Regional Water Supply Study

prepared for

El Paso County Water Authority M.U.D.

El Paso County W.C.I.D. No. 4

and

Texas General Land Office

in conjunction with

Texas Water Development Board

November, 1995

HDR Engineering, Inc.

December 14, 1995

HDR

Mr. Patrick King, General Manager
EL PASO COUNTY WATER AUTHORITY M.U.D.
1539 Pawling Drive
El Paso, Texas 79927

Dear Mr. King:

This report, "Regional Water Supply Study prepared for El Paso County M.U.D., El Paso County W.C.I.D. No. 4, and Texas General Land Office," HDR Engineering, Inc., November, 1995, and the accompanying report, "A Review and Evaluation of the Available Hydrologic Data on the Groundwater Resources under the El Paso County Water Authority and Fabens W.C.I.D. Leases," Geraghty and Miller, Inc., November, 1995, are submitted in final form. Comments received from the Texas Water Development Board (TWDB) have been incorporated or addressed. The copies required by your contract with the Texas Water Development Board Contract 94-483-049 have been submitted to them by copy of this letter.

The reports project that over 90,000 people will live in the area at year 2050 and water use will be nearly 16,000 acre-feet per year. The projected population and related water demands are several times greater than current population and demand. Sources of water that were evaluated were the Wheeler, Fabens, and University Block L well fields where the Rio Grande Alluvium overlies the Hueco Bolson. The Desert Well Field in the Hueco Bolson was also evaluated. These sources, with demineralization treatment where needed to meet drinking water standards, and service from El Paso Water Utilities Public Service Board (EPWUPSB) were compared on the basis of cost to meet water demands. In each case, costs were developed to deliver compliant quality potable water to a central point for each of the two districts. As shown in the report, development and use of freshwater in the existing Desert Well Field with blended water from the Wheeler Well Field is the least costly alternative for EPCWA. The Fabens area is best served by continued use and development of its existing field.

As freshwater supplies become more limiting in the future, advances in demineralization technology and EPWUPSB's costs for additional water supplies appear as the likely factors that will influence water supply decisions. Presently, demineralization of available groundwater and EPWUPSB wholesale service are about equally competitive. University Block L may be an attractive water supply for future development. However, lack of sufficient and recent data is an impediment to evaluating future service from the field. The extent of freshwater and slightly saline reserves in the field must be better defined to analyze the cost effectiveness of any major projects to place the field in service.

HDR Engineering, Inc.

2211 South IH 35
Suite 300
Austin, Texas
78741

Telephone
512 912-5100
Fax
512 442-5069

We appreciate the opportunity to serve the water districts and water users in the El Paso study area. Any questions or comments can be directed to us or our study partner, Geraghty and Miller, Inc.

Sincerely,

HDR ENGINEERING, INC.

G.E. Kretzschmar, Jr., P.E.
Project Manager

SK/xc
Enclosures

cc: Texas Water Development Board

REGIONAL WATER SUPPLY STUDY

prepared for

EL PASO COUNTY WATER AUTHORITY M.U.D.

EL PASO COUNTY W.C.I.D. No. 4

and

TEXAS GENERAL LAND OFFICE

in conjunction with

TEXAS WATER DEVELOPMENT BOARD

FINAL REPORT

November, 1995

HDR

HDR Engineering, Inc.

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

2.0 POPULATION AND WATER DEMAND PROJECTIONS 2-1
- 2.1 Population Projections within Study Area 2-1
- 2.2 Annual Water Demand Projections within Study Area 2-4

3.0 AVAILABLE WATER SUPPLY 3-1
- 3.1 Desert Field 3-2
- 3.2 Wheeler Well Field 3-4
- 3.3 University Block L Well Field and Fabens Well Field 3-6
- 3.4 El Paso Water Utilities Public Service Board 3-8
- 3.5 Demineralization Treatment 3-9
- 3.6 Blending Supplies 3-11
- 3.7 Summary of sources 3-14

4.0 WATER SUPPLY ALTERNATIVES 4-1
- 4.1 Planning Cost Comparisons 4-1
- 4.2 Supply for the El Paso County Water Authority 4-2
- 4.3 Supply for the El Paso County Water Control and Improvement District No. 4 4-10
- 4.4 Water Supply for Outside Demands 4-12

5.0 WATER CONSERVATION PLAN 5-1
- 5.1 Background Purpose and Goals 5-1
- 5.2 Conservation Methods 5-1
- 5.3 Conservation Program 5-6
- 5.4 Drought Management Plan 5-10
- 5.5 Termination Notification 5-12
- 5.6 Implementation 5-12

6.0 INSTITUTIONAL CONSIDERATIONS 6-1

REFERENCES

LIST OF TABLES

Table 2-1	Population Projections for El Paso County Water Authority and El Paso County W.C.I.D. No. 4 Service Areas	2-2
Table 2-2	Per Capita Water Use Gallons per Person per Day (GPCD) El Paso County Water Authority and El Paso County W.C.I.D. No. 4 Service Areas	2-4
Table 2-3	Water Demand Projections for El Paso County Water Authority and El Paso County W.C.I.D. No. 4 Service Areas	2-5
Table 2-4	Study Area Maximum Day Water Demands (GPM)	2-8
Table 3-1	Cost of Water Analysis: Desert Field	3-4
Table 3-2	Cost of Water Analysis: Wheeler Field	3-5
Table 3-3	Cost of Water Analysis: Wheeler Field Expanded	3-6
Table 3-4	Cost of Water Analysis: University Block L/Fabens Fields	3-7
Table 3-5	Cost of Water Analysis: EPWUPSB Purchase	3-8
Table 3-6	Cost of Water Analysis: Wheeler Field with Reverse Osmosis	3-12
Table 3-7	Cost of Water Analysis: University Block L Field with Reverse Osmosis	3-12
Table 3-8	Summary of Sources	3-15
Table 4-1	Summary of Water Cost to EPWCA	4-4
Table 4-2	Summary of Water Cost to EPCWCID	4-12
Table 5-1	Water Conservation Literature and Price List	5-9
Table 6-1	Water and Wastewater Project Ownership, Construction, and Operation	6-2

LIST OF FIGURES

Figure 1-1	Study Area	1-2
Figure 1-2	Outside Area Demands	1-3
Figure 2-1	Population Projections for Study Area	2-3
Figure 2-2	Water Demand Projections for Study Area	2-6
Figure 3-1	Regional Groundwater Resources	3-3
Figure 3-2	Reverse Osmosis Desalting Process	3-10
Figure 3-3	Blended Water Quality	3-13
Figure 4-1	EPCWA Water Supply Alternatives	4-2
Figure 4-2	EPCWCID Water Supply Alternatives	4-11
Figure 4-3	Outside Area Water Supply Alternatives	4-13

LIST OF ABBREVIATIONS

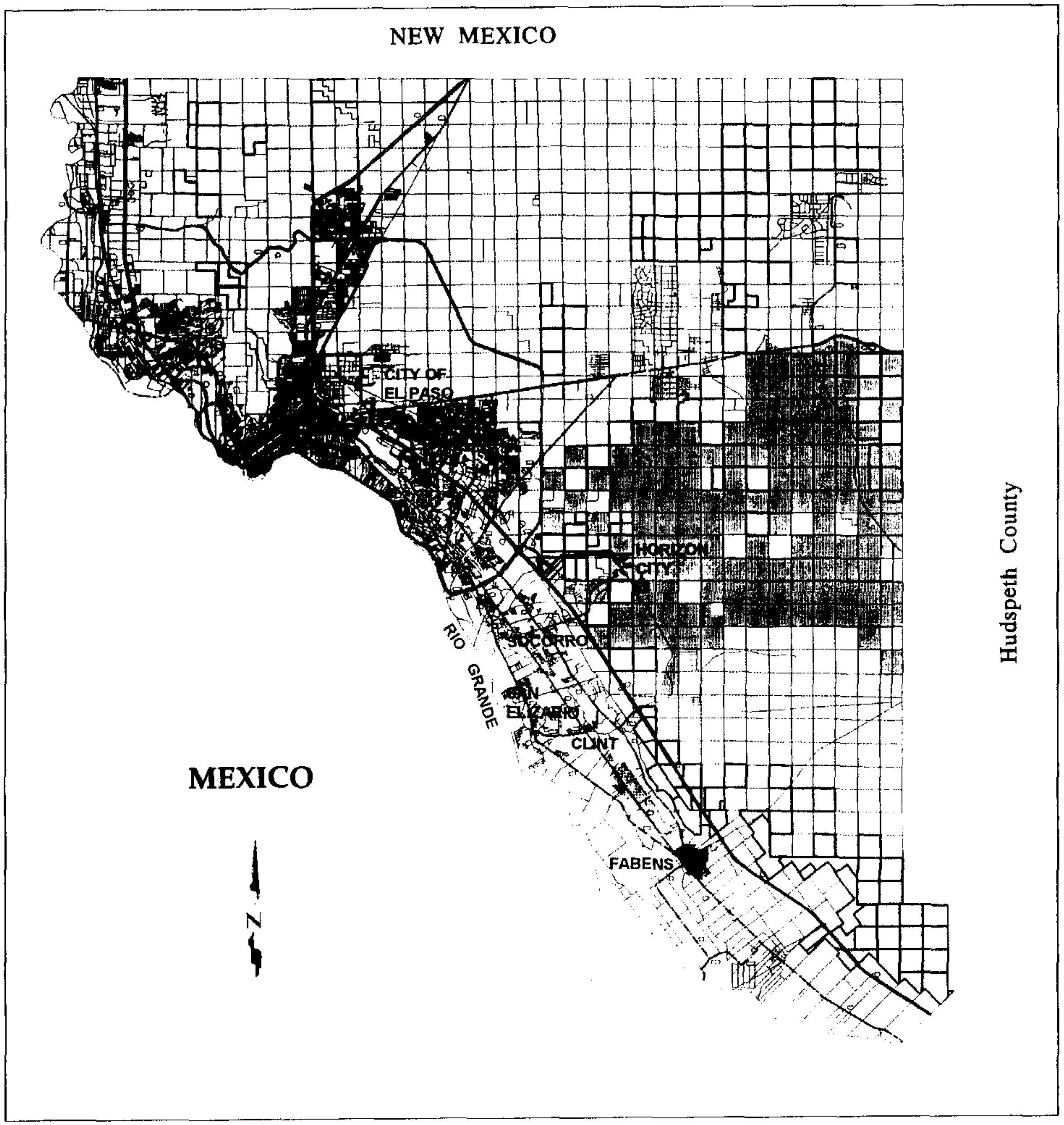
EPCWA	El Paso County Water Authority M.U.D.
EPCWCID	El Paso County WCID (Fabens WCID)
EPWUPSB	El Paso Water Utilities Public Service Board
ETJ	Extraterritorial Jurisdiction
GLO	General Land Office of the State of Texas
gpcd	Gallons per person per day
gpm	Gallons per minute
mgd	Million Gallons per Day
mg/l	Milligrams per Liter
MUD	Municipal Utility District
TAC	Texas Administrative Code
TDS	Total Dissolved Solids
TNRCC	Texas Natural Resource Conservation Commission
TWDB	Texas Water Development Board
WCID	Water Control and Improvement District

REGIONAL WATER SUPPLY STUDY
for
EL PASO COUNTY WATER AUTHORITY M.U.D.,
EL PASO COUNTY WATER CONTROL & IMPROVEMENT
DISTRICT NO. 4, and
TEXAS GENERAL LAND OFFICE
in conjunction with
TEXAS WATER DEVELOPMENT BOARD

1.0 INTRODUCTION

The El Paso County Water Authority M.U.D. (EPCWA), El Paso County Water Control and Improvement District No. 4 (EPCWCID), and the Texas General Land Office (GLO), in conjunction with the Texas Water Development Board (TWDB), have retained HDR Engineering, assisted by Geraghty and Miller, Inc., to prepare a regional water supply study. The purpose of this study is to project water demands in the rapidly growing service areas of the study participants and analyze options to meet their future potable water demands. The study participants currently obtain their water supplies from groundwater sources that are either high quality but low producing or high producing but low quality. The other readily available option is to purchase treated water from the City of El Paso Water Utilities Public Service Board (EPWUPSB).

As shown in Figure 1-1, the potential service areas of the participants cover a relatively wide geographic area in southeast El Paso County. As shown in the figure, EPCWA serves the Horizon City area and a large rural area east of Horizon City, where much of the future growth in the area is projected. EPCWCID provides water service to the City of Fabens and sells water to San Elizario Municipal Utility District. The GLO manages 30,000 acres of State owned land for the benefit of the Public School Fund. The State owned lands in the service area of EPCWA, as shown in Figure 1-2, have been included in the study area. The GLO is planning a 4,400 acre development on the lands they manage, and about 20% of that development will be in EPCWA's service area. The remaining State owned lands and two other proposed developments immediately west of Horizon City have been treated as outside demands which may or may not be served and may impact the amount of water available to serve the study area.



STUDY AREAS

- EL PASO CO. WATER AUTHORITY SERVICE AREA
- EL PASO CO. WATER CONTROL AND IMPROVEMENT DISTRICT NO. 4
- SAN ELIZARIO M.U.D. (SUPPLIED BY EL PASO CO. WATER CONTROL AND IMPROVEMENT DIST NO. 4)
- STATE OWNED LAND (IN WATER DISTRICT)

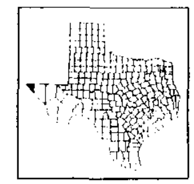
STATE OWNED LAND (OUT OF WATER DISTRICT)

DIVIDED HIGHWAY

FEDERAL OR STATE HIGHWAY

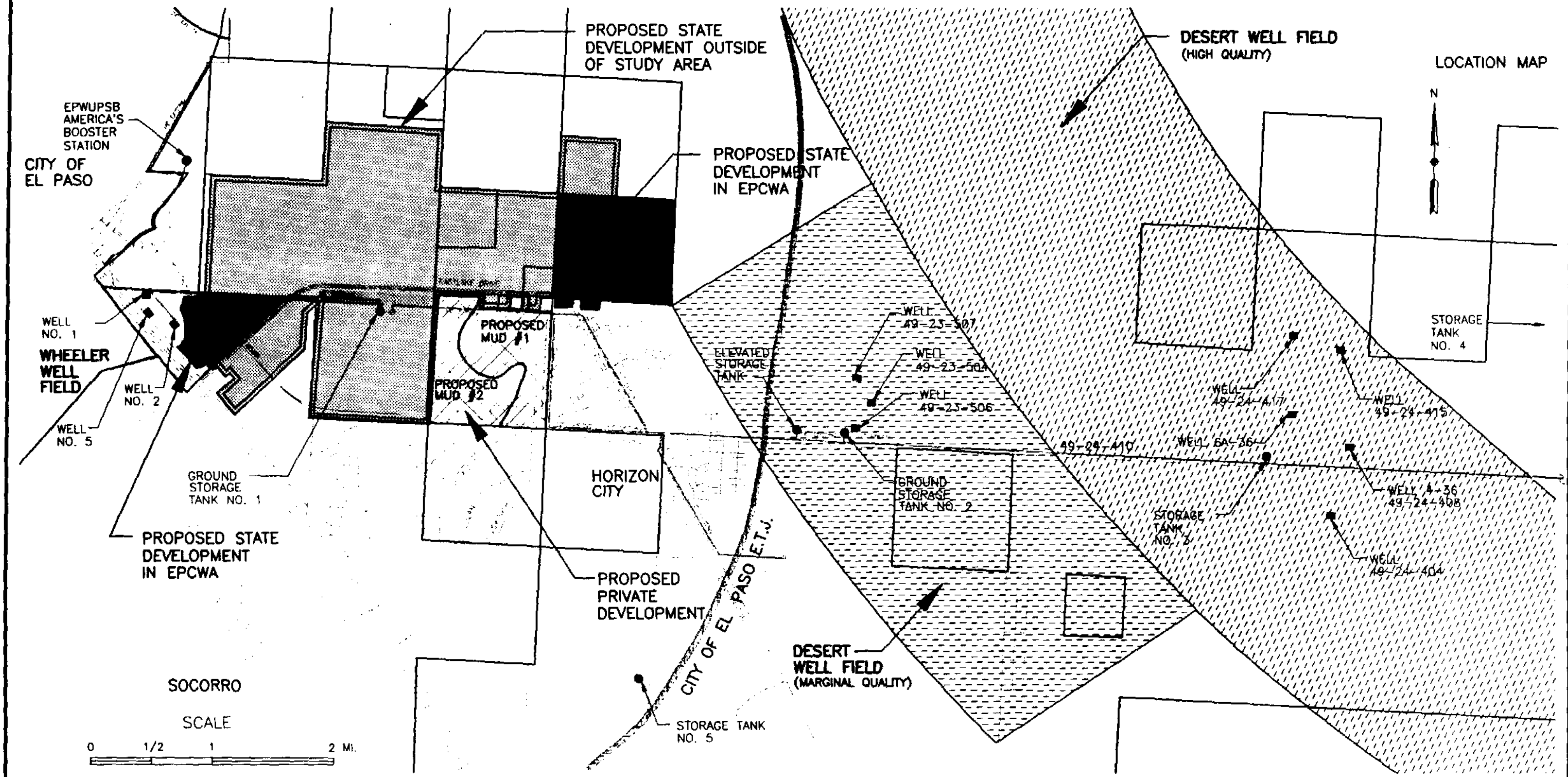
SECONDARY ROADS

TEXAS GENERAL LAND OFFICE



HDR Engineering, Inc.

REGIONAL WATER SUPPLY STUDY	DATE MAY 1995
STUDY AREA	FIGURE 1-1



HDR Engineering, Inc.

REGIONAL WATER SUPPLY STUDY

OUTSIDE DEMAND AREAS

DATE MAY 1995

FIGURE 1-2

2.0 POPULATION AND WATER DEMAND PROJECTIONS

Information sources used in the development of population and water demand projections for the service area include:

TWDB water use information for El Paso County cities, communities, and rural areas;

TWDB projections of population and water demand in El Paso County;

El Paso Water Resource Management Plan, Phase I Completion Report, prepared by EPWUPSB and El Paso County Water Improvement District No. 1, July, 1991; and

EPCWA's Wastewater System Study and Projections of Future Growth, December, 1992.

Projections for proposed developments outside the study area were prepared by the developers.

2.1 Population Projections

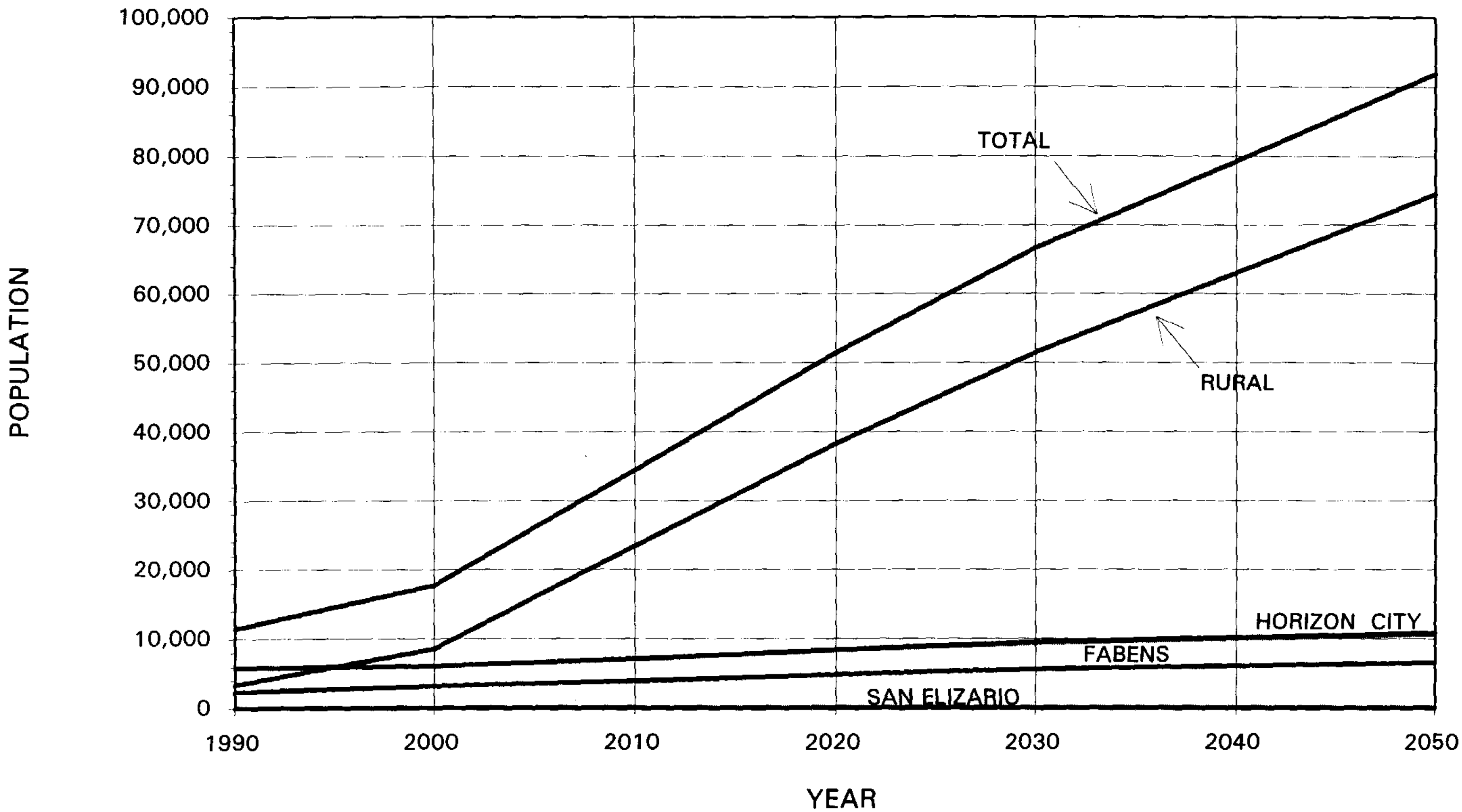
The population of the study area in 1990 was 11,431, of which 5,643 (49%) resided in EPCWA's service area and 5,788 (51%) resided in EPCWCID's service area. The study area is urbanizing at a rapid rate as new homes are constructed and people from other areas move into the area. By the year 2000, the population of the area is projected to increase by more than 50% to 17,700, and in the following 10 years, the area's population is expected to double to 34,415. By 2050, population in the area is projected to reach 91,900 persons. With this large increase in population, the area can be expected to change from a suburban residential community with less than 10 commercial businesses to a city with consumer service businesses (such as restaurants, laundries, car washes, grocery stores, department stores, appliance stores, etc.) and health, professional, and business services.

As shown in Table 2-1, the distribution of population between the service areas of EPCWA and EPCWCID should change dramatically in the next 15 years. While population was fairly well distributed between the two districts in 1990, by 2010 EPCWA's population is expected to be almost 80% of the study area's total population. And, by 2050, EPCWA's service area should contain about 88% of the area's population. The high growth will initially occur in or adjacent to Horizon City, but over time most of the population will eventually reside in the currently rural areas east of Horizon City. Figure 2-1 illustrates graphically how the rural areas are expected to grow relative to Horizon City, Fabens, and San Elizario.

Table 2-1
Population Projections
for El Paso County Water Authority
and El Paso County W.C.I.D. No. 4

System/Community	1990	Population Projections 2000	2010	2020	2030	2040	2050
El Paso County Water Authority							
Horizon City[1]	2,308	3,163	3,914	4,822	5,614	6,076	6,538
Rural[2]	3,335	8,514	23,413	38,263	51,463	63,013	74,563
Subtotal	5,643	11,677	27,327	43,085	57,077	69,089	81,101
El Paso County W.C.I.D. #4							
Fabens[1]	5,599	5,831	6,857	8,100	9,185	9,816	10,447
San Elizario[1]	189	196	231	273	309	331	353
Subtotal	5,788	6,027	7,088	8,373	9,494	10,147	10,800
Total	11,431	17,704	34,415	51,458	66,571	79,236	91,901

[1]TWDB, High Case for 1990 through 2040, April, 1992, Austin, Texas.
[2]Unincorporated areas of the EPCWA service area.



HDR Engineering

FIGURE 2-1
POPULATION PROJECTIONS FOR EL PASO COUNTY WATER AUTHORITY AND EL PASO COUNTY W.C.I.D. # 4 SERVICE AREAS

2.2 Water Use Projections

In 1990, each person in EPCWA's service area used an average of about 150 gallons each day, while people in EPCWCID used about 116 gallons per day. The lower per capita water use in EPCWCID is due to smaller residential lots, differences in economic conditions, and housing with fewer water using appliances than in EPCWA's area. As population increases in both service areas, per capita water use is expected to increase. EPCWA's per capita use is expected to approach the level of per capita water use experienced by El Paso, while EPCWCID's per capita use is expected to grow to a peak of 145 gpcd and then reduce when conservation impacts the area's water use (see Table 2-2).

Table 2-2
Per Capita Water Use
for El Paso County Water Authority
and El Paso County W.C.I.D. # 4

Year	El Paso County Water Authority (gpcd)[1]	El Paso County W.C.I.D. # 4 (gpcd)[2]
1990	150	116
1993	150	---
2000	150	145
2010	160	136
2020	160	128
2030	160	125
2040	160	123
2050	160	120

[1] Computed from EPCWA's hook-up and consumption analyses for 1993 and 1994 and EPWUPSB projections.
[2] TWDB per capita water demand projections, with conservation.

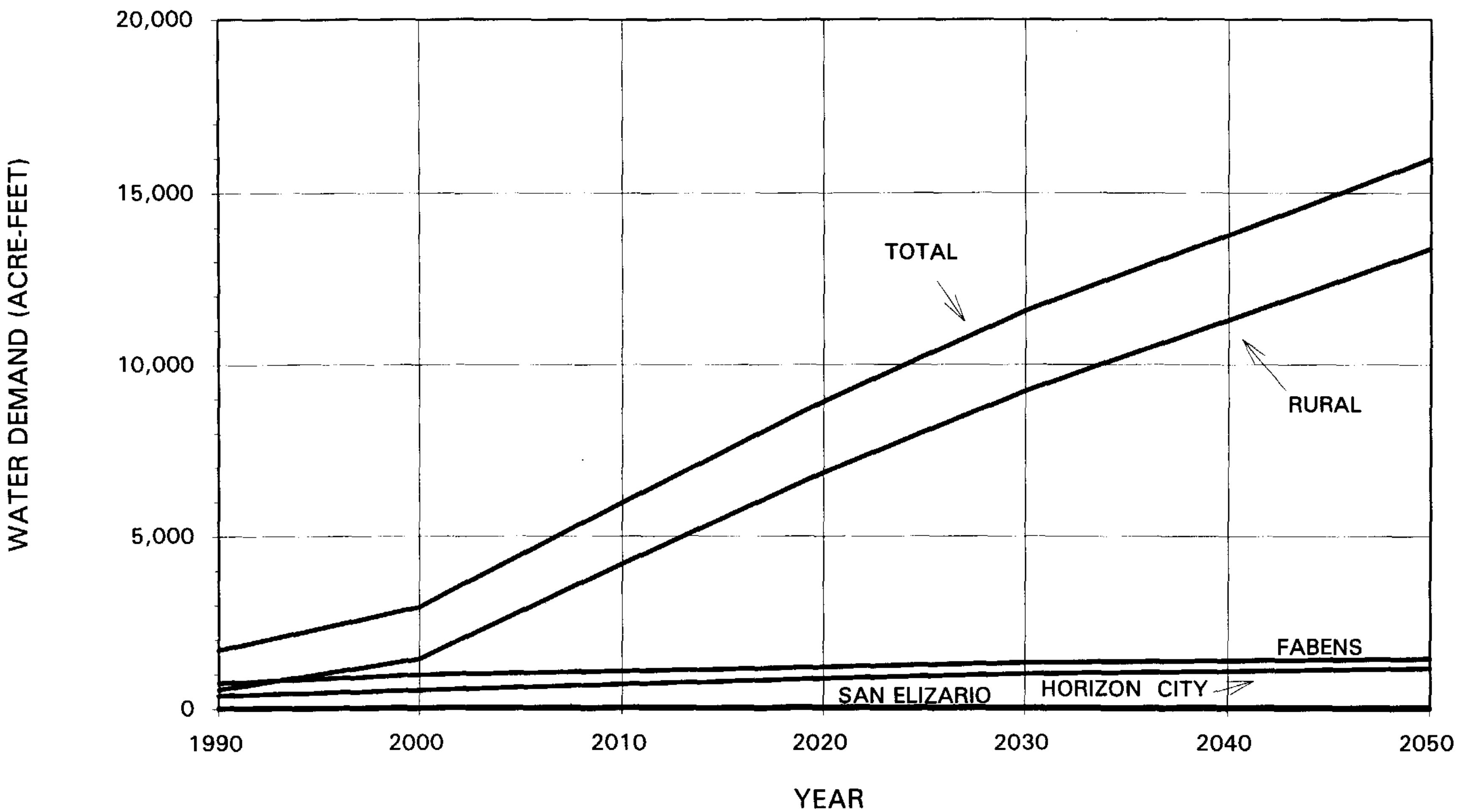
Projections of annual water use are the product of the projected number of people to be served, the projected per capita water use in the area, and the number of days per year. Using the population projections presented in Table 2-1 and the per capita water use projections presented in Table 2-2, water demand projections have been prepared by decade for each subarea of the study area. Water use in the area in 1990 was reported to be 1,700 acre-feet per year (ac-ft/yr) with 56% (948 acre-feet) used in EPCWA's service area and the balance (752 acre-feet) was used in EPCWCID's area. As shown in Table 2-3, water demands are projected to increase to almost 16,000 ac-ft/yr in 2050, with more than 80% of the water use occurring in currently rural areas of EPCWA. Figure 2-2 graphically illustrates water use in the service areas of EPCWA & EPCWCID.

Table 2-3
Water Demand Projections
for El Paso County Water Authority
and El Paso County W.C.I.D. # 4

System/Community	1990	Projections in Acre-Feet per Year 2000	2010	2020	2030	2040	2050
El Paso County Water Authority							
Horizon City[1]	388	532	701	864	1,006	1,089	1,172
Rural[1]	560	1,430	4,196	6,857	9,222	11,292	13,361
Subtotal	948	1,962	4,897	7,721	10,228	12,380	14,533
El Paso County W.C.I.D. # 4							
Fabens[2]	729	947	1,044	1,161	1,286	1,352	1,404
San Elizario[2]	23	32	35	39	43	46	47
Subtotal	752	979	1,080	1,200	1,329	1,398	1,451
Total	1,700	2,940	5,977	8,921	11,557	13,778	15,984

[1] Estimated from records of EPCWA Hook-up and Consumption Analysis for Fiscal Year 1993/94.
[2] TWDB, High Case for 1990 through 2040, April, 1992, Austin, Texas.

Water use projections for the developments adjacent to the study area also indicate significant development is expected. The GLO's planned 4,400 acre development, which is within El Paso's ETJ, is expected to be built out by 2020. Ultimate water demand, estimated by Subland, Inc., is projected to be 14,300 ac-ft/yr, with 8,510 ac-ft/yr attributable to residential uses, 4,970 ac-ft/yr to commercial uses, and 850 ac-ft/yr to community uses. With conservation, it is anticipated the residential use could be lowered to 7,570 ac-ft/yr, resulting in an ultimate demand of 13,390 ac-ft/yr. Of this amount, 20% is expected to occur in EPCWA's service area and has already been included in EPCWA's projections.



HDR Engineering

FIGURE 2-2
WATER DEMAND PROJECTIONS FOR EL PASO COUNTY WATER AUTHORITY AND EL PASO COUNTY W.C.I.D. # 4 SERVICE AREAS

Projections for the private development planned east of EPCWA's service area have been prepared by Rust Lichliter/Jameson & Associates. This development is projected to be open in 1996 and to be fully built out by 2014. Annual water demand at build out is estimated to be 1,713 acre-feet.

The preceding projections of annual water use describe the amount of water which the supply sources must be able to provide on an average for each of the participants. However, distribution systems must be able to supply all of its customer's demands and water usage is not constant throughout the year. The highest demands typically occur during summer months, when lawn watering creates high demands. Additionally, distribution systems must be able to meet these high demands and still have the ability to concurrently provide water at rates necessary to fight fires.

Typically, local portions of the distribution system are sized to deliver the peak flows that are expected to occur during the peak hour of the year, while the primary infrastructure is sized to deliver the expected maximum day flow. The difference between the peak hour and the maximum day are typically met from distribution system storage, which can be either elevated storage or pumped ground storage.

In order to size facilities for the study area, historical data for EPCWA's system was reviewed. This data indicates that maximum day flows are approximately twice the average day demand. This is a relatively low peaking factor, and EPCWA achieves this rate by reusing wastewater effluent for irrigation. Since this is an efficient use of wastewater effluent, it is projected that EPCWA will continue to reuse wastewater effluent and keep its demand factor at two times its annual average water use. As shown in Table 2-4, EPCWCID is projected to achieve a similar peaking factor.

Maximum day demands for proposed adjacent developments were provided by the developers. For the GLO development, the demands have been reduced as conservation is expected to lower their demands. Also, approximately 20% of the GLO development is in the EPCWA's service area, but it is projected that the system necessary to meet these needs will be constructed by the GLO. Therefore, while the supply for the GLO development was included in EPCWA's service area, the distributions system will probably be constructed by GLO. Therefore, the full maximum day demand for the development has been allocated to the GLO.

Table 2-4
Maximum Day Water Demands (gpm)

System/Community	1995	2000	2010	2020	2030	2040	2050
EPCWA							
Horizon City	570	659	870	1,071	1,247	1,350	1,453
Rural	1,234	1,773	5,202	8,502	11,435	14,001	16,567
Subtotal	1,804	2,432	6,072	9,573	12,682	15,351	18,020
El Paso Co. WCID #4							
Fabens	1,039	1,174	1,295	1,440	1,594	1,677	1,741
San Elizario	34	39	44	49	54	57	59
Subtotal	1,073	1,214	1,339	1,488	1,648	1,733	1,800
Subtotal for Study Area	2,877	3,646	7,410	11,061	14,330	17,084	19,820
General Land Office Development	0	4,800	9,580	14,375*	14,375*	14,375*	14,375*
Private Development	0	520	1,722	2,125	2,125	2,125	2,125
Total Developments	0	5,320	11,302	16,500	16,500	16,500	16,500
Grant Total	1,804	7,752	17,374	23,198	26,307	28,976	31,645

*20% of this demand is in EPCWA's service area.

In the case of the private development, demands were prepared for each of the two municipal utility districts planned to serve that development, but the demands for both MUDs have been combined in Table 2-4.

3.0 AVAILABLE WATER SUPPLY, REQUIRED TREATMENT, AND DEVELOPMENT COSTS

This section of the report identifies the groundwater sources available to the participants, the cost to produce the water from those sources, the quality of the water obtained, and the treatment, if any, necessary to meet state drinking water standards. In addition, the costs of obtaining water from EPWUPSB are identified. Other surface water alternatives were not investigated, since surface water is a primary component of EPWUPSB's supply system and the economies of scale from their much larger system should result in the least cost for a surface supply.

For this study, a detailed analysis of groundwater sources was performed by Geraghty & Miller, a groundwater consultant. Their report, presented under separate cover, examines the quantity and quality of water in the Hueco Bolson and the Rio Grande Alluvium Deposits, which supply the Wheeler, Desert, Fabens, and University Block L Well Fields. Geraghty & Miller found the Hueco Bolson contains relatively good quality water in the Desert Field, but it is available in limited quantities and once withdrawn, will not be naturally replenished. They found that the Wheeler, Fabens, and University Block L Fields are in areas where the Rio Grande Alluvium overlies the Hueco Bolson. Wells in these field produce high volumes of water which is replenished naturally, but the quality is relatively poor. Also, they found the two formations are hydraulically connected, resulting in a mixture of the two sources in most well fields.

EPCWA's groundwater supplies are obtained from the Wheeler and Desert Well Fields, both of which are located within its service area. The quality of EPCWA's Wheeler wells has slowly deteriorated while EPCWA's demands have increased. Also EPCWA leases groundwater rights in University Block L, near Fabens, for future water supply. EPCWCID operates wells within the Fabens Well Field as its sole water source.

Water quality standards for public water supplies are set by the Texas Natural Resource Conservation Commission (TNRCC). Limits for the various constituents found in water are set forth in TAC § 290.113. Generally, sulfates, chlorides, and total dissolved solids are often of concern in brackish groundwaters. The current maximum allowable amount of chlorides and sulfates in drinking water is 300 mg/l for each of these constituents. The U.S. Environmental

Protection Agency is scheduled to raise the federal standard for sulfates to 500 mg/l by May 31, 1995, but it is not expected that the state will adopt this standard. The limit for total dissolved solids, which is the total of all constituents in the water, is 1,000 mg/l. Of these standards, total dissolved solids and chlorides are the most difficult to meet in the study area.

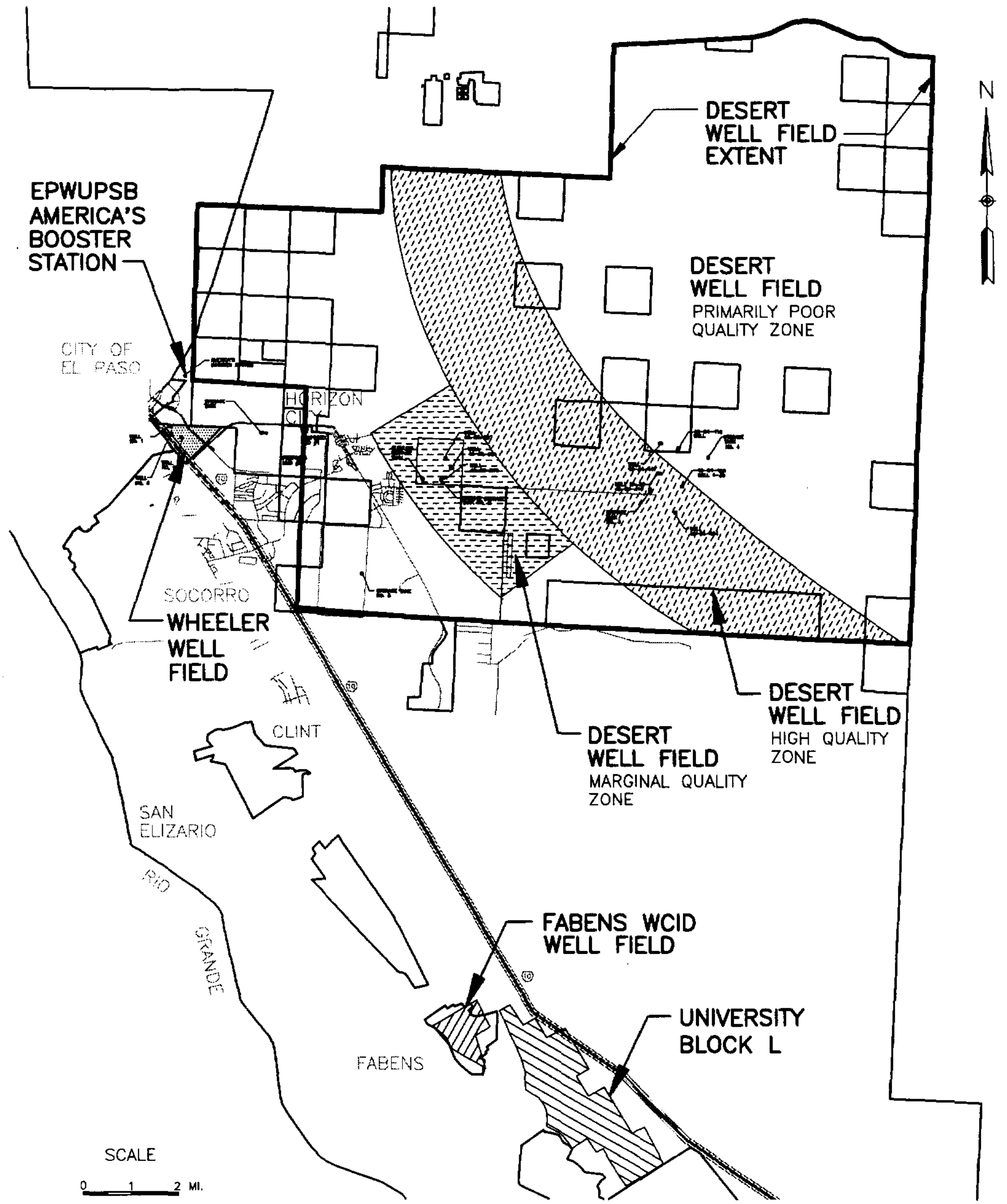
The following sections present estimates of costs to develop additional water from each of the sources discussed. The costs and capacities have been based on year round operation of wells for maximum efficiencies and it has been assumed that economies of scale will be realized, where possible, in construction and operation. Specific costs will vary from site to site, but overall, the costs presented should be adequate for comparison of alternatives. Total costs have been presented for each alternative and costs have been expressed as a cost per thousand gallons of water produced so the various alternatives can be compared.

3.1 Desert Field

The Desert Well Field is located east of Horizon City in the valley between the Franklin and Hueco Mountains. The well field draws primarily from the Bolson deposits which form the Hueco Bolson Aquifer. The quality of water in this field is variable with depth and location. A large region, where water of acceptable quality for public water supply is likely to be available in significant quantities, is located in the central region of the EPCWA as delineated in Figure 3-1. On the fringe of this area, water of lower quality is available. The two areas identified as having high quality water and marginal quality water are primarily within the EPCWA service area, although a few sections containing high quality water are in areas owned by the State of Texas and out of the service area. The areas with high quality water generally lie outside the City of El Paso's ETJ, and approximately half of the area with marginal quality water also lies outside of the ETJ.

To maintain the quantity of water produced by the wells in this field, Geraghty & Miller has recommended a spacing of approximately 2,500 feet between wells or approximately four wells per section. If the groundwater table is lowered after years of extended pumping, Geraghty & Miller has recommended adding wells between the initial wells to maintain production levels. However, costs for these enhancement wells have not been included in the cost estimates in this report, because their need is extremely uncertain.

The production rates of wells in this field are low. Geraghty & Miller suggests that wells in this field should not be constructed to produce more than 120 gpm, if long term use is



HDR

HDR Engineering, Inc.

REGIONAL WATER SUPPLY STUDY

REGIONAL GROUNDWATER RESOURCES

DATE APRIL 1995

FIGURE 3-1

anticipated. The portion of the Desert Field within EPCWA's service area is estimated to hold recoverable reserves of 45,700 acre-feet of marginal quality water and 274,200 acre-feet of high quality water that generally meets TNRCC criteria. Since annual recharge to this aquifer is estimated to be very small, approximately 109 acre-feet per year, the aquifer is essentially a non-renewable resource.

The cost to drill a well in the Desert Field is estimated to be $72,000, and associated equipment, collection system, and land costs are estimated to be $94,500. Annual operating costs for each well are estimated to be $24,648 for power, maintenance, and chemicals based on historical EPCWA operations. As shown in Table 3-1, the estimated cost of water from this field is $0.64 per 1000 gallons before transmission and distribution, based on annually producing 63 million gallons per well.

Table 3-1
Source Development Costs: Desert Field

Capital Cost per Well	
Land Lease	$500
Drilling	$72,000
Equipment	$18,000
Collection System	$76,000
Total	$166,500
Annualized[1]	$15,716
O&M Cost per Well	
Energy	$15,600
Maintenance	$9,000
Chemicals	$48
Total	$24,648
Total Cost per Well	
Total Annual Cost	$40,364
Annual cost Per 1,000 gallons[2]	**$0.64**

[1]Financing based on 7% and 20 years.
[2]Based on 120 gpm per well.

3.2 Wheeler Well Field

The Wheeler Well Field, which draws water from both the Hueco Bolson Aquifer and the Rio Grande Alluvium, is located along Interstate 10 west of Horizon City in EPCWA's service area and within the City of El Paso's ETJ. EPCWA operates three wells in this field, and each produces about 600 gpm of water with about 1,450 mg/l of TDS. Because this water does not meet state drinking water standards, future use of this field will require blending with higher quality water or demineralization in order to reduce TDS levels. Also, with continued pumping, the water quality in the field may further deteriorate, and, as it does so, the amount of high quality water needed for blending will have to be increased.

Geraghty & Miller indicated that the yield of the three wells in this field could be increased to 1,000 gpm each, and the wells should be able to sustain this rate of withdrawal indefinitely because of the high rate of recharge of the Rio Grande Alluvium. Other than upgrading these wells, as recommended, further development of the Wheeler Field was not considered in this study sint the quality does not meet state standards.

Redrilling each well in the Wheeler field to increase its capacity is estimated to cost $45,000, and replacement pumping equipment is estimated to cost $26,000. Annual operating costs for each well, based on EPCWA data, are $114,400 for energy, maintenance, and chemicals. As shown in Table 3-2, water from this field is estimated to cost $0.23 per 1000 gallons before transmission and distribution. It has been assumed that the existing collection system in this field can continue in service and will not need to be improved or replaced.

Table 3-2
Source Development Costs: Wheeler Well Upgrade

Capital Cost per Well	
Drilling	$45,000
Equipment	$26,000
Total	$ 71,000
Annualized[1]	$ 6,702
O&M Cost per Well	
Energy	$106,000
Maintenance	$8,000
Chemicals	$400
Total	$114,400
Total Cost per Well	
Annual Cost	$121,102
Annual cost Per 1,000 gallons[2]	**$0.23**

[1]Financing based on 7% and 20 years.
[2]Based on 1,000 gpm per well.

Alternatively, the three existing wells could be maintained at their current production levels of approximately 600 gpm each and two new wells of the same size could be located in the field. A cost estimate for water from the Wheeler field based on this alternative is $0.24 per 1000 gallons as shown in Table 3.3. This alternative appears to offer no cost savings over developing the existing wells as suggested by Geraghty and Miller.

Table 3-3 Source Development Costs: Wheeler Field Expansion	
Capital Cost for two new wells	
Drilling	$75,000
Equipment & Infrastructure	$157,000
Total	$ 232,000
Annualized[1]	$ 21,889
O&M Cost for Five Wells	
Energy	$318,000
Maintenance	$30,000
Chemicals	$1,200
Total	$349,200
Total Cost for the Field	
Annual Cost	$371,099
Annual cost Per 1,000 gallons[2]	**$0.24**

[1]Financing based on 7% and 20 years.
[2]Based on 1,000 gpm per well.

3.3 University Block L Well Field and Fabens Well Field

The University Block L Well Field covers 4,730 acres southeast of the City of Fabens, and the Fabens Well Field covers 832.5 acres adjacent to the University Block L Field as shown on Figure 3-1. Characteristics of these fields, which draw primarily from the Hueco Bolson Aquifer and the Rio Grande Alluvium, are not significantly different from the Wheeler Field except that the Hueco Bolson deposits exhibit slightly artesian conditions. These fields also contain limited zones of higher quality water. In this area, the Hueco Bolson provides water which generally meets state standards, but water from the Rio Grande Alluvium generally does not. Geraghty & Miller estimates wells in this area could produce 800 to 1,200 gpm, although current wells are operating at lower rates.

The University Block L Field is on State owned land, and EPCWA has a long term lease for well field development. Terms of the lease include a royalty payment of $0.14 per 1,000 gallons pumped. The amount of water in storage in the University Block L Field is estimated to be 378,000 acre-feet, and it is estimated an additional 86,000 acre-feet will be transmitted from the north for a total recoverable reserve of 464,000 acre-feet. Additional recoverable recharge is estimated to be 177 acre-feet per year. Little recent quality data exists for this field, but the limited data indicates that limited zones in the field yield water which meets state drinking water standards, as TDS is about 900 mg/l. However, when the field is fully developed, water quality can be expected to degrade to at least 1,200 to 1,500 mg/l, which will not meet drinking water standards. Once water quality exceeds drinking water standards, blending higher quality water or demineralization will be required.

The Fabens Field, which currently produces water with TDS of about 900 mg/l, is located within the service area of EPCWCID. The field is estimated to have an economically producible reserve of 10,000 acre feet, and recharge rates from the Rio Grande Alluvium may be sufficient to maintain long term production of these wells. Water quality data indicates the field produces water with 900 mg/l TDS in only a limited area. Increased pumpage may cause degradation of the water quality from this field to levels requiring blending or demineralization.

The cost of well development in the University Block L Field is $0.62 per 1,000 gallons which includes a $0.14 royalty charge. Accordingly, water from the Fabens Well Field costs $0.48 per 1,000 gallons. A break down of these costs is shown in Table 3-4.

Table 3-4
Source Development Costs: University Block L Wells and Fabens Wells

Capital Cost per well	
Drilling	$90,000
Equipment & Infrastructure	$176,000
Total	$ 266,000
Annualized[1]	$ 21,109
O&M Cost per well	
Energy	$220,000
Maintenance	$8,000
Lease Cost (University Only)	$73,584
Chemicals	$400
Total	$301,984
Total Cost per University Well	
Annual Cost	$327,093
Annual cost Per 1,000 gallons[2]	**$0.62**
Total Cost per Fabens Well	
Annual Cost	$253,509
Annual cost Per 1,000 gallons[2]	**$0.48**

[1]Financing based on 7% and 20 years.
[2]Based on 1,000 gpm per well.

3.4 El Paso Water Utilities Public Service Board

EPWUPSB has indicated they will sell a limited amount of water to areas adjacent to the City of El Paso. This water would be a combination of treated surface water and groundwater with combined TDS estimated between 750 to 810 mg/l. However, EPWUPSB will not make any guarantees regarding the quality of the water, other than to ensure that it will meet state standards. Based on EPWUPSB laboratory reports, the chloride levels in their well water averages 230 mg/l, which is 77% of the state's limit, and the sulfate levels in their surface supplies average 276 mg/l, which is 92% of the current limit. The actual water delivered would usually be a blend of the two sources. EPWUPSB has indicated that the most water it could make available to the study area for the next ten years (until 2005) is 1,120 acre-feet per year or one million gallons per day, although consideration is being given to meeting the long term needs of EPCWA and the two adjoining developments. After 2005, due to expansion of its supply system, EPWUPSB may have more water available for EPCWA. For purposes of this study, it has been assumed that only the 1.0 mgd currently offered will be available until 2005, however after that time, all the water needed by EPCWA was assumed to be available from EPWUPSB.

Water purchased from EPWUPSB would cost $1.00 per 1,000 gallons, and a one-time water resource connection fee would be charged for each service, with the amount charged based on meter size. For a residential 5/8-inch meter, the one-time fee would be $1,147, which when financed and added to the $1.00 per thousand gallons of water used would result in an average cost of $1.48 per 1,000 gallons. A summary of the costs is presented in Table 3-5.

Table 3-5
Source Development Costs: EPWUPSB Purchase

One Time Charges	
Resource Recovery	$1,842,667
Annualized[1]	$173,935
Annual Charges	
Volume Charge	$364,766
Total Cost	
Annual Cost (1 mgd)	$538,701
Annual cost Per 1,000 gallons[2]	**$1.48**

[1]Financing based on 7% and 20 years.
[2]Based on 1 gpm per well.

3.5 Demineralization Treatment

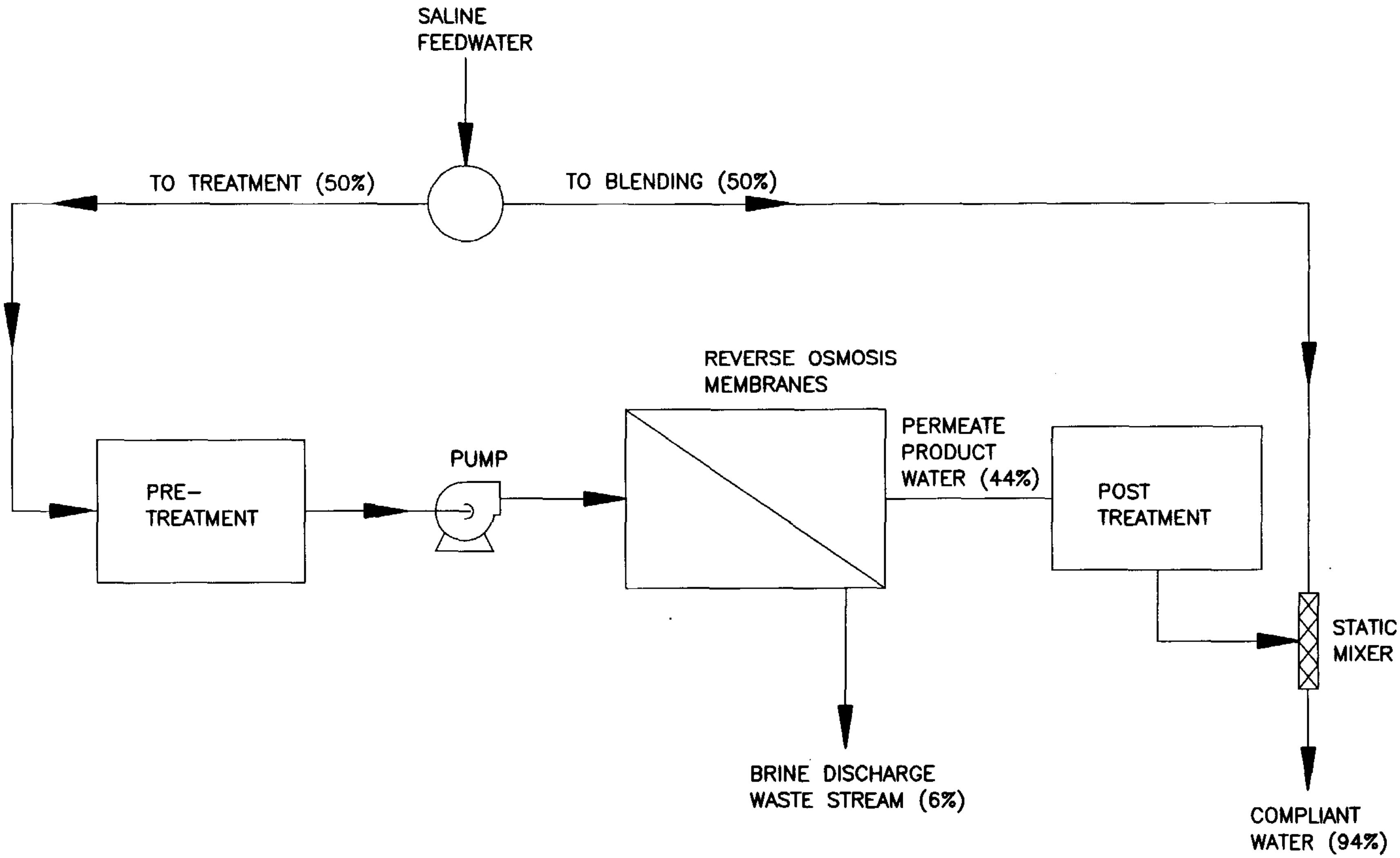
3.5.1 Treatment Processes

There are two membrane demineralization processes that are most frequently used to treat water to reduce the levels of TDS, chlorides, sulfates, and other constituents. They are reverse osmosis (RO) and electrodialysis reversal (EDR). RO and EDR use different processes and membranes to removed dissolved salts from water but the basic systems are similar. Major components for an RO system are shown in Figure 3-2. In each process, feedwater pretreatment consists of cartridge filtration, pH adjustment, chlorination, and scale control. The water is then pumped to a high pressure before it is applied to the membranes. The necessity to create high pressure is a significant component in the high operating costs of demineralization facilities, but recent advances in membrane technologies have somewhat reduced the pressure requirements in this step of the process. Depending on the process and membrane used, a small portion of the feedwater must be wasted to remove the salts separated by the membranes, resulting in a salty brine requiring disposal in accordance with TNRCC rules. The remaining demineralized water, known as permeate or product water, may require additional pH adjustment before introduction to the water supply system since it is often chemically aggressive. After this treatment, the permeate can be blended with the feedwater source to produce the desired end product quality.

For purposes of this study, reverse osmosis was the only technology investigated. Planning estimates are based on 88 percent removal of constituents and a 12% brine waste stream, which would be typical for a spiral cellulose acetate membrane after three years of service. Pressure and energy requirements increase as the membrane ages and salt removal decreases. The membranes are replaced when the performance drops to unacceptable levels.

Disposal of the brine is a significant operational issue and cost. The brine waste stream is considered a waste discharge by the TNRCC and therefore its disposal must be permitted. Disposal methods may include deep well injection, transfer to sanitary sewer, or solar evaporation. Previous studies by HDR in arid regions of Texas have found solar evaporation to usually be the most cost effective disposal method.

Operation and maintenance of a demineralization process is technically complex and demanding compared to conventional treatment processes. The membranes require careful monitoring and routine maintenance, including cleaning. All membranes have a finite useful life



HDR Engineering, Inc.

REGIONAL WATER SUPPLY STUDY

REVERSE OSMOSIS DESALINIZATION

Date MAY 1995

Figure 3-2

and must be periodically replaced. Energy requirements for demineralization are also high.

Demineralization processes benefit from economies of scale. The cost of treatment on a per gallon basis decreases dramatically as the size of the treatment process increases, with unit costs tending to stabilize around 2 mgd. Therefore demineralization treatment was not evaluated for meeting small demands.

3.5.2 Demineralization of Water from Wheeler Well Field

Because of the large capacity of the Wheeler Field and its low quality, the water from this field is a candidate for demineralization. A typical reverse osmosis process could provide 88% reduction in minerals, therefore only 50% of the well production would have to be demineralized to provide a blended water meeting state standards. However, the yield of the field would be reduced by about 6% due to the brine which would have to be wasted in the treatment process. After demineralization and blending, water from this field is estimated to cost $1.51 per 1000 gallons before transmission and distribution (see Table 3-6). Because of the economies of scale, desalinization costs would increase above this amount if lower amounts of water were treated.

3.5.3 Demineralization of Water from University Block L and Fabens Fields

Since the University Block L and Fabens Fields are not located near another reliable high quality water source which could be used for blending, demineralization should be considered if water quality deteriorates or if sufficient volumes of compliant water are not present.

After demineralization and blending, water from the University field is estimated to cost $1.85 per 1000 gallons before transmission and distribution as shown in Table 3-7. Costs for treatment of Fabens would be $0.14 less or $1.71 since this field is not subject to a royalty charge.

3.6 Blending Supplies

Based on current estimates of water quality, the Desert Field produces water with 630 mg/l TDS and the Wheeler Field produces water with 1,450 mg/l TDS. A blend of 60% Desert Field water and 40% Wheeler Field water should produce water with 952 mg/l TDS, which meets the secondary standards for public water supplies. The reduction of constituents by

Table 3-6 Source Development Costs: Wheeler Field; Three Wells Upgraded with 50% Demineralization	
Capital Costs	
Drilling	$135,000
Pump Equipment	$78,000
RO Treatment	$6,480,000
Brine Disposal	$5,200,000
Total	$11,893,000
Annualized[1]	$1,122,615
O & M Costs	
Wells	$318,000
Treatment	$515,000
Brine Disposal	$155,000
Total	$988,000
Cost Total	
Annual Cost[1]	$2,110,615
Annual cost Per 1,000 gallons[2]	**$1.43**

[1]Financing based on 7% for 20 years.
[2]Based on 3,000 gpm and 2.1 mgd RO Plant.

Table 3-7 Source Development Costs: University Field Three 1000 gpm Wells with 50% Demineralization	
Capital Costs	
Drilling	$270,000
Pump Equipment	$78,000
Infrastructure	$157,500
RO Treatment	$6,480,000
Brine Disposal	$5,200,000
Total	$12,185,500
Annualized[1]	$1,150,225
O & M Costs	
Wells	$905,952
Treatment	$515,000
Brine Disposal	$155,000
Total	$1,575,952
Cost Total	
Annual Cost[1]	$2,726,177
Annual cost Per 1,000 gallons[2]	**$1.85**

[1]Financing based on 7% for 20 years.
[2]Based on 3,000 gpm and 2.1 mgd RO Plant.

blending is graphically illustrated in Figure 3-3A.

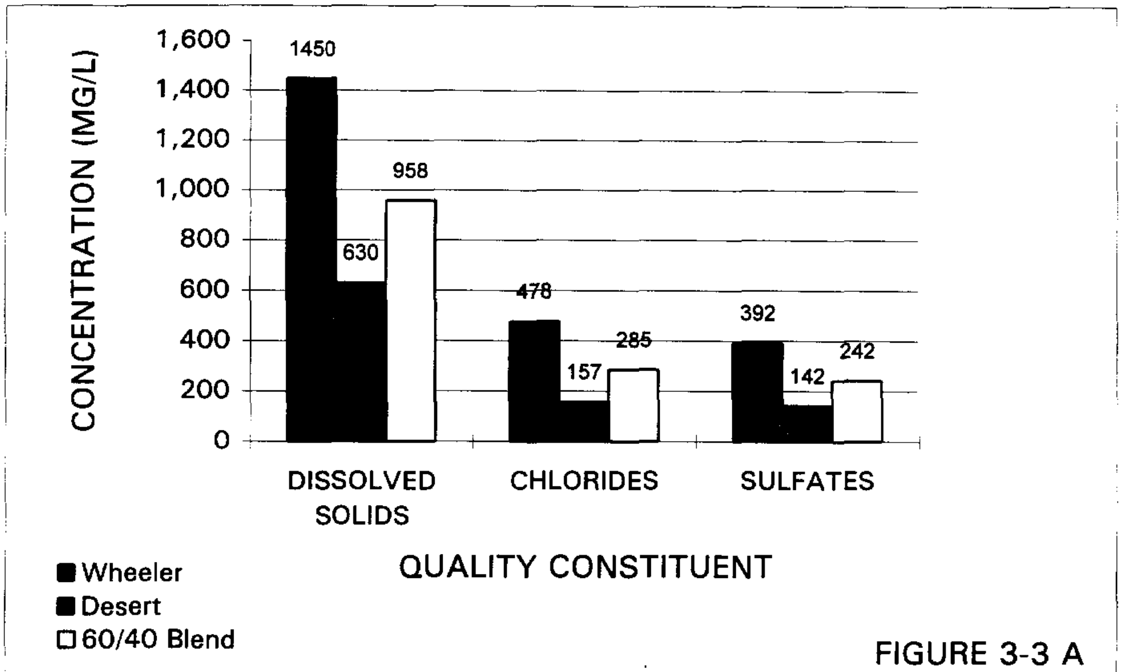


FIGURE 3-3 A

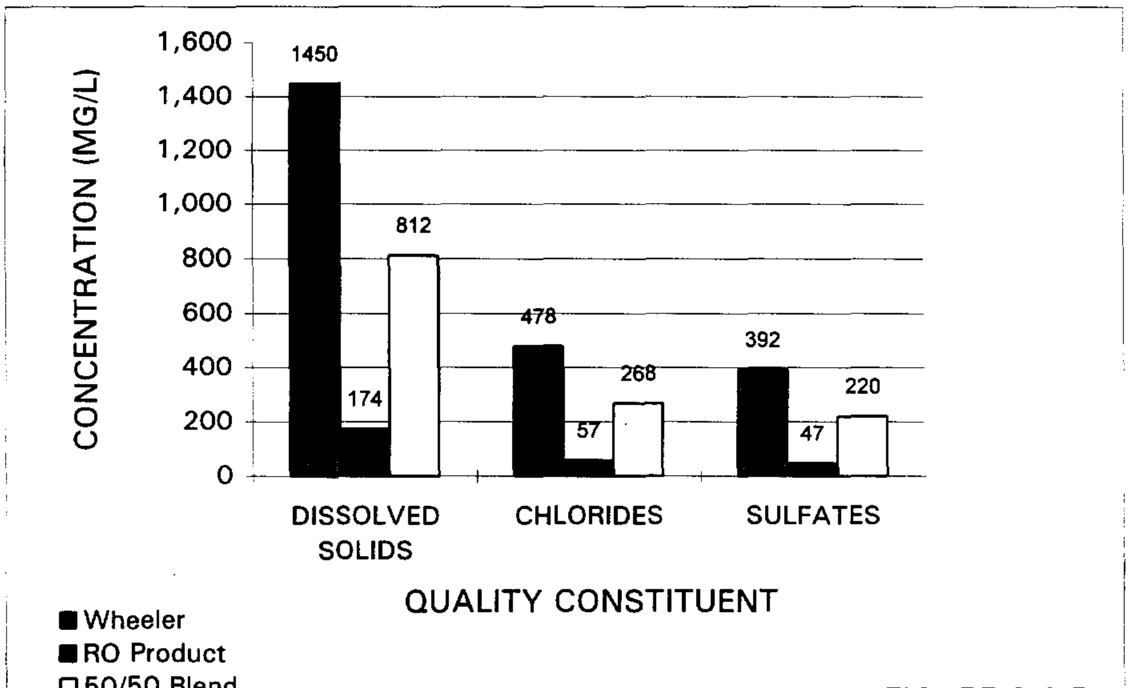


FIGURE 3-3 B

HDR Engineering, Inc.

FIGURE 3-3
BLENDED WATER QUALITY
USING WHEELER WELL FIELD

EPCWA has a long history of mixing these waters in their distribution system without blending problems, and based on this history and the similar characteristics of the waters, problems associated with mixing the two waters are not anticipated.

Demineralizing a portion of water from the Wheeler Field and blending the treated water with untreated water was also investigated. Based on removing 12% of the minerals, chlorides become the limiting constituent in the subsequent blending operation. By blending 50% untreated Wheeler Field water with 50% demineralized product water a blend could be produced which would meet state drinking water standards. Total dissolved solids would be reduced to 812 mg/l while chlorides would be reduced to 268 mg/l. The reduction in constituents due to demineralization treatment is illustrated graphically in Figure 3-3B. If the quality of the Wheeler Field water deteriorated significantly, the amount of water requiring demineralization would have to be increased.

Use of water purchased from EPWUPSB was not considered for blending with the Wheeler Field water since there is no assurance that the water will continue to exhibit sufficiently low levels of TDS or other constituents to make blending feasible.

3.7 Summary of Sources

Each of the sources is summarized in Table 3-8. The advantages and disadvantages of each source are varied. The Desert Field water has the best initial quality, is available in the greatest quantity, and has a low development cost. However, it is a non-renewable resource so dependence on Desert Field water will appear to have been short sighted in the future. Also, the quality of water in the Desert Field could deteriorate, although it would have to deteriorate significantly in order to fall below state standards.

On the other extreme, water purchased from EPWUPSB is the most expensive option, but the quality of the water is guaranteed to meet state standards. The future availability of the amount of water contracted from EPWUPSB is more certain, and there is the possibility the quantity available could be increased after 2005.

Wheeler Field water is conveniently located to the largest future demands and the areas that are most likely to develop first. Additionally, this field draws from the Rio Grande Alluvium which is recharged at a high rate, resulting in a long life for the wells in this field. However, the water does not meet state drinking water standards and meeting those standards

Table 3-8 Summary of Sources					
Source	**TDS (mg/l)**	**Chlorides (mg/l)**	**Sulfates (mg/l)**	**Renewable Resource**	**Cost of Water per 1,000 gallons**
Desert -high	630	160	140	no	$0.64
Desert - marginal	1,000	n/a	n/a	no	$0.64
Wheeler	1,450	285	240	yes	$0.23
Wheeler (RO)	812	268	220	yes	$1.43
Desert/Wheeler Blend	958	285	242	no	$0.39
University Block L	900	160	170	yes	$0.62
University (RO)	812	268	220	yes	$1.85
Fabens	900	160	170	yes	$0.48
EPWUPSB	710	230	275	yes	$1.48

will involve a significant blending effort or demineralization facilities. With extended production, water quality is projected to deteriorate, potentially requiring increased treatment.

Water from the Fabens/University Block L Fields is similar to water from the Wheeler Field except that the University Block L Field has great development potential and it's long-term average quality could be better than the Wheeler Field. However, it is distant from the demand centers, except for EPCWCID. The cost of water per 1,000 gallons for each source is summarized in Table 3-8. These costs represent an estimate of the most efficient use of each source without transmission costs. In actual operations, not all sources can be used with equal efficiency since some will be needed for peaking capacity and will be unused during off-peak times. Therefore, the cost per 1,000 gallons produced as shown in the table, is less than the unit cost that will be experienced. However, these costs are valid for comparison of sources.

4.0 WATER SUPPLY ALTERNATIVES

The following section presents water supply alternatives for the study participants for the 50 year planning period. Alternatives were based on;

1) Feasible use of the four sources of supply and two treatment processes, demineralization and blending.
2) Delivery of adequate supplies to meet all projected demands with compliant quality water.
3) Cost effective implementation of the alternatives over time.

Because the demands and sources are distributed geographically and sparsely, one region wide supply system for all participants could not be developed. Similarly, institutional considerations would make a regional supply system difficult to implement. Recognizing these difficulties, participants should continue work toward a long-term, coordinated and cooperative partnership with EPWUPSB and other systems in the area.

4.1 Planning Cost Comparisons

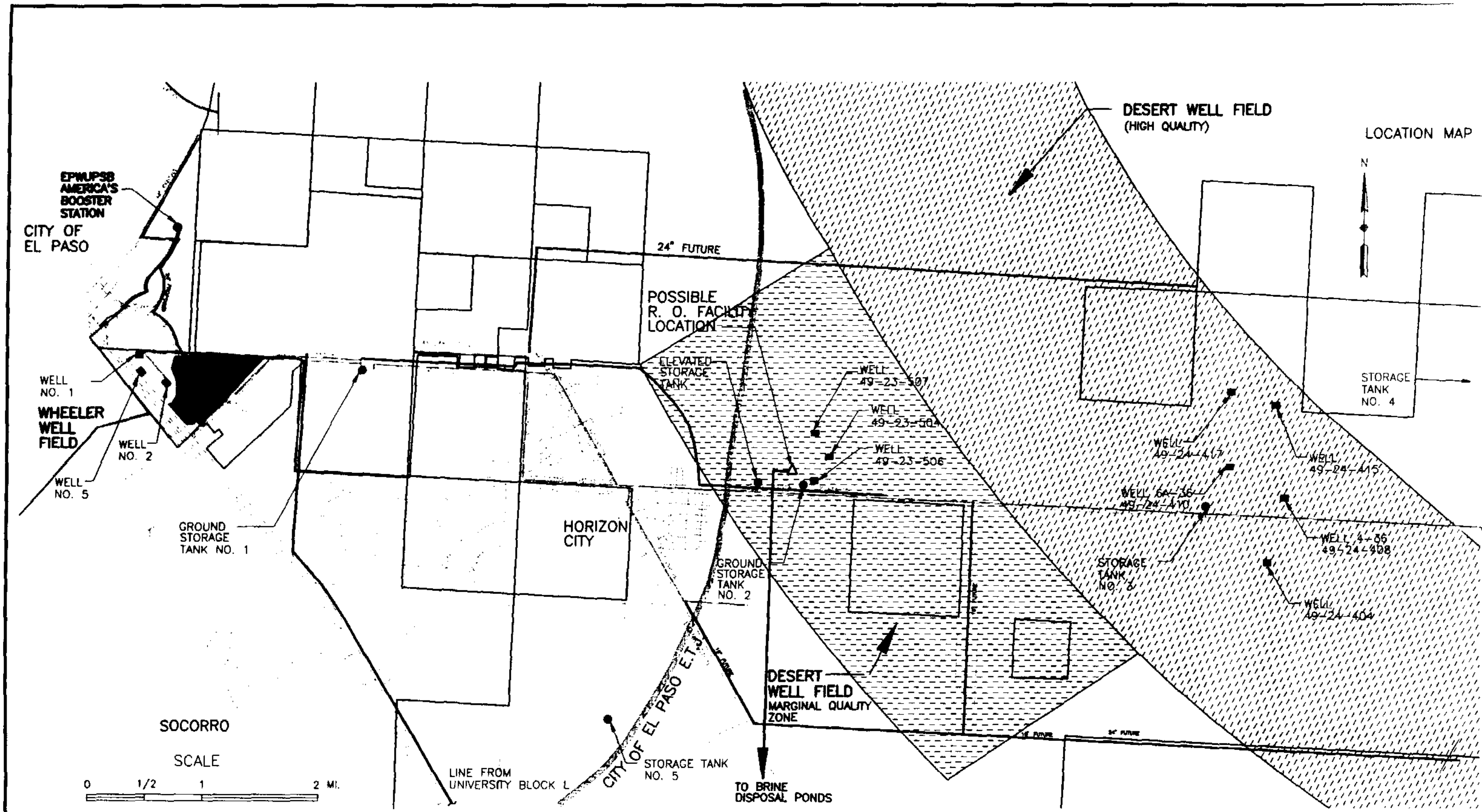
Cost estimates have been developed for each alternative. These are feasibility level cost estimates and should not be considered detailed cost estimates. Financing terms for all analyses are based on a 7% interest rate for 20 years.

In the following sections, development costs presented in Section 3.0 will be combined with transmission costs to determine the total cost of delivered water to each participants system. Then, for each alternative, the present value of costs are presented, so alternatives with very different capital and operational expense schedules can be compared on a common basis. While cost is a necessary factor for participants' consideration, relative risk of failure, degree of operational difficulty, system flexibility, and community preferences are among other factors to be considered by participants in finally selecting an alternative.

4.2 Supply for the El Paso County Water Authority

4.2.1 Existing System

EPCWA currently obtains water from the Wheeler and Desert Fields. Both of these fields are within EPCWA's service area as shown in Figure 4-1. Current rated production capacity is about 1,800 gpm from three wells in the Wheeler Field and 1,100 gpm from seven



HDR

HDR Engineering, Inc.

REGIONAL WATER SUPPLY STUDY	DATE MAY 1995
EPCWA SUPPLY ALTERNATIVES	FIGURE 4-1

wells in the Desert Field, resulting in total supply capacity of 2,900 gpm. Approximately 340 gpm of the Desert Field water is obtained from the zone of marginal quality. The total supply is not utilized due to transmission difficulties in the distribution system and water quality problems. However, EPCWA is in the process of designing system improvements, which must include additional Desert Field production, to begin metered blending of water from the Wheeler and Desert Fields. If constructed, this system improvement will resolve current quality problems and improve transmission capacities.

Some well spacings in the Desert Field are closer than the 2,500 feet recommended by Geraghty & Miller. Additionally, existing wells exceed the recommended 120 gpm pumping rate. When additional well field capacity is developed, the existing larger capacity wells should be operated intermittently to achieve the recommended pumping rate. When maintenance is needed, EPCWA may choose to replace failed pumps with smaller capacity pumps and abandon any failed wells to achieve the recommended spacing and reduce pumping rates in the interest of long term production and quality. If pumping capacity and spacing recommendations are implemented for the existing wells, the installed pumping capacity of the Desert Field wells would be reduced by about 500 gpm leaving a total pumping capacity of 2,400 gpm from existing wells.

4.2.2 Supply Alternatives

To meet future demands, EPCWA could:

1) Increase capacity of the Wheeler Field;
2) Develop additional supply from the Desert Field;
3) Purchase water from EPWUPSB; and
4) Obtain water from its lease on the University Block L Well Field.

The cost of water and transmission for each of these sources to the demand centers in EPCWA's service area are shown in Table 4-1. These costs reveal that Wheeler Field water blended with the Desert Field water is the least expensive due to the high productivity of the Wheeler wells, the excellent quality of the Desert wells, and the fields' close proximity to the demand center. The next most cost effective source appears to be water from the University Block L Field if it could be found in sufficient fresh quantities. However, it is likely that pumpage rates sufficiently large to justify transmission from the University Field would not be sustainable without degrading the water quality below state standards for drinking water, thereby incurring

Table 4-1 Summary of Water Cost to EPWCA			
Cost of Source Development per 1,000 gallons			
Water Source	**Capital**	**O&M**	**Total**
Desert - High Quality	$0.25	$0.39	$0.64
Desert - Marginal Quality	$0.25	$0.39	$0.64
Wheeler - for Blending	$0.01	$0.22	$0.23
Wheeler - RO	$0.76	$0.67	$1.43
University Block L	$0.03	$0.57	$0.60
University Block L - RO	$0.78	$1.07	$1.85
EPWUPSB	$0.48	$1.00	$1.48
Cost of Transmisstion per 1,000 gallons			
Water Source	**Capital**	**O&M**	**Total**
Desert - High Quality	$0.08	$0.02	$0.10
Desert - Marginal Quality	$0.04	$0.02	$0.06
Wheeler - for Blending	$0.10	$0.01	$0.10
Wheeler - RO	$0.00	$0.00	$0.00
University Block L	$0.16	$0.05	$0.21
University Block L - RO	$0.16	$0.05	$0.21
EPWUPSB	$0.02	$0.00	$0.02
Cost of Development & Transmission per 1,000 gallons			
Water Source	**Capital**	**O&M**	**Total**
Desert - High Quality	$0.33	$0.41	$0.74
Desert - Marginal Quality	0.29	$0.41	$0.70
Wheeler - for Blending	$0.11	$0.22	$0.33
Wheeler - RO	$0.76	$0.67	$1.43
University Block L	$0.19	$0.62	$0.81
University Block L - RO	$0.94	$1.12	$2.05
EPWUPSB	$0.50	$1.00	$1.50

demineralization costs. The third most cost effective source is the previous Wheeler and Desert Field alternative coupled with a 1 mgd constant supply from EPWUPSB. The next to the most expensive option is demineralizing Wheeler Field water. Full wholesale water service from EPWUPSB is the most costly source. The following sections describe combinations of these alternatives.

4.2.3 Blend of Wheeler and Desert Field Water

This alternative was developed such that future increases in demand will be met from new wells in the Desert Field and increased utilization of the Wheeler field with blending as quality constraints permit. The demand on the Desert Fields reserves will be heavy. If this alternative is implemented, it is projected that only 15% of the identified economically recoverable reserves will be remain at the end of the planning period.

If this alternative is pursued, 823 gpm of capacity will be needed in the high quality region of the Desert Field, with another 342 gpm coming from the marginal quality region by the end of 1995. Meeting the demand in this way will require the addition of at least one more well, at the recommended 120 gpm, in the high quality region of the Desert Field. However, distribution system constraints will likely require a total of three new wells in this field for proper operation. In 2010 the demand from the Wheeler Field will exceed the capacity of the proposed 12-inch blending line and this line will need to be paralleled. By 2020, a 24-inch line will likely be required to transmit water from the south region of the high quality area of the Desert Field, as shown on Figure 4-1. This development follows the recommendation by Geraghty and Miller for long term use of the Desert Field. After the Wheeler field is developed to its capacity of 3,000 gpm in year 2020, blended quality will improve, assuming no degradation in Wheeler quality, and allow for additional capacity from the marginal region of the Desert Field which has a slightly lower operating cost than the high quality region because of its proximity to the demand center. Around 2030, a second 24-inch transmission main will be needed to obtain water from the northern portion of the Desert Field as shown in Figure 4-1. By year 2050, the Desert Field will be almost completely developed with 113 wells in the high quality region and five in the marginal region. The Wheeler Field will be operating at its capacity of 3,000 gpm. A detailed breakdown of projected expansion schedules is shown in Appendix 4-1.

Cost estimates were developed based on financing all capital costs for installing system requirements to meet peak demands. Operation and maintenance costs were developed based on average annual demand requirements. The present value of future expenses related to this alternative is $8,897,000. This is the lowest present value of the three alternatives investigated. However, it is predicated on minimal degradation of groundwater quality from current conditions.

4.2.4 Supply from Desert Field and Wheeler Field with Demineralization

The second alternative investigated the benefit of installing desalting facilities at the Wheeler Field in year 2010. This could be the future situation confronting the district if the Wheeler Field degraded in quality after several years such that bending was no longer cost effective. Demands not met from the desalting facility were projected to be met from the Desert Field. Under this alternative, the demand on the Desert Fields reserves would still be heavy. It is projected that only 29% of the identified economically recoverable reserves will be remain at the end of the planning period.

If this alternative is pursued, at the end of 1995, 823 gpm of capacity will be needed in the high quality region of the Desert Field, with 342 gpm from the marginal area. Meeting the demand in this way may require the addition of three more wells, at the recommended 120 gpm production rate as discussed in the previous section. Two of the wells would be needed to account for service to connections in the Desert Field vicinity that cannot be served with blended water until additional raw water transmission facilities are built.

Under this alternative, significant infrastructure improvements would be constructed around 2010. The Wheeler Field would be expanded to its full production capacity of 3,000 gpm with a desalting facility. Production of the desalting facility would be about 2,809 gpm. The facility may be located central to EPCWA's distribution system as shown on Figure 4-1. Blending with high quality water from the Desert Field will no longer be needed when the desalting facility starts so the 12-inch blending line could then be converted to a distribution system component. The marginal zone of the Desert Field can be developed earlier and to a greater extent under this alternative, since blending is not required, to take advantage of the lower transmission costs from this field. However, expansion of the high quality zone will still be required and a transmission main from the field will be needed around 2010.

Around 2030, a second 24-inch transmission main will be needed to obtain water from the northern portion of the Desert Field as shown in Figure 4-1. By year 2050, the Desert Field will be almost completely developed with 115 wells in the high quality region and five in the marginal region. This alternative requires a few more wells by 2050 than the blending alternative due to the loss of water for brine disposal in the desalting process. The Wheeler Field will be operating at its capacity of 3,000 gpm but an estimated 191 gpm will be wasted as brine. A detailed breakdown of projected implementation schedules is shown in Appendix 4-2.

Cost estimates were developed based on financing all capital costs for installing system requirements to meet peak demands. Operation and maintenance costs were developed based on average annual demand requirements. The present value of future expenses related to this alternative is $12,964,000. The construction and operation of a desalting facility is the largest factor increasing this value over the blending alternative estimate.

4.2.5 Supply from Desert and Wheeler Fields with 1 mgd purchase from EPWUPSB

The third alternative investigated is supplementing the EPCWA's supply with potable water purchased from EPWUPSB under terms of the current offer. These terms are for 1 mgd at a rate of $1 per 1,000 gallons and peaking over 1 mgd at a rate of $2 per 1,000 gallons. When average daily demands exceed the 1 mgd average as determined on a monthly basis, the quantity used in excess of the average rate would incur a $2 per 1,000 gallons rate charge. In addition the EPWUPSB would charge a resource fee of $1,147 per residential connection currently on the system. For purposes of this study it was estimated that additional connections to the system would not be charged since the sale volume is capped at 1 mgd. Use of this source at the offered volume would delay the need for expansion of the blending line from the Wheeler Field. It would not reduce dependence on the Desert Well Field significantly. It is projected that only 24% of the identified economically recoverable reserves will remain at the end of the planning period.

If this alternative is pursued, at the end of 1995, 823 gpm of capacity will be needed in the high quality region of the Desert Field, with 342 gpm from the marginal region. Meeting the demand in this way will likely require the addition of three more wells, at the recommended 120 gpm, in the high quality region of the Desert Field.

Under this alternative, a pipeline would need to be constructed from the Americas Booster Pump Station to the EPCWA system similar to the line shown on Figure 4-1. The EPCWA would begin to use the purchased water starting upon completion but peak demands would be met from well supplies in order to avoid the peak charge rate. The full 1 mgd would be used prior to 2010 and a 24-inch transmission line from the Desert Field would be needed by 2010. The blending operation would continue but expansion of the blend line would still be needed in 2020. The blending operation would provide for much of the peak system demands. Around 2030, a second 24-inch transmission main will be needed to obtain water from the northern portion of the Desert Field as shown in Figure 4-1. By year 2050, the Desert Field will be significantly developed with 110 wells in the high quality region and five in the marginal region. A detailed breakdown of projected implementation schedules is shown in Appendix 4-3.

Cost estimates were developed based on financing all capital costs for installing the peak system requirements. Operation and maintenance costs were developed based on average annual demand requirements. The present value of future expenses related to this alternative is $10,433,000.

4.2.6 Conversion to supply from EPWUPSB

The last alternative investigated involved transitioning to EPCWA's supply and only maintaining limited well field capacity with little expansion of the current system. Expansion would include the facilities to get the current facility into compliance while meeting projected 2005 demands . These facilities include a blending pipeline and facility and three wells completions in the high quality zone of the Desert Well Field. All future increases in demand not met from this system would be satisfied from water purchased from EPWUPSB including peak demands.

The current offer from EPWUPSB does not address the terms for the type of operation described in this alternative. Therefore, estimated terms were assumed to be the same as the current offer. It was estimated that demands in excess of 1 mgd could be purchased from EPWUPSB around 2005 and that volume charges would remain $1 per 1000 gallons of base or average day demand. Demand in excess of this amount or peak demands would be charged at a double rate. In addition the EPWUPSB would charge a resource fee of $1,147 per residential connection for current and future connections. Use of the EPWUPSB service would greatly reduce dependence on the Desert Well Field significantly. It is projected that 85% of the identified economically recoverable reserves will remain at the end of the planning period.

If this alternative is pursued, at the end of 1995, 823 gpm of capacity will be needed in the high quality region of the Desert Field, and 342 gpm from the marginal area. Meeting the demand in this way will likely require the addition of three wells, at the recommended 120 gpm production rate, in the high quality region of the Desert Field. A detailed breakdown of projected implementation schedules is shown in Appendix 4-4.

Under this alternative, a pipeline would need to be constructed from the Americas

Booster Pump Station to the EPCWA system similar to the line shown on Figure 4-1. The EPCWA would begin to use the purchased water upon completion of connection to the system. Peak demands would also be met from EPWUPSB system. An expansion of the blending line and transmission lines from the Desert Well Field would not be necessary.

Cost estimates were developed based on financing all capital costs for installing the system requirements to meet peak demands. Operation and maintenance costs were developed based on average annual demand requirements. The present value of future expenses related to this alternative is $15,334,000.

4.2.7 Recommendations for EPCWA

As shown in Table 2-3, growth in EPCWA's service area is projected to be slower until the year 2000 and then escalate rapidly thereafter. However, as we have seen with the swift economic changes experienced in Texas in the 1980s, conditions can change rapidly. Therefore, options which incur the lowest cost with the highest flexibility would seem to be most appropriate until the customer base is significantly larger.

Based on the maximum day demands presented in Table 2-4, peak water consumption in the year 2000 is projected to be 2,400 gpm. If the lower production rates suggested by Geraghty & Miller were instituted, the production rate of EPCWA's current Desert Field wells and Wheeler Field wells would be 2,400 gpm (see Section 4.2.1). Therefore, EPCWA could meet it's projected demands through the year 2000, although additional facilities are needed to meet quality criteria.

It may be prudent for EPCWA to ensure that the projected growth first occurs as rapidly as expected before it commits to a large expenditure to connect to the EPCWA system for a portion of its water. However, the 50 year difference in present value of future expenses of initially obtaining 1 mgd from EPWUPSB is $1.6 million more expensive than the total Desert/Wheeler blend option. And 1 mgd from EPWPSB will somewhat extend the use of the Desert Field beyond the year 2050.

In conclusion, it appears EPCWA can meet their needs for several years by blending Desert Field and Wheeler Field water. Purchasing water from EPWUPSB should be undertaken when growth indicates additional supply will be needed. Groundwater quality should be charted frequently and any deterioration in the quality of water from individual wells should be analyzed.

Geraghty and Miller's recommendations for groundwater test drilling and monitoring should be followed. Purchase of EPWUPSB water should be expedited whenever growth is more accelerated than envisioned in this report, attractive opportunities are available to share facilities to connect to EPWUPSB system, or groundwater production and quality trends are significantly lower than estimated by Geraghty and Miller.

4.3 Supply for the El Paso County Water Control and Improvement District No. 4

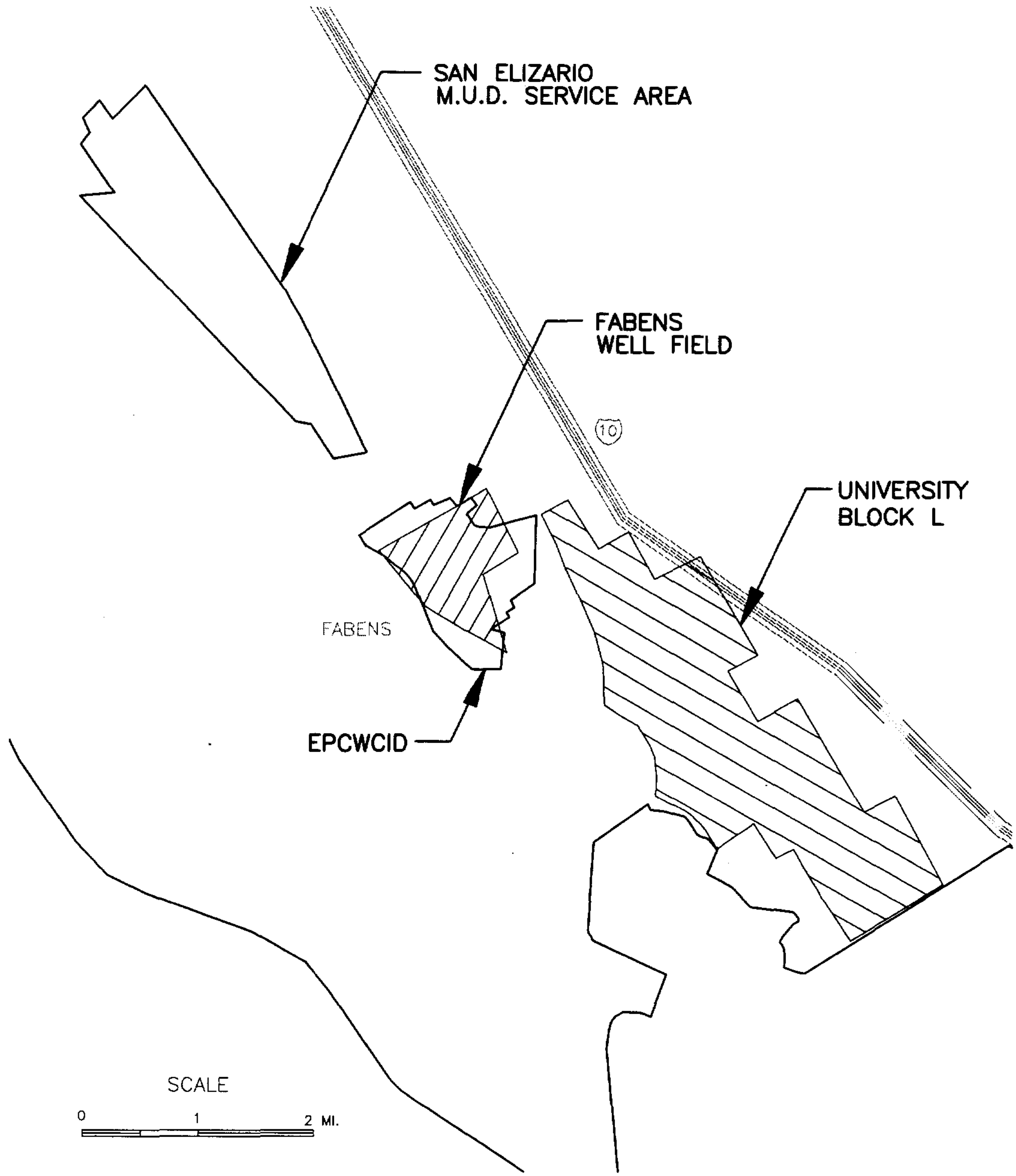
4.3.1 Existing System

EPCWCID operates three wells in the Fabens Field and plans to complete two more. Well production rates average 550 gpm for a total production capacity of 3,300 gpm. The CC Camp well, which has degraded in quality, has been abandoned and has not been included in this total. EPCWCID is pumping from an isolated area in the Fabens Field which has acceptable quality water. The District supplies water to the San Elizario MUD shown in Figure 4-2. However, this outside demand is projected to remain relatively small.

4.3.2 Supply Alternatives and Recommendations

The total demand on the system at the end of the planning period is projected to be 1,800 gpm. Based on this projection, it appears that the district has sufficient installed capacity. The District's long term supply needs are therefore likely to be driven by the quality of the water produced from the Fabens Field. Based on the degradation of the CC Camp well and well samples in the area, it appears that the high quality zone is limited. Since the size of this zone is unknown, the longevity of the current supply cannot be projected.

If the District were to exhaust this high quality zone, it could explore the University Block L Field for similar high quality zones. This would require a lease from the EPCWA which currently has rights to the field. The University Block L Field offers EPCWCID the lowest cost alternative to the Fabens Field, as shown in Table 4-2. Development in the Fabens field at 1,000 gpm per well results in a unit cost of $0.29 per 1000 gallons. This cost is low because the field is nearby and the infrastructure is already in place. The cost of development of comparable wells in the University Block L Field would be about $0.57 per 1000 gallons. Any charges to EPCWCID by EPCWA for use of the field other than the state's royalty would be in addition to this estimate.



HDR Engineering, Inc.

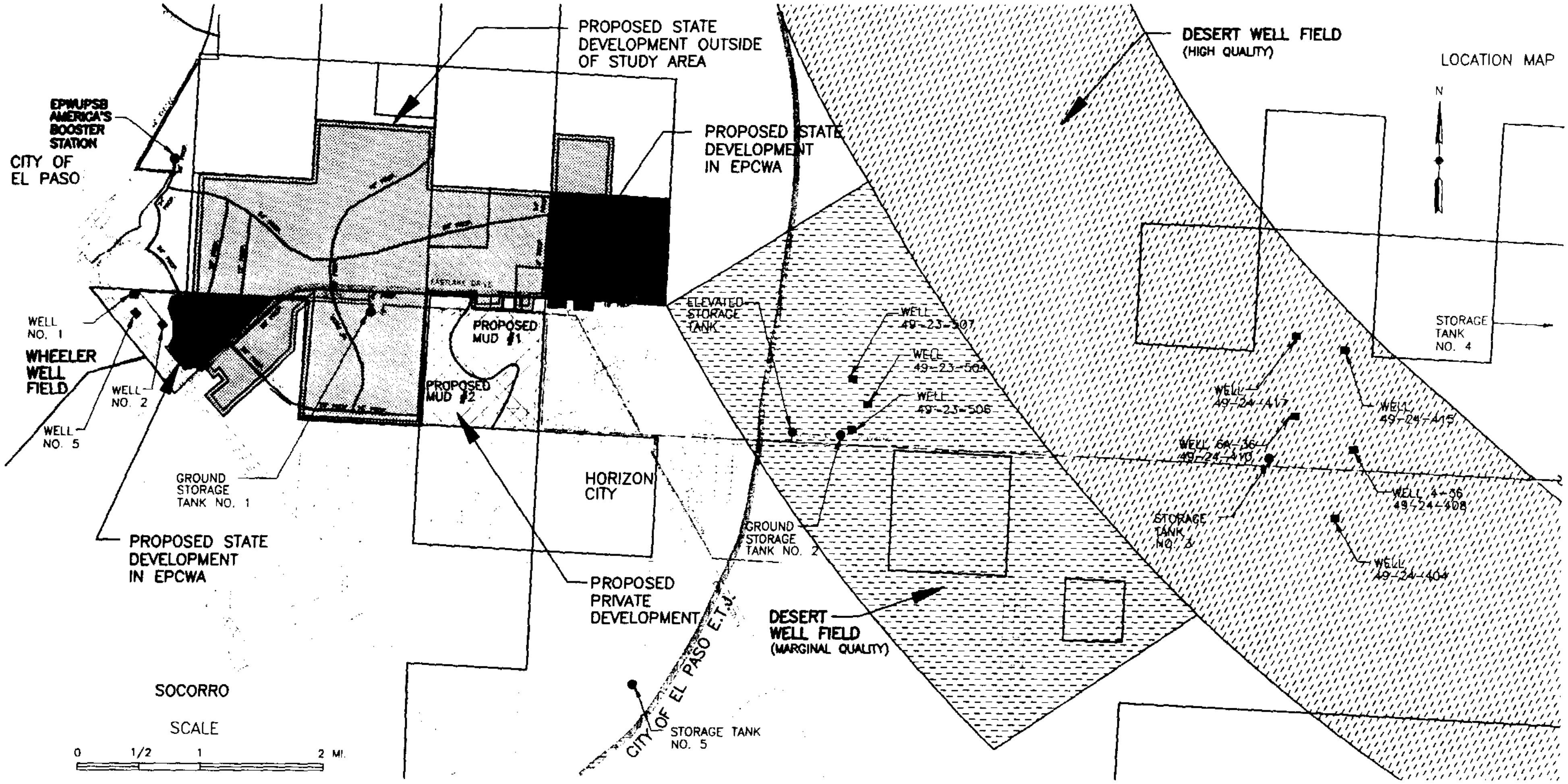
REGIONAL WATER SUPPLY STUDY	DATE MAY 1995
EPCWCID SUPPLY ALTERNATIVES	FIGURE 4-2

Table 4-2 Summary of Water Cost to EPCWCID			
Cost of Source Development per 1,000 gallons			
Water Source	**Capital**	**O&M**	**Total**
University Block L	$0.03	$0.57	$0.60
University Block L - RO	$0.78	$1.07	$1.85
Fabens	$0.03	$0.43	$0.46
EPWUPSB	$0.57	$0.98	$1.55
Cost of Transmisstion per 1,000 gallons			
Water Source	**Capital**	**O&M**	**Total**
University Block L	$0.10	$0.07	$0.17
University Block L - RO	$0.10	$0.07	$0.17
Fabens	$0.00	$0.00	$0.00
EPWUPSB	$0.28	$0.07	$0.35
Cost of Development & Transmission per 1,000 gallons			
Water Source	**Capital**	**O&M**	**Total**
University Block L	$0.13	$0.64	$0.77
University Block L - RO	$0.88	$1.14	$2.01
Fabens	$0.03	$0.43	$0.46
EPWUPSB	$0.85	$1.05	$1.90

If high quality zones cannot be found or use of the University Block L Field is not feasible, EPWCID could investigate service from EPWUPSB. If charges were similar to the charges proposed for service to EPCWA, EPCWCID could expect to pay about $1.90 per 1000 gallons of capacity including transmission costs. This cost is only slightly more than the unit cost for demineralizing water from the University Block L Fields, assuming facilities could be economically sized by sharing treatment facilities with another entity.

4.4 Water Supply for Outside Demands

The City of El Paso Water Utilities Public Service Board has prepared a study investigating service to both the proposed state and private developments. A proposed system for distributing this water is shown on Figure 4-3. EPWUPSB appears prepared to supply these demands. Use of water from EPWUPSB to service these outside demands will reduce future



HDR

HDR Engineering, Inc.

REGIONAL WATER SUPPLY STUDY	DATE MAY 1995
OUTSIDE WATER SUPPLY	FIGURE 4-3

demands on the regional groundwater resources currently used by the other study participants. Also, should the state and private developments elect service from EPWUPSB, EPCWA may have the opportunity to participate with them in jointly owned transmission facilities.

5.0 WATER CONSERVATION PLAN

5.1 Background Purpose and Goals

In 1985, the Texas Legislature broadened the definition of water conservation to include "those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses." The Legislature also empowered the Texas Natural Resource Conservation Commission to require the formulation and submission of water conservation plans as defined by the conservation clauses in the water code[1]. This water conservation definition and water conservation planning also applies to applications for financial assistance from the funding programs administered by the Texas Water Development Board.

The purpose of water conservation planning is to encourage and promote the efficient use of water supplies and to manage available supplies during droughts. Each water system should set water conservation goals consistent with the State water planning goal, which in the 1990 Texas Water Plan was the reduction of per capita water use by 15 percent by the year 2020.

5.2 Conservation Methods

The objective of water conservation is to permanently reduce the quantity of water required per person per day for living and business activities. The Water Conservation Methods of the Texas Water Code are as follows:[2]

1. Education and Information;
2. Water Conserving Plumbing Code;
3. Retrofit Programs;
4. Conservation Oriented Water Rate Structure;
5. Universal Metering and Meter Repair;
6. Water Conservation Landscaping;
7. Leak Detection and Repair; and

---

[1]V.T.C.A., Water code, Sections 11.002 and 11.1271, 1988.

[2]V.T.C.A., Water code, Section 17.125.

8. Recycling and Reuse.

Recommended methods of saving water are listed below[3].

5.2.1 Bathroom

1. Take a shower instead of filling the tub and taking a bath. Showers usually use less water than tub baths.

2. Install a low-flow shower head which restricts the quantity of flow at 60 psi to no more than 2.75 gallons per minute.

3. Take short showers and install a cutoff valve or turn the water off while soaping and back on again only to rinse.

4. Do not use hot water when cold will do. Water and energy can be saved by washing hands with soap and cold water, hot water should only be added when hands are especially dirty.

5. Reduce the level of the water being used in a bath tub by one or two inches if a shower is not available.

6. Turn water off when brushing teeth until it is time to rinse.

7. Do not let water run when washing hands. Instead, hands should be wet, and water should be turned off while soaping and scrubbing and turned on again to rinse. A cutoff valve may also be installed on the faucet.

8. Shampoo hair in the shower. Shampooing in the shower takes only a little more water than is used to shampoo hair during a bath and much less than shampooing and bathing separately.

9. Hold hot water in the basin when shaving instead of letting the faucet continue to run.

10. Test toilets for leaks. To test for a leak, a few drops of food coloring can be added to the water in the tank. The toilet should not be flushed. The customer can then watch to see if the coloring appears in the bowl within a few minutes. If it does, the fixture needs adjustment or repair.

11. Use a toilet tank displacement device. A one-gallon plastic milk bottle can be filled with stones or with water, recapped, and placed in the toilet tank. This will

[3]Texas Water Development Board, Austin, Texas, 1991.

reduce the amount of water in the tank but still provide enough for flushing. (Bricks which some people use for this purpose are not recommended since they crumble eventually and could damage the working mechanism, necessitating a call to the plumber).

12. Install faucet aerators to reduce water consumption.

13. Never use the toilet to dispose of cleaning tissues, cigarette butts, or other trash. This can waste a great deal of water and also places an unnecessary load on the sewage treatment plant or septic tank.

14. Install a new low-volume flush toilet that uses 1.6 gallons or less per flush when building a new home or remodeling a bathroom.

5.2.2 Kitchen

1. Use a pan of water (or place a stopper in the sink) for rinsing pots and pans and cooking implements when cooking rather than turning on the water faucet each time a rinse is needed.

2. Never run the dishwasher without a full load. In addition to saving water, expensive detergent will last longer and a significant energy savings will appear on the utility bill.

3. Use the sink disposal sparingly, and never use it for just a few scraps.

4. Keep a container of drinking water in the refrigerator. Running water from the tap until it is cool is wasteful. Better still, both water and energy can be saved by keeping cold water in a picnic jug on a kitchen counter to avoid opening the refrigerator door frequently.

5. Use a small pan of cold water when cleaning vegetables rather than letting the faucet run.

6. Use only a little water in the pot and put a lid on it for cooking most food. Not only does this method save water, but food is more nutritious since vitamins and minerals are not poured down the drain with the extra cooking water.

7. Use a pan of water for rinsing when hand washing dishes rather than a running faucet.

8. Always keep water conservation in mind, and think of other ways to save in the kitchen. Small kitchen savings from not making too much coffee or letting ice cubes melt in a sink can add up in a year's time.

5.2.3 Laundry

1. Wash only a full load when using an automatic washing machine.

2. Use the lowest water level setting on the washing machine for light loads whenever possible.

3. Use cold water as often as possible to save energy and to conserve the hot water for uses which cold water cannot serve. (This is also better for clothing made of today's synthetic fabrics.)

5.2.4 Appliances and Plumbing

1. Check water requirements of various models and brands when considering purchasing any new appliance that uses water. Some use less water than others.

2. Check all water line connections and faucets for leaks. If the cost of water is $1.00 per 1,000 gallons, one could be paying a large bill for water that simply goes down the drain because of leakage. A slow drip can waste as much as 170 gallons of water EACH DAY, or 5,000 gallons per month, and can add as much as $10.00 per month to the water bill.

3. Learn to replace faucet washers so that drips can be corrected promptly. It is easy to do, costs very little, and can represent a substantial amount saved in plumbing and water bills.

4. Check for water leakage that the customer may be entirely unaware of, such as a leak between the water meter and the house. To check, all indoor and outdoor faucets should be turned off, and the water meter should be checked. If it continues to run or turn, a leak probably exists and needs to be located.

5. Insulate all hot water pipes to avoid the delays (and wasted water) experienced while waiting for the water to "run hot."

6. Be sure the hot water heater thermostat is not set too high. Extremely hot settings waste water and energy because the water often has to be cooled with cold water before it can be used.

7. Use a moisture meter to determine when house plants need water. More plants die from over-watering than from being too dry.

5.2.5 Out-Of-Door Uses

1. Water lawns early in the morning during the hotter summer months. Much of the

water used on the lawn can simply evaporate between the sprinkler and the grass.

2. Use a sprinkler that produces large drops of water, rather than a fine mist, to avoid evaporation.

3. Turn soaker hoses so the holes are on the bottom to avoid evaporation.

4. Water slowly for better absorption, and never water on windy days.

5. Forget about watering the street or walks or driveways. They will never grow a thing.

6. Condition the soil with compost before planting grass or flower beds so that water will soak in rather than run off.

7. Fertilize lawns at least twice a year for root stimulation. Grass with a good root system makes better use of less water.

8. Learn to know when grass needs watering. If it has turned a dull grey-green or if footprints remain visible, it is time to water.

9. Do not water too frequently. Too much water can overload the soil so that air cannot get to the roots and can encourage plant diseases.

10. Do not over-water. Soil can absorb only so much moisture and the rest simply runs off. A timer will help, and either a kitchen timer or an alarm clock will do. An inch and one-half of water applied once a week will keep most Texas grasses alive and healthy.

11. Operate automatic sprinkler systems only when the demand on the town's water supply is lowest. Set the system to operate between four and six a.m.

12. Do not scalp lawns when mowing during hot weather. Taller grass holds moisture better. Rather, grass should be cut fairly often, so that only 1/2 to 3/4 inch is trimmed off. A better looking lawn will result.

13. Use a watering can or hand water with the hose in small areas of the lawn that need more frequent watering (those near walks or driveways or in especially hot, sunny spots).

14. Learn what types of grass, shrubbery, and plants do best in the area and in which parts of the lawn, and then plant accordingly. If one has a heavily shaded yard, no amount of water will make roses bloom. In especially dry sections of the state, attractive arrangements of plants that are adapted to arid or semi-arid

climates should be chosen.

15. Consider decorating areas of the lawn with rocks, gravel, wood chips, or other materials now available that require no water at all.

16. Do not "sweep" walks and driveways with the hose. Use a broom or rake instead.

17. Use a bucket of soapy water and use the hose only for rinsing when washing the car.

5.3 Conservation Program

Effective water conservation programs should address each of nine recommended conservation methods: (1) public information and education; (2) recommended water conserving plumbing fixtures; (3) water conservation retrofit programs; (4) water conservation-oriented rate structures; (5) metering and meter testing; (6) water conserving landscaping; (7) leak detection and water audits; (8) wastewater reuse and recycling; and (9) implementation. Each method is explained below, and in Section 2.3.9, implementation procedures are presented.

5.3.1 Public Information and Education

Water system owners should organize and operate an ongoing program to:

- Provide qualified individuals to speak at institutions, organizations, and groups throughout the area at regular intervals;

- Conduct or sponsor exhibits on conservation, water saving devices, and other methods to promote water conservation and efficiency;

- Provide and distribute brochures and other materials to the citizens of the area. Materials available from agencies such as the Texas Agricultural Extension Service and the TWDB can be used;

- Work in cooperation with builders, developers, and governmental agencies to provide exhibits of xeriscape landscaping for new homes;

- Work in cooperation with schools to establish an education program within these institutions and to provide them with landscape videos, brochures, and other training aids; and

- Develop welcome packages for new citizens to educate them in the benefits of conservation and inform them of water efficient plumbing fixtures and water efficient plants, trees, shrubs, and grasses best suited to this area.

5.3.2 Plumbing Fixtures

Customers should be informed about water-conserving plumbing fixtures, and should use such fixtures in new homes, new commercial and public buildings, and when replacing fixtures in existing homes and commercial and public buildings. Plumbing codes should require the use of water-conserving plumbing fixtures. The fixtures listed below are water-conserving fixtures which meet state water conservation standards, as specified in Senate Bill 587, 1991 Regular Session, Texas Legislature:

- <u>Toilets:</u> Wall mounted, flushometer types that have a maximum flush of 2.0 gallons, with all other types having a maximum flush that does not exceed 1.6 gallons of water;
- <u>Urinals:</u> Maximum flush of one gallon of water;
- <u>Showerheads:</u> Maximum flow rate of 2.75 gallons per minute at 80 psi (pounds per square inch), except where necessary for safety reasons;
- <u>Faucets:</u> Maximum flow rate of 2.2 gallons per minute at 60 psi for all lavatory, kitchen, and bar sink faucets;
- <u>Drinking Water Fountains</u>: Must be self closing; and
- <u>Hot Water Piping:</u> All hot water lines not in or under a concrete slab should be insulated.

5.3.3 Retrofitting Plumbing Fixtures

Retrofit of existing plumbing fixtures through the voluntary efforts of individual consumers for their homes and businesses should be encouraged. Adoption of a water conservation plumbing code (as described in Section 5.3.2) will provide a gradual up-grading of plumbing fixtures in existing structures.

5.3.4 Water Rates

Flat or increasing block rate structures encourage water users to reduce water use and thereby increase water conservation. With an increasing block rate, the price per 1,000 gallons of water increases as the quantity used increases, thereby discouraging excessive and wasteful water use.

5.3.5 Metering and Meter Testing

The purpose of metering is to measure the quantity of water being distributed to customers throughout the system, to account for all water being produced, and to accurately bill for the quantity of water delivered to each customer. A recommended schedule for testing meters is as follows:

- Production or master meters, test once per year;
- Meters large than 1", test once every three years; and
- Meters 1" or less, test once every 10 years.

5.3.6 Landscaping

Water-conserving landscaping through public information and education should be promoted. Well-designed and properly maintained demonstration landscapes located in parks and other highly visible areas can promote the water-conserving landscape concept.

5.3.7 Leak Detection and Water Audits

Water system operators should perform leak detection studies and water audits. Technical assistance can be obtained from the Texas Water Development Board at little cost to the water utility. Leak detection and repair of leaks will reduce the quantity of water that must be pumped from aquifers and/or obtained from surface water sources.

5.3.8 Wastewater Reuse and Recycling

Water reuse and recycling whenever it is found to be fiscally, environmentally, and institutionally feasible should be implemented. The leading potential types of water reuse projects are:

- Use of wastewater effluent for irrigation of parks and/or golf courses;
- Delivery of treated wastewater effluent to commercial and industrial users who can appropriately supplant use of potable sources;
- Installation of gray water (water from the washing machines, showers, and bath tubs) tanks in homes for lawn and landscape watering.

5.3.9 Implementation and Enforcement

The water conservation plan should be implemented and enforced through efforts of the water utility systems and cities. Guidance and informational material is available from the American Water Works Association and TWDB. Examples of publications available from TWDB and costs are shown in Table 5-1. Limited quantities of English and Spanish language publications are available free of charge.

Table 5-1
Water Conservation Literature and Price List*

Title	Cost per Copy ($)
Forty-Nine Water Savings Tips: TWDB WC-1, Pamphlet, 8 pp.	$0.10
A Homeowner's Guide to Water Use and Water Conservation: TWDB WC-3, Booklet, 26 pp.	$0.15
Saving Water Inside the Home: TWDB WC-4, Pamphlet, 8 pp.	$0.10
Conserve Water Poster for Businesses: TWDB, Poster, 11" x 15"	$0.15
Saving Water Outside the Home: TWDB WC-6, Pamphlet, 8 pp.	$0.10
Lawn Watering Guide: TWDB WC-12 Card, 3.5"x5"	$0.04
Drip Irrigation: TWDB WC-8, Pamphlet, 6 pp.	$0.15
A Directory of Water Saving Plants and Trees for Texas: TWDB WC-13, Booklet, 26 pp.	$0.55
Xeriscape-Principles, Benefits: TWDB WC-14A, Pamphlet, 4 pp., Size 3.5"x7.5".	$0.10
* Texas Water Development Board, Austin, Texas.	

5.4 Drought Management Plan

Drought disrupts the availability of water supplies from either ground or surface sources. Limitations on the supply of either ground or surface water, or on facilities to pump, treat, store, or distribute water can also present a public water supply utility with an emergency demand management situation. The purpose of a drought management plan is to establish methods to be used only as long as the emergency exists. An emergency condition may more often result from failure or circumstances other than drought. An acceptable plan includes the following:

1. Trigger conditions signaling the start of an emergency period;
2. Drought contingency measures and initiation of water demand management procedures;
3. Information and education; and
4. Termination notification actions.

5.4.1 Drought Trigger Conditions, Contingency Measures, and Initiation of Water Demand Management Procedures

The following actions could be taken when trigger conditions are met. Trigger conditions may be set for varying levels of severity. The water utility system should monitor water pressure in the distribution system and water levels in the storage tanks, and activate measures for each drought condition, as appropriate.

<u>Mild Condition</u>

a. Initiate engineering studies to identify and evaluate alternatives, should conditions worsen and implement projects that would help alleviate shortages;

b. Inform public by giving notice of a mild drought to the customers served by the system, post the notice, and notify news media of the mild drought;

c. Included in the information to the public will be the recommendation that water users look for ways to conserve water; and

d. Through the news media, the public will be advised daily of the water supply conditions.

Moderate Condition

a. Continue implementation of all relevant actions of preceding phase.

b. Inform the public through the news media that a trigger condition has been reached, and they should look for ways to voluntarily reduce water use. Specific steps which can be taken will be provided through the news media (see water saving methods in Section 2.2);

c. Notify major commercial water users of the situation and request voluntary water use reductions;

d. A lawn watering schedule should be implemented: Customers with even numbered street addresses may water on even numbered days of the month. Customers with odd numbered street addresses may water on odd numbered days of the month. Watering should occur only during early to mid-morning and evening periods; and

e. Recommend water users to insulate pipes rather than running water to prevent freezing during winter months.

Severe Condition

a. Continue implementation of all relevant actions in preceding phase;

b. Car washing, window washing, and pavement washing will be prohibited except when a bucket is used;

c. The following public water uses, not essential for public health or safety, will be prohibited:

1). Street washing;
2). Water hydrant flushing;
3). Filling swimming pools;
4). Athletic field watering;
5). Park watering; and
6). Golf course watering.

d. A nurseries' plant stock may be watered during off-peak hours, only, to the extent essential.

e. Certain industrial and commercial water uses which are not essential to the health and safety of the community should be prohibited; and

f. Through the news media, the public will be advised daily of the water supply conditions.

5.4.2 Information and Education

Once trigger conditions have been reached, the public will be informed of the conditions and measures to be taken. The process for notifying the public includes:

1. Posting the Notice of Drought conditions at City Hall, Post Office, Public Library, Senior Citizens Centers, and Shopping Centers.
2. Copy of notice to newspapers, and hold press conferences; and
3. Copy of notice to local radio and television stations.

5.5 Termination Notification

Termination of the drought measures should take place when the trigger conditions which initiated the drought measures have subsided, and an emergency situation no longer exists. The public can be informed of the termination of the drought measures in the same manner that they were informed of the initiation of the drought measures.

5.6 Implementation

EPCWA rules and regulations adopted in April, 1992, contain Part IX, Water Conservation to establish its current water conservation program. The program is modeled after the Water Conservation Policy developed by EPWUPSB. A summary of the program contained in EPCWA's Master Plan, Water Systems, March, 1993, follows:

1) Low water use plumbing fixtures and devices are required for all new construction, including replacement for remodeling or repair.

2) Mandatory restrictions are placed on lawn and landscape irrigation.

3) Non-essential water uses are restricted. The uses affected by these restrictions are vehicle washing, swimming pools, evaporative cooler bleeder liens and single pass heating and cooling systems.

4) Large water users, primarily in the commercial and industrial sector, must prepare and submit water conservation plans.

5) Authority for enforcement and implementing more stringent requirements in emergencies is set forth.

EPCWA also operates a rebate program for users to retrofit their homes with water conserving toilets.

EPCWCID has been able to meet the relatively modest demands of its users without adopting stringent water conservation policies. In the case of proposed developments mentioned previously in the report, planners are incorporating water conservation principles in their plans.

6.0 INSTITUTIONAL FRAMEWORK

There are several types of political subdivisions of local government that can build, own, and operate water systems. Governmental units in and near the planning area are cities and water districts. Cities in the area have generally allowed water (and wastewater) service to be provided by districts, or, in the case of the City of El Paso, an independent utility, the EPWUPSB. Table 6-1 identifies several types of cities and districts and sources of revenues, taxes or system revenues, authorized for them to build, own, and operate water systems.

In addition to the existing water provides in the area, state law allows for the creation of a number of other types of entities to provide such services.

6.1 Water Districts

6.1.1 General. Article XVI, Section 59 of the Texas Constitution authorizes the creation of water districts with authority to construct, own and operate water and wastewater systems. Districts may be created either under the general law provisions of the Texas Water Code or by special legislative act.

6.1.2 General Law Districts. The more flexible and useful of the general law districts are the water control and improvement district ("WCID"), authorized under Chapter 51, Texas Water Code, and the municipal utility district ("MUD"), authorized under Chapter 54, Texas Water Code. A WCID may be created by the county commissioners court if it is located solely within one county and is only to have water, not wastewater powers. Otherwise, WCID's must be created at the Texas Natural Resource Conservation Commission (the "Commission"). MUDs are created at the Commission.

Each of these districts is created by the commissioners court or Commission upon a petition signed by landowners within the district filed with the creating governmental body. If created, voters in the district are required to confirm the creation at an election called and held for that purpose. Either type of district is governed by a board of five (5) directors elected by residents within the district.

Taxes may only be levied within any such district if approved by the voters. Taxes levied within any such district must be levied on an equal and uniform basis. MUDs authorize taxes only on the ad valorem basis. WCIDs may tax on either the ad valorem or benefits basis.

WCIDs and MUDs larger than 1,500 acres are specifically authorized to designate defined areas within the district which may receive special benefits

Table 6-1 Water and Wastewater Project Ownership, Construction, and Operation						
Type of Entity	**Own Water System**	**Own Sewer System**	**Finance Construction Debt with**		**Finance Maintenance with**	
			Taxes	**Revenue**	**Taxes**	**Revenue**
1) El Paso County[(1)]	X		X	X	X	X
2) General Law City	X	X	X	X	X	X
3) Home Rule City	X	X	X	X	X	X
4) Water Control and Improvement District	X	X	X	X	X	X
5) Underground Water Conservation District	X		X	X	X	X
6) Fresh Water Supply District	X	X	X	X	X	X
7) Municipal Utility District	X	X	X	X	X	X
8) Water Improvement District	X		X	X		X
9) Special Utility District	X	X		X		X
10) Article 1434A Water Supply Corporation	X	X		X		X
11) For Profit Corporation	X	X		X		X

[(1)]If, prior to September 1, 1963, a county has adopted the provisions of Article 2352e, V.T.C.W., it may construct a water project up to a maximum amount of $250,000 per project "for county purposes." Also, Section 16.345, Texas Water Code, grants counties authority to participate in projects to serve economically distressed areas.

from a particular project. Upon voter approval within the entire district and within the defined area, debt supported by a tax levied only within the defined area, and not within the entire district, may be issued for a project benefiting the defined area. This mechanism provides flexibility for financing projects benefiting particular areas of any district without taxing the entire district.

6.1.3 Legislatively Created District. In addition to creating districts under the general laws contained in the Texas Water Code, the Legislature often creates districts by special act. The El Paso County Lower Valley Water District Authority is a special act district.

Creating a district by special act provides broad flexibility to tailor the district's powers, financing and authority to meet the particular needs of any area. The Legislature typically requires a confirmation election to approve the creation of any such district. Elections to approve any tax on such a district are required by the Texas Constitution.

6.1.4 Combinations of Political Subdivisions. Many water and wastewater projects jointly serve two or more political subdivisions. Such projects are usually owned by one entity who agrees to provide water or wastewater services to the other. However, joint ownership or operation is also authorized under state law.

6.1.5 Interlocal Cooperation Act. The Interlocal Cooperation Act, Article 4413(32c), Vernon's Texas Civil Statutes, is the most commonly used statute for jointly owned or operated projects. It offers flexibility for existing cities and districts to create an agency to perform the administrative functions associated with any such jointly owned project. However, financing of any such project is usually borne separately by each individual entity for its pro rata share of the cost of constructing and maintaining the facilities.

6.1.6 Underground Water Conservation Districts. Chapter 52 of the Texas Water Code allows creation of locally governed groundwater districts to protect and control withdrawals of groundwater. The district creation process is initiated by local petition. The area governed by the district is determined in the creation process after consideration of the occurrence, use, character, and extent of the subject groundwater resource.

6.2 TNRCC Jurisdiction - Rates and Service

The TNRCC has, historically, regulated the rates charged for sales of state surface water. Over time, that authority has expanded into an area of wholesale water sales such as those now occurring in and near the area. Such sales are likely to significantly grow in the future. Under Chapter 13 Texas Water Code, TNRCC jurisdiction exists when a complaint is filed for rates charged in wholesale water contracts for potable water service, regardless of the water source. Recently, a public interest test has become the initial step in rate proceedings (30 TAC §§291.128-291.138). The test does not focus on cost of service but rather on whether or not the rate impairs the seller's or purchaser's ability to continue to provide service, whether the rate constitutes the seller's abuse of a monopoly power, and whether the rate is unreasonably preferential, prejudicial, or discriminatory. Should the TNRCC find the rate contrary to public interest, the case can go forward into the second part of the process where a reasonable rate based on cost of service will be determined.

Contracts for wholesale water service may involve costs other than those classified as rates. Capital recovery fees or impact fees imposed by cities in the Local Government Code are not addressed by TNRCC jurisdiction. However a water district's impact fees, as well as other kinds of charges for service, are regulated by TNRCC.

Should study participants engage in consideration of contracted water purchases or sales, it will be necessary to develop the contracts in accordance with applicable laws, rules and regulations.

REFERENCES

El Paso County Water Authority. *Wastewater System Study and Projections of Future Growth.* December, 1992

El Paso Water Utilities Public Service Board. *Water and Wastewater Feasibility Study for Proposed East El Paso Area.* January 26, 1995.

El Paso Water Utilities Public Service Board and El Paso County Water Improvement District No. 1. *El Paso Water Resource Management Plan, Phase I Completion Report.* July, 1991

Faught and Associates, Inc. *El Paso County Water Authority Master Plan - Water Systems.* March 1993.

Geraghty & Miller, Inc. *A Review and Evaluation of the Available Hydrologic Data on the Groundwater Resources Under the El Paso County Water Authority Leases, Draft.* February 1995.

HDR Engineering, Inc. *Water and Wastewater Improvements, El Paso County Water Authority M.U.D.* December 1994

Lichliter/Jameson & Associates. Unpublished Planning Data. El Paso County M.U.D. 1 and M.U.D. 2 Water System Demand. March 10, 1995

Texas Water Development Board. Population and Water Demand Information, High Case, With Conservation. Unpublished Planning Data. April, 1992.

APPENDIX

EPCWA Water Supply Alternative: Desert and Wheeler Blended

		ANNUAL WATER DEMAND AND SUPPLY SCHEDULE (acre-feet)						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Annual Demand		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Well Field Demand	TDS							
Desert - High	650	699	1,003	2,764	4,327	5,831	7,123	9,185
Desert - Marginal	1000	290	290	290	509	509	509	509
Wheeler	1450	466	669	1,843	2,885	3,888	4,749	4,839
Annual Supply		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Annual Blended TDS (mg/l)		976	974	972	972	971	971	929

	REMAINING ECONOMICALLY RECOVERABLE RESERVES (acre-feet) YEAR						
Well Field	*1995*	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert-High	274,200	270,490	252,744	218,379	168,677	104,996	24,546
Desert-Marginal	45,700	44,250	41,350	37,355	32,265	27,175	22,085
TOTAL RESERVE	319,900	314,740	294,094	255,734	200,942	132,171	46,631

		REQUIRED INSTALLED SUPPLY CAPACITY (GPM) YEAR						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Max Day Demand		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Well Field	TDS							
Desert - High	650	823	1,181	3,256	5,495	8,448	10,984	13,519
Desert-Marginal	1000	342	342	342	600	600	600	600
Wheeler	1450	549	788	2,171	3,000	3,000	3,000	3,000
Total Capacity		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Max Day Blended TDS (mg/l)		976	974	972	937	867	829	802

	Pumpage	MINIMUM NUMBER OF SUPPLY WELLS AT RECOMMEDED PUMPAGE						
Well Field	gpm/well	*1995**	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert - High	120	9	10	28	46	71	92	113
Desert-Marginal	120	3	3	3	5	5	5	5
Wheeler	1000	1	1	3	3	3	3	3
Total Wells		13	14	34	54	79	100	121

* Currently, existing wells in the Desert high quality region produce 760 gpm (about 6 planned wells), and existing wells in the Desert marginal quality region produce 340 gpm (about 3 planned wells.)

Well Field	Annual Cost/gpm	New Capital Debt Service Costs of Alternative 1995	2000	2010	2020	2030	2040	2050
Desert - High	$173	$61,971	$358,882	$387,328	$510,944	$438,641	$438,641	
Desert-Marginal	$152		$0	$39,211	$0	$0	$0	
Wheeler Blend	$57		$85,500		$0	$0	$0	
Total Annual Cost		61,971	444,382	426,539	510,944	438,641	438,641	0

	Present Value of Capital Debt Service Costs 1995	2000	2010	2020	2030	2040	2050
Immediate Improvements	1,186,500						
Planning Increment Value	1,843,026	4,707,793	4,518,759	5,412,952	4,646,968	4,646,968	
Present Value of Capital Expenses	$6,583,810						

Well Field	Annual Cost/gpm	O&M Costs of Alternative 1995	2000	2010	2020	2030	2040	2050
Desert - High	$215	93,164	133,702	368,459	576,789	777,324	949,481	1,224,358
Desert-Marginal	$215	38,657	38,657	38,657	67,850	67,850	67,850	67,850
Wheeler Blend	$117	33,799	48,506	133,674	209,254	282,006	344,463	351,021
Total Annual Cost		165,621	220,865	540,790	853,892	1,127,179	1,361,793	1,643,229
Total Period Cost		303,731	1,820,489	2,106,302	2,220,327	2,300,250	2,768,970	
Present Value of O&M Expenses		$2,313,080						

	Financial Summaries 1995	2000	2010	2020	2030	2040	2050
Installed capacity cost ($/gpm/yr)	$133	$315	$245	$197	$172	$154	$122
Produced water charge ($/1000g/yr	$0.48	$1.04	$0.61	$0.54	$0.47	$0.45	$0.35
Total PV	**$8,896,890**						

EPCWA Water Supply Alternative: Desert with Wheeler Blended and RO in 2010

		ANNUAL WATER DEMAND AND SUPPY SCHEDULE (acre-feet)						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Annual Demand		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Well Field Demand	TDS							
Desert - High	650	699	1,003	76	2,900	5,407	7,559	9,712
Desert - Marginal	1000	290	290	290	290	290	290	290
Wheeler Blend	1450	466	669					
Wheeler RO	812			4,531	4,531	4,531	4,531	4,531
Annual Supply		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Annual Blended TDS (mg/l)		976	974	821	758	732	717	707

	REMAINING ECONOMICALLY RECOVERABLE RESERVES (acre-feet) YEAR						
Well Field	*1995*	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert-High	274,200	270,490	266,186	252,398	211,955	148,212	62,945
Desert-Marginal	45,700	44,250	41,350	38,450	35,550	32,650	29,750
TOTAL RESERVE	319,900	314,740	307,536	290,848	247,505	180,862	92,695

		REQUIRED INSTALLED SUPPLY CAPACITY (GPM) YEAR						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Max Day Demand		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Well Field	TDS							
Desert - High	650	823	1,181	2,360	5,686	8,640	11,175	13,711
Desert-Marginal	1000	342	342	599	599	599	599	599
Wheeler - Blend	1450	549	788					
Wheeler RO	812			2,809	2,809	2,809	2,809	2,809
Total Capacity		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Max Day Blended TDS (mg/l)		976	974	765	723	705	696	689

	Pumpage	MINIMUM NUMBER OF SUPPLY WELLS AT RECOMMEDED PUMPAGE						
Well Field	gpm/well	*1995**	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert - High	120	9	10	20	48	72	94	115
Desert-Marginal	120	3	3	5	5	5	5	5
Wheeler	1000	1	1	3	3	3	3	3
Total Wells		13	14	28	56	80	102	123

* Currently, existing wells in the Desert high quality region produce 760 gpm (about 6 planned wells), and existing wells in the Desert marginal quality region produce 340 gpm (about 3 planned wells.)

Well Field	Annual Cost/gpm	New Capital Debt Service Costs of Alternative 1995	2000	2010	2020	2030	2040	2050
Desert - High	$173	$61,971	$203,918	$575,433	$510,944	$438,641	$438,641	
Desert-Marginal	$152	$0	$39,125	$0	$0	$0	$0	
Wheeler RO in 2010	$400		$0	$1,122,813	$0	$0	$0	
Total Annual Cost		61,971	243,043	1,698,247	510,944	438,641	438,641	0

	Present Values of Capital Debt Service Costs 1995	2000	2010	2020	2030	2040	2050
Immediate Improvments	1,186,500						
Planning Increment Value	1,843,026	2,574,799	17,991,250	5,412,952	4,646,968	4,646,968	
Present Value of Capital Expenses	$8,981,505						

Well Field	Annual Cost/gpm	O&M Costs of Alternative 1995	2000	2010	2020	2030	2040	2050
Desert - High	$215	93,164	133,702	10,116	386,525	720,750	1,007,678	1,294,607
Desert-Marginal	$215	38,657	38,657	38,657	38,657	38,657	38,657	38,657
Wheeler Blend	$117	33,799	48,506	0	0	0	0	0
Wheeler RO	$352			988,768	988,768	988,768	988,768	988,768
Total Annual Cost		165,621	220,865	1,037,541	1,413,950	1,748,175	2,035,103	2,322,032
Total Period Cost		303,731	4,304,247	2,919,585	3,085,073	3,182,818	3,469,747	
Present Value of O&M Expenses		$3,982,374						

	Financial Summaries 1995	2000	2010	2020	2030	2040	2050
Installed capacity cost ($/gpm/yr)	$133	$228	$516	$398	$224	$200	$161
Produced water charge ($/1000g)	$0.48	$0.73	$1.71	$0.77	$0.66	$0.61	$0.49
Total PV	**$12,963,879**						

EPCWA Water Supply Alternative: Desert and Wheeler Blended with EPWUPSB

		ANNUAL WATER DEMAND AND SUPPLY SCHEDULE (acre-feet)						
		1995	2000	2010	2020	2030	2040	2050
Annual Demand		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Well Field Demand	TDS							
Desert - High	650	699	583	2,936	3,786	5,291	6,582	8,284
Desert - Marginal	1000	290	290	290	290	290	290	290
Wheeler	1450	466	389	551	2,524	3,527	4,388	4,839
EPWUPSB	950		700	1,120	1,120	1,120	1,120	1,120
Annual Supply		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Annual Blended TDS (mg/l)		976	628	829	968	969	969	946

	REMAINING ECONOMICALLY RECOVERABLE RESERVES (acre-feet) YEAR						
Well Field	1995	2000	2010	2020	2030	2040	2050
Desert-High	274,200	271,540	255,036	222,514	178,218	119,943	46,702
Desert-Marginal	45,700	44,250	41,350	38,450	35,550	32,650	29,750
TOTAL RESERVE	319,900	315,790	296,386	260,964	213,768	152,593	76,452

		REQUIRED INSTALLED SUPPLY CAPACITY (GPM) YEAR						
		1995	2000	2010	2020	2030	2040	2050
Max Day Demand		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Well Field	TDS							
Desert - High	650	823	687	3,458	4,460	7,387	9,922	12,458
Desert-Marginal	1000	342	342	342	342	342	342	342
Wheeler	1450	549	458	649	2,973	3,000	3,000	3,000
EPWUPSB	950	0	825	1,319	1,319	1,319	1,319	1,319
Total Capacity		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Max Day Blended TDS (mg/l)		976	967	829	968	892	850	820

	Pumpage	MINIMUM NUMBER OF SUPPLY WELLS AT RECOMMEDED PUMPAGE						
Well Field	gpm/well	1995*	2000	2010	2020	2030	2040	2050
Desert - High	120	9	6	29	38	62	83	104
Desert-Marginal	120	3	3	3	3	3	3	3
Wheeler	1000	1	1	1	3	3	3	3
Total Wells		13	10	33	44	68	89	110

* Currently, existing wells in the Desert high quality region produce 760 gpm (about 6 planned wells), and existing wells in the Desert marginal quality region produce 340 gpm (about 3 planned wells.)

Well Field	Annual Cost/gpm	New Capital Debt Service Cost						
		1995	2000	2010	2020	2030	2040	2050
Desert - High	$173	($23,624)	$479,468	$173,320	$506,341	$438,641	$438,641	
Desert-Marginal	$152	$0	$0	$0	$0	$0	$0	
Wheeler Blended	$57	$0	$0	$85,500	$0	$0	$0	
EPWUPSB - Trans	$13	$10,720						
EPWUPSB - Fee	$251		$206,975	$124,185	$0	$0	$0	
Total Annual Cost		-12,904	686,443	383,004	506,341	438,641	438,641	0

	Present Value of Capital Debt Service Costs						
	1995	2000	2010	2020	2030	2040	2050
Inmediate Improvements	1,186,500						
Total Period Cost	1,049,793	7,272,184	4,057,553	5,364,187	4,646,968	4,646,968	
Present Value of Capital Expenses	$6,968,674						

Well Field	Annual Cost/gpm	O&M Costs of Alternative						
		1995	2000	2010	2020	2030	2040	2050
Desert - High	$215	93,164	77,716	391,354	504,727	705,262	877,419	1,104,255
Desert-Marginal	$215	38,657	38,657	38,657	38,657	38,657	38,657	38,657
Wheeler Blended	$117	33,799	28,195	39,970	183,110	255,862	318,319	351,021
EPWUPSB	$646	0	280,364	448,582	448,582	448,582	448,582	448,582
Total Annual Cost		165,621	424,932	918,563	1,175,076	1,448,363	1,682,978	1,942,515
Total Period Cost		813,898	2,893,089	2,201,129	2,541,511	2,621,435	2,980,665	
Present Value		$3,463,901						

	Financial Summaries						
	1995	2000	2010	2020	2030	2040	2050
Installed capacity cost ($/gpm/yr)	$89	$475	$345	$227	$199	$176	$139
Produced water charge ($/1000g/yr	$0.32	$1.74	$0.82	$0.67	$0.57	$0.53	$0.41
Total PV	**$10,432,575**						

EPCWA Water Supply Alternative: Conversion to PSB

		ANNUEAL WATER DEMAND AND SUPPLY SCHEDULE (acre-feet)						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Annual Demand		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Well Field Demand	TDS							
Desert - High	650	699	709	709	709	709	709	709
Desert - Marginal	1000	290	290	290	290	290	290	290
Wheeler	1450	466	473	473	473	473	473	473
EPWUPSB	950		490	3,425	6,249	8,756	10,909	13,061
Annual Supply		1,455	1,962	4,897	7,721	10,228	12,380	14,533
Annual Blended TDS (mg/l)		976	732	958	955	954	953	953

	REMAINING ECONOMICALLY RECOVERABLE RESERVES (acre-feet) YEAR						
Well Field	*1995*	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert-High	274,200	271,225	265,225	259,225	253,225	247,225	241,224
Desert-Marginal	45,700	44,250	41,350	38,450	35,550	32,650	29,750
TOTAL RESERVE	319,900	315,475	306,575	297,675	288,775	279,875	270,974

		REQUIRED INSTALLED SUPPLY CAPACITY (GPM) YEAR						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Max Day Demand		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Well Field	TDS							
Desert - High	650	823	835	835	835	835	835	835
Desert-Marginal	1000	342	342	342	342	342	342	342
Wheeler	1450	549	557	557	557	557	557	557
EPWUPSB	950	0	577	4,035	7,361	10,314	12,850	15,385
Total Capacity		1,714	2,311	5,768	9,094	12,048	14,583	17,119
Max Day Blended TDS (mg/l)		976	969	958	955	954	953	953

	Pumpage	MINIMUM NUMBER OF SUPPLY WELLS AT RECOMMEDED PUMPAGE						
Well Field	gpm/well	*1995**	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert - High	120	9	9	9	9	9	9	9
Desert-Marginal	120	3	3	3	3	3	3	3
Wheeler	1000	1	1	1	1	1	1	1
Total Wells		13	13	13	13	13	13	13

* Currently, existing wells in the Desert high quality region produce 760 gpm (about 6 planned wells), and existing wells in the Desert marginal quality region produce 340 gpm (about 3 planned wells.)

Well Field	Cost	New Capital Debt Service on Costs						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert - High	$173	$2,060	$0	$0	$0	$0	$0	
Desert-Marginal	$152	$0	$0	$0	$0	$0	$0	
Wheeler Blended	$57	$0	$0	$0	$0	$0	$0	
EPWUPSB - Trans	$13	$7,503	$44,947	$43,240	$38,394	$32,961	$32,961	
EPWUPSB - Fee	$1,147		173,052	1,036,613	997,261	885,498	760,192	
Total Annual Cost		9,563	217,998	1,079,854	1,035,656	918,459	793,153	0

	Present Value of Capital Debt Service Costs						
	1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Immediate Improvments	1,186,500						
Total Period Cost	1,287,812	2,309,476	11,439,985	10,971,751	9,730,171	8,402,674	
Present Value of Captial Expenses	$7,795,694						

Well Field	Annual Cost/gpm	O&M Costs of Alternative						
		1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Desert - High	$215	93,164	94,512	94,512	94,512	94,512	94,512	94,512
Desert-Marginal	$215	38,657	38,657	38,657	38,657	38,657	38,657	38,657
Wheeler Blended	$117	33,799	34,288	34,288	34,288	34,288	34,288	34,288
EPWUPSB	$646	0	196,255	1,371,860	2,502,837	3,507,066	4,369,186	5,231,307
Total Annual Cost		165,621	363,712	1,539,317	2,670,294	3,674,523	4,536,643	5,398,764
Total Period Cost		660,848	6,241,739	7,194,202	7,691,436	7,985,126	8,847,246	
Present Value of O&M		$7,537,989						

	Financial Summaries						
	1995	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Installed capacity cost ($/gpm/yr)	$102	$256	$492	$526	$467	$428	$362
Produced water charge ($/1000g/yr)	$0.37	$0.91	$1.64	$1.47	$1.38	$1.32	$1.14
Total PV	**$15,333,684**						