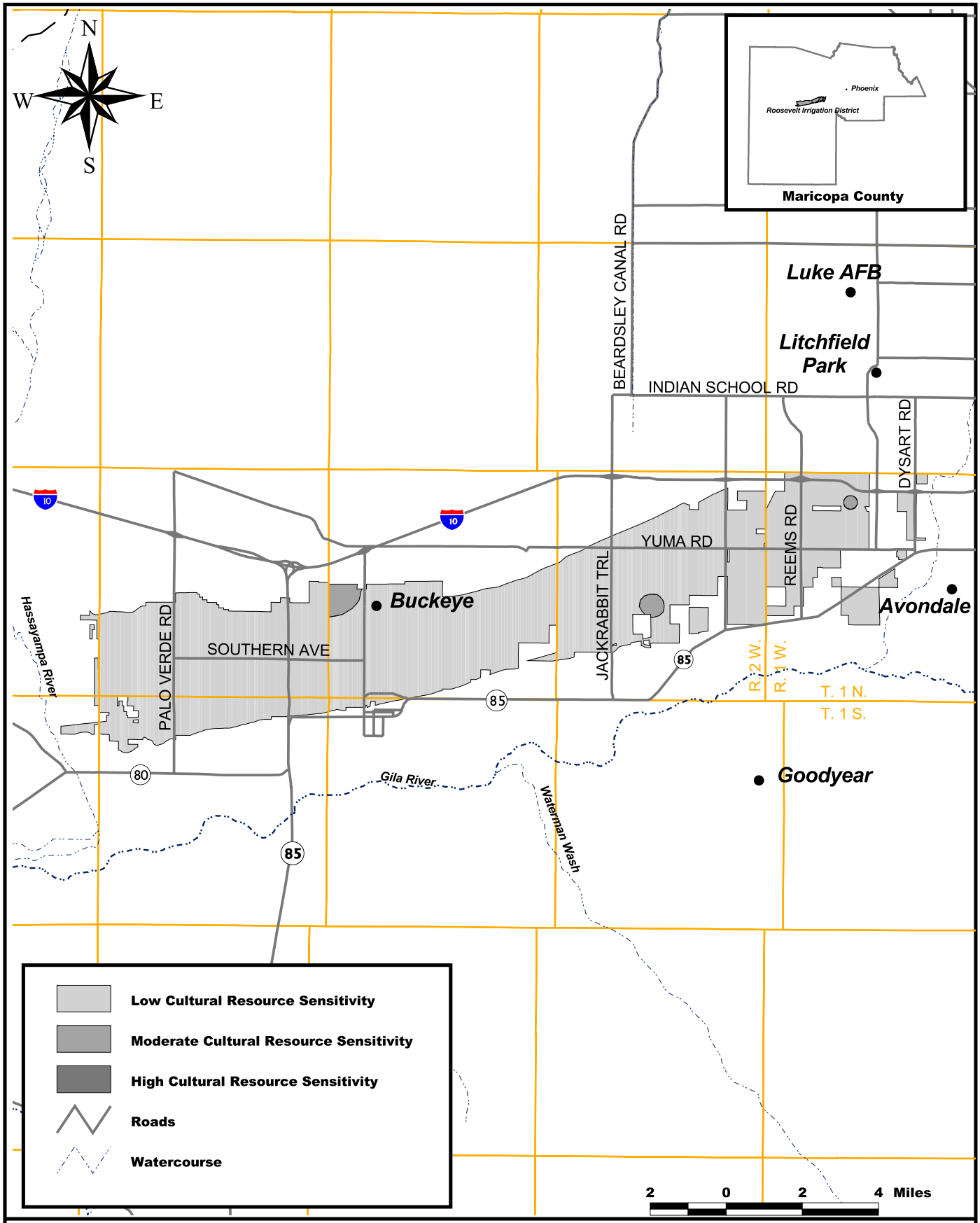
VI.D.4. Water Resources

RID has met historical irrigation demands using groundwater. Groundwater levels have declined historically in response to the groundwater pumping. The TDS concentration of groundwater ranges generally from about 1,000 to 3,000 ppm.

Presented in Table L-NIA-24 are estimated changes in groundwater levels from 2001 to 2051. Estimated groundwater level impacts for each alternative (changes from levels under the No Action Alternative) are also shown. Groundwater conditions were estimated in the analysis for three areas that include RID, and the values shown represent conditions from east to west in RID. Estimated groundwater level changes are larger in the western part of RID, although the changes relative to the No Action Alternative are similar (less than 10 feet) throughout RID.

Under the No Action Alternative, groundwater levels would rise throughout RID over the 2001 to 2051 period. These groundwater levels are influenced by recharge in the Gila River. The higher groundwater levels would result in a reduction in groundwater pumping costs. Subsidence and groundwater quality impacts would not be anticipated.

Groundwater levels under the Settlement Alternative and all Non-Settlement Alternatives would also rise by year 2051. The relatively small differences in groundwater levels primarily reflect differences in the availability of CAP water to RID and changes in underflow to adjacent areas. As with the No Action Alternative, the higher groundwater levels would result in a



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CAP Allocation Draft EIS
Cultural Resources
Roosevelt Irrigation District

June 2000

Figure #L-NIA-13

reduction in groundwater pumping costs, and subsidence and groundwater quality impacts would not be anticipated.

Table L-NIA-24
CAP Allocation Draft EIS
RID – Groundwater Data Table

Alternative	RID*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	35 / 52 / 55	--
Settlement Alternative	28 / 50 / 55	-6 / -1 / 0
Non-Settlement Alternative 1	36 / 57 / 55	1 / 5 / 0
Non-Settlement Alternative 2	31 / 49 / 55	-3 / -3 / 0
Non-Settlement Alternative 3A	26 / 47 / 55	-9 / -4 / 0
Non-Settlement Alternative 3B	32 / 51 / 55	-3 / 0 / 0

* Values correspond to the Avondale, East Buckeye, and West Buckeye sub-areas, respectively.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

VI.D.5. Socioeconomic

RID was excluded in the economic analysis because no change in output associated with water price is projected to occur. Groundwater pumping costs in RID are sufficiently low so that farmers' total water costs do not become too costly for the cultivation of certain crops even when availability of CAP excess water declines. Therefore, no socioeconomic impacts associated with the CAP reallocation strategies analyzed in this EIS were analyzed for this irrigation district.

VII. SAN CARLOS IRRIGATION AND DRAINAGE DISTRICT

The San Carlos Irrigation and Drainage District (SCIDD) includes 50,000 acres of private and public lands of the San Carlos Irrigation Project. Waters of the Gila River for lands of the San Carlos Irrigation Project are diverted at the Ashurst-Hayden Diversion Dam on the Gila River about 10 miles east of Florence, as shown on Figure L-NIA-14. The San Carlos Project was authorized by an Act of Congress, commonly called the San Carlos Act. The organization of the San Carlos IDD was completed on July 16, 1928.

All facilities and works of the Project are in the name of the United States. These are divided into three parts: Joint Works, Indian Works, and District Works. The United States, through the Bureau of Indian Affairs, operates and maintains the Joint Works, which are those that are used jointly by the District and Indian parts of the Project. The Indian Works are those used solely for Indian Lands, and the District Works are those used only for District lands.

Total irrigable area in the district is 50,000 acres. According to 1995 district crop and acreage reports, the net acreage cropped was 37,513 acres. The 13-year average number of acres irrigated during 1983-95 was approximately 32,434 acres.

An apportionment of water is made to the irrigated lands early in each calendar year based upon the amount of stored and pumped water available at that time, reduced by the anticipated conveyance losses. As additional supply becomes available during the year, the apportionment is increased. Normal flow in the river system is additionally available to lands covered by the priority schedule during each 10-day delivery period.

The district per acre assessment covers repayment of construction costs and cost of operation and maintenance, and entitles each acre to two af per acre if available in a given year.

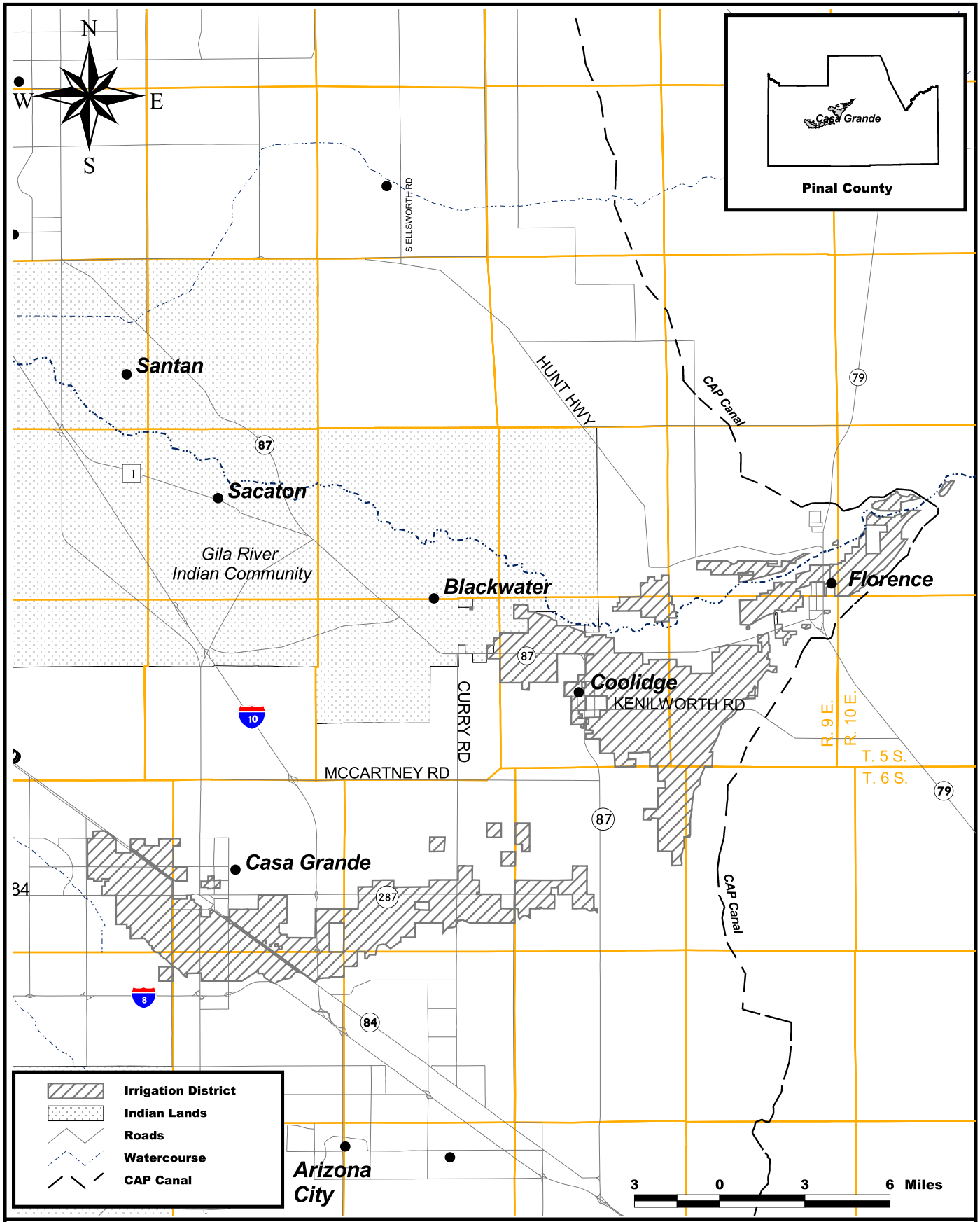
The 1936-1995 average quantity of water diverted to the district, from both pumped and gravity systems, was about 153,709 afa, and the quantity delivered to the lands was about 101,503 af or 66 percent of annual diversions.

In the San Carlos IDD service area in 1998, a total of 180,808 af of water was produced and delivered. Of that total, 92,683 af, or 51 percent, was from groundwater, 87,958 af, or 48 percent, was from Gila River water, and 167 af, or one percent, was from CAP.

VII.A. CAP Water Allocation History

The San Carlos IDD has not entered into a subcontract with the United States and CAWCD for a CAP allocation, although it has expressed an interest in doing. For the purpose of this analysis, SCIDD's 1983 CAP allocation is treated as excess water.

Under Non-Settlement Alternative 3A, San Carlos IDD would be offered and would accept an allocation of the available NIA CAP water supply. For purposes of analysis only, this percentage amount has been converted to 8,284 afa. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051) on an as-available basis, with less water anticipated as being available later in time. The CAP water would be used to supplement water supply demands over the next 50 years and would help reduce the continuing dependence on



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BUREAU OF RECLAMATION

CAP Allocation Draft EIS
General Location Map
San Carlos Irrigation and Drainage District

June 2000

Figure #L-NIA-14

pumping groundwater from an overdrafted groundwater system. Under all the other alternatives, San Carlos IDD would not receive an additional allocation. Under the Settlement Alternative, SCIDD would receive 8.13 percent of the Ag Pool. Under all other alternatives, SCIDD would not receive a percentage of the Ag Pool. Table L-NIA-25 outlines the proposed CAP allocation by alternative.

Table L-NIA-25
CAP Allocation Draft EIS
San Carlos IDD – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	8,284[b]	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	16,276[c]	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]This allocation is San Carlos IDD's calculated percentage from the uncontracted NIA pool.
[c]Based on 4.09 percent of the available NIA CAP water supply. San Carlos IDD has not contracted for this CAP allocation.

VII.B. Water Demand and Supply Quantities

San Carlos IDD contains 50,000 total acres. No new acreage can be brought into production as a result of the 1980 GMA. Currently, San Carlos IDD uses approximately 2,175 afa of CAP water, which is Colorado River surplus water. Additionally, San Carlos IDD pumps 43,023 afa of groundwater. This water use pattern is based on a five-year average from 1998 to 1994. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next fifty years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not a certain wheat will be grown based on the marginal costs of growing wheat, given the prices and availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify San Carlos IDD's ability to pump and afford the projected groundwater use. Acreage was also decreased based on urbanization due to population growth.

VII.C. Specific Construction-Related Impacts

No new water delivery facilities would be required. However, under Non-Settlement Alternative 3A, it is assumed San Carlos IDD would be required to line its system in order to be eligible to receive CAP water. The lining of the Florence-Casa Grande Canal was described at the programmatic level in the EIS for the PMIP. However, supplemental NEPA and other environmental compliance would be required prior to the lining of the San Carlos IDD system.

VII.D. Environmental Effects

In addition to the impacts from lining its system, additional environmental impacts to San Carlos IDD would result from the availability of CAP water and its cost, under the different alternatives.

VII.D.1. Land Use

Table L-NIA-26 shows the land use pattern for years 2001 to 2051 within the San Carlos IDD area. Approximately 1,100 acres are projected to be urbanized over the study period. No land is projected to be retired and fallowed due to farm economics.

Table L-NIA-26
CAP Allocation Draft EIS
San Carlos IDD – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	31,790	0	0
	2004	32,389	322	0
	2017	32,156	233	0
	2030	31,902	254	0
	2043	31,726	176	0
	2051	31,605	121	0
No Action	2001	31,790	0	0
	2004	32,389	322	0
	2017	32,156	233	0
	2030	31,902	254	0
	2043	31,726	176	0
	2051	31,605	121	0
Non-Settlement Alternative 1	2001	31,790	0	0
	2004	32,389	322	0
	2017	32,156	233	0
	2030	31,902	254	0
	2043	31,726	176	0
	2051	31,605	121	0
Non-Settlement Alternative 2	2001	31,790	0	0
	2004	32,389	322	0
	2017	32,156	233	0
	2030	31,902	254	0
	2043	31,726	176	0
	2051	31,605	121	0
Non-Settlement Alternative 3A	2001	31,790	0	0
	2004	32,389	322	0
	2017	32,156	233	0
	2030	31,902	254	0
	2043	31,726	176	0
	2051	31,605	121	0
Non-Settlement Alternative 3B	2001	31,790	0	0
	2004	32,389	322	0
	2017	32,156	233	0
	2030	31,902	254	0
	2043	31,726	176	0
	2051	31,605	121	0

VII.D.2. Archaeological Resources

Much of the project area has been surveyed, and numerous sites are documented within entity boundaries. The Casa Grande Ruins National Monument, an area of high cultural resource sensitivity, extends onto the northwest portion of the entity just north of Coolidge City limits. This extensive Hohokam site complex—which includes the Casa Grande Site, the Grewe Site, and other National Register-eligible properties—contains habitations, mounds, canals, a ball court, and cremation areas. It is likely that associated cultural remains (e.g., artifact scatters, agricultural features) could be present in the surrounding moderate-sensitivity areas. Several additional prehistoric properties in the vicinity have been recommended for inclusion on the National or State Historic Register, including Adamsville Ruin, Poston Butte, and the Blackwater Archaeological District. Other resource types that might be expected to occur within this entity's boundaries include protohistoric Pima sites, historic farmsteads, irrigation features, roads, and features associated with the Phoenix & Eastern, the Southern Pacific, and other early railroad routes. For information on the local historic preservation program, contact Ms. Jan Petersons. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-15. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high to moderate. Urbanization of farmlands could impact any intact cultural/deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

VII.D.3. Biological Resources

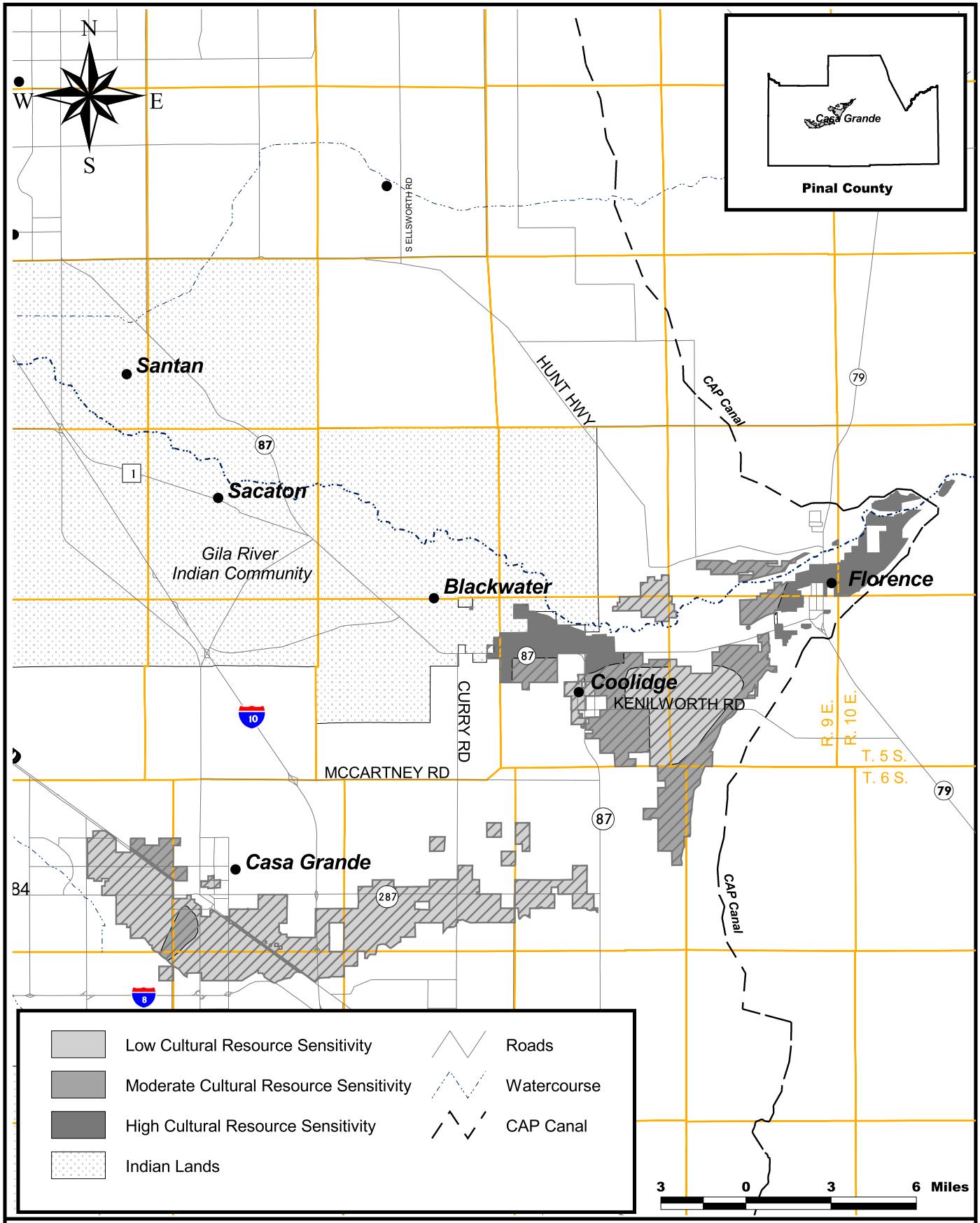
Table L-NIA-26 shows land use over the period of study by alternative. Land stays in agricultural production or is converted to urban uses. When conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals.

VII.D.4. Water Resources

SCIDD has met historical irrigation demands primarily using groundwater and Gila River water. Groundwater levels have declined historically in response to the groundwater pumping. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm, but higher TDS concentrations occur in some areas. Parts of SCIDD have experienced subsidence historically, due to the groundwater level declines.

Presented in Table L-NIA-27 are estimated changes in groundwater levels from 2001 to 2051. Estimated groundwater level impacts for each alternative (changes from levels under the No Action Alternative) are also shown. Groundwater conditions were estimated in the analysis for three areas that include lands in SCIDD. Three values are presented in Table L-M&I-109 for each alternative, representing groundwater levels for (in order) the western, central, and eastern parts of SCIDD. Estimated groundwater level changes are largest in the central part of SCIDD and smallest in the western part of SCIDD.

Under the No Action Alternative, groundwater levels would decline from 2001 to 2051, reflecting the continued reliance on groundwater both in SCIDD and in adjacent areas. The



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CAP Allocation Draft EIS
Cultural Resources
San Carlos Irrigation and Drainage District

June 2000

Figure #L-NIA-15

lower groundwater levels would cause an increase in groundwater pumping costs, and a continuation of the subsidence that has been historically experienced. Lower groundwater levels might also result in production of poorer quality groundwater at some wells in SCIDD where there is poorer quality water at depth.

Groundwater levels under the Settlement Alternative and all Non-Settlement Alternatives would also decline by year 2051. While groundwater levels would decline for the Settlement Alternative, the decline would be as much as 29 feet less than under the No Action Alternative. The smaller decline reflects that SCIDD would receive water from the Ag Pool under the Settlement Alternative. For the Non-Settlement Alternatives, SCIDD would not receive CAP water, and groundwater levels would generally be slightly deeper than under the No Action Alternative. Substantial changes in groundwater quality and subsidence would not be anticipated for the Settlement and Non-Settlement Alternatives.

Table L-NIA-27
CAP Allocation Draft EIS
San Carlos IDD – Groundwater Data Table

Alternative	San Carlos IDD*	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	Groundwater Level Impact** (in feet)
No Action	-27 / -77 / -67	--
Settlement Alternative	-11 / -48 / -58	16 / 29 / 9
Non-Settlement Alternative 1	-31 / -77 / -67	-4 / 0 / 0
Non-Settlement Alternative 2	-38 / -79 / -68	-11 / -2 / -1
Non-Settlement Alternative 3A	-38 / -79 / -66	-11 / -2 / 1
Non-Settlement Alternative 3B	-39 / -83 / -73	-12 / -6 / -7

* Values correspond to the SCIDD, HIDD / SCIDD, and Casa Grande sub-areas, respectively.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

VII.D.5. Socioeconomic

SCIDD was not included in the economic analysis because no change in output associated with water price is projected to occur. Groundwater pumping costs in SCIDD are sufficiently low so that farmers' total water costs do not become too costly for the cultivation of certain crops even when availability of CAP excess water declines. Therefore, no socioeconomic impacts associated with the CAP reallocation strategies analyzed in this EIS were analyzed for this district.

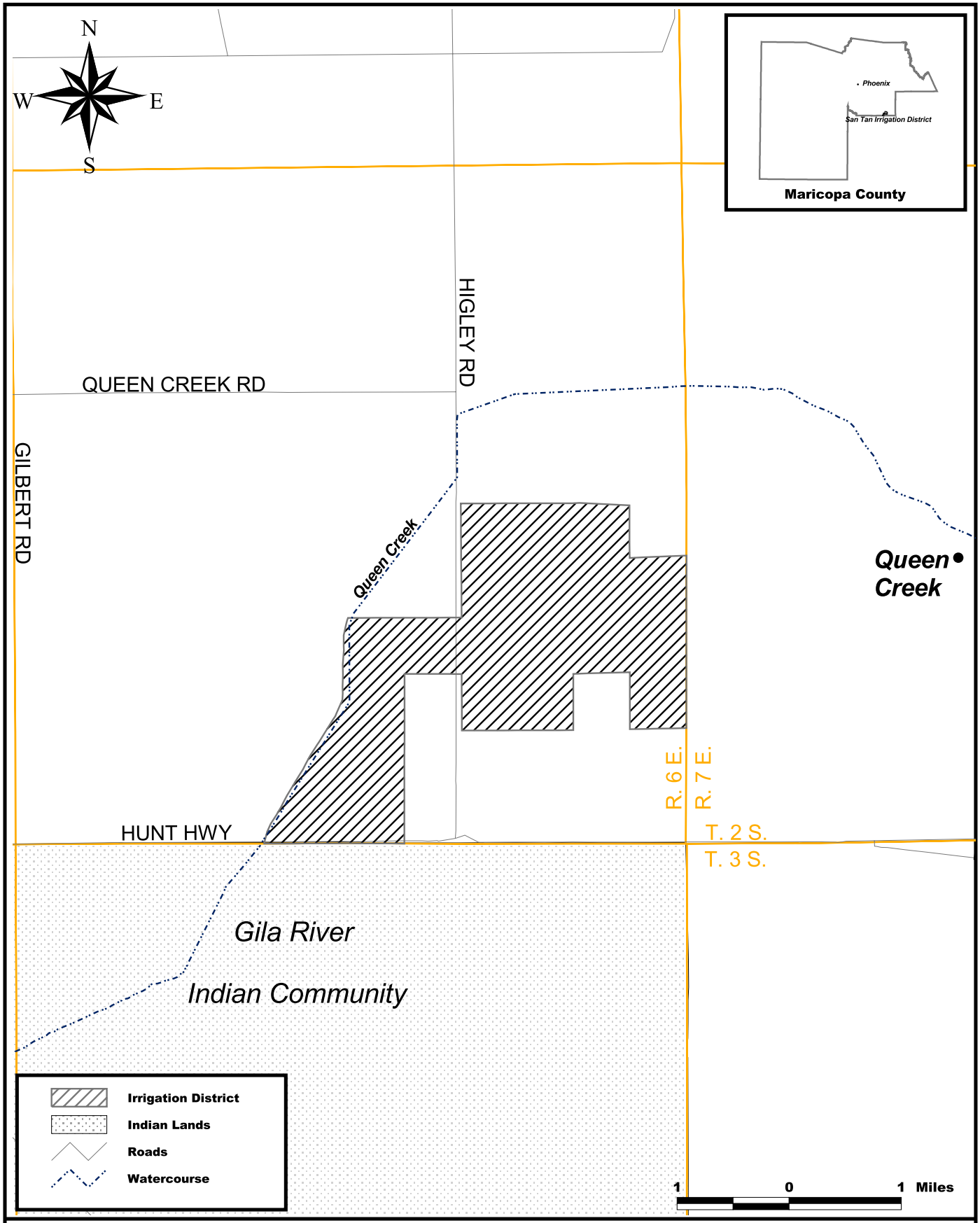
VIII. SAN TAN IRRIGATION DISTRICT

The San Tan Irrigation District (STID) was organized in 1955. It is located in Maricopa County north of the Gila River Indian Reservation and approximately 12 miles southeast of Chandler, as shown on Figure L-NIA-16. The STID owns 11 wells; there are no private wells in the service area. Also, the distribution system consists of 26 miles of lined pipe. Approximately 10,000 af of water are delivered to users by the district annually. One hundred percent of the water is used for irrigation. Nearly all of the 3,185 acres within the District are irrigated. The primary crop is citrus, followed by cotton and potatoes. In the STID service area in 1997, a total of 10,622 af of water was produced and delivered. Of that total, 5,760 af, or 54 percent, was from groundwater, and 4,862 af, or 46 percent, was from CAP.

VIII.A. CAP Water Allocation History

The STID entered into a contract with the United States and CAWCD for 0.77 percent of the available NIA pool, effective October 1, 1993. Had the 1992 NIA reallocation process been completed, STID's percentage of the available NIA pool would not have increased. In late 1993, San Carlos IDD entered into a two-party letter agreement with CAWCD under which STID and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract." The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, STID has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original contract requirements.

Under the Settlement Alternative, STID would voluntarily relinquish its allocation of CAP water in exchange primarily for debt relief and access to affordably priced CAP Ag Pool water for the next thirty years (see Chapter II for full description of all alternatives). Under all of the alternatives, STID would not receive an additional allocation. It should by noted that, even without an allocation, CAP water will continue to be available to STID from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative, STID would receive 0.34 percent of the Ag Pool. Under all other alternatives, STID would receive 1.1 percent of the Ag Pool. Table L-NIA-28 outlines the proposed CAP allocation by alternative.



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CAP Allocation Draft EIS
General Location Map
San Tan Irrigation District

June 2000

Figure #L-NIA-16

Table L-NIA-28
CAP Allocation Draft EIS
STID – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	3,064[(b)]	NIA

Notes:
[a] All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b] Based on 0.77 percent of the available NIA CAP water supply. The status of this allocation is in dispute.

VIII.B. Water Demand and Supply Quantities

STID contains 2,832 CAP-eligible acres and 78 acres of CAP excess land. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, STID uses approximately 4,598 afa of CAP water, of which 0 afa is provided as in-lieu groundwater recharge. Additionally, STID pumps 6,459 afa of groundwater. This water use pattern is based on a five-year average from 1994 to 1999. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next fifty years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not wheat will be grown, based on the marginal costs of growing wheat, given the prices and availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify STID's ability to pump and afford the projected groundwater to be used. Acreage was also decreased based on urbanization due to population growth.

VIII.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one exception. Under the Settlement Alternative, RRA restrictions may be lifted and STID may desire to build new facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

VIII.D. Environmental Effects

Since construction of water delivery facilities would not likely be required, the primary environmental impacts to STID would result from the availability of CAP water and its cost under the different alternatives.

VIII.D.1. Land Use

Table L-NIA-29 shows the land use pattern for years 2001 to 2051 within the STID area. The district is fully urbanized under all alternatives by 2043.

Table L-NIA-29
CAP Allocation Draft EIS
STID – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	3,477	0	0
	2004	2,780	697	0
	2017	2,444	336	0
	2030	246	2,198	0
	2043	0	246	0
	2051	0	0	0
No Action	2001	3,477	0	0
	2004	2,780	697	0
	2017	2,444	336	0
	2030	246	2,198	0
	2043	0	246	0
	2051	0	0	0
Non-Settlement Alternative 1	2001	3,477	0	0
	2004	2,780	697	0
	2017	2,444	336	0
	2030	246	2,198	0
	2043	0	246	0
	2051	0	0	0
Non-Settlement Alternative 2	2001	3,477	0	0
	2004	2,780	697	0
	2017	2,444	336	0
	2030	246	2,198	0
	2043	0	246	0
	2051	0	0	0
Non-Settlement Alternative 3A	2001	3,477	0	0
	2004	2,780	697	0
	2017	2,444	336	0
	2030	246	2,198	0
	2043	0	246	0
	2051	0	0	0
Non-Settlement Alternative 3B	2001	3,477	0	0
	2004	2,780	697	0
	2017	2,444	336	0
	2030	246	2,198	0
	2043	0	246	0
	2051	0	0	0

VIII.D.2. Archaeological Resources

Four archaeological surveys have been conducted within this entity's boundaries; no sites have been recorded. However, the area's proximity to Pozos de Sonoqui, a major Hohokam village

complex with a ball court and platform mound, suggests associated cultural resources – such as artifact scatters, rock piles, and agricultural fields – might be present. The area's western boundary borders the Roosevelt Canal, a historic canal that is presently in use. The Roosevelt Canal, part of the RID, has been in operation since 1926 and is eligible for inclusion on the NRHP. Although the Roosevelt Canal is not expected to be impacted by the proposed undertaking, it is possible that sites related to its construction might be present in the area. It is not known whether this entity has a local historic preservation program. Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-17. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low. Urbanization of farmlands could impact any intact cultural deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

VIII.D.3. Biological Resources

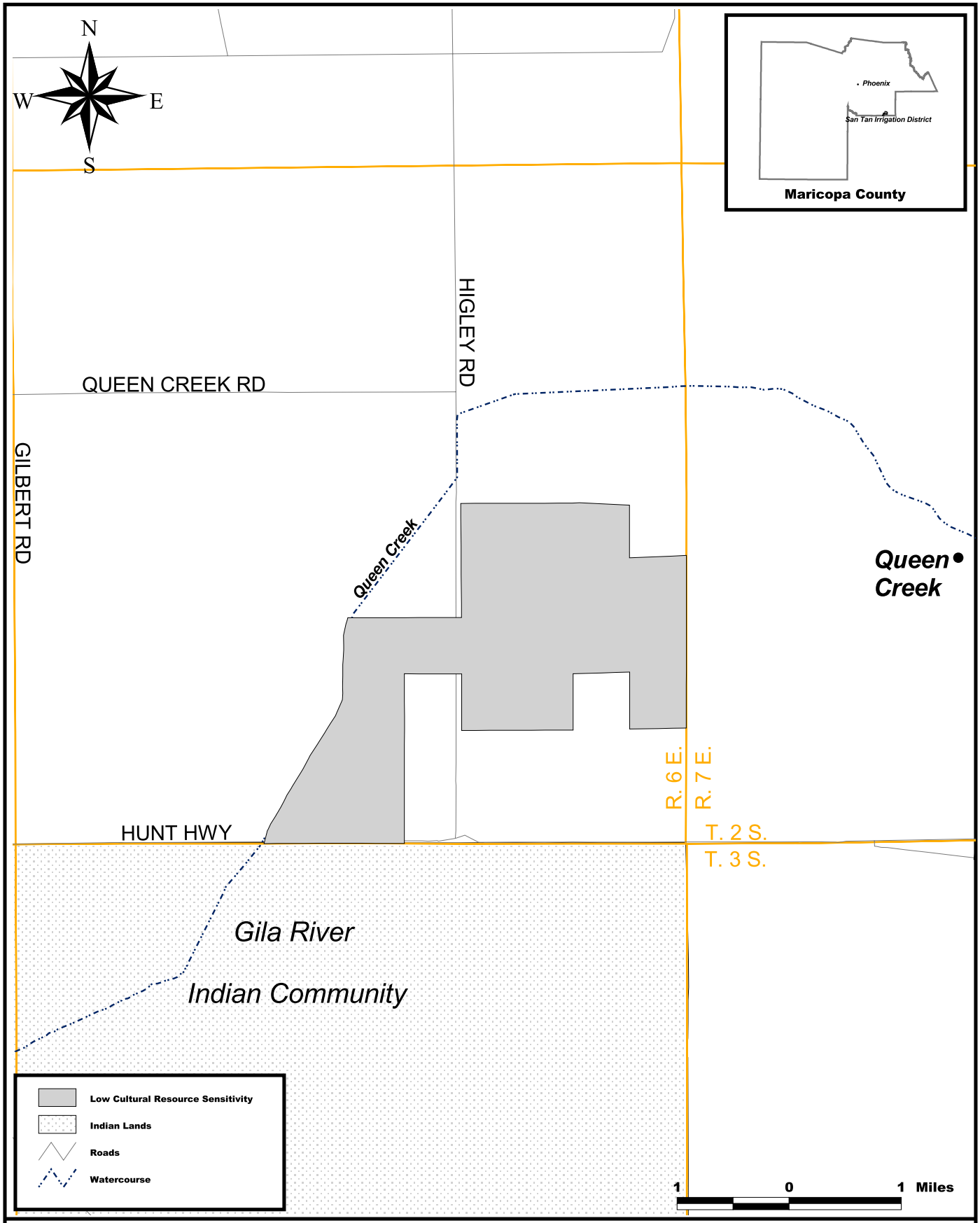
Table L-NIA-29 shows land use over the period of study by alternative. All agricultural land is converted to urban uses by 2043. When conversion of agricultural lands to urban use occurs, loss of natural habitat or wildlife is minimal. However, adjacent lands may contain wildlife that might be impacted such as burrowing owls, nests of local birds, and habitat for small mammals.

VIII.D.4. Water Resources

STID has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater levels have declined historically in response to the groundwater pumping, and a groundwater level depression is located in the general vicinity of STID. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm. This area has experienced subsidence historically, due to the groundwater level declines.

Presented in Table L-NIA-30 are estimated changes in groundwater levels from 2001 to 2051 and estimated groundwater level impacts for each alternative. Under the No Action Alternative, groundwater levels rise by about 44 feet through about 2051. This rise in groundwater levels reflects the interplay of a number of factors, including urbanization and changes in irrigated acreage in QCID (located adjacent to STID) due to economic considerations. The rise in groundwater levels would likely cause a reduction in pumping costs. The rise in groundwater levels would tend to eliminate subsidence. Also, the groundwater level rise in this area would eliminate the current local groundwater depression, which would tend to improve groundwater quality.

Groundwater levels in year 2051 under the Settlement Alternative and all Non-Settlement Alternatives would be lower than under the No Action Alternative, except for Alternative 1. As with the No Action Alternative, these groundwater levels reflect a number of different factors, including urbanization and changes in irrigated acres in the adjacent QCID due to economic considerations. There would be the potential for subsidence under the Settlement Alternative and Non-Settlement Alternatives 2 and 3A, due to the lower groundwater levels. There would also be the potential for adverse groundwater quality impacts under the Settlement Alternative, as a groundwater level depression would remain in the vicinity of STID.



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San Tan Irrigation District

June 2000

Figure #L-NIA-17

Table L-NIA-30 CAP Allocation Draft EIS STID – Groundwater Data Table		
Alternative	**STID***	
	Estimated Groundwater Level Change from 2001-2051 (in feet)	**Groundwater Level Impact** (in feet)**
No Action	44	--
Settlement Alternative	-18	-62
Non-Settlement Alternative 1	53	+8
Non-Settlement Alternative 2	-31	-75
Non-Settlement Alternative 3A	-27	-71
Non-Settlement Alternative 3B	1	-44

* Values correspond to the QCID.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

VIII.D.5. Socioeconomic

STID was excluded in the economic analysis because predominantly high-values crops are cultivated in STID that are not sensitive to the range of water prices examined in this study. No crop acreage is projected to go out of production due to increases in water prices. Therefore, no socioeconomic impacts associated with the CAP reallocation strategies analyzed in this EIS were analyzed for this irrigation district.

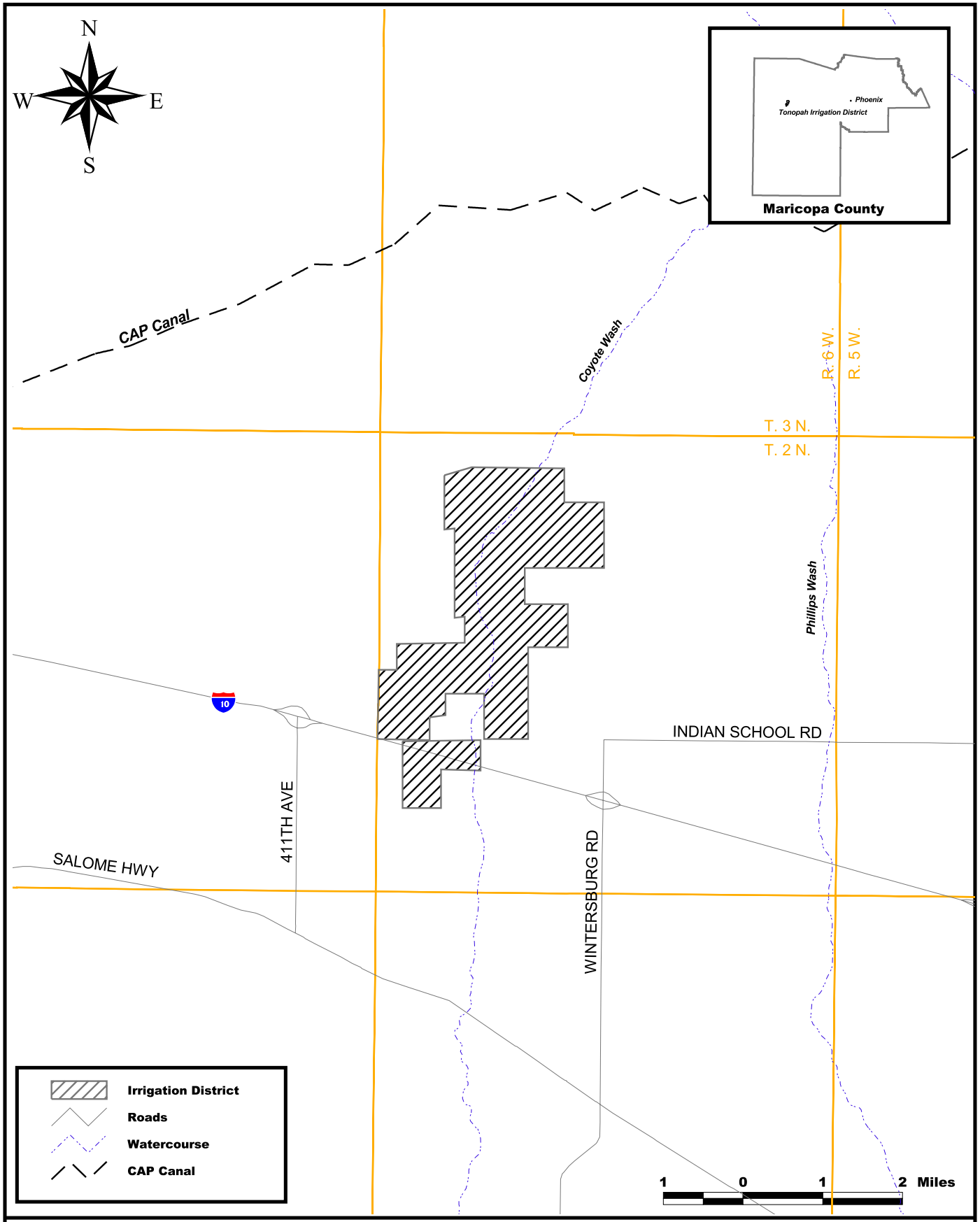
IX. TONOPAH IRRIGATION DISTRICT

The Tonopah Irrigation District (TID) is located approximately 40 miles west of Phoenix and was formed in 1977 to apply for CAP water. Interstate 10 crosses the TID in the southern portions, as shown on Figure L-NIA-18. The district has canals which are used to distribute CAP water to farms within the district. In the TID service area in 1998, a total of 9,364 af of water was produced and delivered. Of that total, 9,364 af, or all of the water, was obtained from CAP deliveries.

IX.A. CAP Water Allocation History

The TID entered into a contract with the United States and CAWCD for 1.98 percent of the available NIA pool, effective October 1, 1993. Had the 1992 NIA reallocation process been completed, TID's percentage of the available NIA would not have increased. In late 1993, TID entered into a two-party letter agreement with CAWCD under which TID and CAWCD "mutually agreed to waive certain rights and obligations under the Water Service Subcontract". The United States is challenging these agreements in ongoing litigation regarding operation of the CAP. Nevertheless, TID has contracted for CAP water pursuant to this agreement from the Ag Pools on an annual basis and at a rate reduced from the original contract requirements.

Under the Settlement Alternative, TID would voluntarily relinquish its allocation of CAP water in exchange primarily for debt relief and access to affordably priced CAP Ag Pool water for the next 30 years (see Chapter II for full description of all alternatives). Under all of the alternatives, TID would not receive an additional allocation. It should be noted that, even without an allocation, CAP water will continue to be available to TID from the Ag Pool, which is comprised of excess water. Under the Settlement Alternative TID would receive 0.42 percent of the Ag Pool. Under all other alternatives, TID would receive 1.3 percent of the Ag Pool. Table L-NIA-31 outlines the proposed CAP allocation by alternative.



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June 2000

CAP Allocation Draft EIS
General Location Map
Tonopah Irrigation District

Figure #L-NIA-18

Table L-NIA-31
CAP Allocation DEIS
TID – Proposed Additional CAP Allocation

Alternative	Additional Allocation[a] (in afa)	Priority
Settlement Alternative	0	-
No Action	0	-
Non-Settlement Alternative 1	0	-
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	NIA
Non-Settlement Alternative 3B	0	-
Existing CAP Allocation	7,879[(b)]	NIA

Notes:
[a]All NIA allocations are percentages of the available NIA CAP water supply. They are converted to fixed af amounts only for ease of calculation in the draft EIS. See Appendix B for the calculation of NIA allocation numbers.
[b]Based on 1.98 percent of the available NIA CAP water supply. The status of this allocation is in dispute.

IX.B. Water Demand and Supply Quantities

TID contains 3,433 CAP-eligible acres and 51 acres of CAP excess lands. No new net acreage can be brought into production as a result of the 1980 GMA. Currently, TID uses approximately 9,180 afa of CAP water, of which 3,592 afa are provided as in-lieu groundwater recharge. This water use pattern is based on a five-year average from 1998 to 1994. This water use pattern could change if acreage is taken out of production due to economic reasons or urbanization. Reductions in total water use reflect reductions in farmed acres due to water costs or the lack of access to CAP water.

In order to estimate impacts for the next 50 years, assumptions were made regarding the availability and pricing of CAP water for each alternative. These assumptions are fully described in Appendix A, Background Assumptions. Using the CAP water availability as a base, a model was developed (as described in Appendix D, Socioeconomic Analysis) to project water use and the number of cropped acres based on economic decisions. For example, the economic model predicts whether or not wheat will be grown based on the marginal costs of growing wheat, given the prices and the availability of water. The water uses projected by the economic model were incorporated into the groundwater model to verify TID's ability to pump and afford the projected groundwater to be used. Acreage was also decreased based on urbanization due to population growth.

IX.C. Specific Construction-Related Impacts

No new water delivery facilities would be required with one exception. Under the Settlement Alternative, RRA restrictions may be lifted and TID may desire to build new facilities to deliver CAP water to previously ineligible lands. This possibility is considered speculative at this time and is beyond the scope of this EIS.

IX.D. Environmental Effects

Since the construction of water delivery facilities would not likely be required, the primary environmental impacts to TID would result from the availability of CAP water and its costs under the different alternatives.

IX.D.1. Land Use

Table L-NIA-32 shows the land use pattern for years 2001 to 2051 within the TID area. No land is expected to be urbanized over the study period. Approximately 550 acres are projected to be retired and fallowed due to farm economics, the timing of which varies by alternative.

Table L-NIA-32
CAP Allocation Draft EIS
Tonopah ID – Projected Agricultural Land Use
(Acres)

Alternative	Year	Land Farmed	Land Urbanized Per Time Step	Land Fallowed Due to Economic Reasons per Time Step
Settlement Alternative	2001	3,031	0	0
	2004	2,485	0	546
	2017	2,485	0	0
	2030	2,485	0	0
	2043	2,485	0	0
	2051	2,485	0	0
No Action	2001	3,031	0	0
	2004	2,485	0	546
	2017	2,485	0	0
	2030	2,485	0	0
	2043	2,485	0	0
	2051	2,485	0	0
Non-Settlement Alternative 1	2001	3,031	0	0
	2004	2,485	0	546
	2017	2,485	0	0
	2030	2,485	0	0
	2043	2,485	0	0
	2051	2,485	0	0
Non-Settlement Alternative 2	2001	3,031	0	0
	2004	2,485	0	546
	2017	2,485	0	0
	2030	2,485	0	0
	2043	2,485	0	0
	2051	2,485	0	0
Non-Settlement Alternative 3A	2001	3,031	0	0
	2004	3,031	0	0
	2017	2,485	0	546
	2030	2,485	0	0
	2043	2,485	0	0
	2051	2,485	0	0
Non-Settlement Alternative 3B	2001	3,031	0	0
	2004	2,485	0	546
	2017	2,485	0	0
	2030	2,485	0	0
	2043	2,485	0	0
	2051	2,485	0	0

IX.D.2. Archaeological Resources

Only one linear survey (O'Brien et al. 1987) has taken place within this entity. The northeastern portion borders an area of moderate cultural resource sensitivity which includes agricultural rock features associated with artifact scatters (e.g., AZ T:5:13 and T:5:13(ASM). Cultural resource sensitivity areas in this entity are shown in Figure L-NIA-19. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is low. Urbanization of farmlands could impact any intact cultural/deposits that might be preserved below the plow zone. Mitigation for these potential impacts would be determined by local jurisdictions. No impacts to cultural resources are expected from land fallowing.

IX.D.3. Biological Resources

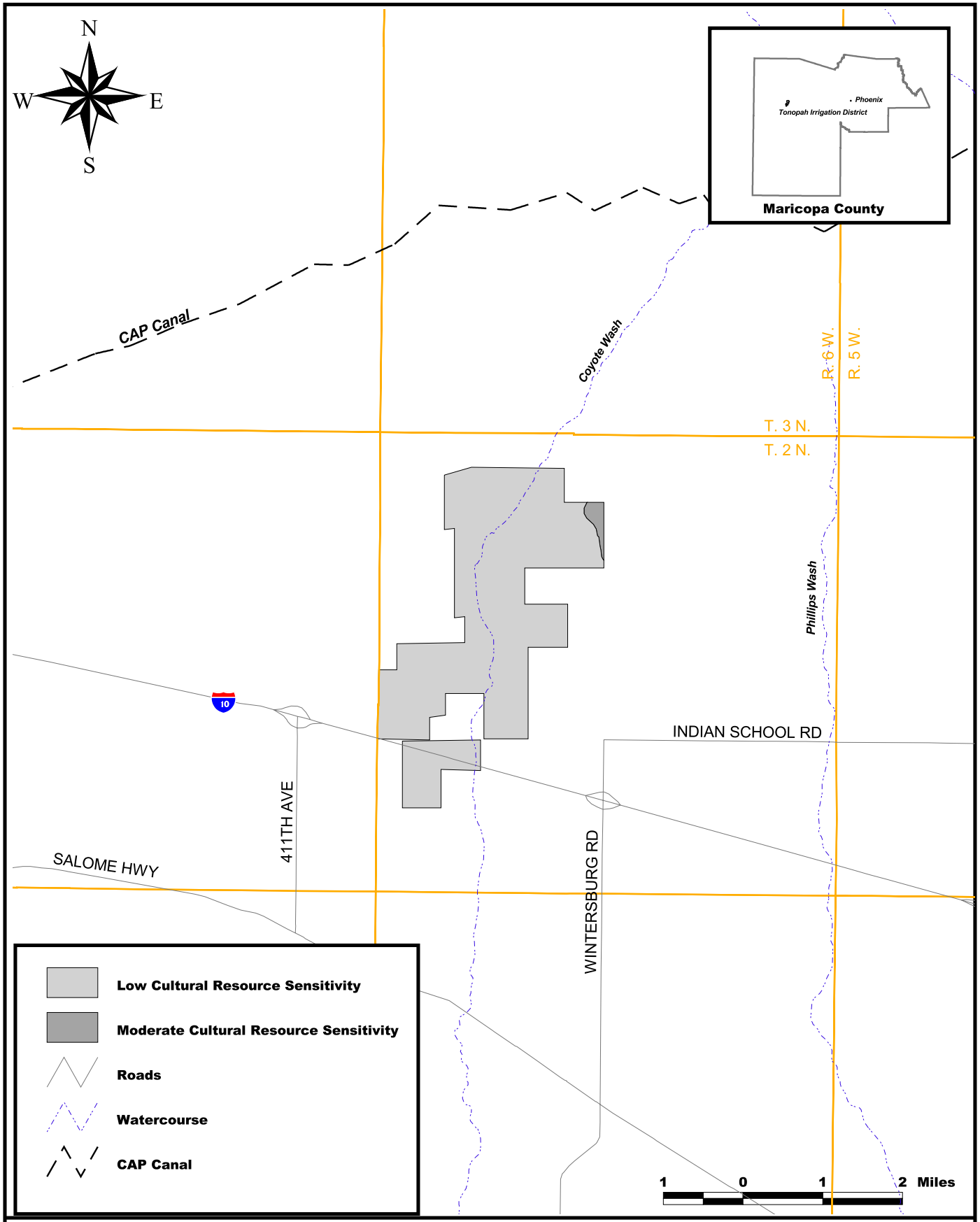
Table L-NIA-32 shows land use over the period of study by alternative. Land stays in agricultural production or is fallowed. When conversion of agricultural lands to fallow fields occurs, these fallow fields can provide fair wildlife habitat in the long term. Reclamation with natural vegetation can enhance the process of natural revegetation if these fields will not be developed in the future. Fallow fields often become areas of potential dispersal of noxious weeds.

IX.D.4. Water Resources

TID has met historical irrigation demands using groundwater, supplemented in later years with CAP water. Groundwater occurs under unconfined conditions, and groundwater levels have declined historically in response to the groundwater pumping. The TDS concentration of groundwater ranges generally from about 500 to 1,000 ppm. Subsidence has not been documented in this area.

Presented in Table L-NIA-33 are estimated changes in groundwater levels from 2001 to 2051 and estimated groundwater level impacts for each alternative. Under the No Action Alternative, groundwater levels rise through about 2017, reflecting the availability of CAP water from the Recharge Pool to TID during those years. The reduction in in-lieu recharge water beginning in 2017 results in increased groundwater pumping and declining groundwater levels. For the 2001 to 2051 period, groundwater levels decline by about 17 feet for the TID area. This magnitude of decline is not likely to substantially change the pumping costs, or cause substantial changes in groundwater quality or subsidence problems.

Groundwater levels under the Settlement Alternative and all Non-Settlement Alternatives would be lower in year 2051 than under the No Action Alternative. These lower groundwater levels reflect reduced availability of CAP water relative to the No Action Alternative. This includes reductions in both the CAP Recharge and Ag Pools. The magnitude of the declines relative to the No Action Alternative would not be likely to substantially change pumping costs or result in substantial changes in groundwater quality. There would be some increase in the potential for subsidence.



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CAP Allocation Draft EIS
Cultural Resources
Tonopah Irrigation District

June 2000

Figure #L-NIA-19

Table L-NIA-33 CAP Allocation Draft EIS TID – Groundwater Data Table		
Alternative		
	Estimated Groundwater Level Change from 2001-2051 (in feet)	**Groundwater Level Impact** (in feet)**
No Action	-17	--
Settlement Alternative	-58	-41
Non-Settlement Alternative 1	-33	-16
Non-Settlement Alternative 2	-40	-23
Non-Settlement Alternative 3A	-43	-26
Non-Settlement Alternative 3B	-44	-27

* Values correspond to the analysis of the TID area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

IX.D.5. Socioeconomic

Table L-NIA-34 shows the estimated lost agricultural gross revenues over the 50-year study period resulting from the fallowing of approximately 550 acres, the timing of which varies by alternative. For more information regarding impacts of CAP water reallocation on NIA districts, refer to Appendix D of this publication.

Table L-NIA-34 CAP Allocation Draft EIS TID Estimated Lost Gross Agricultural Revenues 2001-2051 ($)	
Alternative	**Lost Gross Revenues 2001-2051**
Settlement Alternative	21,119,300
No Action	19,852,142
Non-Settlement Alternative 1	19,852,142
Non-Settlement Alternative 2	19,852,142
Non-Settlement Alternative 3A	19,852,142
Non-Settlement Alternative 3B	19,852,142

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APPENDIX L

INDIVIDUAL ENTITY DESCRIPTIONS

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

Central Arizona Project Allocation
Draft Environmental Impact Statement

Appendix L

Table of Contents

	Page #
INTRODUCTION	L-1
M&I INTRODUCTION	L-1
1. Arizona Water Company-Apache Junction	L-M&I-6
2. Avra Water Cooperative	L-M&I-13
3. Cave Creek Water Company	L-M&I-19
4. City Of Chandler	L-M&I-26
5. Chaparral City Water Company	L-M&I-34
6. Community Water Company Of Green Valley	L-M&I-41
7. City Of El Mirage	L-M&I-49
8. City Of Glendale	L-M&I-55
9. City Of Goodyear	L-M&I-63
10. H2O Water Company	L-M&I-72
11. City Of Mesa	L-M&I-79
12. Metropolitan Domestic Water Improvement District	L-M&I-87
13. Town Of Oro Valley	L-M&I-95
14. City Of Peoria	L-M&I-103
15. City Of Phoenix	L-M&I-111
16. City Of Scottsdale	L-M&I-120
17. Town Of Superior / Arizona Water Company-Superior	L-M&I-127
18. City Of Surprise	L-M&I-134
19. City Of Tucson	L-M&I-143
20. Vail Water Company	L-M&I-152
21. Valley Utilities Water Company	L-M&I-159
NIA INTRODUCTION	L-NIA-1
I. Central Arizona Irrigation and Drainage District	L-NIA-3
II. Chandler Heights Citrus Irrigation District	L-NIA-9
III. Maricopa-Stanfield Irrigation & Drainage District	L-NIA-15
IV. New Magma Irrigation Drainage District	L-NIA-21
V. Queen Creek Irrigation District	L-NIA-27
VI. Roosevelt Irrigation District	L-NIA-34
VII. San Carlos Irrigation and Drainage District	L-NIA-39
VII. San Tan Irrigation District	L-NIA-45

VIII. Tonopah Irrigation District L-NIA-51

INDIAN INTRODUCTION IND-L-1

I. Gila River Indian Community IND-L-3
II. Hopi Tribe and Navajo Nation IND-L-14
III. San Carlos Apache Tribe IND-L-22
IV. Tohono O'odham Nation IND-L-31

REFERENCES

APPENDIX L INTRODUCTION

This appendix provides a description of the affected environment of each entity that could receive CAP water from the proposed allocation. It also describes anticipated environmental impacts associated with each entity's potential plans for taking and using the CAP water.

Background

In 1982, the Bureau of Reclamation (Reclamation) prepared a final Environmental Impact Statement (EIS) to address the potential environmental impacts associated with the Secretary of Interior's (Secretary) proposed allocation of CAP water to municipal and industrial (M&I) entities, non-Indian agricultural (NIA) districts and Indian Tribes and communities (Reclamation 1982). That final EIS Appendix F included a description of each water user's preliminary plans for the delivery and use of CAP water and a general description of the environmental impacts anticipated to occur as a result.

In order to contract for CAP water, each M&I entity and NIA district that was given an allocation in the 1983 Record of Decision (ROD) was required to enter into a three-party water service subcontract with both Reclamation and the Central Arizona Water Conservation District (CAWCD), the operator of the CAP system. Each Indian Tribe or community was required to enter into a two-party contract with the Secretary. Reclamation, as part of its contracting approval process, included a second level of environmental review for each CAP water allottee. This second level review consisted of reviewing specific plans provided by the allottee and comparing the plans and potential impacts against what was described in the 1982 EIS and, specifically, what is shown in Appendix F. Subsequent additional environmental review and documentation have been completed as appropriate, if plans were not consistent with what was originally described in Appendix F to the 1983 EIS.

Current Setting

This appendix is intended to serve a similar purpose for the Secretary's current proposed allocation of CAP water supply and expected long-term contract execution.

This appendix includes a description of plans to take and use CAP water for each individual entity that could receive an allocation under any of the action alternatives. The entities are discussed alphabetically by sector (M&I, NIA, and Indian Tribes). The following information was estimated for each entity: projected population, water supply and projected demand, land use changes, impacts to biological and cultural resources, and impacts to groundwater that would occur under each alternative. The alternatives are described in detail in Chapter 2, and the assumptions used in establishing water supply conditions and demands are explained in further Appendix A of this draft EIS.

A brief description of the existing conditions within each entity's service or municipal planning area (MPA), as well as a discussion of the impacts that could result from the proposed alternative allocations, is provided in this appendix. Population projections for the study period (2001 through 2051) were approximated based upon the Arizona Department of Economic Security's (DES) 1997 population projections for 2000 through 2050 (DES 1997).

Detailed analyses of the various resource impacts addressed in the draft EIS are documented in technical studies that are included as appendices to the document. These technical appendices include Appendix C-M&I Sector Water Uses, Appendix D-Socioeconomic Analysis; Appendix E-Biological Resources; Appendix G-Cultural Resources; and Appendix I-Hydrological Resources.

2. AVRA Water Cooperative

The AVRA Water Cooperative service area is within the general Tucson area and is located north and west of Saguaro National Park (west), east Range 10 east, and south of Magee Road. The AVRA Water Cooperative is a nonprofit water cooperative regulated by the Arizona Corporation Commission. It is located in the Avra Valley sub-basin and encompasses about 12 square miles just northwest of the Saguaro National Monument West. Water use is about 79 percent residential and 14 percent non-residential. In the AVRA Water Cooperative service area in 1998, a total of approximately 935 af of groundwater was pumped and delivered.

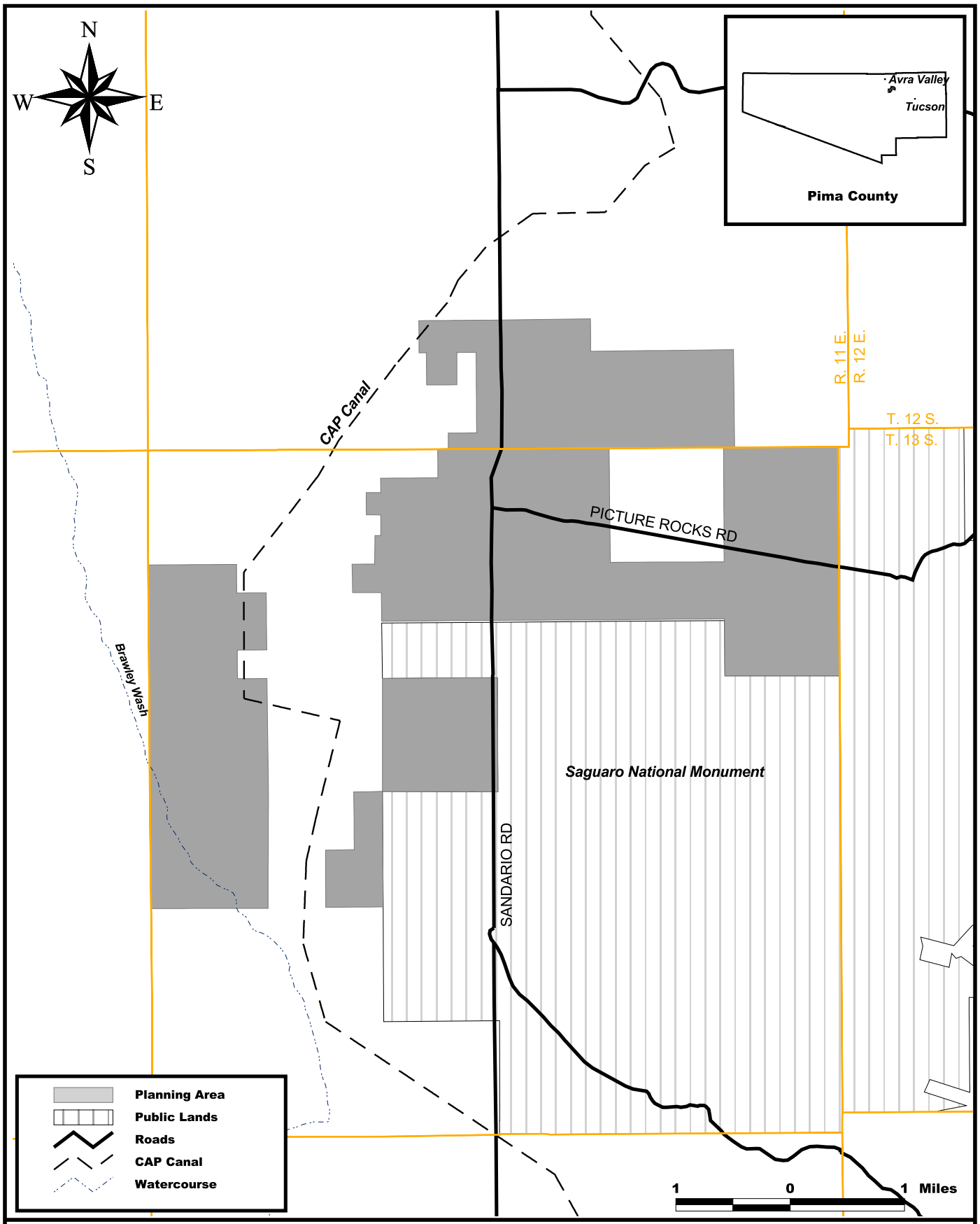
A. Plans to Take and Use CAP Water

AVRA Water Cooperative currently has no contract for CAP water. Under the Settlement Alternative AVRA Water Cooperative would receive 808 af of CAP water. That CAP water would be delivered for a 50-year contract period (i.e., from 2001-2051). The CAP water would be used to supplement both current and projected water supply demands over the next 50 years and would help reduce the continuing dependence on pumping groundwater from an overdrafted groundwater system. Table L-M&I-9 outlines the proposed allocation by alternative.

Table L-M&I-9
CAP Allocation Draft EIS
AVRA Water Cooperative – Proposed CAP Allocation

Alternative	Allocation (in afa)	Priority
Settlement Alternative	808	M&I
No Action	0	-
Non-Settlement Alternative 1	808	M&I
Non-Settlement Alternative 2	0	-
Non-Settlement Alternative 3A	0	-
Non-Settlement Alternative 3B	884	NIA
Existing CAP Allocation	-	-

Figure L-M&I-5 shows the AVRA Water Cooperative service area, which covers approximately 7,864 acres. As they are not currently receiving an allocation, they currently have no facilities in place to take and use CAP water. In order to take and use the allocation, AVRA Water Cooperative would recharge the CAP water and recover it through pumping groundwater. The recharge could be indirect as in-lieu with local farmers. Alternatively, AVRA Water Cooperative would work together with other agencies to use the allocation for direct recharge. The AVRA Water Cooperative would likely work with the AVRA Valley Recharge Facility in this effort. They currently have no plans for constructing any facilities to obtain and deliver CAP water (Lytle 2000).



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CAP Allocation Draft EIS
General Location Map
AVRA Water Cooperative

June 2000

Figure #L-M&I-5

B. Population Projection

The estimated 2001 population level for the AVRA Water Cooperative service area is 5,623 and the estimated 2051 population level is estimated to be 19,621.

C. Water Demand and Supply Quantities

As previously shown in Appendix C–M&I Sector Water Uses, it is estimated that water demand for the AVRA Water Cooperative service area would increase from 755 af in year 2001 to 2,634 af in year 2051. The projected water uses both by water source and alternatives are provided below in Table L-M&I-10. Based on anticipated water demands, the CAP water which would be allocated under the Settlement Alternative would provide 100 percent and 31 percent of the estimated water supply required for the AVRA Water Cooperative service area for the years 2001 and 2051, respectively.

Table L-M&I-10
CAP Allocation Draft EIS
AVRA Water Cooperative – Projected Water Use

Alternative	Annual CAP Deliveries		Groundwater		Effluent		CAGRD (Groundwater)		Total Demand	
	2001	2051	2001	2051	2001	2051	2001	2051	2001	2051
Settlement Alternative	0	808	755	0	0	0	0	1,826	755	2,634
No Action	0	0	0	0	0	0	755	2,634	755	2,634
Non-Settlement Alternative 1	0	808	755	0	0	0	0	1,826	755	2,634
Non-Settlement Alternative 2	0	0	0	0	0	0	755	2,634	755	2,634
Non-Settlement Alternative 3A	0	0	0	0	0	0	755	2,634	755	2,634
Non-Settlement Alternative 3B	0	808	755	0	0	0	0	1,826	755	2,634

Note: A more detailed breakdown of supplies may be found in Appendix C.

It is estimated that the demand for water at the end of the CAP contract period would be approximately 2,634 af. For all alternatives, there is estimated to be no unmet demand. In the Settlement Alternative, Non-Settlement Alternative 1 and 3B, 808 afa of demand are met by the additional CAP allocation. Alternatively, this 808 afa of demand is met by CAGRD membership under the No Action Alternative and Non-Settlement Alternative 2 and 3A.

D. Environmental Effects

The following sections include a general description of existing conditions relating to land use, water resources and socioeconomics for each entity. The following summaries also include a description of the existing conditions and brief description of the impacts to biological and cultural resources that would result from construction of CAP delivery facilities and conversion of desert and agricultural lands to urban uses.

1. Land Use

Land use data for the AVRA Water Cooperative were obtained based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping completed as part of the biological analysis in this EIS. Table L-M&I-11 provides the projected acres of land within the AVRA Water Cooperative service area which are agriculture, desert or urban and the number of acres expected to change from the existing category for the years 2001 and 2051.

TableL-M&I-11
CAP Allocation Draft EIS
AVRA Water Cooperative – Projected Land Use Changes Within the Service Area (in acres)

Alternative	Year	Agriculture	Agriculture Urbanized	Desert	Desert Urbanized	Urban	Changes to Urban Acreage
Settlement Alternative	2001	0	--	3,388	--	4,476	--
	2051	0	0	1,294	2,094	6,570	2,094
No Action	2001	0	--	3,388	--	4,476	--
	2051	0	0	1,294	2,094	6,570	2,094
Non-Settlement Alternative 1	2001	0	--	3,388	--	4,476	--
	2051	0	0	1,294	2,094	6,570	2,094
Non-Settlement Alternative 2	2001	0	--	3,388	--	4,476	--
	2051	0	0	1,294	2,094	6,570	2,094
Non-Settlement Alternative 3A	2001	0	--	3,388	--	4,476	--
	2051	0	0	1.294	2,094	6,570	2,094
Non-Settlement Alternative 3B	2001	0	--	3,388	--	4,476	--
	2051	0	0	1,294	2,094	6,570	2,094

2. Archaeological Resources

Only three surveys are documented for the AVRA Water Cooperative service area, most notably, portions of Reclamation's CAP survey (Teague and Crown 1984). No sites have been recorded within the AVRA Water Cooperative service area; however, some portions of the service areas are of moderate cultural resource density (e.g., Camp Pima, a Civilian Conservation Corps installation) (Allen 1979; Wells 1984). Numerous prehistoric, protohistoric, and historic sites also have been documented to the south (Saguaro National Monument) and northeast (Safford Peak). Prehistoric manifestations consist primarily of lithic scatters and small, special-use sites, although trails, petroglyphs, and multicomponent habitation sites also are present.

Cultural resource sensitivity areas in this entity are shown in Figure L-M&I-6. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in the AVRA Water Cooperative service area is low. Mitigation of cultural resource impacts due to urban expansion would be determined by local jurisdictions and development of applicable permit requirements (such as the CWA Section 404 permit). Impacts on cultural resources due to future land use changes would be identical for each of the five alternatives. Mitigation for such impacts would be dependent on the requirements of the local jurisdiction. If any new direct recharge facility is constructed to take their CAP allocation, there could be direct impacts on cultural resources. Reclamation would review the AVRA Water Cooperative's final plans for taking CAP water prior to water deliveries, and carry out additional cultural resources compliance as appropriate.

3. Biological Resources

Existing Habitats

The AVRA Water Cooperative service area occurs at the northwest base of the Tucson Mountains. Higher, coarser soils support a Bursage/Foothill Paloverde Association dominated mainly by bursage and creosote-bush. Dominant tree species include saguaro, foothill paloverde, desert ironwood and velvet mesquite. Saguaros are densely distributed. Most areas of silty alluvium have been developed for agriculture or housing but some Velvet Mesquite Association remains where saguaro density is low. The habitat zones located in the AVRA Water Cooperative service area are shown on Figure L-M&I-7. Table L-M&I-12 provides the habitat acreages in the AVRA Water Cooperative service area for the habitat zones described above.

TableL-M&I-12
CAP Allocation Draft EIS
AVRA Water Cooperative – Habitat Acreages

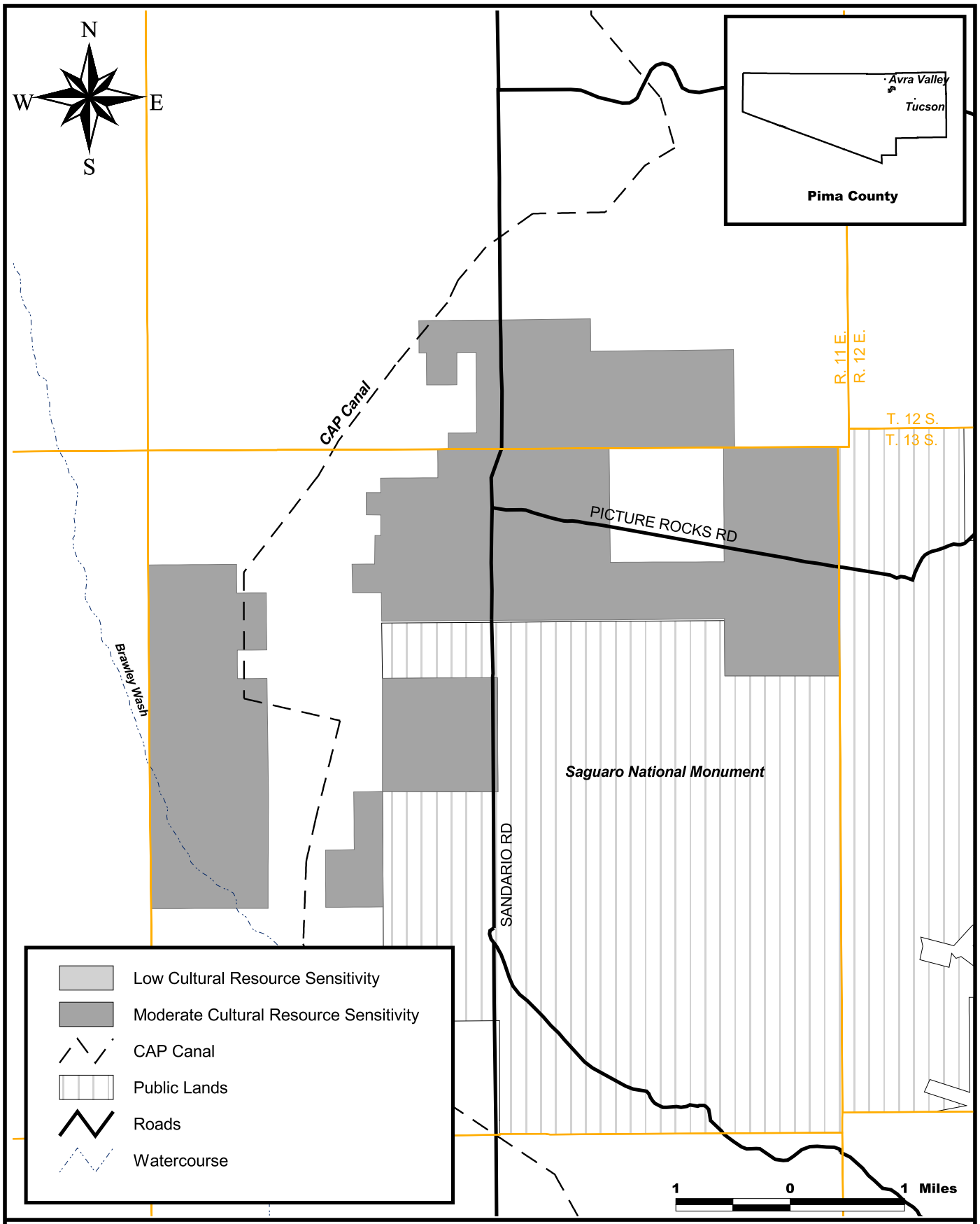
Vegetation Name	Acres
Developed	4,345
Bursage/Foothills Paloverde	1,675
Velvet Mesquite	1,194
Creosote Bush	650
Total	**7,864**

Impacts to Biological Resources

Under the No Action Alternative, urban growth within the AVRA Water Cooperative service area would result in loss of an estimated 4,476 acres of Sonoran Desertscrub and associated wildlife resources. Under the action alternatives, there is no difference in impacts from the No Action baseline. If direct recharge facilities are constructed to take CAP water, there could be impacts to biological resources, depending on the specific locations of the facilities. Once AVRA Water Cooperative's final plans are made, Reclamation would carry out the additional environmental review.

Potential T&E Species and Acres of Potential T&E Species Habitat

Because the allocation of CAP water has no effect on urban growth, there would be no effect on T&E species from the CAP allocation. The appropriate municipal or other local government



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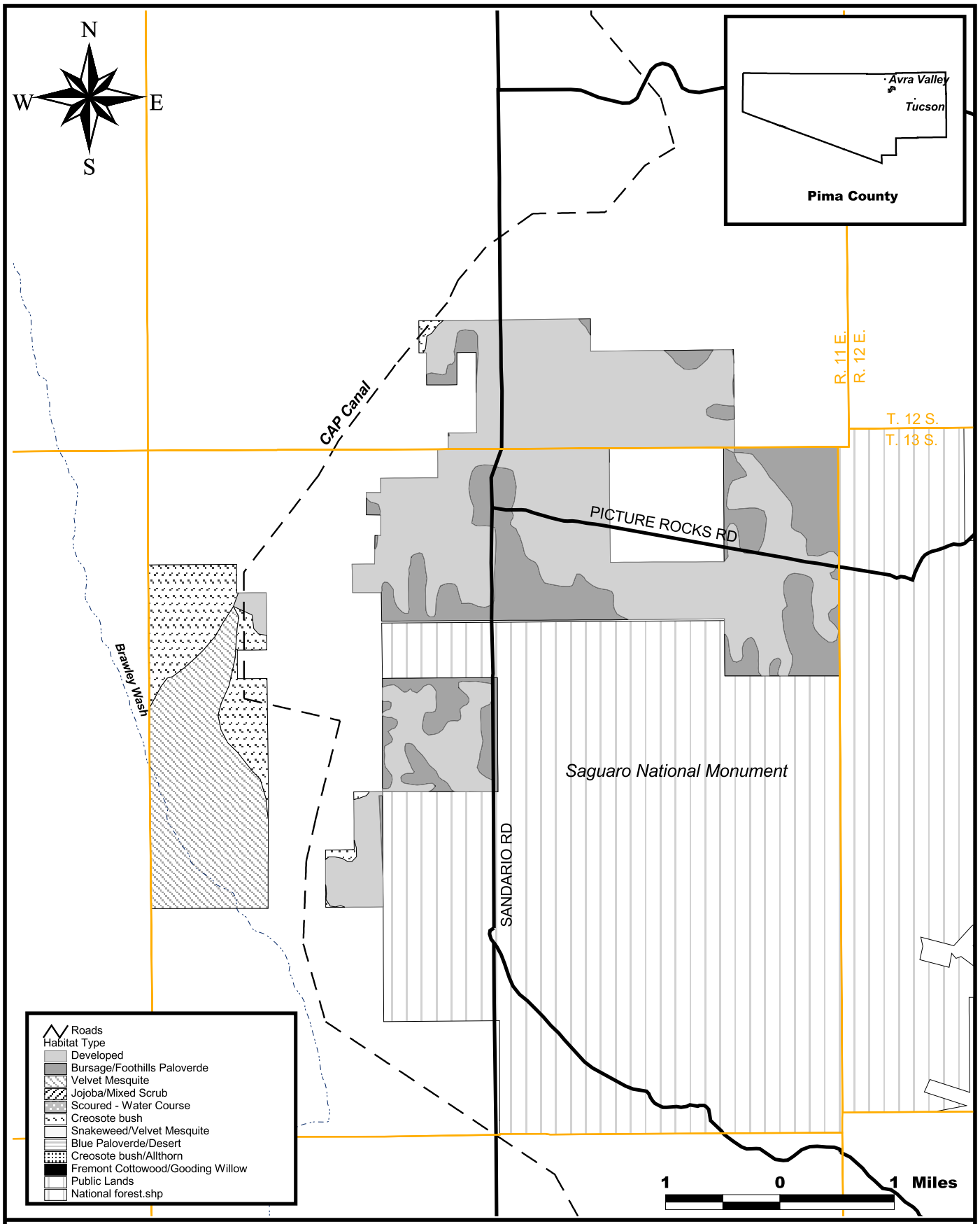
CAP Allocation Draft EIS
Cultural Resources
AVRA Water Cooperative

June 2000

Figure #L-M&I-6



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CAP Allocation Draft EIS
Habitat Zones
AVRA Water Cooperative

June 2000

Figure No. L-M&I-7

jurisdiction would be responsible for complying with the relevant provisions of the ESA as it permits and approves future urban growth.

The AVRA Water Cooperative service area is located within Pima County for which there are 16 T&E species listed by USFWS. However, potential habitat only exists for cactus ferruginous pygmy-owl. Approximately 2,869 acres of potentially suitable habitat for the cactus ferruginous pygmy-owl were also identified within the service area. None of this habitat is within designated critical habitat.

4. Water Resources

Demands in the Avra Water Cooperative have historically been met by pumping groundwater from the underlying basin fill. This reliance on groundwater has resulted in declining groundwater levels over time. The concentration of TDS in the underlying groundwater is generally less than 500 ppm.

Estimated groundwater level impacts are summarized in Table L-M&I-13 which shows the estimated groundwater level change for the period from 2001-2051 as well as the groundwater level impacts or the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative.

All of the alternatives show more than 300 feet of rise in groundwater levels from 2001 to 2051, which largely occurs due to the substantial recharge at the CAVSARP recharge site. The action alternatives result in small declines in groundwater levels relative to the No Action Alternative of three to six feet. Substantial changes in groundwater quality and subsidence would not be anticipated to occur for any of the alternatives.

Table L-M&I-13
CAP Allocation Draft EIS
AVRA Water Cooperative–Groundwater Data Table

Alternative	**AVRA Cooperative***	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	**Groundwater Level Impact** (in Feet)**
No Action	+312	--
Settlement Alternative	+306	-6
Non-Settlement Alternative 1	+308	-3
Non-Settlement Alternative 2	+307	-5
Non-Settlement Alternative 3A	+307	-5
Non-Settlement Alternative 3B	+306	-6

***Values correspond to the AVRA Coop sub-area, as discussed in Appendix I.
** Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

5. Socioeconomic

The same population growth is supported under all alternatives, including the No Action Alternative. However, the cost of providing water may vary by alternative. Costs were estimated, on a per af basis, of providing the proposed allocations and, in their absence, alternative water supplies. The source of the alternative water supplies includes joining the CAGRD and, if needed, treating and reusing effluent. The difference in cost for this small increment of AVRA Water Cooperative's total water supply is considered insignificant. It should be noted that the increment of demand met by the proposed CAP allocation is approximately 30.7 percent of the total year 2051 demand for AVRA Water Cooperative.

Table L-M&I-14
CAP Allocation Draft EIS
AVRA Water Cooperative –Cost of Potable Water for Additional Allocation Increment

Alternative	Cost of Water ($ per af)	Water Source
Settlement Alternative	154[a]	CAP Allocation
No Action	224-225[b]	CAGRD
Non-Settlement Alternative 1	154[a]	CAP Allocation
Non-Settlement Alternative 2	224-225[b]	CAGRD
Non-Settlement Alternative 3A	224-225[b]	CAGRD
Non-Settlement Alternative 3B	154[a]	CAP Allocation

Notes:
a. Estimated average unit cost in year 2000 dollars.
b. Estimated range of unit costs in year 2000 dollars. Range is due to estimated change in groundwater pumping lifts during study period and does not include wellhead treatment costs.

I. GILA RIVER INDIAN COMMUNITY

The Gila River Indian Reservation (GRIC) is located on 372,000 acres in south-central Arizona to the south of Phoenix and on both sides of the Gila River from the Salt River confluence upstream for more than 55 miles. Figure L-IND-2 shows the location of the GRIC.

The GRIC is steadily increasing industrial, retail and recreational development activities. Agriculture also continues to play a dominant role, and the GRIC also owns and operates related agricultural businesses such as chemical fertilizer, cotton gin and grain storage facilities. The Gila River casinos are also owned and managed by the GRIC. All profits from gaming are utilized by the GRIC to expand the Tribe's economic development, to provide additional social services to community members, and for Tribal operations.

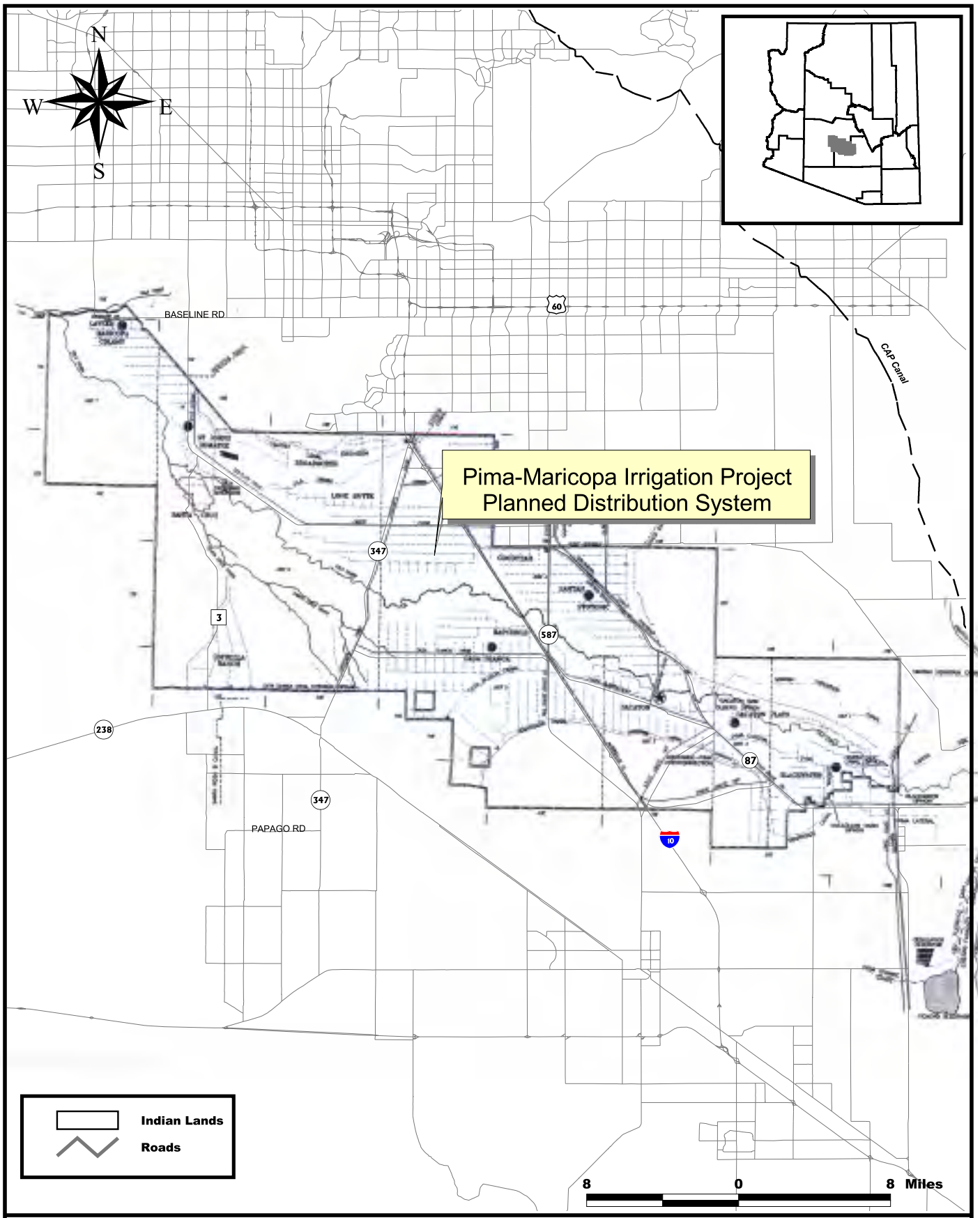
The Pima Indians have farmed this valley since before the arrival of European settlers. Maricopa Indians have been located in the area since the 1700s. At the time of the Treaty of Guadalupe Hidalgo (1848) and the Gadsden Purchase (1853), the Tribe had an economy of abundance due to its farming system out of the Gila River. Upstream development by non-Indian farmers in the mid to late 1800s severely limited the amount of water reaching these lands, thereby causing abandonment of much of the irrigated land. To date, various efforts to restore a water supply to the lands have been only partially successful. Reservation agriculture is dependent upon irrigation water from the Gila River through the San Carlos Indian Irrigation Project (SCIIP), pumped groundwater, the GRIC's existing CAP water allocation, and a small amount of drainage water.

In 1998, GRIC applied a total of 202,453 af of water to 22,211 acres of on-Reservation agricultural lands. Of that total, 174,498 af, or 86 percent, were from Gila River water and 27,955 af, or 14 percent, were from groundwater.

I.A. Proposed Allocations

The GRIC received an original CAP allocation of 173,100 afa. GRIC plans to utilize this CAP water along with other existing and future water supplies to rehabilitate existing agricultural lands and develop new lands for agriculture up to a maximum of 146,330 acres. The lands to be rehabilitated/developed, and associated facilities to be constructed and/or rehabilitated, are identified in the *Final Programmatic Environmental Impact Statement for the Pima-Maricopa Irrigation Project* (U.S. Department of the Interior, 1997) PMIP PEIS. This agricultural development, called the PMIP, represents a component of GRIC's Master Plan for Land and Water Use (Franzoy Corey, 1985). The Master Plan identifies GRIC's major goals and preferences for improving and developing Reservation land and water resources.

Under the proposed alternatives, GRIC would receive additional CAP allocations ranging from 0 afa (under the No Action Alternative) to 170,200 afa (under Non-Settlement Alternative 3). Under the non settlement alternatives, an additional 17,800 af of CAP water would be designated for use in a GRIC water settlement, consistent with requirements of the FMIC Water Rights Settlement Act, which requires that the water be used in the settlement of Indian water rights claims to the Salt and Verde River watershed. Table L-Indian-2 summarizes the



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June 2000

CAP Allocation Draft EIS
General Location Map
Gila River Indian Community

Figure #L-IND-2

proposed allocations by alternative. Table L-Indian-3 provides detail of the allocations' priorities under each alternative.

Table L-Indian-2
CAP Allocation Draft EIS
GRIC
Total CAP Allocations
(in afa)

	Alternative				
CAP Allocation	No Action	Settlement	Non Settlement 1	Non Settlement 2	Non Settlement 3
Existing	173,100	173,100	173,100	173,100	173,100
Proposed-allocated	0	155,400[a,b]	35,600[b]	75,099[b]	170,200[a,b]
Proposed-designated	0	0	17,800[a]	17,800[a]	17,800[a]
Total	173,100	328,500[a,b]	226,500[a,b]	265,999[a,b]	361,100[a,b]

Notes:
(a) Consistent with FMIC Water Rights Settlement Act provisions, 17,800 afa of HVID water would be converted to Indian priority and allocated under Settlement Alternative; under non settlement alternatives, the water is only designated but cannot be allocated without an Indian water rights settlement.
(b) Includes 18,600 afa relinquished by RWCD, NIA priority and 17,000 afa relinquished by ASARCO, M&I priority.

Table L-Indian-3
CAP Allocation Draft EIS
GRIC
Priority of CAP Allocations
(in afa)

	Alternative				
CAP Allocation Priority	**No Action**	**Settlement**	**Non Settlement 1**	**Non Settlement 2**	**Non Settlement 3**
Indian	173,100	190,900	190,900[a]	190,900[a]	190,900[a]
M&I	0	17,000	17,000	37,000	37,000
Non-Indian Ag	0	120,600	18,600	38,099	133,200
Total	173,100	328,500	226,500	265,999	361,100

Notes:
(a) Includes 17,800 afa designated but not allocated to the GRIC, consistent with FMIC Water Rights Settlement Act provisions.

I.B. Non-Binding Plans to Take and Use CAP Water

A letter soliciting information regarding nonbinding plans to take and use CAP water was sent to GRIC. In the absence of a response, the plans presented in this section were developed based upon information provided in the PMIP PEIS and discussions with Reclamation staff. They are

speculative in nature and are presented merely to provide a basis for comparing the potential extent of impacts that could occur across the range of alternatives.

The location of the GRIC Reservation and the PMIP are shown on Figure L-IND-2.

I.B.1. Uses

Potential non-binding uses of CAP water received under each of the action alternatives are summarized in Table L-Indian-4. Because the PMIP PEIS described a PMIP maximum build-out that exceeds existing water supplies, for purposes of the draft EIS it is assumed the primary use of any CAP water received from this project would be for agricultural irrigation, in support of the PMIP. Figure L-IND-2 shows the common-use system and acreage to be farmed as part of the PMIP.

Under the Settlement Alternative, 102,500 afa would be leased or exchanged with seven Salt River Valley area municipalities, ASARCO, and PD, as described in Table L-Indian-5.

Table L-Indian-4
CAP Allocation Draft EIS
GRIC
Additional CAP Allocations
Potential Non-Binding End Uses of Water
(in afa)

Use	Alternative				
	No Action	**Settlement**	**Non Settlement 1**	**Non Settlement 2**	**Non Settlement 3**
Irrigation-PMIP	0	93,500[(a)]	35,600[(d)]	75,099[(e)]	170,200[(f)]
Lease or Exchange Off-Reservation[(b)]	0	102,500	0	0	0
Water Reserved for Future Final Water Rights Settlement (HVID Water)	0	0	17,800	17,800	17,800
Total	0	155,400[c]	53,400	92,899	188,000

Notes:
(a) Detail of 93,500 afa:
102,000 (new CAP allocation)
+18,600 (RWCD CAP water assigned to GRIC)
+17,800 (HVID CAP water assigned to GRIC)
+17,000 (ASARCO CAP water assigned to GRIC)
155,400 afa
-41,000 (lease to seven cities)
-17,000 (CAP water leased to ASARCO)
-12,000 (CAP water leased to PD)
-32,500 (exchange with Mesa and Chandler)
+40,600 (reclaimed water received from Mesa and Chandler)
93,500 (Net water used on-farm by GRIC resulting from the settlement and additional CAP allocation.)
(b) Detail on leases and exchanges provided in Table GRIC-5.
(c) This column does not sum neatly because of the net addition of reclaimed water, see footnote (a).
(d) 35,600 afa = 18,600 (RWCD CAP) + 17,000 (ASARCO CAP).
(e) 75,099 afa = 35,600 + 39,499 (new CAP allocation).
(f) 170,200 afa = 35,600 + 134,600 (new CAP allocation).

Table L-Indian-5
CAP Allocation Draft EIS
GRIC
Leases and Exchanges Under Settlement Alternative
(in afa)

Description	Amount
100-year lease to be divided among Chandler, Glendale, Goodyear, Mesa, Peoria, Phoenix, and Scottsdale	41,000
Lease to ASARCO	17,000
Lease to PD	12,000
Exchange with Mesa[(a)]	23,540
Exchange with Chandler[(b)]	8,960
Total	102,500

Notes:
(a) Mesa will provide GRIC with 29,400 afa of reclaimed water in exchange for 23,540 afa of CAP water for net to GRIC of 5,860 afa.
(b) Chandler will provide GRIC with 11,200 afa of reclaimed water in exchange for 8,960 afa of CAP water for a net to GRIC of 2,240 afa.

I.B.2. Facilities

The facilities required to develop the entire PMIP, and the environmental consequences of constructing and operating them, were described in the PMIP PEIS. Of the total 146,330 acres to be developed through PMIP, each alternative would be able to serve a portion of that acreage, based upon a 4.5 af/acre water duty. It cannot be estimated if these acres would be rehabilitated acres or new acreage. For the purposes of estimating impacts in this draft EIS, it is assumed that it would be all new acreage. Table L-Indian-6 summarizes the agricultural acreage that would be developed, by alternative.

Table L-Indian-6
CAP Allocation Draft EIS
GRIC
New Agricultural Acreage as a Result of Additional CAP Allocation
(in afa)

	Alternative				
	No Action	Settlement	Non Settlement 1	Non Settlement 2	Non Settlement 3
New Agricultural Land Brought into Production	0	20,800	8,000	16,700	38,000

Should on-farm distribution systems need to be constructed to deliver CAP water allotted through this project, there would be some on-the-ground construction; however, these impacts, and impacts from land subjugation itself, were already described in the PMIP PEIS. The PMIP PEIS has an environmental commitment to evaluate and provide environmental clearances for

all subsequent construction related to the implementation of the PMIP. Environmental assessments are being prepared for all major features of the PMIP prior to construction, tiered from the PMIP PEIS.

I.C. Population Projection

The population in 1985 for the GRIC was 10,538. The estimated 2001 population level for the GRIC is 11,057, and the 2051 population level is estimated to be 15,203. The population is expected to grow by approximately 38 percent over the 50-year CAP contract period (i.e., 2001-2051).

I.D. Environmental Effects

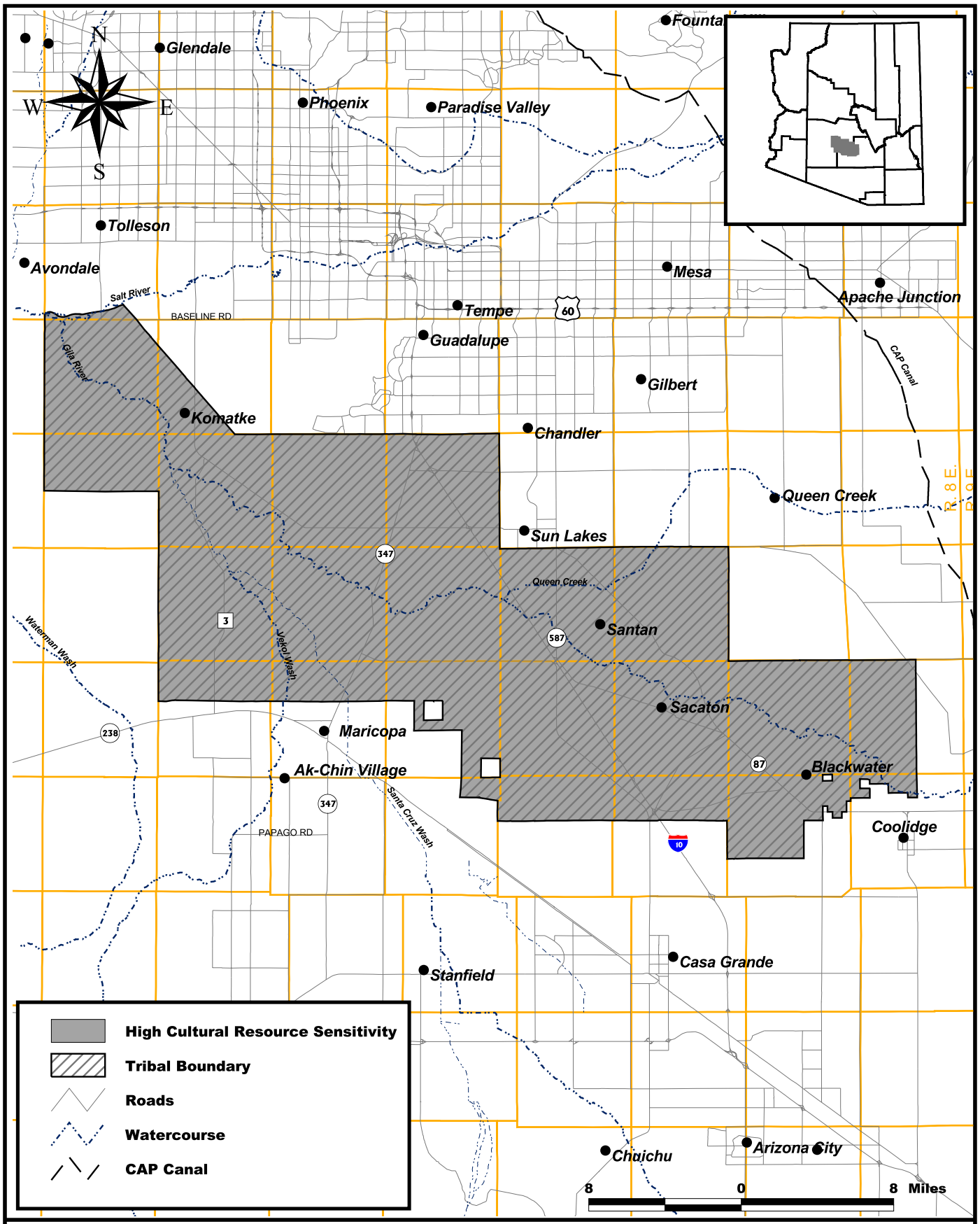
This analysis considers only those effects anticipated to occur due to developing and farming additional acreage, as a result of receiving additional CAP water under each of the action alternatives considered in the draft EIS.

I.D.1. Land Use

The PMIP PEIS identified a total of 146,330 acres that would be developed and farmed under the PMIP. Of that total, about 69,321 acres are under agricultural development or are retired agricultural land (U.S. Department of the Interior 1997). Therefore, up to about 77,000 acres of native desert would be converted to agricultural land when all 146,330 acres are developed. As mentioned above, for purposes of this analysis, it is assumed that any development, resulting from receipt of additional CAP water under any of the action alternatives, would occur on areas that are currently native vegetation. This assumption is reflected in the following discussions, which describe the possible impacts resulting from each action alternative, as well as the No Action Alternative. Potential mitigation measures identified in the PMIP PEIS that are applicable are also noted.

I.D.2. Archaeological Resources

The GRIC is located in the Middle Gila River Valley, within the heart of the Hohokam “core” area. It has long been the home of the Akimel O’odham (also known as the River Pima) and the Pi-Posh (Maricopa) Tribes. Many prehistoric sites—including Snaketown—as well as protohistoric and historic Pima and Maricopa sites, are known to be present within GRIC boundaries. Recent surveys (e.g., Gregory and Huckleberry 1995) suggest a site density of four to five prehistoric and historic sites per square mile (m^2). Of particular importance are sites dating from the earliest phases of the Pima and Pi-Posh occupation, much of which remains undocumented archaeologically. Other prehistoric cultural resources that might be expected in this entity include trails, petroglyphs, artifact scatters, special-use sites, isolated features, and agricultural fields. Historic properties might include individual households, farmsteads, water-control features (e.g., the Hoover irrigation ditch in St. Johns), telegraph lines, and transportation-related sites such as stage stations, railroad features, and roads. The GRIC has a Cultural Resources Division. Cultural resource sensitivity areas in this entity are shown in Figure L-IND-3. Based on the limited data used to generate the cultural sensitivity designations,



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2000

CAP Allocation Draft EIS
Cultural Resources
Gila River Indian Community

Figure #L-IND-3

the potential for cultural resource impacts in this entity is high. Section 106 consultations, pursuant to the NHPA, will be carried out for all features of PMIP prior to construction.

I.D.3. Biological Resources

I.D.3.a. Existing Habitats

The Reservation is traversed by ephemeral reaches of the Gila River (1,100-1,500 feet elevation (E)). Riparian vegetation along the Gila River consists of sparse stands or individual salt cedar. Outside the flood plain, Creosote-bush Association occurs with a few mesquite. Mesquite, seep willow, salt cedar, and desert broom were found along part of Santa Cruz Wash. Most of the adjoining area is agricultural or urban. At higher E's (2,000-2,700 feet), Bursage-Foothill Paloverde Association occurs on the alluvial fans and higher plains where co-dominants include buckhorn cholla, Engelmann hedgehog, chain-fruit cholla, and creosote-bush. Other common trees include velvet mesquite, desert ironwood, and saguaro. Creosote-bush Association occurs in the deeper soils

I.D.3.b. Impacts to Biological Resources

Estimates of farmland that will be created are 20,800 acres for Settlement Alternative, 8,000 acres for the Non-Settlement Alternative 1, 16,700 acres for the Non-Settlement Alternative 2, and 38,000 acres for Non-Settlement Alternative 3. This farmland will result in loss of natural habitat in the lower E of the Reservation.

I.D.3.c. Summary of Possible Impact to T&E Species

Impacts to federally listed species are possible on the GRIC. However, the extent of the possible impacts can only be fully assessed when site-specific development plans are available. Reclamation and the GRIC have an established process for site specific ESA compliance for each feature of the PMIP, as detailed planning is completed. Potentially suitable habitat will be surveyed for T&E species as appropriate and the results will be used in Section 7 consultations with USFWS.

I.D.4. Water Resources

Under present conditions, GRIC meets municipal, industrial, and irrigation demands by delivery of both surface water and groundwater. The primary source of surface water to GRIC is Gila River water, which is delivered by the SCIIP. That water is currently conveyed in a system of unlined canals, which have significant seepage losses.

Groundwater is obtained from the alluvium beneath GRIC lands. Groundwater is also pumped by SCIIP off the Reservation and is delivered to GRIC via the SCIIP conveyance facilities. Groundwater levels have historically declined on much of the Reservation. The TDS concentration of groundwater beneath GRIC ranges from less than 1,000 to over 3,000 ppm, with TDS generally increasing from the southeast to the northwest.

Estimated groundwater level impacts are summarized in Table L-Indian-7, which shows the estimated change in groundwater levels from 2001 to 2051 for each alternative, and the groundwater level impact (i.e., the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative). The impacts for GRIC are shown for six sub-areas. These impacts reflect that, under all alternatives, it was assumed that the GRIC would line their canals prior to receiving CAP water. Impacts to groundwater quality on GRIC are not anticipated.

Under the No Action Alternative, changes in estimated groundwater levels are very small in the western portion of GRIC, with a decline in groundwater levels of one foot in the Maricopa Village sub-area and a rise in groundwater levels of one foot in the Komatke sub-area. Larger declines occur to the east, ranging from 12 feet in the GRIC South sub-area to 47 feet in the GRIC North sub-area. Under the No Action Alternative, additional lands would be developed for irrigated agriculture, and additional supplies would be provided to meet those demands. Based on the assumptions for this analysis, there would be a net recharge for GRIC absent consideration of groundwater underflows to adjacent areas. The declines in groundwater levels for GRIC appear to be a reflection of the groundwater level declines in the adjacent sub-areas and the resulting changes in groundwater underflows.

Groundwater level impacts of the Settlement and Non-Settlement Alternatives in GRIC reflect a number of factors that vary for each alternative. These factors include the amount of CAP water allocated to GRIC, the total acres developed for irrigation and the buildout schedule for those acres, the assumed proportion of the demands which are met with groundwater, and changes in underflow between sub-areas.

The net groundwater pumping (groundwater pumping less incidental recharge) integrates each of these factors except changes in groundwater underflow between GRIC and adjacent areas. The relative impacts of these alternatives reflect the differences in net pumping, with greater net pumping resulting in lower groundwater levels. Groundwater levels also reflect that there is a net groundwater outflow from GRIC under all alternatives.

Changes in groundwater quality would not be anticipated on GRIC. However, there would be the potential for subsidence due to the lower groundwater levels, particularly in the eastern portions of GRIC.

Table L-Indian-7
CAP Allocation Draft EIS
GRIC – Groundwater Data Table

Alternative	Sacaton Sub-area		East Sub-area		North Sub-area		South-Sub-area		Komatke Sub-area		Maricopa Village Sub-area	
	Estimated Ground-water Decline From 2001 to 2051 (in Feet)	Ground-water Level Impact[a] (in Feet)	Estimated Ground-water Decline From 2001 to 2051 (in Feet)	Ground-water Level Impact[a] (in Feet)	Estimated Ground-water Decline From 2001 to 2051 (in Feet)	Ground-water Level Impact[a] (in Feet)	Estimated Ground-water Decline From 2001 to 2051 (in Feet)	Ground-water Level Impact[a] (in Feet)	Estimated Ground-water Decline From 2001 to 2051 (in Feet)	Ground-water Level Impact[a] (in Feet)	Estimated Ground-water Decline From 2001 to 2051 (in Feet)	Ground -water Level Impact[a] (in Feet)
No Action	-44	--	-26	--	-48	--	-12	--	1	--	0	--
Settlement Alternative	-56	-12	-42	-16	-73	-26	-38	-26	-8	-15	-8	-8
Non Settlement Alternative 1	-43	1	-25	2	-43	4	-10	2	2	-2	2	2
Non Settlement Alternative 2	-46	-2	-29	-2	-56	-8	-15	-3	-5	-4	-5	-5
Non Settlement Alternative 3A	-61	-17	-35	-9	-73	-25	-22	-11	-3	-6	-3	-3
Non Settlement Alternative 3B	-63	-19	-35	-9	-70	-22	-33	-21	-4	-7	-4	-4

Notes:
a) Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration.
b) The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

I.D.5. Socioeconomic

The reallocation of non-Indian agricultural water to Indian agriculture will have significant socioeconomic impacts on the Gila River Indians. The Pima and Maricopa Tribes who now comprise GRIC were historically agrarian peoples. Archaeologists believe the Pima and Maricopa Tribes farmed the Gila-Salt Valley since about 300 B.C. Between 700 and 1300 A.D. the Pima and Maricopa Tribes built an extensive system of irrigation canals for farming. Agriculture is central to their culture.[1] The GRIC 1998 Gaming Report cited agriculture and gaming, "… as the main lifeline of economic support for GRIC."

Presently the primary components of the GRIC economy are agriculture, commerce and industry, recreation, and services. However, poverty levels in GRIC are high. In 1989, 63 percent of persons lived below the poverty line. Unemployment in 1990 for GRIC was 30 percent. Below are comparative Arizona data.

Table L-Indian-8
CAP Allocation Draft EIS
Income Statistics for GRIC

Type of Income	GRIC	Pinal County	Maricopa County	Arizona
Median household income	$10,069	$21,301	$30,797	$27,540
Per capita income (Poverty Status)	$3,354	$9,228	$14,970	$13,461
Persons below poverty	63%	23.6%	12.3%	15.7%
Families below poverty	60.4%	18.7%	8.8%	11.4%
Female households, families below poverty	74.9%	52%	25.8%	31.6%
Households with public assistance income	33%	9.6%	4.9%	6.1%

Source: Bureau of the Census, 1990 Population and Housing Statistics

Although economic conditions have improved, the GRIC still face major challenges compounded by generations of economic depression, poverty and subsistence living. Increased agricultural production may provide additional job opportunities and increase overall GRIC income.

Under the No Action Alternative, the agricultural output of the GRIC is estimated to be $78.361 million in the year 2051. Under the Settlement Alternative the GRIC increase their agricultural output by an estimated $29.650 million above the No Action Alternative level in 2051. Similarly, the increases in agricultural output in year 2051 above that in the No Action

[1] Final Programmatic Environmental Impact Statement – Pima-Maricopa Irrigation Project, U. S. Bureau of Reclamation, date.

Alternative are $7.612 million for Non-Settlement Alternative 1, $15.531 million for Non-Settlement Alternative 2, and $47,299 million for Non-Settlement Alternative 3.

II. HOPI TRIBE AND NAVAJO NATION

Hopi Tribe

The Hopi Reservation is located in northeastern Arizona within Navajo and Coconino Counties. Reservation lands are primarily high desert dominated by three mesas ranging in E from 5,000 to 6,500 feet. Relatively dense population and a cultural center are located on these three natural features, with most of the 34 clans living in 12 villages on or near these mesas. The Reservation covers 1,560,993 acres. The land is suitable for grazing with the potential for expanded agricultural development. The Hopi people have practiced agriculture for hundreds of years despite an arid landscape and only 12 inches of annual rainfall.

Significant issues on the Reservations include high unemployment rates and lack of adequate supplies of safe drinking water. The main source of water is from groundwater and is principally used for domestic purposes. At the present time, the water levels of the aquifer are declining which is a cause of concern.

Navajo Nation

The Navajo Reservation was established in 1868, and it expanded through a series of executive orders to become the largest Indian Reservation in the United States. The Navajo Nation covers an area of approximately 27,000 square miles including portions of Arizona, New Mexico and Utah. The Navajo Nation is divided into 110 chapters, which are areas of local government.

Significant issues on the Reservation include high unemployment rates and lack of adequate supplies of safe drinking water. Approximately 40 percent of the population on the western portion of Navajo Reservation haul water a distance of seven to ten miles. The main source of water on the western portion of the Navajo Reservation is the “N” aquifer. Presently, water is withdrawn for domestic use and for use in a coal slurry pipeline for the Peabody Coal Mine. At the present time, the water levels of the aquifer are declining which is a cause of concern.

Federally funded programs (including the Bureau of Indian Affairs, Indian Health Services, Tribal Government and the public schools) represent almost half of the employment on the Navajo Nation and Hopi Tribe Reservations combined. Other economic activities include cattle production, tourism, royalties from coal mining and construction.

II.A. Proposed Allocations

Neither the Hopi Tribe nor the Navajo Nation currently have an existing CAP allocation. Under Non-Settlement Alternative 2 and Non-Settlement Alternative 3, the Hopi Tribe and Navajo Nation would receive a combined allocation of CAP water that would total 13,500 afa of M&I priority water. Pursuant to the Boulder Canyon Project Act of 1928 (PL 70-642), CAP water received as a result of this project would have to be used within the Lower Colorado River Basin. The following table summarizes the proposed allocations under each alternative.

Table L-Indian-9 CAP Allocation Draft EIS Navajo Nation and Hopi Tribe Combined CAP Allocations (in afa)					
	Alternative				
Combined CAP Allocation	**No Action**	**Settlement Alternative**	**Non Settlement Alternative 1**	**Non Settlement Alternative 2**	**Non Settlement Alternative 3**
Existing	0	0	0	0	0
Proposed	0	0	0	13,500	13,500
Total	0	0	0	13,500	13,500
Note: All of the 13,500 afa CAP allocation considered is M&I priority.					

II.B. Non-Binding Plans to Take and Use CAP

In response to a letter from Reclamation soliciting information regarding non-binding plans to take and use CAP water, letters were received from the Navajo Nation (December 29, 1999) and Hopi Tribe (December 30, 1999). Each letter described the Tribes' potential uses for CAP water that could be allocated under the draft EIS alternatives. Plans presented in this section were developed based upon information provided in those letters, as well as discussions with Reclamation staff. They are speculative in nature and are presented merely to provide a basis for comparing the potential extent of impacts that could occur across the range of alternatives.

The division of water between the Navajo Nation and Hopi Tribe is under negotiation as part of the on-going settlement agreement for the resolution of Indian water rights claims in the Little Colorado River watershed, pursuant to the Little Colorado General Stream Adjudication. Nothing has been finalized; therefore, no attempt is made in this document to speculate as to what the division might be, and the allocations are treated as one combined allocation for purposes of this evaluation.

II.B.1. Uses

Uses for purposes of this analysis, it is assumed all of the 13,500 afa allocation would be used for M&I purposes, most likely in conjunction with or complementary to water uses that are being considered as part of other ongoing settlement negotiations. These include providing a renewable surface water source for use by Peabody Western Coal Company's Black Mesa Mine coal slurryline operation[2], providing a reliable potable water supply for residents who currently are without one, supporting future population growth, and stimulating economic development.

[2]Currently, the mine and slurry operations are served by groundwater pumping under an agreement with the Hopi Tribe. If Peabody Western Coal Company elects to participate in the proposed Lake Powell Pipeline Project, it is currently envisioned approximately 4,000 afa would be used by the slurryline operation for the life of the Black Mesa Mine, estimated to close sometime from 2027 to 2032. After the mine closes, the water would shift to M&I use by Navajo and Hopi Communities.

For purposes of this analysis, it is anticipated the total estimated population from both entities that could be served by CAP water obtained through this project would be about 75,000 members by the year 2040. Currently, the populations in these areas are served mainly by groundwater.

Potential areas where the CAP water could be used, which would need to be located in the Lower Colorado River Basin, are shown in Figure L-IND-4.

Table L-Indian-10 summarizes the non-binding CAP allocation uses of the Navajo Nation and Hopi Tribe.

Table L-Indian-10
CAP Allocation Draft EIS
Navajo Nation and Hopi Tribe
Combined Total CAP Allocations
Potential Non-Binding End Uses of Water
(in afa)

	Alternative				
Use	**No Action**	**Settlement Alternative**	**Non Settlement Alternative 1**	**Non Settlement Alternative 2**	**Non Settlement Alternative 3**
Municipal and Industrial [(a)]	0	0	0	13,500	13,500
Total	0	0	0	13,500	13,500

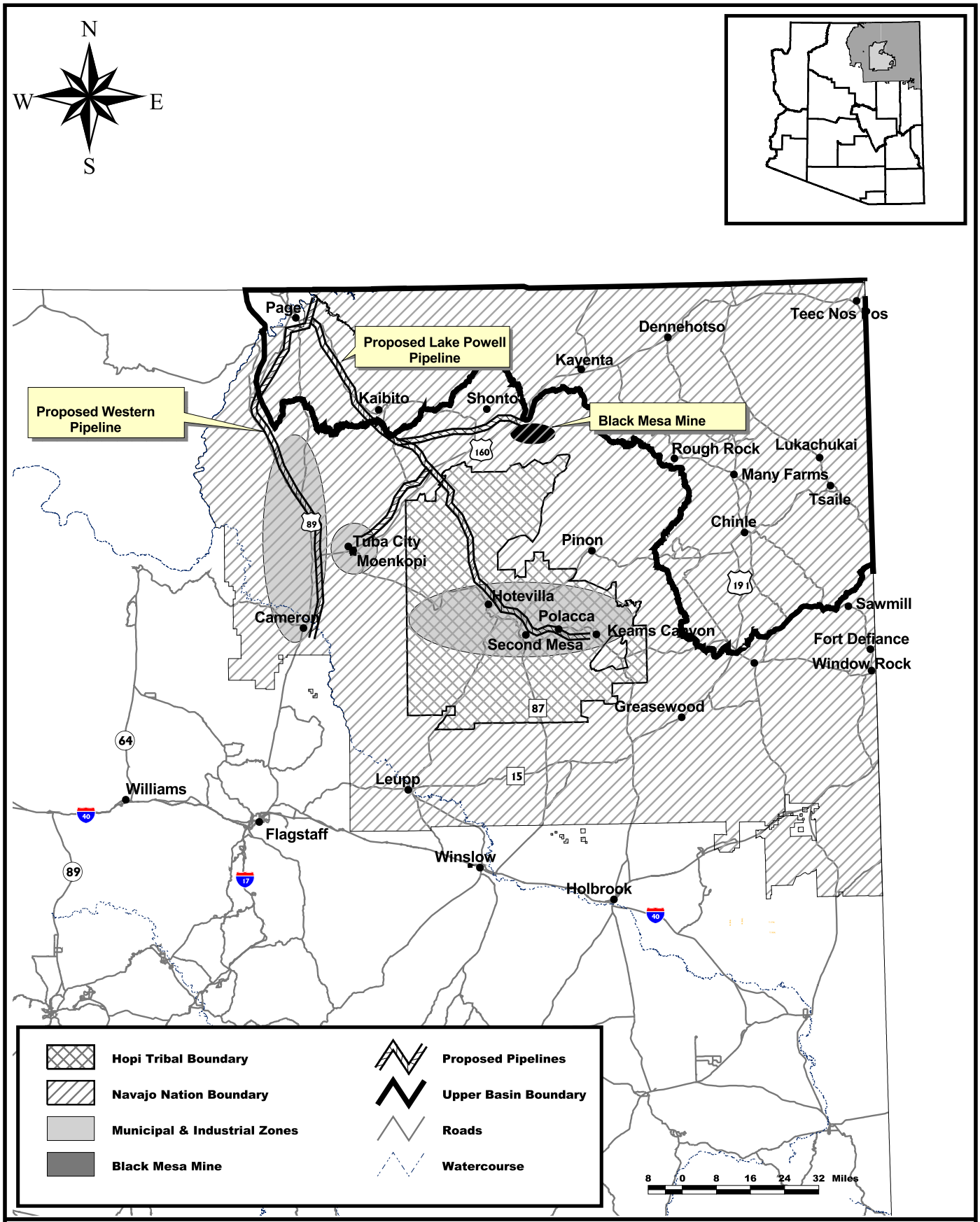
Note:
(a) Municipal and industrial uses could include approximately 4,000 afa of CAP water for use in the slurryline operation originating at the Black Mesa Coal Mine on the Navajo Reservation.

L.II.b.2. Facilities

For purposes of this analysis, it is assumed the CAP allocations would most likely be diverted out of Lake Powell and delivered to end users through one or more proposed pipelines. Two currently under consideration are the Western Pipeline and the Lake Powell Pipeline, whose alignments are shown in Figure L-IND-4. Certain institutional arrangements would be required to divert CAP water out of Lake Powell.

The proposed Western Pipeline could provide water to Communities located in the general vicinity of Highway 89 from Bitter Springs to Cameron, including the Communities of Coppermine, Cedar Ridge, Bodaway, and Gap. Assuming a 100-foot construction right-of-way, approximately 1,100 acres would be impacted by the construction of the Western pipeline.

The Lake Powell Pipeline would supply water for the slurryline operation which transports coal from the Black Mesa Coal Mine to the Mojave Generating Station in Laughlin, Nevada. It could also provide water to Communities located in the general vicinity of Tuba City and throughout the Hopi Reservation. Assuming a 100-foot construction right-of-way, approximately 2,000 acres would be impacted by the construction of the main trunkline of the Lake Powell Pipeline.



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CAP Allocation Draft EIS
General Location Map
Hopi Tribe and Navajo Nation

June 2000

Figure #L-IND-4

Additional land would be disturbed from any distribution lines that would be constructed off the main pipelines, and for other construction-related activities.

Water diversions from Lake Powell, which is located within the Upper Basin, would require additional approvals for water from this diversion to be used for Lower Basin uses.

II.C. Population Projection

II.C.1. Hopi Tribe

The estimated 2001 population level for the Hopi Tribe is 8,237[3] and the estimated 2051 population level 13,427. The population is expected to grow by approximately 63 percent over the 50-year study contract period (i.e., 2001-2051).

II.C.2. Navajo Nation

The estimated 2001 population level for the Navajo Nation within Arizona is 62,077[4] and the 2051 population level is estimated to be 100,893. The population is expected to grow by approximately 63 percent over the 50-year CAP contract period (i.e., 2001-2051). The estimated 2001 population level for the lower basin portion of the Navajo Nation is 22,544 and the estimated 2051 population level is 36,788. The CAP allocation would be used in the lower basin portion of the Navajo Nation.

II.D. Environmental Effects

The following discussion provides some general information regarding these probable construction projects and provides a general identification of potential environmental impacts and potential mitigation measures.

II.D.1. Land Use

II.D.1.a. Hopi Tribe

There are twelve Hopi villages and several small residential areas along the Arizona Highway 264 corridor. The villages range in size from 180 people to 1,418. Gift shops, trading posts, and service stations are located in the villages and at other points along the highway.

The land surrounding the Hopi villages is used for farming, grazing, subsistence gathering, and religious purposes. Lands further from the villages are used primarily for grazing, but also support uses such as seasonal homes, limited farming, gathering, and recreation. Gathering is an important land use. Hopis gather pinyon nuts and firewood; yucca for baskets; building

[3] The population figures cited here are from ADES. They do not agree with United States estimates for current or projected population.

[4] As noted in the introduction to the Appendix, the population figures used for all entities in the Drat EIS are from ADES; however, according to the Navajo Division of Community Development, in 1997 the Navajo population of the Reservation was 172,399. The ADES figures are also significantly below U.S. population estimates.

stone; sand and rock for mixing concrete, and clay, sheep manure, and mineral colors for making pottery.

II.D.1.b. Navajo Tribe

The major population centers on the Navajo Reservation include Kayenta, Chinle, Many Farms, Shiprock, Tuba City, Leupp, Cameron, Ganado, and Window Rock. A large percentage of the population lives in traditional hogans in widely scattered settlements. The land uses include agriculture, grazing, forestry, and mining. The major mineral resources include coal, uranium, and petroleum.

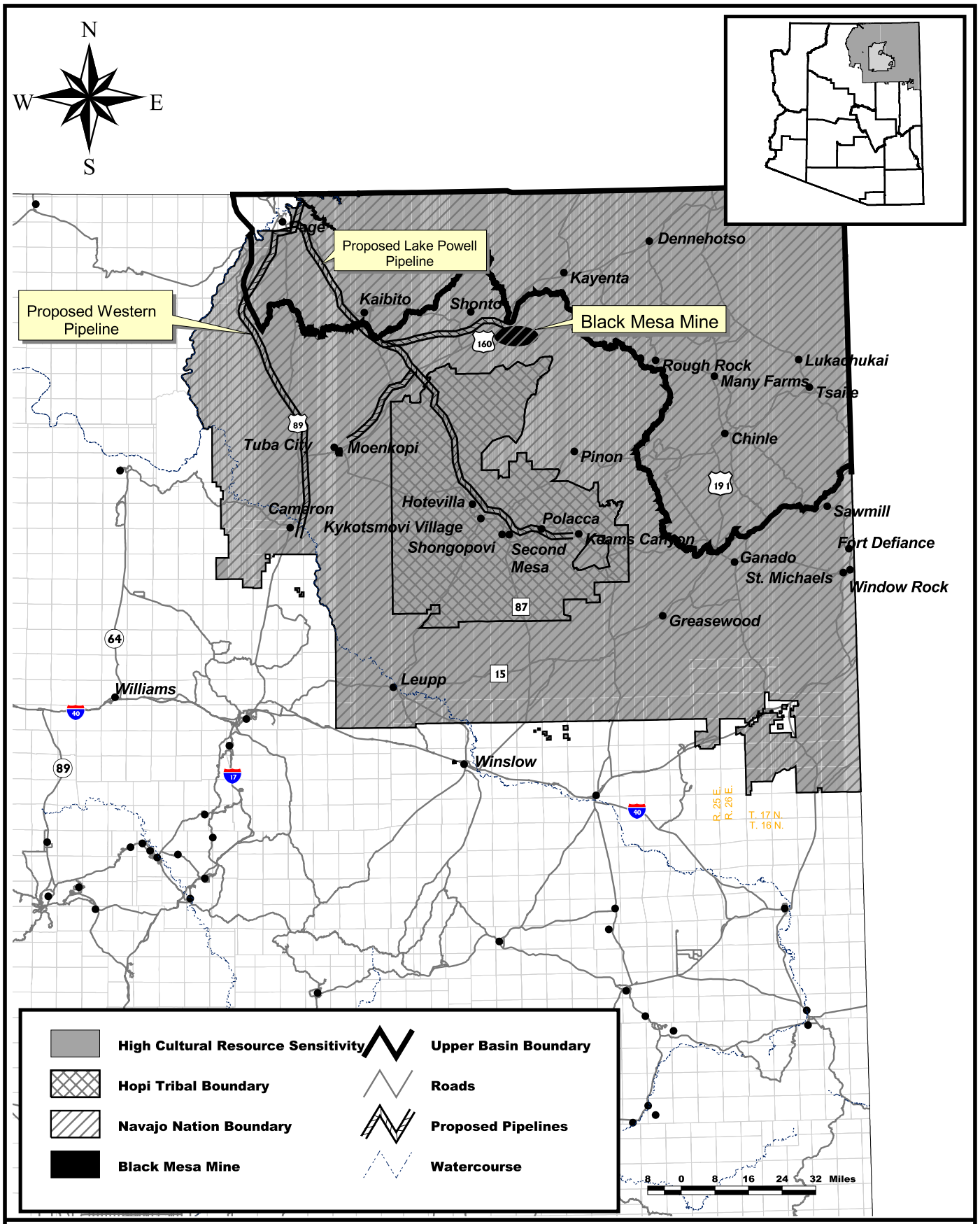
II.D.2. Archaeological Resources

II.D.2.a. Hopi Tribe

Cultural deposits dating to the Paleoindian and Archaic periods have been documented in the vicinity of the Hopi Reservation (Gumerman 1966). Basketmaker and Puebloan occupations also are known; during the later Puebloan periods, Western Anasazi groups aggregated in a few locations—including Hopi—and large villages were established on the Hopi Mesas (e.g., Walpi, Awatovi, Kawaika'a, Kisakovi, Sikiatki, Old Mishongnovi, Old Shongopovi, Oraibi, Chacpahu, Chuckovi, Kuchaptuvela) (Cordell 1997; Upham 1982). Although some of these sites had been abandoned by the mid-1500s, some are still in use. Other site types that might occur throughout the area's occupational sequence include artifact scatters, farms, trails, rockshelters, isolated features, petroglyphs, cairns, shrines, coal and salt mines, and agricultural fields (Adams 1981; Ahlstrom and Hays 1991). The Hopi Tribe has a Cultural Resource Division. Cultural resource sensitivity areas in this entity are shown in Figure L-IND-5. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high.

II.D.2.b. Navajo Nation

The human occupation of northeastern Arizona dates to the Paleoindian period; Paleoindian and Archaic components and isolated finds have been documented throughout the Navajo territory (e.g., Ayres 1966; Nichols and Smiley 1985; Peckham and Wilson 1967; Vogler et al. 1993). Ceramic period sites are primarily affiliated with the Anasazi cultural tradition; resource types include Basketmaker cave and rockshelter sites, early pit house villages, and aggregated Puebloan Communities characterized by great kivas, specialized activity areas, and associated agricultural features (e.g., Black Mesa). Important early Protohistoric site types include defensive pueblitos, dating to the Pueblo Revolt of 1680, which document Navajo-Puebloan interaction; dwellings; trails; resource procurement and processing loci; and other limited activity sites. Historic resources include mining and herding camps, roads, and shrines. The Navajo Nation has an independently acting Tribal Historic Preservation Officer (THPO) who should be consulted regarding any proposed undertaking that could potentially affect cultural resources within Navajo lands. Cultural resource sensitivity areas in this entity are shown in Figure L-IND-5. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high.



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June 2000

CAP Allocation Draft EIS
Cultural Resources
Hopi Tribe and Navajo Nation

Figure #L-IND-5

II.D.2.c. Impacts

Pipeline construction as well as associated activities such as borrow sites, spoil areas, construction yards, equipment storage, and field offices have the potential to impact historic and archaeological sites. Section 106 compliance, including consultation with the affected Tribes would be carried out to identify significant sites and develop a plan to mitigate or avoid them.

II.D.3. Biological Resources

II.D.3.a. Existing Habitat

This large area is composed of mainly sedimentary soils that support many vegetation associations. In terms of broad biotic Communities, these include Great Basin Conifer Woodland (122.4), Plains and Great Basin Grassland (142.1), and Great Basin Desertscrub (152.1). At higher elevations within the Chuska Mountains (Navajo Nation), there is Petrane Montane Conifer Forest (122.3), Petrane Subalpine Conifer Forest (121.3), and Subalpine Grassland (141.4). Specialized niches and soil types, such as riparian corridors, springs, saline seeps, rock faces, sand dunes, and gypsiferous substrates, support numerous rare species.

II.D.3.b. Impacts to Biological Resources

Additional acreage to accommodate the M&I growth within this planning area over the 50-year study period has not been estimated, but the pipelines associated with this allocation will result in loss of an estimated 3,100 acres of natural habitat. Lake Powell pipeline will be an estimated 165 miles long and disturbance of 100 feet wide creating an impact of approximately 2,000 acres, and the west pipeline will be an estimated 90 miles long and disturbance of 100 feet wide creating an impact of approximately 1,100 acres. With regard to biological resources, only Non-Settlement Alternatives 2 and 3 have impacts.

II.D.3.c. Summary of Possible Impact to T&E Species

These Tribal entities are located within Coconino and Navajo County for which there are 20 T&E species listed by USFWS. Any number of these species or their habitat might be affected. However, the extent of the possible impacts can only be fully assessed when site-specific development plans are available. In order for Reclamation to comply with Section 7 of the EASA, detailed species surveys of the potentially suitable habitat would be required. Based on the results of these surveys, Reclamation will consult with USFWS.

II.D.4. Water Resources

Groundwater supplies essentially all of the domestic water needs of the population in the area. It also supplies the industrial needs, with the largest need being for a coal slurry pipeline for the Black Mesa Mine. The TDS concentration of local groundwater is generally less than 750 mg/l.

The analysis of impacts for the Navajo and Hopi Reservations was performed on a qualitative rather than a quantitative basis. It considers the potential change in groundwater storage (rather than groundwater levels) in the N-Aquifer in the Black Mesa area, which underlies both

Tribes. While the potential amount of CAP water available to both the Navajo and Hopi Tribes is known to be 13,500 afa for Non-Settlement Alternatives 2, 3A, and 3B, the distribution of that water between the two Tribes is contingent on resolution of issues outside the scope of this EIS. Therefore, this discussion of water resources applies to both tribes.

Under the No Action Alternative, Settlement Alternative, and Non-Settlement Alternative 1, ongoing pumping from the N-Aquifer withdrawals would be greatest near the centers of pumping. This would include the Peabody mining complex and the communities of Kayenta, Pinon, Polacca, Shonto and Moenkopi. It is likely that future drawdowns in certain local areas will be substantial and could impair the ability to recover groundwater using existing wells.

The allocation of CAP water under Non-Settlement Alternatives 2, 3A and 3B would result in a reduction in groundwater pumping (as compared to the No Action Alternative) of 675,000 af over the 50-year period. This would result in an incremental increase in groundwater storage relative to the No Action Alternative of 675,000 af, or about 0.23 to 0.38 percent of the estimated overall N-Aquifer storage. The increased groundwater storage would result in higher average groundwater levels overall in the N-Aquifer for these alternatives relative to the No Action Alternative. However, evaluation of local impacts is outside the scope of this EIS, and the improvement in overall N-Aquifer storage may not translate into significant improvements in groundwater levels for all local areas that experience substantial drawdowns under the No Action Alternative.

Subsidence would not be anticipated due to changes in groundwater levels in consolidated sedimentary rocks, like the N-Aquifer.

II.D.5. Socioeconomic

Under Non-Settlement Alternatives 2 and 3a and 3b, the Navajo and Hopi Nations would be allocated 13,500 af of CAP water. A portion of the allocation of CAP water to the Navajo and Hopi Nations would provide a renewable source of surface water for coal mining and other M&I purposes. The Navajos and Hopis sell coal to the Navajo Generating Station in northern Arizona and to the Mohave Power Plant in southern Nevada. Royalties and fees associated with coal mining and operation of electric power plants are important sources of income for both Nations. In addition to potential economic growth, the CAP allocation would provide a reliable potable water supply for many Tribal members living on the Navajo and Hopi Reservations who currently do not have a reliable potable water supply for domestic use.

A source of funding for construction of two pipelines to deliver the CAP water to the Navajo and Hopi Nations has not been identified and is beyond the scope of this analysis. Nevertheless, if constructed, the estimated cost of the two pipelines is $136.5 million at 1995 price levels.[5] Planning and construction of one pipeline, known as the Lake Powell Pipeline, is projected to require seven years. Planning and construction of the second pipeline, known as the Western Pipeline, is projected to require 5 years.

[5] The source of this estimate is a Department of the Interior appraisal level study dated August 1999.

The direct construction expenditures, for the purposes of this analysis are based on a range of from $125 to $150 million, are projected to employ 1,279 persons over the five-to-seven year construction schedule. Total employment, including indirect and induced impacts, is projected to be 2,260 persons over the construction schedule. The employment impacts would occur mainly in Coconino and Navajo Counties. Total output impact is projected to be $201.5 million. The total projected impact to income is $75.5 million.

The employment and income stimulated by the CAP allocation and construction of the two pipelines may improve the standard of living for residents of the Navajo and Hopi Reservations. Income and unemployment statistics are provided in Tables L-Indian-11 and L-Indian-12.

Table L-Indian-11
CAP Allocation Draft EIS
Income Statistics for Hopi Tribe

Type of Income	Hopi Tribe
Median Household Income	$14,325
Per Capita Income (Poverty Status)	$ 4,953
Persons Below Poverty	48%
Families Below Poverty	53%
Female Households, Families Below Poverty	52%
Households with Public Assistance Income	23%

Source: Bureau of the Census, 1990 Population and Housing Statistics

Table L-Indian-12
CAP Allocation Draft EIS
Income Statistics for Navajo Nation

Type of Income	Navajo Nation
Median Household Income	$12,817
Per Capita Income (Poverty Status)	$ 4,788
Persons Below Poverty	49%
Families Below Poverty	47%
Female Households, Families Below Poverty	52%
Households with Public Assistance Income	33%

Source: Bureau of the Census, 1990 Population and Housing Statistics

APPENDIX L

INDIVIDUAL ENTITY DESCRIPTIONS

INDIAN

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

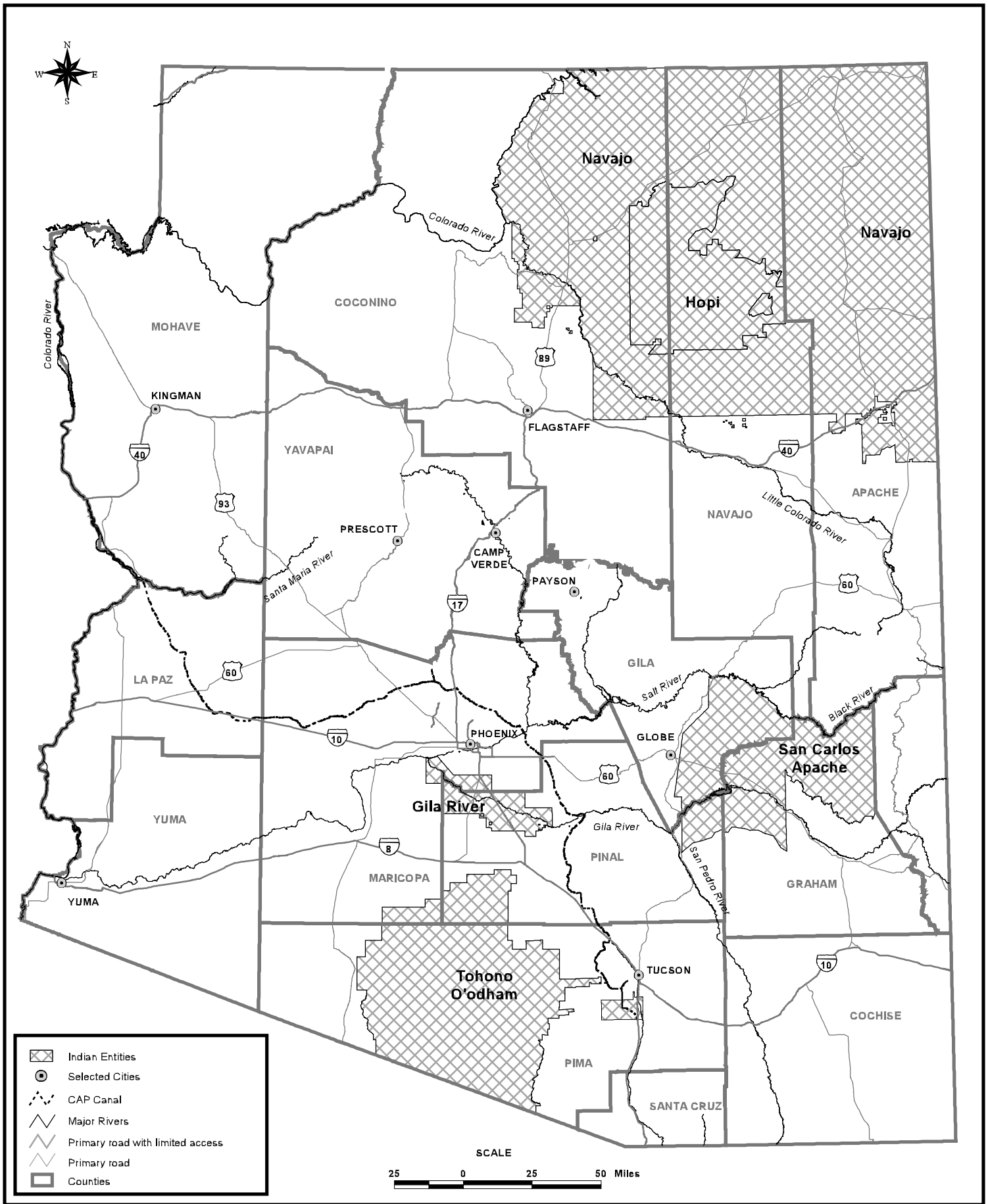
APPENDIX L INDIVIDUAL ENTITY DESCRIPTIONS

INDIAN TRIBES AND COMMUNITIES

There are five Indian Tribes or Communities recommended to receive a CAP allocation under the four action alternatives. These entities, which comprise the Indian water users that are considered in the draft EIS, are located in Coconino, Gila, Graham, Maricopa, Navajo, Pinal, and Pima Counties, Arizona (see Figure L-Indian-1). Under the proposed alternatives, the GRIC would receive additional CAP water of mixed priority up to 170,200 afa, depending upon the alternative implemented. The Navajo Nation and the Hopi Tribe would receive a combined total of 13,500 af of M&I priority water under Non-Settlement Alternative 2 and Non-Settlement Alternative 3. The SC Apache Tribe would receive additional CAP water of mixed priority up to 40,000 afa, depending upon the alternative implemented. Also, the TON would receive 28,200 af of CAP water under the Settlement Alternative, Non-Settlement Alternatives 2 and Non-Settlement Alternative 3 (the water would be either M&I or NIA priority, depending upon the alternatives). This allocation would serve to identify the source of 28,200 afa of water suitable for agricultural use that was received as part of the SAWRSA of 1982 but whose source was not identified in that Act. The water would be divided between the San Xavier District (23,000 af) and the Schuk Toak District (5,200 af). Under the three non-settlement alternatives, 19,318 afa of water would be designated for use in future water settlements with 17,800 af reserved for the GRIC. This water was previously NIA priority water allocated to the HVID but reserved for Federal use in the settlement of Indian water rights claims to the Salt and Verde River watershed pursuant to the FMIC Water Rights Settlement Act of 1990. This water would be converted to Indian priority prior to allocation.

Each entity description includes a brief summary of the Tribe's or Community's location, local economy, and current and projected water supplies. These descriptions were obtained from State of Arizona Indian Profiles (http://www.commerce.state.az.us) and other sources.

In order to assess the potential impacts from the proposed alternative allocations of CAP water to these five Tribes or Communities, hypothetical non-binding plans for taking and using the water were developed for each entity. These non-binding plans were developed solely for use in preparing the draft EIS, to illustrate the manner in which Tribes could use the water and to provide, at a programmatic level, a description of the potential impacts that could result from such use. The plans were developed using existing water development plans, analysis of existing contracts and agreements, and data provided from Tribes and Reclamation staff. Based on these hypothetical non-binding plans, total long-term water deliveries and potential land use changes were estimated. Analysis of potential agricultural development and/or use for M&I purposes assumes that sufficient funds would be provided under all alternatives where an allocation of CAP water would be made, to construct the necessary infrastructure to take and use the water within the 50-year study period. This assumption was made to ensure impacts from using the allocated water would be included in the analysis. In order to provide a worst case analysis, it is assumed for purposes of this draft EIS that all agricultural development resulting from receipt of CAP water from any of the proposed allocation alternatives would occur on undisturbed desert land.



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June 2000

CAP Allocation EIS

Indian Sector Location Map

Figure

L-IND-1

Table L-Indian-1 presents a summary of significant data for all of the Tribes.

Table L-Indian- 1
CAP Allocation Draft EIS
Summary of Significant Data to Indian Sector (5 Tribes)

	Settlement Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3	No Action
Additional CAP Allocation (afa)	183,600[(a)]	53,400	158,046	241,500[(b)]	0
Additional CAP Water Reserved for Future Final Water Rights Settlement (HVID)	0	17,800	17,800	17,800	0
Additional Acres Irrigated (acres)	24,800	8,000	25,400	50,000	0

Notes:
(a) Does not include 69,800 afa reserved for future settlements.
(b) Does not include 72,795 afa reserved for future settlements.

III. SAN CARLOS APACHE TRIBE

The San Carlos Indian Reservation (San Carlos) consists of 1.9 million acres and is located 100 miles east of Phoenix, in Gila and Graham Counties, Arizona. The Reservation lies within three separate watersheds: Upper Gila River, the Salt River, and the San Pedro watersheds. Approximately 82 percent of the Reservation is located within the Gila River system, 17 percent within the Salt River system, and the remaining one percent within the San Pedro River system.

Although located in proximity to water supply sources, the SC Apache Tribe has historically not been able to use these water supplies in substantial quantities due to lack of resources. The SC Apache Tribe has a Globe Equity-59 right[6] to irrigate 1,000 acres with 6,000 afa of Gila River water. The Gila River Water Commissioner's 1999 Then-Being-Irrigated Report lists 350 acres of land on the SC Apache Tribe Reservation as being farmed. The recent SC Apache Tribe Water Settlement Act of 1992 and associated Water Settlement Agreement now make development of additional water supplies possible. Potential uses include expansion of irrigated agriculture, mining, maintenance and/or development of recreational lakes, and leasing.

III.A. Proposed Allocations

The San Carlos' original CAP allocation was for 12,700 afa. Under the SC Apache Tribe Water Settlement Act of 1992, the Tribe received an additional CAP allocation of 48,945 afa. Under that Settlement Act, all of the 48,945 afa may be leased for use outside the Reservation.

Under the proposed allocation alternatives, the SC Apache Tribe would receive an additional CAP allocation ranging from 0 afa (under the No Action Alternative) to 40,000 afa (under Non Settlement Alternative 3). Table L-Indian-13 summarizes the proposed allocations by alternative. Table L-Indian-14 provides detail of the allocations' priorities under each alternative. Table L-Indian-15 describes lease agreements the San Carlos has entered into or has expressed a desire to enter into for the CAP water received through the Settlement Act of 1992.

Table L-Indian-13
CAP Allocation Draft EIS
SC Apache Tribe
CAP Allocations
(afa)

	Alternative				
CAP Allocation	No Action	Settlement	Non-Settlement 1	Non-Settlement 2	Non-Settlement 3
Existing	61,645	61,645	61,645	61,645	61,645
Proposed	0	0	0	23,447	40,000
Total	61,645	61,645	61,645	85,092	101,645

[6] The Globe Equity 59 Decree quantified water rights in the upper Gila River basin.

Table L-Indian-14
CAP Allocation Draft EIS
SC Apache Tribe
Priority of CAP Allocations
(afa)

CAP Allocation Priority	Alternative				
	No Action	Settlement	Non-Settlement 1	Non-Settlement 2	Non-Settlement 3
Indian	43,500	43,500	43,500	43,500	43,500
M&I	18,145	18,145	18,145	22,092	22,092
Non-Indian Ag	0	0	0	19,500	36,053
Total	61,645	61,645	61,645	85,092	101,645

Table L-Indian-15
CAP Allocation Draft EIS
SC Apache Tribe
Leases and Exchanges Under All Alternatives
(afa)

Description	Amount
Lease to Scottsdale, Indian priority water	12,500
Lease to Globe, M&I priority water	3,480
Lease to PD, M&I priority water	14,000
Total	29,980

III.B. Non-Binding Plans to Take and Use CAP Water

A letter soliciting information regarding non-binding plans to take and use CAP water was sent to the SC Apache Tribe. In the absence of a response, the plans presented in this section were developed based upon information provided in the *Technical Assessment of the San Carlos Apache Tribe Water Rights Settlement* (Arizona Department of Water Resources, May 17, 1999) (ADWR San Carlos Apache Tribe Report) and discussions with Reclamation staff. They are speculative in nature and are presented merely to provide a basis for comparing the potential range of impacts that could occur across the range of alternatives.

III.B.1. Uses

Under all alternatives it is assumed that in order to use CAP water, San Carlos would need to enter into an exchange agreement with a downstream party that has both rights to use Gila River water and access to CAP water, most likely GRIC. Under such an exchange agreement, the downstream party would use San Carlos' CAP water in exchange for San Carlos diverting and using Gila River water.

The primary use of CAP water is anticipated to be for agricultural irrigation. The ADWR SC Apache Tribe Report identifies over 20,000 arable acres that are available within the Reservation. Table D-2 in Appendix D in that report summarizes the results of a study performed by Boyle Engineering which classified arable acres by soil type and location. For the purposes of this draft EIS, it is assumed that use of this CAP water for irrigation would occur on

the class 1 and class 2 soils in the vicinity of the Gila and San Carlos Rivers. These areas were chosen because they are closest to San Carlos Reservoir, the anticipated point of diversion. It should be noted that areas of additional arable acreage have been identified within the Reservation that could be developed, and other irrigation systems may be feasible to deliver water to those areas. For purposes of comparing impacts among the alternatives, Table L-Indian-16 lists the maximum arable acres that could potentially be farmed in these areas using the CAP water allocated.

Table L-Indian-16
CAP Allocation Draft EIS
SC Apache Tribe
Combined Total CAP Allocations
Potential Non-Binding Area of Farming
(afa)

Area	Arable Acres		
	Class 1[(b)]	Class 2[(c)]	Total
Tufastone & Seven Mile Wash	1,320	1,727	3,047
Cutter Ranch Creek	1,901	5,725	7,626
Gilson Wash	518	945	1,463
San Carlos River	264	1,373	1,637
Gila River	721	5,092	5,813
Goodwin Wash	884	719	1,603
Sub-Totals	5,608	15,581	21,189
Acreage Removed for Farm Roads, etc.			1,189
Total			20,000

Notes:
(a) Source: Table D-2 from *Technical Assessment of the San Carlos Apache Tribe Water Rights Settlement* (Arizona Department of Water Resources, May 17, 1999).
(b) Class 1 soils were particularly suited for irrigation with few or no limitations.
(c) Class 2 soils were suited for irrigation with one or more limitations that resulted in lower productive capacity than class 1.

Typical crops that could be irrigated with this water include alfalfa, corn, vegetables, and orchards. Under the No Action, Settlement and Non-Settlement Alternative 1, no additional acreage would come into production. Under Non-Settlement Alternative 2, up to 4,700 acres out of the identified 20,000 acres could be developed. And, under Non-Settlement Alternative 3, up to 8,000 acres out of the identified 20,000 acres could be developed. These acreage estimates are based on an assumption that a reasonable water duty for San Carlos farms is five af/ac[7].

Some of the allocated water could also be used for aquaculture, fish hatchery, livestock grazing (both for stockponds and irrigating pastureland), mining peridot and gypsum, and maintaining a minimum pool within the San Carlos Reservoir (up to 40,000 afa). If water were put to any of these uses, the amount of acreage developed for agriculture would be reduced accordingly.

[7] It should be noted that water rights in the upper Gila River system are governed by the Globe Equity 59 Decree, which has a maximum water duty of six af per acre.

A portion or the entire additional amount of CAP water provided under the proposed allocation alternatives could also be leased instead of used on-Reservation; however, this would require additional Federal action, and cannot be considered under the currently proposed allocation.

Table L-Indian-17 summarizes potential uses of SC Apache Tribe's CAP water by alternative.

Table L-Indian-17
CAP Allocation Draft EIS
SC Apache Tribe
Additional CAP Allocations
Potential Non-Binding End Uses of Water
(afa)

Use	Alternative				
	No Action	Settlement	Non Settlement 1	Non Settlement 2	Non Settlement 3
Irrigation	0	0	0	23,447	40,000
M&I/Recreation[(a)]	0	0	0	0	0
Total	0	0	0	23,447	40,000

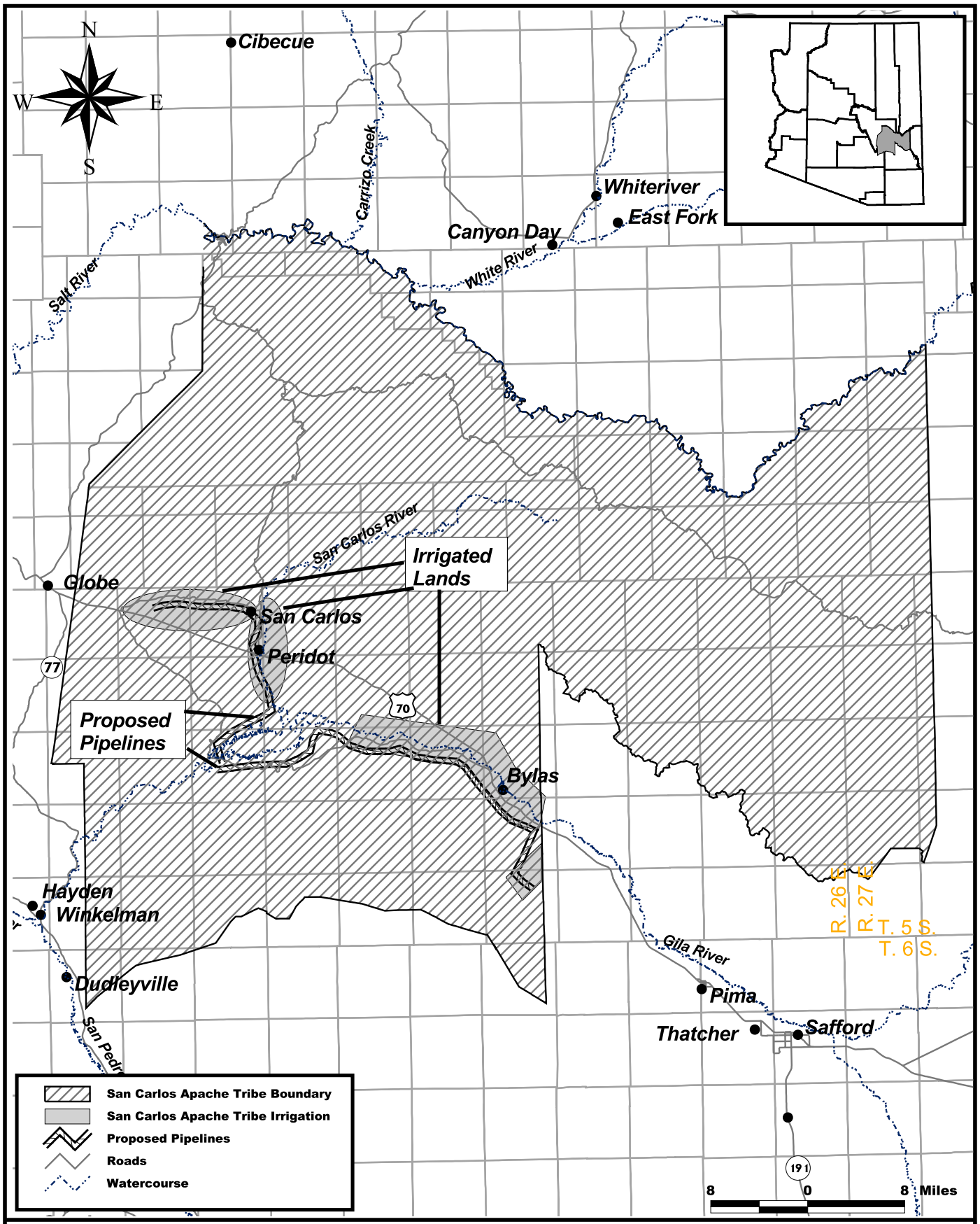
Notes:
(a) Includes uses associated with San Carlos Reservoir.

III.B.2. Facilities

Facilities that would need to be constructed to deliver water to the areas of potential irrigation use identified above include pump stations that would divert water from the San Carlos Reservoir and pipelines to transport the water to the areas shown in Figure L-IND-6 and summarized on Table L-Indian-18. These backbone facilities would serve a maximum of approximately 8,000 acres. Assuming approximately 61 miles of new pipeline and a 100-foot wide cleared area (for construction), approximately 750 acres will be disturbed due to pipeline construction.

Table L-Indian-18
CAP Allocation Draft EIS
SC Apache Tribe
Facilities Required for Additional CAP Allocation Development

Facilities or CAP Allocation	Alternative				
	No Action	Settlement	Non Settlement 1	Non Settlement 2	Non Settlement 3
New Lands (acres)	0	0	0	4,700	8,000
New Pipeline (miles)	0	0	0	61	61
New Pump Stations	0	0	0	2	2



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June 2000

CAP Allocation Draft EIS
General Location Map
San Carlos Apache Tribe

Figure #L-IND-6

III.C. Population Projection

The estimated 2001 population level for the SC Apache Tribe is 9,370 and the estimated 2051 population level is 19,613. The population is expected to grow by approximately 52 percent over the 50-year CAP contract period (i.e., 2001-2051).

III.D. Environmental Effects

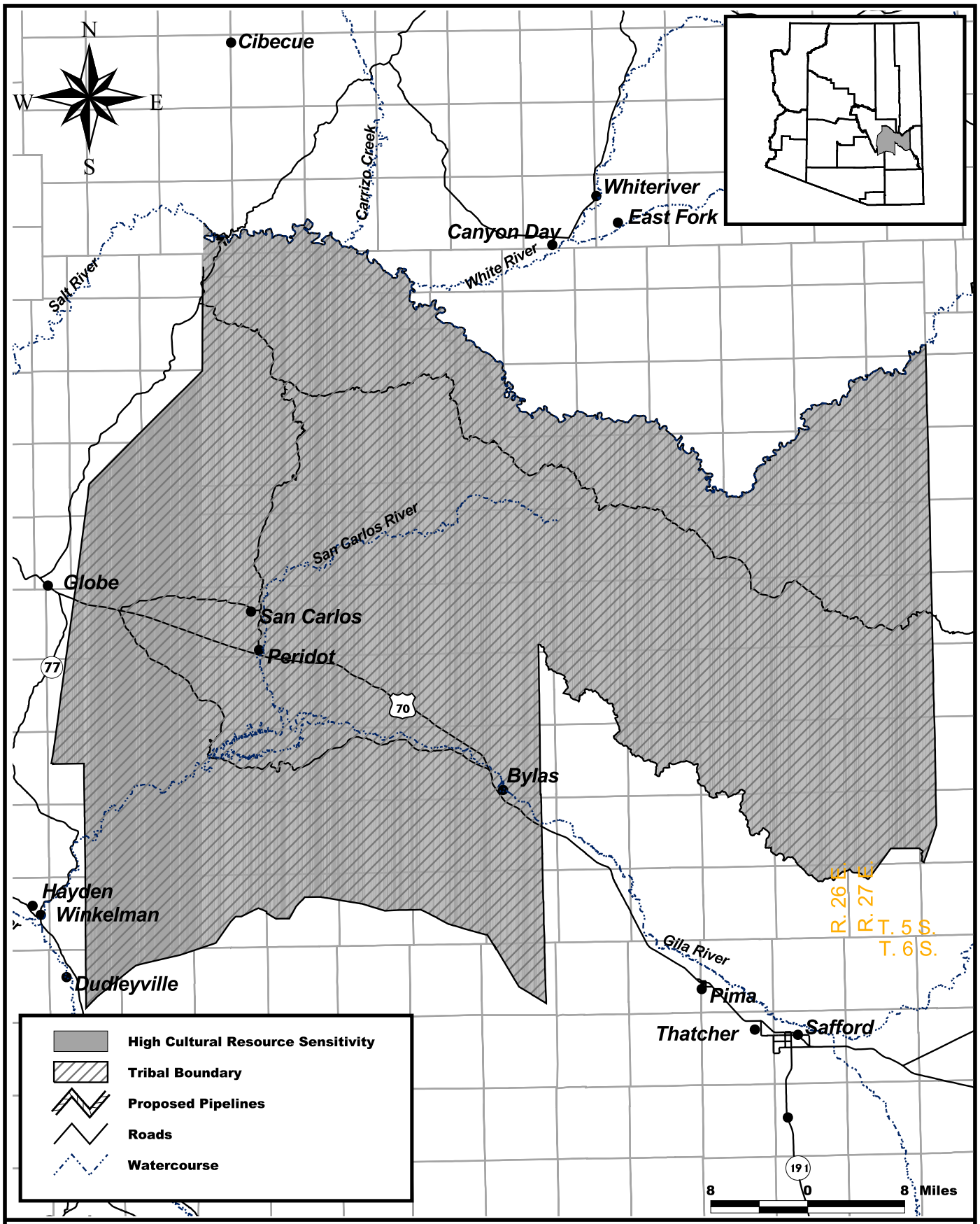
The following discussion provides some general information regarding these probable construction projects and provides a general identification of potential environmental impacts and potential mitigation measures.

III.D.1. Land Use

The land uses on the SC Apache Tribe lands include recreation, grazing, forestry, mining, and fisheries. There are also lands devoted to Tribal Communities. The development of new agricultural lands would displace other land uses – primarily grazing lands. A specific review, pursuant to NEPA, would be carried out to identify land use conflicts prior to development.

III.D.2. Archaeological Resources

Known prehistoric site types within this entity include artifact scatters, agricultural features (e.g., canals, waffle gardens, rock alignments, and possible reservoirs), resource procurement/processing loci, small farming villages, and "composite rancherías" consisting of compounds with multistory room blocks, mounds, and ball courts (e.g., Rice Ruin, Epley Ruin, Buena Vista/Curtis Ruin) (e.g., Black and Green 1995). Cultural affiliation of sites range from the Archaic (e.g., Day Mine Rockshelter) to the Salado; the area's prehistoric resources have been particularly important in defining the origin and nature of the Salado culture (e.g., Brown 1973; Doyel 1978). Protohistoric and historic Apache sites include villages (e.g., Old San Carlos), small settlements, isolated wickiup rings, trash scatters, resource procurement/processing loci, burials, and other limited activity sites. Historic sites affiliated with other Native American, Euroamerican, and possibly Hispanic groups also are known. Historic contexts represented include commerce, transportation, mining, the lumber industry, the military, and water management (e.g., camps associated with the construction of Coolidge Dam) (Effland and Green 1985). The SC Apache Tribe has a Cultural Resources Division. Cultural resource sensitivity areas in this entity are shown in Figure L-IND-7. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high. Farm development and pipeline construction as well as associated activities such as borrow sites, spoil areas, construction yards, equipment storage, and field offices have the potential to impact historic and archaeological sites. Section 106 compliance, including consultation with the affected Tribes, would be carried out to identify significant sites, and develop a plan to mitigate or avoid them.



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June 2000

CAP Allocation Draft EIS
Cultural Resources
San Carlos Apache Tribe

Figure #L-IND-7

III.D.3. Biological Resources

III.D.3.a. Existing Habitats

The San Carlos is situated within a geological mosaic of Tertiary and younger sediments, and granitoid and volcanic rock substrates. The primary biotic community within the San Carlos Basin is the Arizona Upland Subdivision. A portion of the basin is composed of Late Tertiary lakebed deposits and riparian woodland, which are habitats for several rare species. These riparian woodlands are located along the San Carlos River, Gila River, and Black Rivers and their tributaries. Arizona Upland intergrades into Semidesert Grassland on the higher slopes. In the highest E, biotic Communities include Great Basin Conifer Woodland, Plains and Great Basin Grassland, Madrean Evergreen Woodland, and Petrane Montane Conifer Forest.

III.D.3.b Impacts to Biological Resources

New agriculture within this planning area over the 50-year study period and the construction of water delivery pipelines will result in natural habitat loss of an estimated 8,750 acres under Non-Settlement Alternative 3 and 5,450 acres under Non-Settlement Alternative 2. This new agriculture will probably occur along Gilson Wash, San Carlos River, Gila River, and Goodwin Wash. Other uses of the CAP allocation may be aquaculture, fish hatchery, livestock, mining and maintenance of a minimum pool with the San Carlos Reservoir. This last use would maintain a biological resource.

III.D.3.c. Summary of Possible Impact to T&E Species

This Tribal entity is located within Gila and Graham Counties for which there are 16 T&E species listed by USFWS. Any number of these species or their habitat might be affected. However, the extent of the possible impacts can only be fully assessed when site-specific development plans are available. In order for Reclamation to comply with Section 7 of the EASA, detailed species surveys of the potentially suitable habitat may be required. Based on the results of these surveys, Reclamation will consult with USFWS.

III.D.4. Water Resources

Under present conditions, water demands on the SC Apache Tribe lands include irrigation, domestic, stock watering, recreation, and cultural use. Groundwater is used to meet domestic purposes and a portion of the irrigation requirements. Groundwater is obtained from alluvium associated with the San Carlos and Gila Rivers and from basin fill materials. Groundwater likely occurs in the alluvium under unconfined conditions. In the basin fill, groundwater occurs under both confined and unconfined conditions. Groundwater levels are generally stable on the Reservation.

Groundwater in the alluvium and the upper portions of the basin fill along the San Carlos River generally contains less than 500 ppm of TDS. Groundwater along the Gila River generally has TDS concentrations of more than 500 ppm, and some wells produce water which contains more than 4,000 ppm of TDS. The TDS concentration for wells in the basin fill located more than two miles from the Gila River are generally less than 500 ppm.

Estimated groundwater level impacts are summarized in Table L-Indian-19, which shows the estimated change in groundwater levels from 2001 to 2051 for each alternative, and the groundwater level impact (i.e., the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative). Each alternative reflects a rise in groundwater levels to fill currently unfilled space in the alluvium associated with the San Carlos and Gila Rivers. This results from recharge of return flows derived from irrigation of additional lands along these rivers. Impacts in year 2051 are the same for all alternatives.

Impacts of the alternatives on water quality along the San Carlos River are anticipated to be negligible. There may be some potential for improvement in groundwater quality along the Gila River; however, that potential is probably limited. Also, because declines in groundwater levels are not anticipated for the SC Apache Tribe, subsidence is not expected.

Table L-Indian-19
CAP Allocation Draft EIS
SC Apache Tribe–Groundwater Data Table

Alternatives	Along San Carlos River(1)		Along Gila River Area (2)	
	Estimated Groundwater Level Change from 2001-2051 (in Feet)	Groundwater Level Impact** (in Feet)	Estimated Groundwater Level Change from 2001-2051 (in Feet)	Groundwater Level Impact** (in Feet)
No Action	15	--	50	--
Settlement Alternative	15	0	50	0
Non-Settlement Alternative 1	15	0	50	0
Non-Settlement Alternative 2	15	0	50	0
Non-Settlement Alternative 3A	15	0	50	0
Non-Settlement Alternative 3B	15	0	50	0

(1) Represents filing of presently unfilled space in alluvium along San Carlos River.
(2) Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

III.D.5. Socioeconomic

Under Alternative 2, the San Carlos would be allocated an additional 23,447 af of CAP water. Under Alternative 3, the San Carlos would be allocated an additional 40,000 af of CAP water. Under both alternatives, agricultural development is the assumed use of the additional allocation. For the purposes of this draft EIS, CAP Indian distribution system pipelines are assumed to be constructed with sufficient capacity to enable the San Carlos to use the CAP water in agriculture. The time frame for any construction is unknown.

The source of funding for construction of the delivery pipelines has not been identified and is beyond the scope of this analysis. Similarly, no analysis of the financial feasibility of an agricultural development has been carried out. Nevertheless, if constructed, the estimated construction costs are identified below. The construction estimates were performed, in April 2000, on a pre-appraisal basis for the purposes of this draft EIS only.

Under the No Action and Settlement Alternatives and Alternative 1, the San Carlos would receive only their existing CAP allocation of 61,645 af. The capacity of the CAP Indian distribution system would be about 31,665 af because 29,980 af are leased off the San Carlos under all alternatives. The CAP Indian distribution system is estimated to cost approximately $60 million. Planning and construction of the system would require about seven years.

Under Alternative 2, the total construction cost of the CAP distribution system is estimated to be approximately $150 million. The incremental cost would be approximately $90 million. The construction cost would increase because an additional 23,447 af of capacity would have to be added to the CAP distribution system. Construction and planning of the CAP distribution system under Alternative 2 would require 10 years.

Under Alternative 3, the total construction cost of the CAP distribution system is estimated to be approximately $205 million. The incremental cost would be approximately $145 million. The construction cost would increase because an additional 40,000 af of capacity would have to be added to the CAP distribution system. Construction and planning would require about 10 years.

If the pipeline identified under Alternative 2 were constructed, the additional direct construction expenditures are projected to employ, on average, 128 persons each year over the estimated 10-year construction period. Total employment with indirect and induced impacts is projected to average 181 persons each year over the construction period. The total output impact is estimated to be $118.1 million. The income impact is estimated to be $36.4 million. The impacts would occur mainly in Graham County.

If the pipeline identified under Alternative 3 were constructed, the additional direct construction expenditures are projected to employ, on average, 199 persons each year over the estimated 10-year construction period. Total employment with indirect and induced impacts is projected to average 294 persons each year over the construction period. The total output impact is estimated to be $191.3 million. The total income impact is estimated to be $85.8 million. The impacts would occur mainly in Graham County.

The construction jobs and income may temporarily benefit the San Carlos by partially alleviating the high unemployment rate and low income earnings observed on the Reservation. Income statistics and unemployment rates are provided in Table L-Indian-20. Increased agricultural development following construction of the CAP distribution systems are projected to impact the San Carlos in terms of output, income, and employment. The San Carlos are assumed to use a cropping pattern that reflects existing cropping patterns on the Reservation. Thus, the cropping pattern is assumed to be 80 percent alfalfa and 20 percent corn.

Under Alternative 2, direct agricultural production is estimated to increase each year by $3.3 million. The total impact, including indirect and induced output impacts, is estimated to be $4.1 million. Income is estimated to increase by $2.7 million annually.[8] Direct employment impacts are estimated to account for 91 new jobs. A total of 106 jobs are projected to be created from the additional agricultural activity.

Under Alternative 3, direct agricultural production is projected to increase each year by $5.7 million. The total output impact, including indirect and induced impacts, is estimated to be $7.0 million. Income is projected to increase by $4.6 million annually. Direct employment impacts are estimated to account for 155 new jobs. A total of 181 jobs are projected to be created from the additional agricultural activity.

The jobs and income created by the additional agricultural production could benefit the San Carlos by partially alleviating some of the unemployment on the Reservation.

Table L-Indian-20
CAP Allocation Draft EIS
Income Statistics for SC Apache Tribe

Type of Income	SC Apache Tribe
Median Household Income	$8,743
Per Capita Income (Poverty Status)	$3,366
Persons Below Poverty	61%
Families Below Poverty	63%
Female Households, Families Below Poverty	72%
Households with Public Assistance Income	36%

Source: Bureau of the Census, 1990 Population and Housing Statistics

8 The value of the agricultural output is based on five-year average yields and prices for [Graham County or State?] published in the [year] Arizona Agricultural Statistics.

IV. TOHONO O'ODHAM NATION

The Reservation for the TON (formerly the Papago Tribe) is located in extreme south central Arizona in the arid Sonoran Desert, to the west of the City of Tucson. The TON Reservation, which encompasses 2,773,357 acres, stretches 90 miles across Pima County and along the Mexican border. Federal, State and Tribal agencies are the largest employer on the Reservation. Cattle-raising and related activities form the second major economic sector. The agriculture, retail-tourism and utilities sectors of the Reservation's economy are also expected to grow as Tribal development plans are implemented.

IV.A. Proposed Allocations

The TON received an original CAP allocation totaling 45,800 afa, to be distributed to three districts as follows: San Xavier District-27,000 afa; Schuk Toak District-10,800 afa; and Chuichu District-8,000 afa. Construction of facilities needed to deliver CAP water to both the San Xavier and Schuk Toak Districts for agricultural use have been or are in the process of being constructed. Water is scheduled to be delivered through these facilities to both districts during 2000. In addition, the San Xavier District has indicated a desire to recharge additional CAP water, and some portion could be leased by the Nation to other entities within the Tucson area.

SAWRSA of 1982 (PL 97-293), also authorized delivery of an additional 28,200 afa suitable for agricultural use—23,000 af to San Xavier District, and 5,200 af to Schuk Toak District; however, the source of this additional 28,200 afa was not identified. Under Settlement, Non-Settlement 2 and Non-Settlement 3 Alternatives, the source of the 28,200 af would be identified as CAP water and provided to TON. Table L-Indian-21 summarizes the proposed allocations by alternative. Table L-Indian-22 provides detail of the allocations' priorities under each alternative.

Table L-Indian-21
CAP Allocation Draft EIS
TON
CAP Allocations
(afa)

	Alternative				
CAP Allocation	No Action	Settlement	Non-Settlement 1	Non-Settlement 2	Non-Settlement 3
San Xavier District-Existing	27,000	27,000	27,000	27,000	27,000
San Xavier District –Proposed	0	23,000[(a)]	0	23,000[(b)]	23,000[(b)]
San Xavier District-Subtotal	27,000	50,000	27,000	50,000	50,000
Schuk Toak District-Existing	10,800	10,800	10,800	10,800	10,800
Schuk Toak District-Proposed	0	5,200[(a)]	0	5,200[(b)]	5,200[(b)]
Schuk Toak District-Subtotal	10,800	16,000	10,800	16,000	16,000
Chuichu District-Existing	8,000	8,000	8,000	8,000	8,000
Chuichu District-Proposed	0	0	0	0	0
Chuichu District-Subtotal	8,000	8,000	8,000	8,000	8,000
TON – Existing	45,800	45,800	45,800	45,800	45,800
TON – Proposed	0	28,200[(d)]	0	28,200[(d)]	28,200[(d)]
TON – Total	45,800	74,000	45,800	74,000	74,000

Notes:
(a) NIA priority water.
(b) M&I priority water.
(c) All other listed allocations are Indian priority water.
(d) CAP water is identified as the source of water to be provided under SAWRSA.

Table L-Indian-22 CAP Allocation Draft EIS TON Priority of CAP Allocations (afa)					
CAP Allocation Priority	Alternative				
	No Action	Settlement	Non-Settlement 1	Non-Settlement 2	Non-Settlement 3
Indian	45,800	45,800	45,800	45,800	45,800
M&I	0	0	0	28,200	28,200
Non-Indian Ag	0	28,200	0	0	0
Total	45,800	74,000	45,800	74,000	74,000
Notes:					

IV.B. Non-Binding Plans to Take and Use CAP Water

A letter soliciting information regarding non-binding plans to take and use CAP water was sent to TON. In the absence of a response, the plans presented in this section were developed based upon information provided in the Environmental Assessment of the San Xavier Farm Rehabilitation Project (U.S. Bureau of Reclamation, June 1988) (Rehab EA), *Final Environmental Assessment, Tohono O'odham Nation Water Supply Project, Central Arizona Project CAP Link Pipeline Project* (U.S. Bureau of Reclamation, July 1999) (CAP Link Pipeline EA) and discussions with Reclamation staff. They are speculative in nature and are presented merely to provide a basis for comparing the potential range of impacts that could occur across the range of alternatives.

IV.B.1. Uses

Potential uses of CAP water received under each of the alternatives are summarized in Table L-Indian-23. The SAWRSA currently allows the Nation to lease water for use off-Reservation within the Tucson AMA, and water has been leased on a short-term basis in the past. Although discussions have occurred in which lease of CAP water has been brought up, for purposes of this analysis, it is assumed no lease of the water obtained through any of the alternatives considered under this action would occur.

Table L-Indian-23
CAP Allocation Draft EIS
TON
Additional CAP Allocations
Potential Non-Binding End Uses of Water
(afa)

	Alternative				
Use	No Action	Settlement	Non-Settlement 1	Non-Settlement 2	Non-Settlement 3
San Xavier District					
Irrigation-Farm Extension Project, Farm Rehabilitation Project, additional Acreage	0	15,000	0	15,000	15,000
Groundwater Recharge	0	8,000	0	8,000	8,000
San Xavier District Total	0	23,000	0	23,000	23,000
Schuk Toak District					
Irrigation-New Farm Project and Additional Acreage	0	5,200	0	5,200	5,200
Schuk Toak District Total	0	5,200	0	5,200	5,200
Chuichu District-Total[(a)]	0	0	0	0	0
TON Total	0	28,200	0	28,200	28,200

Notes:
(a) Not evaluated as part of this draft EIS.

IV.B.1.a. San Xavier District

Under the Settlement, Non-Settlement 2 and Non-Settlement 3 Alternatives, the San Xavier District would receive 23,000 afa of CAP water. Under the Settlement Alternative, the water would be of an NIA priority; under Non-Settlement 2 and 3 Alternatives, the water would be of an M&I priority. For purposes of this draft EIS, it is anticipated approximately 15,000 af would be used for agricultural purposes. It is estimated approximately 3,000 acres would be developed. Typical crops grown in the area include cotton, alfalfa, small grains, and vegetables.

For purposes of this draft EIS, it is anticipated the balance would be made available for on-Reservation recharge (both managed and constructed). Managed recharge is anticipated to occur within existing arroyos and river channels; constructed recharge would be through constructed recharge basins. Facilities associated with constructed recharge basins include

infiltration basins, pipelines and pumps. The infiltration basins must be dried and scarified on a periodic basis to maintain infiltration rates. Accumulated sediment may need to be scraped and removed periodically; however, CAP water is typically low in sediment, therefore, little or no sedimentation of the basins may occur.

Other uses of water, mentioned in various contexts by the District, include growing mesquite, habitat enhancement, river restoration, recreation and mining.

IV.B.1.b. Schuk Toak District

The Schuk Toak District could use the 5,200 afa it would receive under the Settlement, Non-Settlement 2 and Non-Settlement 3 Alternatives to expand its agricultural development within the District. An estimated 1,000 acres could be developed with this amount of water. Typical crops grown include cotton, alfalfa, small grains, and vegetables. This District could also choose to recharge the water.

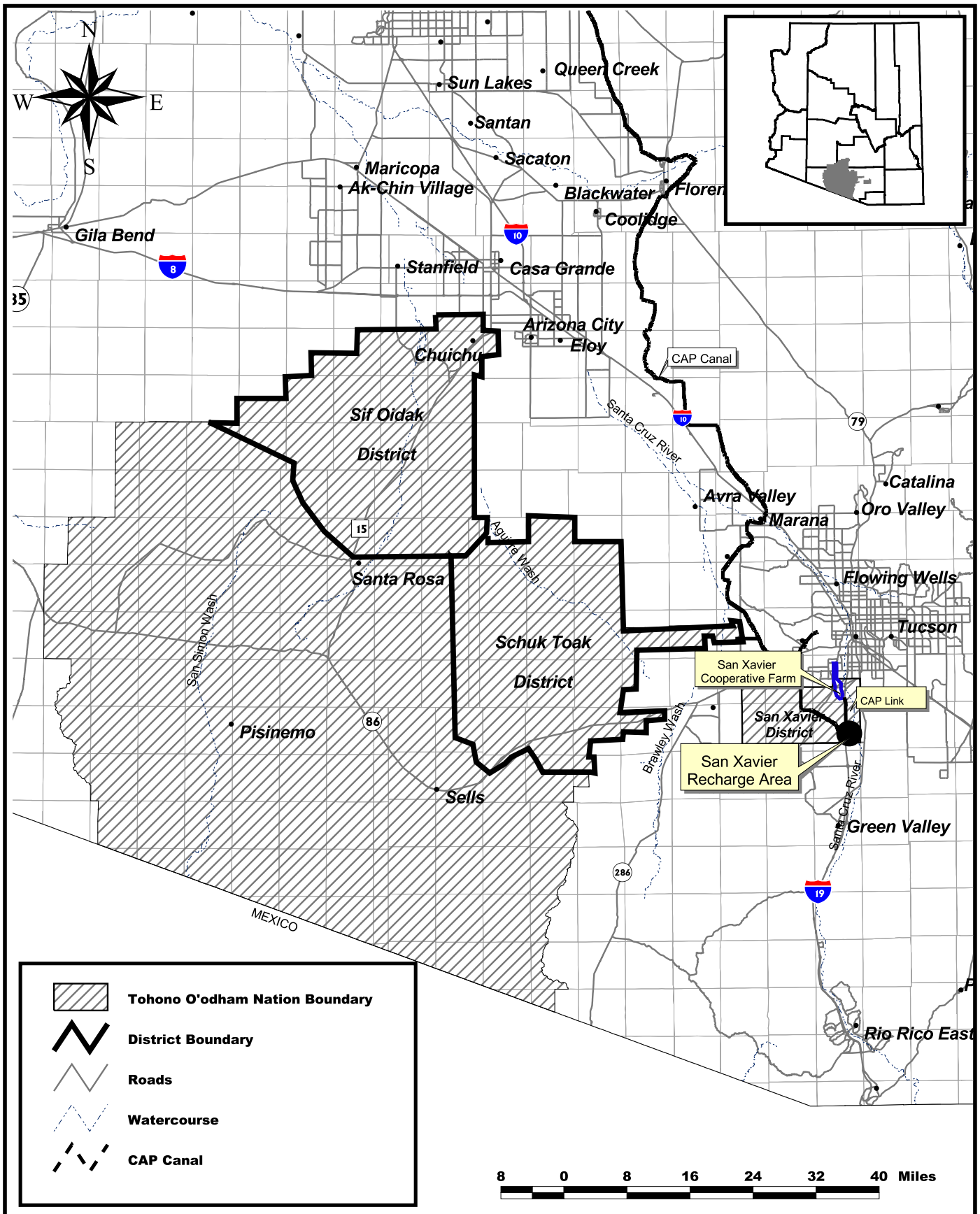
IV.B.2. Facilities

IV.B.2.a. San Xavier District

The San Xavier District is currently initiating construction of the CAP Link pipeline, an estimated 5.6-mile long, underground pipeline to be constructed between the CAP Reach six pipeline at the San Xavier Turnout No. two and the District's existing water distribution network located at the south end of the San Xavier District Cooperative Farm. This pipeline will provide CAP water for agricultural purposes on the rehabilitated San Xavier Farm and Farm Extension project east of Interstate 19. The pipeline alignment is shown in Figure L-IND-8. The pipeline has been designed to deliver up to 11,500 af. Approximately 4,500 af will be used to irrigate the Cooperative Farm, and the remainder will irrigate the future Farm Extension planned to be developed east of Interstate 19.

Assuming the 15,000 af from the proposed allocation would be used for irrigation, it is assumed the additional land to be developed would be located in the same general vicinity of the existing Cooperative Farm and Farm Extension project. Although it may be possible to deliver the additional water through the CAP Link pipeline, it is assumed additional laterals would need to be constructed to deliver the water received as a result of this project out to the new acreage that could be developed.

To estimate the maximum land disturbance that could occur from recharge activities, direct recharge of the remaining 8,000 af was assumed. This would disturb approximately 70 acres—50 acres for the basins themselves and 20 acres for operation and maintenance activities. For purposes of this draft EIS, it is anticipated the constructed recharge basins would be located adjacent to the Santa Cruz River. However, no specific areas can be identified for these facilities; additional testing would be needed to determine feasible locations for direct recharge. Again, it may be possible to deliver the additional water through the CAP Link pipeline; however, additional pipeline(s) would need to be constructed to deliver the water to the recharge area(s).



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June 2000

CAP Allocation Draft EIS
General Location Map
Tohono O'odham Indian Nation

Figure #L-IND-8

Additional investigations would need to be conducted to determine recharge capacities of the areas where in-channel recharge appeared feasible. There would likely need to be construction of facilities to deliver water to these areas, although it is too speculative at this stage to estimate. However, for purposes of this draft EIS it is assumed there would be less disturbance overall if in-channel recharge occurs rather than direct recharge. And, it is assumed there would be even less disturbance, and potentially some benefit, if the water was used for habitat enhancement.

IV.B.2.b. Schuk Toak District

Should the Schuk Toak District decide to directly recharge its 5,200 afa of additional CAP water, approximately 40 acres would be needed—30 acres for the basins themselves and 10 acres for operation and maintenance activities. It is assumed if indirect recharge was chosen, it would disturb less acreage. No tentative or specific locations can be identified for potential recharge areas at this time.

If the Schuk Toak District decided to develop additional agricultural land with this 5,200 afa, the estimated 1,000 acres would likely be developed adjacent to the existing New Farm project.

A pipeline system was recently constructed to deliver CAP water from the Tucson Aqueduct to the Schuk Toak District, for use on the Schuk Toak New Farm project. It is anticipated there would be sufficient capacity in this pipeline to convey the additional 5,200 afa to the District. It is anticipated additional pipeline(s) would need to be constructed to convey the water to either the recharge area(s) or the additional agricultural acreage that would be developed. Additional pipeline alignments are unknown at this time.

IV.C. Population Projection

The population in 1985 for the TON was 3,991. The estimated 2001 population level for the TON is 3,991, and the estimated 2051 population level is 8,984. The population is expected to grow by approximately 56 percent over the 50-year CAP contract period (i.e., 2001-2051).

IV.D. Environmental Effects

The following discussion provides some general information regarding these probable construction projects and provides a general identification of potential environmental impacts and potential mitigation measures.

IV.D.1. Land Use

TON's land use includes agriculture in the San Xavier District, and Tribal Communities in both the San Xavier District and the Schuk Toak District.

IV.D.2. Archaeological Resources

Cultural resources in the TON reflect the long history of human occupation in the Santa Cruz River basin. Significant deposits dating to the Archaic (e.g., AZ AA:15:92(ASM)) and possibly the Paleoindian periods (e.g., AZ AA:16:39(ASM) in the Schuk Toak Archaeological District),

and Hohokam sites ranging from large villages with one or more ball courts (e.g., Punta de Agua, Martinez Hill) to small farmsteads and surface scatters associated with resource procurement and processing, have been documented within the Reservation's boundaries (e.g., Marmaduke and Robinson 1983). Other prehistoric site types include trails, *cerros de trincheras*, and petroglyph loci. Protohistoric and early historic rancherías and other remains of native cultures—including Pima, Papago, Sobaipuri, and Yaqui—might be expected to occur throughout the entity, as are deposits associated with the area's Spanish occupation (e.g., Mission San Xavier del Bac, Garcia Ranch, Agua Caliente Ranch). Later historic sites related to ranching, agriculture, mining, and transportation also are known. The TON has a Cultural Resources Division. Cultural resource sensitivity areas in this entity are shown in Figure L-IND-9. Based on the limited data used to generate the cultural sensitivity designations, the potential for cultural resource impacts in this entity is high. Farm development and pipeline construction as well as associated activities such as borrow sites, spoil areas, construction yards, equipment storage, and field offices have the potential to impact historic and archaeological sites. Section 106 compliance, including consultation with the affected Tribes would be carried out to identify significant sites and develop a plan to mitigate or avoid them.

IV.D.3. Biological Resources

IV.D.3.a. Existing Habitats

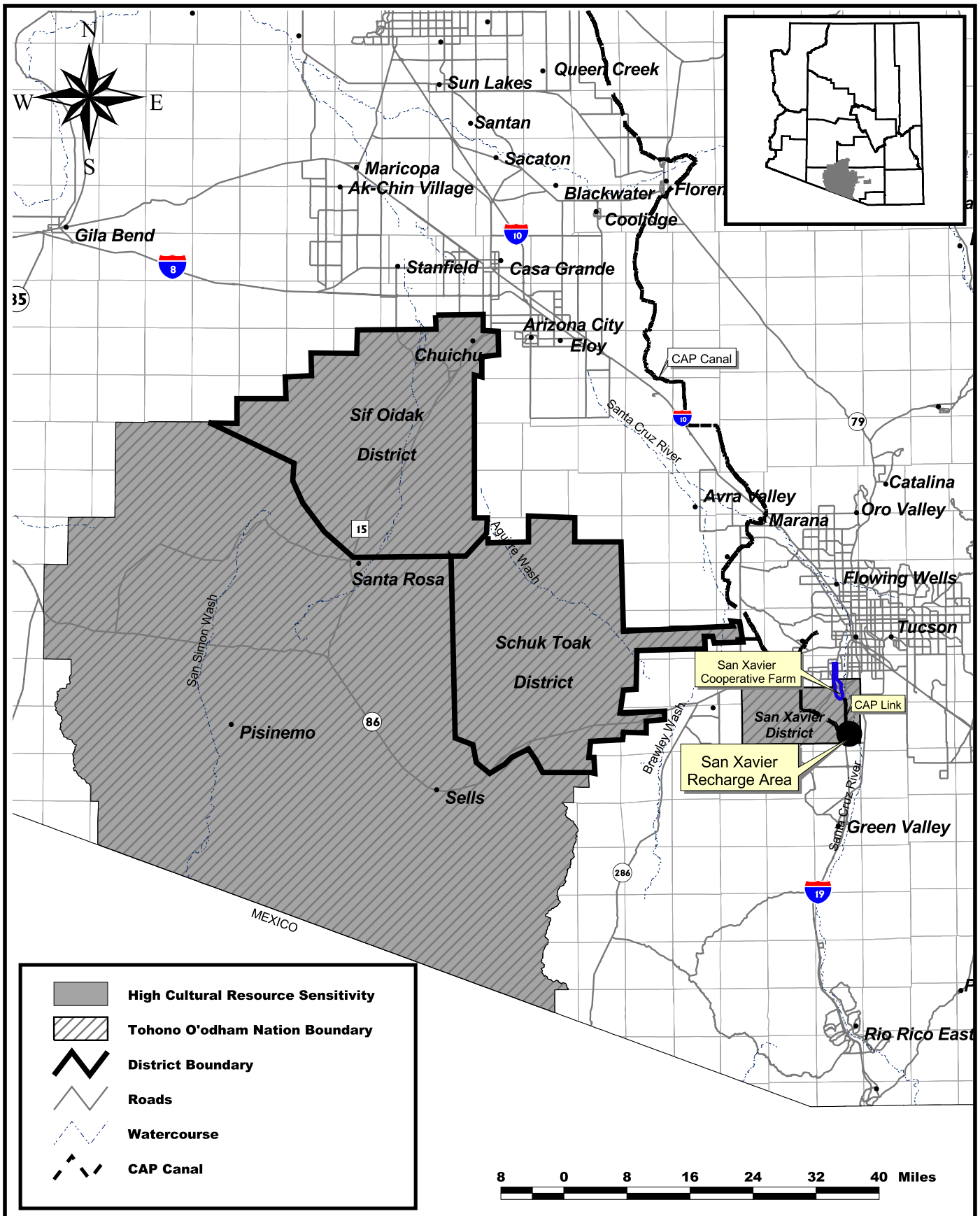
The TON is situated within the basin and range region of the Sonoran Desert, where the low mountain ranges of granitoid and extrusive volcanic rock are interspersed among plains of alluvium. The primary biotic Communities are the Arizona Upland Subdivision and the Semidesert Grassland of the Sonoran Desertscrub. Toward the west, there is some influence from the Lower Colorado Subdivision. Madrean Evergreen Woodland dominates the upper E. Intermittent water along the Santa Cruz supports riparian woodland.

IV.D.3.b. Impacts to Biological Resources

New agriculture and recharge basins within this planning area over the 50-year study period will result in loss of an estimated 4,070 acres of Sonoran desertscrub and Bursage-foothill Paloverde Association. These natural areas have saguaro, mesquite, desert ironwood and several cacti species, which will be lost as this development occurs. The faunal component will also be affected. With regard to biological resources, there is no difference in impacts between Settlement, Non-Settlement 2 or 3. In the San Xavier District, the possible use of CAP allocation includes growing mesquite, habitat enhancement and river restoration, all of which could be positive impacts to the local habitat.

IV.D.3.c. Summary of Possible Impact to T&E Species

This Tribal entity is located within Pima County for which there are 16 T&E species listed by USFWS. However, potential habitat only exist for cactus ferruginous pygmy-owl and the Pima pineapple cactus. There is no designated critical habitat (C) for the Pima pineapple cactus. There is potentially suitable habitat for the cactus ferruginous pygmy-owl within the TON. In order for Reclamation to comply with Section 7 of the ESA, detailed species surveys of the potentially suitable habitat would be required. Based on the results of these surveys, Reclamation will consult with USFWS. The additional CAP water proposed under Settlement



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June 2000

CAP Allocation Draft EIS
Cultural Resources
Tohono O'odham Indian Nation

Figure #L-IND-9

Alternative, Non-Settlement Alternative 2 and 3 would not be delivered to TON until consultation has been completed.

IV.D.4. Water Resources

The CAP allocations for the Schuk Toak and San Xavier Districts would vary under the alternatives considered. These areas are separated geographically, and the impacts for these two Districts are discussed in the subsections which follow.

IV.D.4.a. Schuk Toak District

CAP water would be used to bring new lands under production within the Schuk Toak District. Groundwater is contained in the basin fill materials, and groundwater generally occurs under unconfined conditions in the upper 1,000 feet of these materials. In general, groundwater levels historically declined in this area. The TDS concentration of groundwater in basin fill underlying the Schuk Toak District lands is less than 500 ppm.

Estimated groundwater level impacts are summarized in Table L-Indian-24, which shows the estimated change in groundwater levels from 2001 to 2051 for each alternative and the groundwater level impact (i.e., the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative).

The relatively large decline in groundwater levels for all alternatives (ranging from 149 to 153 feet) is largely a reflection of assumed future pumping at a City of Tucson well field located to the south of the Schuk Toak District lands. The slightly higher groundwater levels (relative to the No Action Alternative) for the Settlement Alternative and Non-Settlement Alternatives 2, 3A, and 3B reflect the availability of CAP water to the Schuk Toak District and the corresponding reduction in groundwater pumping.

Impacts of the alternatives on water quality are anticipated to be negligible. However, there is the potential for subsidence in the southern area due to substantial lowering of groundwater levels in this area under all alternatives.

Table L-Indian-24
CAP Allocation Draft EIS
TON, Schuk Toak[1]–Groundwater Data Table

Alternatives	Estimated Groundwater Decline from 2001 to 2051 (in Feet)	Groundwater Level Impact (in Feet)[2]
No Action	-153	--
Settlement Alternative	-149	4
Non-Settlement Alternative 1	-153	0
Non-Settlement Alternative 2	-150	3
Non-Settlement Alternative 3A	-150	3
Non-Settlement Alternative 3B	-150	3

(1) Corresponds to South Avra sub-area of Avra Valley analysis as discussed in Appendix I.
(2) Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

IV.D.4.b. San Xavier District

There is presently limited agricultural development in the San Xavier District, and a portion of the CAP water would be used to bring additional lands under production which are located west of the Santa Cruz River. Groundwater is contained in the basin fill materials, and groundwater generally occurs under unconfined conditions in the upper portions of these materials that would likely be developed in the San Xavier District. Groundwater levels have historically declined in this area in response to groundwater pumping.

The TDS concentration of groundwater underlying these lands is generally less than 500 ppm, although there are some pockets of groundwater on or near the District to the north and east with TDS concentrations in the range of 1,000 to 3,000 ppm.

Estimated groundwater level impacts are summarized in Table L-Indian-25, which shows the estimated change in groundwater levels from 2001 to 2051 for each alternative and the groundwater level impact (i.e., the difference between the change in groundwater levels for each alternative relative to the change for the No Action Alternative). Higher groundwater levels (relative to the No Action Alternative) are predicted for the Settlement and all Non-Settlement Alternatives.

The San Xavier District receives CAP water under all action alternatives except Non-Settlement Alternative 1, which is used to meet irrigation demands and for direct recharge. This results in a positive impact of 73 to 83 feet due to the additional CAP allocation received under those alternatives. The smaller positive impact for Non-Settlement Alternative 1 results from changes in underflow due to use and recharge of CAP water in adjacent areas.

Impacts of the alternatives on water quality are anticipated to be negligible, although the direct recharge of CAP water could increase TDS concentrations locally. Because groundwater levels would be expected to be improved by the alternatives, subsidence impacts are not expected.

Table L-Indian-25
CAP Allocation Draft EIS
TON, San Xavier[1]–Groundwater Data Table

Alternatives	Estimated Groundwater Decline from 2001 to 2051 (in Feet)	Groundwater Level Impact (in Feet)[2]
No Action	57	--
Settlement Alternative	139	83
Non-Settlement Alternative 1	64	7
Non-Settlement Alternative 2	130	73
Non-Settlement Alternative 3A	130	73
Non-Settlement Alternative 3B	137	81

(1) Corresponds to San Xavier East sub-area of Tucson analysis as discussed in Appendix I.
(2) Computed by subtracting the estimated groundwater decline from 2001 to 2051 for the No Action Alternative from the estimated change in groundwater level for the same period for the alternative under consideration. The estimated impact is considered to be more accurate than the estimated decline in groundwater levels.

IV.D.5. Socioeconomic

Historically, the TON farmed dry-land crops and relied on wild crops such as saguaro fruit, mesquite pods and cholla cactus flower buds. Federal, state and tribal agencies are the largest employers on the reservation. Cattle-raising and related activities form another major economic sector. Gaming was authorized in 1993 and the Desert Diamond Casino opened and created more than 500 jobs for TON members. In 1995 the facility was expanded. The TON has established an Industrial Park with a foreign trade zone. The agricultural, retail-tourism-gaming and utilities sectors of the reservation's economy are also expected to grow as tribal development plans are implemented. The Tohono O'odham Utility Authority along with the Arizona Tribal Coalition and others is developing a technology plan for the TON to connect schools and tribal offices to the internet.

Table L-Indian-26 summarizes the income statistics for the TON.

Table L-Indian-26
CAP Allocation Draft EIS
Income Statistics for Tohono O'odham Nation

Type of Income	Tohono O'odham Nation
Median Household Income	$11,402
Per Capita Income (Poverty Status)	$ 4,144
Persons Below Poverty	54%
Families Below Poverty	66%
Female Households, Families Below Poverty	61%
Households with Public Assistance Income	49%

Source: Bureau of the Census, 1990 Population and Housing Statistics

Under the No Action Alternative, the agricultural output of the San Xavier and Schuk Toak Districts combined is estimated to be $5.764 million in the year 2051. Under the Settlement Alternative and Non-Settlement Alternatives 2 and 3, these districts of the TON increase their agricultural output by an estimated $2.771 million above the No Action Alternative level in 2051. Non-Settlement Alternative 1 is estimated to have the same agricultural output as the No Action Alternative in year 2051.

APPENDIX O

STIPULATION FOR CAWCD V UNITED STATES

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

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DISTRICT OF ARIZONA
BY _____ DEPUTY

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ARIZONA

CENTRAL ARIZONA WATER CONSERVATION DISTRICT, a municipal corporation of the State of Arizona,

Plaintiff,

v.

UNITED STATES OF AMERICA, UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION; BRUCE BABBITT, Secretary of the Interior; PATRICIA J. BENEKE, Assistant Secretary of the Interior; ELUID L. MARTINEZ, Commissioner of Reclamation; ROBERT JOHNSON, Regional Director, Lower Colorado Region, United States Bureau of Reclamation,

Defendant.

No. CIV 95-625-TUC-WDB (EHC)

No. CIV 95-1720-PHX-EHC

(Consolidated Action)

ORDER

438

UNITED STATES OF AMERICA,

Counterclaimant,

v.

CENTRAL ARIZONA WATER CONSERVATION DISTRICT, a municipal corporation of the State of Arizona,

Counterdefendant.

This matter having come before this Court on the Joint Motion of CAWCD and the United States for Stay and Approval of Stipulation and having considered all of the files and records in this matter along with the matters discussed during the April 11, 2000 hearing on the motion and with counsel for the United States and the Central Arizona Water Conservation District ("CAWCD") having executed the Stipulation Regarding a Stay of Litigation, Resolution of Issues During Stay and for Ultimate Judgment Upon the Satisfaction of Conditions ("Stipulation") on May 2, 2000, and May 3, 2000, respectively, and with no party objecting and good cause appearing, IT IS HEREBY ORDERED, as follows:

1. The original Stipulation is ordered to be filed.

2. The above captioned case is stayed for a period of three years from the date of this Order, hereinafter "Expiration Date."

3. Pursuant to paragraph 8(e) of the Stipulation, during the period of the litigation is stayed, the Stipulation shall be effective as between the United States and CAWCD, and CAWCD and the United States shall operate and relevant payments and credits will be adjusted and made pursuant to the Stipulation. The parties' respective positions in the litigation will not be

prejudiced by CAWCD and the United States operating in accordance with the Stipulation while the litigation is stayed, if a settlement ultimately is not achieved. The Court shall, pursuant to the terms of the Stipulation, maintain jurisdiction over the administration of the Stipulation.

4. Upon the occurrence of all conditions within the Stipulation, the Parties shall notify the Court and move for the entry of final judgment consistent with the Stipulation. Objections to the entry of final judgment, if any, can be made in opposition to the motion.

5. If the conditions articulated within paragraph 8 of the Stipulation are not satisfied by the Expiration Date, the Stipulation will automatically terminate and litigation will resume as provided for in paragraph 8(f) of the Stipulation.

6. Pursuant to paragraph 8(f) of the Stipulation, either the United States or CAWCD may petition the Court to terminate the stay prior to the Expiration Date.

7. In the event that litigation resumes, no penalties will be assessed against CAWCD for any underpayments that might be determined to relate to the period from the date of this Order until litigation resumes or the Expiration Date, whichever occurs first.

8. To the extent required by Rule 2.7(b) of the Local Rules of Practice, during the period the litigation is stayed, all other relevant and operative provisions of the Stipulation not specifically mentioned herein are hereby approved and so ordered.

DONE IN OPEN COURT this 9 day of May, 2000.

Earl H. Carroll

The Honorable Earl H. Carroll
United States District Court Judge

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ARIZONA

CENTRAL ARIZONA WATER CONSERVATION DISTRICT, a municipal corporation of the State of Arizona, Plaintiff, v.	No. CIV 95-625-TUC-WDB(EHC) No. CIV 95-1720-PHX-EHC (Consolidated Action) STIPULATION REGARDING A STAY OF LITIGATION,

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UNITED STATES OF AMERICA, UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION; BRUCE BABBITT, Secretary of the Interior; PATRICIA J. BENEKE, Assistant Secretary of the Interior; ELUID L. MARTINEZ, Commissioner of Reclamation; ROBERT JOHNSON, Regional Director, Lower Colorado Region, United States Bureau of Reclamation, Defendants.	RESOLUTION OF ISSUES DURING THE STAY AND FOR ULTIMATE JUDGMENT UPON THE SATISFACTION OF CONDITIONS
UNITED STATES OF AMERICA Counterclaimant, v. CENTRAL ARIZONA WATER CONSERVATION DISTRICT, a municipal corporation of the State of Arizona, Counterdefendant.	

Plaintiff and Counter Defendant Central Arizona Water Conservation District ("CAWCD"), Defendants and Counterclaimants the United States of America, et al. ("United States"), and Intervenors the Tohono O'odham Nation, Cities of Phoenix, Tucson, Tempe, Scottsdale, Mesa, Peoria, Glendale, Chandler and Goodyear, and the Central Arizona Irrigation and Drainage District (hereinafter, collectively referred to as "Parties") agree that judgment may be entered in this action in accordance with the following Stipulation:

1. This Court has jurisdiction over the Parties and the subject matter of this action.

2. The First Claim for Relief in CAWCD's Complaint for Declaratory and Injunctive Relief ("Complaint") filed on or about July 10, 1995, in this action and the First Claim for Relief in the United States First Amended Counterclaim ("Counterclaim") filed on or about August 19, 1998, shall be resolved as follows:

(a) Notwithstanding the disputed provisions of Contract No. 14-06-W-245 entitled "Contract between the United States and the Central Arizona Water Conservation District for Delivery of Water and Repayment of Costs of the Central Arizona Project" dated December 1, 1988 ("1988 Contract"), CAWCD's repayment obligation for the Water Supply

System and the New Waddell and Modified Roosevelt Dams ("Regulatory Storage") Stages of the Central Arizona Project ("CAP") shall be fixed at $1,650,000,000, with annual payments to be made by CAWCD in conformance with the annual payment schedule set forth as Exhibit "A" hereto which is incorporated by reference herein as if set forth in full. The repayment obligation and Exhibit "A" are premised on a total allocation of 665,224 acre feet of Project Water for use by Indian tribes in Arizona.

(b) To the extent Congress provides appropriations therefor, the United States will bear the financial obligation of completing all remaining features of the Water Supply System and Regulatory Storage Stages of the CAP, including any and all environmental mitigation construction work necessary to comply with Biological Opinion Number 2-21-90-F-119, dated April 15, 1994, dealing with the Transportation and Delivery of Central Arizona Project Water, to the Gila River Basin (Hassayampa, Agua Fria, Salt, Verde, San Pedro, Middle and Upper Gila Rivers, and Associated Tributaries) in Arizona and New Mexico ("Gila River Biological Opinion"); and Biological Opinion Number 2-21-91-F-706, dated May 1999 (Draft), dealing with the Impacts of the Central Arizona Project (CAP) to Gila Topminnow in the Santa Cruz River Basin through Introduction and Spread of Nonnative Aquatic Species ("Santa Cruz Biological Opinion"), without any expenses being charged CAWCD except for those accounted for in Exhibit "A." Remaining features of the Water Supply System and Regulatory Storage Stages of the CAP to be completed shall be limited to those features identified in Exhibit "B" hereto which is incorporated by reference as if set forth in full. Exhibit "B" further identifies which remaining features of the Water Supply and Regulatory Storage Stages of the CAP will be completed by the United States and which will be completed, pursuant to subparagraph 6(c)(iii) of this Stipulation, by CAWCD. In the event that additional authorizations or appropriations are needed to capitalize or complete the items identified in Exhibit "B," then CAWCD agrees to support these authorizations and appropriations including any the Secretary may request for the capitalization and payment of environmental mitigation work identified in Exhibit "B." The $1,650,000,000 repayment obligation will not be adjusted regardless of the outcome of litigation dealing with either the Gila River Biological Opinion or the Santa Cruz Biological Opinion.

(c) In addition to the provisions of Article 9.3(e) of the 1988 Contract, CAWCD and the United States shall consult prior to the construction of any CAP feature, facility or stage, of which costs may be allocable to CAWCD, other than the Water Supply System Stage and the Regulatory Storage Stage, and, except as provided in Exhibit "B" hereto, about such construction, relevant costs and any cost allocation associated with that construction.

(d) Nothing herein is intended to preclude CAWCD from supporting or the Secretary from seeking authorizations and appropriations to cover all or part of the funds that may be necessary to pay for major replacements of CAP features or facilities.

(e) CAWCD agrees to support authorizations and appropriations the Secretary may request for CAP Indian distribution systems authorized pursuant to Section 301(a)(9) of the Colorado River Basin Project Act, 43 U.S.C. § 1521(a)(9).

3. The Second and Fifth Claim for Relief in the Complaint and the Second Claim for Relief in the Counterclaim shall be resolved as follows:

(a) Notwithstanding the 1988 Contract (Articles 9.1, 9.2(e), 9.3(d) and 9.10), the repayment schedule set forth in Exhibit "A" hereto shall constitute CAWCD's repayment obligation and all prior billings shall be recalculated and adjusted to reflect the payments provided for in Exhibit "A." These recalculations and adjustments, through the December 1999 bill, are shown on Exhibit "A-1" which is incorporated by reference as if set forth in full. In this recalculation and adjustment, bills have been calculated without penalties being assessed against CAWCD but with any over- or under-payments bearing interest at the Arizona State Treasury investment rates for relevant periods. Exhibit "A-1" also reflects appropriate recalculations and adjustments to account for the credits provided for in paragraph 6 of this Stipulation. To the extent that Exhibit "A-1" reflects a net credit to CAWCD following the January 2000 payment, that credit shall be carried forward with interest at the Arizona State Treasury investment rate and shall be applied to future Exhibit "A" payments due to the United States from CAWCD as needed after application of all revenues and credits described in subparagraph 6(c).

(b) Notwithstanding Article 9.3(d) of the 1988 Contract, 73% of the repayment obligation established in subparagraph 2(a) of this Stipulation shall be interest bearing, and 27%

shall be non-interest bearing. This agreed-upon interest bearing split is reflected in the payment schedule in Exhibit "A" and shall be in effect throughout the repayment period.

4. The Third and Fourth Claims for Relief in the Complaint and the Third and Fourth Claims for Relief in the Counterclaim shall be resolved as follows:

(a) The provisions of this paragraph of the Stipulation shall apply only to how CAWCD determines charges for delivery of Project Water under long-term contracts,[1] specifically: Fixed OM&R Costs and Charges and Pumping Energy Costs and Charges for providing Project Water service for any Indian Tribe or for any other Federal purpose. This paragraph shall not govern, in any way, how either Fixed OM&R Costs and Charges or Pumping Energy Costs and Charges are determined for any other purposes. If CAWCD uses an alternate method of calculating either Fixed OM&R Costs and Charges or Pumping Energy Costs and Charges which results in a lesser cost or charge (exclusive of any water service subcontract or water service capital charges) for Municipal and Industrial ("M&I") priority water or agricultural priority water under long-term subcontracts, then the lesser cost or charge will be billed instead of the costs or charges that would otherwise be billed under the provisions of this paragraph.

(b) For the purposes of this Stipulation, "Fixed OM&R Costs" shall mean: all expenses incurred by CAWCD for the care, operation, maintenance, and replacement of "Transferred Works" as defined in Article 5.18 of the 1988 Contract and identified pursuant to Article 6(a) of Contract No. 7-07-30-W0167, dated August 5, 1987 ("O&M Transfer Contract") (sometimes referred to as "OM&R-related activities") and for the transmission of energy necessary to deliver Project Water that are not otherwise included in Pumping Energy Costs. All costs incurred by Reclamation and reimbursed by CAWCD pursuant to paragraph 8.2.1 of the Operating Agreement attached hereto as Exhibit "C" and hereby fully

[1] As used in this Stipulation, a long-term contract or subcontract means one having a term that extends to 2043 or beyond and any contract or subcontract resulting from the transfer, assignment or lease of such contract or subcontract, or part thereof, or of a Project Water entitlement thereunder.

incorporated herein by reference[2] may be included in Fixed OM&R Costs as may the costs in excess of the funds provided in subparagraph 6(e)(ii) of establishing a reserve to cover the costs associated with major repair or replacement of CAP features. CAWCD shall use its business judgment to allocate joint costs that support both OM&R-related activities and other activities and may include in Fixed OM&R Costs only the portion of joint costs allocable to OM&R-related activities. "Fixed OM&R Charge" shall mean the charge per acre-foot of Project Water imposed by CAWCD each year for the recovery of the Fixed OM&R Costs of water deliveries.

(c) "Pumping Energy Costs" shall mean all of CAWCD's costs for the generation or acquisition of energy necessary to deliver Project Water each year. "Pumping Energy Charge" shall mean the charge per acre-foot of Project Water imposed by CAWCD each year for the recovery of the Pumping Energy Costs of water deliveries.

(d) Pursuant to subparagraph 4(a) above, CAWCD shall annually in advance of Project Water deliveries determine the Fixed OM&R Charge and Pumping Energy Charge for Project Water service for the following year.

(i) CAWCD's Fixed OM&R Charge shall not be more than the amount determined by dividing CAWCD's estimated Fixed OM&R Costs for the following year by the total amount of Project Water that CAWCD estimates will actually be delivered through Project Works in the following year.

(ii) CAWCD's Pumping Energy Charge shall not be more than the amount determined by dividing CAWCD's estimated Pumping Energy Costs for the following year by the total amount of Project Water that CAWCD estimates will actually be delivered through Project Works in the following year.

(iii) Without regard to any prior year's adjustment as may be provided in subparagraphs 4(e) and (f) below, charges for any delivery of Project Water for Federal purposes shall be no more than the sum of the Fixed OM&R Charge and the Pumping Energy Charge as defined in subparagraphs 4 (b) and (c) herein.

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[2] The exhibits and attachments to the original Exhibit C, as executed by the United States and CAWCD are not appended to Exhibit C hereto.

(e) All past fixed OM&R and pumping energy charges paid by the United States on behalf of the Ak-Chin Indian Community, for Roosevelt Dam construction, and for San Carlos Apache Tribe/Phelps Dodge exchange water shall be fairly reconciled with actual past fixed OM&R and pumping energy costs and shall not include the costs in paragraph 14 below nor shall it include the costs of establishing a reserve to cover the costs associated with the major repair or replacement of CAP features referred to in subparagraph 4(b) above, with overpayments bearing interest at the Arizona State Treasury investment rate for the relevant periods, being credited against future charges for deliveries for Federal purposes beginning with amounts due in the year 2001 or refunded at United States option. The accounting methodology used in performing the foregoing reconciliation will be consistent with the methodology used in the applicable years to assess the charge. CAWCD will provide the United States an accounting of the adjustment. Any disputes over the reconciliation dealt with in this subparagraph shall be dealt with pursuant to the ADR procedures set forth in paragraph 11 herein.

(f) To the extent Congress provides appropriations therefor, the United States shall, in advance of Project Water deliveries, pay or provide for payment of all Fixed OM&R Charges and Pumping Energy Charges associated with the delivery of Project Water, whether directly or by exchange, for use by any Indian tribe or its lessees or for any other Federal purpose. CAWCD shall bill the United States for such Charges monthly, based upon CAWCD's annual estimates of these Charges and annual water delivery schedules. The United States shall pay or provide for payment within 30 days of billing. The payment of such Charges directly to CAWCD by lessees or other entities shall discharge, to the extent of the payments made, the obligation of the United States. Within 30 days of the completion of audited financial statements each year, but in no case later than May 30, CAWCD shall adjust Fixed OM&R Charges and Pumping Energy Charges to reflect actual Fixed OM&R Costs and Pumping Energy Costs, with overpayments refunded to or underpayments paid by the United States within 30 days of the recalculation. CAWCD will provide the United States an accounting of the adjustment. The first adjustment shall be in 2001 for charges assessed in the year 2000.

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(g) The United States annually shall have the right, upon 90 days advance written notice, to audit CAWCD's administration of Fixed OM&R and Pumping Energy Costs and Charges. In the case of a dispute over the type of charge or the amount that is billed, the United States shall pay or provide for payment of the full amount billed, but shall do so under protest and CAWCD and the United States shall follow the ADR procedures set forth in paragraph 11 herein.

(h) In those situations in which a lessee of Project Water under contract to an Indian tribe has an obligation to pay Fixed OM&R Charges or Pumping Energy Charges associated with the delivery of Project Water, whether directly or by exchange, nothing herein shall relieve such lessee from the obligation to pay such charges. The United States shall direct such lessee to pay all such charges directly to CAWCD. Nothing herein shall waive any right of the United States to repayment of Fixed OM&R Charges or Pumping Energy Charges from any Indian tribe where an obligation exists for such tribe to pay its own Fixed OM&R Charges or Pumping Energy Charges. Nothing herein is intended to create an obligation on the part of the United States to pay for a lessee where that obligation does not otherwise exist.

5. The Fifth and Sixth Claims for Relief in the Counterclaim shall be resolved as follows:

(a) For purposes of this Stipulation, "Project Water" shall mean:

(1) all Colorado River water to which Arizona is entitled under the U.S. Supreme Court decree in *Arizona v. California* that the CAP Water Supply System is capable of delivering:

(i) after first providing for satisfaction of those rights described in Article 8.7(b)(i) and (ii) of the 1988 Contract, and

(ii) subject to the provisions of Article 8.7(c) of the 1988 Contract;

(2) water available from Central Arizona Project dams and reservoirs;

(3) return flows captured by the Secretary for Project use;

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(4) water delivered to water users in Arizona, through the Project Works, in exchange for water delivered to users in New Mexico from or by means of the Project Works;

(5) Colorado River water acquired from the Yuma Mesa Division of the Gila Project pursuant to the Ak-Chin Water Rights Settlement Act of 1978 (Public Law 95-328), as amended on October 19, 1984 (Public Law 98-530);

(6) Colorado River water acquired from the Wellton-Mohawk Irrigation District pursuant to the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act of 1988 (Public Law 100-512); and

(7) any additional water not included in (i) or (ii) above that is required to be delivered by the Secretary through Project Works pursuant to the Southern Arizona Water Rights Settlement Act of 1982 (Title III of Public Law 97-293) or pursuant to any subsequent act of Congress.

(b) For purposes of this Stipulation, the water supply associated with modification of Roosevelt Dam shall not be counted as Project Water.

(c) CAWCD shall be entitled to divert all Project Water for the benefit of Project Water users.

(d) Excess Water shall be dealt with as follows:

(1) "Excess Water" is all Project Water that is in excess of the amounts used, resold, or exchanged pursuant to long-term contracts and subcontracts for Project Water service.

(2) CAWCD shall have the exclusive right in its discretion to sell or use all Excess Water for any authorized purpose of the CAP.

(3) Excess Water shall be delivered through Project Works for use on Indian lands or non-Indian lands directly or by exchange as permitted by law.

(4) Contracts for the sale or use of Excess Water under this paragraph may be made pursuant to multi-year programs established by CAWCD. Such contracts shall not exceed a term of one year, but may contain a provision for automatic renewal without further

action by the parties thereto. Such automatic renewal shall not give rise to a right in any subsequent year to receive Excess Water, nor preclude future long-term contracts or subcontracts nor limit the terms thereof, including in implementation of Indian water right settlements up to a total for all long-term contracts and subcontracts of 1.415 million acre-feet. By its terms, Subarticle 8.8(b) of the 1988 Contract does not apply to contracts for Excess Water service under this paragraph; however, such contracts entered into after the filing of this Stipulation shall comply substantially with the provisions of Subarticles 8.8(b)(i), 8.8(b)(ii), 8.8(b)(iii), 8.8(b)(iv), 8.8(b)(viii) and 8.8(b)(x). Pursuant to 43 U.S.C. § 1524(b)(1), all contracts that conform to the provisions of this paragraph shall be deemed approved by the Secretary. The Secretary must be a party to or must expressly approve all contracts for Project Water service other than those which conform to the provisions of this paragraph.

(5) CAWCD may, at its discretion, establish programs for the sale of Excess Water under this paragraph that provide for various categories and charges for Excess Water. Through 2030, in any year in which Excess Water is offered for sale under this paragraph, any Indian contractor of Project Water service or the United States shall have the right to purchase Excess Water from any Excess Water category not established exclusively for the use of non-Indian agriculture or the Arizona Water Banking Authority, at the same charge and upon the same terms and conditions as for other users in that category. Any water available within an exclusive category that is not fully used by eligible participants in that category shall be made available to other Excess Water categories. After 2030, in any year in which Excess Water is offered for sale under this paragraph, any Indian contractor of Project Water service or the United States shall have the right to purchase Excess Water from any Excess Water category at the same charge and upon the same terms and conditions as for other users in that category.

(6) Nothing in this paragraph shall preclude the United States or any Indian tribe from entering into a contract with the Arizona Water Banking Authority.

(7) Excess Water purchased under this paragraph may not be resold or transferred, except that a purchaser may enter into an arrangement with a groundwater savings facility allowed under state law to store Excess Water.

(8) This paragraph does not constitute or require approval by the Secretary of any particular Excess Water program.

6. The Fifth Claim for Relief in the Complaint is further dealt with and the Seventh, Eighth, Ninth, Tenth, Eleventh, and Twelfth Claims for Relief in the Counterclaim are resolved as follows:

(a) The Lower Colorado River Basin Development Fund ("LBDF"), established pursuant to Section 403 of the Colorado River Basin Project Act, 43 U.S.C. § 1543, shall be administered, and past accountings adjusted as follows:

(i) Exhibit "A-1" reflects a credit of $127,772,946 for all past payments made by CAWCD pursuant to annual billings issued by the United States since 1993.

(ii) Exhibit "A-1" reflects a credit in the amount of $31,678,364 for CAWCD's advance of funds for the United States' purchase of the Harquahala Valley Irrigation District's CAP allocation for use in Indian water rights settlements.

(iii) Exhibit "A-1" reflects credits totaling $35,942.266 for expenditures made through December 31, 1999 by CAWCD to correct CAP construction deficiencies.

(iv) Exhibit "A-1" reflects a credit in the amount of $2,969,251 for the value of CAWCD's unreimbursed employee-related costs accrued prior to 1994.

(v) Exhibit "A-1" reflects a credit in the amount of $112,999,485 for revenues credited to or deposited in the LBDF from the sale of Navajo Surplus Power through December 31, 1999.

(vi) Exhibit "A-1" reflects credits totaling $32,193,263 for revenues credited to or deposited in the LBDF associated with the Hoover 4.5-mill surcharge through December 31, 1999.

(vii) Exhibit "A-1" reflects credits totaling $599,000 for net miscellaneous revenues credited to or deposited in the LBDF through December 31, 1999.

(viii) Exhibit "A-1" reflects offsets totaling $1,238,600 for Reclamation oversight costs except for those described in paragraph 14 below.

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(b) The amounts set forth in subparagraph 6(a) above shall remain subject to verification and audit for a period of one year from the date of this Stipulation, and CAWCD and the United States shall work diligently with each other to complete this verification within this period of time. In the event of a dispute associated with these verifications and audits, the parties shall follow the ADR procedures set forth in paragraph 11.

(c) The LBDF shall be further administered as follows:

(i) All power revenues, net of generation and associated administrative costs, including all revenues from Navajo Surplus Power sales (other than those pledged to the payment of bonds issued by CAWCD and except as provided in subparagraph 6(e)(ii) hereof), the Hoover 4.5-mill surcharge,[3] and, after June 1, 2005, the Parker Davis 4.5-mill surcharge, shall be placed in the LBDF and credited, in the relevant years, against future Exhibit "A" payments due to the United States from CAWCD prior to their utilization for any other purpose.

(ii) All miscellaneous CAP revenues shall be credited, in relevant years, against future Exhibit "A" payments due to the United States from CAWCD, including, but not limited to, all revenues from the use, rental, sale, exchange or inter-agency or inter-governmental transfer of CAP lands or other property. In the case of exchanges or inter-agency or inter-governmental transfers of real property, credits for transactions which take place after the date of the execution of this Stipulation shall equal the greater of cost or the fair market value of such land or property at the time of the exchange. Fair market value will be determined by independent appraisal funded out of proceeds of the sale or, if no sale takes place, funded as reimbursable oversight costs. Where reimbursable costs are not associated with the acquisition of property, then the provisions of this subparagraph shall not apply to the disposal of that property but, rather, the statutory provisions associated with the acquisition and disposal of that property shall govern how the value of that property shall be accounted for.

(iii) A credit against Exhibit "A" payments due to the United States from CAWCD shall be made annually based upon the agreed-upon costs associated with the agreed

[3] This subparagraph does not apply to the 2.5-mill surcharge to purchasers in California and Nevada.

work undertaken by CAWCD, pursuant to Exhibit "B," to further correct CAP construction deficiencies. Any recoveries on claims made by the United States against CAP siphon construction related contractors shall be divided 35% to CAWCD and 65% to the United States. CAWCD's share of such recoveries, if any, shall be applied as a credit against the Exhibit "A" payments due to the United States from CAWCD. The United States share of such recoveries, if any, shall not be available for credit against Exhibit "A" payments due to the United States from CAWCD. Notwithstanding the foregoing, all decisions regarding claims including litigation and settlement against CAP siphon construction contractors shall be within the sole discretion of the United States and shall not be subject to challenge by CAWCD. However, the United States shall consult with CAWCD regarding proposed settlement of such claims.

(iv) The United States shall apply all revenues described in paragraphs 6(c)(i) and 6(c)(ii) against the current Exhibit "A" payment due to the United States from CAWCD before applying any of the credits described in paragraph 6(c)(iii). To the extent that any of the credits described in paragraph 6(c)(iii) are not needed to satisfy the current year's Exhibit "A" payment due to the United States from CAWCD, those excess credits shall be carried forward for application against future Exhibit "A" payments due to the United States from CAWCD until exhausted, with such excess credits bearing interest at the Arizona State Treasury investment rate.

(d) Costs associated with the miscellaneous revenues addressed in subparagraph 6(c)(ii) shall be billed as part of the work plan referred to in Exhibit "C." In the event of a dispute with respect to the billing provided for herein, CAWCD and the United States shall follow the ADR procedures set forth in paragraph 11.

(e) (i) Nothing in this Stipulation shall affect the establishment, collection, payment and application of the Additional Rate Component charged for Navajo Surplus Power and used for the payment of bonds previously issued by CAWCD (hereinafter "Outstanding Bonds"). CAWCD and the United States acknowledge that the amounts collected from such Additional Rate Component are properly held by the Trustee designated by CAWCD and

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properly used to pay debt service, costs, and rebate obligations associated with such Outstanding Bonds and to fund reserves therefor.

(ii) Except as expressly provided in this subparagraph (ii), nothing in this Stipulation shall affect the establishment, collection, payment and application of the Capacity Charge (including the Additional Rate Component) charged for Navajo Surplus Power (the "Capacity Charge") as provided in the following documents: Reclamation Agreement No. O-CS-30-P1076, as amended by the First Amendment thereto (as amended, the "Interagency Agreement"); Contracts Nos. 89-BCA-10287 and 91-PAO-10404 for Long Term Sale of Navajo Surplus Power (collectively, the "Power Sales Contracts"), the Bond Indenture dated as of May 1, 1990, by and between CAWCD and Citibank (Arizona) as trustee (together with its successors, the "Bond Trustee"), as amended by the First Supplement to Bond Indenture dated as of March 1, 1993, by and between CAWCD and the Bond Trustee, and the Bond Indenture dated as of August 1, 1991, by and between CAWCD and the Bond Trustee, as supplemented by the First Supplement to Bond Indenture dated as of February 1, 1994, by and between CAWCD and the Bond Trustee (collectively, the "Bond Indentures"). This Stipulation does not impose on the United States and the United States does not hereby assume any obligations under the Bond Indentures. Notwithstanding the provisions of the Bond Indentures and the Interagency Agreement, all revenues from the Capacity Charge and all monies held by the Bond Trustee under the Bond Indentures, to the extent such revenues and monies are not necessary to pay debt service, costs, or rebate obligations associated with Outstanding Bonds or to fund reserves therefor, may be paid, at CAWCD's option and in lieu of payment to Reclamation for deposit in the LBDF, to CAWCD to be used by CAWCD solely to establish a reserve to cover the costs associated with major repair or replacement of CAP features. To accomplish this result, the Bond Trustee may be directed by CAWCD to pay such amounts directly to CAWCD from time to time and, whenever it is no longer necessary to have the Capacity Charge paid to the Bond Trustee under the Bond Indentures, CAWCD may designate itself or any institutional trustee acting on CAWCD's behalf, as trustee to receive the Capacity Charge. In consideration for this, CAWCD shall pay the United States $12,000,000 on or before December 31, 2011,

which payment shall be applied as a prepayment of the last $12,000,000 due of the non-interest bearing portion of CAWCD's Exhibit "A" Repayment Obligation. The foregoing applies only to revenues from the sale of Navajo Surplus Power prior to October 1, 2011.

(f) CAWCD shall annually have the right, upon 90 days advance written notice, to audit the United States administration of the LBDF. To the extent that a dispute arises over how the United States administers the LBDF, and no mutually agreeable resolution can be achieved, CAWCD and the United States shall follow the ADR procedures set forth in paragraph 11 herein.

(g) (i) CAWCD will pay administration, oversight and OM&R costs billed by the United States as provided in the Operating Agreement (Exhibit "C").

(ii) CAWCD will not dispute the categories of costs specified in paragraph 8.3 of the Operating Agreement, but may dispute the amount of such costs billed by the United States. CAWCD may dispute any cost billed that is not within the category of costs specified in paragraph 8.3 of the Operating Agreement. If a bill is disputed, CAWCD shall, after noting its protest, nonetheless pay the disputed bill, and CAWCD and the United States shall follow the ADR procedures set forth in paragraph 11 below with respect to the disputed bill. If CAWCD fails to pay the full amount billed, and the United States prevails, in whole or in part, in the ADR process or in litigation, CAWCD shall pay or lose credit in the applicable amount with interest and/or penalties provided for in Article 9.10 of the 1988 Contract. If CAWCD prevails, in whole or in part, in the ADR process or in litigation, the United States shall repay or credit CAWCD with the full amount awarded plus interest at the Arizona State Treasury investment rate for relevant periods.

(h) Beginning January 1, 2000, net revenues in the LBDF that are available as a credit toward CAWCD's repayment obligation shall be accounted for and quantified by Reclamation on a quarterly basis. On the first day of each quarter following the receipt of the revenues, Reclamation shall calculate an offsetting credit calculated at 1/4 of 3.342% (simple interest) on the prior quarter's collected revenues. The additional offsetting credit shall be recorded at the end of each quarter. Reclamation shall provide CAWCD a quarterly report of

LBDF revenues and credits calculated under this paragraph. Each year the accumulated balance of the additional offsetting credit, if any, shall be applied against the annual payment due on the following January 15. The offsetting credits dealt with in this subparagraph 6(h) are for the purpose of offsetting interest, if any, that would otherwise be due from CAWCD. The offsetting credits shall have no effect on the principal payments that are otherwise due from CAWCD.

(i) Article 10.3 of the 1988 Contract requires the establishment of certain reserve funds. Article 10.3(a) provides for the establishment of a $4,000,000 emergency OM&R reserve fund. Article 10.3(b) provides for the establishment of a $40,000,000 repayment reserve fund. Notwithstanding the limitations on the utilization of the reserve funds that may otherwise exist in the 1988 Contract, CAWCD may, at its reasonable discretion, utilize monies in either fund for the purpose of meeting the purposes identified in Article 10.3(a)(iv) of the 1988 Contract.

7. CAWCD and the United States have executed an Operating Agreement (Exhibit "C") setting forth the terms and conditions for performing OM&R-related activities.

8. (a) As a condition to the effectiveness of this Stipulation, the following shall have been addressed, in a manner satisfactory to the Secretary[4] and the Arizona Department of Water Resources, including any necessary actions by Congress:

(i) a final Gila River Indian Community water rights settlement fully enforceable in accordance with the enforceability date provisions of such settlement;

(ii) an amendment to the Southern Arizona Water Rights Settlement Act of 1982 fully enforceable in accordance with the enforceability date provisions of such amendment;

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[4] Any settlement referenced herein involving ongoing litigation shall also be subject to the Attorney General's authority under 28 U.S.C. § 519.

(iii) a final San Carlos Apache Tribe water rights settlement fully enforceable in accordance with the San Carlos Apache Tribe Water Rights Settlement Act of 1992, P.L. 102-575, 106 Stat. 4740, as amended in 1994, 1996 and 1997, and the enforceability date provisions of such settlement;

(iv) the allocation of Project Water for use by Indian tribes in Arizona such that the total amount allocated for Federal purposes shall be 665,224 acre feet; and

(v) 65,647 acre feet of M&I Project Water and approximately 100,000 acre feet of non-Indian agricultural Project Water shall be or shall have been allocated to or for the benefit of various Arizona M&I or non-Indian agricultural water providers.

(b) As a condition to the effectiveness of this Stipulation, any authorizations or appropriations necessary to fund construction work as set forth in Exhibit "B" to comply with the Gila River Biological Opinion and the Santa Cruz Biological Opinion have been obtained from Congress. Nothing in this Stipulation is intended to prejudice the positions of CAWCD or the United States in any litigation associated with these biological opinions.

(c) As a condition to the effectiveness of this Stipulation, the United States shall amend the Navajo Power Marketing Plan of December 1, 1987 ("Plan") to provide for the establishment and collection of rates for the sale or exchange of Navajo Surplus Power after September 30, 2011, which optimize the availability and use of revenues for the purposes of subparagraphs 6(c) and 8(d), in a manner consistent with the Hoover Power Plant Act of 1984 (Pub. L. No. 98-381), and shall market and exchange Navajo Surplus Power after September 30, 2011, in accordance with such amended Plan.

(d) (i) As a condition to the effectiveness of this Stipulation, Congress shall have provided in a manner satisfactory to the Secretary, the Attorney General and CAWCD a means by which:

(1) A firm funding stream not to exceed the annual amount of LBDF revenues previously credited against CAWCD's annual Exhibit "A" repayment obligation is available for, in order of priority:

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(i) First, for Fixed OM&R Charges under long-term contracts payable by the United States pursuant to subparagraph 4(f) and subject to subparagraph 4(h);

(ii) Second, for costs authorized by Congress to be paid to the Gila River Indian Community pursuant to the Gila River Indian Community water rights settlement;

(iii) Third, in addition to funds made available through annual appropriations, for any of the following, without regard to any particular priority:

1) After enactment of the Gila River Indian Community Settlement Act, costs associated with the construction of distribution systems associated with the Gila River Indian Community's Master Contract with the United States for Repayment of Construction Costs and Operation, Maintenance and Replacement of A Water Distribution System (#6-07-30-W0345) dated July 20, 1998;

2) Costs associated with the construction of distribution systems required to implement the provisions of § 3707(a)(1) of the San Carlos Apache Tribe Water Rights Settlement Act of 1992 (Pub. L. No. 102-575, 106 Stat. 4740 as amended);

3) Costs associated with construction of distribution systems required to implement the provisions of §§ 303(a)(1) and (2) of the Southern Arizona Water Rights Settlement Act of 1982 (Pub. L. No. 97-293, 96 Stat. 1279); and

4) Other costs authorized by Congress (including any costs to construct distribution systems but not including costs otherwise payable by non-Federal, non-Indian parties) pursuant to any Arizona Indian water rights settlement act enacted after the date of this Stipulation. It is understood, however, that the actual terms of any such settlement will need to be negotiated by the current or a future Administration and subsequently enacted or amended by Congress on a case-by-case basis.

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(iv) Fourth, in addition to funds made available through annual appropriations, for costs associated with the construction of on-reservation facilities enabling the following tribes to use the CAP water for which they have contracted: Yavapai Apache (Camp Verde), Tohono O'odham Nation (Chuichu), Pascua Yaqui, and Tonto Apache; *Provided,* that in the event of a water rights settlement act authorizing such construction in the case of any of the foregoing tribes, the provisions of subparagraph 8(d)(i)(1)(iii) above shall apply to such tribe or tribes; *Provided further* that, after 2030 and through 2046, any of the foregoing tribes not having facilities enabling them to use the CAP water for which they have contracted or a final water rights settlement act may elect, in lieu of any construction funding by the United States, annual cash payments equal to the average price of any Excess Water sold annually under paragraph 5 above multiplied by the total amount of such Excess Water sold or the unused CAP water contract entitlement of such tribe or tribes, whichever is less.

(2) Any annual revenues within the LBDF, except for revenues derived from the Capacity Charge described in subparagraph 6(e)(ii), that are in excess of what is needed to satisfy CAWCD's annual Exhibit "A" repayment obligation may be used to pay, in order of priority:

(i) Fixed OM&R Costs associated with delivery of CAP water in the current year to Indian tribes under long-term contracts;

(ii) One year of "tail end" prepayment, starting with repayment of non-interest bearing debt, of CAWCD's Exhibit "A" repayment obligation;

(iii) Repayment to the U.S. Treasury of Indian Fixed OM&R Costs previously paid using LBDF revenues that had already been credited against CAWCD's Exhibit "A" repayment obligation;

(iv) Repayment to the U.S. Treasury of costs associated with any Indian water rights settlement previously paid using LBDF revenues that had already been credited against CAWCD's Exhibit "A" repayment obligation;

(v) Payment of any annual installment on any CAP-related 9(d) debt (43 U.S.C. § 485(d)) assumed by the United States; and

(vi) Payment to the U.S. Treasury of the difference between CAWCD's $1,650,000,000 repayment obligation and the result of any CAP cost allocation undertaken by the United States for the Water Supply System and Regulatory Storage Stages of the CAP.

(ii) Reclamation will provide CAWCD an annual accounting of its uses of LBDF revenues under this subparagraph 8(d).

(iii) If for whatever reason a final judgment is not entered into in accordance with this Stipulation then the provisions of this subparagraph shall have no effect and shall not govern the utilization of LBDF revenues. To satisfy this condition, any legislation enacted by Congress must provide that the authority to use LBDF revenues as described herein shall not be effective if a final judgment is not entered in accordance with this Stipulation.

(e) From the date of this Stipulation until litigation resumes or the Expiration Date, whichever occurs first, CAWCD and the United States will operate and relevant payments and credits will be adjusted and made pursuant to this Stipulation. Neither CAWCD nor the United States shall have waived any of the conditions set forth in this paragraph by any action or inaction pursuant to this Stipulation prior to all of the conditions having occurred. Until all of the conditions have occurred, any payment, credit or adjustment made or accepted pursuant to this Stipulation shall be without prejudice to any claim or cause of action of CAWCD or the United States existing prior to the date of this Stipulation. In the event that these conditions are not satisfied and litigation resumes pursuant to subparagraph 8(f) of this Stipulation, then no penalties will be assessed against CAWCD for any underpayments that might be determined to relate to the period from the date of this Stipulation until litigation resumes or the Expiration Date, whichever occurs first. The Arizona State Treasury investment rate shall apply to any over or underpayments during such period.

(f) As noted above, the provisions of this paragraph are a condition to the effectiveness of this Stipulation. They are, however, not intended to, in any way, control the actions of the Secretary or any other Party. The Court shall maintain jurisdiction over the administration of this Stipulation until such time as these conditions are met. Upon the

occurrence of all conditions within this Stipulation, the Parties shall notify the Court and move for entry of a final judgment consistent with this Stipulation. This Stipulation shall be effective on the entry of such final judgment ("Effective Date"). If all conditions within the Stipulation are not met prior to the date that is three years from the date of this Stipulation ("Expiration Date"), this Stipulation shall terminate automatically, and except for the last two sentences of subparagraph 8(e) above regarding non-assessment of penalties, no party shall be bound by any of its terms. If, at any time it appears that all conditions within this Stipulation cannot be met before the Expiration Date, the Parties shall meet and confer about amending this Stipulation. However, absent agreement on an amendment to this Stipulation, either CAWCD or the United States may petition the Court to terminate the Stipulation prior to the Expiration Date, and, upon the granting of that petition, the litigation shall resume. Matters resolved through decision of this Court at the time this Stipulation is filed shall be considered "law of the case" and shall not be relitigated. All appeal rights are reserved, including the United States appeal in *Central Arizona Water Conservation District v. United States*, No. 99-15124 (9th Cir.).

(g) As noted in subparagraph 2(a) and elsewhere herein, the Exhibit "A" repayment obligation is predicated upon the premise that a total of 665,224 acre feet of Project Water has been allocated for Federal purposes. In the event there is a change in the amount of Project Water allocated for Federal purposes from that assumed herein, CAWCD and the United States will meet and confer with respect to any appropriate adjustment to Exhibit "A." In the event that there is a dispute between the parties or over the amount of any such adjustment, then CAWCD and the United States will follow the ADR procedures set forth in paragraph 11 below.

9. Upon the Effective Date, all claims for relief raised by Intervenors in this case are deemed to be fully resolved in accordance with the provisions of this Stipulation. Subject to paragraph 8 of this Stipulation, the United States withdraws its objections filed in the bankruptcy action involving Intervenor Central Arizona Irrigation and Drainage District.

10. (a) Upon the Effective Date, all matters within the Complaint and Counterclaim not specifically mentioned herein are dismissed with prejudice, and the final judgment entered pursuant to subparagraph 8(f) is binding upon all Parties.

(b) Upon the Effective Date, for and in consideration of CAWCD performing its obligations under this Stipulation, the fact and sufficiency of which are hereby acknowledged, the United States releases and forever discharges CAWCD, its present and former officers, directors, employees, agents, attorneys, advisors, representatives, and their respective successors and assigns from any and all claims, demands, rights, and causes of action of whatsoever kind and nature, whether known or unknown, which the Department of the Interior may have against CAWCD on account of the claims for relief in the Complaint and Counterclaim. This release does not apply to claims arising under criminal or tax law, claims sounding in fraud, or the claims of any United States Government agency other than the Department of the Interior.

(c) Upon the Effective Date, for and in consideration of the United States performing its obligations under this Stipulation, the fact and sufficiency of which are hereby acknowledged, CAWCD releases and forever discharges the United States and all Federal Defendants, their present and former officers, employees, agents, attorneys, advisors, representatives, and their respective successors and assigns from any and all claims, demands, rights, and causes of action of whatsoever kind and nature, whether known or unknown, which CAWCD may have against the United States and all Federal Defendants on account of the claims for relief in the Complaint and Counterclaim.

(d) Upon the Effective Date, in accordance with 28 U.S.C. § 2672, this Stipulation is final and conclusive upon CAWCD and constitutes a complete release of any claim by CAWCD against the United States and any employee of the United States whose act or omission gave rise to CAWCD's Federal Tort Claims Act claim, dated January 24, 1992, by reason of the same subject matter. It is further agreed that, as of the Effective Date, this Stipulation constitutes a complete and final settlement of all claims for relief asserted by CAWCD in *Central Arizona Water Conservation District v. United States*, Case Number 92-51C, in the United States Court of Federal Claims.

(e) CAWCD agrees to reimburse, indemnify and hold harmless the United States, its agents, servants, and employees from and against any and all causes of action, claims, liens, rights, or subrogated or contribution interests incident to or resulting from any act,

omission, neglect, or misconduct of CAWCD or its employees in the manner or method of performing any construction, care, operation, maintenance, supervision, examination, inspection, or other duties of CAWCD in order to undertake activities set forth in Exhibit "B."

(f) Notwithstanding subparagraphs 10(b), (c) and (d) above, and except as provided in subparagraph 10(e) above, the releases contained in this Stipulation shall not apply to third party claims that have been made or that may be made in the future against CAWCD or the United States alleging personal injury, death or property damage caused by the design, construction or operation of the CAP. CAWCD and the United States reserve all rights and defenses with regard to such third party claims. It is further agreed that the releases contained in this Stipulation do not modify or affect the provisions of Article 6(f) of the O&M Transfer Contract or section 8 of Exhibit A to the O&M Transfer Contract.

(g) This Stipulation is not intended to be, and should not be construed as, an admission of liability or fault on the part of CAWCD or the United States, their agents, servants, officers, directors, or employees, and they specifically deny that they are liable to one another except as provided herein. This Stipulation is entered into by all Parties for the purpose of compromising disputed claims and avoiding the expenses and risks of further litigation.

(h) The persons signing this Stipulation warrant and represent that they possess full authority to bind the Parties on wbose behalf they are signing to the terms of the settlement.

11. The following non-binding ADR process shall be followed for any dispute arising under subparagraphs 4(e), 4(g), 6(b), 6(f), 6(g) and 8(g) of this Stipulation:

(a) CAWCD and the United States shall meet and confer about the issue or issues in an attempt to resolve the dispute. If there are issues that cannot be resolved by CAWCD and the United States, eacb shall appoint one arbitrator to a panel of arbitrators which will decide the dispute. The appointment of the two arbitrators will occur within 30 days of the meeting referred to above.

(b) Arbitrators appointed to the arbitration panel shall be skilled and experienced in the field or fields pertaining to the dispute. The two selected arbitrators shall meet within 30 days of their appointment, and at their first meeting they shall appoint a third neutral arbitrator

to complete the arbitration panel. The third arbitrator shall act as chairperson of the arbitration panel and shall direct the arbitration proceedings.

(c) The arbitration process shall be limited to the issue or issues submitted by CAWCD or the United States. The arbitration panel shall not rewrite, amend, or modify this Stipulation, the 1988 Contract, the Operating Agreement, or any other agreement or contract between the Parties.

(d) There shall be no discovery beyond the information and documents made available during the informal meet and confer process provided for in subparagraph 11(a) and the general exchange or availability of records provided for within the 1988 Contract.

(e) No formal evidentiary hearing shall be provided unless one is requested by either CAWCD or the United States in writing, at the same meeting that the neutral arbitrator is appointed. Assuming that no hearing has been requested, the arbitration panel will meet as deemed necessary by the panel and shall, in a manner it deems appropriate, receive evidence, receive argument or written briefs from CAWCD and the United States, and otherwise gather whatever information is deemed helpful by the panel. The arbitration process to be followed shall be informal in nature, and CAWCD and the United States shall not be entitled to trial-type proceedings under, for example, formal rules of evidence.

(f) In the event that either CAWCD or the United States requests a hearing, the arbitration panel shall meet to receive evidence, receive argument and written briefs from CAWCD and the United States as follows:

(i) The arbitration panel shall, within 5 days of the appointment of the neutral arbitrator, schedule a date for a hearing which shall be held within 20 days of the appointment of the neutral arbitrator.

(ii) Within 10 days of the appointment of the neutral arbitrator, CAWCD and the United States shall each submit a brief of no longer than 15 pages setting forth its case. The brief shall include discussion of all issues relevant to the party's case. Each party shall, as an attachment to its brief, include declarations of not more than two experts and any relevant factual witness. Declarations of expert witnesses must include all opinions to be elicited upon

direct testimony and a complete explanation of the basis of these opinions. Disputes with respect to the sufficiency of declarations or the appropriateness of the testimony shall be resolved by the arbitration panel who may allow the testimony or exclude it. All expert witnesses must be available for cross-examination at the time of the arbitration hearing. Factual witnesses for which a declaration is prepared shall be made available for cross-examination at the time of the arbitration hearing only if requested by the other party.

(iii) Each party shall have the opportunity, within 5 days of the close of hearing, to submit a closing brief not to exceed 10 pages. The closing brief shall be argument with no additional factual evidence to be submitted.

(iv) There shall be no testifying witness on direct except for expert witnesses, if any.

(v) Each party shall have a maximum of four hours to present its case in total. This time shall include opening and closing statements, direct presentation and any cross-examination of the other party's witnesses. Each party shall have the right to reserve part of its time to present up to one hour of rebuttal testimony.

(vi) The matter shall be deemed submitted at the submission of closing briefs.

(g) The panel of arbitrators shall render its final decision in the dispute within 60 days after the date of naming the third arbitrator. If the arbitrators disagree as to the determination, any two of the three arbitrators may join to form a majority and the decision of those two arbitrators will be final for the panel. The panel will issue a written decision for CAWCD and the United States.

(h) If either CAWCD or the United States declines to accept the decision of the arbitration panel, it may initiate an action in the appropriate Federal court within 60 days of the issuance of the panel's written decision to obtain a judicial determination of the underlying dispute. If an action is not filed within 60 days of the panel's decision, the decision of the panel shall be deemed to be final and not subject to judicial review. The decision of the panel and

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record of the arbitration shall not be privileged and may be submitted as part of the record by either side in support of its case.

(i) All costs incurred by the arbitration panel shall be shared equally by CAWCD and the United States, and the expenses of the arbitration panel shall be paid expeditiously. These costs shall not be included as Fixed OM&R Costs, nor are they to be made reimbursable or a cost billable to CAWCD.

(j) During the period of time in which a disagreement is being addressed in the ADR process or appropriate judicial proceeding, CAWCD and the United States agree that no default or breach of any agreement being addressed in the process will have occurred and that there will be no basis for the termination of water deliveries or other similar punitive actions by either party. The foregoing does not waive any claims for monetary penalties under Article 9.10(a) of the 1988 Contract.

12. Except as provided for herein, the 1988 Contract remains in full force and effect, including but not limited to the provisions of Articles 9.6(e) and 9.9. Article 10.9 of the 1988 Contract shall govern all obligations of the United States under this Stipulation. Except as otherwise provided for herein, terms defined within the 1988 Contract that are used in this Stipulation have been capitalized and shall have the meaning ascribed to them in the 1988 Contract. Notwithstanding the foregoing, to the extent that the 1988 Contract is inconsistent with the provisions of this Stipulation, the provisions of this Stipulation shall govern. Nothing in this Stipulation is intended to affect the rights of long-term contractors and subcontractors of Project Water service or any Colorado River water right holders. Nothing in this Stipulation is intended to preclude CAWCD and the United States from entering into additional agreements or amendments to existing agreements regarding the subjects addressed in this Stipulation. This Stipulation and all actions authorized hereunder are subject to Federal law, including but not limited to the Reclamation Reform Act of 1982 and any exceptions thereto, State of Arizona law, and such rules and regulations as the Secretary may deem appropriate, as those laws and rules and regulations may be amended, and, except as provided herein, the 1988 Contract. Nothing in

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this Stipulation may be used in any way to control the CAP water allocation process or affect its interpretation.

13. The Parties shall cooperate in carrying out the provisions and intent of this Stipulation.

14. Each Party shall pay for its own costs, including attorney fees and expert fees in this litigation. These costs shall not be included as Fixed OM&R Costs; nor are they to be made reimbursable or made part of costs billable to CAWCD.

15. This Stipulation may be executed by the Parties in counterparts.

16. As between CAWCD and the United States, this Stipulation shall be effective upon and the "date of this Stipulation" for the purposes herein shall be the date of entry of an Order of this Court approving the Stipulation in accordance with the Joint Motion of CAWCD and the United States for Stay and Approval of Stipulation to which this Stipulation is appended.

De CUIR & SOMACH
A Professional Corporation
400 Capitol Mall, Suite 1900
Sacramento, CA 95814

Dated: May 3, 2000

By: _____
Stuart L. Somach

and

SNELL & WILMER
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Dated: May 3, 2000

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CENTRAL ARIZONA WATER CONSERVATION DISTRICT
FEDERAL REPAYMENT OBLIGATION

EXHIBIT A

	Beginning Balance Interest Bearing		Beginning Balance Non-Interest Bearing		Payment Due		
	Stage I	Stage II	Stage I	Stage II	Principal	Interest	Total
1994	917,744,685		339,439,815		12,571,845	8,945,716	21,517,561
1995	905,194,412		339,418,243		12,571,845	30,251,597	42,823,442
1996	893,625,867		338,414,943		12,571,845	29,864,976	42,436,821
1997	882,118,224	286,755,315	337,350,741	106,060,185	16,500,000	32,275,538	48,775,538
1998	870,744,611	282,827,160	336,152,509	106,060,185	16,500,000	38,552,369	55,052,369
1999	859,339,950	278,899,005	334,985,325	106,060,185	16,500,000	38,039,946	54,539,946
2000	847,695,473	274,970,850	334,057,957	106,060,185	16,500,000	37,519,509	54,019,509
2001	836,242,764	271,042,695	332,938,821	106,060,185	20,271,554	37,005,480	57,277,034
2002	820,999,366	267,114,540	331,838,821	106,060,185	20,271,554	36,364,767	56,636,320
2003	805,755,967	263,186,385	330,738,821	106,060,185	20,271,554	35,724,053	55,995,607
2004	790,512,569	259,258,230	329,638,821	106,060,185	21,450,000	35,083,340	56,533,340
2005	775,269,170	254,151,629	328,538,821	106,060,185	21,450,000	34,403,243	55,853,243
2006	759,725,772	249,045,027	327,738,821	106,060,185	21,450,000	33,713,120	55,163,120
2007	744,182,373	243,938,426	326,938,821	106,060,185	21,450,000	33,022,997	54,472,997
2008	728,638,975	238,831,824	326,138,821	106,060,185	25,221,554	32,332,874	57,554,428
2009	709,324,023	233,725,223	325,338,821	106,060,185	25,221,554	31,516,706	56,738,259
2010	690,009,071	228,618,621	324,538,821	106,060,185	25,221,554	30,700,537	55,922,091
2011	670,694,119	223,512,020	323,738,821	106,060,185	26,400,000	29,884,369	56,284,369
2012	651,379,167	217,226,972	322,938,821	106,060,185	26,400,000	29,028,817	55,428,817
2013	632,064,215	210,941,924	322,138,821	106,060,185	26,400,000	28,173,265	54,573,265
2014	612,749,263	204,656,876	321,338,821	106,060,185	26,400,000	27,317,713	53,717,713
2015	593,434,311	198,371,828	320,538,821	106,060,185	31,428,738	26,462,161	57,890,899
2016	569,090,621	192,086,780	319,738,821	106,060,185	31,428,738	25,438,549	56,867,287
2017	544,746,931	185,801,732	318,938,821	106,060,185	31,428,738	24,414,936	55,843,674
2018	520,403,241	179,516,684	318,138,821	106,060,185	33,000,000	23,391,324	56,391,324
2019	495,859,551	171,660,374	317,538,821	106,060,185	33,000,000	22,308,516	55,308,516
2020	471,315,861	163,804,064	316,938,821	106,060,185	33,000,000	21,225,708	54,225,708
2021	446,772,171	155,947,754	316,338,821	106,060,185	33,000,000	20,142,900	53,142,900
2022	422,228,481	148,091,444	315,738,821	106,060,185	40,543,107	19,060,092	59,603,199
2023	390,141,684	140,235,134	315,138,821	106,060,185	40,543,107	17,725,193	58,268,300
2024	358,054,887	132,378,824	314,538,821	106,060,185	40,543,107	16,390,295	56,933,402
2025	325,968,090	124,522,514	313,938,821	106,060,185	42,900,000	15,055,396	57,955,396
2026	293,731,293	114,309,311	313,488,821	106,060,185	42,900,000	13,636,717	56,536,717
2027	261,494,496	104,096,108	313,038,821	106,060,185	42,900,000	12,218,038	55,118,038
2028	229,257,699	93,882,905	312,588,821	106,060,185	42,900,000	10,799,359	53,699,359
2029	197,020,902	83,669,702	312,138,821	106,060,185	44,157,185	9,380,680	53,537,864
2030	163,526,920	73,456,499	311,688,821	106,060,185	44,157,185	7,919,986	52,077,170
2031	130,032,939	63,243,296	311,238,821	106,060,185	44,157,185	6,459,292	50,616,476
2032	96,538,957	53,030,093	310,788,821	106,060,185	44,550,000	4,998,598	49,548,598
2033	63,024,176	42,424,074	310,359,821	106,060,185	44,550,000	3,524,080	48,074,080
2034	29,488,594	31,818,056	309,951,221	106,060,185	44,550,000	2,048,868	46,598,868
2035	-	21,212,037	305,495,834	106,060,185	44,550,000	708,906	45,258,906
2036	-	10,606,019	271,551,852	106,060,185	44,550,000	354,453	44,904,453
2037	-	-	237,607,871	106,060,185	44,550,000	-	44,550,000
2038	-	-	203,663,889	85,454,167	44,550,000	-	44,550,000
2039	-	-	169,719,908	84,848,148	44,550,000	-	44,550,000
2040	-	-	135,775,926	74,242,130	44,550,000	-	44,550,000
2041	-	-	101,831,945	63,636,111	44,550,000	-	44,550,000
2042	-	-	67,887,963	53,030,093	44,550,000	-	44,550,000
2043	-	-	33,943,982	42,424,074	44,550,000	-	44,550,000
2044	-	-	-	31,818,056	10,606,019	-	10,606,019
2045	-	-	-	21,212,037	10,606,019	-	10,606,019
2046	-	-	-	10,606,019	10,606,019	-	10,606,019
					1,650,000,000	973,384,980	2,623,384,980

3/21/2000

CENTRAL ARIZONA WATER CONSERVATION DISTRICT
CREDITS TO FEDERAL REPAYMENT OBLIGATION

	Exhibit A Pmt. Due Next Jan. 15	Cash Payments	HVID Advance	Deficiencies	Employee Related	LBDF Navajo	LBDF Hoover	Net Misc. Revenues	B.O.R. Oversight	Interest on Credit Bal.	Total Credits	(Over) Under Payment	Credit Balance	AZ Interest
												-	-	
1993	21,517,961	-	17,412,080	-	2,069,251	-	858,460	267,440	(4,679)	-	21,517,961	(16,830,065)	(16,830,065)	6.26%
1994	42,823,442	34,331,708	14,266,276	169,368	-	5,993,263	3,732,431	9,731	(40,287)	-	58,453,507	11,424,574	(4,205,491)	6.26%
1995	42,436,821	-	-	352,076	-	26,319,132	3,519,477	(33,134)	(126,671)	961,859	31,012,547	(7,388,405)	(11,570,896)	6.75%
1996	48,775,938	10,850,476	-	22,438,705	-	18,591,770	4,261,017	(41,170)	(227,633)	241,816	56,140,943	(8,635,887)	(12,440,783)	5.92%
1997	55,062,289	18,249,989	-	6,861,720	-	23,166,200	7,143,485	57,748	(240,855)	884,897	65,922,256	(15,195,021)	(27,735,804)	6.12%
1998	64,538,949	38,443,365	-	2,172,381	-	21,695,221	6,731,690	20,809	(189,904)	761,376	69,634,987	(312,807)	(28,048,611)	5.87%
1999	64,018,808	25,698,378	-	3,948,017	-	17,033,946	5,926,578	302,577	(406,370)	1,828,092	64,332,318			
Total		127,772,946	31,678,364	35,942,266	2,069,251	112,999,485	32,193,236	588,000	(1,238,600)	4,297,849	347,213,797	(28,048,611)	<--Credit as of 1-15-00	

EXHIBIT A-1

03/27/2000

Exhibit B
Project Construction Completion List
Central Arizona Project
January 28, 2000

CAWCD will complete to receive Repayment Credit the following items:

Item Description	Last Year Credit Allowed (Calendar Year)	Total Credit Not to Exceed ($ in Thousands)
Siphon Tendon Repair Hassayampa/Centennial/Jackrabbit	2005	$3,400
Hassayampa River Erosion Protection	2002	1,650
Mark Wilmer Pumping Plant Impellers	2003	3,900
Completion of Standing Operating Procedures	2002	906
ADA Modifications at Project Headquarters	2002	100
Cathodic Protection Phases II	2001	3,000
Cathodic Protection Phases III	2002	2,300

United States will complete the following items as budget allows:

Hayden-Rhodes Aqueduct
- Complete Litigation on Siphon Defects
- Activities necessary to close out all open construction contracts

New Waddell Dam
- Misc. Lands and Rights Activities
- North Entry Road
- MWD Conference Center
- FWL Coordination Act
- Fish Liminology Follow-up
- Cook's Lake
- Archaeology Survey Report
- Electronic Archaeology Database
- Archaeological Road Barrier at site 99
- Activities necessary to close out all open construction contracts
- Complete final reports and achieving

Modified Roosevelt Dam
- First Fill
- Stream Gaging
- Stewart Wash Bridge Slope Protection
- Marina Store Removal-Intersection for Ranger Station
- Platform Mound Archaeological Study
- Design F/I Museum Exhibits
- NAGPRA Burial of Remains
- Heritage Education Program
- FWL Coordination Act
- Bald Eagle Nest Watch
- Allotment Management Plan/Wildlife Mitigation
- Tonto Creek Riparian Monitoring
- SWF Banding/Genetics
- SWF GIS Database/Update
- SWF Aerial Photography
- SWF Habitat Monitoring

SWF San Pedro Preserve Management
SWF Cowbird Management
SWF Nest Monitor/Dispersal Count
SWF Management Fund
Activities necessary to close out all open construction contracts
Complete final reports and achieving

Tucson Aqueduct

Lands and Rights for Del Bac Transmission Line
Complete Del Bac Transmission Line
Activities necessary to close out all open construction contracts

Other Project Costs

Canal Vegetation Study
CAP Repository Design/Construction
CAP Repository Curation/O&M
Lands and Rights for Native Fish Protection
Nonnative Fish Eradication Funding Transfers
Native Fish Conservation Funding Transfers
Aravaipa Fish Barriers
Native Fish Public Information and Education Program
San Pedro Fish Barriers
Section 7 Santa Cruz Fish Opinion Activities
Archiving of records as necessary
Financial closeout of construction

Navajo Project Participation

Installation of Scrubbers at Navajo Generating Station

Recreation Development

Grant with City of Phoenix
Hayden-Rhodes Canal Trails – Federal/Nonfederal
Tucson Recreation – Federal/Nonfederal
Tucson Canal Trails – Federal/Nonfederal

EXHIBIT C

Revised 2/16/2000

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

OPERATING AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND THE CENTRAL ARIZONA WATER CONSERVATION DISTRICT FOR OPERATION AND MAINTENANCE OF THE CENTRAL ARIZONA PROJECT

1. Preamble

THIS OPERATING AGREEMENT, hereinafter referred to as "Agreement," made as of this ____ day of _____, 2000, pursuant to the Reclamation Act of June 17, 1902 (32 Stat. 388), and acts amendatory thereof or supplementary thereto, particularly the Reclamation Extension Act of August 13, 1914 (38 Stat. 686), the Reclamation Project Act of August 4, 1939 (53 Stat. 1187), as amended, the Movable Property Transfer Act of July 29, 1954 (68 Stat. 580), as amended, and the Colorado River Basin Project Act of September 30, 1968 (82 Stat. 885), as amended, all collectively hereinafter referred to as the "Federal Reclamation Laws," between the UNITED STATES OF AMERICA, hereinafter referred to as the "United States," acting through the Department of the Interior, Bureau of Reclamation, hereinafter referred to as "Reclamation," and the CENTRAL ARIZONA WATER CONSERVATION DISTRICT, a district created, organized, and existing under and by virtue of the laws of the State of Arizona, hereinafter referred to as the "District";

WITNESSETH THAT:

2. Explanatory Recitals

2.1 WHEREAS, the District and the United States entered into Contract No. 14-06-W-245, Amendment No. 1, dated December 1, 1988, hereinafter referred to as the "1988 Contract," which provides, among other things, for the United States to construct the Central Arizona Project, hereinafter

1 referred to as "CAP," and for the District to repay to the United States the construction costs of the CAP
2 allocated to reimbursable functions; and
3 2.2 WHEREAS, the United States and the District entered into Contract No. 7-07-30-W0167,
4 dated August 5, 1987, for the transfer of OM&R of CAP facilities, hereinafter referred to as the "O&M
5 Transfer Contract"; and
6 2.3 WHEREAS, Article 5 of the O&M Transfer Contract provides that the District and the United
7 States shall enter into an operating agreement to cover details of Project operations, maintenance, OM&R
8 funding, and environmentel compliance and commitments applicable to the Transferred Works; and
9 2.4 WHEREAS, the United States has constructed the CAP for storage, diversion, carriage,
10 and distribution of Project Waters for agricultural, municipal, industrial, domestic, and other purposes; and
11 2.5 WHEREAS, the United States, Reclamation, and the District, hereinafter "the Parties,"
12 desire to define and prescribe their respective responsibilities for OM&R of the Transferred Works; and
13 2.6 WHEREAS, paragraph 7 of the Stipulation and Order for Judgment, executed by the
14 District, the United States, and intervenors in Central Arizona Water Conservation District v. United States
15 of America, Consolidated Action No. CIV. 95-625 (EHC) & No. CIV. 95-1720-PHX-EHC (D. Ariz.),
16 hereinafter referred to as the "Stipulation," provides that the District and the United States shall enter into
17 an Operating Agreement setting forth the terms and conditions for the OM&R of the Transferred Works.
18 2.7 NOW THEREFORE, the Parties agree as follows:
19 3. Purpose of Agreement
20 3.1 The purpose of this Agreement is to define and prescribe, pursuant to Article 5 of the O&M
21 Transfer Contract, and paragraph 7 of the Stipulation, the District's and Reclamation's responsibilities for
22 CAP OM&R and administration of associated Federal land interests.

3.2 All provisions of the Stipulation, as presently constituted or amended, shall apply to this Agreement and shall be controlling in the event of conflict between the Stipulation and this Agreement unless otherwise expressly provided herein.

3.3 All provisions of the O&M Transfer Contract shall apply to this Agreement and shall be controlling in the event of conflict between the O&M Transfer Contract and this Agreement unless otherwise expressly provided.

3.4 The Stipulation has superseded the Article 7 funding provisions of the O&M Transfer Contract.

4. Definitions

4.1 Definitions included in the Stipulation and the 1988 Contract are applicable to this Agreement, with the following exceptions:

4.1.1 All references to the designation "Granite Reef Aqueduct" in the 1988 Contract shall be replaced by the designation "Hayden-Rhodes Aqueduct."

4.1.2 All references to the designation "Salt Gila Aqueduct" in the 1988 Contract shall be replaced by the designation "Fannin-McFarland Aqueduct."

4.2 For the purposes of this Agreement and when used herein, unless otherwise distinctly expressed or manifestly incompatible with the intent hereof, the terms:

4.2.1 "Contracting Officer" means the Regional Director of the Lower Colorado Region, Bureau of Reclamation, or the duly authorized representative.

4.2.2 "OM&R" means the care, operation, maintenance and replacement of Transferred Works.

4.2.3 "Project Lands" means lands or land interests acquired or withdrawn by the United States for the construction, operation, and maintenance of the features of the CAP.

4.2.4 "Project Waters" means all Project Water as defined in Paragraph 5 of the Stipulation plus the grandfathered water rights assigned to the District in connection with the Transferred Works.

4.2.5 "Standing Operating Procedures" or "SOPs" means the primary controlling documents (with associated supporting documents) which are the complete, accurate, current and structure-oriented operating instructions for the CAP control center, CAP aqueduct and each CAP pumping plant or dam and reservoir and their related structures. The SOPs contain information and instructions necessary for personnel to perform their duties.

4.2.6 "Substantial Change" means modifications which would significantly alter the operational capabilities or performance of the Transferred Works. This definition supersedes the definition of substantial change in the O&M Transfer Contract.

4.2.7 "Transferred Works" means those project works as transferred under the sequentially numbered transfer notices issued pursuant to the O&M Transfer Contract and the 1988 Contract and included in Exhibit A hereto.

5. <u>Modifications to this Agreement</u>

5.1 This Agreement shall be reviewed by the Parties in the light of actual operating experience. Modifications to this Agreement shall be evidenced by amendment of this Agreement.

6. <u>District's Failure to Comply with Terms of this Agreement</u>

6.1 If the Contracting Officer finds the District is operating the Transferred Works or any part thereof in violation of this Agreement, the United States shall notify the District of the violation and provide the District a reasonable opportunity of not less than 60 days to cure the violation or provide an agreed upon plan to cure the violation.

6.2 If the violation is not cured as provided in 6.1, the United States may take over from the District the OM&R responsibility of the Transferred Works as provided in Article 6(h) of the O&M Transfer Contract, in which case the provisions of Article 6(h) shall apply.

7. OM&R Responsibilities for the Transferred Works

7.1 By letters dated April 29, 1993, September 1, 1993, September 10, 1993, October 7, 1993, March 25, 1994, and June 29, 1994, Reclamation transferred OM&R responsibility for certain features of the CAP to the District. In the future, OM&R responsibility for other Transferred Works and Project Lands may be transferred by a subsequent letter(s). Such transfers shall include such right of possession as shall be necessary or convenient for the OM&R of the Transferred Works by the District as hereinafter provided.

7.2 District Responsibilities:

The District is the operating agent for the Transferred Works and shall perform the following activities:

7.2.1 Perform the OM&R of the Transferred Works, as provided for in Article 6(b) of the O&M Transfer Contract. Submit quarterly reports to Reclamation similar to reports provided to the District's Board listing OM&R expenses and comparing those actual expenses to budgeted expenses.

7.2.2 Ensure the OM&R program will include all features and activities necessitated by the commitments made by the United States for the protection of the environment as listed in Exhibit B, attached hereto.

7.2.3 Ensure the OM&R program will include all environmental assessments, mitigations and remediations regarding hazardous materials including, but not limited to: solid waste assessments, hazardous materials/waste storage, transportation and diaposal, waste minimization, recycling, pollution prevention, aboveground and underground tank management, spill/release reporting, emergency contingencies, employee training, facility discharges, pesticide management, facility design, facility

auditing, site assessments, mitigations, and remediations/cleanups, in accordance with Federal, State, and local laws, rules and regulations. The District will make the required notifications in accordance with Federal, State, and local laws, rules and regulations, of any hazardous materials or solid waste spills or releases on Project Lands and will provide a copy of any written notification to Reclamation.

7.2.4 Make deliveries of Project Waters and collect payments therefor. For the purpose of Reclamation's administration of the Reclamation Reform Act of 1982, other Federal Reclamation laws, and agency regulatory requirements, the District shall coordinate and consult in advance with Reclamation regarding such contracting and delivery of Project Waters for agricultural purposes.

7.2.5 In accordance with article 6(c) of the O&M Transfer Contract, make promptly any and all repairs to the Transferred Works, which, in the opinion of the Contracting Officer, are deemed necessary for the proper OM&R of the same. As-built drawings will be maintained by the District to reflect the current status of the Transferred Works and copies will be made available to Reclamation upon request.

7.2.6 For Project Waters delivered through use of the Transferred Works, perform storage, delivery and reporting obligations of the United States under existing CAP delivery contracts including any extensions thereof, and with respect to future CAP delivery contracts as to which the District is not a party, perform said obligations of the United States not inconsistent with (a) existing CAP delivery contracts as to which the District is not a party, (b) the Stipulation, (c) the 1988 Contract and (d) priorities of Project Water. Reclamation shall consult with and seek the concurrence of the District prior to executing any such contract. If after such consultation the District fails to concur and Reclamation executes such contract, the District shall have the right to arbitrate (i) whether or not the additional obligation is consistent with "a" through "d" above or (ii) the reasonableness of the additional cost pursuant to the arbitration provisions of Paragraph 11 of the Stipulation.

7.2.7 Administer groundwater rights associated with Project Waters as identified in Exhibit C, which is attached hereto and by reference made a part hereof. Any filing fees or penalties levied for noncompliance with the groundwater rights shall be the responsibility of the District.

7.2.8 Issue rights-of-entry, permits and licenses for periods of 25 years or less for the use of Project Lands in accordance with Article 6(e) of the O&M Transfer Contract and Exhibit D hereto. This Agreement constitutes Reclamation's written consent as required under Article 6(e) of the O&M Transfer Contract under the terms, limitations and conditions set forth in Exhibit D. The District shall forward to the Area Manager, Phoenix Area Office, a copy of all documents evidencing such rights-of-entry, permits or licenses at the time issued. The District shall not execute renewable rights-of-entry, permits or licenses for use of federally-owned land that, by exercising a right to renew, will provide options to use land for cumulative periods greater than twenty-five years. The District shall also submit to the Area Manager an annual accounting of revenues it collected from rights-of-entry, permits or licenses during the fiscal year.

7.2.9 Provide for an OM&R budget process that permits meaningful participation of Reclamation and water users in the budget process prior to adoption of the budget. This process includes an open meeting with an opportunity to comment sufficiently in advance of adoption of the budget to allow the District to consider comments submitted. The District shall make information relating to the budget and OM&R costs available to Reclamation and water users prior to the open meeting. Provide to Reclamation a copy of the budget as adopted.

7.3 <u>Reclamation Responsibilities</u>

7.3.1 If the District neglects, fails, or is unable to make repairs or replacements or correct noted deficiencies, the United States may cause the repairs or replacements to be made, in accordance with Article 6(c) of the O&M Transfer Contract.

7.3.2 Reclamation shall administer recreation programs serving the CAP purposes of conservation and development of fish and wildlife resources and enhancement of recreation opportunities.

In furtherance of such purposes, Reclamation will negotiate and administer land use agreements with local entities. Reclamation shall consult with and seek the concurrence of, the District prior to executing any such agreements that might impose additional OM&R obligations on CAP water users. If after such consultation the District fails to concur and Reclamation executes such contract, the District shall have the right to arbitrate the reasonableness of the additional obligation pursuant to the arbitration provisions of Paragraph 11 of the Stipulation.

7.3.3 By October 10 each year, Reclamation shall provide the District with annual water delivery schedules for the Indian contractors. By November 15 each year, the District shall provide written confirmation of the Indian water delivery schedules. If the District cannot confirm that all scheduled Indian water can be delivered, it shall meet and confer with Reclamation to determine the water deliveries. If mutually agreed, a direct scheduling relationship with the ultimate user may be worked out by Reclamation and the District provided that such relationship gives notice to Reclamation of scheduled deliveries.

8. Funding/Costs and Accounting

8.1 The District shall perform the following activities:

8.1.1 Advance funds to Reclamation on a quarterly basis pursuant to paragraph 6(g) of the Stipulation to cover the projected costs on the basis of the annual work plan which will be developed in accordance with Article 8.2.1 herein.

8.1.2 Fund all OM&R costs for the Transferred Works.

8.1.3 The District shall submit to Reclamation all fees, net of expenses, collected from rights-of-entry, permits, licenses and other miscellaneous revenues from the Transferred Works, and Reclamation shall deposit those funds into the Lower Colorado River Basin Development Fund.

8.2 Reclamation shall perform the following activities:

8.2.1 Based upon a five year forecast, develop an annual work plan which estimates the annual funding anticipated to be necessary for the administration of the 1988 Contract, the O&M Transfer

Contract, all long-term water delivery contracts and subcontracts, all work related to the general oversight of the District's OM&R program for the Transferred Works, and any OM&R activities and oversight performed by or on behalf of Reclamation. A draft work plan will be submitted to the District by August 1 of each year. The final work plan will be submitted to the District by October 1 of each year. Reclamation will bill the District quarterly for the projected costs of the annual work plan. Bills will be submitted 30 days in advance of the required payment date.

8.2.2 Reclamation will use all funds obtained from the recreation partners/sponsors to provide oversight of the recreation program. To the extent covered by these funds, the costs of Reclamation's oversight of the recreation program will not be chargeable to the District. Reclamation will use its best efforts, through future contractors and other means, to recover the costs from the recreation partners/sponsors.

8.3 Categories of expenses that may be included in the work plan and shall not be disputed by the District as provided in 6(g)(ii) of the Stipulation provided the scope and character of charges allocated thereto do not go beyond the scope and character of charges included in such category through 1999, include the following:

8.3.1 All categories of expenses previously paid by the District without dispute.

8.3.2 Colorado River Operations as defined in Exhibit E. (Note: Exhibit E is a version of a Reclamation document.)

8.3.3 Administration, oversight, and OM&R Costs of recreation contracts, lands, facilities, or programs that are not specifically covered in agreements with entities other than the District.

8.3.4 OM&R and monitoring costs related to Endangered Species Act or Biological Opinion that have not been overturned by court. Reclamation shall use its best efforts to consult with the District prior to incurring costs associated with general environmental, Endangered Species Act ("ESA") or National Environmental Policy Act ("NEPA") compliance. In any event, the United States will consult with

the District regarding all costs associated with general environmental, ESA or NEPA compliance. For the purposes of any "consultation" pursuant to Section 7(a)(2) of the ESA, with respect to "actions associated with the CAP, the District shall be treated as if it were an "applicant" under the ESA, 16 U.S.C. § 1532(12), 50 C.F.R. § 402.02.

8.3.5 Field and related work associated with administration, oversight and OM&R costs of archeological and historical resources located on the Transferred Works.

8.3.6 Environmental assessment work for exchange contracts. Reclamation shall use its best efforts to consult with the District prior to incurring costs associated with such environmental assessments and in any event will use its best efforts to recover in advance its costs from the entity seeking to achieve the exchange.

8.4 In the future, other categories of costs not specifically identified in Article 8.3 may be included in the work plan. Reclamation and the District will discuss the reasonableness of those categories and costs in the work plan process and, if not resolved in that process, may be disputed as provided in 6(g)(ii) of the Stipulation.

8.5 Reclamation will not include in the work plan costs associated with administration, oversight, or O&M of Indian or non-Indian distribution systems or related contracts or for which any other entity is liable under a construction, repayment, water service, or other third party contract.

9. <u>Standing Operating Procedures</u>

9.1 The District shall review Standing Operating Procedures at least annually. Procedure changes or deviations shall be reported to Reclamation before implementation. The District shall send notice of such proposed and implemented deviations to the Area Manager, Phoenix Area Office, who will approve, disapprove, or comment. The District shall obtain Reclamation's advanced written approval of any procedure change which could affect the safety of the Transferred Works. During emergencies or critical operating conditions, the District may obtain oral approval from the Area Manager, Phoenix Area

Office. Any modifications made during emergency operations that are intended to be permanent shall follow the written approval process described above after the emergency is over.

10. Examination and Inspection of Transferred Works

10.1 Reclamation may, from time to time, examine the District's books, records, and reports and the Transferred Works being operated by the District to determine the condition of the Transferred Works, and the adequacy of the OM&R and dam safety programs, and any water conservation program as provided for in Articles 6(g) and 8(a) of the O&M Transfer Contract. Further, Reclamation may examine any or all of the Transferred Works or CAP facilities which were constructed by the District with funds advanced or reimbursed by the United States as provided for in Article 8(a) of the O&M Transfer Contract. Whenever reasonably possible, any such examinations shall be coordinated and conducted during the District's regular maintenance activities.

10.2 Reclamation may, or the District may request Reclamation to, conduct special inspections of any Project Works being operated by the District and special audits of the District's books and records to ascertain the extent of any OM&R deficiencies, to determine the remedial measures required for their correction, and to assist the District in solving specific problems, as provided for in Article 8(b) of the O&M Transfer Contract. Except in an emergency, any special inspection or audit shall be made only after written notice thereof has been delivered to the District by Reclamation, as provided for in Article 8(b) of the O&M Transfer Contract. The District shall provide access to the Transferred Works and the District's books and records, operate any equipment, and be reasonably available to assist in an examination, inspection, or audit as provided for in Article 8(c) of the O&M Transfer Contract.

10.3 Reclamation shall prepare reports based on the examinations, inspections, or audits, and furnish copies of such reports and any recommendations to the District as provided for in Article 8(d) of the O&M Transfer Contract. Within 30 days of receipt of the request for a schedule, the District shall provide a written schedule for completing the recommendations.

10.4 Reclamation may, at any time, with advance notice to the District, examine the Transferred Works and associated project rights of way, specifically to determine the adequacy of the District's OM&R program related to environmental commitments. The District will be given the opportunity to participate in these examinations. Reclamation will notify the District in writing of the results of these examinations including any recommendations or requirements for correcting deficiencies found. Reclamation will include an estimate of the cost of such examinations in its annual work plan provided in Article 8.2. Within 30 days of the request for a schedule, the District shall provide a written schedule for completing the recommendations.

10.5 Reclamation shall coordinate and consult with the District in advance regarding the anticipated costs to perform any examinations as part of the Reclamation work plan referred to in Article 8.2.1. Reclamation's costs for the activities in 10.1 through 10.4 shall be included in the work plan except for unanticipated special or emergency inspections or audits.

10.6 Reclamation may provide the State of Arizona an opportunity to observe and participate, at the State of Arizona's expense, in the examinations and inspections of Transferred Works which are covered under the Reclamation's dam safety program as provided for in Article 8(f) of the O&M Transfer Contract. The State of Arizona may be provided copies of reports and any recommendations relating to such examinations and inspections.

10.7 The District will make facilities available to the United States for public relations activities. Reclamation will consult and coordinate with the District prior to scheduling such activities.

11. <u>Agreements Affecting Project Operations</u>

11.1 The operation of New Waddell Dam will be in accordance with any future agreement with respect to the OM&R of New Waddell Dam, Reservoir and related facilities.

11.2 The operation of the Snyder Hill/Black Mountain Pumping Plant will be in accordance with the agreement titled "Agreement among the United States of America, the City of Tucson, and the Central

Arizona Water Conservation District Providing for the Operation, Maintenance, and Replacement of the Snyder Hill and Black Mountain Pumping Plants and the Tucson Water Treatment Plant," Agreement No. 2-MOA32-00040, which is attached hereto as Exhibit F.

11.3 The administration of the right-of-way for the Salt River siphon, which is located on the Salt River Indian Reservation, shall be in accordance with Resolution No. SR-1574-93, between Reclamation and the Salt River Pima-Maricopa Indian Community, which is attached hereto as Exhibit G.

11.4 The performance of the obligations of the United States with respect to maintaining a diversion drainage channel as stipulated in the agreement titled *Junker v. United States*, (Cl. Ct. No. 251-86), which is attached hereto as Exhibit H.

11.5 The operation of the right-of-way for recreation purposes will be in accordance with the recreation agreements listed in Exhibit I, as that list may be supplemented or amended pursuant to 11.9.

11.6 The performance of the obligations of the United States and the District in accordance with the Memorandum of Agreement Between Bureau of Reclamation and Fish and Wildlife Service, dated July 29, 1993, which is attached hereto as Exhibit J.

11.7 The performance of the obligations of the Arizona Projects Office, Bureau of Reclamation, set forth in the Memorandum of Understanding Between the Soil Conservation Service and the Bureau of Reclamation, dated September 9, 1993, which is attached hereto as Exhibit K.

11.8 The performance of the obligations of the United States under the Contract with the Atchison, Topeka and Santa Fe Railway Company for Crossing Its Tracks and Right-of-Way Near Vicksburg, Arizona, dated December 28, 1977, which is attached hereto as Exhibit L.

11.9 The agreements listed in 11.2 through 11.8 may not be all inclusive. Other agreements that Reclamation has entered into, or may enter into, under which the District may perform OM&R obligations will be provided to the District and the District may assume those obligations in accordance with this Agreement.

11.10 Reclamation will notify the District of its intent to enter into or renegotiate existing OM&R contracts of non-Transferred Works. Reclamation will provide the District an opportunity to comment on such contracts prior to their finalization.

12. Modifications to Transferred Works

12.1 The District shall notify Reclamation of its intent to make any material physical change to the Transferred Works, such as adding turnouts, crossings, or relocations. No later than 60 days after receiving such notice, Reclamation shall determine whether the proposed change is a Substantial Change. If the Contracting Officer determines that the proposed change is a Substantial Change, the District may make the change only after receiving the Contracting Officer's written consent as provided in Article 6(d) of the O&M Transfer Contract.

13. Meet and Confer

The parties hereto agree to meet and confer as necessary to resolve interagency differences with respect to the implementation of this Agreement.

14. Release and Indemnity of the United States

As provided for in Article 6(f) of the O&M Transfer Contract, the District shall indemnify the United States for, and hold the United States and all of its representatives harmless from, all damages resulting from suits, actions, or claims of any character brought on account of any injury to any person or property arising out of any act, omission, neglect, or misconduct of the District or its employees, in the manner or method of performing any construction, care, operation, maintenance, supervision, examination, inspection, or other duties of the District required under this Agreement.

15. Exhibits Made Part of this Agreement

Inasmuch as the Project Works transferred, environmental commitments, groundwater rights, and administration of federal rights-of-way, may change during the term of this Agreement, they will be set forth in the Exhibits as formulated or modified from time to time. The initial Exhibits A through L are

attached hereto, and each is incorporated into this Agreement in accordance with its respective provisions until superseded by a subsequent exhibit.

16. Term

This Agreement shall become effective on _____, 2000, and shall remain in effect until modified by mutual consent of the Parties hereto or until OM&R responsibility of the District for the Transferred Works is terminated pursuant to the provisions hereof.

APPROVED:

BUREAU OF RECLAMATION:

By: _____
Regional Director

CENTRAL ARIZONA WATER CONSERVATION DISTRICT:

By: _____
General Manager

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