UPPER GILA WATER SUPPLY STUDY

SPECIAL REPORT ON ALTERNATIVES

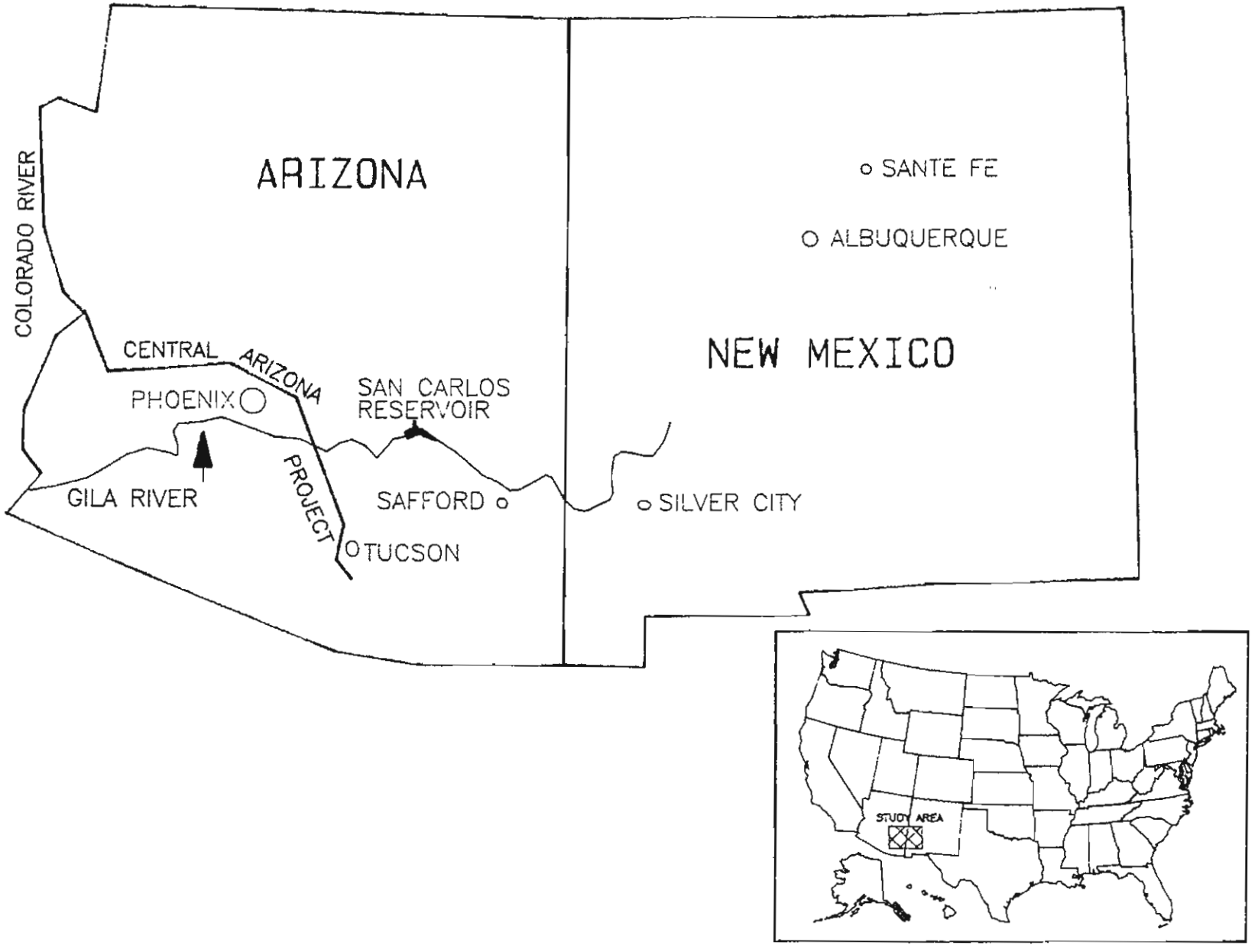
OCTOBER 1987

LOWER COLORADO REGION

BUREAU OF RECLAMATION

UNITED STATES DEPARTMENT OF THE INTERIOR

UPPER GILA WATER SUPPLY STUDY



FRONTICEPIECE

CONTENTS

PAGE

I. Introduction 1

A. Authorization 1

B. Past Planning Activities 1

C. Purpose of Document 1

D. Further Activities Required to Prepare a Draft Environmental Statement (DES) 2

II. Description of Alternatives 2

A. Explanation of Formulation 2

B. Hydrologic Considerations 2

1. Water Rights 2

2. Flow Requirements for Federally-Protected Native Fish . . 3

C. Population Projections, Per Capita Use, Existing Groundwater Supplies, and Resulting Water Needs 4

D. Future Without the Project 7

E. Alternatives 8

1. Mangas Diversion to Mangas Creek Dam 8

2. Mangas Diversion to Schoolhouse Dam 9

3. Mangas Diversion to Groundwater Recharge/Recovery in Silver City Wellfields 9

4. Top of the Box Diversion to Saddlerock Canyon Dam 9

5. Top of the Box Diversion to Groundwater Recharge/Recovery in Silver City Wellfields 9

6. Distribution System 10

PAGE

III. Costs and Economic Analyses 10

A. Cost Implications of Downstream Water Rights and Selected Flows For Federally-Protected Native Fish 10

B. Cost Comparisons of UGWSS Options 11

C. Economic Comparison of Use Options 11

D. Benefit/Cost Analysis 12

IV. Environmental Factors 13

V. Exchange Agreement 13

VI. Repayment 13

VII. Factors Affecting Selection of a Proposed Action 14

A. National Economic Development Account 14

B. Financial 14

C. Public Input 15

IIX. Conclusions 15

FIGURES

PAGE

Study Area Frontispiece
1. Location of Alternatives 3
2. Spikedace Minnow Recommended Flow Requirements 4
3. Daily Flow Duration Data, Red Rock Gage 4
4. Population Through Time 4a
5. Needs Through Time 5a
6. Pattern of Water Use Options 6
7. Relative Costs For Four Hydrologic Scenarios 10a
8. Total Annual Equivalent Costs - Full Supply Options 11
9. Total Annual Equivalent Costs - Conjunctive Use Options 11a
10. Present Value Analysis - Use Scenarios 11a

Appendix 1 - Cost Summaries
Appendix 2 - Present Value Analyses

I. Introduction

A. Authorization

The authorization for the Upper Gila Water Supply Study (UGWSS) is the Colorado River Basin Project Act (CRBPA), Public Law 90-537, enacted in 1968. The CRBPA authorized the Central Arizona Project (CAP), the purpose of which is to allow Arizona an opportunity to develop it's remaining entitlement to Colorado River as determined by the U.S. Supreme Court in Arizona v. California.

One of the authorized features of the CAP is Hooker Dam or suitable alternative, the purpose of which is to allow an additional depletion of water from the Gila River in New Mexico of up to an average annual 18,000 acre-feet over and above the amount allowed in Arizona v. California. This new supply would be provided via an exchange of waters. CAP water would be delivered to downstream Arizona Gila River water rights holders, thereby allowing the retention of Gila River water in New Mexico that would have gone to those Arizona water rights holders.

B. Past Planning Activities

The Bureau of Reclamation (Reclamation) began advance planning activities on the UGWSS in 1980. A report was prepared in 1982 summarizing the initial planning activities. During these initial studies, comparisons were made of nine damsites along the Gila and San Francisco Rivers in New Mexico and Arizona, two offstream storage sites in New Mexico, and groundwater pumping along the Gila River in New Mexico. From this original array, two damsites (Conner and Quail Springs), the offstream storage sites, and groundwater pumping were retained for further study. Hooker Dam was eliminated from further study at that time due to high costs and environmental impacts.

During the next stage of the study, which is the topic of this document, significant environmental information related to native fish communities on the Gila and San Francisco Rivers was developed. This new information resulted in the granting of Endangered Species Act protection for two species of native fish: the spikedace (Meda fulgida) and the loach minnow (Tiaroga cobitis). The granting of Endangered Species Act protection to these native fish has effectively precluded the implementation of mainstream dams in areas that would adversely affect these species. Hence these options have been eliminated from further consideration. There may, however, be other mainstream sites not intensively studied during UGWSS that would not affect these fish species.

C. Purpose of Document

The purpose of this document is to provide a summary of the most recent planning information available on the water supply alternatives, their costs, environmental impacts and effects, and related financial aspects. This information can be used to help establish the course of action that the Bureau

of Reclamation should pursue related to the Upper Gila Water Supply Study environmental impact statement process.

D. Further Activities Required to Prepare a Draft Environmental Statement (DES)

The information provided in this document is a brief summary of the information presently available for UGWSS, additional information may need to be developed depending on the alternative. The information provided herein is preliminary and would require further refinements to be considered adequate for a DES and subsequent decisionmaking. While this information is preliminary, it is considered to be an accurate reflection of the information that could ultimately be presented in a DES.

A Plan Formulation Working Document (PFWD) will need to be prepared prior to the preparation of the DES. The purpose of the PFWD would be to explain the formulation activities and allow for a decision by Reclamation on the alternative to select as the proposed action for the DES.

II. Description of Alternatives

A. Explanation of Formulation

The alternatives presented in this document are formulated toward two separate water supply yield objectives. They are:

1. Develop an adequate supply of Gila River water to meet all of the reasonably anticipated municipal water needs in the Central Grant County area through the 50-year planning period (1995-2045) without reliance on present ground water supplies.

2. Develop an adequate supply of Gila River water that, when combined with the existing groundwater supplies currently held by the local municipalities, meets all reasonably anticipated water needs of the local communities through the planning period.

The objective of providing 18,000 acre-feet of Gila River water is no longer considered a formulation objective because of the lack of anticipated need for that amount of water in the planning period. Therefore, only alternatives that provide up to 9,000 acre-feet per year of net yield are presented in this report.

B. Hydrologic Considerations

1. Water Rights

The CRBPA requires that the development of water in New Mexico via the UGWSS feature of the CAP be done in a manner so there is no economic injury or cost to downstream water rights holders. To identify the water supply that would be available to the UGWSS feature, over and above the amounts required to satisfy downstream water rights holders in the Duncan and

Safford areas, a series of computer models have been developed. These models have been used as planning tools. Ultimately it is expected that a computer model will be developed that can be used in the actual operation of the UGWSS feature to monitor opportunities for diversions in New Mexico and help establish the downstream CAP exchange delivery requirements. It is expected that this operational model will evolve from the planning models currently in use.

Existing water rights from the Gila River in the Duncan and Safford, Arizona areas are used almost exclusively for agricultural purposes and have a typical agricultural diversion pattern: Minimal winter diversions; extensive late spring and summer diversions. The sizing of UGWSS facilities shown in this study are based on the assumption that water not diverted for use in these areas would be available for diversion by an UGWSS feature without causing economic injury or cost to these water rights holders. However it should be understood that these water rights, while not presently exercised during the winter non-irrigation season, may legally be exercised during any season regardless of historic patterns of use. A change in the timing of use may occur due to a change, for example, from agricultural to municipal and industrial use. It is not expected however, that a significant change in use would occur during the planning period.

2. Flow Requirements for Federally-Protected Native Fish

Of major importance to the development of alternatives are the flow requirements for native fish protected under the Endangered Species Act. Three general diversion locations are available that would have differing flow requirements. The Mangas Creek area (and upstream locations) has been identified by the U.S. Fish and Wildlife Service as having the greatest flow requirements for protected fish, the diversion location at the top of the Gila Middle Box has a moderate level of flow requirements, and a diversion located in the Red Rock Valley or below would have the least flow requirement for fish. This last diversion location is impractical for project purposes due to the long distance to transport the water to the Central Grant County area. Therefore, no alternatives have been developed using this location. The two diversion locations used in this analysis are shown on Figure 1.

The U.S. Fish and Wildlife Service (FWS) has provided their preliminary flow requirements for the spikedace, which is considered to be of the most critical concern at the Mangas Creek and top of the Gila Middle Box diversion locations. These

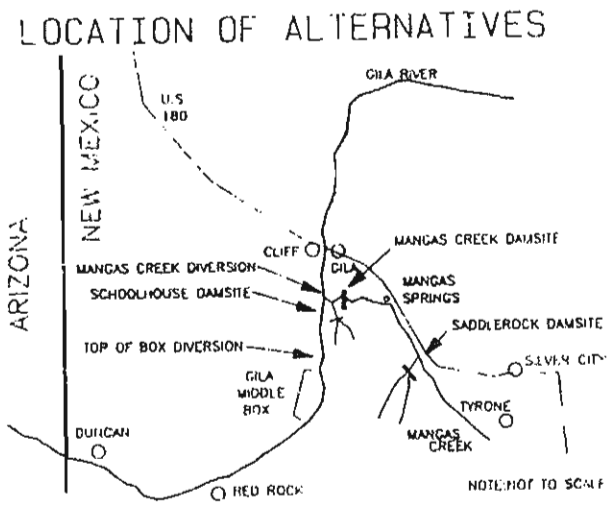


Figure 1

preliminary flow requirements are shown on Figure 2. For historical comparison, Figure 3 shows the daily flow duration data from the Red Rock streamgage, located immediately below the Gila Middle Box, for the period 1931 to 1982.

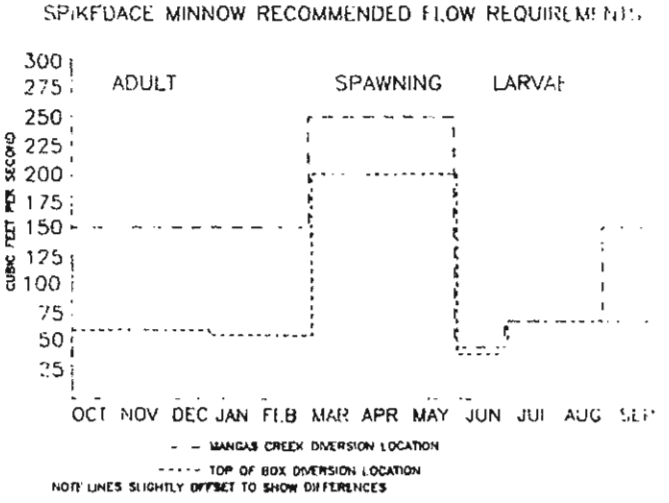


Figure 2

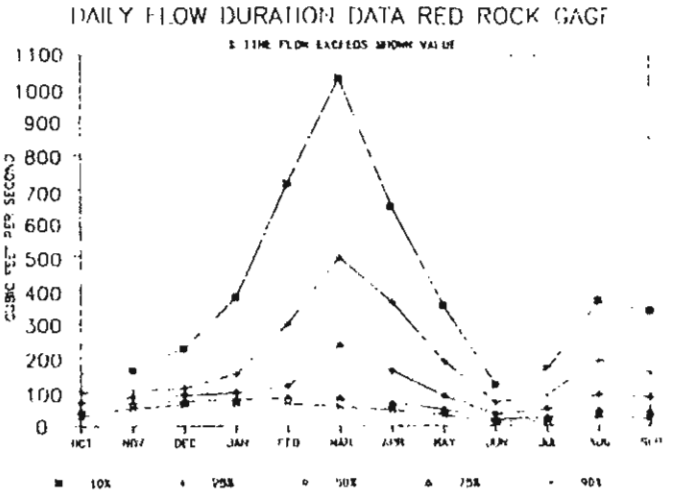


Figure 3

Review of these recommended flow requirements is ongoing by Reclamation. These recommended flows represent near optimum flow requirements. Since they occur infrequently, it is thought that they allow the fish populations to develop to a level that is needed to sustain the species through those years when the flows available in the Gila River are such that stress is placed on the population and population levels decline.

C. Population Projections, Per Capita Use Levels, Existing Groundwater Supplies, and Resulting Water Needs

The population in the Central Grant County area has been projected to grow at a little less than 1 percent per year through the planning period. This would result in a growth from the present levels from about 28,000 to 44,400 in the year 2045. The source of this population projection is a study prepared by a consultant retained by Silver City and is consistent with projections made by the University of New Mexico, Bureau of Business and Economic Research in 1980. Figure 4 shows the projected population through the planning period.

Per capita use is the average amount of water used per person per day and, when combined with the population projections, provides an estimate of the total amount of water required. The present per capita use in Silver City is estimated at about 85-90 gallons per person per day (gpcd) for residential use and 20-25 gpcd for commercial uses, for a total of 105-115 gpcd. Additionally about 20 gpcd is unaccountable due to leaks, losses, unmetering, etc., but this amount should be reduced with anticipated system improvements independent of the UGWSS. The residential per capita use level of Silver City (85-90 gpcd) reflects the average residential per capita use of the Central Grant County area.

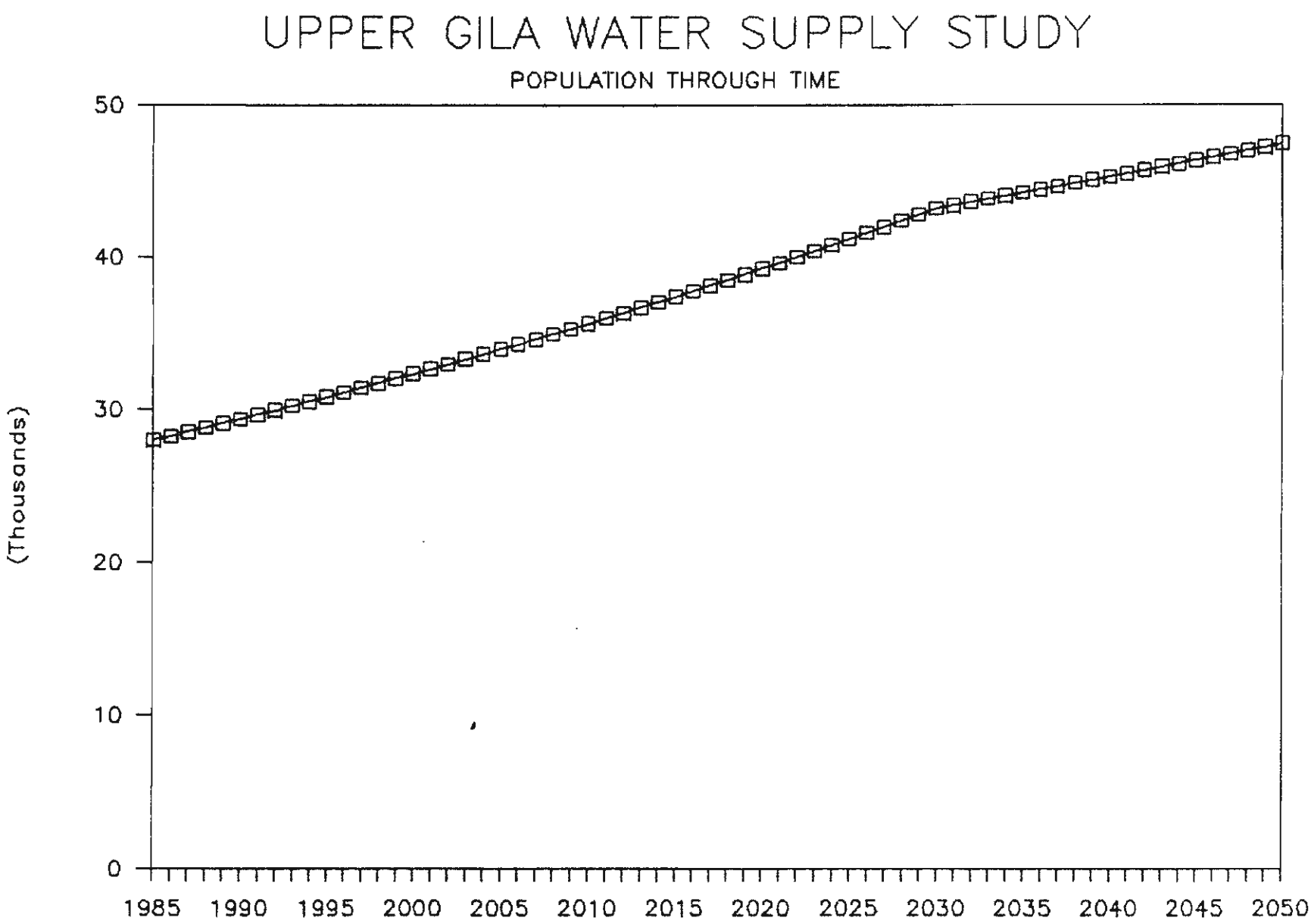

UPPER GILA WATER SUPPLY STUDY
POPULATION THROUGH TIME
(Thousands)
50
40
30
20
10
0
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050

FIGURE 4

The present residential per capita use level is low in comparison to other cities in the CAP service area. For example, in 1980 Phoenix had a per capita use of about 270 gpcd, Tucson - 160 gpcd, and Prescott - 140 gpcd. It is not unreasonable to expect that per capita use in the Central Grant County area would increase in the future.

The study prepared by Silver City's consultant that established the population levels used in formulation also proposed a per capita use increase from the present 105-115 gpcd level (assuming the leaks etc. are corrected) to 165 gpcd by the year 2030 where it would remain constant until the end of the planning period. This level of per capita use is not inconsistent with the present levels in the CAP service area. However, the future per capita use is expected to decline in the CAP service area in Arizona and is encompassed in the municipal and industrial water allocations made by the Secretary of the Interior for CAP water users in Arizona. The CAP water allocations in Arizona are based on a gradual reduction in per capita use to 140 gpcd for the lower elevation cities such as Phoenix and Tucson, and 130 gpcd for the higher elevation cities such as Prescott. The reason for this reduction is that there will not be an adequate supply of CAP municipal and industrial water to meet the projected population levels at higher per capita use rates. Since New Mexico has the opportunity to use up to an additional 18,000 acre-feet of Gila water under the CAP authorization and since there is not currently need for this full amount, the need to constrain per capita use as part of the UGWSS does not exist as it does in Arizona. However, to be consistent with the other CAP allocations, alternatives are displayed with both the 165 gpcd and 130 gpcd use levels. Only alternatives at 165 gpcd are used in the economic analysis.

The total amount of groundwater that is available from the wellfields currently owned by Central Grant County municipalities is estimated for this analysis to be about 150,000 acre-feet based on information provided by the New Mexico Interstate Stream Commission. The amount of water that can be extracted each year is limited by the water right. The municipalities in Central Grant County hold about 5,200 acre-feet of water rights almost all of which are located in the Mimbres Basin, though a small amount is in the Gila River Basin. The available groundwater supply would meet all projected needs through about the year 2010 at a per capita use level of 165 gpcd. At that time the 5,200 acre-foot water right would be exceeded and an additional supply would be required, though there still would be adequate water in the wellfields to continue to provide the 5,200 acre-foot water right until about the year 2025. If the smaller 130 gpcd use level is used, new supplies would be required in about the year 2018 and the existing wellfields again are expected to provide the 5,200 acre-feet of rights until about 2025.

Using a per capita use of 165 gpcd, the total water supply needed for municipal uses in Central Grant County through the planning period (1995 - 2045) is 315,000 acre-feet. The maximum amount needed in 1 year would be in the year 2045 and would be about 8,200 acre-feet. When the 130 gpcd rate is used, the total amount would be 260,000 acre-feet. The maximum amount needed again would occur in the year 2045 and would be about 6,500 acre-feet. Refer to Figure 5.

UPPER GILA WATER SUPPLY STUDY

NEEDS THROUGH TIME—CENTRAL GRANT COUNTY

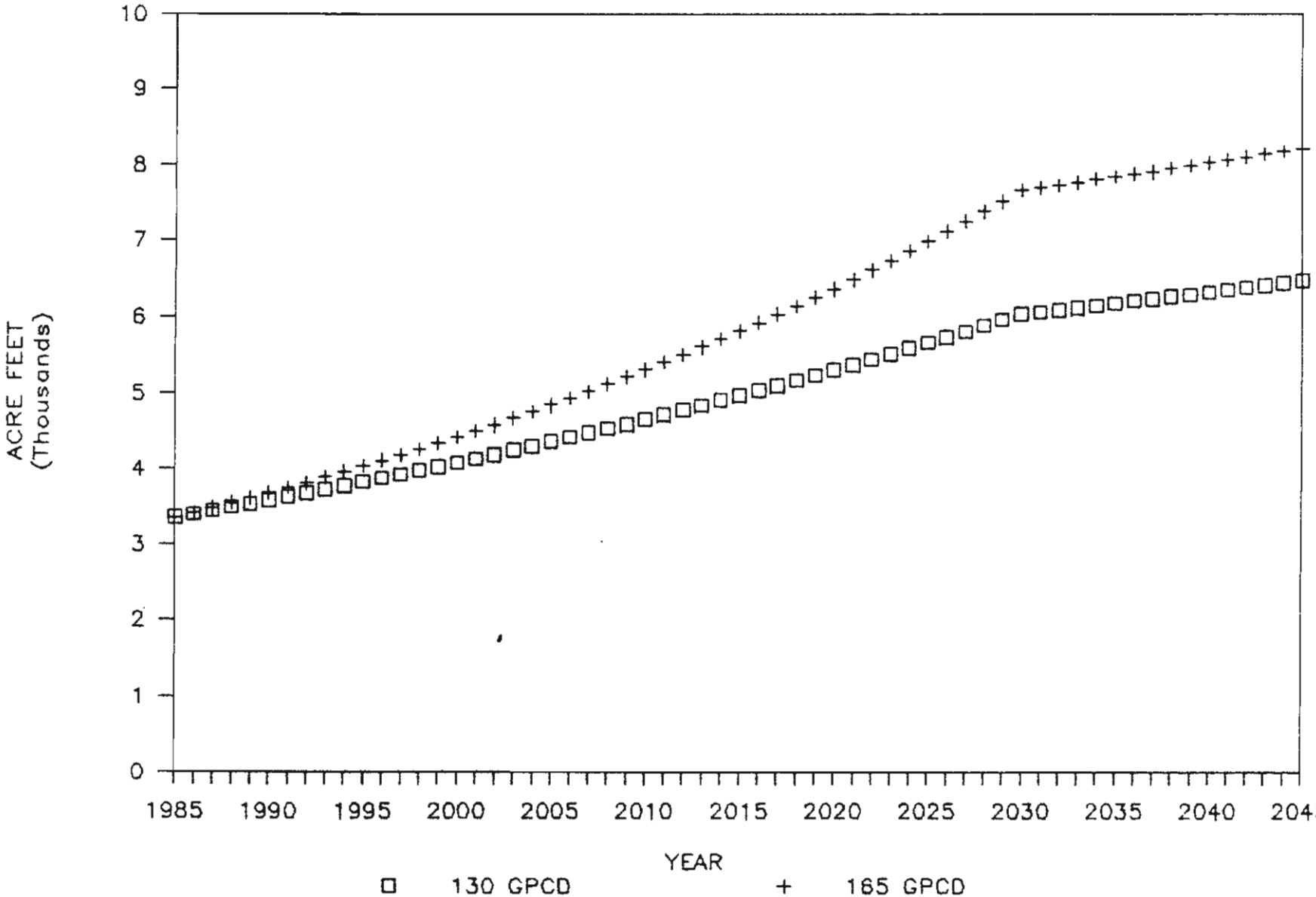


FIGURE 5

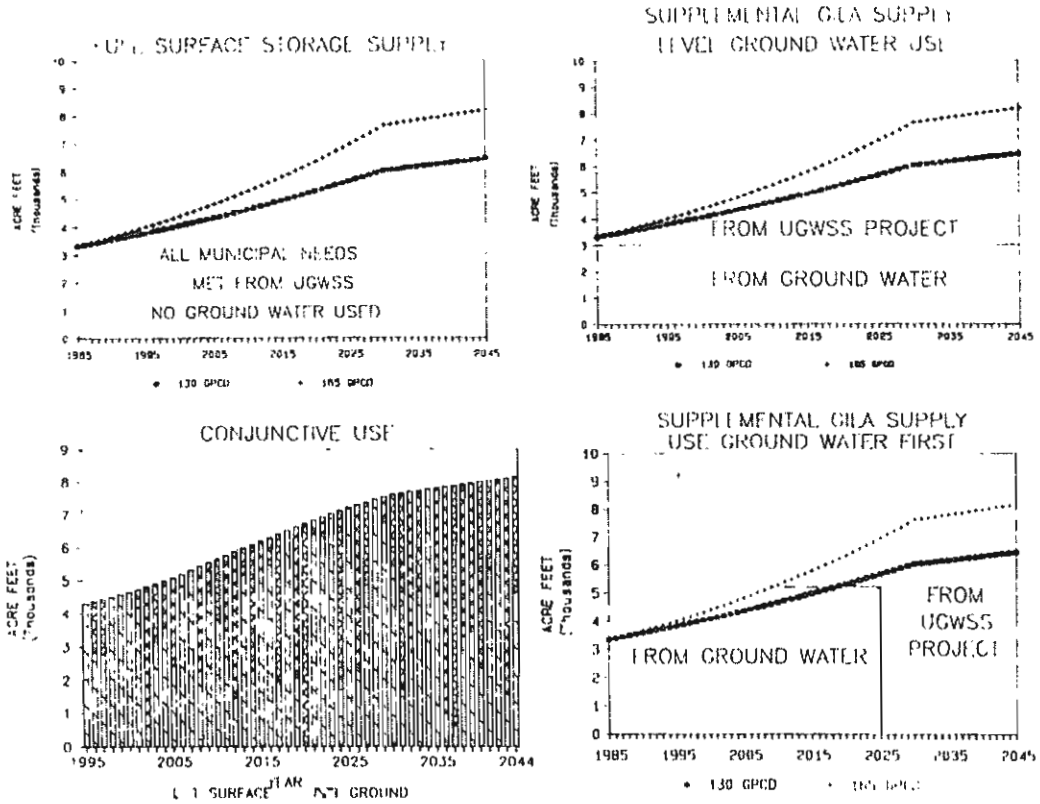


Figure 6: Pattern of Water Use Options

For the alternatives that would provide all of the municipal needs from an UGWSS alternative, the above amounts would be required. For those alternatives that would provide an UGWSS supply to supplement the existing groundwater supply, the amount of groundwater could then be subtracted from the total to determine the required UGWSS supply. When 165 gpcd is used, this amount would be 165,000 acre-feet. When 130 gpcd is used, 110,000 would be required from UGWSS. Figure 6 shows the expected pattern of use with a full supply from UGWSS and three representative patterns of use of UGWSS water when combined with existing supplies. Each of the supplemental supply patterns would result in a different size UGWSS project and a different pattern of use, although the total amount of UGWSS water and existing groundwater used would be the same. A more detailed explanation of these use options is provided in Section III.C.

In addition to the needs in the Central Grant County area, needs have also been identified in the Gila-San Francisco Basin. Due to the restrictions placed on water use in these basins by the U.S. Supreme Court, development of a new water right is only allowed for "in-house" domestic use. No new uses of water are allowed for outside purposes such as livestock or gardening purposes. These uses can take place only through the purchase of existing water rights or through the development of new water supplies such as those that could be provided through the UGWSS. A total of 700 acre-feet of need has been projected in these basins that could be served from UGWSS and are included in the alternatives formulated to provide 9,000 acre-feet of net yield.

D. Future Without the Project

The purpose of defining the "future without the project" is to establish the baseline conditions through time that allows comparison with the expected conditions "with the project".

As stated above, the population is expected to grow about 1 percent per year. The UGWSS project would not affect future population levels. Per capita use will grow to 165 gpcd. Implicit in the above assumptions is that water will be acquired to service these needs even without this project.

The source of the water in the "future without the project" is difficult to determine. However, a water supply will be required and it is assumed that the necessary price will be paid. Potential sources of water are: the Mimbres Basin and the Gila Basin.

Available sources of water in the Mimbres Basin include the purchase of existing surface and groundwater rights. Development of new water rights in the Mimbres Basin is severely limited due to administrative action taken by the New Mexico State Engineer to control groundwater overdraft in the basin. Some new water rights may be developed under the existing administrative criteria but in limited quantities. The present criteria has as a purpose the objective of protecting the agricultural economic pumping depth for groundwater through the year 1994. After 1994, when the assumed agricultural economic pumping depth for groundwater is exceeded, the ability to develop new rights for municipal use may change.

In the Gila Basin in New Mexico no new water rights can be developed (hence the exchange mechanism contemplated in the CRBPA) due to the U. S. Supreme Court order in Arizona v. California. It is assumed that this will not change and New Mexico's use of Gila Basin water will remain at present levels through the planning period. Available supplies for Central Grant County municipal use, if satisfied from the Gila Basin, would need to come from existing water rights. Some water rights in the Gila Basin are currently available for sale but only in small quantities. Recent sales of Gila River water rights have been about $3,000 per acre-foot. However, there is one potential source of water that could provide an adequate supply for Central Grant County municipal uses. This is the Gila River water supply currently used by Phelps Dodge Corporation's Tyrone Mine. Phelps Dodge recently announced that the Tyrone Mine will reduce operations in the early 1990's and entirely cease operations about 5 to 10 years later. To replace the loss in ore production, Phelps Dodge has purchased a share in the Chino Mine, also located in the Central Grant County area. The Chino Mine has an adequate water supply for the present level of production and also has additional water rights that have been granted but not yet put to use. It is unknown whether Gila River water would be required for this operation.

Phelps Dodge has a Gila River water right of about 12,000 acre-feet. Phelps Dodge has a diversion and transmission system from the Gila River to the Tyrone Mine that comes within about 5 miles of the existing Silver City transmission system from Silver City's wellfields.

If this water supply and transmission facility became available for purchase by Silver City, the future needs of the municipal users would be met. However it is not yet possible to determine if this water supply would become available for municipal uses. As Phelps Dodge stated, the Tyrone Mine will reduce operations and close entirely in the early 2000's. It is assumed that in that timeframe the availability of this water supply will become known.

Because of these uncertainties concerning the "future without the project" water supply, the assumption made for the economic analysis is that the local municipal users would purchase 8,300 acre-feet of existing groundwater rights from agricultural users in the Deming area and transport that water to the Central Grant County area. These rights currently sell for about $725 per acre-foot. The cost for a pipeline from the Deming area to the Central Grant County area and the water rights were estimated to be $93.2 million at the 1987 price level. It is assumed that this pipeline would be constructed in the year 2005. It was also assumed that the needs in the Gila-San Francisco Basins would be met through the purchase of 700 acre-feet of water rights in those basins at a cost of $3,100 per acre-foot. For this economic analysis all costs are shown at 1987 price levels.

E. Alternatives

All of the alternatives available for providing a CAP water supply to New Mexico include diverting water from the Gila River to offstream storage facilities. Two diversion locations are available: One at the confluence with Mangas Creek and one located about 5 miles downstream at the top of the Gila Middle Box.

The storage sites are combined with the two diversion locations as listed below and shown on Figure 1.

Mangas Diversion
- Mangas Creek
- Schoolhouse Canyon
- Groundwater Recharge and Recovery in the Silver City Wellfields

Top of the Box Diversion
- Saddlerock Canyon
- Groundwater Recharge and Recovery in the Silver City Wellfields

The following paragraphs describe the alternatives developed for this report. The cost estimates for these alternatives at various sizes are included in Appendix 1.

1. Mangas Diversion to Mangas Creek Dam (MD/MC)

The location of the Mangas diversion from the Gila River would be between the confluence of Mangas Creek and the Gila River and the existing Phelps Dodge diversion dam. The diversion would be accomplished through the use of an infiltration gallery buried in the Gila River bed below scour depth

(30 feet). An infiltration gallery would be used in lieu of a surface diversion because high sediment loads would occur when the diversion would take place and to minimize possible impacts on Federally-protected fish species.

The infiltration gallery would feed water to a pumping plant on the east side of the Gila River. From the pumping plant the water would be pumped through a pipeline about 2 miles to Mangas Dam.

2. Mangas Diversion to Schoolhouse Dam (MD/SH)

This alternative differs from MD/MC only in the location of the storage facility. A full supply cannot be provided here due to the site's limitations. A maximum of about 5,500 acre-foot annual yield can be developed at Schoolhouse Dam.

3. Mangas Diversion to Groundwater Recharge/Recovery in Silver City Wellfields (MD/GW)

This alternative is comprised of an infiltration gallery and a pumping plant pipeline system from the Gila River to the Silver City wellfield area. Storage would be provided through a recharge/recovery operation at the Silver City wellfields. It is assumed for this analysis that the water would be recharged using injection wells. Significant questions remain concerning the technical aspects of recharge that would need to be answered prior to project implementation. This alternative provides an adequate supply only when combined with a conjunctive use operation because the costs would be prohibitive to provide a full water supply through high volume pipelines.

4. Top of the Box Diversion to Saddlerock Canyon Dam (TB/SR)

The location of the top of the box diversion would be located in the Gila River near the mouth of Ira Canyon. An infiltration gallery would be used. The infiltration gallery would feed water to a pumping plant on the east side of the Gila River. From the pumping plant, water would be pumped through a pipeline about 5 miles to Saddlerock Canyon Dam.

5. Top of Box Diversion to Groundwater Recharge/Recovery in Silver City Wellfields (TB/GW)

This alternative is similar to MD/GW except for the diversion location and the pipeline route from the Gila River to the wellfields. This alternative is comprised of an infiltration gallery and a pumping plant pipeline system from the Gila River to the Silver City wellfield area. Storage would be provided through a recharge/recovery operation at the Silver City wellfields. The water would be recharged using injection wells. This alternative can only provide an adequate supply with the conjunctive use operation because the costs would be prohibitive for high volume pipelines.

6. Distribution System

In addition to the Federal storage facilities, a distribution system would be required to transport project water to the users. The three major components to such a system would include a single major distribution line from storage to the Central Grant County area, treatment facilities, and an internal distribution system providing deliveries to the local communities, which is assumed to occur after treatment. Under a repayment contract, Federal funds are available under the CAP authorization for the major distribution line. The conditions for these funds include a 20-year repayment contract, 20 percent of the total cost provided by the local entity prior to or during construction, and a repayment interest rate of 3.342 percent. Federal funds under CAP are not available for the treatment plant or the internal distribution system. Other funding sources would be required.

When a surface storage facility is used, all three conditions listed above would be required. However, when groundwater recharge and recovery in the Silver City wellfields is used as the storage facility, the initial large pipeline is assumed to be a Federal facility covered under the master CAP repayment contract. If treatment is required prior to recharge, the treatment plant also is assumed to be a Federal facility covered under the master CAP repayment contract.

III. Costs and Economic Analyses

A. Cost Implications of Downstream Water Rights and Selected Flows For Federally-Protected Native Fish

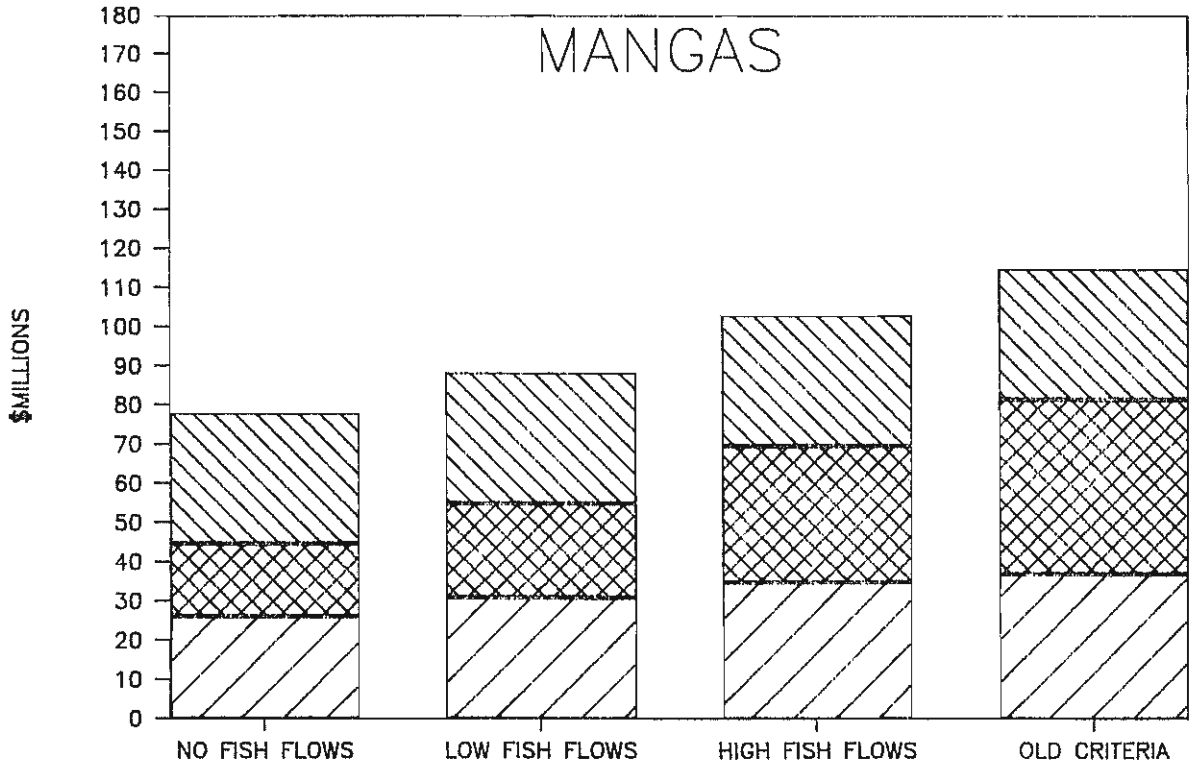
Figure 7 shows the related construction costs for developing 9,000 acre-feet using the Mangas and Top of the Box diversion locations at four operational scenarios. The costs are separated for the dam, the large volume pumping plant and pipeline from the diversion location to the dam (Pipe), and the cost for the local distribution system from storage to the users (Dist). These scenarios are described below:

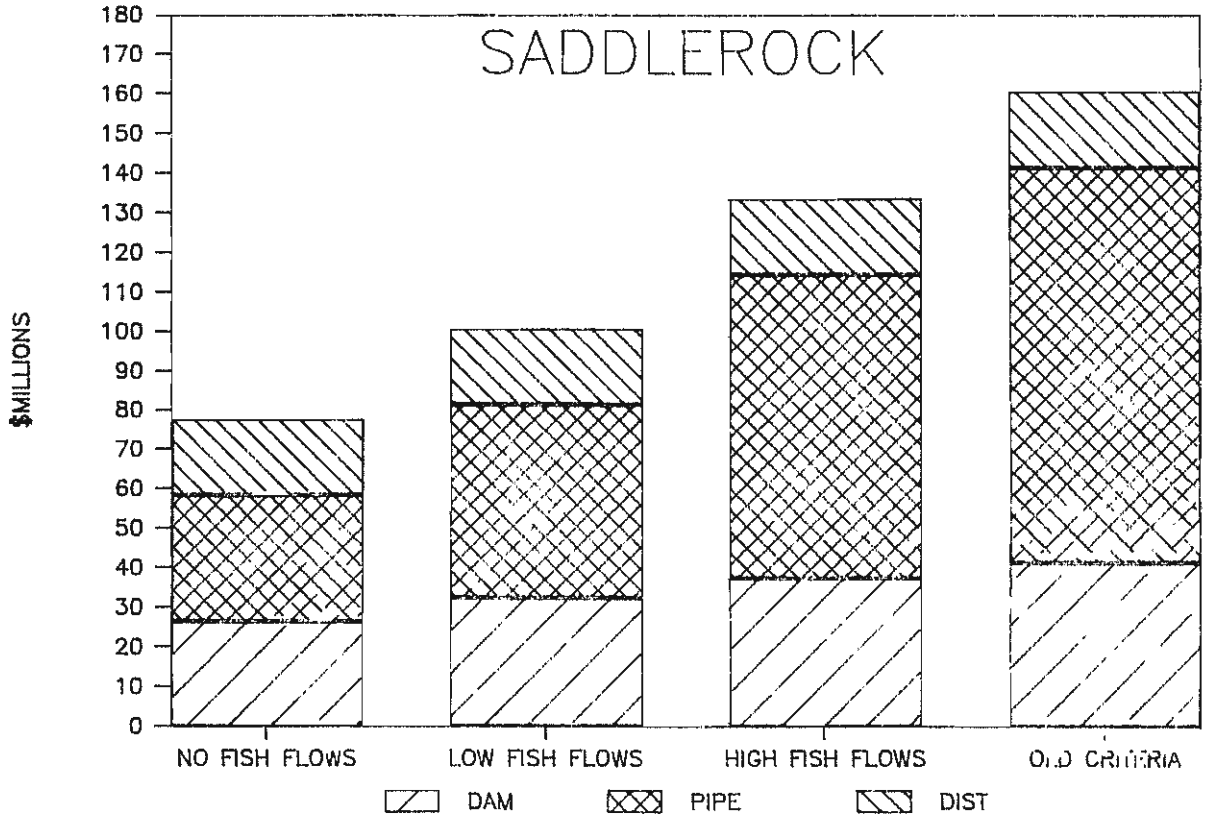
No Fish Flows - No flows are considered for Federally-protected native fish. Downstream water rights would be met on a seasonal need basis and diversions would be made primarily in the winter months whenever excess water is available after meeting the downstream demands. This scenario is the least restrictive of the scenarios presented.

Low Fish Flows - The values provided by the FWS for the Top of the Box diversion are used representing a low level of flows for fish. Downstream water rights would be treated the same as in the No Fish Flows scenario.

High Fish Flows - The values provided by the FWS for the Mangas Creek diversion location are used representing a high level of fish flows. Downstream water rights would be treated the same as in the No Fish Flows scenario.

RELATIVE COSTS AT FOUR HYDROLOGIC SCENARIOS





NOTE:YIELDS EQUAL 9,000 ACRE FEET

FIGURE 7

Old Criteria - The No Fish Flows scenario is considered. Downstream water rights would be held at the fully decreed level throughout the year regardless of agricultural diversion requirements. In this scenario, no advantage is taken for a lack of significant agricultural diversions in the winter months.

This display shows the sensitivity of the costs to the operational scenarios. The costs associated with the Mangas Creek diversion location are less sensitive to the operational scenario than is the Top of the Box diversion location.

B. Cost Comparisons of UGWSS Options

Figure 8 shows a total annual equivalent cost comparison at various yields for the Mangas Creek and the Top of the Box diversion locations. The costs displayed reflect the recommended flow levels for Federally-protected fish at the appropriate diversion location as shown in Figure 2 (following page). All of the economic analyses shown in this report use a discount rate of 8.875 percent. As can be seen, the Top of the Box diversion costs less at the 3,000 and 6,000 acre-foot levels than the Mangas Creek diversion location. At the 9,000 acre-foot yield, the costs are about the same.

Figure 9 shows a similar comparison for the conjunctive use options. In this case, the Top of the Box diversion costs less than the Mangas Creek diversion for all yields shown.

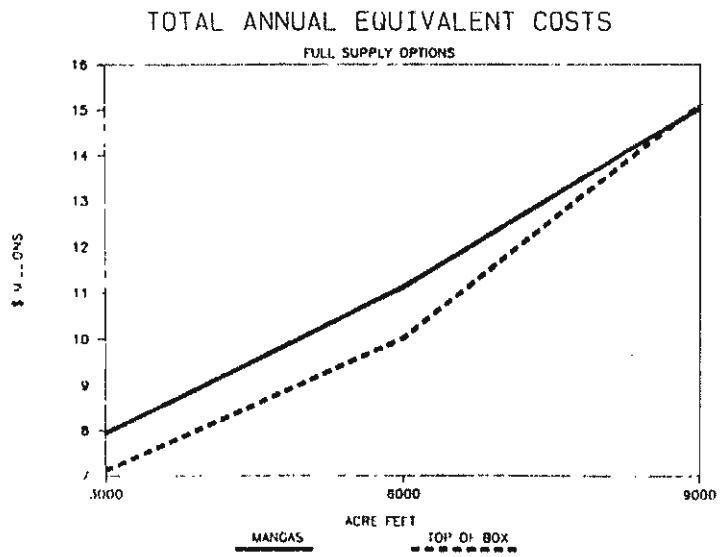


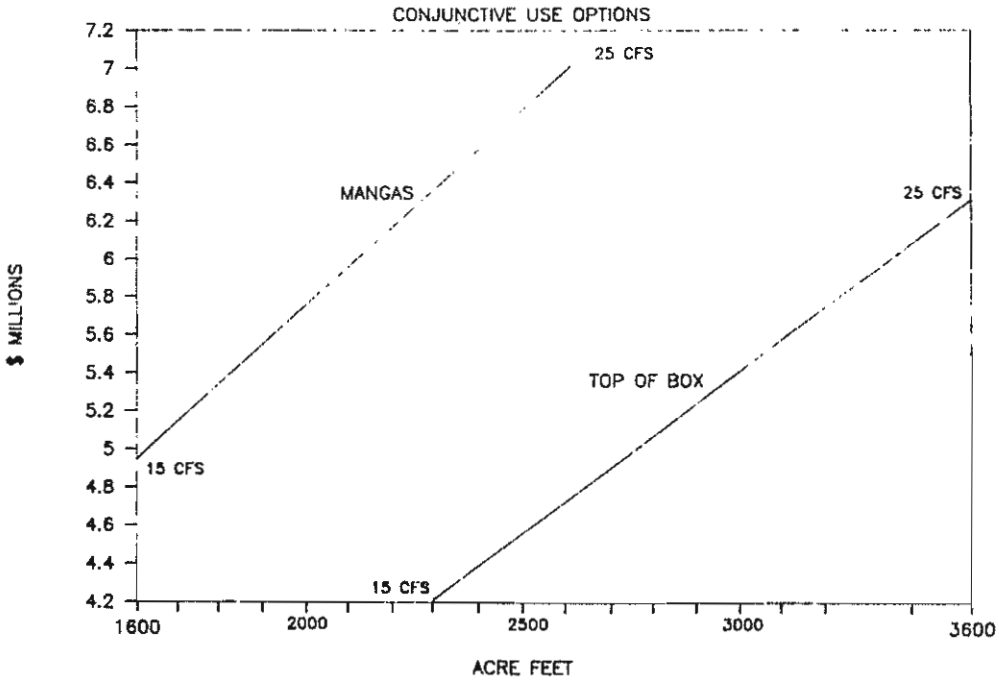
Figure 8

From these cost comparisons it is clear that at less than a 9,000 acre-foot yield, the Top of the Box diversion is superior from a total annual equivalent cost perspective. With 9,000 acre-feet of yield, there is no economic advantage of one diversion location over another.

C. Economic Comparison of Use Options

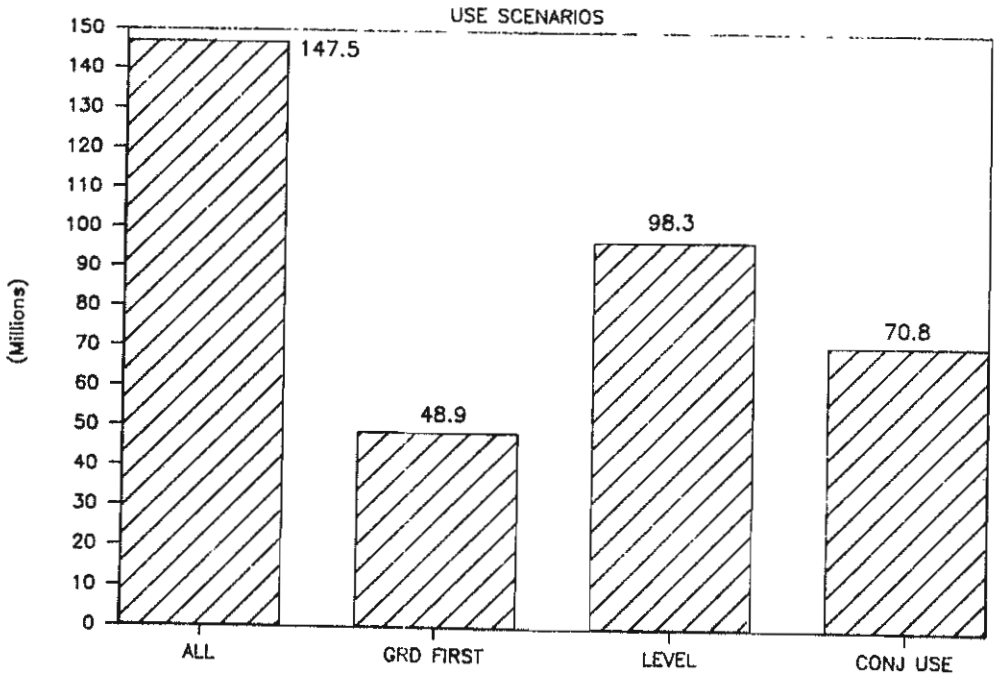
Figure 10 shows a present value analysis of the four use options shown in Figure 6. For this analysis, the Top of the Box diversion alternatives with appropriate flows for native fish were used. The four use option scenarios are described below.

Figure 9: Total Annual Equivalent Costs



NOTE: COSTS ARE FOR OPERATION OF FEDERAL FACILITIES ONLY
DOES NOT INCLUDE COSTS FOR EXISTING WATER RIGHTS
ASSUMES ALL NEW FACILITIES

Figure 10: Present Value Analysis



NOTE:INCLUDES COSTS FOR CENTRAL GRANT COUNTY USERS TO PUMP
THEIR EXISTING GROUND WATER SUPPLIES

All - In this use scenario, all of the needs of the Central Grant County municipal water users would be met from UGWSS. No groundwater would be used through the planning period. The groundwater would remain available at the end of the planning period. Construction of this option would occur in 1995 and would have a water yield capability of 9,000 acre-feet.

Groundwater (GRD) First - In this scenario, groundwater would be used first to meet the municipal needs until the supply is no longer able to meet the full needs about the year 2010. The available groundwater would be exhausted by about the year 2025. Construction of this option would occur in 2010 and would have a water yield capability of 9,000 acre-feet.

Level - In this scenario, groundwater use would be held to 3,000 acre feet per year throughout the planning period. The available groundwater would be exhausted by about the year 2045. Construction of this option would occur in 1995 and would have a water yield capability of 6,000 acre-feet.

Conjunctive (CONJ) Use - In this scenario, project water would be used whenever available to the maximum amount possible. Only when project water is not available would groundwater be used. The available groundwater would be exhausted by the year 2045. Construction of this option would occur in 1995 and would have an average water yield of 3,600 acre-feet.

As can be seen from the analysis, the use scenario that provides the smallest present value is the Groundwater First. This scenario would be the one that also provides the greatest net benefits.

D. Benefit/Cost Analysis

This analysis was conducted by comparing the present value of the options shown in Figure 10 to the present value of the No Action Alternatives (purchase of water rights in Deming and in the Gila-San Francisco Basin and construction of a pipeline from Deming). This comparison was used to measure the water supply benefits. Recreation benefits were not included in this analysis. It is assumed that the recreation benefits will equal the cost of the recreational facilities provided. Past analyses have shown that recreational benefits are not significant and should not affect these results. The present value analyses are contained in Appendix 2 and the results are shown below.

OPTION	BENEFITS ($Millions)	COSTS ($Millions)	NET BENEFITS ($Millions)	B/C RATIO
ALL	48.4	147.6	-99.2	.3/1
GRD FIRST	48.4	48.9	-0.5	1/1
LEVEL	48.4	98.3	-49.9	.5/1
CONJ USE	48.4	70.8	-22.4	.7/1

IV. Environmental Factors

The limitations placed on diversions from the Gila River were provided to Reclamation as preliminary flow requirements for Federally-protected fish by the U.S. Fish and Wildlife Service. These limitations are expected to negate adverse affects on native fish, although minor residual impacts may still occur.

The only alternatives that would have significant residual impacts after mitigation are those that include Mangas Creek storage. The impacts would affect biological resources, cultural resources, and the relocation of the residents.

Biological impacts would affect the native fish community inhabiting Mangas Creek and the riparian community (streambank vegetation) found along Mangas Creek. Although the Mangas Creek below Mangas Springs contains a native fish community, this community does not include any Federally-protected species. Mitigation of the impacts to both the fish and riparian communities is considered possible.

Cultural resource impacts would be related to prehistoric and historic sites. Mitigation of these sites would be possible.

Relocation of the residents in the Mangas Springs area would be required if they are located in the storage pool. Compensation for relocations would be provided as part of the project costs. Reclamation realizes opposition to relocation has been expressed by area residents.

V. Exchange Agreement

To implement the UGWSS project, an exchange of CAP water for Gila River water currently used by San Carlos Project (SCP) water rights holders would be required. Attempts to negotiate exchange arrangements with SCP water rights holders to exchange at the full 18,000 acre-foot level have not been successful. SCP water rights holders are reluctant to discuss an exchange without a commitment from Reclamation to construct Buttes Dam on the Gila River below San Carlos Reservoir. Unfortunately, recent studies indicate that Buttes Dam would not be an economical increment to the overall CAP, hence it is not part of the CAP's current construction program.

VI. Repayment

The capital repayment required for the project is based on the percent of the CAP water supply provided to downstream water rights holders in exchange for the New Mexico depletion, multiplied by the total CAP cost allocated to the water supply function, which is about 1 percent of the total CAP water supply and subsequently 1 percent of the water supply system cost, assuming a 1:1 exchange ratio. Repayment of the capital costs would be over a 50-year period at an interest rate of 3.342 percent. For simplicity, the repayment obligation for New Mexico water users can be converted into an annual cost per acre-foot based on the annual yield capability of the New Mexico feature. This

cost is about $70 per acre-foot capacity per year. For example, if a facility were constructed to develop a 9,000 acre-foot net yield, the annual repayment obligation would approximate $70 X 9,000, about $630,000 per year over the 50-year repayment period. These numbers are not precise but are considered to be reasonable for use in a planning process oriented towards determining financial viability of options.

In addition to capital repayment, an operation, maintenance, and replacement (OM&R) charge would be assessed for each acre-foot of CAP water delivered downstream for the exchange. This charge is presently estimated at about $60 per acre-foot. The OM&R cost to transport project water from storage to the users would be the responsibility of the users and would be in addition to the $60 CAP OM&R charge.

VII. Factors Affecting Selection of Proposed Action

A. National Economic Development Account

By Reclamation policy, this study is being conducted under the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (P&G). P&G states, "A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan), unless the Secretary ... grants an exception to this rule. Exceptions may be made when there are overriding reasons for recommending another plan, based on Federal, state, local, and international concerns."

Based on the results of the economic analysis, the NED plan would be to use groundwater first and construct an UGWSS alternative in about the year 2010. To implement any other alternative discussed in this report would require an exception from the NED criteria. A basis for requesting an exception may be that one of the objectives of CAP is to "reduce groundwater depletions" in the CAP service area.

B. Financial

Currently there is no commitment to contract for the project water supply. Prior to construction, a contract for repayment will be required.

The current Federal policy requires sharing the initial financing of construction costs with the project beneficiaries. The applicability of this Federal policy to this study is, however, uncertain. Experience on another CAP feature, Plan 6 of the Regulatory Storage Division, resulted in the local beneficiaries providing approximately 30 percent of the project costs during construction.

The Plan 6 agreement was negotiated between the local interests, the Department of the Interior, and the Office of Management and Budget following the filing of the Plan 6 Final Environmental Statement.

C. Public Input

The purpose of this document is to solicit input from major interests in the project on the course of action that Reclamation should pursue relative to the preparation of an environmental statement. This public input will be considered in deciding which alternative should be recommended as the agency proposed action.

IIX. Conclusions

The greatest net benefits are provided by using the existing groundwater rights to meet the municipal needs in the Central Grant County area as long as those rights are adequate to meet the needs. Based on Reclamation's analysis, these rights should be adequate until about the year 2010 when a supplemental supply would be required.

It should be noted that the results of this analysis are sensitive to certain assumptions. The primary assumptions that affect the cost and economic relationships are:

- Future availability of Phelps Dodge water
- The "future without the project" water supply assumption used to measure the benefits
- The interest rate used to discount the costs
- Water needs (gpcd and population)
- Quantities of available groundwater
- The year features are assumed to be required in the economic analysis
- Finally-determined fish flow requirements
- Technical aspects of recharge/recovery.

APPENDIX 1

COST SUMMARIES

DIRECT PUMPING TO MANGAS CREEK
(9,000 acre-foot net yield) ★ Closest to AWSA Water allocation

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Dam	$ 36,000.
Pumping Plant/Discharge Line	41,100.
Distribution Pipeline	39,000.
Recreation Facilities	2,000.
Environmental Mitigation	4,250.
Interest During Construction	19,650.
Total Capital Cost	$ 142,000.
Annualized Capital Cost 1/	$ 12,605.
Annualized Costs	
Operation, Maintanance, and Replacement	
Dam	$ 72.3
Pumping Plant/Discharge Line	141.0
Distribution Pipeline	216.0
Energy	1,836.0
TOTAL ANNUAL EQUIVALENT COSTS	$ 14,870.3

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

DIRECT PUMPING TO MANGAS CREEK
(6,000 acre-foot net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Dam	$ 34,500.
Pumping Plant/Discharge Line	21,900.
Distribution Pipeline	29,000.
Recreation Facilities	1,900.
Environmental Mitigation	4,000.
Interest During Construction	14,664.
Total Capital Cost	$ 105,960.
Annualized Capital Cost[1/]	$ 9,406.
Annualized Costs	
Operation, Maintanance, and Replacement	
Dam	$ 71.4
Pumping Plant/Discharge Line	102.0
Distribution Pipeline	200.1
Energy	1,207.0
TOTAL ANNUAL EQUIVALENT COSTS	$ 10,986.5

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

DIRECT PUMPING TO SCHOOLHOUSE
(3,000 acre-foot net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Dam	$ 26,200.
Pumping Plant/Discharge Line	11,100.
Distribution Pipeline	29,000.
Recreation Facilities	1,000.
Environmental Mitigation	1,400.
Interest During Construction	11,034.
Total Capital Cost	$ 79,734.
Annualized Capital Cost 1/	$ 7,078.
Annualized Costs	
Operation, Maintanance, and Replacement	
Dam	$ 57.0
Pumping Plant/Discharge Line	85.0
Distribution Pipeline	23.8
Energy	604.0
TOTAL ANNUAL EQUIVALENT COSTS	$ 7,848.8

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

DIRECT PUMPING TO SADDLEROCK
(9,000 acre-feet net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Dam	$ 33,400.
Pumping Plant/Discharge Line	58,000.
Distribution Pipeline	22,600.
Recreation Facilities	2,000.
Environmental Mitigation	1,500.
Interest During Construction	18,872.
Total Capital Cost	$ 136,372.
Annualized Capital Cost 1/	$ 12,105.
Annualized Costs	
Operation, Maintanance, and Replacement	
Dam	$ 73.1
Pumping Plant/Discharge Line	258.4
Distribution Pipeline	129.7
Energy	2,380.0
TOTAL ANNUAL EQUIVALENT COSTS	$ 14,946.2

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

DIRECT PUMPING TO SADDLEROCK
(6,000 acre-feet net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Dam	$ 29,300.
Pumping Plant/Discharge Line	34,000.
Distribution Pipeline	10,500.
Recreation Facilities	1,700.
Environmental Mitigation	1,400.
Interest During Construction	12,351.
Total Capital Cost	$ 89,251.
Annualized Capital Cost 1/	$ 7,923.
Annualized Costs	
Operation, Maintanance, and Replacement	
Dam	$ 67.2
Pumping Plant/Discharge Line	204.0
Distribution Pipeline	128.0
Energy	1,586.0
TOTAL ANNUAL EQUIVALENT COSTS	$ 9,908.2

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

DIRECT PUMPING TO SADDLEROCK
(3,000 acre-feet net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Dam	$ 14,700.
Pumping Plant/Discharge Line	30,200.
Distribution Pipeline	10,500.
Recreation Facilities	1,000.
Environmental Mitigation	900.
Interest During Construction	9,203.
Total Capital Cost	$ 66,503.
Annualized Capital Cost 1/	$ 5,903.
Annualized Costs	
Operation, Maintanance, and Replacement	
Dam	$ 51.
Pumping Plant/Discharge Line	173.
Distribution Pipeline	111.
Energy	794.
TOTAL ANNUAL EQUIVALENT COSTS	$ 7,032.

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

CONJUNCTIVE USE-RECHARGE/RECOVERY-MANGAS CREEK DIVERSION
(1.6 thousand acre-foot net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Pumping Plant/Discharge Line (15 cfs)	$ 35,900.
Recharge Facilities	1,700.
Treatment Plant	1,000.
Interest During Construction	6,200.
Total Capital Cost	$ 44,800.
Annualized Capital Cost 1/	$ 3,977.
Annualized Costs	
Operation, Maintanance, and Replacement	
Pumping Plant/Discharge Line	$ 281.
Treatment Plant	128.
Energy (includes recovery)	517.
TOTAL ANNUAL EQUIVALENT COSTS	$ 4,903.

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

CONJUNCTIVE USE-RECHARGE/RECOVERY-MANGAS CREEK DIVERSION
(2.6 thousand acre-foot net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Pumping Plant/Discharge Line (25 cfs)	$ 50,300.
Recharge Facilities	2,500.
Treatment Plant	1,600.
Interest During Construction	8,737.
Total Capital Cost	$ 63,137.
Annualized Capital Cost 1/	$ 5,605.
Annualized Costs	
Operation, Maintanance, and Replacement	
Pumping Plant/Discharge Line	$ 298.
Treatment Plant	196.
Energy (includes recovery)	840.
TOTAL ANNUAL EQUIVALENT COSTS	$ 6,939.

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

CONJUNCTIVE USE-RECHARGE/RECOVERY-TOP OF BOX DIVERSION
(2.3 thousand acre-foot net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Pumping Plant/Discharge Line (15 cfs)	$ 26,800.
Recharge Facilities	1,700.
Treatment Plant	1,000.
Interest During Construction	4,738.
Total Capital Cost	$ 34,238.
Annualized Capital Cost 1/	$ 3,039.
Annualized Costs	
Operation, Maintanance, and Replacement	
Pumping Plant/Discharge Line	$ 270.3
Treatment Plant	128.0
Energy (includes recovery)	742.9
TOTAL ANNUAL EQUIVALENT COSTS	$ 4,180.2

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

CONJUNCTIVE USE-RECHARGE/RECOVERY-TOP OF THE BOX DIVERSION
(3.6 thousand acre-foot net yield)

	1/87 PRICE LEVEL (thousands)
Capital Cost	
Pumping Plant/Discharge Line (25 cfs)	$ 43,800.
Recharge Facilities	2,500.
Treatment Plant	1,600.
Interest During Construction	7,693.
Total Capital Cost	$ 55,593.
Annualized Capital Cost 1/	$ 4,935.
Annualized Costs	
Operation, Maintanance, and Replacement	
Pumping Plant/Discharge Line	$ 296.
Treatment Plant	196.
Energy (includes recovery)	1,163.
TOTAL ANNUAL EQUIVALENT COSTS	$ 6,590.

1/ Annualized capital cost was determined by annualizing total capital cost 100 years at 8.875 percent interest, or multiplying by .088768007.

APPENDIX 2.

PRESENT VALUE ANALYSES

APPENDIX 2
PRESENT VALUE ANALYSES

The following spreadsheets show the method used to develop the present values of the options used to establish the benefit/cost ratios. There are two sets of spreadsheets: The first set contains three sheets showing the various steps required to develop the present value of the No Action Plan. The last four sheets reflect the four alternatives shown in the benefit/cost analysis.

The method used to develop the present values was:

1. Establish the needs through time

2. Determine the amount of water that would come from a surface supply and the amount of water that would come from a groundwater supply

3. Establish the energy required to remove this water from the ground and from the surface supply. The following formula was used:

$$\text{Pumping Energy (KWH)} = \frac{1.204 \times V \times H}{Ep}$$

where;
- H = Total Dynamic Head
- V = Volume (AF)
- Ep= Plant Efficiency = Eq x Em
- Eq= Pump Efficiency (Assume 85%)
- Em= Motor Efficiency (Assume 96%)

$$\text{Total Energy} = \frac{\text{Pumping Energy}}{Et}$$

Where; Et = Transmission Line Efficiency (Assume 92%)

A 60% efficiency was assumed for all well pumping

4. The energy required was then multiplied by 110 mills to establish the cost

5. Costs were included for the OM&R and the capital facility from the values included in Appendix 1

6. The total cost through time was then developed by adding the energy costs, the OM&R costs, and the capital costs. These totals were then discounted at 8.875 percent, the current discount rate used for planning purposes

NO ACTION BUY NEW RIGHTS IN 2009 AND BUILD PIPE

YEAR	TOTAL SILVER CITY NEEDS	PUMPED FROM EXISTNG WELLS	PUMPED FROM FRANKS (AF)	TDH FRANKS (FEET)	ENERGY FROM FRANKS (KW HRS)	PUMPED FROM WOODWARD (AF)	TDH WOODWARD (FEET)
1995	4031	4031	605	630	609487	3426	630
1996	4106	4106	616	633	623784	3490	633
1997	4182	4182	627	636	638340	3555	636
1998	4260	4260	639	639	653314	3621	639
1999	4339	4339	651	642	668553	3688	642
2000	4419	4419	663	645	684061	3756	645
2001	4501	4501	675	648	699996	3826	648
2002	4584	4584	688	651	716204	3896	651
2003	4669	4669	700	654	732846	3969	654
2004	4756	4756	713	657	749926	4043	657
2005	4844	4844	727	660	767290	4117	660
2006	4933	4933	740	663	784939	4193	663
2007	5025	5025	754	666	803196	4271	666
2008	5118	5118	768	669	821746	4350	669
2009	5213	5213	782	672	840753	4431	672
2010	5309	5200	780	675	842400	4420	675
2011	5407	5200	780	678	846144	4420	678
2012	5508	5200	780	681	849888	4420	681
2013	5610	5200	780	684	853632	4420	684
2014	5714	5200	780	687	857376	4420	687
2015	5819	5200	780	690	861120	4420	690
2016	5927	5200	780	693	864864	4420	693
2017	6037	5200	780	696	868608	4420	696
2018	6149	5200	780	699	872352	4420	699
2019	6263	5200	780	702	876096	4420	702
2020	6379	5200	780	705	879840	4420	705
2021	6497	5200	780	708	883584	4420	708
2022	6617	5200	780	711	887328	4420	711
2023	6740	5200	780	714	891072	4420	714
2024	6865	5200	780	717	894816	4420	717
2025	6992	5200	780	720	898560	4420	720
2026	7121			723			723
2027	7253			726			726
2028	7387			729			729
2029	7524			732			732
2030	7664			735			735
2031	7694			738			738
2032	7730			741			741
2033	7766			744			744
2034	7803			747			747
2035	7839			750			750
2036	7876			753			753
2037	7913			756			756
2038	7950			759			759
2039	7987			762			762
2040	8025			765			765
2041	8062			768			768
2042	8100			771			771
2043	8138			774			774
2044	8176			777			777
TOTAL	314821	152180	22827		24722114	129353	
NPV							

ENERGY FROM WOODWARD (KW HRS)	ENERGY FROM WELLS TO"X" (KW HRS)	PUMPED FROM NEW RIGHTS	TDH NEW WELLS (FEET)	ENERGY FROM NEW WELLS (KW HRS)	PIPELINE ENERGY NEW RIGHTS (KW HRS)	TOTAL ENERGY (KW HRS)
3453761	1289920					5353168
3534773	1313920					5472477
3617263	1338240					5593843
3702110	1363200					5718624
3788468	1388480					5845501
3876347	1414080					5974488
3966641	1440320					6106957
4058490	1466880					6241574
4152795	1494080					6379722
4249581	1521920					6521427
4347974	1550080					6665344
4447987	1578560	0	409	0	0	6811486
4551444	1608000	0	412	0	0	6962640
4656561	1637760	0	415	0	0	7116067
4764265	1668160	0	418	0	0	7273178
4773600	1664000	109	421	73415	351569	7704984
4794816	1664000	207	424	140376	667658	8112994
4816032	1664000	308	427	210288	993423	8533631
4837248	1664000	410	430	281818	1322414	8959112
4858464	1664000	514	432	355672	1657856	9393367
4879680	1664000	619	435	431181	1996523	9832503
4900896	1664000	727	438	509761	2344866	10284387
4922112	1664000	837	441	590748	2699660	10745128
4943328	1664000	949	444	674170	3060905	11214754
4964544	1664000	1063	447	760054	3428600	11693294
4985760	1664000	1179	450	848427	3802747	12180774
5006976	1664000	1297	453	939319	4183344	12677222
5028192	1664000	1417	456	1032755	4570392	13182667
5049408	1664000	1540	458	1129498	4967116	13701094
5070624	1664000	1665	461	1228850	5370291	14228581
5091840	1664000	1792	464	1330840	5779917	14765156
	0	7330	467	5477445	23642182	29119627
	0	7410	470	5571372	23900214	29471586
	0	7490	473	5666035	24158246	29824281
	0	7570	476	5761436	24416278	30177714
	0	7650	479	5857574	24674310	30531884
	0	7687	481	5921327	24793650	30714977
	0	7724	484	5985420	24912990	30898410
	0	7761	487	6049855	25032329	31082184
	0	7798	490	6114630	25151669	31266299
	0	7835	493	6179747	25271009	31450756
	0	7874	496	6246791	25396800	31643590
	0	7913	499	6314194	25522590	31836784
	0	7952	502	6381957	25648381	32030338
	0	7991	504	6450079	25774171	32224251
	0	8030	507	6518561	25899962	32418523
	0	8066	510	6584953	26016076	32601030
	0	8102	513	6651677	26132191	32783868
	0	8138	516	6718733	26248305	32967038
	0	8174	519	6786120	26364420	33150540
140091982	48697600	163128		127775075	526153051	867439823

TOTAL COST ENERGY $	COST PIPE AND WATER RIGHTS $	OM&R PIPELINE	TOTAL COSTS $
588848			588848
601972			601972
615322			615322
629048			629048
643005			643005
657193			657193
671765			671765
686573			686573
701769			701769
717356			717356
733187			733187
749263			749263
765890			765890
782767			782767
800049	93200000	3700000	97700049
847548		3700000	4547548
892429		3700000	4592429
938699		3700000	4638699
985502		3700000	4685502
1033270		3700000	4733270
1081575		3700000	4781575
1131282		3700000	4831282
1181964		3700000	4881964
1233622		3700000	4933622
1286262		3700000	4986262
1339885		3700000	5039885
1394494		3700000	5094494
1450093		3700000	5150093
1507120		3700000	5207120
1565143		3700000	5265143
1624167		3700000	5324167
3203158		3700000	6903158
3241874		3700000	6941874
3280670		3700000	6980670
3319548		3700000	7019548
3358507		3700000	7058507
3378647		3700000	7078647
3398825		3700000	7098825
3419040		3700000	7119040
3439292		3700000	7139292
3459583		3700000	7159583
3480794		3700000	7180794
3502046		3700000	7202046
3523337		3700000	7223337
3544667		3700000	7244667
3566037		3700000	7266037
3586113		3700000	7286113
3606225		3700000	7306225
3626374		3700000	7326374
3646559		3700000	7346559

TOTAL	321818380
NPV	48362216

PRESENT VALUE ANALYSIS
165 GPCD
ALL NEEDS

YEAR	NEEDS (AF)	SURFACE USE (AF)	GROUND USE (AF)	SURFACE COST$	LIFT (FEET)	GROUND COST$	CAPITOL FACILITY$	OM&R$	TOTAL COST$
1995	4031	4031	0	1282012		0	136000000	461200	137743212
1996	4106	4106	0	1305758		0	0	461200	1766958
1997	4182	4182	0	1329944		0	0	461200	1791144
1998	4260	4260	0	1354577		0	0	461200	1815777
1999	4339	4339	0	1379667		0	0	461200	1840867
2000	4419	4419	0	1405222		0	0	461200	1866422
2001	4501	4501	0	1431250		0	0	461200	1892450
2002	4584	4584	0	1457760		0	0	461200	1918960
2003	4669	4669	0	1484761		0	0	461200	1945961
2004	4756	4756	0	1512262		0	0	461200	1973462
2005	4844	4844	0	1540272		0	0	461200	2001472
2006	4933	4933	0	1568802		0	0	461200	2030002
2007	5025	5025	0	1597859		0	0	461200	2059059
2008	5118	5118	0	1627455		0	0	461200	2088655
2009	5213	5213	0	1657600		0	0	461200	2118800
2010	5309	5309	0	1688302		0	0	461200	2149502
2011	5407	5407	0	1719573		0	0	461200	2180773
2012	5508	5508	0	1751424		0	0	461200	2212624
2013	5610	5610	0	1783864		0	0	461200	2245064
2014	5714	5714	0	1816905		0	0	461200	2278105
2015	5819	5819	0	1850558		0	0	461200	2311758
2016	5927	5927	0	1884835		0	0	461200	2346035
2017	6037	6037	0	1919746		0	0	461200	2380946
2018	6149	6149	0	1955304		0	0	461200	2416504
2019	6263	6263	0	1991521		0	0	461200	2452721
2020	6379	6379	0	2028408		0	0	461200	2489608
2021	6497	6497	0	2065979		0	0	461200	2527179
2022	6617	6617	0	2104246		0	0	461200	2565446
2023	6740	6740	0	2143221		0	0	461200	2604421
2024	6865	6865	0	2182918		0	0	461200	2644118
2025	6992	6992	0	2223351		0	0	461200	2684551
2026	7121	7121	0	2264533		0	0	461200	2725733
2027	7253	7253	0	2306477		0	0	461200	2767677
2028	7387	7387	0	2349198		0	0	461200	2810398
2029	7524	7524	0	2392711		0	0	461200	2853911
2030	7664	7664	0	2437029		0	0	461200	2898229
2031	7694	7694	0	2446683		0	0	461200	2907883
2032	7730	7730	0	2458152		0	0	461200	2919352
2033	7766	7766	0	2469675		0	0	461200	2930875
2034	7803	7803	0	2481251		0	0	461200	2942451
2035	7839	7839	0	2492882		0	0	461200	2954082
2036	7876	7876	0	2504568		0	0	461200	2965768
2037	7913	7913	0	2516308		0	0	461200	2977508
2038	7950	7950	0	2528103		0	0	461200	2989303
2039	7987	7987	0	2539953		0	0	461200	3001153
2040	8025	8025	0	2551859		0	0	461200	3013059
2041	8062	8062	0	2563821		0	0	461200	3025021
2042	8100	8100	0	2575839		0	0	461200	3037039
2043	8138	8138	0	2587913		0	0	461200	3049113
2044	8176	8176	0	2600044		0	0	461200	3061244
								NPV	147556766

PRESENT VALUE ANALYSIS
165 GPCD
GROUND
LEVEL

YEAR	NEEDS (AF)	GROUND USE (AF)	SURFACE USE (AF)	SURFACE COST$	LIFT (FEET)	LIFT TO X (FT)	GROUND COST$	CAPITOL FACILITY$	OM&R$	TOTAL COST$
1995	4031	3000	1031	328012	615	200	431787	89300000	399200	90458999
1996	4106	3000	1106	351758	617	200	432582	0	399200	1183540
1997	4182	3000	1182	375944	618	200	433376	0	399200	1208520
1998	4260	3000	1260	400577	620	200	434171	0	399200	1233948
1999	4339	3000	1339	425667	621	200	434966	0	399200	1259833
2000	4419	3000	1419	451222	623	200	435761	0	399200	1286182
2001	4501	3000	1501	477250	624	200	436555	0	399200	1313005
2002	4584	3000	1584	503760	626	200	437350	0	399200	1340310
2003	4669	3000	1669	530761	627	200	438145	0	399200	1368105
2004	4756	3000	1756	558262	629	200	438939	0	399200	1396401
2005	4844	3000	1844	586272	630	200	439734	0	399200	1425206
2006	4933	3000	1933	614802	632	200	440529	0	399200	1454530
2007	5025	3000	2025	643859	633	200	441323	0	399200	1484383
2008	5118	3000	2118	673455	635	200	442118	0	399200	1514773
2009	5213	3000	2213	703600	636	200	442913	0	399200	1545712
2010	5309	3000	2309	734302	638	200	443708	0	399200	1577210
2011	5407	3000	2407	765573	639	200	444502	0	399200	1609275
2012	5508	3000	2508	797424	641	200	445297	0	399200	1641920
2013	5610	3000	2610	829864	642	200	446092	0	399200	1675156
2014	5714	3000	2714	862905	644	200	446886	0	399200	1708991
2015	5819	3000	2819	896558	645	200	447681	0	399200	1743439
2016	5927	3000	2927	930835	647	200	448476	0	399200	1778511
2017	6037	3000	3037	965746	648	200	449270	0	399200	1814217
2018	6149	3000	3149	1001304	650	200	450065	0	399200	1850569
2019	6263	3000	3263	1037521	651	200	450860	0	399200	1887581
2020	6379	3000	3379	1074408	653	200	451655	0	399200	1925263
2021	6497	3000	3497	1111979	654	200	452449	0	399200	1963628
2022	6617	3000	3617	1150246	656	200	453244	0	399200	2002690
2023	6740	3000	3740	1189221	657	200	454039	0	399200	2042460
2024	6865	3000	3865	1228918	659	200	454833	0	399200	2082952
2025	6992	3000	3992	1269351	660	200	455628	0	399200	2124179
2026	7121	3000	4121	1310533	662	200	456423	0	399200	2166155
2027	7253	3000	4253	1352477	663	200	457217	0	399200	2208894
2028	7387	3000	4387	1395198	665	200	458012	0	399200	2252410
2029	7524	3000	4524	1438711	666	200	458807	0	399200	2296717
2030	7664	3000	4664	1483029	668	200	459602	0	399200	2341830
2031	7694	3000	4694	1492683	669	200	460396	0	399200	2352280
2032	7730	3000	4730	1504152	671	200	461191	0	399200	2364543
2033	7766	3000	4766	1515675	672	200	461986	0	399200	2376860
2034	7803	3000	4803	1527251	674	200	462780	0	399200	2389232
2035	7839	3000	4839	1538882	675	200	463575	0	399200	2401657
2036	7876	3000	4876	1550568	677	200	464370	0	399200	2414137
2037	7913	3000	4913	1562308	678	200	465164	0	399200	2426672
2038	7950	3000	4950	1574103	680	200	465959	0	399200	2439262
2039	7987	3000	4987	1585953	681	200	466754	0	399200	2451907
2040	8025	3000	5025	1597859	683	200	467549	0	399200	2464608
2041	8062	3000	5062	1609821	684	200	468343	0	399200	2477365
2042	8100	3000	5100	1621839	686	200	469138	0	399200	2490177
2043	8138	3000	5138	1633913	687	200	469933	0	399200	2503046
2044	8176	3000	5176	1646044	689	200	470727	0	399200	2515972
									NPV	98267694

PRESENT VALUE ANALYSIS
165 GPCD
GROUND
FIRST

YEAR	NEEDS (AF)	GROUND USE (AF)	SURFACE USE (AF)	SURFACE COST$	LIFT (FEET)	LIFT TO X (FT)	GROUND COST$	CAPITOL FACILITY$	OM&R$	TOTAL COST$
1995	4031	4031	0	0	630	200	590927	0		590927
1996	4106	4106	0	0	633	200	604048	0		604048
1997	4182	4182	0	0	636	200	617452	0		617452
1998	4260	4260	0	0	639	200	631145	0		631145
1999	4339	4339	0	0	642	200	645134	0		645134
2000	4419	4419	0	0	645	200	659425	0		659425
2001	4501	4501	0	0	648	200	674023	0		674023
2002	4584	4584	0	0	651	200	688936	0		688936
2003	4669	4669	0	0	654	200	704171	0		704171
2004	4756	4756	0	0	657	200	719733	0		719733
2005	4844	4844	0	0	660	200	735630	0		735630
2006	4933	4933	0	0	663	200	751869	0		751869
2007	5025	5025	0	0	666	200	768458	0		768458
2008	5118	5118	0	0	669	200	785403	0		785403
2009	5213	5213	0	0	672	200	802712	136000000	461200	137263912
2010	5309	5213	97	30702	675	200	805473	0	461200	1297376
2011	5407	5213	195	61974	678	200	808235	0	461200	1331409
2012	5508	5213	295	93824	681	200	810997	0	461200	1366021
2013	5610	5213	397	126264	684	200	813758	0	461200	1401223
2014	5714	5213	501	159306	687	200	816520	0	461200	1437026
2015	5819	5213	607	192959	690	200	819282	0	461200	1473440
2016	5927	5213	715	227235	693	200	822043	0	461200	1510479
2017	6037	5213	824	262147	696	200	824805	0	461200	1548152
2018	6149	5213	936	297705	699	200	827566	0	461200	1586471
2019	6263	5213	1050	333921	702	200	830328	0	461200	1625450
2020	6379	5213	1166	370809	705	200	833090	0	461200	1665099
2021	6497	5213	1284	408380	708	200	835851	0	461200	1705431
2022	6617	5213	1405	446646	711	200	838613	0	461200	1746459
2023	6740	5213	1527	485622	714	200	841375	0	461200	1788196
2024	6865	5213	1652	525319	717	200	844136	0	461200	1830655
2025	6992	5213	1779	565752	720	200	846898	0	461200	1873849
2026	7121	0	7121	2264533	723	200	0	0	461200	2725733
2027	7253	0	7253	2306477	726	200	0	0	461200	2767677
2028	7387	0	7387	2349198	729	200	0	0	461200	2810398
2029	7524	0	7524	2392711	732	200	0	0	461200	2853911
2030	7664	0	7664	2437029	735	200	0	0	461200	2898229
2031	7694	0	7694	2446683	738	200	0	0	461200	2907883
2032	7730	0	7730	2458152	741	200	0	0	461200	2919352
2033	7766	0	7766	2469675	744	200	0	0	461200	2930875
2034	7803	0	7803	2481251	747	200	0	0	461200	2942451
2035	7839	0	7839	2492882	750	200	0	0	461200	2954082
2036	7876	0	7876	2504568	753	200	0	0	461200	2965768
2037	7913	0	7913	2516308	756	200	0	0	461200	2977508
2038	7950	0	7950	2528103	759	200	0	0	461200	2989303
2039	7987	0	7987	2539953	762	200	0	0	461200	3001153
2040	8025	0	8025	2551859	765	200	0	0	461200	3013059
2041	8062	0	8062	2563821	768	200	0	0	461200	3025021
2042	8100	0	8100	2575839	771	200	0	0	461200	3037039
2043	8138	0	8138	2587913	774	200	0	0	461200	3049113
2044	8176	0	8176	2600044	777	200	0	0	461200	3061244
									NPV	48945053

PRESENT VALUE ANALYSIS
165 GPCD
CONJUNCTIVE
USE

YEAR	NEEDS (AF)	GROUND USE (AF)	SURFACE USE (AF)	SURFACE COST$	LIFT (FEET)	LIFT TO X (FT)	GROUND COST$	CAPITOL FACILITY$	OM&R$	TOTAL COST$
1995	4031	0	4031	1282012	615	200	0	55600000	492000	57374012
1996	4106	1076	3030	963590	617	200	155153	0	492000	1610743
1997	4182	0	4182	1329944	618	200	0	0	492000	1821944
1998	4260	2740	1520	483257	620	200	396543	0	492000	1371800
1999	4339	4339	0	0	621	200	629106	0	492000	1121106
2000	4419	0	4419	1405222	623	200	0	0	492000	1897222
2001	4501	0	4501	1431250	624	200	0	0	492000	1923250
2002	4584	0	4584	1457760	626	200	0	0	492000	1949760
2003	4669	3110	1559	495781	627	200	454210	0	492000	1441991
2004	4756	4	4752	1510990	629	200	585	0	492000	2003575
2005	4844	3710	1134	360492	630	200	543804	0	492000	1396297
2006	4933	350	4583	1457502	632	200	51395	0	492000	2000897
2007	5025	330	4695	1492919	633	200	48546	0	492000	2033465
2008	5118	450	4668	1484355	635	200	66318	0	492000	2042673
2009	5213	570	4643	1476340	636	200	84153	0	492000	2052493
2010	5309	3950	1359	432202	638	200	584215	0	492000	1508417
2011	5407	3006	2401	763665	639	200	445391	0	492000	1701056
2012	5508	1212	4296	1366008	641	200	179900	0	492000	2037908
2013	5610	1008	4602	1463320	642	200	149887	0	492000	2105207
2014	5714	3714	2000	635853	644	200	553245	0	492000	1681098
2015	5819	5170	649	206498	645	200	771504	0	492000	1470002
2016	5927	5698	229	72871	647	200	851805	0	492000	1416676
2017	6037	3126	2911	925678	648	200	468140	0	492000	1885818
2018	6149	2954	3195	1015932	650	200	443164	0	492000	1951096
2019	6263	4202	2061	655285	651	200	631504	0	492000	1778789
2020	6379	1760	4619	1468728	653	200	264971	0	492000	2225699
2021	6497	1858	4639	1475135	654	200	280217	0	492000	2247352
2022	6617	5356	1261	401038	656	200	809191	0	492000	1702229
2023	6740	2384	4356	1385109	657	200	360809	0	492000	2237919
2024	6865	3312	3553	1129702	659	200	502136	0	492000	2123838
2025	6992	3690	3302	1049931	660	200	560422	0	492000	2102354
2026	7121	5850	1271	404233	662	200	890024	0	492000	1786257
2027	7253	2410	4843	1540097	663	200	367298	0	492000	2399395
2028	7387	5170	2217	705138	665	200	789308	0	492000	1986446
2029	7524	2570	4954	1575451	666	200	393044	0	492000	2460495
2030	7664	2650	5014	1594329	668	200	405981	0	492000	2492310
2031	7694	5677	2017	641397	669	200	871223	0	492000	2004620
2032	7730	2724	5006	1591920	671	200	418761	0	492000	2502682
2033	7766	6511	1255	399177	672	200	1002663	0	492000	1893840
2034	7803	7668	135	42827	674	200	1182866	0	492000	1717694
2035	7839	2835	5004	1591352	675	200	438078	0	492000	2521431
2036	7876	2874	5002	1590636	677	200	444866	0	492000	2527502
2037	7913	2913	5000	1589974	678	200	451675	0	492000	2533648
2038	7950	6312	1638	520887	680	200	980378	0	492000	1993265
2039	7987	2991	4996	1588815	681	200	465354	0	492000	2546169
2040	8025	6650	1375	437159	683	200	1036399	0	492000	1965559
2041	8062	3206	4856	1544313	684	200	500503	0	492000	2536816
2042	8100	3102	4998	1589403	686	200	485089	0	492000	2566492
2043	8138	3138	5000	1590029	687	200	491549	0	492000	2573579
2044	8176	3504	4672	1485772	689	200	549809	0	492000	2527582
		147834	166985					NPV		70761222