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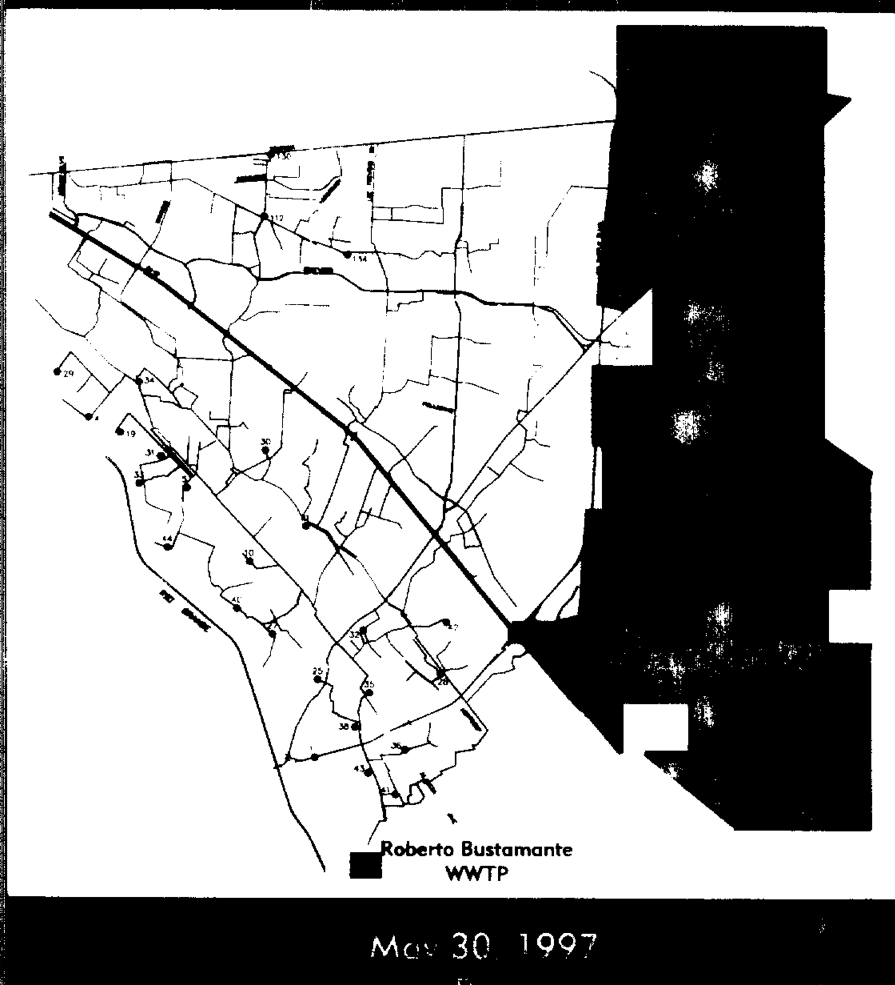
Regional Wastewater Plan For East El Paso Area - May 30, 1997

REGIONAL WASTEWATER PLAN
FOR
THE EAST EL PASO AREA

Prepared for:

EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD



May 30, 1997

By

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REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

EXECUTIVE SUMMARY

The Texas Natural Resources Conservation Commission (TNRCC) requires facility planning activities be initiated when wastewater flows exceed seventy-five percent of a treatment plant's permitted capacity for three consecutive months (Texas Administrative Code, Title 30, Chapter 305.125). In response to the Roberto R. Bustamante Wastewater Treatment Plant (WWTP) exceeding this limit, seven collection and treatment alternatives were developed and evaluated for providing wastewater service to the east El Paso Area through the year 2015. The alternative selected as the recommended plan consists of conveying the entire flow generated in the area to the existing Bustamante WWTP. This would require a phased expansion of the Bustamante plant, improvement of some existing large diameter interceptors in the Mesa Drain Interceptor system, the construction of a new backbone interceptor to convey flows from east of the current El Paso city limits, and the construction of a 2 million gallons per day (mgd) reclamation plant north of Interstate Highway 10 (IH-10) to meet demands for reclaimed water in the area.

EAST EL PASO AREA

Providing wastewater service to the east El Paso area is the focus of this Plan. In order to develop flow projections and distributions as well as the treatment and conveyance alternatives, it was important to delineate the service area. The regional area, shown on Figure 3-1, includes the Bustamante WWTP service area, a portion of the Lower Valley Water District (LVWD), a portion of the El Paso County Water Authority (EPCWA), and an area referred to as the Principal Study Area (PSA) that extends approximately three miles east from the existing El Paso city limits and north from IH-10 to approximately one mile north of Montana Avenue.

Population projections used in this Plan are shown in Table 1. The current population of the Bustamante WWTP service area and the PSA is about 239,712. The population of these areas is expected to reach 537,778 by buildout.

Table ES-1 East El Paso Area Populations and Flows

Region	1996		Buildout	
	Population	Flow, mgd	Population	Flow, mgd
Bustamante WWTP [a]	237,825	28.6	319,873	39.6
LVWD[b]	N/A	0	N/A	9.5
EPCWA[c]	N/A	0.5	N/A	1.5
PSA[a]	1,887	0.2	217,905	23.2
Total	> 239,712	29.3	> 537,778	73.8

[a] Population values provided by City of El Paso Metropolitan Planning Office.
[b] Flow projections for the LVWD were obtained from Economically Depressed Area Program (EDAP) connected capacity data.
[c] EPCWA flow information was obtained from Gray-Jansing Facility Plan.

Wastewater flow projections are calculated by multiplying the per capita flow contribution by the population. The per capita flow contribution is based on combined residential, commercial, and industrial flows entering the Bustamante WWTP divided by the current population. Nine high volume industrial dischargers are accounted for separately in order to localize their effects on the existing collection system. According to this method, the per capita flow contribution is 108 gallons per capita per day (gpcd). Projected flows from the Bustamante WWTP service area and the PSA are calculated by multiplying the per capita flow rate by the projected population. Existing facility plans are referenced for the flow projections from the LVWD and the EPCWA. Since the EPCWA needs to expand its existing plant immediately, it was not incorporated into the regional system until after the year 2012. The total projected flow values are shown on Table ES-1.

EXISTING FACILITIES

Public Service Board (PSB) operated facilities currently serve the majority of sewered areas within the Regional Study Area (RSA). A brief description of other wastewater collection and treatment facilities within the RSA is also included.

PSB Facilities

Existing PSB collection and treatment facilities that serve east El Paso consist of the Bustamante WWTP and its collection and conveyance facilities. These facilities are described below.

Concurrent with this study, detailed modeling and analysis of the Bustamante WWTP collection system was performed. Comprehensive presentation of this modeling effort was published as a separate report.

The existing PSB collection system is comprised of 136 miles of primary collector lines 12 inches and larger and covers an area of approximately 54 square miles. This corresponds to the area extending west from the current El Paso City Limits to Robert E. Lee Road and north from the Rio Grande River to Montana Avenue. In addition, there are twenty-eight lift/pump stations in the Bustamante WWTP service area.

The Bustamante WWTP is the only PSB operated treatment facility included in the RSA. It began operations in January 1991 as a conventional activated sludge plant and is designed for a 39-mgd peak month flow.

EPCWA

The EPCWA operates the only other wastewater treatment facility in the RSA. This system currently operates as an aerated lagoon with the effluent filtered and chlorinated prior to being used for irrigation. Current permitting allows for both reuse and surface discharge.

The plant has capacity of 0.5-mgd and operating conditions have indicated the need for expansion. A planning study recommends the implementation of a new plant installed in increments of 0.5-mgd to replace the lagoon system over the next 15 years. After decommissioning, the existing lagoon system may be converted to reuse storage for the additional reuse water generated by treating the projected flow of 1.5-mgd by 2015.

LVWD

The LVWD is constructing a sewer system infrastructure to provide wastewater disposal to colonia areas under the EDAP. Under an agreement with the EPWU, the LVWD will discharge to the Bustamante WWTP. Projected flows from the LVWD were used to determine the amount of treatment capacity needed at the Bustamante WWTP.

ALTERNATIVES

The objective of this effort is to develop regional wastewater management alternatives in sufficient detail to provide a reliable basis for selection of a recommended program. Several assumptions, as outlined below, were made to provide the basis for a fair relative comparison of each alternative.

Phasing

The development of long range wastewater management alternatives is based on a phased implementation program as follows:

Initial Improvements. Initial improvements include those facilities which, based on projected growth rates and patterns, need to be constructed and on-line by 2005. Although the need for new facilities is largely driven by existing and projected future growth, the planning process must provide sufficient time to allow for detailed planning, design and construction of new facilities. The proposed nine year initial improvement period (1997 to 2005) allows sufficient time for planning and construction of new major facilities.

Phase I Improvements. Phase I improvements include those improvements for which planning, design and construction must be completed between the years 2005 and 2010. Common to each alternative is the need to construct a new interceptor to serve the PSA. To reduce initial capital investment, a phased plan has been developed for construction of this new interceptor. This phasing of construction of the new interceptor is feasible because of the short term availability of residual capacity within existing sewer lines. However, based on projected growth within existing and future service areas, this residual capacity is only sufficient to meet projected needs through the year 2007. The new interceptor serving the PSA must, therefore, be completed by this time.

Phase II Improvements. Phase II includes those improvements which would be completed between the years 2011 and 2015. Additional treatment capacity is anticipated to be needed during this period. Additional sewer line capacity will be required for certain alternatives.

Ultimate Improvements. Ultimate improvements identify additional treatment facilities required to be constructed and on-line beyond the year 2015. Sizing of these facilities is based on ultimate or build-out population and flow projections within the study area. Although there is significant opportunity for growth within the study area beyond the year 2015, it is not possible to accurately predict the rate at which continued growth will occur. Identifying the size and location of long range future treatment facilities helps to insure that proper consideration is given to those long term needs in the planning and design of nearer term improvements.

Line Sizing

New gravity and force main sewer lines will be constructed in phases as described above. Sewer lines will be sized to convey ultimate projected peak flows. Sewer lines are constructed to provide long term service of 40 years or more. By sizing sewer lines to convey projected long term flows, significant future costs and disruption due to construction of parallel or replacement lines within paved right-of-ways and developed areas are avoided.

Description Of Alternatives

Conceptually, seven alternatives were considered as long range wastewater management programs for the east El Paso area:

- Alternative 1. All wastewater generated within the RSA would be conveyed to the Bustamante WWTP for treatment. The capacity of the Bustamante plant would be initially expanded by 21-mgd.
- Alternative 1a. All wastewater produced within the RSA would be conveyed to the Bustamante WWTP for treatment. The capacity of the Bustamante plant would be expanded in smaller increments than in Alternative 1: 11-mgd by 2002 and 10-mgd by 2012.
- Alternative 2a. A new wastewater treatment/reclamation plant would be constructed. This facility would be located north of IH-10 and would treat all of the flow from the PSA. The Bustamante WWTP would not be initially expanded.

- Alternative 2b. Similar to Alternative 2a, a new wastewater treatment/reclamation plant would be constructed north of IH-10. This facility would treat a portion of the flow from the PSA. The remainder of the flow would be treated at the Bustamante WWTP. The new reclamation plant would not be expanded beyond its initial construction.

- Alternative 2c. In addition to improvements recommended under Alternative 1a, this alternative utilizes the construction of a small 2-mgd reclamation plant to meet the projected water demand of a proposed golf course north of IH-10.

- Alternative 3a. This alternative is similar to Alternative 2a in that all of the flow generated within the PSA would be initially treated at a new plant north of IH-10. In addition, a second plant would be constructed after 2015 within the North/Central quadrant of the new service area for more effective distribution of reclaimed water.

- Alternative 3b. Similar to Alternative 3a, a new wastewater treatment and reclamation plant would be initially constructed just north of IH-10 to treat a portion the flow from the PSA and a second plant would be constructed after 2015 within the North/Central quadrant. The remainder of the flow would be treated at the Bustamante WWTP.

EVALUATION OF ALTERNATIVES

The alternatives were evaluated on the basis of both economic and non-economic considerations. Non-cost issues considered as part of this evaluation are as follows:

- Reuse Potential
- Flexibility
- Reliability
- Public Acceptance
- Environmental Impact
- Implementation
- Constructability

A discussion of each of these considerations is presented below.

Reuse Potential

Reuse of treated wastewater is an important part of the PSB's long term program to conserve El Paso's limited water resources. Long range water resource management planning includes wastewater reuse as a critical element in assuring sufficient resources to meet anticipated future needs. Enhancement of wastewater reuse opportunities is, therefore, a highly desirable feature for any long range wastewater management program. Since a smaller reclamation plant proposed for Alternative 2c would be sized based on the demand for reclaimed water thus eliminating the need for a costly discharge line, this alternative was rated the best for reuse potential.

Flexibility

This criteria is a measure of the flexibility of each alternative to adapt to future changes in population growth and distribution, deferment of capital expenditures, and changing regulatory and environmental controls. A small reclamation plant located in the PSA sized to meet demand for reclaimed water and the flexibility to adopt any alternative in the future resulted in Alternative 2c receiving the highest flexibility rating.

Reliability

Reliability refers to the ability of the selected program to consistently meet or exceed all service requirements. Alternatives 1, 1a, and 2c provide greater overall reliability as compared to Alternatives 2a, 2b, 3a, and 3b since regional treatment is centralized at the Bustamante WWTP. The new reclamation plant proposed for Alternative 2c does not affect the overall system reliability since it is intended to operate as a seasonal plant.

Public Acceptance

Public acceptance primarily relates to acceptance by local residents to building and operating wastewater conveyance and treatment facilities. Although both Alternative 1 and 1a involve the publicly preferential expansion of an existing WWTP, Alternative 1a has the added advantage of deferring capital costs with the phased expansion of Bustamante WWTP. It was rated the highest for public acceptance.

Environmental Impact

An assessment of environmental impact is based upon consideration of short and long term impacts upon threatened or endangered species habitats, sensitive archaeological, historical, floodplain, wetland, or groundwater areas. Consequently, Alternatives 2a, 2b, 3a, and 3b are rated as having a less positive environmental impact.

Implementation

Implementation deals with the relative ease or difficulty of acquiring right-of-ways, properties, and public agency and regulatory approvals needed to build and operate new facilities. Alternative 1 and 1a are rated easier to implement than the other alternatives since they involve only the expansion of an existing plant.

Constructability

This criteria is a measure of the relative ease or difficulty of constructing each alternative. The lack of major interceptors south of IH-10 under Alternatives 2a and 3a are considered advantages over the other alternatives with respect to constructability.

Costs

Each alternative was evaluated for both capital and annual operating costs. For comparison purposes, the present value of each of the alternatives was calculated and is summarized in Table ES-2.

Table ES-2 Summary of Total Present Worth of Alternatives

Alternative	Total Present Worth
Alternative 1	$78,635,000
Alternative 1a	$72,308,000
Alternative 2a	$85,069,000
Alternative 2b	$85,069,000
Alternative 2c	$81,465,000
Alternative 3a	$85,069,000
Alternative 3b	$85,069,000

Comparison Of Alternatives

Based on both cost and non-cost criteria as discussed above, Alternative 2c provides several advantages including:

1. Minimizes the number of large treatment plants.
2. Smaller Initial Phase expansion of Bustamante WWTP allows for more efficient utilization of plant capacity.
3. Enhanced reuse potential by providing a second source of reuse water supply north of IH-10 that corresponds with the demand for reuse water.
4. Lowest overall cost for a reuse alternative.
5. Construction of new parallel interceptors from IH-10 to the Bustamante WWTP helps relieve overloaded areas of existing collection system.
6. Initial Phase capital costs are deferred.
7. Optimizes operation and maintenance costs.

For reasons as outlined above, Alternative 2c was selected as the recommended wastewater management program for the east El Paso area. In addition to the collection system improvements described for Alternative 2c, the Roberto Bustamante Service Area Modeling Report recommended collection system improvements to handle projected wastewater flows within the Bustamante WWTP Service Area.

The following paragraphs summarize the treatment facility and collection system improvements required by the recommended plan.

TREATMENT PLANT IMPROVEMENTS

Treatment plant improvements, including design criteria and proposed layouts, are outlined below.

Roberto R. Bustamante WWTP

The major component of treatment facility improvement is the phased expansion of the existing Roberto R. Bustamante WWTP. Expansion of the Bustamante WWTP will be achieved in three increments, two of which are within the 20-year planning period. An initial expansion of 11-mgd will need to be under construction by 2001 and, depending on the rate of growth in the region, a 10-mgd expansion is projected to be under construction by 2010. The final increment of expansion will ultimately be required when buildout occurs.

Figure 9-1 presents the proposed layout for the Initial and Phase I expansions to the Bustamante WWTP. The Initial Phase expansion of the Bustamante WWTP will increase the rated capacity of the plant from 39-mgd to 50-mgd. All improvements are the same size as existing units except where noted. The 10-mgd expansion projected for 2010 will consist of a second module of equal size, except where noted.

Preliminary Treatment. The existing preliminary treatment system consists of three mechanical bar screens, eight raw sewage pumps of various sizes, three grit basins, and three preaeration basins. One additional bar screen, grit basin, and preaeration basin sized to match the existing facilities will be added in the Initial Phase. Additionally, raw sewage pumping facilities will need to be increased. Careful study of the means and methods to achieve the increased capacity will be required. For the purposes of this plan, it has been assumed that two of the existing 3.3-mgd pumps will be replaced by two 13.2-mgd units. Further improvements in Phase II will be sized to match existing facilities for ease of operations. Hydraulic evaluations will dictate the final design requirements for these facilities.

Primary Treatment. Initial Phase improvements will increase the number of primary clarifiers from four to five and the number of primary sludge pumps from six to eight. Careful evaluation of the existing odor control system will be required to determine whether foul air from the new clarifier can be delivered to the existing units.

Secondary Treatment. Expansion of the secondary treatment system requires additional tank capacity for the activated sludge process and secondary clarification and additional blower capacity to maintain the activated sludge process under projected loading conditions. Currently there are four aeration tanks, three operating blowers, and four secondary clarifiers. One new aeration tank, secondary clarifier, and blower of the same size as the existing units will be provided under the Initial Phase expansion. It should be noted that the system has been sized for mixed liquor levels of 3,200 milligrams per liter (mg/l). Also, sizing did not assume the use of an anoxic selector.

Disinfection. A third chlorine contact tank will be necessary in order to maintain the required peak flow detention time.

Solids Handling. Because of the additional volume provided by a new digester to be constructed in the initial phase, detention times will be more than adequate well beyond 2010.

Discharge Facilities. The effluent from the expanded Bustamante WWTP will be discharged to the Riverside Drain. No additional facilities are needed.

New Eastside Reclamation Plant

A 2-mgd liquid-stream only, reclamation plant is recommended in the PSA to meet the demand for reuse water projected for a proposed golf course north of IH-10. It is proposed to operate as a seasonal plant to eliminate the need for storage or for a discharge line required for unused effluent. Effluent criteria for the new plant was based on Type II reclaimed water standards. Golf courses irrigated when the public does not have access to the course are eligible for Type II reuse water (30 TAC 310.33). These regulations were published by TNRCC in draft form in 1996.

Since the new reclamation plant will be sized to meet only the seasonal water requirements of a proposed golf course, its implementation is governed by demand. The size of the plant can be increased if the demand for reuse water in the area increases. For costing purposes, it was assumed that the plant would be online by 2002.

Figure 9-2 presents the proposed layout of the new reclamation plant. Solids handling facilities are not required at this plant since it was assumed that they would be disposed of into the Bustamante WWTP collection system, thus centralizing solids handling at the Bustamante WWTP. Site dimensions were calculated not to preclude future expansion. The site shown is meant only as a reference point, siting studies are recommended. Further development of a plant site is required and should coincide with an interceptor alignment study.

The proposed layout of the reclamation plant shown on Figure 9-2 was determined based on design criteria presented in Table 9-2. Influent quality was assumed to be the same as that for the Bustamante WWTP.

COLLECTION SYSTEM IMPROVEMENTS

This study evaluated the existing Bustamante WWTP collection system capacity as well as the additional interceptors required to serve the PSA. Alternative 2c outlines only the improvements required to convey the wastewater flows generated in the PSA to the Bustamante plant. The existing collection system was modeled and evaluated separately. The results of that study can be found in the "Roberto R. Bustamante WWTP Service Area Modeling Report." The recommended plan incorporates the results into a single improvement plan.

Existing Collection System

The existing Bustamante collection system was modeled using population projections for the years of 1996, 2005, 2015, and for buildout. Several areas of the collection system were identified as requiring improvements in the 20-year study period. The criteria for improvement was the projected peak flow exceeding the pipe capacity by 10 percent.

Areas of major concern were identified along both the 48-inch Lower Valley, or Socorro, Interceptor (LVI) and the 48-inch Mesa Drain Interceptor (MDI) as needing improvement by 2007. An additional area of concern is the segment of line that conveys the Chevron Refinery discharge since it is on the outreaches of the collection system.

In the long-term, areas of the MDI and LVI will need to be replaced or paralleled in order to convey the projected flows. A short-term solution to some of the MDI overloading problems is to take advantage of two diversion points upstream: the Alfalfa lift station and at Mauer. Additionally, this will help provide residual capacity in the system for conveying the short-term PSA flows.

The long-term improvements to the MDI involve paralleling the existing 48-inch line by 2007. In the areas east of Loop 375, where the PSA collection system will join the MDI, this new line is sized at 60 inches. It is large enough to handle the projected flows from both the PSA and the Bustamante service area.

A detailed evaluation of the model and the results are contained in the modeling report. It is recommended that a thorough flow monitoring study be implemented to verify the information used in the model prior to designing and constructing new facilities.

PSA Collection System

The PSA collection system implementation was selected for its flexibility. The alignment shown on Figure 7-6 is based on the City of El Paso's 2010 Thoroughfare Plan and topographical information of the area. A detailed alignment and easement study is recommended in order to ensure that the proposed system is coordinated with growth patterns and infrastructure planning.

Initial improvements enable service to developments in any part of the PSA along Loop 375 by utilizing residual capacity in the existing collection system. These improvements include two lift stations that can be re-used as part of the future interceptor system. Additionally, there are approximately four miles of collector line proposed for initial improvements, including approximately 1 mile of 30-inch line to be used in the future as part of the backbone system. The 18-inch diversion line from RV Road is dependent on the construction of the new reclamation plant. Similarly, if the flow at RV Road is insufficient for the 2-mgd plant, the diversion line would have to extend to the Saul Kleinfeld line just east of Zaragosa and may require a lift station.

Phase I improvements require the new backbone interceptor to be constructed by 2007. The interceptor would extend south from Montana Avenue through the PSA then along the existing RV Road easement to the Bustamante plant. The diameter of the interceptor varies from 18- to 60-inches. The total length of the interceptor is approximately eleven miles. It is recommended that the information in this study be updated and re-evaluated prior to beginning construction on this interceptor.

LIFT STATIONS

An evaluation of the lift stations in the Bustamante WWTP service area was performed. Table ES-3 summarizes the lift stations requiring further study. These stations were identified by modeling of the collection system. The criteria for improvement was the projected peak flow exceeding ninety percent of the firm capacity.

Table ES-3 Lift Station Improvements				
Lift Station Number	Lift Station Name	Year Required	Current Firm Capacity/mgd	Required Firm Capacity, mgd
22	Jail Annex	Buildout	2.04	2.16
28	Navarrette	2015	0.36	0.36
30	Nina	2015	0.22	0.23
35	Ysleta	2015	28.80	30.09
40	Prado	2015	1.30	2.82
41	Socorro	2015	0.72	0.78
44	Mansfield	2015	0.72	0.72
112	Album	2015	3.46	3.34
134	Pico Norte	2015	10.51	10.64

The improvement costs for the identified lift stations was not included in Cost Table 9-6, since the nature of the required modifications was unclear. In order to develop accurate cost information, it is recommended that further study of each station be conducted.

FACILITIES PLANNING

Because of the dynamic nature of the growth in the area, it is recommended that this plan be periodically updated at an interval not greater than five years. The proposed airport expansion is an example of a project that can dramatically impact the plan's recommendations. Planning information for the airport work was not well developed for incorporation into this study. However, significant development could cause modifications to the plan which were not originally envisioned.

The following text describes the timing necessary for pre-construction activities such as facility planning and design.

Treatment Facilities

Planning and design activities for wastewater treatment facilities are assumed to require at least eighteen months each. Additional time will be required for a new reclamation plant due to plant siting and land acquisition.

Currently, existing wastewater treatment facilities in Texas must adhere the TNRCC 75/90 rule (30 TAC 305.126) which states that a utility must initiate planning activities when the average daily flow exceeds 75 percent of the permitted flow for three consecutive months and initiate construction activities by the time the flow exceeds 90 percent of the permitted flow.

Collection System

This section discusses the planning and design activities recommended prior to the implementation of collection system improvements.

Existing System. The existing Bustamante WWTP collection system improvements recommended by this plan are based on an extensive modeling effort. It is estimated that six months is required for model verification and approximately nine to twelve months for pipeline design.

New Backbone Interceptor. A new backbone interceptor will be required to convey flows generated in the PSA to the Bustamante WWTP. The PSA is currently an undeveloped area lacking infrastructure. Although the interceptor was aligned using the City of El Paso 2010 Thoroughfare Plan, a detailed alignment and easement study is recommended in order to ensure that the proposed system is coordinated with growth patterns and infrastructure planning.

IMPLEMENTATION PROGRAM

Implementation of recommended improvements is scheduled over a 20-year timeline. This section outlines the implementation program for these improvements. A summary of the implementation program is shown below.

Table ES-4 Schedule of Improvement Programs.

1998-1999:	• Flow monitoring study of existing Bustamante WWTP service area collection system. • Bustamante WWTP Initial Phase facilities planning. • Design of Initial Phase collection system facilities within PSA (governed by demand). • Siting study and facilities planning for the new Eastside WWTP and diversion line from RV Road.
1999-2001	• Design of New Eastside WWTP (governed by demand). • Design of Initial Phase Bustamante WWTP expansion.

Table ES-4 (Continued) Schedule of Improvements Programs.	
2001-2002	• Construction of New Eastside WWTP (governed by demand). • Construction of Initial Phase Bustamante WWTP expansion.
2002-2003:	• Initial Phase Expansion of the Bustamante WWTP online. • Design improvements to the Lower Valley Interceptor between the Ysleta lift station and the Mesa Drain Interceptor junction box. • Update and review planning information. • New Eastside WWTP online (governed by demand). • Reclamation plant diversion line online (governed by demand).
2003-2004:	• PSA interceptor route study and design. • Design of Mesa Drain Interceptor improvements from Zaragosa to the Bustamante WWTP completed.
2005-2006	• Construction of PSA interceptor. • Construction of Mesa Drain Interceptor improvements from Zaragosa to the Bustamante WWTP completed.
2007:	• PSA interceptor online. • Mesa Drain Interceptor improvements from Zaragosa to the Bustamante WWTP completed.
2007-2008:	• Facilities planning for Phase I Bustamante WWTP expansion.
2008-2009	• Design of Phase I Bustamante WWTP expansion.
2010-2012:	• Phase I expansion of Bustamante WWTP online. • Connect to EPCWA WWTP.

The improvements listed above are estimated to cost a total present worth value of $89 million.

CHAPTER 1

INTRODUCTION

This Chapter provides a brief background on the basis for undertaking this study, a description of the scope of work, and an explanation of how this report has been organized.

BACKGROUND

The City of El Paso (City) is located at the westernmost tip of Texas and borders New Mexico and Mexico, with the Rio Grande serving as the international border. In May 1952, the City created the El Paso Water Utilities Public Service Board (PSB) to provide water and wastewater service to this arid southwestern community. The City, as well as adjoining areas within the County of El Paso (County), is growing rapidly. With growth comes the need for planning and construction of expanded water and wastewater facilities.

In many areas of El Paso County which are outside of the City, the availability of adequate water and wastewater services is limited. Although there are a number of small utility and improvement districts, "Colonias" exist in many areas which have no water or wastewater services. Continued growth places severe pressures on these areas to provide reliable and cost effective service. In many instances, the financial and physical resources are not available to meet these needs. Recognizing that these problems exist, the Legislature recently enacted Senate Bill 450 designating the City through its PSB as the regional water and wastewater planner for the County of El Paso. As the regional water and wastewater planner, PSB has been given the charge and authority to conduct regional planning in order to identify the most feasible solutions to existing and future problems.

One area of the County where current pressures for continued rapid growth are especially strong, is the eastside area adjoining the existing City limits boundary. The PSB has been working cooperatively conducting in-depth negotiations with recently formed El Paso Municipal Utility Districts (MUDs) No. 1 and 2, the State of Texas General Land Office (GLO), EPCWA and the LVWD on how to provide reliable and cost effective water supply to this area. In conjunction with the need to provide reliable water service to this area is the need to provide wastewater service. A wastewater service program that includes reuse will be an important element of the water service program for this arid, water short area.

The purpose of this study is to conduct a regional planning study to provide wastewater service for the east El Paso area. This study is jointly funded by PSB and the Texas Water Development Board (TWDB). PSB has conformed with TWDB guidelines in development of this plan.

SCOPE OF WORK

Based on specific requirements for the preparation of an State Revolving Fund/Water Quality Enhancement Loan (SRF/WQEL) Engineering Feasibility Report and input from PSB and participating agencies, a detailed scope of work for this study has been developed. The SRF/WQEL Engineering Feasibility Report must be a new plan which addresses all of the wastewater questions within the east El Paso area over the next 20 years. Specifically, this report addresses the following:

1. Definition of the study area for the planning period (1996 to 2015). Includes identification of all key political jurisdictions within the study area.

2. Estimation of existing and future service populations within the study area over the planning period. For purposes of sizing collection and conveyance facilities, build-out service populations are also estimated.

3. Based on existing wastewater production data, base water consumption data and estimated service populations, existing and future wastewater flows are calculated.

4. Definition of wastewater characteristics and composition based on actual influent wastewater quality data for existing facilities.

5. Definition of effluent wastewater quality requirements.

6. Characterization of existing collection systems and treatment facilities.

7. Development of alternative wastewater management programs to serve the study area over the planning period.

8. Evaluation of alternatives on the basis of cost and non-cost considerations.

9. Agency and Public Participation in the development and evaluation of alternatives.

10. Selection and further development of a long range wastewater management program to serve the study area.

11. A preliminary biotic and archaeologic assessment of the study area to identify unique resources and threatened or endangered species that might exist within the area.

REPORT ORGANIZATION

This report has been organized in general conformance with the TWDB's Guidance Outline for an SRF/WQEL Engineering Plan. Report contents are as follows:

- An Executive Summary presents key points from each chapter and includes specific conclusions and recommendations.
- Chapter 1 provides pertinent background information on the project and defines the scope of work.
- Chapter 2 presents project identification data as specifically required for an SRF/WQEL Engineering Feasibility Report.
- Chapter 3 describes planning area conditions, including the study area boundary, political jurisdictions within the study area and existing and projected future service populations.
- Chapter 4 presents existing and projected future wastewater flows.
- Chapter 5 presents wastewater characteristics and composition as it relates to treatment requirements and receiving water quality.
- Chapter 6 describes existing treatment and collection facilities and assesses their adequacy to accommodate existing and projected future demands.
- Chapter 7 develops seven long range wastewater management alternatives.
- Chapter 8 provides an evaluation of each alternative based on both cost and non-cost considerations. Based on this evaluation, the recommended program is identified.
- Chapter 9 describes major treatment and conveyance elements of the recommended program. The implementation schedule and cash flow for the recommended project are also presented.
- Chapter 10 presents findings of a preliminary biotic and archaeological assessment of the study area.
- Chapter 11 summarizes results of public and agency participation.

REFERENCES

Texas Water Development Board. Guidelines for the Preparation of SRF/WQEL Engineering Feasibility Report. ED-2. January 26, 1996.

CHAPTER 2

PROJECT IDENTIFICATION

Specific information to identify the project is presented in this chapter.

OWNER

Legal Name

Through State Legislation, the PSB has been designated as the wastewater planning agency for El Paso County and as such is the lead agency in conducting this study.

Authority

PSB was created by the City on May 22, 1952 under Ordinance No. 752 as amended, pursuant to Article 1115, Revised Statutes.

Regional water and wastewater planning authority was granted to PSB by the State of Texas under S.B. 450 approved on May 11, 1995.

Representative

Mr. Edmund G. Archuleta, P.E.
General Manager
El Paso Water Utilities
Public Service Board
1154 Hawkins Boulevard
El Paso, Texas 79925
Telephone Number: (915) 594-5501
Fax Number: (915) 594-5699

ENGINEER

PSB has contracted with the firm of Brown and Caldwell to perform this work.

Representative

Mr. Stuart Oppenheim, P.E.
Managing Engineer
Brown and Caldwell
5959 Gateway West, Suite 470
El Paso, Texas 79925
Telephone Number: (915) 778-2024
Fax Number: (915) 778-2476

PARTICIPANTS

PSB has enlisted the following participating partners in this project:

- LVWD
- EPCWA
- MUDs Nos. 1 and 2
- Homestead Municipal Utility District
- GLO
- TWDB

In addition, the planning effort has been coordinated with several other agencies including:

- City County Health Department
- El Paso County
- Rio Grande Council of Governments
- TNRCC
- Environmental Protection Agency (EPA) - El Paso Office

PROJECT NEED

A comprehensive regional plan to provide cost-effective and reliable wastewater service is essential for the east El Paso area. Significant pressure is being applied by various parties for rapid development of this area. These parties include the GLO which has expressed an interest in developing six square miles within the proposed study area. In addition, an application by a private developer has been recently approved by the state to form two new MUDs covering about one square mile within the study area. The study area also includes sites for the State prison facility which is ready for occupancy and for the proposed El Paso County Jail Annex. Portions of the service areas for both LVWD and the EPCWA are also included within the proposed study area.

The principal goals in preparing a regional wastewater facilities plan for the proposed study area are as described below.

Cost Effectiveness/Reliability

Developing a regional plan for providing wastewater services to the study area will help to ensure the cost effectiveness and reliability of the program.

Comprehensive Services

Scattered Colonias are known to exist within the proposed study area. A regional planning effort will ensure that the needs of these developments are addressed.

Wastewater Reuse/Conservation

El Paso is an arid, water short area. Aggressive water conservation and wastewater reuse programs are important elements of PSB's program to efficiently manage this limited resource. Wastewater reuse will be emphasized in the regional planning of wastewater services for the proposed study area.

Continuity

As noted above, several different parties have wastewater service needs within or adjoining the proposed study area. Individual plans to provide for those needs may not be contiguous or may be overlapping. A regional approach to planning will ensure continuity in the planning of wastewater services to these areas.

PRINCIPAL DRINKING WATER AQUIFER

The City's water supply comes from three sources: the Rio Grande, the Hueco Bolson aquifer, and the Mesilla Bolson aquifer. The project study area includes portions of the Rio Grande and the Hueco Bolson. The extent of the Hueco Bolson is shown on Figure 2-1. The amount of groundwater in the Hueco Bolson is significant as a water supply.

The average annual recharge to the Hueco Bolson is estimated to be 6,000 acre-feet per year. (Ashworth, 1990). The annual withdrawal by pumpage currently exceeds recharge, resulting in long-term, cumulative water-level declines up to 150 feet in the vicinity of municipal well fields. The quantity of groundwater to meet future demands is limited. In implementing their long range water resources management plan, PSB has and will continue to increase use of treated surface water and reclaimed wastewater in an effort to meet increased future demands.

COMPLIANCE WITH 208 PLAN

The Texas Department of Water Resources' (TDWR) and West Texas Council of Governments' Water Quality Management Plan was completed in July 1978, in compliance with Section 208 of the Clean Water Act of 1977. Within Texas, eight areas have been designated by the Governor as being complex water quality problem areas: Killeen-Temple, Southeast Texas, Corpus Christi, Dallas-Fort Worth, Houston, Lower Rio Grande Valley, San Antonio, and Texarkana. In order to prepare a water quality management plan for the remainder of the state, the state has been divided into 15 planning areas. The boundaries of these 15 areas essentially follow the hydrologic boundaries of the major river basins. The study area boundary for this Engineering Plan is contained within planning area 2307. Segment 2307 begins at the Riverside Diversion Dam in El Paso County and continues 222 miles downstream to the confluence of the Rio Conchos in Presidio County.

The Texas Water Commission (TWC), currently the TNRCC, analyzed water quality for Segment 2307 of the Rio Grande and designated this portion of the Rio Grande as high quality aquatic habitat. Waste load allocations upon which the 208 water quality management program for this area was based, were originally presented in the Waste Load Evaluation for Water Quality Segment Number 2307 prepared in 1974. No update of this original waste load evaluation has been prepared for Segment 2307. Treatment levels and effluent limitations recommended for Segment 2307 are conformed with in this study.

The Bustamante WWTP provides wastewater treatment for the current population within the City limits of East El Paso. Design of the Bustamante WWTP was completed in 1988. Construction of this facility was completed in 1991.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

The Bustamante WWTP currently operates under NPDES Permit Number TX0101605. The permit became effective on September 1, 1995 and shall expire at midnight on August 31, 2000. Effluent Limitations defined in the permit are as specified on Table 2-1. Additional effluent limitations defined in the permit are as follows:

Table 2-1 Bustamante WWTP - NPDES Effluent Limitations

Effluent Characteristics	Discharge Limitation	
	30-day Average	7-day Average
Carbonaceous Biochemical Oxygen Demand (5 day)	20 mg/l	30 mg/l
Total Suspended Solids (TSS)	20 mg/l	30 mg/l
Ammonia Nitrogen (seasonal April 1 - October 31)	5 mg/l	10 mg/l
Dissolved Oxygen	4 mg/l	N/A

Note: NPDES Permit Number TX0101605.

1. "The effluent shall contain a total residual chlorine of at least 1.0 mg/l and shall not exceed a chlorine residual of 4.0 mg/l, after a detention time of at least 20 minutes (based on peak flow) and prior to final disposal."

2. "The pH shall not be less than 6.0 standard units or greater than 9.0 standard units."

As demonstrated in Chapter 5 of this report, the Bustamante WWTP operates in full compliance with NPDES permit requirements.

STATE PERMIT

The Bustamante WWTP currently operates under TNRCC Permit Number 10408-010. The permit was approved and effective on April 20, 1994 and expires at midnight five years from this date. Effluent Limitations defined in the permit are as specified on Table 2-2. Additional effluent limitations defined in the permit are as follows:

1. "The effluent shall contain a chlorine residual of at least 1.0 mg/l and shall not exceed a chlorine residual of 4.0 mg/l after a detention time of at least 20 minutes (based on peak flow)."

2. "The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units."

3. "The effluent shall contain a minimum dissolved oxygen of 4 mg/l."

Table 2-2 Bustamante WWTP - TNRCC Permit Limitations

Effluent Characteristics	Discharge Limitation		
	Daily Average[a]	7-day Average[b]	Daily Maximum[c]
Carbonaceous Biochemical Oxygen Demand (5 day)	20 mg/l	30 mg/l	45 mg/l
TSS	20 mg/l	30 mg/l	45 mg/l
Ammonia Nitrogen (April - October)	5 mg/l	10 mg/l	20 mg/l

[a] Defined as the arithmetic average of all effluent. samples within a period of one calendar month.
[b] Defined as the arithmetic average of all effluent samples within a period of one calendar week.
[c] Defined as the maximum concentration measured on a single day.

Note: TNRCC Permit Number 10408-010.

The Bustamante WWTP operates in full compliance with TNRCC permit requirements.

SLUDGE DISPOSAL

The PSB is authorized to dispose of sludge from the Haskell R. Street Plant (Permit No. 10408-04), Fred Hervey Plant (Permit No. 10408-07), Northwest Plant (Permit No. 10408-09), Socorro Plant (Decommissioned Permit No. 10408-08), Bustamante Plant (Permit No. 10408-10) and

Jonathan Rogers Water Treatment Plant (Water System Identification Number 0710002) at a sludge-only landfill located at the northwest corner of the intersection of McCombs Road and Farm-to-Market Road 2529 in El Paso County.

The sludge-only landfill shall be operated in accordance with the following requirements:

a) Sludge shall be stabilized prior to disposal.

b) Sludge shall be dewatered to a minimum solids content of 20 percent prior to disposal.

c) A minimum daily cover of six inches shall be applied over active landfill areas.

d) Stormwater run-off shall be prevented from entering active areas of the landfill.

e) Stormwater run-off from a 25-year storm or less shall be prevented from entering the entire landfill area.

f) Upon completion of landfill activities, a minimum soil cover of three feet shall be applied to all landfill areas and the site shall be mounded to provide a slope between 2 and 5 percent.

REFERENCES

Ashworth, J.B., 1990, Evaluation of Groundwater Resources in El Paso County, Texas, Texas Water Development Board, Report 324, 25p.

Land, L.F., and Armstrong, L.A., 1985, A Preliminary Assessment of Land-Surface Subsidence in the El Paso Area, Texas; U.S. Geological Survey Water-Resources Investigations Report 85-4155, 96 p.

CHAPTER 3

PLANNING AREA CONDITIONS

This chapter provides a summary of planning area conditions which, along with Chapters 4 and 5, provides the basis for the development and evaluation of wastewater conveyance and treatment alternatives required to service the east El Paso area. Information presented in this chapter includes; the definition of the planning area boundary and the basis for selection, political jurisdictions, existing and future service subareas, and existing and future service populations.

STUDY AREA BOUNDARIES

As discussed in Chapters 1 and 2, this study develops a long range regional plan for providing wastewater service to the east El Paso area to meet future demands. The limits of the area considered in this study, which is referred to as the Regional Study Area (RSA), include; the Bustamante WWTP existing service area inside the City from approximately Airway Boulevard East to Loop 375, a portion of the LVWD, Horizon City, and a three mile zone east of El Paso's present city limits. Water and wastewater service to Horizon City is provided by the EPCWA. The RSA is shown on Figure 3-1.

Wastewater planning activities have been conducted by both the LVWD, under the EDAP, and the EPCWA. This study attempts to address the needs and goals identified by these agencies as part of a comprehensive regional plan. It is not the intent of this study to rework the planning activities of these two jurisdictions. Population data and wastewater flow projections developed in studies prepared by these agencies were used as the basis for determining their potential regional wastewater services needs. In the LVWD's case, only the wastewater projected under the EDAP program to be treated at the Bustamante WWTP was considered in this plan.

The Bustamante WWTP provides wastewater treatment for the current population within the city limits of east El Paso. Population information provided by the City was used to project future wastewater flows. Proposed improvements to existing collection and treatment facilities were developed and evaluated based on this information.

A primary focus of this study is to develop a viable long range plan for extending wastewater service to an area that extends approximately three miles east of the present City limits. This area is referred to in this study as the PSA. The focus on this area is due to several reasons, including; its location within a projected high growth area adjacent to the existing City limits, the level of interest expressed to the PSB by developers, and the City's interest in annexing the area.

The evaluation and placement of conveyance and treatment facilities required to serve the PSA includes the integration of these new facilities with existing facilities. The PSA extends three to four miles east of Loop 375, is bounded to the north by the Fort Bliss Army Reservation and to the south by IH-10. The PSA boundary is presented on Figure 3-2.

POLITICAL JURISDICTIONS

In addition to the PSB, several agencies have jurisdiction within the PSA. Limits of their jurisdiction boundaries are presented on Figure 3-3.

The PSA encompasses several square miles each of properties which are within service boundaries for both the LVWD and EPCWA. In addition, MUDs No. 1 and 2 covering an area of approximately one square mile have recently been formed in the southern portion of the PSA.

Although not a utility service agency, the State of Texas GLO is a major property owner in the PSA and is actively pursuing development opportunities in this area. Their holdings include approximately 6 square miles of property just north of IH-10 as shown on Figure 3-3.

SEWER SERVICE AREAS

To facilitate the development of sewer collection and treatment alternatives, existing and future service areas must be identified.

Existing PSB Service Areas

PSB is by far the largest provider of sewer service within the RSA. PSB's existing service limits for East El Paso is the area served by the Bustamante WWTP. As illustrated on Figure 3-1 this service area is bounded on the west by Airway Boulevard and extends east to the current city limits. The area is bounded on the north by Montana Avenue and extends south to the Rio Grande. In addition, service has recently been extended to the El Paso County and Texas State jail sites which are located within the PSA, immediately north of Montana Avenue.

The existing Bustamante service area covers approximately 54 square miles. Conveyance facilities include approximately 136 miles of primary collector lines and interceptors as well as 28 lift stations. For purposes of the sewer system analysis, this large service area has been divided into 95 service subareas. A schematic layout of PSB's existing sewer system and service subareas is presented on Figure 3-4.

Other Service Areas

As discussed earlier, the RSA is comprised of four distinct areas: the existing PSB service area, EPCWA, LVWD and the PSA. EPCWA and the LVWD have prepared separate planning and design studies to meet projected future needs. This project focuses on incorporating the results of these studies into a regional plan.

EPCWA has a wastewater collection and treatment system currently in place. The EPCWA initiated planning activities for expansion of these facilities as required to meet future demands from a rapidly growing service population. The goal of those studies was to develop treatment and permitting options to meet anticipated demands through the year 2016. Future requirements of MUDs No. 1 and 2 were tentatively included in those planning activities. For purposes of this study, wastewater flows and loads as projected by EPCWA were accounted for in developing a long range wastewater management program for the region.

The LVWD has completed planning and design phase activities and is in the process of constructing sewer lines throughout the Lower Valley. This work was largely funded by the state EDAP which was established to aid areas in the development of infrastructure and to eliminate the health risks associated with poor water supply and wastewater collection systems. By contract, PSB will provide wholesale treatment of all wastewater collected within the LVWD. Connections have been constructed to convey wastewater from the LVWD to the Bustamante WWTP. The initial phase of construction of sewer collection facilities within the LVWD is nearing completion with delivery of flow to the Bustamante WWTP scheduled to begin within one year.

Principal Service Area

In order to plan for future growth and expansion within the PSA, this area has been divided into service subareas. Development of these subareas was based on topographic information from 7.5 minute USGS maps of the area as well as the 2010 Thoroughfare Plan provided by the El Paso City Planning Department. The PSA subareas are shown on Figure 3-5.

POPULATION

Existing and future population projections have been estimated for four planning horizons: 1996, 2005, 2015, and buildout conditions. These projections were used as the basis for determining future sewer service requirements.

Population data for the RSA were obtained from three sources; the TWDB 1996 Consensus Texas Water Plan, El Paso Metropolitan Planning Organization 2020 projections, and the City of El Paso Department of Planning, Research, and Development El Paso Region Demo-Pack. A comparison of the population projections provided from each of these sources from 1995 to 2030 is presented on Figure 3-6 and in Table 3-1.

Table 3-1 El Paso County Population Projections from 1995 to 2030			
Year	TWDB[a]	City of El Paso[b] Department of Planning	Metropolitan[c] Planning Office
1995	-	660,750	-
1996	-	-	663,227
1999	-	-	710,140
2000	731,781	731,904	-
2005	-	-	815,343
2010	875,421	876,560	-
2015	-	-	978,551
2020	1,028,006	1,034,560	1,053,124
2030	1,191,411	1,205,676	-

[a] 1996 Consensus Texas Water Plan.
[b] El Paso Region Demo-Pack.
[c] 2020 Population Projections.

As illustrated on Figure 3-6, population projections for El Paso County from these three sources agree favorably. Since data from the El Paso Metropolitan Planning Organization provided the most detailed information concerning the distribution of growth within the RSA, and since it agreed well with other projections for the area, this was the primary source of population data used in this study. A summary of existing and projected future populations within the existing service area and PSA is presented in Table 3-2.

Table 3-2 Existing and Projected Populations				
	Year			
Location	1996	2005	2015	Buildout
Existing Service Area	237,825	271,697	319,873	319,873
PSA	2,887	17,055	37,396	217,905
Total	239,712	288,752	357,269	537,778

As discussed later in this report, estimates of ultimate or buildout service populations and associated projected wastewater flows are needed for layout and sizing of sewer interceptors and lift stations. Estimated buildout populations within the study area were not directly available from published data. Based on discussions with City of El Paso Planning Department staff, assessment of growth trends in the area, and comparison with other fully developed areas, an estimation was made of buildout populations within the Bustamante service area and the PSA. Buildout within the existing Bustamante WWTP service area is assumed to occur by the year 2015. Buildout populations within the PSA were estimated based on average buildout population densities within the existing service area. On this basis, buildout population densities were estimated to be 10 people per acre.

Population Distribution

Population projections presented on Table 3-2 were distributed within the study area based on transportation study projections prepared by the El Paso Metropolitan Planning Organization. A summary of this work is presented in Appendix A. The Transportation study provides population projections by Transportation Serial Zone (TSZ). TSZ's define relatively small areas (approximately 100 to 300 acres) and are, therefore, useful in defining the distribution of service populations within the study area.

Populations by TSZ were redistributed into service subareas as shown on Figure 3-4 and Figure 3-5. Redistribution of TSZ populations into subareas was done uniformly based on area. The process is described in more detail in the Collection System Modeling Report which was conducted in parallel to this study and which has been published as a separate report.

CHAPTER 4

WASTEWATER FLOW PROJECTIONS

The projection of wastewater flows for the planning horizons of 2005, 2015, and buildout provides the basis for sizing and scheduling of collection and treatment facility improvements required to serve the east El Paso area. A summary of flow projections developed for this study and the methods used to determine them are presented in this chapter.

BASIS

Wastewater flow projections developed for this study were calculated using population data as presented in Chapter 3, and representative per capita flow contributions. Per capita flows were determined primarily from influent flow data from the Bustamante WWTP. Results were calibrated by comparison with additional data including:

1. Correlation with water consumption by metering zones in the East El Paso Area.
2. Parkhill, Smith, and Cooper, Wastewater Facilities Improvements for the City: 1985 Thru 2005, August 1980.
3. Brown and Caldwell, El Paso Water Utilities Northwest Area Wastewater Engineering Plan, April 1991.

Per capita flows used in this study account for average residential, commercial and industrial flow contributions per individual served. Large (greater than 100,000 gallons per day (gpd)) commercial and industrial point sources have been accounted for separately. Nine of these large point sources were identified within the existing service area.

The per capita flow contribution, peaking factor, and population estimates, were inputted into the "Hydra Graphics" sewer model to project the quantity and distribution of wastewater flows for each of the three planning periods (2005, 2015 and buildout). Flow distribution is based on population distribution by service subarea as discussed in Chapter 3.

BUSTAMANTE WWTP INFLUENT FLOW DATA

Unit Flow

Bustamente WWTP influent flow data for 1995 was the primary data used to calculate the average per capita wastewater flow rate and peaking factor. Plant influent flows were adjusted by subtracting the average daily wastewater discharge from the Chevron Refinery (estimated by PSB staff to be 2-mgd). Flow contributions from this large point source were considered separately. Average monthly total and per capita flow contributions for the Bustamante WWTP are as presented on Table 4-1. Average monthly per capita flow contributions to the Bustamante WWTP for 1995 ranged from 98 to 122 gpcd. The average annual per capita flow contribution for this period was 108 gpcd.

Table 4-1 Unit Wastewater Flows Based on Bustamante WWTP Data

Monthly	Average Daily Flow[a] mgd	Unit Flow[b] gpcd
January 1995	24.4	102
February 1995	23.7	99
March 1995	24.8	104
April 1995	25.4	106
May 1995	26.8	112
June 1995	29.3	122
July 1995	26.1	109
August 1995	29.0	121
September 1995	28.1	117
October 1995	25.6	107
November 1995	23.8	99
December 1995	23.4	98
Average	25.9	108

[a] Bustamante WWTP Influent data minus Chevron facilities discharge (2-mgd).
[b] Average daily flow divided by estimated existing service population of 239,444 (refer to Chapter 3).

Peak Flow

The maximum peak two hour flow for 1995 was 47.37 mgd. The ratio of the wet weather peak two hour flow to the average daily flow for this period is 1.7. For purposes of the model, a peaking factor of 1.7 was applied to flows within all sewers 21-inch and larger. Recognizing that attenuation of peak flows occurs as flows combine downstream within a wastewater conveyance system, a somewhat higher peaking factor was used for smaller diameter collector sewers. A peaking factor of 2.0 was used for all sewers 18-inch and smaller. Since the peaking factor was derived from the wet weather peak flow, any influence of inflow or infiltration is accounted for in the collection system analysis.

Point Sources

The high volume dischargers presented in Table 4-2 were applied as point sources to evaluate areas directly impacted by these flows. The jail facilities were not accounted for in the per capita wastewater flow value because no flows were generated in 1995, but they have been added to flow projections for the service subarea to which they apply.

Table 4-2 High Volume Dischargers		
Facility Name	Address	Discharge, mgd
Chevron Refineries	6501 Trowbridge	2[a]
State and County Jails	East Montana and Loop 375	0.6 - 2.2[b]
Greater Texas Finishing	1430 Vanderbilt	0.69
Levi Strauss	11460 Pellicano	0.48
Wrangler	12173 Rojas	0.33
Desert Cleaners	7025 Alameda	0.12
Therm-o-Link	1245 Henry Brennan	0.05
True Blue Sky	7477 Lomaland	0.03
Levi Strauss	1359 Lomaland	0.03

[a] Combination of average discharges from Chevron North and Chevron South.
[b] Based on design flows for jail lift station: 1996 - 414 gpm; 2005 - 750 gpm; 2015 - 1000gpm; and estimated for Buildout - 1,500 gpm. Provided by PSB staff.

WATER CONSUMPTION

The PSB is the sole source of potable water within the City limits. With the exception of a few industrial generators that have independent water wells, PSB supplied potable water is the source of virtually all domestic and non-domestic wastewater generated in the east El Paso area. PSB water consumption records can, therefore, be used as a basis for estimating per capita wastewater generation. This process was used as an alternative means of validating per capita flow estimates used in this study.

The existing service area for the Bustamante WWTP encompasses parts of ten water metering zones. PSB water consumption data for this service area is presented by meter zone on Table 4-3. The data presented is based on the six month total usage from January 1996 through June 1996 for single family residential, industrial, and commercial accounts.

According to 1990 Census Data, single family residences account for 70 percent of the housing units in El Paso. The average number of persons per housing unit for the East and Lower Valley sections of El Paso was found to be 3.25. The meter zone populations were found by dividing the number of single-family residential accounts by 70 percent and multiplying by 3.25 persons per housing unit. Table 4-3 shows the average water consumption estimated population, and unit water consumption by water meter zone.

Based on the water consumption and population estimates as presented on Table 4-3, unit water consumptions were calculated for the east El Paso area. Unit water consumptions were calculated based on the sum of three service categories as follows:

- Residential
- Industrial
- Commercial

Table 4-3 Unit Water Consumption by Meter Reading Zone

	Average Water Consumption[a], mgd			Estimated Population[b]	Unit Water Consumption, gpcd
Meter Water Zone	Residential	Industrial/ Commercial	Combined		
01	2.2	1.2	3.4	27059	125.7
02	2.0	1.4	3.4	24700	137.7
03	2.0	0.3	2.3	24203	95
04	2.4	0.6	3.0	29607	101.3
05	1.2	1.2	2.4	16111	148
21	1.9	3.0	4.9	24737	198.1
23	3.6	0.2	3.8	38879	97.7
24	3.6	0.3	3.9	42751	91.2
26	3.2	0.2	3.4	39850	85.8
27	2.4	2.6	5.0	27467	182
Total	24.5	11.0	35.5	295365	120.2[c]

[a] Reference: PSB Water Consumption Data for January through June 1996.
[b] Based on 1990 Census Data.
[c] Average unit water consumption for east El Paso area.

Unit water consumption estimates were converted to unit wastewater flow projections, using a typical percentage conversion factor of ninety percent for residential flow and a conversion factor of 100 percent for industrial/commercial flows. The resulting unit wastewater flows are presented on Table 4-4 by meter zone. The average projected per capita wastewater flow value shown on Table 4-4 is slightly higher than the value arrived at using the Bustamante WWTP influent data (Table 4-1). Using the procedure outlined above, the average per capita wastewater flow for the service is calculated to be about 112 gpcd. Although higher than the value predicted using actual flow data for the Bustamante WWTP, this analysis generally validates results obtained using actual wastewater flows.

Table 4-4 Unit Wastewater Flows by Meter Reading Zone

Meter zone	Combined Flow[a] gpcd
01	117.5
02	129.6
03	86.8
04	93.2
05	141.5
21	190.4
23	88.5
24	82.8
26	77.3
27	173.3
Average	111.9

[a] 90 percent of unit water consumption.

PREVIOUS STUDIES

Another method of verifying the appropriateness of unit wastewater flows developed on Table 4-1 is to compare them with the unit flows reported in other El Paso facility plans. The unit flows for the Northwest El Paso Area, Haskell Street WWTP service area, Socorro WWTP service area, and the Bustamante WWTP service area are presented in Table 4-5. The current Bustamante WWTP service area includes the former Socorro WWTP service area. The unit flow determined from the Bustamante WWTP influent data is approximately equal to the value reported for the Socorro WWTP in August 1980. Again, the unit flow calculated for the Bustamante service area using wastewater flow data, conforms well to unit flows derived from other sources. For this reason 108 gpcd was selected as the basis for flow estimates presented in this study.

Table 4-5 Comparison of Unit Flows from Previous Wastewater Plans

Service Area	Unit Flow, gpcd
Northwest WWTP[a]	116
Haskell Street WWTP[b]	120
Socorro WWTP[b]	110
Bustamante WWTP[c]	108

[a] Brown and Caldwell, El Paso Water Utilities Northwest Area Wastewater Engineering Plan, April 1991.
[b] Parkhill, Smith, and Cooper, Wastewater Facilities Improvements for the City of El Paso: 1985 Thru 2005, August 1980.
[c] From Table 4-6.

FUTURE CONDITIONS

As discussed above, future average wastewater flows were projected by applying the per capita flow rate to the population of the service areas making up the east El Paso area. The service subareas are as shown on Figures 3-4 and 3-5. The resulting average flows are presented by subarea on Table 4-6. Included in Table 4-6 are flow projections from Horizon City and LVWD as reported in planning documents prepared by the EPCWA and EDAP, respectively. As summarized on the Table, total current wastewater flow within the RSA is over 29-mgd. Flows increase to 52-mgd by the year 2015 and to 74-mgd for the Buildout condition. Results are presented graphically on Figure 4-1.

Table 4-6 Projected Average Wastewater Flows By Service Subarea

Service Area ID	AREA, acres	1996, mgd	2005, mgd	2015, mgd	Buildout, mgd
Existing Service Subarea					
1[a]	783.6	0.6	1.4	2.1	2.8
2	851.8	0.4	0.6	0.9	0.9
3	487.0	0.2	0.3	0.5	0.5
4	469.9	0.0	0.1	0.1	0.1
6	716.3	0.3	0.5	0.7	0.7
7	495.5	0.3	0.5	0.6	0.6
9	1184.2	0.1	0.3	0.5	0.5
10	1054.2	0.4	0.7	1.1	1.1
11	553.0	0.4	0.4	0.5	0.5
12	141.7	0.1	0.2	0.2	0.2
13	716.8	0.5	0.6	0.7	0.7
14	754.0	0.3	0.4	0.5	0.5
15	1057.1	1.2	1.3	1.4	1.4
16	391.0	0.5	0.5	0.6	0.6
17	296.2	0.3	0.3	0.3	0.3
18	246.4	0.4	0.4	0.4	0.4
19	214.4	0.3	0.3	0.3	0.3
20	655.6	0.8	0.9	1.0	1.0
21	621.9	0.3	0.3	0.3	0.3
23	232.1	0.3	0.3	0.3	0.3
24	512.5	0.4	0.5	0.5	0.5
25	523.8	0.4	0.4	0.5	0.5
26	179.4	0.2	0.2	0.2	0.2
28	448.1	0.4	0.4	0.4	0.4
29	333.6	0.2	0.2	0.2	0.2
30	49.8	0.0	0.0	0.0	0.0
31	337.8	0.3	0.3	0.3	0.3
32	440.9	0.5	0.5	0.5	0.5
33	149.0	0.2	0.2	0.2	0.2
34	251.6	0.4	0.4	0.5	0.5

Table 4-6 Projected Average Wastewater Flows By Service Subarea

Service Area ID	AREA, acres	1996, mgd	2005, mgd	2015, mgd	Buildout, mgd
35	359.9	0.5	0.5	0.5	0.5
36	219.0	0.3	0.3	0.3	0.3
37	24.3	0.0	0.0	0.0	0.0
38	162.4	0.1	0.1	0.1	0.1
39	212.6	0.3	0.3	0.3	0.3
40	206.8	0.2	0.2	0.2	0.2
41	368.3	0.4	0.4	0.4	0.4
42	237.7	0.3	0.3	0.3	0.3
43	392.1	0.4	0.4	0.4	0.4
44	309.9	0.2	0.2	0.2	0.2
45	193.9	0.0	0.0	0.0	0.0
46	721.5	0.9	0.9	0.9	0.9
48	592.4	0.1	0.3	0.6	0.6
49	348.0	0.3	0.4	0.4	0.4
50	66.0	0.0	0.1	0.1	0.1
51	247.6	0.0	0.1	0.1	0.1
52	289.0	0.0	0.0	0.0	0.0
53	297.6	0.1	0.1	0.2	0.2
55	144.1	0.1	0.1	0.2	0.2
56	179.3	0.2	0.2	0.2	0.2
57	451.0	0.2	0.3	0.4	0.4
58	33.4	0.0	0.0	0.1	0.1
60	790.9	0.7	0.7	0.8	0.8
61	527.2	0.3	0.3	0.4	0.4
62	414.5	0.3	0.4	0.4	0.4
63	392.6	0.3	0.3	0.4	0.4
64	312.8	0.3	0.3	0.3	0.3
65	177.2	0.1	0.2	0.2	0.2
66	183.5	0.2	0.3	0.3	0.3
67	159.0	0.2	0.3	0.3	0.3
68	231.0	0.2	0.3	0.3	0.3
69	301.3	0.3	0.3	0.3	0.3
70	102.4	0.1	0.1	0.1	0.1
71	248.5	0.0	0.0	0.0	0.0
72	133.6	0.2	0.2	0.2	0.2
73	158.6	0.2	0.2	0.2	0.2
74	118.0	0.1	0.2	0.2	0.2
75	174.1	0.1	0.2	0.2	0.2
76	211.5	0.3	0.3	0.4	0.4
77	48.8	0.1	0.1	0.1	0.1
78	188.8	0.3	0.3	0.4	0.4
79	442.5	0.4	0.5	0.6	0.6
80	260.6	0.2	0.3	0.4	0.4
81	295.4	0.3	0.3	0.4	0.4

Table 4-6 Projected Average Wastewater Flows By Service Subarea					
Service Area ID	AREA, acres	1996, mgd	2005, mgd	2015, mgd	Buildout, mgd
82	230.2	0.2	0.3	0.3	0.3
83	216.0	0.2	0.3	0.3	0.3
84	356.5	0.4	0.4	0.5	0.5
85	178.3	0.2	0.3	0.3	0.3
86[b]	935.9	2.5	2.5	2.8	2.8
87	151.6	0.0	0.0	0.0	0.0
88	55.8	0.1	0.1	0.1	0.1
89	86.5	0.1	0.1	0.1	0.1
90	451.9	0.5	0.5	0.6	0.6
91	60.4	0.1	0.1	0.1	0.1
92	160.7	0.2	0.3	0.3	0.3
93	70.4	0.1	0.1	0.1	0.1
94	40.0	0.0	0.0	0.1	0.1
95	581.6	0.9	0.9	0.9	0.9
96	1025.5	0.0	0.1	0.2	0.2
97	484.1	0.0	0.1	0.2	0.2
98	233.8	0.2	0.2	0.3	0.3
99	702.6	0.6	0.7	0.9	0.9
100	737.7	0.5	0.5	0.7	0.7
101	37.7	0.0	0.0	0.0	0.0
102	434.3	0.7	0.7	0.7	0.7
Subtotal	34310.0	28.6	32.9	38.8	39.6
Lower Valley[c]		0.0	5.2	7.5	9.5
Study Area					
104	847.1	0.0	0.1	0.1	0.9
105	1847.0	0.0	0.0	0.1	2.0
106	1206.2	0.0	0.1	0.1	1.3
107	403.8	0.0	0.1	0.1	0.4
108 (Sparks)					
109	1275.4	0.0	0.0	0.1	1.3
110	1381.4	0.0	0.1	0.1	2.5
111	738.9	0.1	0.1	0.3	0.8
112	905.0	0.1	0.1	0.2	1.0
113	2387.1	0.0	0.1	0.2	2.3
114	1313.9	0.0	0.1	0.1	1.0
115	1239.4	0.0	0.1	0.1	1.3
116	1203.5	0.0	0.1	0.1	1.3
117	874.7	0.0	0.0	0.1	0.6
118	817.0	0.0	0.1	0.1	0.8
119	479.4	0.0	0.1	0.2	0.5
120	1236.3	0.0	0.2	0.6	1.4
121	668.6	0.0	0.2	0.4	0.7

Table 4-6 Projected Average Wastewater Flows By Service Subarea					
Service Area ID	AREA, acres	1996, mgd	2005, mgd	2015, mgd	Buildout, mgd
122	623.5	0.0	0.1	0.2	0.7
123	561.7	0.0	0.1	0.2	0.6
124	719.9	0.0	0.1	0.2	0.8
125	1989.5	0.0	0.1	0.2	1.5
Subtotal	22315.4	0.2	1.8	3.9	23.2
Horizon[d]		0.5	1.0	1.5	1.5
Total		29.3	40.9	51.7	73.8

[a] Includes flows from county and state jail facilities: 414 gpm, 750 gpm, 1000 gpm, and 1500 gpm in 1996, 2005, 2015, and estimated for Buildout, respectively. Based on design data for jail lift station provided by PSB staff.

[b] Includes wastewater discharge from Chevron Refinery North and South facilities - 2-mgd for all planning horizons.

[c] Flow projections provided by LVWD.

[d] Flow projections for Horizon provided by EPCWA.

CHAPTER 5

WASTEWATER CHARACTERISTICS AND COMPOSITION

The composition and characteristics of future wastewater flows and the required limitations on effluent quality are important to the selection of viable treatment alternatives. Wastewater quality information presented in this chapter has been divided into three sections, as follows:

1. Treatment Plant Design
2. Receiving Water Quality
3. Reuse Water Quality

The first section presents wastewater quality data for the Bustamante WWTP. Influent wastewater characteristics used to design the Bustamante WWTP are compared with actual influent characteristics in order to determine future design loads. Current effluent quality information is presented and compared with existing permit limits.

The second section discusses the implications of receiving water quality standards on the level of treatment required for municipal wastewaters. The current discharge requirements for the Bustamante WWTP and the anticipated discharge quality standards for a proposed new treatment plant are identified.

An assessment of reuse water quality standards, as outlined by state regulations, and as required for possible reuse water consumers is presented in the third section. The use of treated effluent for irrigation, industrial, or commercial purposes is a critical element of El Paso's long term water resource management program.

TREATMENT PLANT DESIGN

Design of the Bustamante WWTP was completed in 1988. Construction of this facility was completed in 1991. The design of the Bustamante WWTP was based on anticipated influent wastewater characteristics and effluent discharge limits imposed by the TWC (currently the TNRCC). Table 5-1 presents the original Bustamante WWTP influent design data.

Table 5-1 Bustamante Design Data

Parameter	Original[a]	Capacity[b]
Biochemical Oxygen Demand (BOD_5), mg/l	180	225
Total Suspended Solids (TSS), mg/l	150	285
NH_3-N, mg/l	30	25

[a] Parkhill, Smith, and Cooper. Southeast Treatment Plant Design Drawings, March 1988.

[b] Public Service Board. Roberto R. Bustamante Wastewater Treatment Plant: Performance Evaluation at Full Capacity, June 1993.

Also presented on Table 5-1 is actual performance data for the Bustamante WWTP. These performance parameters were established while conducting a full capacity simulation at the plant to evaluate the plant's ability to nitrify at full capacity. The simulation involved operating the plant at 39-mgd for approximately two months with one-fourth of the plant off line. The results of the full capacity simulation indicated that the plant is capable of operating at required effluent standards with higher influent loads than anticipated in the original design.

Influent Water Quality

Table 5-2 summarizes actual influent wastewater quality data for the Bustamante WWTP for 1995. A comparison of Tables 5-1 and 5-2 shows that the average influent wastewater characteristics are well within the operating range of the plant.

Table 5-2 Bustamante WWTP Influent Data

	Actual		
Constituents	Minimum[a] Daily	Maximum[b] Daily	Average[c] Daily
pH	7.0	7.5	7.3
BOD_5, mg/l	102	264	164
TSS, mg/l	107	311	200
NH_3-N, mg/l	5.0	35.0	15

[a] Minimum daily value for 1995, based on plant data.
[b] Maximum daily value for 1995, based on plant data.
[c] Average of monthly averages for 1995, based on plant data.

In addition to the PSB service area, the RSA consists of the EPCWA and the LVWD. Currently, the EPCWA operates a wastewater treatment facility to serve the population of Horizon City. Both the EPCWA and the LVWD intend to provide expanded services in the next few years. The LVWD will convey wastewater flows to the Bustamante WWTP and the EPCWA will expand their existing facility to provide sufficient treatment for projected increases in flow.

The characteristics of the wastewaters produced within the LVWD and EPCWA are anticipated to be similar to those of wastewater currently generated within the Bustamante WWTP service area. The wastewater can generally be characterized as predominantly residential with moderate industrial and commercial contributions. Inflow and Infiltration (I/I) contributions for areas North of Interstate 10 are expected to be low. Although the groundwater levels within much of the LVWD service area is high, sewer collection lines in this area are new and being constructed to current tight standards. I/I contributions to wastewater flow within the LVWD are, therefore, also expected to be limited.

For purposes of this study, it is assumed that existing influent wastewater quality at the Bustamante WWTP, reasonably characterizes wastewater quality within the entire regional study area. Wastewater quality data presented in Table 5-2 will, therefore, be used as the basis for determining treatment requirements for new and expanded facilities presented in this study.

Effluent Water Quality

Table 5-3 presents existing effluent quality data and effluent limits defined by current discharge permits for the Bustamante WWTP. TNRCC and EPA require acute, 24-hour toxicity testing of the discharged effluent using Daphnia pulex and Fathead Minnow. Additionally, EPA requires a 48-hour acute toxicity test on the same species.

Table 5-3 Bustamante WWTP Effluent Quality

Parameter	Existing Average Effluent Quality[a]	Current Permit Limits[b]
pH	7.0	>6.0 and <9.0
BOD_5, mg/l	4	20
TSS, mg/l	6	20
NH_3-N, mg/l	3.13	5
DO, mg/l	5.5	greater than 4
Chlorine, mg/l	1.86	>1 and <4
Fecal Coliform, #/100 ml	3	200/100 ml

[a] Based on 1995 plant operational data.
[b] TNRCC discharge Permit No. 10408-010 and NPDES Permit No. TX0101605.

The data shown in Table 5-3 shows that the Bustamante WWTP is discharging well within the effluent limits imposed by current discharge permits.

RECEIVING WATER QUALITY

Receiving water quality used by the TNRCC to determine permitted effluent quality criteria is presented in this section.

Discharge From Bustamante WWTP

The Bustamante WWTP discharges treated effluent primarily to the Riverside Intercepting Drain and, at the request of the El Paso Water Improvement District No. 1, to the Riverside Canal. Effluent can be discharged to either or both of these facilities. Both outfalls are considered part of drainage area Segment No. 2307 of the Rio Grande Basin.

In 1993, the TWC (now the TNRCC) made a determination that the Riverside Irrigation Canal maintained a limited aquatic life use and therefore required a minimum dissolved oxygen level of 3.0 mg/l. It was determined that the minimum required dissolved oxygen level for the Riverside Intercepting Drain was 2.0 mg/l.

Segment 2307 begins at the Riverside Diversion Dam in El Paso County and continues 222 miles to the confluence of the Rio Conchos in Presidio County. It has been designated for the following water uses:

- Contact Recreation
- High Quality Aquatic Habitat
- Public Water Supply

Numerical criteria established to ensure that acceptable water quality within Segment 2307 is maintained, is presented in Table 5-4.

Table 5-4 Water Quality Standards for Rio Grande Segment 2307	
Parameter	Criteria[a]
Dissolved Oxygen (DO)	Not less than 5.0 mg/l
Temperature	Not to exceed 93.0 °F
pH	Not less than 6.5 nor greater than 9.0
Chloride	Not to exceed 300 mg/l
Sulfate	Not to exceed 550 mg/l
Total Dissolved Solids	Not to exceed 1,500 mg/l
Fecal Coliform	Not to exceed 200/100 ml

[a] Source: The Texas Water Commission, Regional Assessment of Water Quality in the Rio Grande Basin, GP 92-02, November 1992.

Discharge From A New Treatment Facility

In this study, a number of alternatives that include new treatment facilities will be evaluated for treating wastewater generated in the PSA. As discussed in the development of this alternative (refer to Chapter 8), treated effluent from a new treatment facility which can not be reused can be handled in one of two ways: discharge of the excess flow into a nearby arroyo or the use of percolation beds to discharge the excess flow into the subsurface. Standards for these two alternative means of effluent discharge are discussed below.

Table 5-5 Intermittent Stream Discharge Standards	
BOD_5	20 mg/l
TSS	20 mg/l
DO	2 mg/l (24 hour mean)

Source: From 30 TAC 307.4 (h)(2)

Surface Discharge. According to 30 TAC 307.4 (h)(2), discharge into an intermittent stream or arroyo shall meet effluent quality limits as shown in Table 5-5. In addition, toxic materials standards (30 TAC 307.6) apply for discharges greater than 1-mgd. Typically, the most stringent toxic material standards with respect to discharge of treated effluent include specific numerical aquatic life criteria (30 TAC 307.6(c)) and total (whole effluent) toxicity criteria (30 TAC 307.6 (e)). Acute criteria for toxic materials standards as opposed to more conservative chronic criteria for perennial streams would apply for effluent discharging into an intermittent stream. Although less stringent, some percolation standards may also apply to intermittent stream discharges since a significant portion of this water would percolate into relatively permeable arroyo channel sediment.

On-site Percolation Systems. Percolation disposal systems provide for ultimate disposal of wastewater by evaporation and percolation with no resulting discharge to surface waters. The following TNRCC regulatory requirements for percolation systems are from 30 TAC 309.20 (c):

1. Percolation systems will not be permitted in those locations where seepage would adversely affect the uses of groundwater resources.

2. Primary treatment of the raw sewage shall be provided prior to land disposal.

3. Percolation systems shall be limited to sites having soil textures suitable for sustaining a rapid intake rate. Percolation dosing sites shall be limited to soils classified as sands, loamy sands, or sandy loams having a minimum infiltration rate of six inches per hour.

4. Multiple dosing basins shall be provided for the application of wastewater. The wastewater distribution system shall be designed to provide a maximum dosing period of 24 hours upon any individual dosing basin and a minimum resting period for any individual dosing basin of five days following a dosing period.

5. The hydraulic loading rate will be considered on a case-by-case basis. The designing engineer shall identify the permeability of the limiting soil layer.

REUSE WATER QUALITY

As previously discussed, reuse of treated wastewater is an important element of El Paso's long-range water resources management plan. Careful consideration is given, therefore, to wastewater management programs which support or enhance wastewater reuse in the east El Paso area. Within the study area possible users include, existing and proposed golf courses, industries near Loop 375, and public landscapes. Quality standards for using reclaimed water (formerly 30 TAC 310.33 revised July 26, 1996 in the Texas Register and renumbered as 30 TAC 210.33) fall into two categories or types depending on its intended use as defined in 30 TAC 210.32. Type I reclaimed water use includes irrigation or other applications in areas where the public would normally be present during the time when irrigation normally takes place or other times where the public might normally come in contact with the reclaimed water. Type II reclaimed water use includes irrigation or other

Table 5-6 Type I Reclaimed Water Standards

BOD_5 or $CBOD_5$	5 mg/l[a]
Turbidity	3 NTU
Fecal Coliform	20 CFU/100 ml[b]
Fecal Coliform	75 CFU/100 ml[c]

[a] 30-day average
[b] Geometric Mean.
[c] Single Grab.
Source: 30 TAC 210.33

Table 5-7 Type II Reclaimed Water Quality Standards

BOD_5	20 mg/l[a]
or $CBOD_5$	15 mg/l[a]
Fecal Coliform	200 CFU/100 ml[b]
Fecal Coliform	800 CFU/100 ml[c]

[a] 30-day average
[b] Geometric Mean
[c] Single Grab
Source: 30 TAC 210.33

uses in areas where the public is not normally present when irrigation activities occur or uses where the public would not normally come in contact with the reclaimed water.

Quality Standards for Type I, reclaimed water use, are presented in Table 5-6. Type II reclaimed water quality requirements are presented in Table 5-7.

REFERENCES

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3. State of Texas, Texas Administrative Code, Title 30, Environmental Quality, Chapters 307 and 309, 1996.

4. Boyle Engineering Corporation, Feasibility Report on Water Reuse Opportunities, November 1992

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6. Texas Natural Resource Conservation Commission, Permit to Discharge of Wastes No. 10408-010, Approved May 1988, Renewed April 1994.

7. Enrique Woo, P.E. Roberto R. Bustamante WWTP Performance Evaluation at Full Capacity Simulation, June 1993.

8. Public Service Board, Roberto R. Bustamante WWTP - Monthly Plant Summary Reports for January 1995 through December 1995.

9. The Texas Water Commission, Regional Assessment of Water Quality in the Rio Grande Basin, GP 92-02, November 1992.

10. Environmental Protection Agency, NPDES Permit No. TX0101605.

CHAPTER 6

EXISTING FACILITIES

This chapter provides a description of existing collection and treatment facilities in the RSA. Most of the information presented in this chapter focuses on facilities operated by the PSB, since they currently serve the majority of sewered areas within the RSA. Information provided includes a description of the east El Paso collection system, a summary of existing lift stations, and an evaluation of the Bustamante WWTP. A brief description of other wastewater collection and treatment facilities within the RSA is also included.

PSB FACILITIES

Existing PSB collection and treatment facilities that serve east El Paso consist of the Bustamante WWTP and its collection and conveyance facilities. These facilities are described below.

Collection System

Concurrent with this study, detailed modeling and analysis of the Bustamante WWTP collection system was performed. Comprehensive presentation of this modeling effort has been published as a separate report. A summary of this information is included in Chapter 9.

The existing PSB collection system is comprised of 136 miles of primary collector lines 12 inches and larger and covers an area of approximately 54 square miles. This corresponds to the area extending west from the current El Paso City limits to Robert E. Lee Road and north from the Rio Grande River to Montana Avenue. Figure 6-1 presents a layout of the Bustamante WWTP existing collection system. A schematic representation of the collection system is presented on Figure 6-2.

The backbone of the existing collection system is a pair of large diameter interceptors. The Mesa Drain Interceptor (MDI) runs southeast from Westmoreland (north of IH-10) along the Mesa Drain to the City limit and turns southwest to the Bustamante WWTP. The MDI is a gravity flow collector that varies in diameter from 18 to 48 inches.

The second major collector line in the PSB service area is the Lower Valley Interceptor (LVI). It extends southeast from the Alfalfa Lift Station to Alameda and turns south to the Bustamante WWTP. The LVI varies in diameter from 21 to 48 inches. It includes one large capacity lift station (Ysleta) to connect two gravity flow segments.

There are twenty-eight lift/pump stations in the Bustamante WWTP service area. A summary of station capacities and modeled flows for existing conditions are show in Table 6-1.

Table 6-1 shows the capacity and current and projected peak flows for the lift/pump stations in the Bustamante WWTP service area.

Peaking factors are based on the inlet line diameter: 1.7 for lines less than 21 inches and 2.0 for 21 inches and larger. According to 30 TAC 317.3, lift stations should have enough capacity to convey peak flows with the largest pump out of service.

Table 6-1 Lift Station Data

Station No.	Address / Name	Pump Data	Capacity Firm[a], mgd Installed[b], mgd	Projected Peak Flows 1996, mgd	Projected Design Flows, mgd year
1[d]	708 S. Americas Zaragosa Port of Entry	2 - 6" Cornell 5 Hp 1800 rpm 180 gpm @ 30' TDH	0.26 0.52	Not Modeled	Not Modeled
2	13085 Gateway West TX-DOT	2 - Flygt Submersible 350 gpm @ 36' head	0.50 1.01	Not Modeled	Not Modeled
4[d]	201 Coronado Mimosa	2 - 4"x4" F.M. 5 Hp, 300 gpm	0.43 0.86	0.31	0.34 2015
5	7935 Sunnyfield Sunnyfield	2 - 1 1/4" Myers 15 gpm Submersible Pumps	0.02 0.04	Not Modeled	Not Modeled
10	8356 Roseway Roseway	2 - Paco 6" 1100 gpm @ 40' TDH	1.58 3.17	0.59	0.80 2015
19[d]	160 S. Carolina Carolina 1	2 - Flygt, 10 Hp, 627 gpm @ 34.3' TDH	0.90 1.73	0.67	0.74 2015
21[d]	8369 North Loop Marion Manor	2 - Flygt, 7.5 Hp, 319 gpm, 25.9' TDH	0.43 0.86	0.45	0.5 2015
22	12301 Montana Jail Annex	3 - Flygt Submersible 4" 20 hp, 710 gpm @ 39' TDH	2.04 3.06	0.6[c]	2.16[c] Buildout
25[d]	204 Lone Star Lone Star	2 - 6"x6" Chicago 15 Hp, 900 gpm @ 36' TDH	1.30 2.59	1.38	1.53 2015
27[d]	8600 Independence Independence	2 - 5"x5" Fairbanks Morse 10 Hp, 400 gpm 1150 rpm @ 40' TDH	0.58 1.15	0.59	0.90 2015
28	955 Navarrette Navarrette	2 - 4"x4" Paco 3 hp, 250 gpm 1170 rpm	0.36 0.72	0.19	0.36 2015
29[d]	200 George Orr George Orr	2 - Flygt, 10 Hp, 620 gpm @ 34.6' TDH	0.89 1.79	0.62	0.67 2015
30	665 Mauer Nina	2 - Ebarco, 8 Hp, 150 gpm, @ 19.4' TDH	0.22 0.43	0.17	0.23 2015
31[d]	113 McCarthy Thomas Manor I	1 - 4"x4" Fairbanks Morse 10 hp, 600 gpm; 1 - 4"x4" F.M. 3 hp, 150 gpm	0.22 1.08	0.58	0.80 2015

Table 6-1 Lift Station Data					
Station No.	Address / Name	Pump Data	Capacity Firm[a], mgd Installed[b], mgd	Projected Peak Flows 1996, mgd	Projected Design Flows, mgd year
32	344 Coventry The Village	2 - 4"x4" F.M. 10 hp, 400 gpm @ 40' TDH 1500 rpm	0.58 1.15	0.43	0.50 2015
33[d]	7776 Knights Thomas Manor II	2 - 6"x6" Chicago 20 hp, 1000 gpm @ 40' TDH	1.44 2.88	0.57	0.72 2015
34	7300 Stiles Alfalfa Yards	3 - 8" F.M. 30 hp, 1500 gpm @ 15' TDH	4.32 6.48	4.26	4.26 2015
35	9330 Alameda Ysleta	2 - 20" F.M. 10,000 gpm, 555 rpm @ 13.5 TDH; 1 - 20x20 10,000 gpm, 505 rpm	28.80 43.20	25.89	30.09 2015
36[d]	120 Ingelwood Ingelwood	2 - 6"x6" F.M. 7.5 hp, 800 gpm @ 18.5 TDH	1.15 2.30	0.23	0.35 2015
38[d]	9800 Carl Longuemare Singh Addition	2-Flygt, 20 Hp, 1,340 gpm	1.93 3.86	0.30	0.33 2015
40	200 Prado Prado	2 - 6"x8" F.M. 900 gpm @ 46' TDH	1.30 2.59	1.89	2.82 2015
41	9690 Socorro Socorro	2 - 4"x4" F.M. 5 hp, 500 gpm @ 27' TDH 1150 rpm	0.72 1.44	0.57	0.78 2015
42	9455 N. Loop Le Barron	2 - 6" Worthington 1200 gpm @ 54' TDH 1150 rpm	1.73 3.46	0.84	1.51 Buildout
43	9700 Carl Longuemare Pan American	2 - 4"x4" Worthington 5 hp, 550 gpm @ 20' TDH	0.79 1.58	0.48	0.54 2015
44	7897 Mansfield Mansfield	2 - 4"x4" Chicago 500 gpm @ 29' TDH	0.72 1.44	0.52	0.72 2015
112	1203 Wedgewood Album	3 - 6" Cornell 30 hp 1200 gpm, 1165 rpm @ 50' TDH	3.46 5.18	3.18	3.34 2015
130	3358 Wedgewood Orkney	2 - 4" Flygt 3.4 hp, 150 gpm @ 30' TDH	0.22 0.43	Not Modeled	Not Modeled
134	10675 Pico Norte Pico Norte	3 - 10"x22" Aurora 3650 gpm, 875 rpm @ 85' TDH	10.51 15.77	8.95	10.64 2015

[a] Assumes largest pump out of service (30 TAC 317.3 (c) (2)).
[b] Summation of nominal pump capacities.
[c] Values based on lift station design flows: 1996 - 414 gpm; 2005 - 750 gpm; 2015 - 1000 gpm; and estimated for buildout - 1500 gpm. Provided by EPWU Engineering staff.
[d] Lift station to be upgraded as part of EPWU lift station improvement plan.

Due to the lack of detailed verification of the system model and pump capacities, it was assumed that a lift station would require improvement if the projected peak flow exceeded ninety percent of the nameplate capacity. According to this criteria, there are eighteen lift stations that would require further evaluation to determine if improvements would be needed. Four of these stations are included in the EPWU Lift Station Improvement project. Four stations that were not modeled due to incomplete planning information, are included. Eight of the nine remaining stations, Numbers 28, 30, 35, 40, 41, 44, 112, 134, are projected to require improvements by 2015. Only the Jail Annex station would be improved after 2015.

Treatment Facilities

The Bustamante WWTP is the only EPWU operated treatment facility included in the RSA. It began operations in January 1991 as a conventional activated sludge plant and is designed for a 39-mgd peak monthly average flow.

Influent and Effluent Quality. Design and actual influent and effluent quality data are presented in Table 6-2. As shown, the existing TSS loading is higher than the design value. The NH_3-N and BOD_5 loadings are actually lower than the design criteria.

Actual plant operating data shows that the Bustamante WWTP effluent quality exceeds original design criteria. Results of a full capacity simulation performance evaluation of the plant verify that the facility is capable of exceeding original design performance criteria at the design flow.

Unit Processes. The process train at the Bustamante WWTP includes screening, grit removal, preaeration, primary sedimentation, aeration, secondary clarification, and disinfection. Chlorine is used for effluent disinfection.

Table 6-2 Comparison of Design Data with Actual Performance

Item	Value		
	Design[a]	Actual[b]	Performance Tested[c]
Flow Rate, mgd			
Average	30	27.9	30
Peak	51.3	47.5 (2-hr)	51
Maximum Month	39		
Influent Characteristics			
BOD_5 load, lbs/day	58,600	37,569	73,184
TSS load, lbs/day	48,800	45,697	92,700
BOD_5 concentration, mg/l	180	164	225
TSS concentration, mg/l	150	200	285
NH_3-N, mg/l	30	15	25
Effluent Characteristics			
BOD_5 concentration, mg/l	15	4	< 10
TSS concentration, mg/l	15	6	< 15
NH_3-N, mg/l	0	2	< 3
Dissolved Oxygen, mg/l	>2	5.5	> 4
Removal Efficiencies			
BOD_5, percent	91.7	97.6	> 95
TSS, percent	90	97.0	> 94

[a] Parkhill, Smith, and Cooper, Southeast Treatment Plant Design Drawings, March 1988.
[b] 1995 operational data.
[c] Results from Bustamante Performance Evaluation at Full Capacity Simulation, June 1993.

Waste activated sludge (WAS) is thickened using dissolved air flotation thickeners. The thickened WAS is combined with concentrated primary sludge and then digested, and dewatered prior to disposal in a sludge only landfill. A schematic of the plant's treatment process train is presented in Figure 6-3. A layout of facilities is presented on Figure 6-4. Unit process data is presented in Table 6-3.

Table 6-3 Treatment Processes

Item	Value
Preliminary Treatment	
Mechanical bar screens	
Number	3
Type	Rotating, circular, front cleaning
Channel width, feet	4
Channel depth, feet	4.23
Capacity, mgd, total	52.5
Grit Removal Units	
Number	3
Volume, cubic feet, total	29,700
Preaeration Basins	
Number	3
Length, feet	77
Width, feet	24
Side Water Depth, feet	15.38
Volume, cubic feet, total	87,500
Detention time, minutes at design flow	30
Screenings and Grit Conveyor	
Number	1
Width, inches	30
Primary Treatment	
Primary Clarifiers	
Number	4
Type	Circular
Diameter, feet	120
Side Water Depth, feet	10
Overflow Rate, gpd/ft^2	
Average	663
Peak	1134
Primary Sludge Pumps	
Number	6
Type	Diaphragm
Capacity, gpm, total	180
Secondary Treatment	
Aeration Basins	
Number	4
Length, feet	170
Width, feet	90
Side water depth, feet	15

Table 6-3 Treatment Processes	
Item	Value
Volume, cubic feet, total	945,225
Loading rate, lb. BOD/ 1,000 ft^3/day	34.0
Detention time, hours at average flow	5.6
Aeration Blowers	
Number	4
Type	N/A
Capacity, SCFM	27,000
Plant elevation, feet	3648
Discharge pressure, psig	7.5
Horsepower, each	1250
Secondary Clarifiers	
Number	4
Type	Circular
Diameter, feet	140
Side Water Depth, feet	16
Overflow Rate, gpd/ft^2	
Average	487
Peak	833
Return Sludge Pumps	
Number	6
Type	Horizontal, non-clog, centrifugal
Capacity, gpm	5770
Disinfection	
Chlorine Contact Basin	
Volume, cubic feet	92,000
Contact time, minutes	
Peak	20.3
Sludge Handling	
Waste Sludge Pumps	
Number	3
Capacity, gpm	300
Gravity Belt Thickener	
Number	3
Size, meter	2.2
Loading, gpm, average	125
Thickened Sludge Pumps	
Number	2
Capacity, gpm	100
Anaerobic Digester	
Number	2
Diameter, feet	104
Side Water Depth, feet	34
Working volume, cubic feet, total	550,000
Detention time, days, average	33
Mixers, mixing guns per tank	14

Table 6-3 Treatment Processes	
Item	Value
Cover Type	Floating, gas holder
Digested Sludge Pumps	
Number	4
Capacity, gpm	150
Belt Filter Press	
Number	4
Size, meter	2.2
Loading, lbs/hr/meter	677

OTHER FACILITIES

The EPCWA operates the only other wastewater treatment facility in the PSA. This system currently operates as an aerated lagoon system with the effluent filtered and chlorinated prior to being used for irrigation at a community golf course. Current permitting allows for both reuse and surface discharge. Discharge limits are established at 100/100 mg/l BOD_5/TSS for reuse at the golf course and 30/30 mg/l BOD_5/TSS for surface discharge to an arroyo.

The plant has an existing capacity of 0.5-mgd and operating conditions have indicated the need for expansion. A planning study prepared by Moreno Cardenas, Inc. recommends the implementation of a complete mix treatment plant installed in increments of 0.5-mgd to replace the lagoon system over the next 15 years. After decommissioning, the existing lagoon system would then be converted to reuse storage for the additional reuse water generated by treating the projected flow of 1.5-mgd by 2015.

As discussed in Chapter 4, projected wastewater flows from the EPCWA plant were accounted for in the development of collection and treatment alternatives for the RSA. These alternatives are discussed in Chapters 7 through 9.

REFERENCES

1. Parkhill, Smith, and Cooper, Design Drawings for the Southeast Treatment Plant, prepared for El Paso Water Utilities Public Service Board, March 1988.

2. Cardenas-Salcedo and Associates, Inc. Lift Station Infrastructure Study and Preventive Maintenance Program Review, prepared for El Paso Water Utilities Public Service Board, October 1992.

3. Existing archive maps, 1-inch=300 feet series, provided May 1996 by PSB.

4. Enrique Woo, P.E., Roberto R. Bustamante WWTP Performance Evaluation at Full Capacity Simulation, June 1993.

5. Texas Natural Resource Conservation Commission, Discharge Permit for the Bustamante WWTP - Permit # 10408-010, issued August 1987, renewed April 20, 1994.

6. Boyle Engineering Corporation, Bustamante Effluent Receiving Water Study, 1993.

7. PSB Lift Station Failure Procedures.

8. Moreno Cardenas Inc., Wastewater Facilities Engineering Plan for the El Paso County Water Authority - Draft Report, July 17, 1996.

CHAPTER 7

DEVELOPMENT OF ALTERNATIVES

This Chapter presents the development of alternatives for the construction of treatment and conveyance facilities needed to meet long term wastewater service requirements for the east El Paso study area.

BASIS OF DEVELOPMENT

The objective of this effort was to develop regional wastewater management alternatives in sufficient detail to provide a reliable basis for selection of a recommended program. Several assumptions, as outlined below, were made to provide the basis for a fair relative comparison of each alternative.

Phasing

The development of long range wastewater management alternatives was based on a phased implementation program as follows:

Initial Improvements. Initial improvements include those facilities which, based on projected growth rates and patterns, would be constructed and on-line by 2005. Although the need for new facilities will be largely driven by existing and projected future growth, the planning process must provide sufficient time to allow for detailed planning, design and construction of new facilities. For example, a minimum of five years will be required for planning, permitting, designing and constructing a major expansion to the Bustamante WWTP, an improvement element common to each the wastewater management alternatives presented. Construction of a new wastewater treatment facility, which is an element common to many of the alternatives presented, will require an even longer implementation period. Siting and permitting issues for a new facility could be very time consuming. The proposed nine-year initial improvement period (1997 to 2005) allows sufficient time for planning and construction of these and other new major facilities.

Phase I Improvements. Phase I improvements include those improvements for which planning, design and construction would be completed between the years 2005 and 2010. As discussed later in this chapter, common to each alternative would be the need to construct a new interceptor to serve the PSA. To reduce initial capital investment to a manageable level, a phased plan has been developed for construction of this new interceptor. This phasing of construction of the new interceptor would be feasible because of the short-term availability of residual capacity within existing sewer lines (refer to subsequent sections for a more detailed explanation). However, based on projected growth within existing and future service areas, this residual capacity would only be sufficient to meet projected needs through the year 2007. The new interceptor serving the PSA must, therefore, be completed by this time.

Phase II Improvements. Phase II improvements include those improvements which would need to be completed between the years 2011 and 2015. Additional treatment capacity is anticipated to be needed during this period. Additional sewer line capacity would be required for certain alternatives.

Buildout Improvements. Ultimate improvements identify additional treatment facilities required to be constructed and on-line beyond the year 2015. Sizing of these facilities was based on ultimate or buildout population and flow projections within the study area. Although there is significant opportunity for growth within the study area beyond the year 2015, it was not possible to accurately predict the rate at which continued growth would occur. Identifying the size and location of long-range future treatment facilities helps to insure that proper consideration would be given to those long-term needs in the planning and design of nearer term improvements.

Line Sizing

New gravity and force main sewer lines will be constructed in phases as described above. Sewer lines will be sized to convey ultimate projected peak flows. Sewer lines would be constructed to provide long-term service of 40 years or more. By sizing sewer lines to convey projected long-term flows, significant future costs and disruption due to construction of parallel or replacement lines within paved right-of-ways and developed areas would be avoided.

Existing System Improvements

Alternatives presented in this Chapter include only those improvements to the existing sewer system that are integrally tied to alternative sewer system improvements proposed for the PSA. Additional improvements to the existing system have been identified and are presented as part of the overall recommended program (refer to Chapter 9). These improvements are common to each of the alternatives presented in this Chapter and, therefore, have no impact on the relative comparison of alternatives and the selection of a recommended program.

Service to Other Jurisdictions

As previously discussed, both the LVWD and EPCWA have jurisdictional boundaries which lie within the PSA (refer to Figure 3-3). In addition, MUDs No. 1 and 2 have recently been formed within this area. In considering future annexation and/or service to most, if not all of the PSA, the City and PSB must resolve certain potential jurisdictional conflicts. This process has been initiated as part of this planning effort, and will need to continue beyond completion of this study. For purposes of this study, it has been assumed that the proposed wastewater management program will be sized and configured to serve the entire study area, including those areas currently inside other jurisdictional boundaries.

Lower Valley Water District. PSB has contracted with the LVWD for the wholesale treatment of wastewater collected within their District. Collected flows from the LVWD are accounted for in the sizing of new facilities presented in this Chapter.

Horizon City. Horizon City is located directly east of the study area (see Figure 3-1) and is served by the EPCWA. Studies have been prepared by the EPCWA to expand their existing wastewater treatment facility, to include service to nearby areas including El Paso Hills and MUDs No. 1 and 2. Current plans are to proceed with expansion of the existing wastewater treatment plant to serve immediate and short-term needs for additional capacity.

For planning purposes, it has been assumed that the EPCWA would build and maintain treatment facilities as needed to serve growth and development of Horizon City through the Initial and Phase I improvement periods (1997 to 2010). The development of regional alternatives, as presented in this Chapter, includes provisions to serve a portion of Horizon City around 2012. This assumption is not intended to presume a commitment by the EPCWA to participate in a regional program at this time. The objective was to identify the size and costs of those facilities, should they be required at some future date.

FLOW PROJECTIONS

Detailed flow projections which provide the basis for development of alternatives, were presented by service subarea in Chapter 4. For discussion purposes, the PSA has been divided into service quadrants as illustrated on Figure 7-1. Average flows by PSA quadrant are presented on Table 7-1.

Table 7-1 Projected Average Flow Contributions

REGION	FLOW PROJECTIONS[a] (mgd)			
	1996	2005	2015	Ultimate
Existing Service Area	**28.6**	**32.9**	**38.8**	**39.6**
Principal Study Area (PSA)				
North	<0.1	0.6	1.2	4.3
North/Central	<0.1	0.4	1.1	3.3
South/Central	0.2	0.7	1.3	11.4
South	<0.1	0.1	0.3	4.2
Subtotal	**0.2**	**1.8**	**3.9**	**23.2**
Lower Valley Water District	**0.0**	**5.2**	**7.5**	**9.5**
Horizon	**0.5**	**1.0**	**1.5**	**1.5**
Total	**29.3**	**40.9**	**51.7**	**73.8**

[a] Summarized From Table 4-5.

Growth Pattern

In addition to assumptions as outlined above, the pattern of growth in the PSA is important to the development of alternative wastewater management programs for east El Paso. Existing conveyance and treatment facilities for El Paso include the Bustamante WWTP and large diameter interceptors which convey flow south from IH-10 to the plant (refer to Chapter 6 for a description of these facilities). New infrastructure such as wastewater conveyance and treatment facilities must be constructed to support a logical pattern of growth. The most cost effective means to expand wastewater service to the PSA, is to expand outward from the existing facilities. For the east El Paso area, growth has been assumed to proceed east from Loop 375 and north from IH-10. Alternatives developed in this chapter are generally designed to support this pattern of growth. Since growth is initially expected in the north and central regions of the PSA instead of logically from the south, initial phase improvements incorporate the flexibility to meet the demand of sporadic growth along Loop 375.

DESCRIPTION OF ALTERNATIVES

Conceptually, three general alternatives have been considered as long range wastewater management programs for the east El Paso area:

- Alternative 1. All wastewater generated within the region would be conveyed to the Bustamante WWTP for treatment. The capacity of the Bustamante plant would be initially expanded by 21-mgd.

- Alternative 1a. All wastewater produced within the RSA would be conveyed to the Bustamante WWTP for treatment. The capacity of the Bustamante plant would be expanded in smaller increments than in Alternative 1: 11-mgd by 2002 and 10-mgd by 2012.

- Alternative 2a. In addition to continued long-term treatment at the Bustamante WWTP, a new wastewater treatment and reclamation plant would be constructed. This facility would be located just north of IH-10 and would treat all of the flow from the PSA.

- Alternative 2b. Similarly to Alternative 2a, a new wastewater treatment and reclamation plant would be constructed just north of IH-10. This facility would treat a portion the flow from the PSA. The remainder of the flow will be treated at the Bustamante WWTP.

- Alternative 2c. In addition to improvements recommended under Alternative 1a, this alternative utilizes the construction of a small 2-mgd reclamation plant to meet the projected water demand of a proposed golf course north of IH-10.

- Alternative 3a. This alternative is similar to Alternative 2a in that all of the flow generated within the PSA would be initially treated at a new plant north of IH-10. However, in addition to a new plant located immediately north of IH-10, a second plant would be constructed after 2015 within the North/Central quadrant of the new service area for more effective distribution of reclaimed water.

- Alternative 3b. Similarly to Alternative 3a, a new wastewater treatment and reclamation plant would be initially constructed just north of IH-10 to treat a portion the flow from the PSA and a second plant would be constructed after 2015 within the North/Central quadrant. The remainder of the flow would be treated at the Bustamante WWTP.

Alternative 1

Major conveyance and treatment facilities needed to provide a long-range wastewater management program for east El Paso under Alternative 1 are as presented on Figure 7-2.

Conveyance Facilities. As presented on the Figure, a new interceptor would be constructed from Montana Avenue south to IH-10 for conveyance of wastewater generated within the PSA. To minimize the need for lift stations and force mains, the proposed interceptor alignment will closely match the natural drainage alignment for the service area. The predominant drainage pattern within the PSA is from north to south. A gentle ridge roughly paralleling the existing City Limits divides the existing and principal study areas. Within the PSA, the elevation drops from the eastern boundary west towards the predominant drainage alignment.

As illustrated in Figure 7-2, the new PSA interceptor would be constructed in phases. In order to serve growth within the northern quadrant, the initial phase of improvements includes construction of approximately one mile of 18-inch gravity sewer from Montana, south to the future extension of Edgemere. At this point, a new lift station and short segment of sewer force main would be constructed to lift flow from the new gravity interceptor into the existing 18-inch Edgemere Line. Sufficient residual capacity is available in this existing line to accommodate projected future flows through the initial and part of the Phase I planning periods (1997 to 2007).

Initial improvements include construction of a second segment of the new gravity interceptor system to serve existing and anticipated future development within the North Central quadrant. As illustrated on Figure 7-2, approximately one mile of 30-inch gravity sewer would be constructed from Zaragosa Road south to the future Triumph Street alignment. A new lift station and force main would tie this new line to an existing 15-inch sewer along Montwood.

As previously discussed, the Texas GLO anticipates significant development and growth of their properties located within the South/Central Service quadrant. Initially, insufficient flow would be generated to meet suitable low flow criteria for the new 36-inch gravity sewer which will be ultimately required. Thus, a new 12-inch collector sewer would be initially constructed along an alignment immediately east of the present City limits. An additional one mile of 18-inch gravity interceptor would be constructed along Rojas Drive to convey flow from the new collector line into an existing 18-inch line.

The remainder of the proposed new gravity sewer system would be constructed during the Phase I planning period (2006-2010). By the year 2007, it is projected that little or no residual conveyance capacity will be available in existing sewer lines. Therefore, during the Phase I planning period, temporary tie-ins to existing sewers at Edgemere Boulevard and Montwood Avenue would be disconnected and all flow collected within the PSA would be conveyed south in the new interceptor.

The topography of this area is such that insufficient grade is available to convey wastewater entirely by gravity south from Montana Avenue to IH-10. One or more intermediate lift stations are required. Lift stations constructed as part of initial improvements at Edgemere Boulevard and Triumph Streets are suitably located for this purpose. Those lift stations would, therefore, be configured for future expansion, as required to handle anticipated future flows.

Phase I improvements would include new 15- and 18-inch gravity sewers to serve development within the south quadrant. New sewers could be constructed along the existing IH-10 frontage road alignment to convey flow by gravity northwest to a location near the El Paso/Socorro City limits boundary. From there, flow would need to be lifted into a new 54-inch gravity interceptor along Rojas Drive. By the year 2007, projected flows will be nearing the capacity of the existing 21-inch gravity interceptor located just east of Loop 375 so that a new parallel sewer would be needed. Proposed Phase I improvements include, therefore, the new 54-inch gravity sewer, paralleling the existing 21-inch line.

As previously discussed, provisions are included in this regional planning effort for future wholesale wastewater service to Horizon City. A new 15-inch gravity sewer constructed along Horizon Boulevard is included in Phase I for this purpose. Wastewater from Horizon City would be intercepted by 2012 in the vicinity of their existing wastewater treatment plant and conveyed by gravity in this new pipeline.

Conveyance of wastewater collected north of IH-10 to the Bustamante WWTP would require future increase of the carrying capacity of the existing 48- and 60-inch gravity interceptors in the Mesa Drain Interceptor system. As presented on Figure 7-2, Phase II improvements include construction of a new 54-inch gravity interceptor roughly paralleling the alignment of these existing interceptors. A comprehensive alignment study would be required to determine the most cost-effective alignment for construction of this large diameter sewer.

Treatment Facilities. In order to treat projected future flows, an expansion of the Bustamante WWTP would be required in the initial phase of improvements. Capacity of the existing facility is 39-mgd. The proposed initial module of expansion of this facility is a nominal 21-mgd, increasing total treatment capacity to 60-mgd. This larger expansion element has the advantage of minimizing the number and frequency of future expansions.

To treat the projected buildout flows for the entire study area, including the Lower Valley and Horizon City, the ultimate capacity of the Bustamante WWTP would be increased to approximately 74-mgd. Thus, an additional 14-mgd of treatment capacity would be added to the plant during the ultimate planning period (beyond the year 2015). The actual rate of growth beyond the year 2015 would dictate the exact time frame for design and construction of this future treatment element.

Alternative 1a

The basic concept of Alternative 1a is the same as that of Alternative 1, the conveyance and treatment of all wastewater generated in the Region at the Bustamante WWTP. The primary difference between Alternative 1 and Alternative 1a is the size of the Bustamante plant expansion. The conveyance system improvements required under Alternative 1a are the same as those required under Alternative 1. The estimated layout and timing of the improvements required under Alternative 1a are presented on Figure 7-3.

With this alternative, an initial 11-mgd expansion of Bustamante would need to be on-line by 2002 instead of the 21-mgd expansion proposed in Alternative 1. Additionally, a 10-mgd expansion of Bustamante would be needed by 2010. The phased expansion of Bustamante allows PSB to defer part of the cost of expanding the plant thus matching more closely the plant's influent flow with it's capacity. A smaller plant expansion reduces the initial capital investment and allows for future flexibility to adopt a different alternative.

Alternative 2a

Major conveyance and treatment facilities proposed for Alternative 2a are presented in Figure 7-4. A significant element of this alternative is construction of a new Eastside WWTP immediately north of IH-10. The facilities are as described below.

Conveyance Facilities. As with Alternative 1, the backbone of Alternative 2a collection system is the phased construction of a new gravity interceptor from Montana Avenue to IH-10. Phasing of construction of this new interceptor, including temporary tie-ins to existing sewer lines during the initial planning period, is the same as described for Alternative 1. In addition to constructing elements of the backbone interceptor, initial phase conveyance facilities to be constructed include a new 30-inch gravity sewer line along Rojas Drive. The new line would begin at a 24-inch tie-in to the existing sewer line east of Zaragosa Road and terminate at the new Eastside WWTP. The purpose of this new sewer line is to intercept flow from the existing sewer system and convey it for treatment at the new plant. Preliminary assessment indicates that the new Rojas Drive diversion sewer may require an intermediate lift in the vicinity of Loop 375. Refined analysis would be required to verify this preliminary conclusion.

Phase I conveyance system improvements are identical to those presented for Alternative 1. Phase I improvements include completion of the new backbone gravity sewer system within the PSA and new 15- and 18-inch sewers to serve Horizon City and the South service quadrant.

All flow within the PSA would be treated at the new Eastside WWTP. This configuration significantly reduces the amount of flow to be conveyed south of IH-10 for treatment at the Bustamante WWTP. As a result, the need to construct future parallel sewers to increase carrying capacity to the Bustamante plant is eliminated.

A 30-inch line is required for the conveyance of the initial 8-mgd discharge from the new Eastside WWTP to the irrigation drain system south of IH-10. Preliminary conclusions indicate that the effluent would need to be conveyed to the Riverside Drain adjacent to the Bustamante WWTP. Future expansion of the new plant would require additional effluent disposal capacity.

Treatment Facilities. As presented on Figure 7-4, initial improvements include construction of the new Eastside WWTP. A new treatment facility north of IH-10, provides a cost effective source of reclaimed water to meet demands in this area. Advantages of this location include; minimizing required pumping, the availability of large tracts of undeveloped property and well developed drainage facilities to accommodate surface discharge of treated wastewater. A detailed siting investigation would be required, however, for final site selection.

For purposes of alternative development, initial plant size was selected to be 8-mgd. Flows from the Rojas Drive diversion sewers through the year 2005 are anticipated to be in the range of 3 to 4-mgd. Projected flows within the principal study area could contribute an additional 1.5 to 2.0-mgd. Total flow to the plant during the initial planning period has been estimated to be between 4.5 to 6.0-mgd. Although a smaller initial plant size may be feasible, the number and size of subsequent plant expansions would be increased. Refinements in initial plant size selection would be made as part of further development of this alternative.

As development within the existing service area continues, future expansion of the Bustamante WWTP will be required. As presented on Figure 7-4, an 11-mgd expansion of the Bustamante plant will be required during the Phase I improvement period.

As the PSA continues to develop, future expansion of the Eastside WWTP will also be required. An additional 16-mgd expansion of the Eastside plant would be required beyond the year 2015 to treat the projected buildout flow within the PSA.

Alternative 2b

With Alternative 2b, as presented in Figure 7-5, the size of the new Eastside plant would remain at 8-mgd to more closely match demands for reclaimed water. Future flows in excess of this capacity would be conveyed to the Bustamante WWTP for treatment. As a consequence, future expansions to the Bustamante WWTP and portions of the Mesa Drain Interceptor system would be required. As illustrated on Figure 7-5, a new 36-inch parallel sewer from IH-10 south to the Bustamante WWTP would be required sometime after the 2015. In addition, a 16-mgd expansion of the Bustamante WWTP would also be required during this time frame.

Alternative 2c

Alternative 2c is similar to Alternative 1a with the addition of a small reclamation plant located in the PSA. Figure 7-6 shows the layout of the improvements required by this alternative. The required improvements are outlined below:

Conveyance Facilities. The conveyance improvements are the same as those required under Alternative 1a with the addition of a temporary 18-inch diversion line along Rojas Drive constructed during the Initial Phase. The purpose of this diversion line is to provide flow to the new 2-mgd reclamation plant until the new 36-inch interceptor is constructed in Phase I. Collection system modeling predicts the diversion line will have to connect with an existing 21-inch line along Rojas east of Loop 375. If the flow available in this line is insufficient, the diversion would have to connect with the Saul Kleinfeld Interceptor east of Zaragosa and an intermediate lift station would be required.

Treatment Facilities. In addition to the improvements outlined for Alternative 1a, a 2-mgd reclamation plant would be constructed north of IH-10. It has been estimated that the new plant would operate on a seasonal basis. This plant is sized to provide reuse water for a golf course proposed in the vicinity. The reclamation plant will not have solids handling capabilities; thus, requiring the solids to be discharged into the Bustamante collection system. Although plans do not include an increase in the size of the reclamation plant, this alternative does not preclude this future requirement.

Alternative 3a

Major conveyance and treatment facilities proposed for Alternative 3a are presented on Figure 7-7. Alternative 3a is similar to Alternative 2a in that it includes construction of a new Eastside WWTP in an area immediately north of IH-10. The major difference, between these alternatives, is the future construction of a second treatment plant within the North/Central Service quadrant to treat flows from the northern half of the PSA.

Initial and Phase I improvements for construction of conveyance and treatment facilities under this alternative are identical to Alternative 2a. They include; completion of the backbone interceptor sewer to serve the PSA, new gravity sewers to serve the South quadrant and Horizon City and an 11-mgd expansion of the Bustamante WWTP. Since a portion of the future flows from the North and North/Central service quadrants would be intercepted and treated at the new Montwood plant, downstream interceptor sewer sizes would be smaller than those required under Alternative 2a.

Construction of the new Montwood plant would be completed sometime after the year 2015. The concept for this facility is that it would be sized as needed to meet reclaimed water demands in the northern portions of both the existing and future service areas. A thorough study of viable reuse opportunities within this area as part of future detailed planning of this facility will provide the basis for final sizing of the plant. For purposes of development and evaluation of this alternative, 4-mgd has been selected as a representative size.

Alternative 3a shares the effluent disposal issue as described for Alternative 2a. A 30-inch line is required for conveyance of the initial 8-mgd discharge from the new Eastside WWTP to the irrigation drain system south of IH-10. Due to the quantity of effluent, the discharge would be conveyed to the Riverside Drain adjacent to the Bustamante WWTP. Future expansion of the new plant would require additional discharge capacity. With this alternative, the construction of the new Montwood plant would be required by the smaller downstream interceptor size. This presents a significant effluent disposal issue since the proposed site of the new Montwood plant is about three miles further away from the preferred discharge point.

Alternative 3b

Alternative 3b is similar to Alternative 2b in that the size of the new Eastside plant would remain at its initial size to more closely match demands for reclaimed water. The new Eastside WWTP would be constructed at an initial capacity on the order of 8-mgd with no future expansion. All future flows generated within the PSA would be treated in the PSA resulting in a significant surface discharge when the demand for reclaimed water is exceeded. Excess flows would be conveyed to the Bustamante plant for treatment.

This alternative includes the construction of the new Montwood plant in the PSA sometime after the year 2015 thus reducing the flows conveyed to the Bustamante WWTP. As illustrated on Figure 7-8, the new parallel sewer required after the year 2015 would be 30-inches in diameter, compared to the 36-inch line required under Alternative 2b. Additionally, the expansion to the Bustamante WWTP required during the same time frame would be 12-mgd rather than the 16-mgd required for Alternative 2b.

The discharge concerns described for Alternative 3a also apply to this alternative. A 30-inch pipeline would be initially required between the plant and the Riverside Drain. The construction of the new Montwood plant would be required due to the lack of downstream interceptor capacity. Effluent disposal would become a major issue as presented under Alternative 3a.

PLANNING TIMELINES

As a means to illustrate when facilities need to be planned, developed, designed, and constructed, the flow projections were plotted versus time. This tool helps visualize the timelines associated with each alternative. The results are shown on Figures 7-9 through 7-11.

As shown, the initial improvements for all alternatives are required to be under construction by 2001. Alternatives 2a/2b and Alternatives 3a/3b, shown on Figure 7-11, require the most expedient initial planning activities for planning of the new Eastside plant. The planning activities required for the 2-mgd reclamation plant proposed under Alternatives 1a and 2c are not shown on Figure 7-10 because there is no net gain in treatment capacity due to its seasonal operation.

CHAPTER 8

EVALUATION OF ALTERNATIVES

This Chapter presents the evaluation of the alternatives, which forms the basis for selecting the recommended plan. Each alternative is evaluated then compared to the others on the basis of both economic and non-economic considerations.

NON-ECONOMIC CONSIDERATIONS

When evaluating long-range facility improvement programs such as the ones developed in this study, issues in addition to cost, must be carefully considered. Non-cost issues considered as part of this evaluation are as follows:

- Reuse Potential
- Flexibility
- Reliability
- Public Acceptance
- Environmental Impact
- Implementation
- Constructability

A discussion of each of these considerations has been presented below.

Reuse Potential

Reuse of treated wastewater is an important part of the PSB's long-term program to conserve El Paso's limited water resources. Long-range water resource management planning includes wastewater reuse as a critical element in assuring sufficient resources to meet anticipated future needs. Enhancement of wastewater reuse opportunities is, therefore, a highly desirable feature for any long-range wastewater management program.

Alternatives 1 and 1a, centralize all treatment at the Bustamante WWTP which is located at the southern end of the service area.

Preliminary reuse planning has identified approximately 1.5 billion gallons of annual reuse water demand from potential users within approximately 5 miles of the Bustamante WWTP. Principal among the potential users is the Riverside International Industrial Center. Design is currently completed for conveyance, pumping, storage and filtration facilities needed to supply reuse water to the Center.

Although the proposed reuse program would make a substantial contribution towards reduction of potable water demands for industrial use and large turf irrigation needs, projected demands of 1.5 billion gallons per year equate to an average daily use of just over 4-mgd or about 10-percent of the Bustamante WWTP's current treatment capacity.

The estimated cost for major transmission lines, pumping stations and storage tanks, needed to supply reuse water to users within the 5 mile service zone would be over $7,000,000. Extending reuse conveyance facilities significantly beyond a 5 mile service zone would substantially increase the cost of needed facilities. Developing a reuse program to use all or a substantial portion of the treated effluent produced at the Bustamante WWTP has been, therefore, very costly.

Construction of the new Eastside WWTP, as proposed for Alternatives 2a, 2b, 2c, 3a, and 3b, offers a second point of supply of reuse water for areas north of IH-10. Although a more complete investigation would need to be conducted, significant reuse opportunities exist in the vicinity of the proposed new treatment plant site. Among these opportunities are a proposed golf course, parks and other large turf areas being considered as part of proposed Texas General Land Office (GLO) developments in the area. Industrial and commercial activities along the IH-10 corridor may offer additional significant reuse opportunities. By providing a second point of supply north of IH-10, Alternatives 2a, 2b, and 2c reduce the costs of reuse, and significantly expand the opportunities for effluent reuse in the east El Paso area. While Alternatives 2a and 2b initially require a discharge to the Riverside Drain, the 2 mgd reclamation plant proposed for Alternative 2c closely corresponds with the reuse demand of the area. A smaller plant would operate seasonally to minimize storage but can be operated continuously or it could be expanded to meet increased demand.

Alternatives 3a and 3b further enhance the distribution of reuse water supplies in the east El Paso area. Although not constructed until some time beyond the year 2015, the new Montwood Reclamation plant would provide a third source of reuse water to meet future demands within the North and North/Central quadrants of the PSA. Compared with other alternatives developed in this study, Alternatives 3a and 3b maximize the number of distribution points for reclaimed water within the PSA. Consequently, if demand for reclaimed water decreases, these Alternatives will require discharge facilities for conveying effluent to the Riverside Drain.

Thus, Alternatives 1 and 1a were ranked the worst for reuse potential due to the high cost of providing reclaimed water to the PSA. Since a smaller reclamation plant proposed for Alternative 2c would be sized based on the demand for reclaimed water thus eliminating the need for a costly discharge line, this alternative was rated the best for reuse potential.

Flexibility

This criteria has been a measure of the flexibility of each alternative to adapt to future changes in population growth and distribution, deferment of capital expenditures, and changing regulatory and environmental controls.

Under Alternative 1, a large capital expenditure has been made initially to expand the Bustamante WWTP. If the anticipated rate and distribution of growth within the service area varies from that planned, then effective utilization of these treatment facilities may be reduced. Once the 21-mgd expansion has been constructed, the PSB has been committed to this alternative through the 20-year planning period. If the demand for reclaimed water increases in the PSA, the cost of adding new reuse facilities to Alternative 1 would be prohibitive.

The phased expansion of the Bustamante WWTP for Alternative 1a allows for effective utilization of plant capacity with a smaller Initial Phase expansion by deferring construction of the second expansion until the need arises. By comparison, the other alternatives propose multiple plant construction in modules which more closely match the anticipated growth rate.

The Initial Phase improvements described for Alternative 2a are the same as Alternatives 2b, 3a, and 3b. This feature provides flexibility by deferring the final decision for subsequent improvements. For example, with Alternatives 2a and 2b, the final decision as to whether to expand the new Eastside WWTP (Alternative 2a) or to expand the Bustamante WWTP (Alternative 2b) can be deferred until the Phase I improvement period. This provides the significant advantage of allowing future assessment of regulatory, environmental, growth and economic conditions to ensure selection of the best improvement program at that time.

Alternative 2c has been the most flexible alternative. The use of an initially smaller reclamation plant closely meets the demand for reclaimed water. Additionally, the decision to expand this plant; expand the Bustamante plant; or construct the new Montwood plant has been deferred until demand for reclaimed water increases in those areas or until the large diameter interceptors are built south of IH-10.

Under Alternatives 3a and 3b, however, constructing smaller diameter downstream sewer lines, commits the PSB to future construction of the new Montwood facility. The future cost to parallel or replace downstream sewer lines, should the new Montwood facility not be constructed, would be prohibitively expensive. Alternatives 3a and 3b have therefore been evaluated with the same size interceptor as proposed under Alternatives 2a and 2b. The cost analysis of these alternatives includes this change.

The inflexibility of Alternative 1 to adjust to changes in the pattern and rate of growth and the prohibitive costs associated with distributing reclaimed water to the PSA resulted in the lowest flexibility rating. A small reclamation plant located in the PSA sized to meet demand for reclaimed water and the flexibility to adopt any alternative in the future resulted in Alternative 2c receiving the highest flexibility rating.

Reliability

Reliability refers to the ability of the selected program to consistently meet or exceed all service requirements. In general, for all alternatives, mechanical systems including lift stations and treatment facilities would be designed with appropriate redundancies to ensure continued service in the event of limited equipment failures.

Alternatives 1, 1a, and 2c provide greater overall reliability as compared to Alternatives 2a, 2b, 3a, and 3b since regional treatment has been centralized at the Bustamante plant. The new reclamation plant proposed for Alternative 2c does not affect the overall system reliability since it has been intended to operate as a seasonal plant.

Public Acceptance

Public acceptance primarily relates to acceptance by local residents to building and operating wastewater conveyance and treatment facilities. All alternatives consist of both publicly desirable and undesirable items.

Alternatives 1 and 1a are the lowest cost alternatives, a very important aspect of public acceptance. Provisions have been made in the design and layout of the Bustamante WWTP for future expansion of this facility. Sufficient property has been available to provide an appropriate buffer between the expanded plant and development as it occurs in this area. Extensive public participation was conducted in planning this facility to ensure public input into the original selection process.

Negative public acceptance aspects of Alternatives 2a, 2b, 2c, 3a, and 3b are the increased capital costs and the need to construct a new treatment plant in a future residential zone. Additionally, new pipelines would traverse developed areas and may need to be constructed within major thoroughfare alignments. Although appropriate measures would be taken to minimize disruption, some adverse impact to area residents would be expected.

Public scrutiny of Alternatives 3a and 3b would be the greatest due to the proposal of two new treatment plant in future residential zones. These alternatives were rated the lowest for public acceptance.

Although both Alternative 1 and 1a involve the publicly preferential expansion of an existing WWTP, Alternative 1a has the added advantage of deferring capital costs with the phased expansion of Bustamante. It was rated the highest for public acceptance.

Environmental Impact

An assessment of environmental impact has been based upon consideration of short and long term impacts upon threatened or endangered species habitats, sensitive archaeological, historical, floodplain, wetland, or groundwater areas.

Expansion of the Bustamante WWTP, proposed under Alternatives 1, 1a, and 2c, has been considered less likely to have an adverse environmental impact than construction of either the new Eastside or Montwood Reclamation Plants. The reclamation plant proposed for Alternative 2c has been considered to have a positive environmental impact associated with the production of reclaimed water, thus, reducing the demands on fresh water supplies. Therefore, Alternatives 1, 1a, and 2c are rated the highest for environmental impact.

As discussed in Chapter 10, a primary concern associated with constructing new facilities within the PSA has been the potential for archaeologically significant areas. This concern has been consistent with all alternatives since a new interceptor backbone has been absolutely required. Proper planning and monitoring minimizes any potential adverse impacts as part of siting new treatment facilities. Consequently, Alternatives 2a, 2b, 3a, and 3b are rated as having a less positive environmental impact.

Implementation

Implementation deals with the relative ease or difficulty of acquiring right-of-ways, properties, and public agency and regulatory approvals needed to build and operate new facilities.

As previously discussed, siting and permitting of new treatment facilities would be significant activities. Thus, Alternative 1 and 1a are rated easier to implement than the other alternatives since they involve only the expansion of an existing plant.

Constructability

This criteria has been a measure of the relative ease or difficulty of constructing each alternative.

As previously discussed, due to physical constraints, constructing large diameter sewers within developed areas as required under Alternative 1 would be difficult. Increased capacity of the Bustamante WWTP interceptors would also be required in the future for Alternatives 2b and 3b. The phased expansion of the Bustamante WWTP increases the constructability of Alternatives 1a and 2c. The lack of major interceptors south of IH-10 under Alternatives 2a and 3a are, therefore, considered advantages over the other alternatives with respect to constructability.

ESTIMATE OF COSTS

Costs presented in this Chapter are intended to provide a fair relative comparison of the costs of each alternative. Estimates for both construction and operating and maintenance costs are derived from a data base compiled for costs of similar facilities. When available, actual costs for construction and operation and maintenance of El Paso Water Utilities Facilities were used.

Generally, for planning level estimates, no attempt was made to characterize construction details such as soil types, groundwater depths, utility conflicts, etc. which may affect the actual costs for construction of new facilities. A 20 percent contingency has been added to the construction costs estimates presented in this study to account for these considerations.

All costs are estimated based on 1997 dollars. To provide a basis for comparison, the present worth of all future costs were calculated through the Phase II improvement period (1997 to 2015). A rate of 3 percent has been used to inflate the cost estimates to future values. A discount rate of 6 percent was used to calculate present worth values.

Cost estimates for each alternative were presented in Tables 8-1 through 8-5. A detailed breakdown of costs as presented in these tables has been provided in Appendix B. The recommended plan would include additional costs for improvements to the existing Bustamante WWTP collection system outlined in the Collection System Modeling Report. These costs were not included in the values discussed below.

Alternative 1

As presented in Table 8-1, the total estimated present worth of capital costs for Initial Phase improvements under Alternative 1 would be $54,508,000. Annual operating and maintenance costs for those facilities were estimated to be between $98,000 and $170,000 for the period between 2001 and 2005. The total present worth of costs for the Alternative 1 Initial Phase improvement period would be $54,773,000. Similar estimates of costs have been made for the Phase I and Phase II planning periods. Based on these estimates, the total present worth cost of Alternative 1 would be $78,635,000.

The addition of reuse capabilities to Alternative 1 could be achieved with the addition of a 2-mgd filter, a high-head 2-mgd effluent pump station, and approximately 30,500 feet of 14-inch pipe. These facilities would allow Bustamante WWTP effluent to be used for irrigation of the proposed golf course north of IH-10 and would add an estimated $10,000,000 to the total present worth value of Alternative 1.

Alternative 1a

By phasing the expansion of the Bustamante WWTP, the Initial Phase improvements for Alternative 1a were substantially less than those proposed for Alternative 1, as presented in Table 8-2. The total estimated present worth of capital costs for Initial Phase improvements under would be $30,327,000. Annual operating and maintenance costs for those facilities were estimated to be the same as those outlined for Alternative 1. The total present worth for the Alternative 1a Initial Phase improvement period would be $30,592,000. Similar estimates of costs have been made for the Phase I and Phase II planning periods. Based on these estimates, the total present worth cost of Alternative 1a would be $72,308,000.

The addition of reuse capabilities to Alternative 1a could be achieved in the manner as outlined for Alternative 1. This would raise the total present worth cost of Alternative 1a by approximately $10,000,000.

Alternatives 2a and 2b

Estimated costs for Alternatives 2a and 2b were as presented in Table 8-3. Proposed improvements and their costs were the same for each of these alternatives through the Phase II planning period. Differences between these two alternatives occur beyond the year 2015 when decisions must be made to either expand the new Eastside WWTP or to expand the Bustamante WWTP and associated interceptors south of IH-10.

Total estimated present worth of capital costs for Initial Phase improvements under Alternatives 2a and 2b were $36,032,000, or almost $6,000,000 more than Alternative 1a Initial Phase improvements.

Unit costs for operation of the new Eastside WWTP were higher than unit costs for operation of the Bustamante WWTP. Estimated annual operation and maintenance costs for Initial Phase improvements under Alternative 2a and 2b were between $1,530,000 and $1,797,000. This includes additional permitting and laboratory costs required for a new plant. The Initial Phase total present worth cost estimate for Alternatives 2a and 2b would be $39,337,000.

The estimated capital costs for Phase I improvements for Alternative 2a and 2b were significantly higher than Phase I improvement costs for Alternative 1a. Estimated Phase I present worth capital improvement costs under Alternatives 2a and 2b total $31,969,000 compared with costs of $12,527,000 under Alternative 1a for this same period. The need to expand the capacity of the Bustamante WWTP with Phase I of Alternatives 2a and 2b accounts for this difference. This expansion would be deferred five years under Alternative 1a.

As presented in Table 8-3, the total present worth cost of Alternatives 2a and 2b would be estimated to be $85,069,000. This cost would be approximately $13,000,000 or 15 percent more than the estimated total present worth cost of Alternative 1a. Adjusting for reuse capabilities, the difference between Alternative 1a and Alternatives 2a and 2b becomes about $3,000,000.

Alternative 2c

As presented in Table 8-4, the total estimated capital cost for Initial Phase improvements under Alternative 2c would be $36,009,000. Annual operating and maintenance costs for those facilities were estimated to be between $552,000 and $601,000. These values account for additional permitting and laboratory costs for the new 2-mgd reclamation plant. The total present worth for the Alternative 2c Initial Phase improvement period would be $37,153,000. Similar estimates of costs have been made for the Phase I and Phase II planning periods. Based on these estimates, the total present worth of Alternative 2c would be $81,465,000.

Alternative 3a and 3b

The costs shown in Table 8-5 account for the use of an interceptor of the same size as proposed for Alternatives 2a and 2b which increases the flexibility of this alternative to an acceptable level. In doing so, the cost of Alternatives 3a and 3b becomes the same as the cost of Alternative 2a and 2b within the 20-year planning period. As a result, the total estimated present worth of Alternatives 3a and 3b would be $ 85,069,000.

Differences between the costs of Alternatives 2a/2b and Alternatives 3a/3b occur beyond the year 2015 when the new Montwood WWTP has been proposed for construction.

Differences between the costs of Alternatives 3a and 3b occur beyond the year 2015 when a decision must be made to proceed with expansion of either the Bustamante or New Eastside WWTP. Associated with expansion of the Bustamante WWTP, would be the need to construct additional interceptor capacity south of IH-10.

COMPARISON OF ALTERNATIVES

Based on both cost and non-cost criteria as discussed above, a numerical rating and ranking of each alternative has been prepared. The ranking values shown for Alternative 3a and 3b have been adjusted to account for the use of a larger backbone interceptor, resulting in Alternatives 2a/2b and 3a/3b being equal in the 20-year planning period. Results were summarized on Table 8-6. Based on this analysis, Alternative 2c received the highest overall rating with Alternative 1a receiving a slightly lower rating. Alternative 2c provides several advantages including:

1. Minimizes the number of large treatment plants.

2. Smaller Initial Phase expansion of Bustamante WWTP allows for more efficient utilization of plant capacity.

3. Enhanced reuse potential by providing a second source of reuse water supply north of IH-10 that corresponds with the demand for reuse water.

4. Lowest overall cost for a reuse alternative.

5. Construction of new parallel interceptors from IH-10 to the Bustamante WWTP helps relieve overloaded areas of existing collection system.

6. Initial Phase capital costs are deferred.

7. Optimizes operation and maintenance costs.

For reasons as outlined above, Alternative 2c was selected as the recommended wastewater management program for the East El Paso area.

REFERENCES

1. Feasibility Report on Wastewater Reuse Opportunities, Boyle Engineers Corporation, November 1992.

TABLE 8-1

ESTIMATE OF COSTS - ALTERNATIVE 1

Item	Estimated Costs, Dollars		
	INITIAL	PHASE 1	PHASE 2
Construction - Year Initiated	**2001**	**2007**	**2012**
Pipelines	$1,797,000	$9,259,300	$3,927,000
Lift Stations	$900,000	$1,510,000	$2,320,000
Treatment Facilities	$36,750,000	$0	$0
Subtotal (With Inflation)	$44,397,000	$14,473,000	$9,733,000
Overhead and Profit (10%)	$4,439,700	$1,447,300	$973,300
Administrative (5 percent) Engineering and Legal (20 percent)	$11,099,250	$3,618,250	$2,433,250
Contingency (Engineering (10 percent), Construction (10 percent))	$8,879,400	$2,894,600	$1,946,600
Total Capital Costs	$68,815,350	$22,433,150	$15,086,150
Present Worth of Capital Costs	$54,508,000	$12,527,000	$6,295,000
Annual Operation and Maintenance (O&M)			
Pipelines	$5,000	$34,000	$52,000
Lift Stations	$61,000	$132,000	$269,000
Treatment Facilities	$32,000	$585,000	$877,000
Permitting	$0	$0	$0
Laboratory Analysis	$0	$0	$0
Phase O&M Subtotal	$402,000	$4,359,000	$7,030,000
Present Worth of O&M	$265,000	$2,285,000	$2,755,000
Total Present Worth	$54,773,000	$14,812,000	$9,050,000
Total PW =			**78,635,000**

Note: See Appendix B for capital and O&M costs breakdown.

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TABLE 8-2

ESTIMATE OF COSTS - ALTERNATIVE 1a

Item	Estimated Costs, Dollars		
	INITIAL	PHASE 1	PHASE 2
Construction - Year Initiated	**2001**	**2007**	**2010**
Pipelines	$1,797,000	$9,259,300	$3,927,000
Lift Stations	$900,000	$1,510,000	$2,320,000
Treatment Facilities	$19,250,000	$0	$17,500,000
Subtotal (With Inflation)	$24,701,000	$14,473,000	$34,873,000
Overhead and Profit (10%)	$2,470,100	$1,447,300	$3,487,300
Administrative (5 percent) Engineering and Legal (20 percent)	$6,175,250	$3,618,250	$8,718,250
Contingency (Engineering (10 percent), Construction (10 percent))	$4,940,200	$2,894,600	$6,974,600
Total Capital Costs	$38,286,550	$22,433,150	$54,053,150
Present Worth of Capital Costs	$30,327,000	$12,527,000	$25,342,000
Annual Operation and Maintenance (O&M)			
Pipelines	$5,000	$34,000	$52,000
Lift Stations	$61,000	$132,000	$269,000
Treatment Facilities	$32,000	$307,000	$555,000
Permitting	$0	$0	$0
Laboratory Analysis	$0	$0	$0
Phase O&M Subtotal	$402,000	$2,883,000	$6,034,000
Present Worth of O&M	$265,000	$1,508,000	$2,339,000
Total Present Worth	$30,592,000	$14,035,000	$27,681,000
Total PW =			**72,308,000**

Note: See Appendix B for capital and O&M costs breakdown.

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TABLE 8-3

ESTIMATE OF COSTS - ALTERNATIVES 2a and 2b

Item	Estimated Costs, Dollars		
	INITIAL	PHASE 1	PHASE 2
Construction - Year Initiated	**2001**	**2007**	**2012**
Pipelines	$4,086,000	$6,334,000	$0
Lift Stations	$1,990,000	$1,900,000	$2,320,000
Treatment Facilities	$20,000,000	$19,250,000	$0
Subtotal (With Inflation)	$29,348,000	$36,936,000	$3,614,000
Overhead and Profit (10%)	$2,934,800	$3,693,600	$361,400
Administrative (5 percent) Engineering and Legal (20 percent)	$7,337,000	$9,234,000	$903,500
Contingency (Engineering (10 percent), Construction (10 percent))	$5,869,600	$7,387,200	$722,800
Total Capital Costs	$45,489,400	$57,250,800	$5,601,700
Present Worth of Capital Costs	$36,032,000	$31,969,000	$2,337,000
Annual Operation and Maintenance (O&M)			
Pipelines	$13,000	$34,000	$40,000
Lift Stations	$111,000	$205,000	$354,000
Treatment Facilities	$1,195,000	$1,470,000	$2,035,000
Permitting	$358,000	$138,000	$160,000
Laboratory Analysis	$119,000	$130,000	$151,000
Phase O&M Subtotal	$4,954,000	$10,607,000	$14,934,000
Present Worth of O&M	$3,305,000	$5,566,000	$5,860,000
Total Present Worth	$39,337,000	$37,535,000	$8,197,000
Total PW =			**85,069,000**

Note: See Appendix B for capital and O&M costs breakdown.

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TABLE 8-4

ESTIMATE OF COSTS - ALTERNATIVE 2c

Item	Estimated Costs, Dollars		
	INITIAL	PHASE 1	PHASE 2
Construction - Year Initiated	**2001**	**2007**	**2010**
Pipelines	$2,409,000	$9,259,300	$3,927,000
Lift Stations	$900,000	$1,510,000	$2,320,000
Treatment Facilities	$22,750,000	$0	$17,500,000
Subtotal (With Inflation)	$29,329,000	$14,473,000	$34,873,000
Overhead and Profit (10%)	$2,932,900	$1,447,300	$3,487,300
Administrative (5 percent) Engineering and Legal (20 percent)	$7,332,250	$3,618,250	$8,718,250
Contingency (Engineering (10 percent), Construction (10 percent))	$5,865,800	$2,894,600	$6,974,600
Total Capital Costs	$45,459,950	$22,433,150	$54,053,150
Present Worth of Capital Costs	$36,009,000	$12,527,000	$25,342,000
Annual Operation and Maintenance (O&M)			
Pipelines	$7,000	$37,000	$56,000
Lift Stations	$84,000	$158,000	$299,000
Treatment Facilities	$386,000	$729,000	$1,043,000
Permitting	$60,000	$0	$0
Laboratory Analysis	$30,000	$33,000	$38,000
Phase O&M Subtotal	$1,721,000	$5,520,000	$9,091,000
Present Worth of O&M	$1,144,000	$2,899,000	$3,544,000
Total Present Worth	$37,153,000	$15,426,000	$28,886,000
Total PW =			**81,465,000**

Note: See Appendix B for capital and O&M costs breakdown.

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TABLE 8-5

ESTIMATE OF COSTS - ALTERNATIVES 3a and 3b

Item	Estimated Costs, Dollars		
	INITIAL	PHASE 1	PHASE 2
Construction - Year Initiated	**2001**	**2007**	**2012**
Pipelines	$4,086,000	$6,334,000	$0
Lift Stations	$1,990,000	$1,900,000	$2,320,000
Treatment Facilities	$20,000,000	$19,250,000	$0
Subtotal (With Inflation)	$29,348,000	$36,936,000	$3,614,000
Overhead and Profit (10%)	$2,934,800	$3,693,600	$361,400
Administrative (5 percent) Engineering and Legal (20 percent)	$7,337,000	$9,234,000	$903,500
Contingency (Engineering (10 percent), Construction (10 percent))	$5,869,600	$7,387,200	$722,800
Total Capital Costs	$45,489,400	$57,250,800	$5,601,700
Present Worth of Capital Costs	$36,032,000	$31,969,000	$2,337,000
Annual Operation and Maintenance (O&M)			
Pipelines	$13,000	$34,000	$40,000
Lift Stations	$111,000	$205,000	$354,000
Treatment Facilities	$1,195,000	$1,470,000	$2,035,000
Permitting	$358,000	$138,000	$160,000
Laboratory Analysis	$119,000	$130,000	$151,000
Phase O&M Subtotal	$4,954,000	$10,607,000	$14,934,000
Present Worth of O&M	$3,305,000	$5,566,000	$5,860,000
Total Present Worth	$39,337,000	$37,535,000	$8,197,000
Total PW =			**85,069,000**

Note: See Appendix B for capital and O&M costs breakdown.

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TABLE 8-6 COMPARISON OF ALTERNATIVES

EVALUATION CRITERIA

ALTERNATIVE	Cost	Reuse Potential	Flexibility	Reliability	Public Acceptance	Environmental Impact	Implementation	Constructability	Overall Score	Overall Rank
Weighting Factor	8	7	4	5	5	5	4	4		
Alternative 1 **Expansion of Bustamante WWTP**	4 / 32	2 / 14	1 / 4	3 / 15	3 / 15	3 / 15	3 / 12	2 / 8	115	3
Alternative 1a **Phased Expansion of Bustamante WWTP**	4 / 32	2 / 14	3 / 12	3 / 15	4 / 20	3 / 15	3 / 12	3 / 12	132	2
Alternative 2a **New Eastside WWTP**	2 / 16	3 / 21	3 / 12	2 / 10	2 / 10	2 / 10	2 / 8	4 / 16	103	4
Alternative 2b **New Eastside WWTP**	2 / 16	3 / 21	3 / 12	2 / 10	2 / 10	2 / 10	2 / 8	2 / 8	95	5
Alternative 2c **Phased Expansion of Bustamante WWTP with a 2 mgd reclamation plant**	3 / 24	4 / 28	4 / 16	3 / 15	3 / 15	3 / 15	2 / 8	3 / 12	133	1
Alternative 3a **New Montwood Reclamation Plant and Eastside WWTP**	2 / 16	3 / 21	3 / 12	2 / 10	2 / 10	2 / 10	2 / 8	4 / 16	103	4
Alternative 3b **New Montwood Reclamation Plant and Eastside WWTP**	2 / 16	3 / 21	3 / 12	2 / 10	2 / 10	2 / 10	2 / 8	2 / 8	95	5

Rating Schedule
Excellent = 4
Good = 3
Fair = 2
Poor = 1

Weighting Factor
1 Least Important
10 Most Important

Rating / Weighted Score

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CHAPTER 9

RECOMMENDED PROGRAM

This Chapter outlines the collection system and treatment facility improvements recommended by this plan. Required planning and implementation timelines were presented and discussed.

Alternative 2c was selected as the recommended wastewater management plan based on both cost and non-cost criteria, as discussed in Chapter 8. In addition to the collection system improvements described for Alternative 2c, the Roberto R. Bustamante WWTP Service Area Modeling Report recommended collection system improvements to handle projected wastewater flows within the Bustamante WWTP Service Area. In the following discussion, both the treatment plant and collection system improvements are described.

TREATMENT PLANT IMPROVEMENTS

Treatment plant improvements, including design criteria and proposed layouts, are outlined below.

Roberto R. Bustamante WWTP

The major component of treatment facility improvement has been the phased expansion of the existing Roberto R. Bustamante WWTP. Current Bustamante plant operational information was presented in Chapters 5 and 6.

Expansion of the Bustamante WWTP would be achieved in three increments, two of which are within the 20-year planning period. An initial expansion of 11-mgd would need to be under construction by 2001 and, depending on the rate of growth in the region, a 10-mgd expansion has been projected to be under construction by 2010. The final increment of expansion would ultimately be required when buildout occurs.

Figure 9-1 presents a layout for the Initial and Phase I Expansions to the Bustamante WWTP. No additional siting studies should be required for this plant due to it's current location and layout. Table 9-1 presents the existing and the initial phase design criteria.

Table 9-1 Roberto R. Bustamante WWTP Initial Phase Design Data		
Item	Existing	Proposed
Flow, mgd		
Average (ADF)	30	38.5
Maximum Month (MMF)	39	50.0
Peak Wet Weather (PWWF)	51.3	66.0
Influent Characteristics, mg/l		
BOD_5	164[a]	180
TSS	200[a]	200
NH_3 - N	15[a]	20
Loadings, lbs/day		
BOD_5		
Average	41,000	57,800
Max Month	53,300	68,200[b]
TSS		
Average	50,000	64,200
Max Month	65,052	86,000[b]
NH_3 - N		
Average	3,800	6,400
Max Month	4,900	8,500
Preliminary Treatment		
Mechanical Bar Screens		
Number	3	4
Capacity, each, mgd	17.5	17.5
Capacity, total	52.5	70.0
Raw Sewage Pumping		
Number	4 @ 13mgd, 4 @ 3.3mgd	6 @ 13mgd, 2 @ 3.3 mgd
Firm Capacity, mgd	52.1	71.6
Grit Basins		
Number	3	4
Volume, ft^3, each	9,900	9,900
Detention time @ PWWF, mins	6.0[c]	9.6[c]
Preaeration Basins		
Number	3	4
Volume, ft^3, each	29,170	29,170
Detention time @ ADF, mins	30[c]	31.2[c]
Primary Treatment		
Primary Clarifiers		
Number	4	5
Diameter	120	120
Total surface area, ft^2	45,240	56,550

Table 9-1 Roberto R. Bustamante WWTP Initial Phase Design Data		
Item	Existing	Proposed
Surface overflow rate, gpd/ ft^2		
Average	660	680
Maximum month	860	884
PWFF	1139	1170
Primary Sludge Pumping		
Number	6	8
Capacity, gpm, each	180	180
Secondary Treatment		
Activated Sludge Process		
Number of tanks	4	5
Dimensions, each		
Length, ft	170	170
Width, ft	90	90
Depth, ft	15	15
Volume, Mgal	1.77	1.77
Maximum Month Operating Conditions		
SRT, days	5	6
MLSS, in contact, mg/l	2,000	3,250
No. of blowers (+ 1 standby)	4	5
Blower capacity, each, scfm	27,000	27,000
Air Requirements, scfm		
Maximum Month	44,900	84,500
Peak Day	69,600	109,500
Secondary Clarification		
Number of tanks	4	5
Diameter, ft	140	140
Total surface area, ft^2	61,752	76,965
Number of RAS Pumps	6	8
Return pump capacity, each, gpm	6,770	6,770
Surface overflow rate, gpd/ ft^2		
Average	487	500
Maximum Month	633	650
PWWF	836	860
Disinfection		
Chlorine Contact Basins		
Number	2	3
Volume, total, ft^3	92,000	138,000
Detention time, min		
Average	34.7	38.5
PWWF	20.3	22.5

Table 9-1 Roberto R. Bustamante WWTP Initial Phase Design Data		
Item	Existing	Proposed
Effluent quality at Max Month, mg/l		
BOD_5	4[a]	10
TSS	6[a]	10
NH_3 - N	3.1[a]	3
Solids Handling		
Sludge Production		
Primary Sludge		
Maximum Month, lb/day	30,500	37,400
Concentration, TS, percent	6.0	6.5
Flow rate, gpd	61,000	69,000
Waste Secondary Sludge		
Maximum Month, lb/day	36,500	37,400
Concentration, mg/l	7,000	9,800
Flow rate, gpd	625,000	500,400
Gravity Belt Thickener		
Number of units	3	3
Belt width, m	2.0	2.0
Sludge concentration, percent	5.5	5.5
Solids capture, percent	95	95
Digester Feed at Max Month, gpd	137,000	155,400
Anaerobic Digestion		
Number of tanks	2	3
Diameter, ft	104	104
Sidewater depth, ft	34	34
Volume, each, ft^3	288,825	288,825
Hydraulic residence time at Max Month, days	31.6	41.7
Digested sludge, lbs/day	37,800	44,800
Belt Filter Press		
Number of units	4	4
Belt width, m	2.2	2.2
Operating units	3	3
Hours operation	10	11
Loading rate, lb/m/hr	677	677
Sludge concentration, percent	20	20
Dewatered cake at average flow cy/day	59	76

[a] Based on 1995 Plant Data.

[b] BOD Max Mo/Ave = 1.18; TSS Max Mo/Ave - 1.34; NH_3 - N Max Mo/Ave = 1.32 using Haskell WWTP data.

[c] Includes recycle flows of 4 percent of total flow.

As outlined in Table 9-1, the Initial Phase expansion of the Bustamante WWTP would increase the rated capacity of the plant from 39-mgd to 50-mgd. All improvements are the same size as existing units except where noted. The 10-mgd expansion projected for 2010 will consist of a second module of equal size, except where noted.

Preliminary Treatment. The existing preliminary treatment system consists of three mechanical bar screens, eight raw sewage pumps of various sizes, three grit basins, and three preaeration basins. One additional bar screen, grit basin, and preaeration basin sized to match the existing facilities would be added in the Initial Phase. Additionally, raw sewage pumping facilities would need to be increased. Careful study of the means and methods to achieve the increased capacity would be required. For the purposes of this plan, it has been assumed that two of the existing 3.3-mgd pumps would be replaced by two 13.2-mgd units. Further improvements in Phase II would be sized to match existing facilities for ease of operations. Hydraulic evaluations would dictate the final design requirements for these facilities.

Primary Treatment. Initial Phase improvements would increase the number of primary clarifiers from four to five and the number of primary sludge pumps from six to eight. Careful evaluation of the existing odor control system would be required to determine whether foul air from the new clarifier can be delivered to the existing units.

Secondary Treatment. Expansion of the secondary treatment system requires additional tank capacity for the activated sludge process and secondary clarification and additional blower capacity to maintain the activated sludge process under projected loading conditions. Currently there are four aeration tanks, three operating blowers, and four secondary clarifiers. One new aeration tank, secondary clarifier, and blower of the same size as the existing units would be provided under the Initial Phase expansion. It should be noted that the system has been sized for mixed liquor levels of 3,200 mg/l. Also, sizing did not assume the use of an anoxic selector.

Disinfection. A third chlorine contact tank would be necessary in order to maintain the required peak flow detention time.

Solids Handling. The additional volume of a new digester constructed in the Initial Phase provides adequate detention times well beyond 2010. Desired operating times and existing equipment capacities would be evaluated to determine the size of gravity thickening and digested sludge dewatering units.

Discharge Facilities. The effluent from the expanded Bustamante WWTP would be discharged to the Riverside Drain. No additional facilities are needed.

New Reclamation Plant

A 2-mgd liquid-stream only, reclamation plant has been recommended in the PSA to meet the demand for reuse water projected for a proposed golf course north of IH-10. It is proposed to function as a seasonal plant to eliminate the need for storage or the need for a discharge line for surplus effluent. The influent flow could be regulated at the RV Road diversion to maintain a constant flow at the plant, thus, reducing operations and maintenance costs due to adjusting process for fluctuating flow. Effluent criteria for the new plant was based on Type II reclaimed water standards. Golf courses irrigated when the public does not have access to the course are eligible for Type II reuse water (30 TAC 310.33). These regulations were published by TNRCC in draft form in 1996.

Since the new reclamation plant would be sized to meet only the seasonal water requirements of a proposed golf course, its implementation is governed by demand. The size of the plant would be determined by the demand for reuse water in the area. For costing purposes, it was assumed that the plant would be online by 2002.

Figure 9-2 presents a proposed layout of the new reclamation plant. Solids handling facilities would not be required at this plant. Solids would be discharged into the Bustamante WWTP collection system, thus centralizing solids handling at the Bustamante WWTP. Site dimensions were calculated to allow for future expansion. Further development of a plant site would be required.

The layout of the reclamation plant was based on design criteria presented in Table 9-2. Influent quality was assumed to be the same as for the Bustamante WWTP.

Table 9-2 Proposed Reclamation Plant Design Data

Item	Proposed
Flow, mgd	
Average	2.0
Peak, Wet Weather	3.4
Influent Characteristics, mg/l[a]	
BOD_5	180
TSS	200
NH_3 - N	20
Loadings, lbs/day	
BOD_5	
Average	3,000
Peak	5,100
TSS	
Average	3,300
Peak	5,700
NH_3 - N	
Average	330
Peak	570

Table 9-2 Proposed Reclamation Plant Design Data	
Item	Proposed
Primary Treatment	
Primary Clarifiers	
Number	2
Diameter	40
Total surface area, ft^2	2,500
Surface overflow rate, gpd/ ft^2	
Average	800[b]
Peak	1,360
Secondary Treatment	
Activated Sludge Process	
Number of tanks	2
Total Volume, ft^3	94,800
Air Requirements, scfm	2,900
Secondary Clarification	
Number of tanks	2
Diameter, ft	50
Total surface area, ft^2	4,200
Surface overflow rate, gpd/ ft^2	
Average	480[b]
Peak	810
Effluent Filters	
Number of Filters	2
Total Surface Area, ft^2	560
Filtration Rate, gpm/ ft^2	
Average[d]	2.5
Peak	4.25
Disinfection	
Chlorine Contact Basins	
Number	2
Volume, total, ft^3	7580
Detention time, min	
Average[c]	40.8
PWWF	24
Effluent Limits, mg/l	
BOD_5	10[e]
TSS	15[e]
NH_3 - N	5[f]

[a] Assumed to be the same as Bustamante WWTP design data
[b] 80 percent of TNRCC design overflow rate (30 TAC 317.4.d.9).
[c] From Northwest WWTP Expansion Operations and Maintenance Manual.

[d] Haskell R. Street WWTP Process Upgrade Design Data.
[e] Based on permit limits for Roberto R. Bustamante WWTP. TNRCC permit no. 10408-010.
[f] Based on permit limits for Northwest WWTP. National Pollutant Discharge Elimination System (NPDES) permit no. TX0087149.

Figure 9-3 presents the final schematic layout of the recommended plan. Please note that the phasing of improvements to the MDI from Loop 375 to the Bustamante WWTP changed from what was shown for Alternative 2c (Figure 7-6). Modeling of the existing collection system revealed improvements to this area that were not reflected in Figure 7-6.

COLLECTION SYSTEM IMPROVEMENTS

An element of this study was to evaluate the existing Bustamante WWTP collection system capacity and the additional interceptors required to serve the PSA. Alternative 2c outlines only the improvements required to convey the wastewater flows generated in the PSA to the Bustamante plant. The existing collection system was modeled and evaluated separately. The results of that study can be found in the "Roberto R. Bustamante WWTP Service Area Modeling Report."

Existing Collection System

The existing Bustamante collection system was modeled using population projections for the years of 1996, 2005, 2015, and for buildout. Several areas of the collection system were identified as requiring improvements in the 20-year study period. The criteria for improvement was a peak flow that exceeded the capacity by 10 percent. Figure 9-4 presents the collection system improvement plan. Table 9-3 presents a summary of the improvements to existing collection system. The results shown are based on information available at the time of modeling.

Table 9-3 Summary of Improvements to Existing Collection System		
Year of Improvement	Old Pipe Diameter, inches	Total Length, feet
1996	12	6686
	15	1391
	24	905
	33	5504
	36	551
	48	8237
2005	21	181
	48	18303
2015	12	372
	24	2169
	48	2601
>2015	24	736

Note: Summary of improvements highlighted in the Bustamante WWTP Collection System Modeling Report.

Recommended improvement timing was based on flow projections for the existing Bustamante WWTP collection system. The addition of the PSA to the Bustamante service area would force the improvements to the Mesa Drain Interceptor system to be required earlier than the time periods shown in Table 9-3 and on Figure 9-4. This was accounted for in the schedule of improvements shown at the end of this chapter.

Sections of the 48-inch Lower Valley, or Socorro, Interceptor (LVI) and the 48-inch MDI were identified as needing improvement.

In the long-term, portions of the MDI and LVI would need to be replaced or paralleled. A short-term solution to some of the MDI overloading problems is to take advantage of two existing diversion points upstream: the Alfalfa lift station and the Mauer area diversion. It can be achieved by pumping more flow from the Alfalfa Lift Station to the LVI. The existing Mauer diversion can be reconnected to the MDI and can handle 2.7-mgd of diverted flow. This will help provide residual capacity in the existing system for conveying short-term PSA flows.

The long-term improvements to the MDI involve paralleling the portions of the existing 48-inch line by 2007. In the areas east of Loop 375, where the PSA collection system will join the MDI, this new line is sized at 60-inches. It will be large enough to convey the projected peak flows from both the PSA and the Bustamante WWTP service area.

A detailed discussion of the model and the results has been contained in the modeling report. Although the report identifies some pipe sections that may be overloaded, the model was developed with limited field calibration. Thus, prior to committing funds to address the undersized sections shown in Figure 9-4, it has been recommended that detailed calibration of the model be performed. In order to accomplish the necessary calibration, flow monitoring of critical locations in the collection system should be conducted.

PSA Collection System

The PSA collection system was laid out in order to maximize its flexibility. The alignment shown on Figure 9-3 was based on the City of El Paso's 2010 Thoroughfare Plan and topographical information. It was recommended that more detailed alignment studies be conducted. The studies should be prepared in coordination with water and other utility planning. Also, the alignment study should coordinate with the City Planning Office to identify the necessary easements. Since very little development has occurred in the PSA, early identification of easements would minimize future costs and delays.

Improvements were planned to serve developments in any part of the PSA along Loop 375 by using available capacity in the existing collection system. Two lift stations are planned to initially discharge into the existing collection system. As flows in the existing and new systems increase, it was planned to modify the lift stations to discharge into the new PSA interceptor system. Additionally, there are approximately four miles of collector line proposed for initial improvements, including approximately 1 mile of 30-inch line to be used in the future as part of the backbone system. The 18-inch diversion line from RV Road would only be required when the new reclamation plant is built. Likewise, if the flow at RV Road is insufficient for the 2 mgd plant, the diversion line would need to be extended to the Saul Kleinfeld line just east of Zaragosa. This may require a lift station since there is insufficient grade.

Phase I improvements require the new backbone interceptor to be constructed by 2007. The interceptor would extend south from Montana Avenue through the PSA then along the RV Road easement to the Bustamante plant. The interceptor diameter will vary from 18-inches to 60-inches with a total length of approximately eleven miles. Changes in growth rates and population distribution will change the amount and timing of future flows. It is recommended that this information be updated and re-evaluated prior to the construction of this interceptor.

LIFT STATIONS

In accordance with Texas State requirements (30TAC 317.3 (c)(2)), pumping stations must be sized to convey the peak flow with the largest pump out of service. Some of the pumping stations do not meet the required capacities either in the near or longer term. In a separate project, the EPWU has initiated a lift station improvement program to address many of the deficiencies. Table 9-4 identifies the lift stations which require capacity enhancements that are not part of the lift station improvement plan.

Table 9-4 Lift Station Improvements				
Lift Station Number	Lift Station Name	Year Required	Current Firm Capacity/mgd	Required Firm Capacity, mgd
22	Jail Annex	Buildout	2.04	2.16
28	Navarrette	2015	0.36	0.36
30	Nina	2015	0.22	0.23
35	Ysleta	2015	28.80	30.09
40	Prado	2015	1.30	2.82
41	Socorro	2015	0.72	0.78
44	Mansfield	2015	0.72	0.72
112	Album	2015	3.46	3.34
134	Pico Norte	2015	10.51	10.64

It should be noted that the existing station capacity was developed from nameplate data. More accurate flow information could be developed by conducting pump field tests, which would account for factors such as impeller wear, pipe friction factors, and actual wet well operating levels. In addition, it should be noted that the peaking factor used for lift stations with inlet lines smaller than 21-inches in diameter was 2.0 and for stations with larger inlet lines was 1.70. The cost of improving the lift stations shown in Table 9-4 was not estimated due to the lack of pump accurate capacity information. Therefore, the costs of improvements are not included in the total project cost estimate.

The improvement costs for the identified list stations was not included in Cost Table 9-6, since the nature of the required modifications was unclear. In order to develop accurate cost information, it is recommended that further study of each station be conducted.

FACILITIES PLANNING

Because of the dynamic nature of the growth in the area, it is recommended that this plan be periodically updated at an interval not greater than five years. The proposed airport expansion is an example of a project that can dramatically impact the plan's recommendations. Planning information for the airport work was not well developed for incorporation into this study. However, significant development could cause modifications to the plan which were not originally envisioned.

The following text describes the timing necessary for pre-construction activities such as facility planning and design.

Treatment Facilities

Planning and design activities for wastewater treatment facilities are assumed to require at least eighteen months each. Additional time would be required for a new reclamation plant due to plant siting and land acquisition.

Currently, existing wastewater treatment facilities in Texas must adhere the TNRCC 75/90 rule (30 TAC 305.126) which states that a utility must initiate planning activities when the average daily flow exceeds 75 percent of the permitted flow for three consecutive months and initiate construction activities by the time the flow exceeds 90 percent of the permitted flow.

Collection System

This section discusses the planning and design activities recommended prior to the implementation of collection system improvements.

Existing System. The existing Bustamante WWTP collection system improvements recommended by this plan are based on an extensive modeling effort. It is estimated that six months is required for model verification and approximately nine to twelve months for pipeline design.

New Backbone Interceptor. A new backbone interceptor will be required to convey flows generated in the PSA to the Bustamante WWTP. The PSA is currently an undeveloped area lacking infrastructure. Although the interceptor was aligned using the City of El Paso 2010 Thoroughfare Plan, a detailed alignment and easement study is recommended in order to ensure that the proposed system is coordinated with growth patterns and infrastructure planning.

IMPLEMENTATION PROGRAM

Implementation of recommended improvements is scheduled over a 20-year timeline. This section outlines the implementation program for these improvements. A summary of the implementation program is shown below.

Table 9-5 Schedule of Improvement Programs	
1998-1999:	• Flow monitoring study of existing Bustamante WWTP service area collection system. • Bustamante WWTP Initial Phase facilities planning. • Design of Initial Phase collection system facilities within PSA (governed by demand). • Siting study and facilities planning for the new Eastside WWTP and diversion line from RV Road.
1999-2001	• Design of New Eastside WWTP (governed by demand). • Design of Initial Phase Bustamante WWTP expansion.
2001-2002	• Construction of New Eastside WWTP (governed by demand). • Construction of Initial Phase Bustamante WWTP expansion.
2002-2003:	• Initial Phase Expansion of the Bustamante WWTP online. • Design improvements to the Lower Valley Interceptor between the Ysleta lift station and the Mesa Drain Interceptor junction box. • Update and review planning information. • New Eastside WWTP online (governed by demand). • Reclamation plant diversion line online (governed by demand).
2003-2004:	• PSA interceptor route study and design. • Design of Mesa Drain Interceptor improvements from Zaragosa to the Bustamante WWTP completed.
2005-2006	• Construction of PSA interceptor. • Construction of Mesa Drain Interceptor improvements from Zaragosa to the Bustamante WWTP completed.
2007:	• PSA interceptor online. • Mesa Drain Interceptor improvements from Zaragosa to the Bustamante WWTP completed.
2007-2008:	• Facilities planning for Phase I Bustamante WWTP expansion.
2008-2009	• Design of Phase I Bustamante WWTP expansion.
2010-2012:	• Phase I expansion of Bustamante WWTP online. • Connect to EPCWA WWTP.

The estimated cost of the recommended plan is presented in Table 9-6.

TABLE 9-6

ESTIMATE OF COSTS - RECOMMENDED PLAN

Item	Estimated Costs, Dollars		
	INITIAL	PHASE 1	PHASE 2
Construction - Year Initiated	**2001**	**2007**	**2010**
Pipelines	$4,683,000	$13,050,700	$3,927,000
Lift Stations	$900,000	$1,510,000	$2,320,000
Treatment Facilities	$22,750,000	$0	$17,500,000
Subtotal (With Inflation)	$31,889,000	$19,568,000	$34,873,000
Overhead and Profit (10%)	$3,188,900	$1,956,800	$3,487,300
Administrative (5 percent) Engineering and Legal (20 percent)	$7,972,250	$4,892,000	$8,718,250
Contingency (Engineering (10 percent), Construction (10 percent))	$6,377,800	$3,913,600	$6,974,600
Total Capital Costs	$49,427,950	$30,330,400	$54,053,150
Present Worth of Capital Costs	$39,152,000	$16,936,000	$25,342,000
Annual Operation and Maintenance (O&M)			
Pipelines	$9,000	$37,000	$56,000
Lift Stations	$84,000	$158,000	$299,000
Treatment Facilities	$386,000	$729,000	$1,043,000
Permitting	$60,000	$0	$0
Laboratory Analysis	$30,000	$33,000	$38,000
Phase O&M Subtotal	$1,726,000	$5,520,000	$9,091,000
Present Worth of O&M	$1,148,000	$2,899,000	$3,544,000
Total Present Worth	$40,300,000	$19,835,000	$28,886,000
Total PW =			**89,021,000**

Note: See Appendix B for capital and O&M costs breakdown.

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CHAPTER 10

PRELIMINARY ENVIRONMENTAL EVALUATION

This Chapter provides a preliminary environmental evaluation of the PSA. Information on the general environmental setting is first presented to provide a foundation for the following sections on the preliminary biotic and archeological assessments. These assessments were conducted in order to provide a general characterization of the study area, and to identify unique cultural resources and threatened and endangered species that might occur in the area.

Environmental Setting

The PSA is located in the northern margin of the Rio Grande Valley in west Texas. This portion of the Rio Grande Valley is located within the Mexican Highlands Section of the Basin and Range Physiographic Province (Gile et al. 1981). The Hueco Bolson lies to the north, and encompasses the northern portion of the PSA. The Hueco Bolson is a broad, relatively flat intermontane basin which extends from central New Mexico into northern Mexico. This bolson is bounded on the east by the Hueco, Quitman and Sierra de Amargosa mountain chains and on the west by the Franklin Mountains and Sierra Juarez. The average elevation of the Hueco Bolson is approximately 3,800 feet above sea level. The average annual rainfall is 8.6 inches, although this has varied tremendously from year to year, from a high of 18.3 inches to a low of 2.2 inches (Knowles and Kennedy, 1958).

The Rio Grande River Valley lies southwest of the PSA and it's corresponding northern valley margin comprises the entire southern portion of this area. The rim of the valley margin in the PSA corresponds to an elevation of approximately 4,000 feet above sea level. The slope of the valley margin is relatively steep compared to the adjacent Hueco Bolson and Rio Grande River floodplain. The transition from the valley margin to the Rio Grande River floodplain roughly coincides to an elevation of 3,680 feet above sea level.

The subsurface of the Hueco Bolson, valley margin and Rio Grande valley floor consists of alluvium comprised of various mixtures of gravel, sand, silt and clay. Soils within the PSA are separated into two main associations. Bluepoint Association soils occur on the valley margins above the Rio Grande floodplain (Jaco, 1971). Included in this association are Bluepoint loamy fine sand and Bluepoint gravely fine sand. Bluepoint Association soils are highly susceptible to wind erosion and are well-drained with low available moisture capacity.

In the Hueco Bolson, Hueco soils of the Hueco-Wink Association predominate. The Hueco soils are loamy fine sand and fine sandy loam underlain by massive indurated caliche or calcrete deposits at a depth of approximately 20 to 40 inches below the surface (Jaco, 1971). Similar to Bluepoint Association soils, Hueco soils are highly susceptible to wind erosion and are well-drained with low available moisture capacity. For this reason, soils of both associations are not well suited for agricultural irrigation compared to soils within the Rio Grande floodplain. Historically, much of the study area was utilized and better suited for livestock grazing.

The land surrounding the project area has been the site of extensive residential, commercial and agricultural development. Residential and commercial developments already exist in the northern portion of the PSA. Much of the valley floor southwest of the study area consists of irrigated cropland. The valley and Hueco Bolson margins, which had been used as rangeland or left idle, are rapidly becoming sites of extensive residential and commercial development as El Paso expands.

Environmental Assessment

The following sections provide a summary of preliminary biotic and archeological assessments results. Dr. Richard D. Worthington of Floristic Inventories of the Southwest Program conducted a biotic assessment of the PSA. Barbara E. Kauffman, Archaeology and Historic Preservation Consultant, conducted a Class I cultural resources overview of the PSA. The biotic and Class I cultural resources assessment reports are provided in Appendix C and D, respectively. These reports should be referred to in order to obtain more detailed information regarding the above assessments.

Biotic Assessment. The biotic assessment consisted of visiting 17 locations within the PSA, reviewing previous studies conducted within the area, reviewing aerial photographs to assist in locating habitats for site visits, and searches for records of plants and animals in the Resource Collections of the Laboratory of Environmental Biology at the University of Texas at El Paso. The biotic assessment report (Appendix C) provides a detailed inventory of all fauna (mammals, birds, amphibians, reptiles, and invertebrates) and flora (lichens, fungi, mosses, liverworts, pteridophytes, gymnosperms, and flowering plants) identified within the PSA.

Few threatened or endangered species occur in El Paso County. All but one of those that do, including candidate species, occur in the mountains. Although some sensitive bird and bat species migrate through the El Paso area, no threatened or endangered species were encountered or identified in this study.

The results of this preliminary biotic assessment indicate that no biological limitations or impacts on the location or identification of wastewater treatment alternatives are present in the study area. This conclusion is drawn from this assessment which indicated that no threatened or endangered fauna or flora species have been identified in the study area.

Archaeological Assessment. The archaeological assessment consists of a Class I prehistoric and historic cultural resources overview of the PSA. The Secretary of the Interior's "Standards and Guidelines for Archaeology and Historic Preservation" (48 FR 44716) were followed in the efforts to identify and evaluate historic properties as part of this assessment. In addition to these guidelines, the assessment provides an overview of applicable federal and state codes related to this project and implementation of the selected alternative, and existing Memorandum of Understandings (MOUs) between the numerous organizations involved in this project relevant to this Master Plan that set forth procedures which must be followed to identify, evaluate, and treat significant cultural properties (Appendix D). In addition to the literature review, which included overview and planning documents and recent reports of archaeological investigations within or part of the study area, a brief reconnaissance of portions of the project area was conducted during the preparation of this overview. This reconnaissance survey was performed in order to identify the project setting, nature of prior disturbance, and the probability of historic and prehistoric cultural resources.

The Class I cultural resources overview (Appendix D) is organized with the following individual headings: proposed action, project environment, archaeological background, protohistoric and historic periods, overview of previous research, prehistoric sites, historic sites, topographic setting of expected resources, summary and discussion, and management recommendations. The most significant sections with respect to recommended additional cultural resources assessments related to project construction are provided in the summary and discussion, and management recommendations sections. A summary of these recommendations, largely derived from the abstract of this overview report, is provided in the following paragraphs.

Those portions of the PSA that have not been surveyed by an archaeologist should be surveyed prior to development in order to identify and record any archaeological or historical sites. Portions of the PSA which have already been surveyed do not have to be resurveyed. Existing archaeological sites which have already been recorded within the project area and additional sites which may be discovered through further survey, will need to be assessed to determine their eligibility or potential eligibility for listing on the National Register of Historic Places and as Texas State Archaeological Landmarks. Such surveys will require that previously recorded sites be revisited to determine their present state of preservation and data recovery potential, and may further require archaeological testing to determine their eligibility. Sites eligible for listing on the National Register of Historic Places, or as state Archaeological Landmarks, and which will be directly or indirectly impacted by project development, will need to have the effects of that impact mitigated or avoided and protected from impact through project redesign (plant, lift station, and/or pipeline relocation).

Summary

In summary, results of the biotic assessment indicate that evaluation of alternatives with respect to WWTP, lift station, and/or pipeline locations will not be influenced by threatened or endangered species due to the lack of presence thereof. Based on results of the Class I cultural resources overview, proposed construction of wastewater conveyance and treatment facilities within the PSA, will be influenced by the presence of archaeological sites. Although proposed WWTP and lift stations associated with the recommended alternative (refer to Chapter 9 for detailed description) are not located within known low or high density archaeological site findings, pipelines associated with the Initial and Phase I improvements of this alternative transect known low and high density sites findings. Therefore, implementation of this or any other alternative may require an archaeological survey of the selected location of construction sites prior disturbance.

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CHAPTER 11

AGENCY AND PUBLIC PARTICIPATION PROGRAM

The regional nature of this project required a concerted effort to maintain communication with interested agencies and to inform the public of the results. This chapter summarizes those activities.

AGENCY REVIEW

Due to the breadth of this project, it was necessary to gather information from a variety of agencies concerning growth, development, and jurisdiction in the PSA. Meetings were held to solicit agency input for the development and evaluation of treatment and conveyance alternatives.

The following agencies and entities were integral to the development of the information contained in this document. Most are directly affected by the results and the greatest effort was extended to maintain close contact with them.

- El Paso Water Utilities (EPWU)
- El Paso County Water Authority
- Lower Valley Water District
- City of El Paso Department of Planning
- Texas Water Development Board
- Texas General Land Office

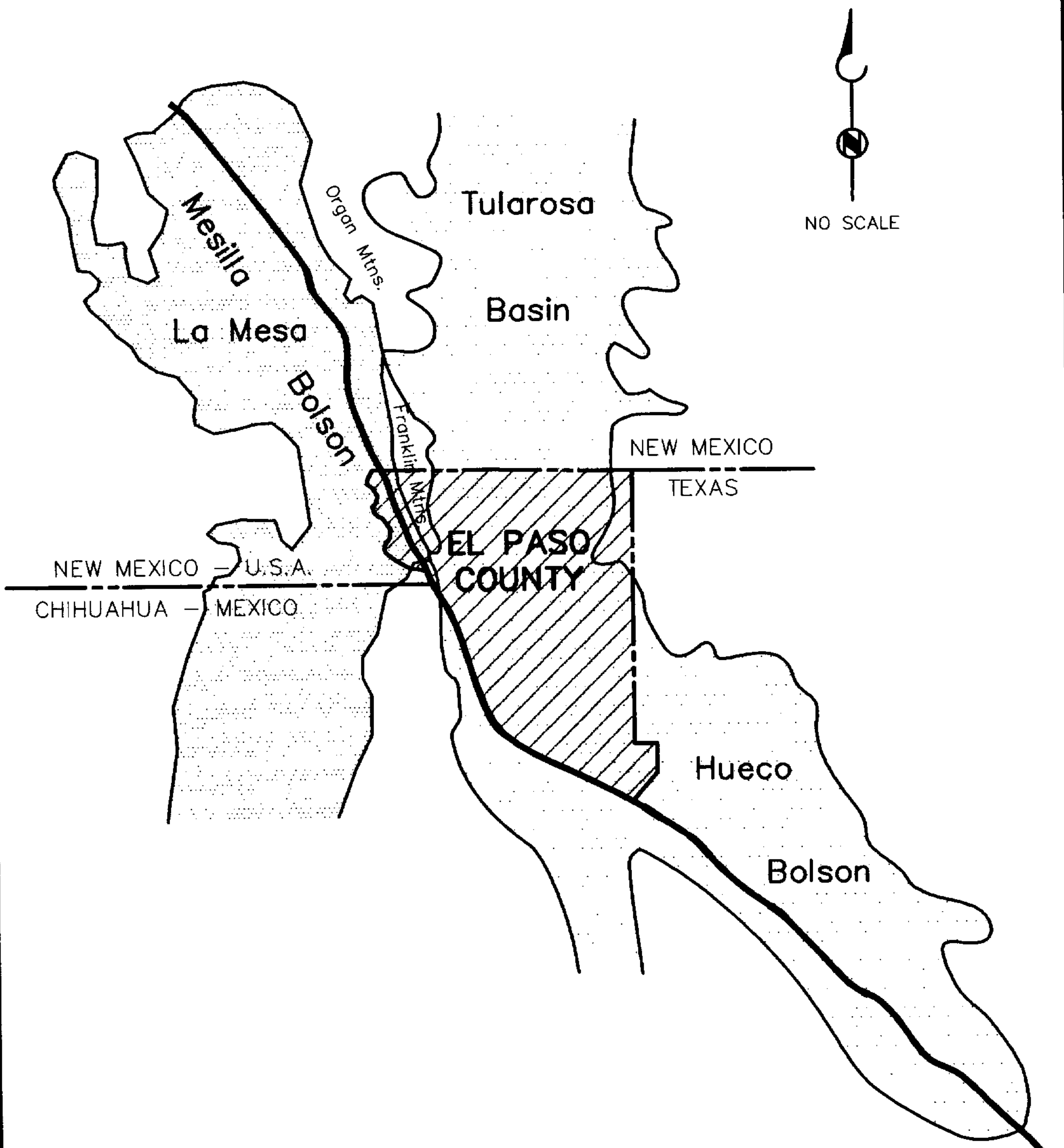
Due to the complexity of the jurisdictional boundary issue, several of these meetings involved one-on-one discussions concerning agency support for the project. Representatives of several additional agencies were invited to two project review meetings held in August 1996 and February 1997.

A draft report was published in October 1996 and distributed to agencies for review. Agency comments on the draft report were requested in an effort to address any concerns. The comments and the replies are presented in Appendix E.

PUBLIC REVIEW

After several in-depth review meetings with EPWU staff and addressing the agency review comments, the recommended plan was developed for public review. A meeting was conducted on March 11, 1997. Copies of the announcement requests and the meeting minutes are presented in Appendix F. No opposition to the recommended plan was expressed.

FIGURES



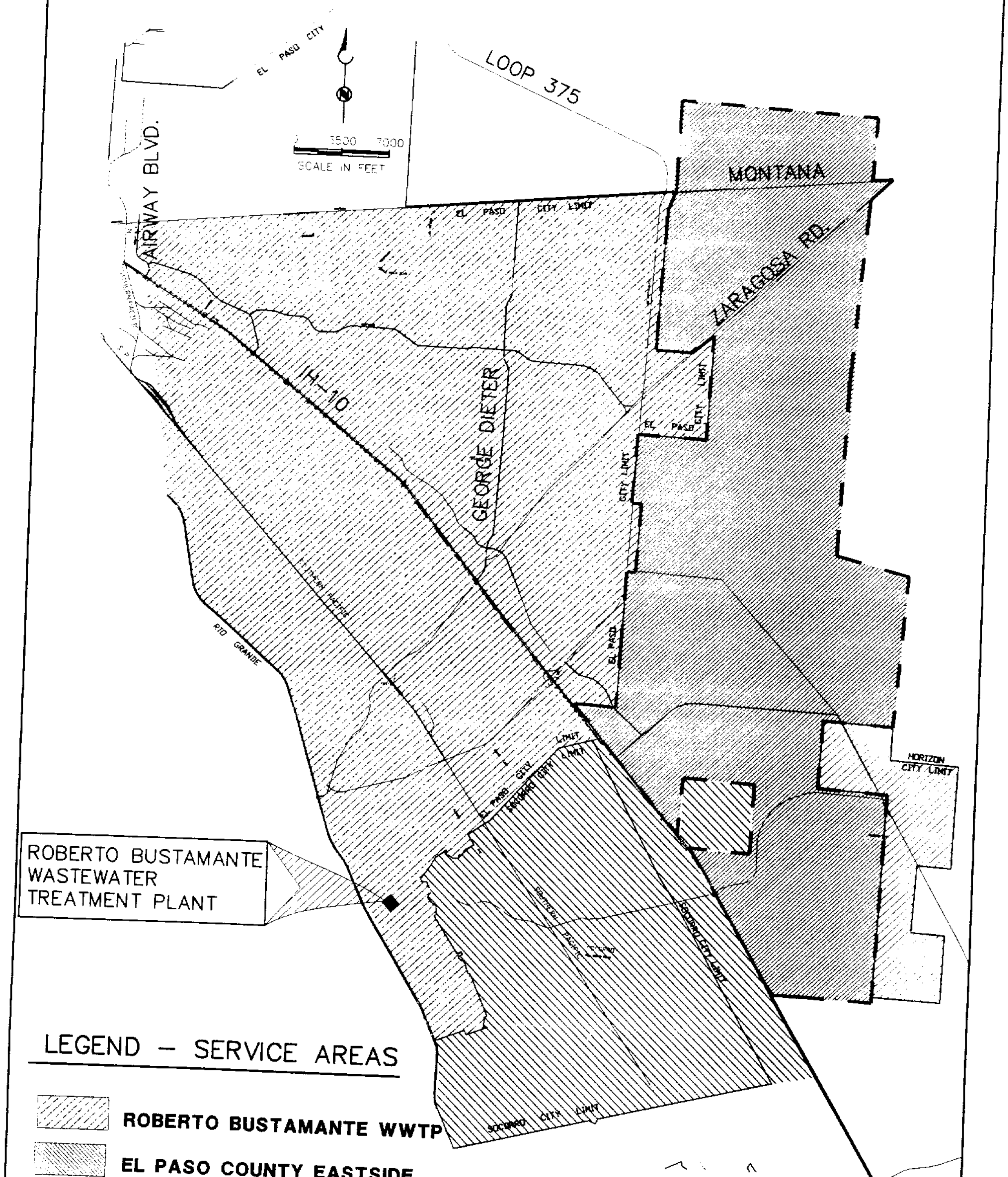
E:\EPWU\3254\FIG2-1 (1=1) 10-18-96 JerryA

REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

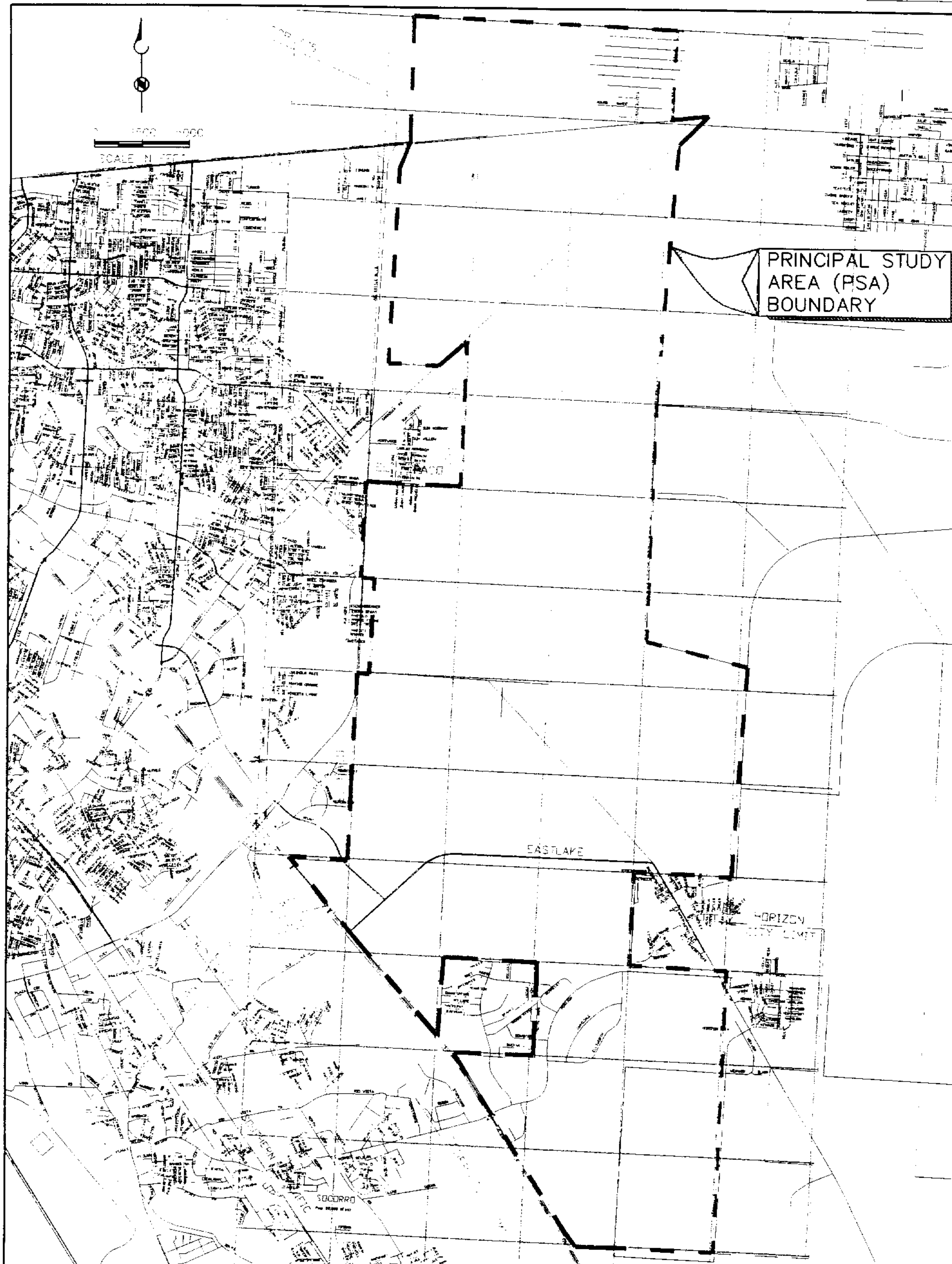
EL PASO AREA PHYSIOGRAPHIC MAP
FIGURE 2-1

E:\EPWU\3254\REGIONAL (1=1) 03-03-97 JerryA

EASTBASE EASTCONT



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	REGIONAL STUDY AREA FIGURE 3–1

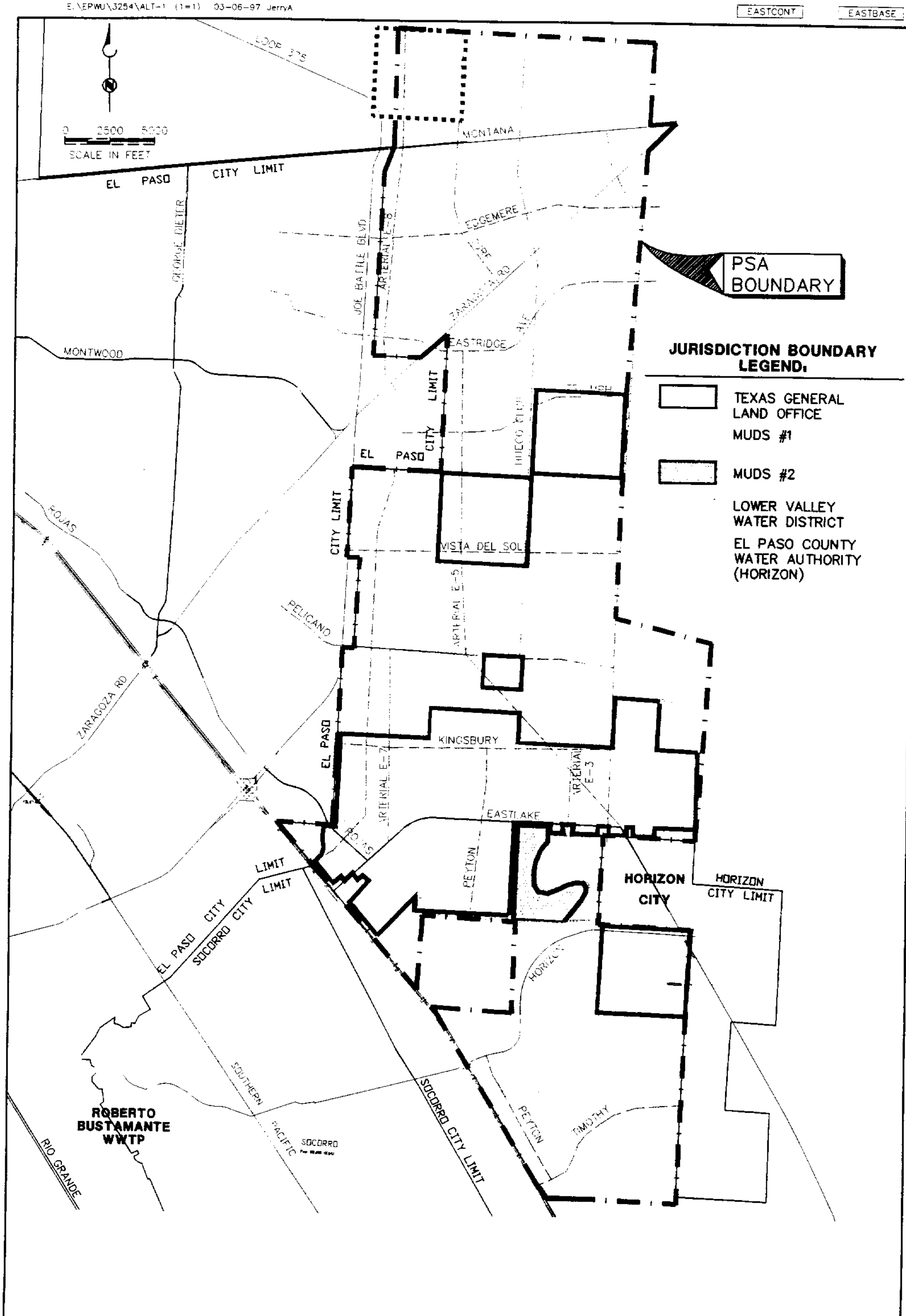


REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

PRINCIPAL STUDY AREA
FIGURE 3-2

E:\EPWU\3254\ALT-1 (1=1) 03-06-97 JerryA

EASTCONT EASTBASE



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

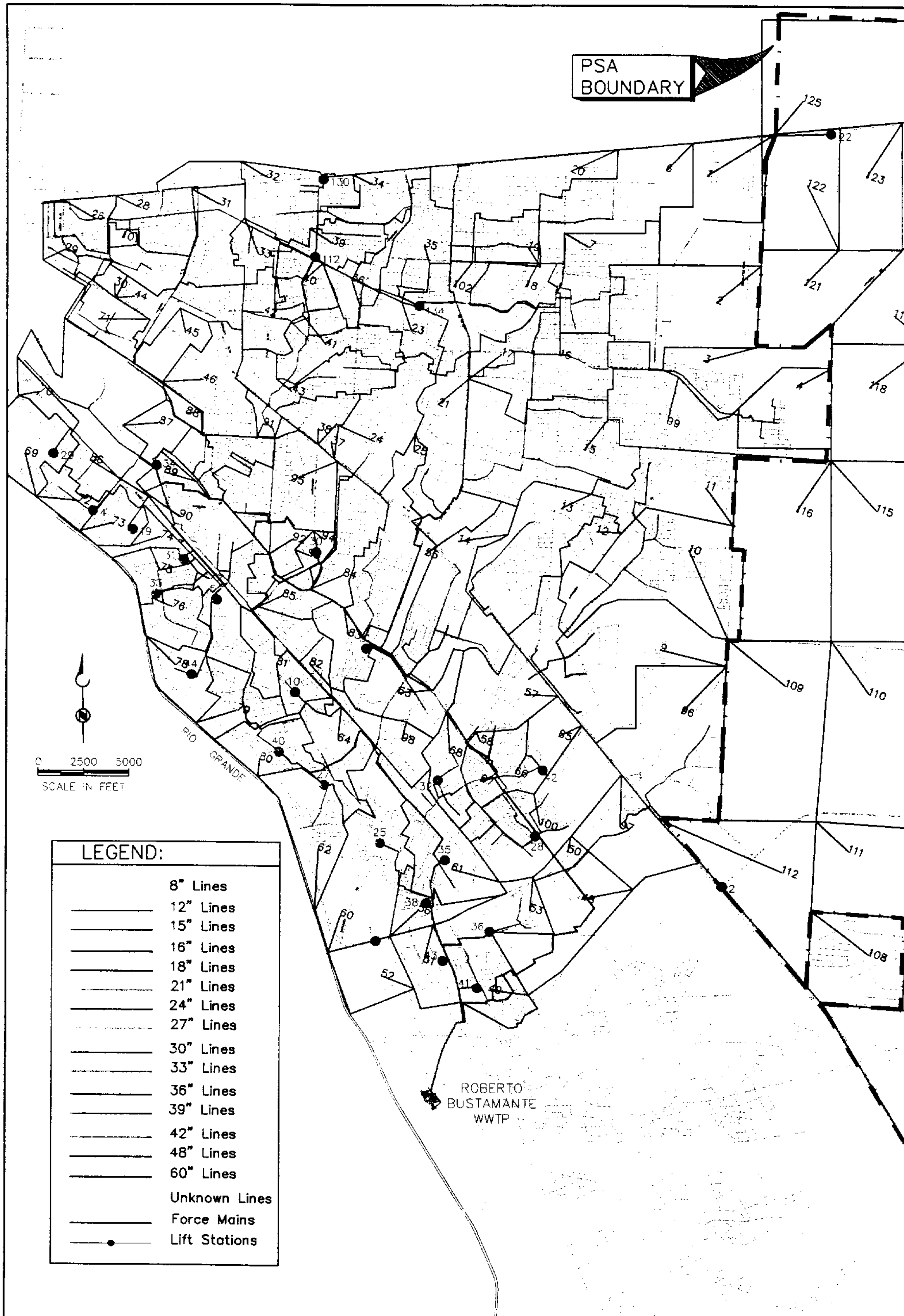
JURISDICTION BOUNDARIES

FIGURE 3-3

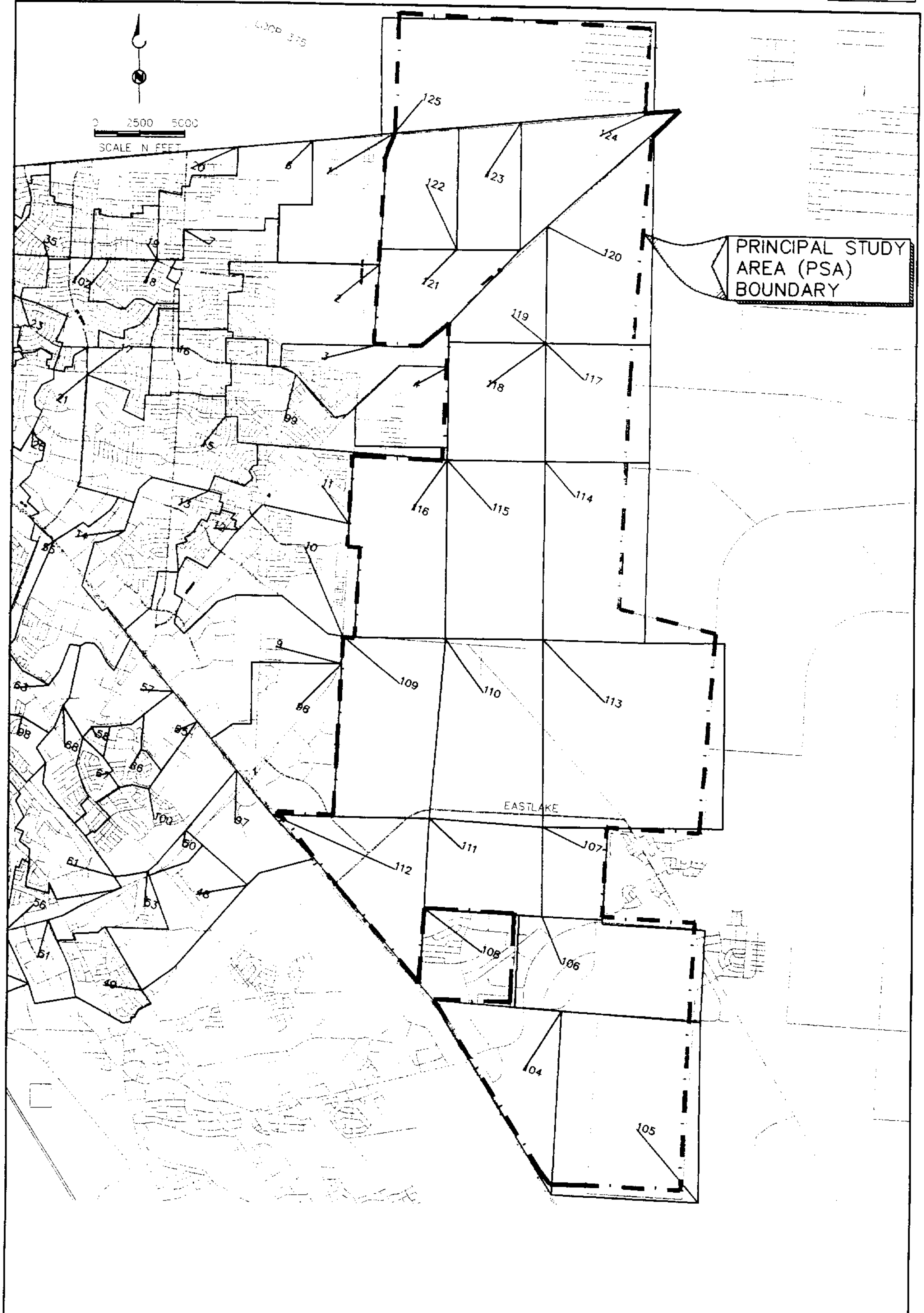
E:\EPWU\3254\FIG3-4 (1=1) 03-03-97 JerryA

EASTPIPE

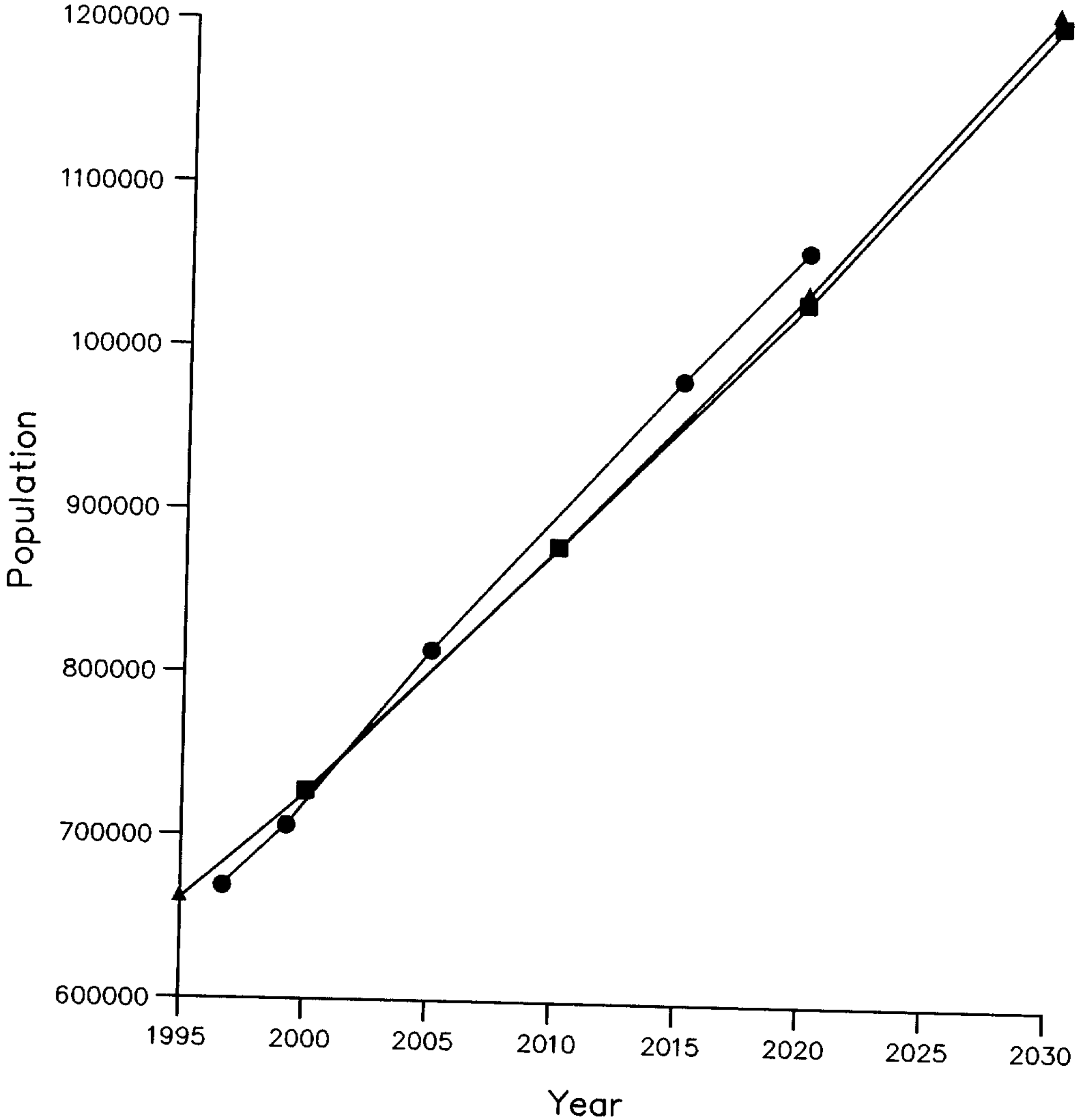
E1



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	EXISTING EPWU-PSB SEWER SYSTEM AND SERVICE SUB AREAS FIGURE 3-4



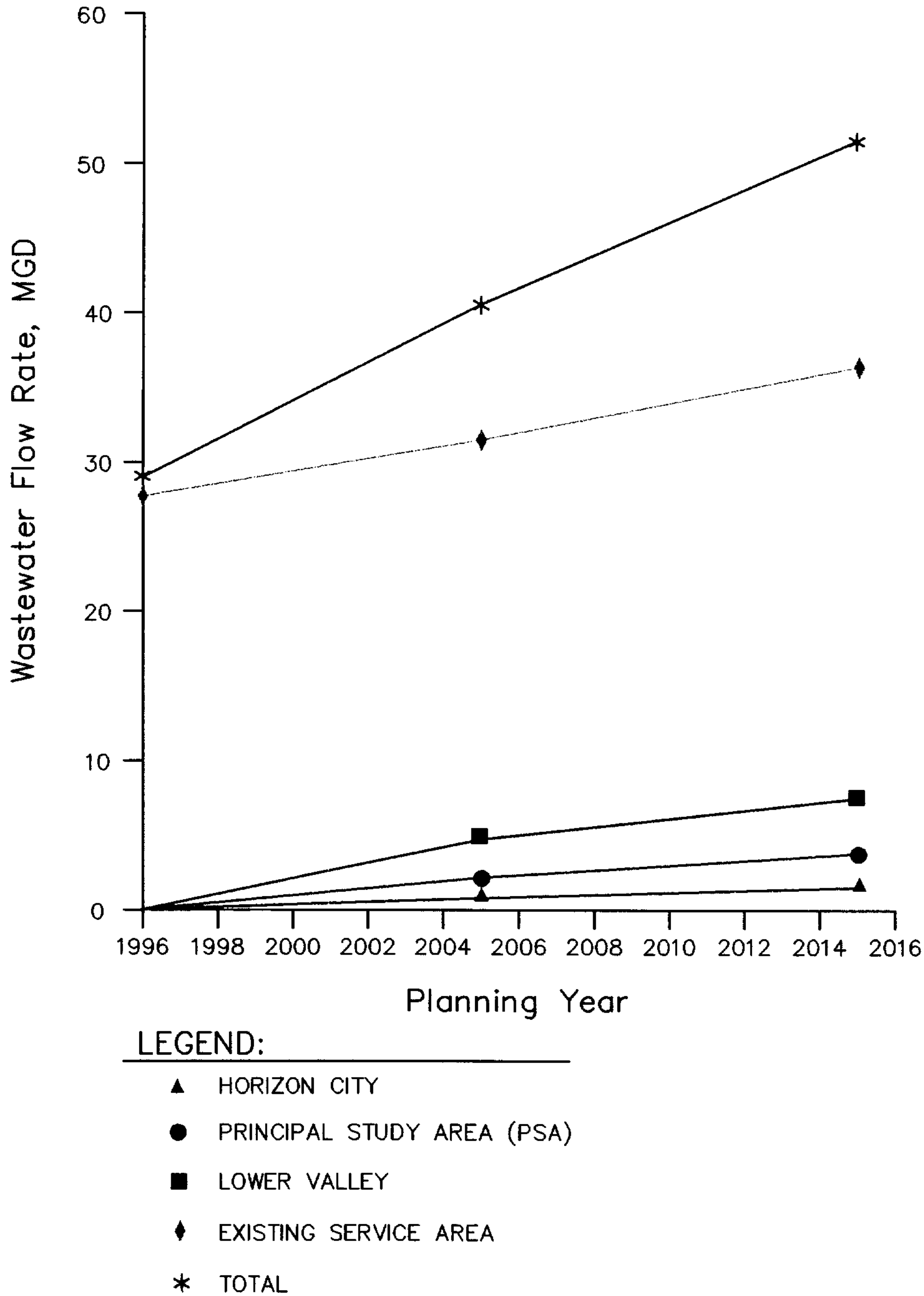
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	SERVICE SUB AREAS WITHIN THE PRINCIPAL STUDY AREA FIGURE 3–5



LEGEND:

- ▲ CITY OF EL PASO DEPARTMENT OF PLANNING, RESEARCH AND DEVELOPMENT
- ● EL PASO METROPOLITAN PLANNING ORGANIZATION
- ■ TEXAS WATER DEVELOPMENT BOARD

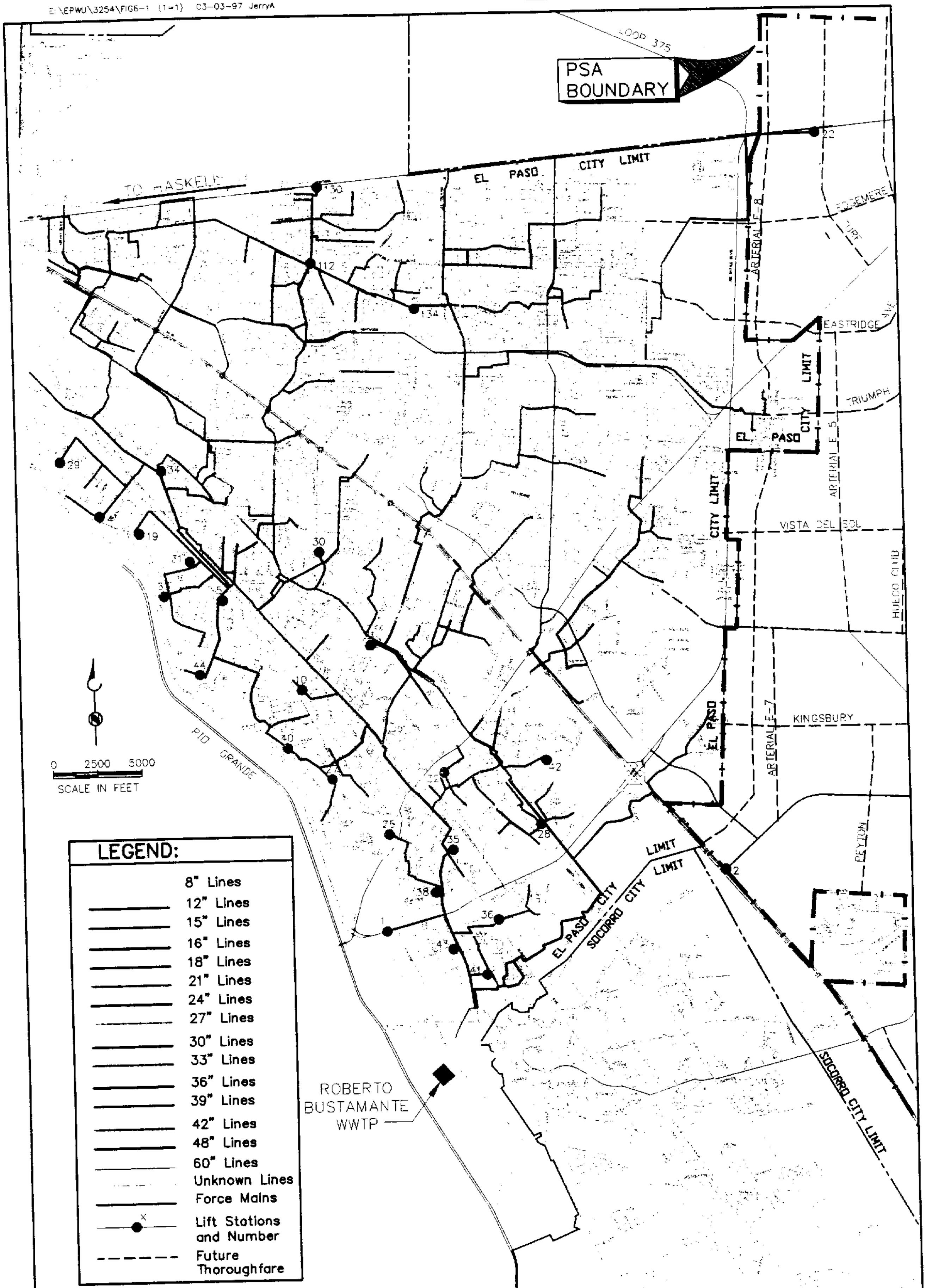
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	POPULATION PROJECTIONS FOR EL PASO COUNTY FIGURE 3-6



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	WASTEWATER FLOW PROJECTION REGIONAL STUDY AREA FIGURE 4-1

EASTPIPE EASTBASE THOROUGH

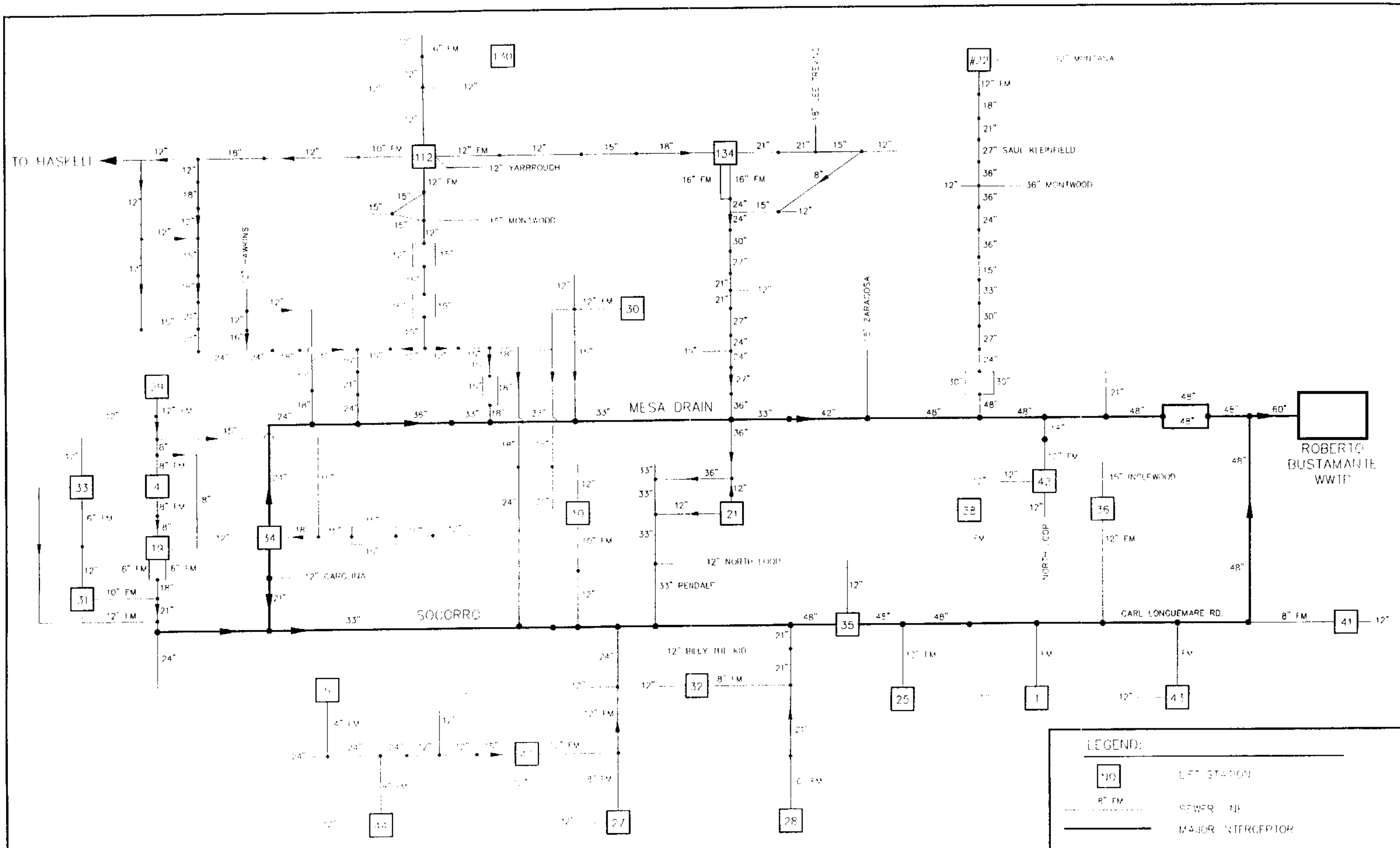
E:\EPWU\3254\FIG6-1 (1=1) 03-03-97 JerryA



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

LAYOUT OF EXISTING BUSTAMANTE COLLECTION SYSTEM

FIGURE 6-1



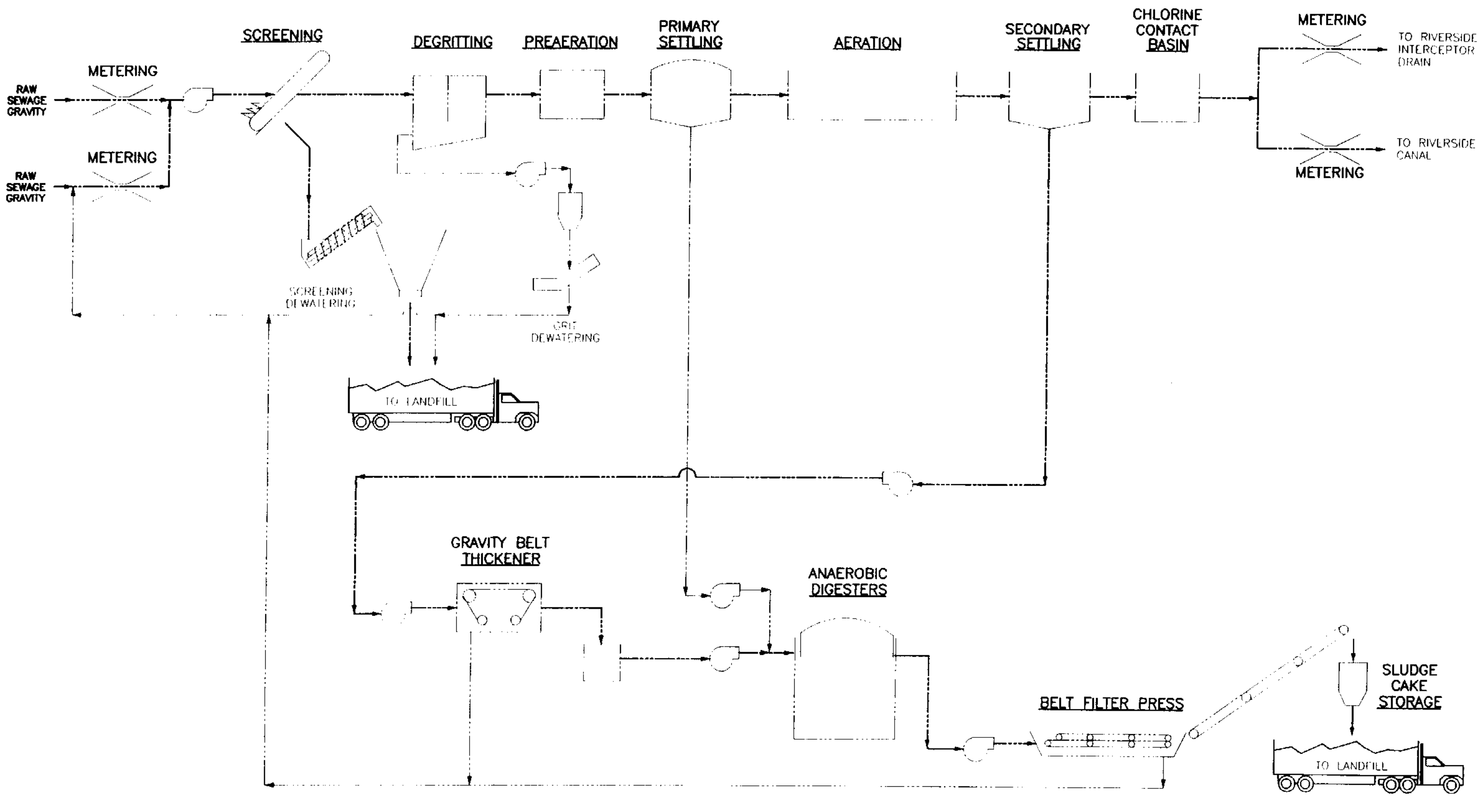
BROWN AND CALDWELL

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

SEWER AND LIFT STATION SCHEMATIC

FIGURE 6-2

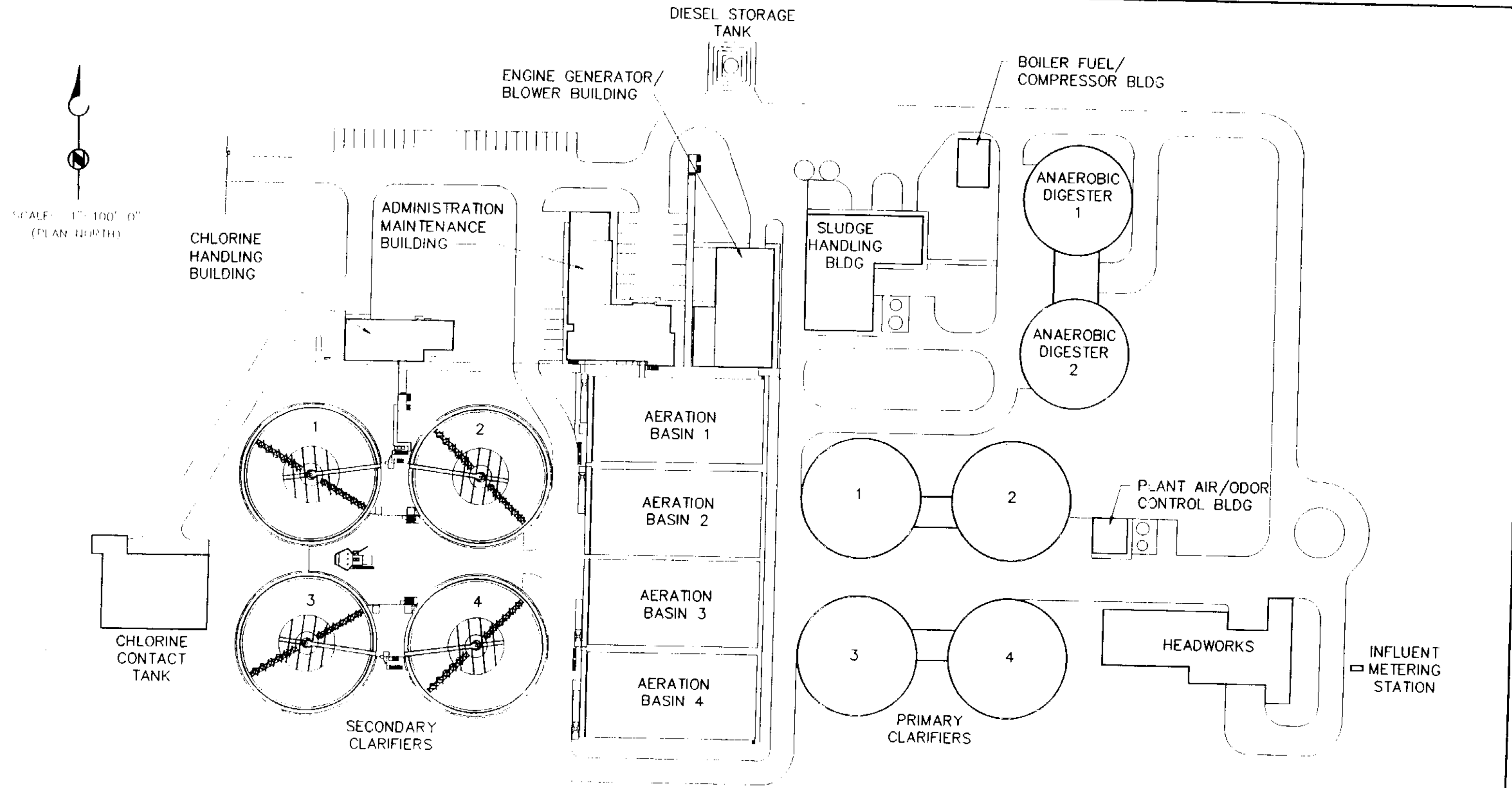


BROWN AND CALDWELL

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

BUSTAMANTE FLOW SCHEMATIC
FIGURE 6-3



BROWN AND CALDWELL

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

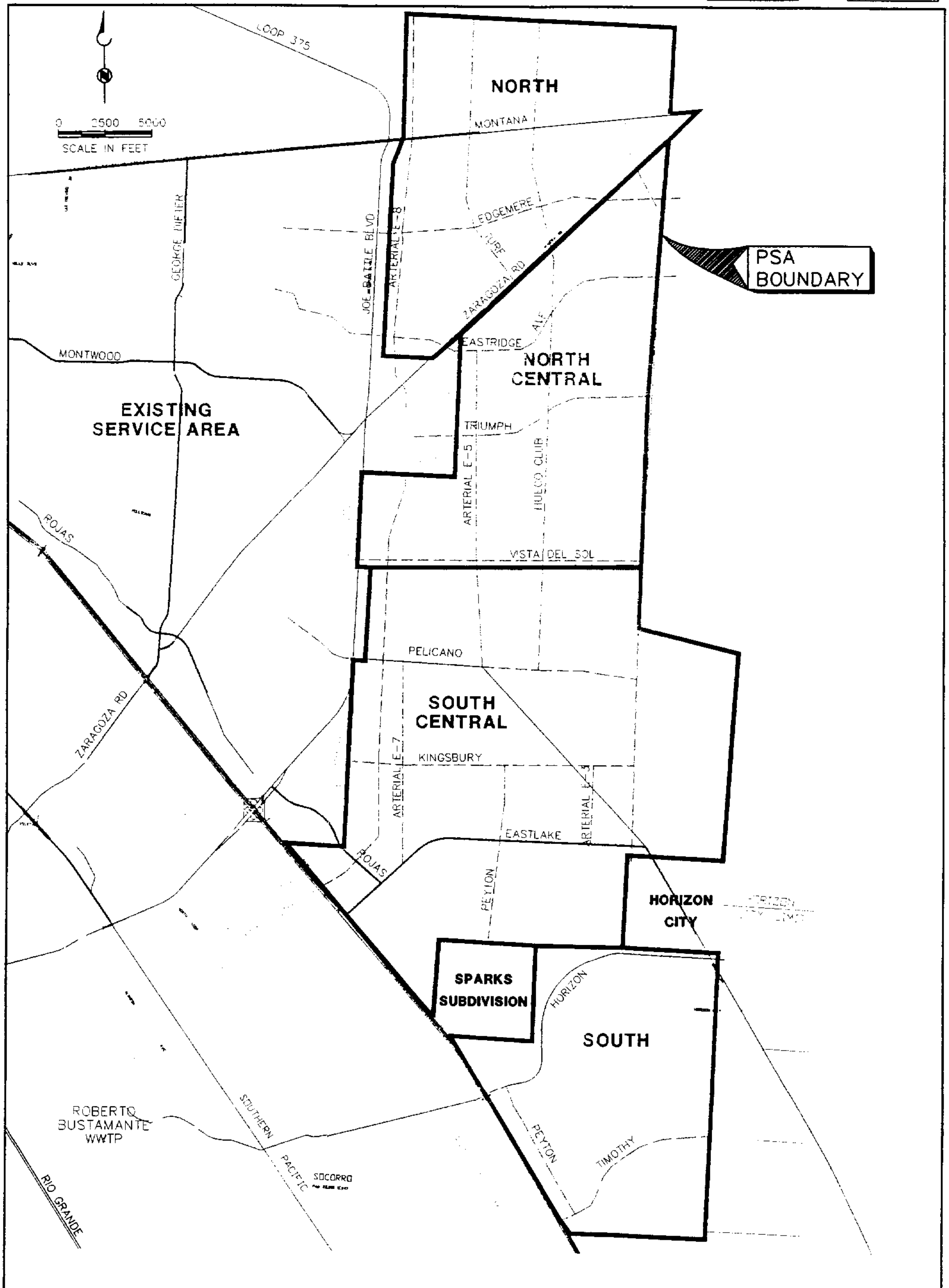
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

BUSTAMANTE WWTP PLAN

FIGURE 6-4

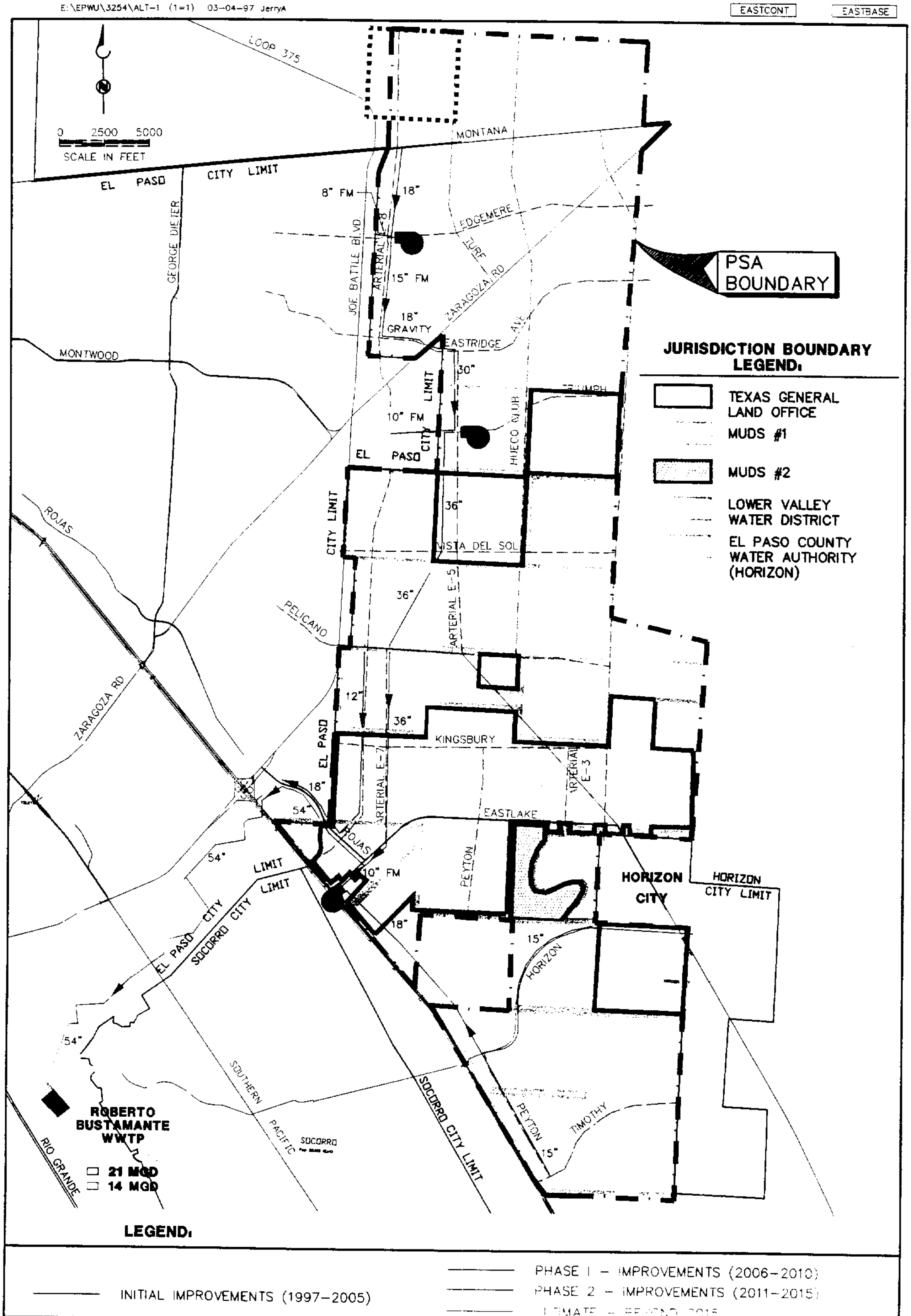
E:\EPWU\3254\FIG7-1 (1=1) 03-04-97 JerryA

EASTBASE



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	STUDY AREA SERVICE AREA QUADRANTS FIGURE 7-1

E:\EPWU\3254\ALT-1 (1=1) 03-04-97 JerryA



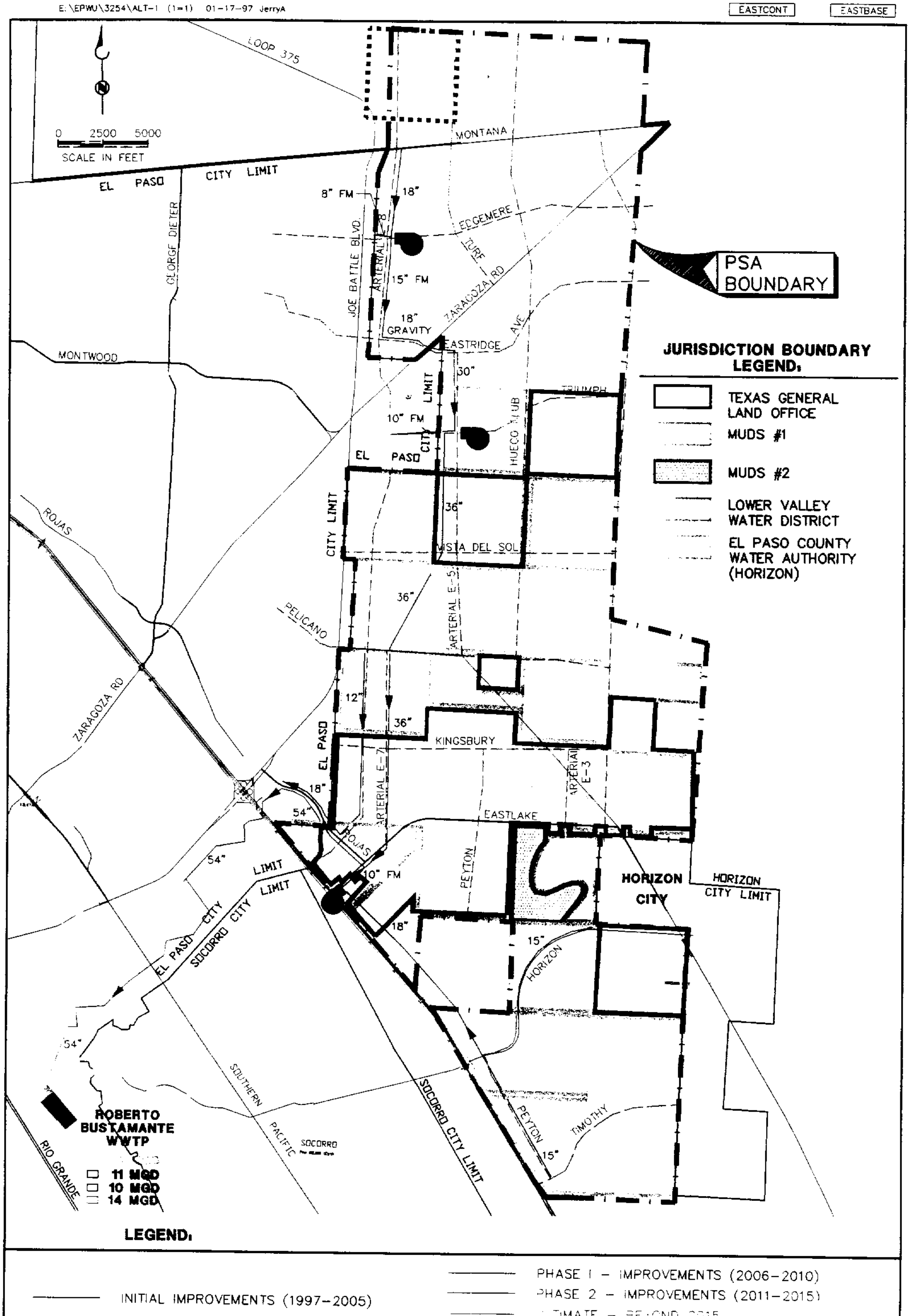
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

ALTERNATIVE 1
EXPANSION OF BUSTAMANTE WWTP SERVICE AREA
FIGURE 7-2

E:\EPWU\3254\ALT-1 (1=1) 01-17-97 JerryA

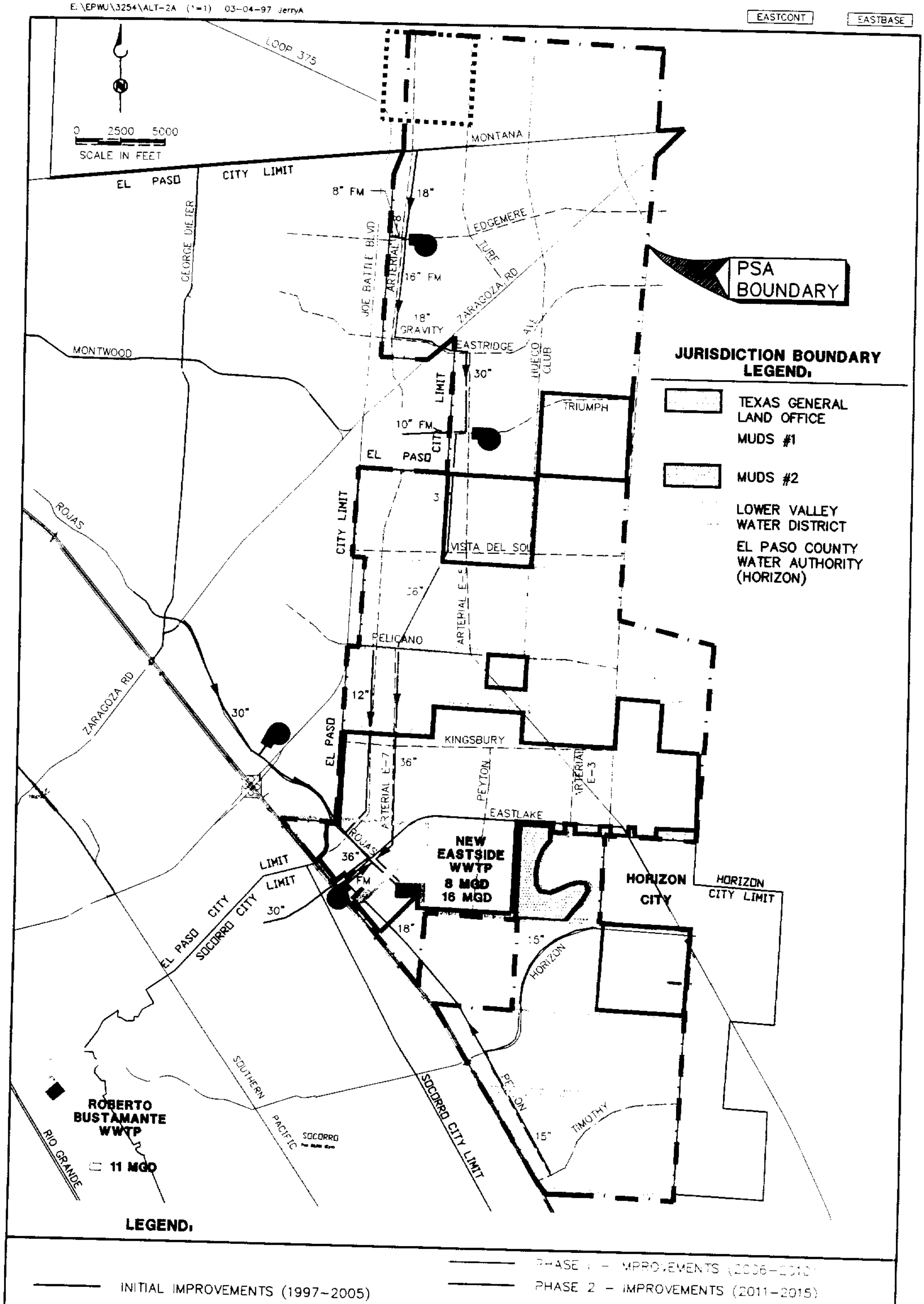
EASTCONT

EASTBASE



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

ALTERNATIVE 1a
EXPANSION OF BUSTAMANTE WWTP SERVICE AREA
FIGURE 7-3

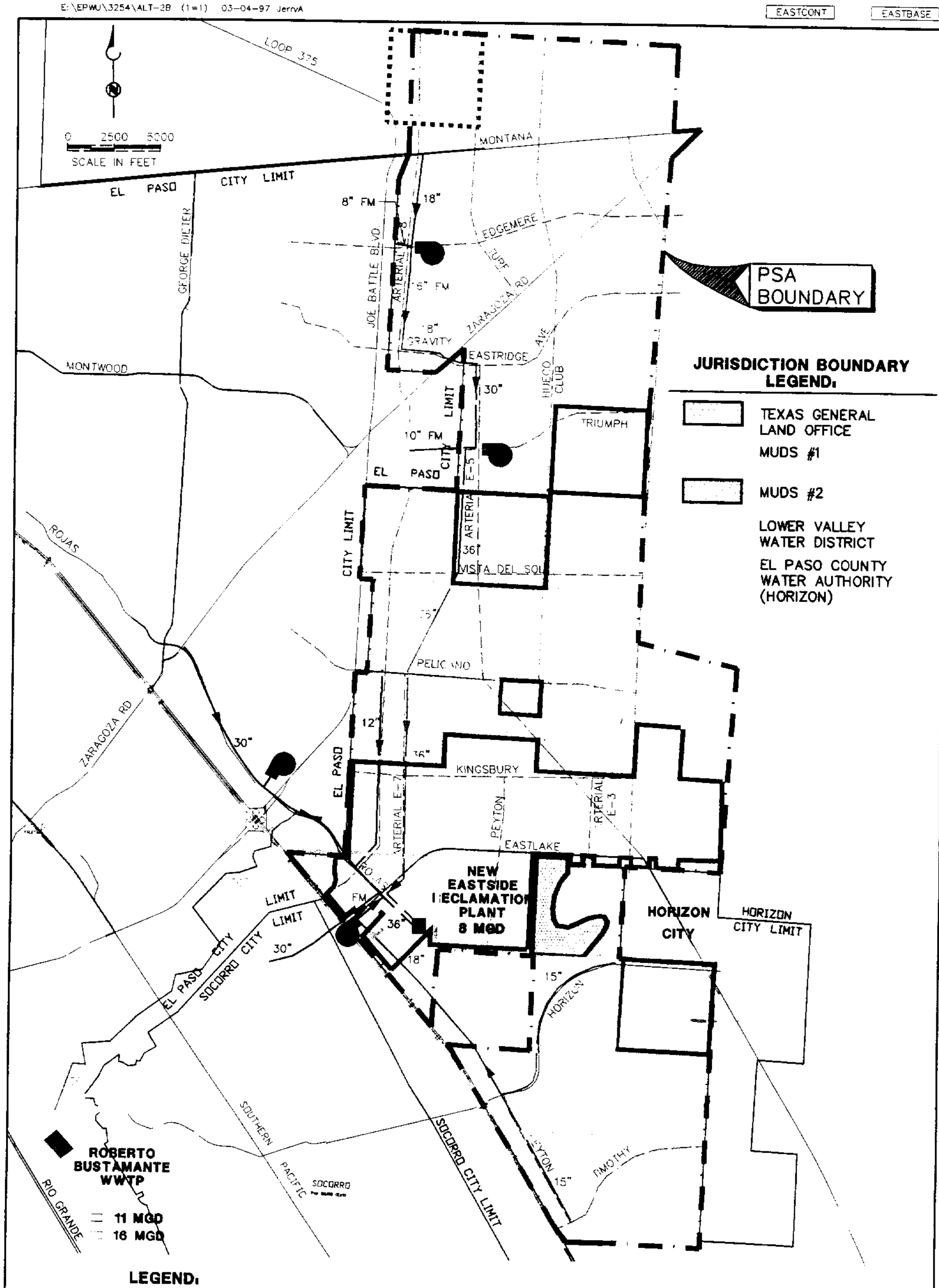


REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

ALTERNATIVE 2a
NEW EASTSIDE WWTP
FIGURE 7-4

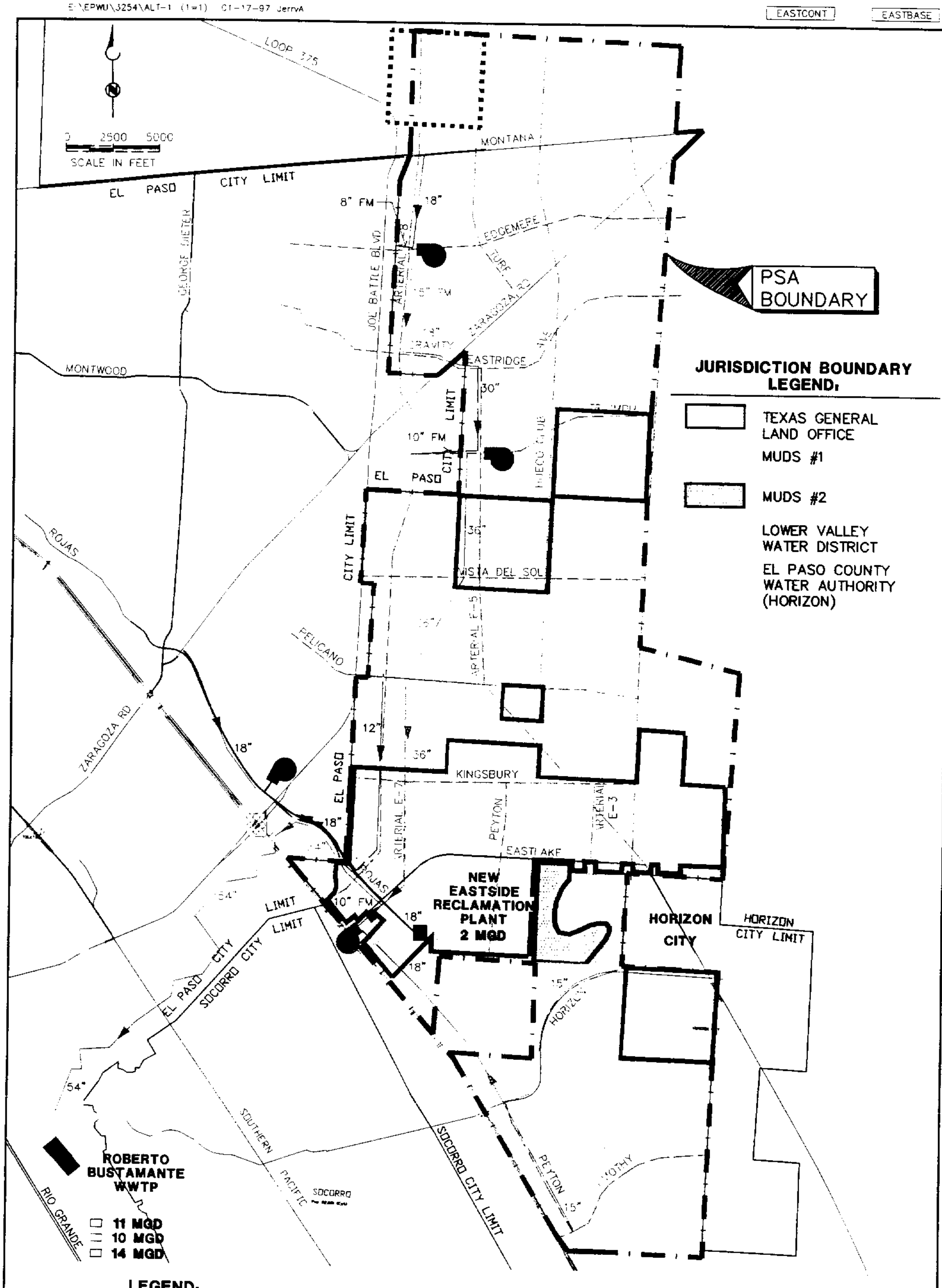
E:\EPWU\3254\ALT-2B (1=1) 03-04-97 JerryA

EASTCONT EASTBASE



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	ALTERNATIVE 2b NEW EASTSIDE WWTP FIGURE 7-5

E:\EPWU\3254\ALT-1 (1=1) 01-17-97 JerryA



INITIAL IMPROVEMENTS (1997–2005)

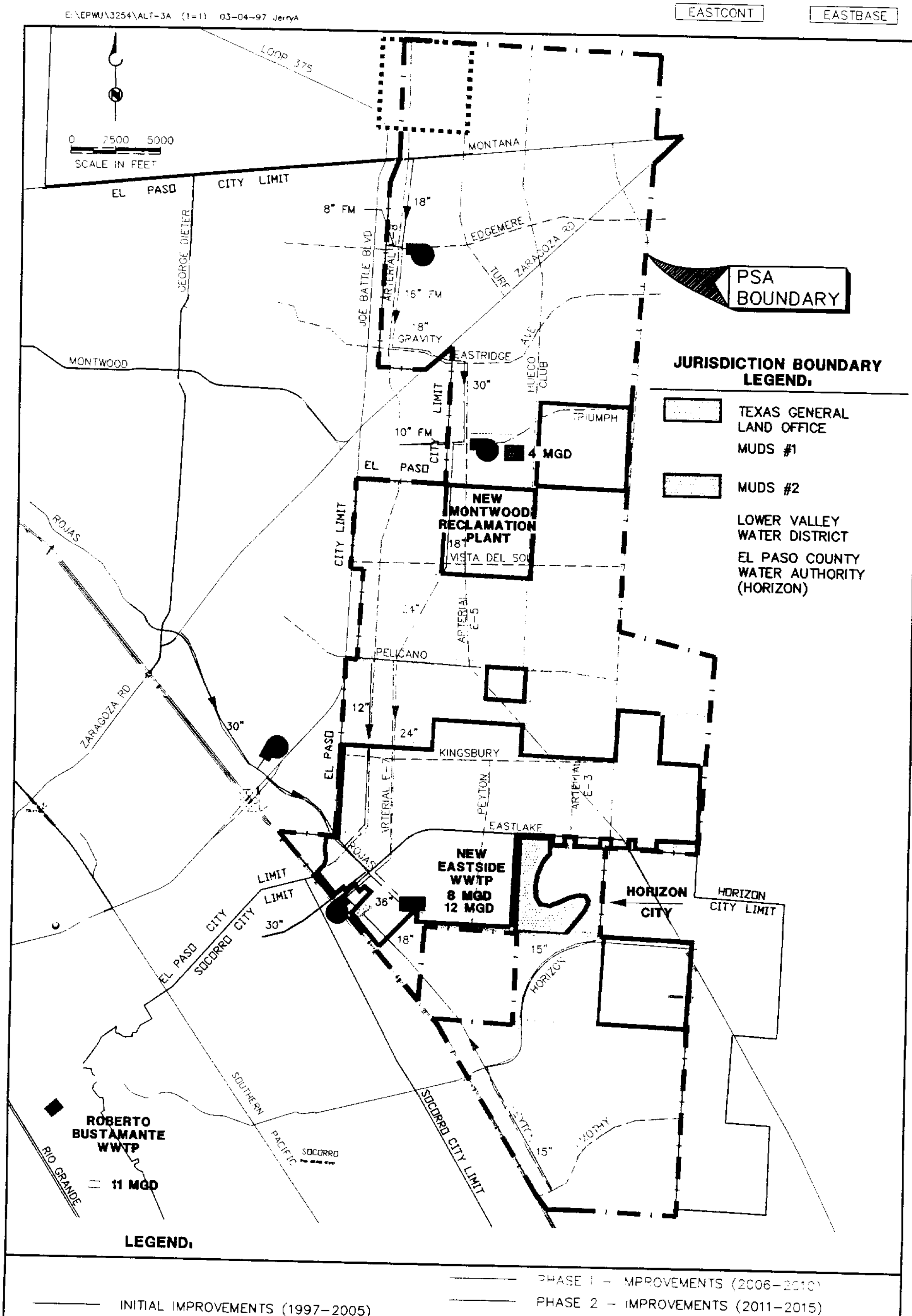
PHASE 1 – IMPROVEMENTS (2006–2010)

PHASE 2 – IMPROVEMENTS (2011–2015)

ULTIMATE – BEYOND 2015

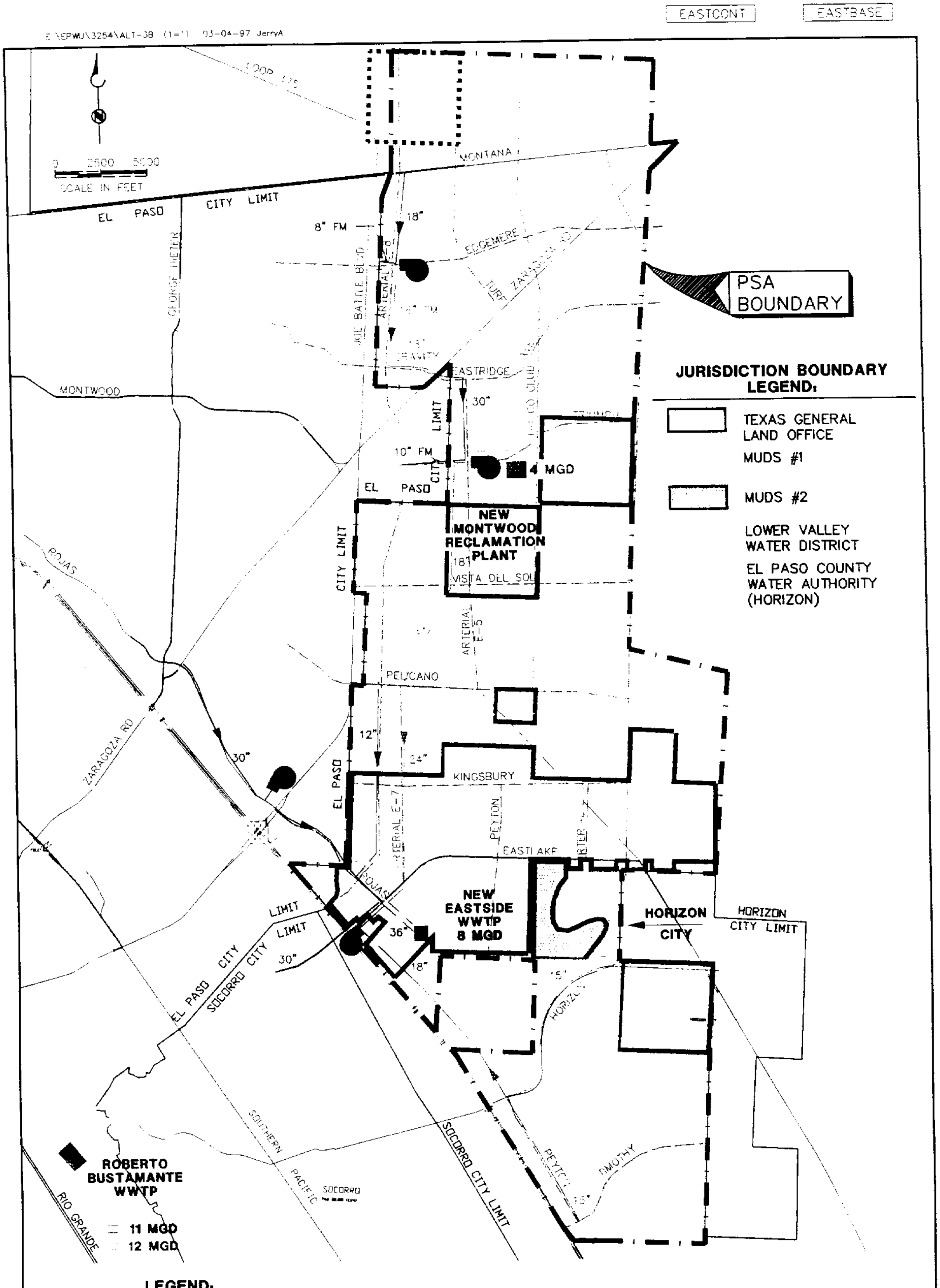
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

ALTERNATIVE 2c
EXPANSION OF BUSTAMANTE WWTP SERVICE AREA
FIGURE 7-6



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

ALTERNATIVE 3a
NEW MONTWOOD RECLAMATION PLANT AND EASTSIDE WWTP
FIGURE 7-7

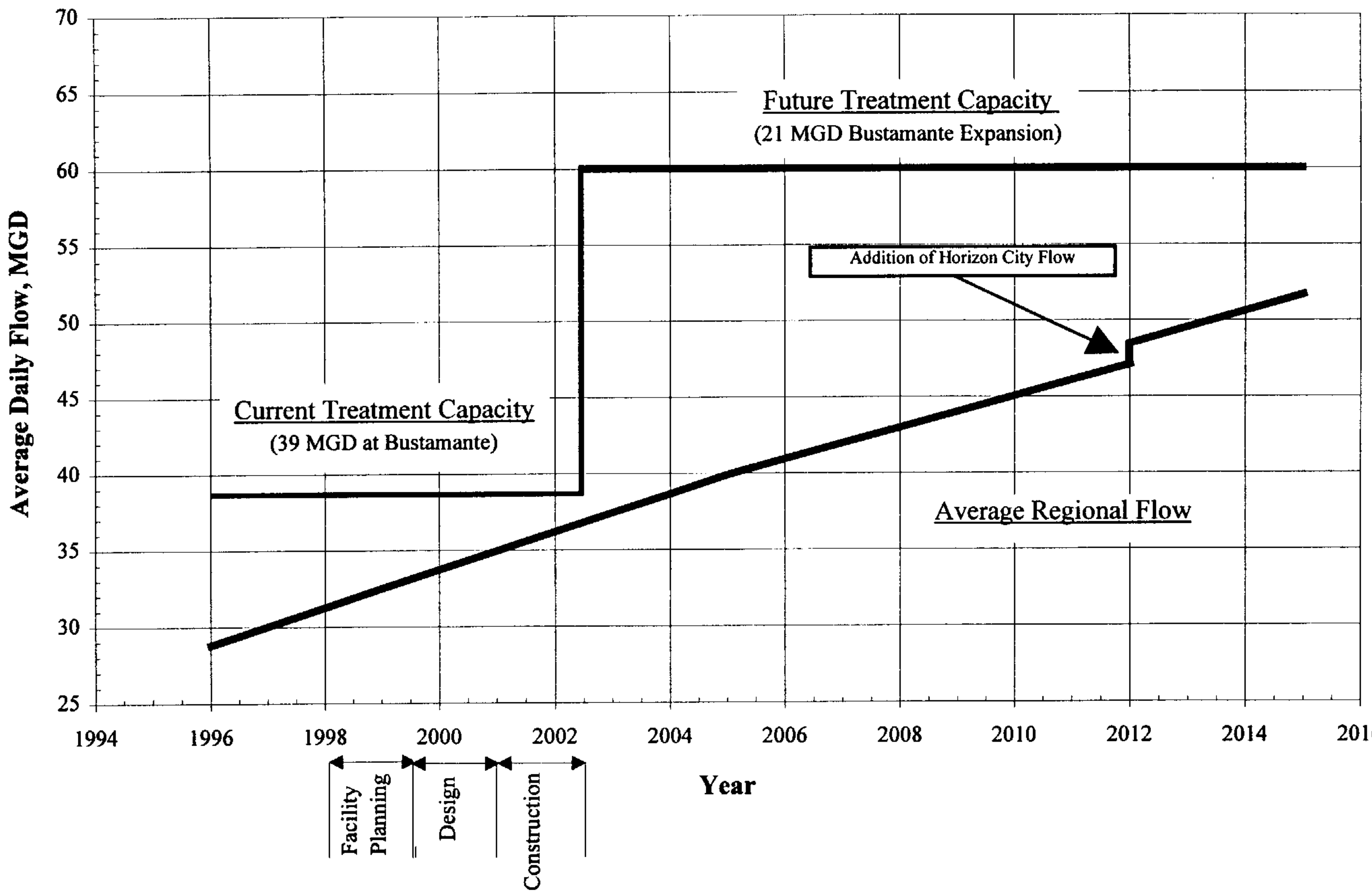


REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

ALTERNATIVE 3b
NEW MONTWOOD RECLAMATION PLANT AND EASTSIDE WWTP
FIGURE 7-8

FIGURE 7-9

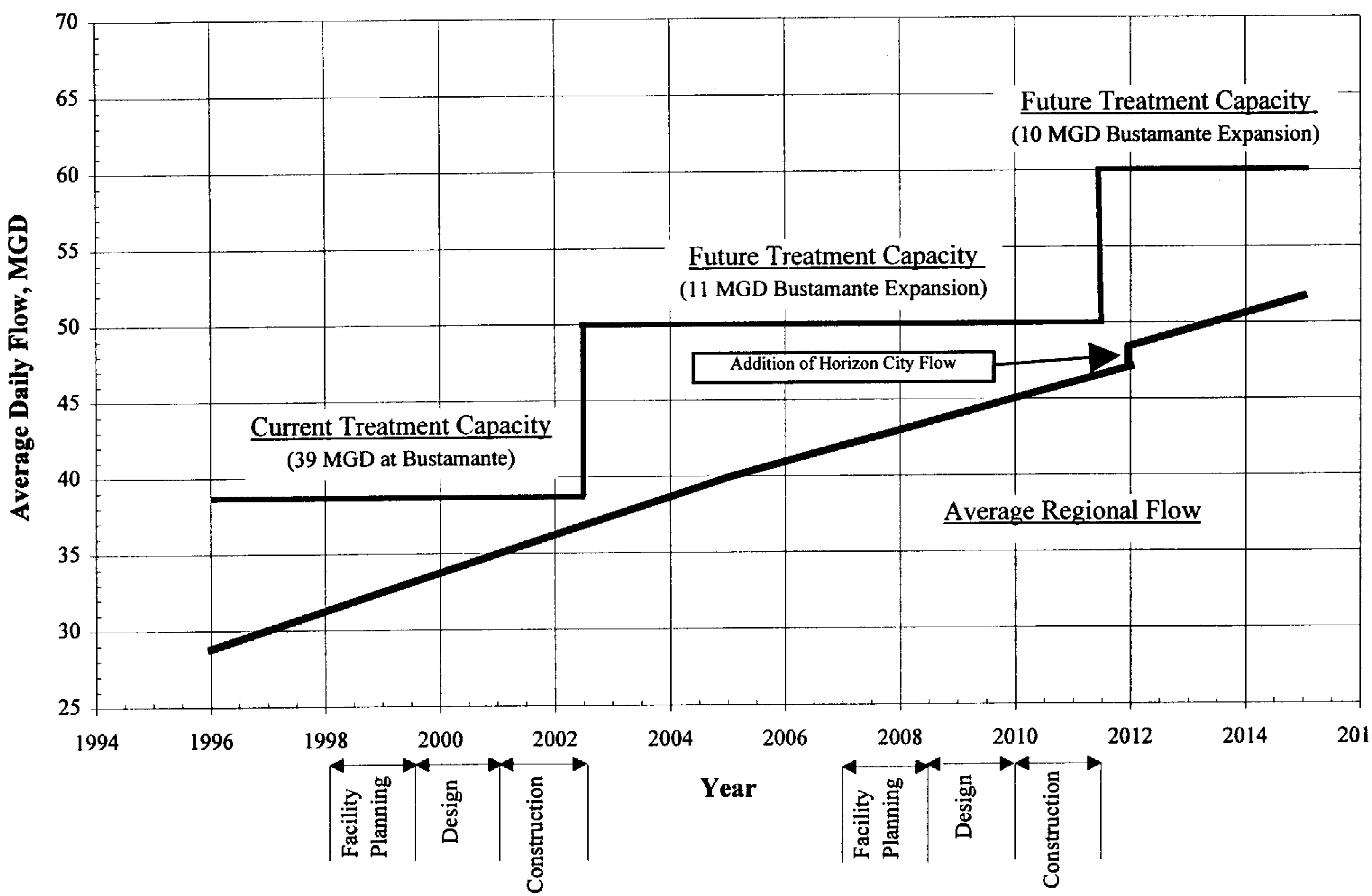
ALTERNATIVE 1 - PLANNING TIMELINE



e:\epwu\eastside\3254\report\final\Timeline.xls3/12/97/drc

FIGURE 7-10

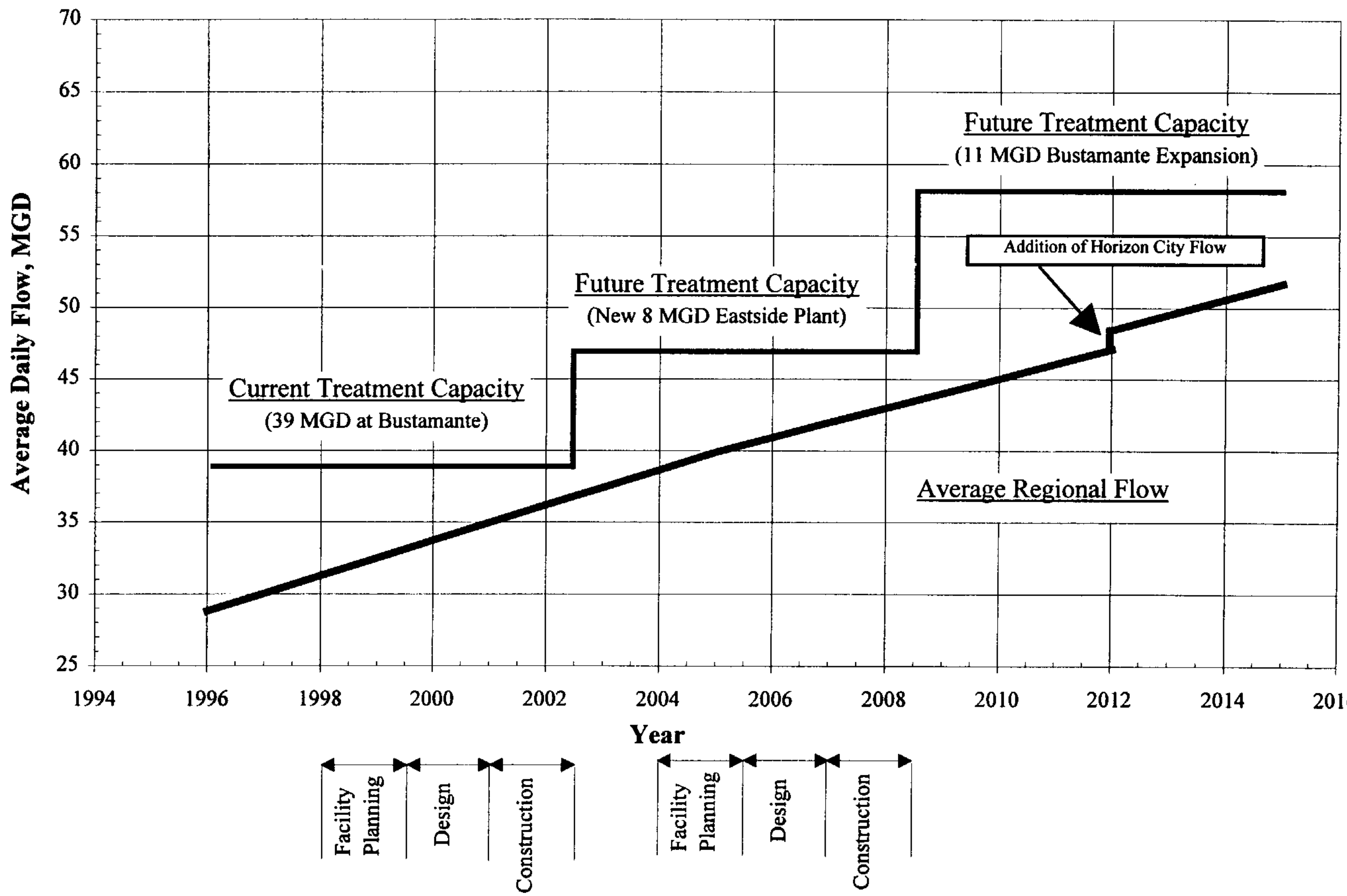
ALTERNATIVES 1a and 2c - PLANNING TIMELINE



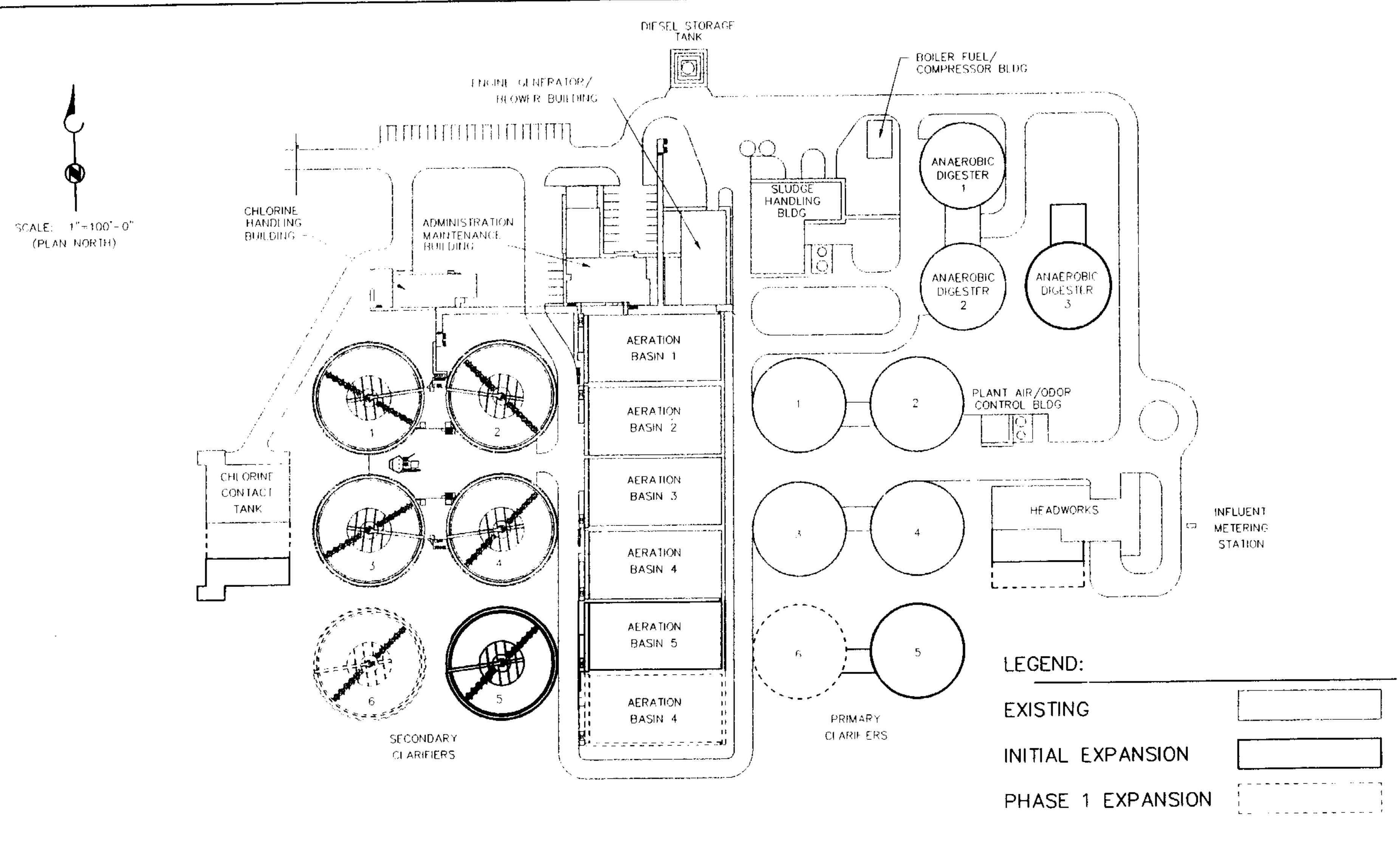
e:\epwu\eastside\3254\report\final\Timeline.xls3/12/97/drc

FIGURE 7-11

ALTERNATIVES 2a/2b AND 3a/3b - PLANNING TIMELINE



e:\epwu\eastside\3254\report\final\Timeline.xls3/12/97/drc



BROWN AND CALDWELL

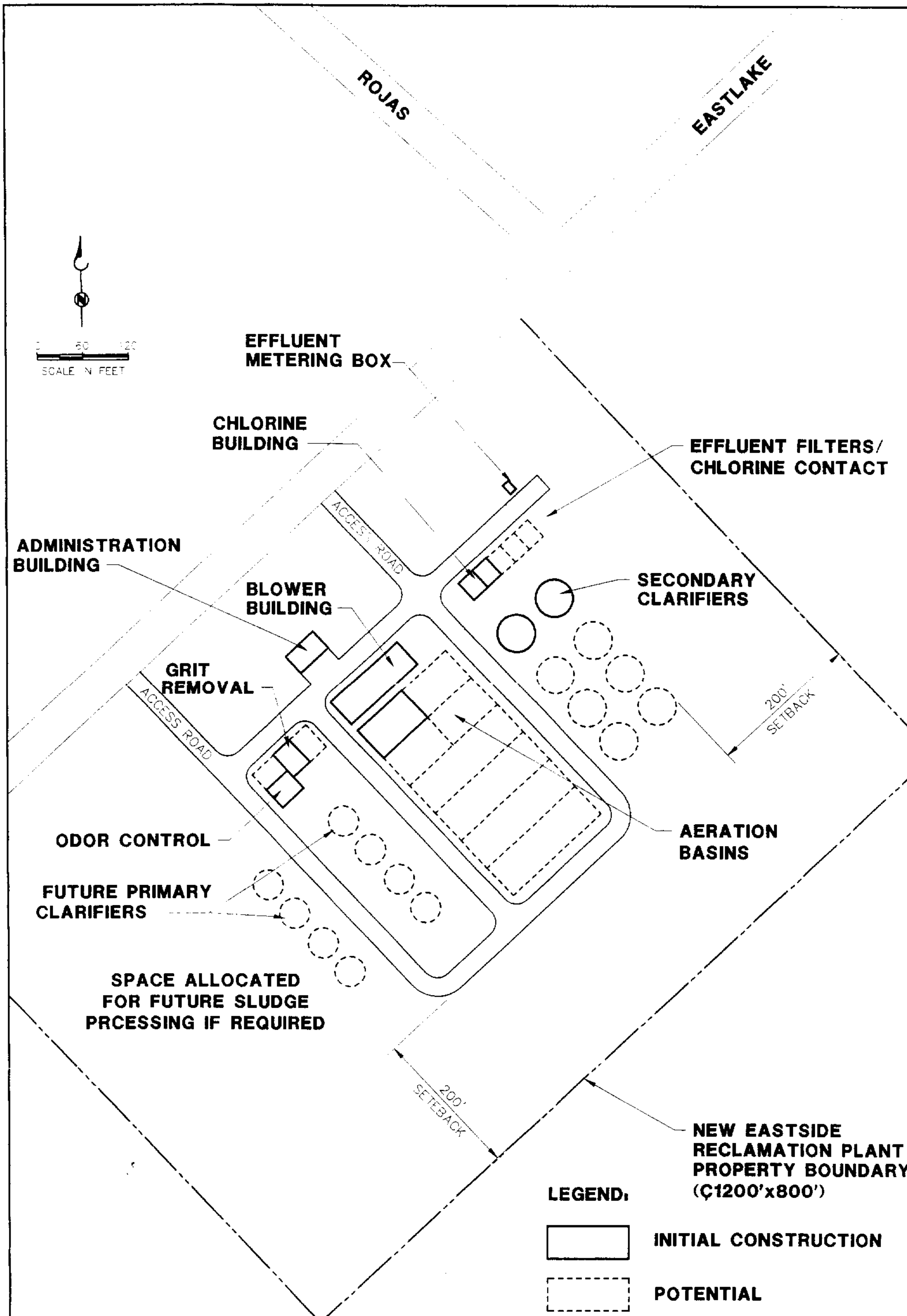
EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

BUSTAMANTE WWTP EXPANSION
FIGURE 9-1

E:\EPWU\3254\NEWPLANT (1=1) 12-31-96 JerryA

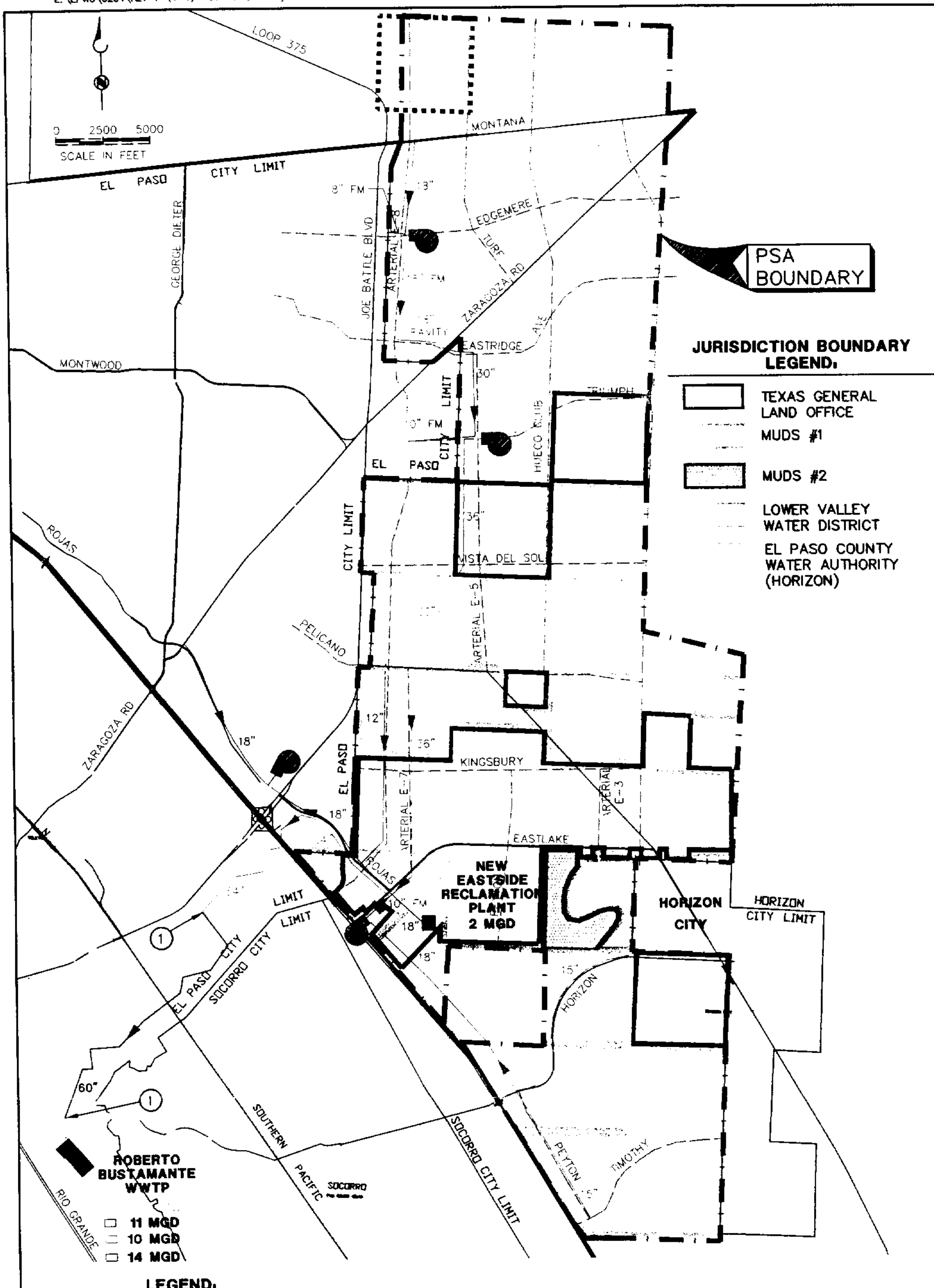
EASTPIPE EASTBASE THOROUGH



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	NEW EASTSIDE RECLAMATION PLANT 2.0 MGD (POTENTIAL 24.0 MGD) FIGURE 9-2

E:\EPWU\3254\ALT-1 (1=1) 01-17-97 JerryA

EASTCONT EASTBASE



INITIAL IMPROVEMENTS (1997–2005)

(1) REFER TO FIGURE 9-4

PHASE [illegible] IMPROVEMENTS (2006–20[illegible])

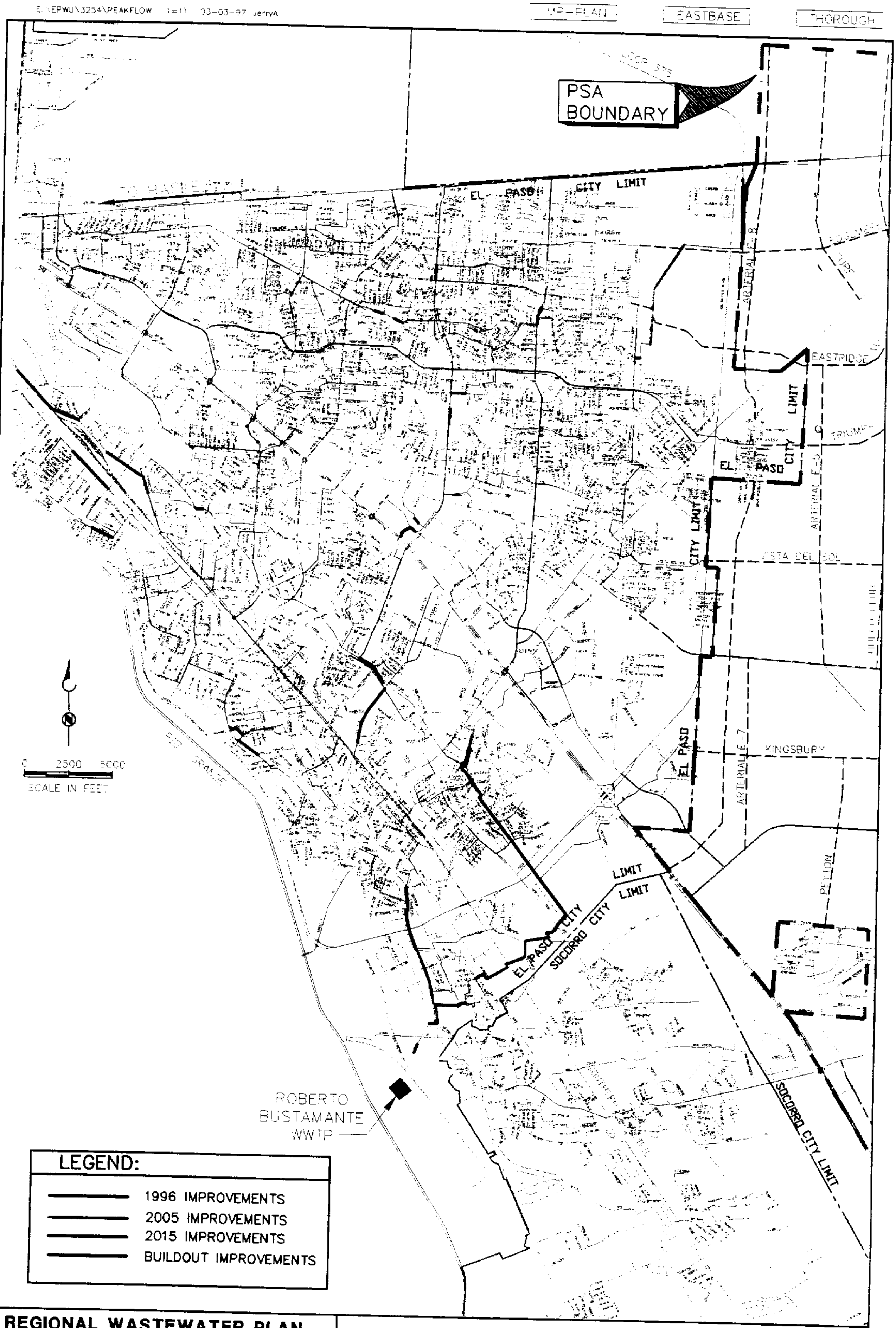
PHASE 2 – IMPROVEMENTS (2011–2015)

ULTIMATE – BEYOND 2015

REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

RECOMMENDED PLAN

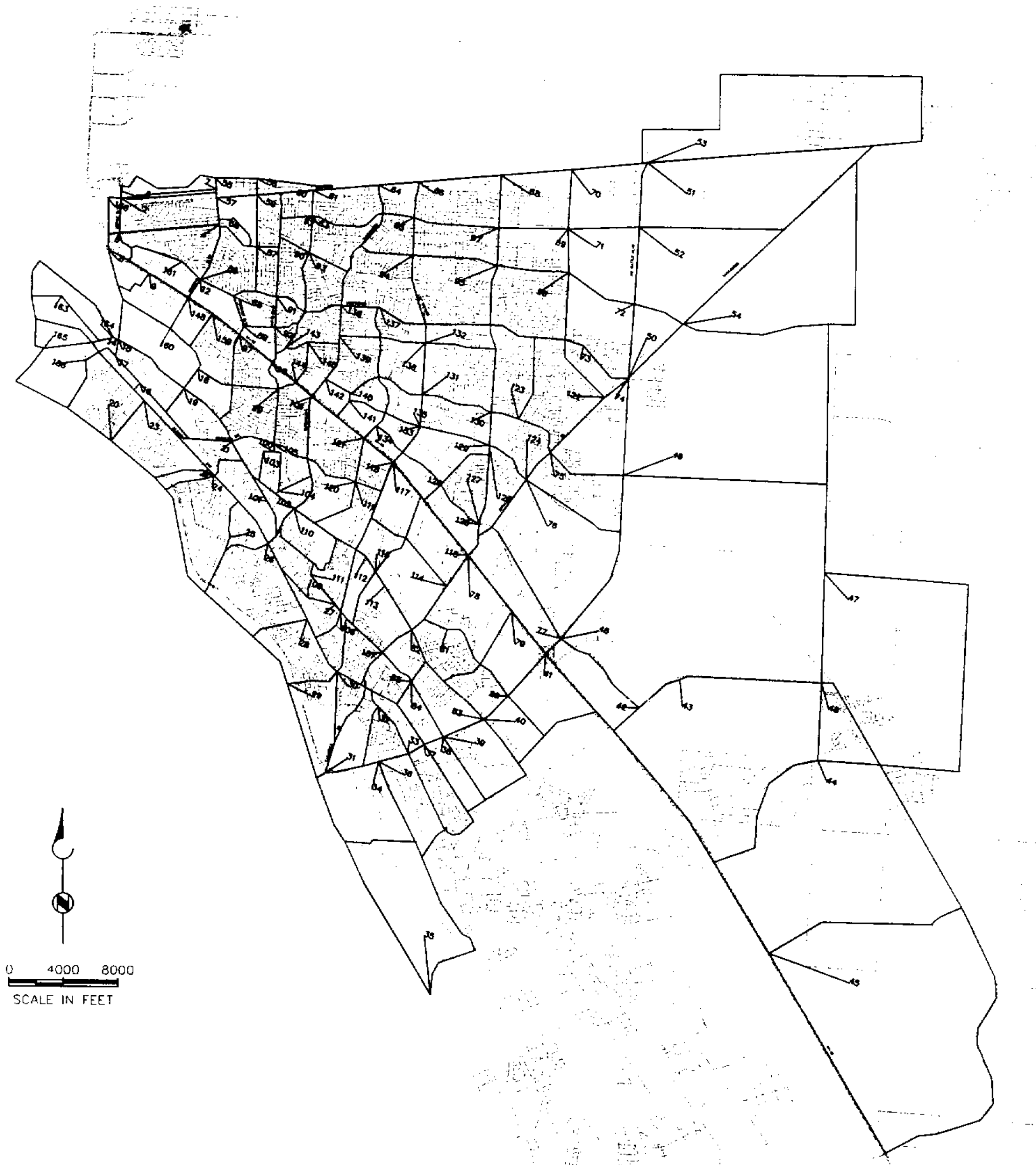
FIGURE 9-3



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

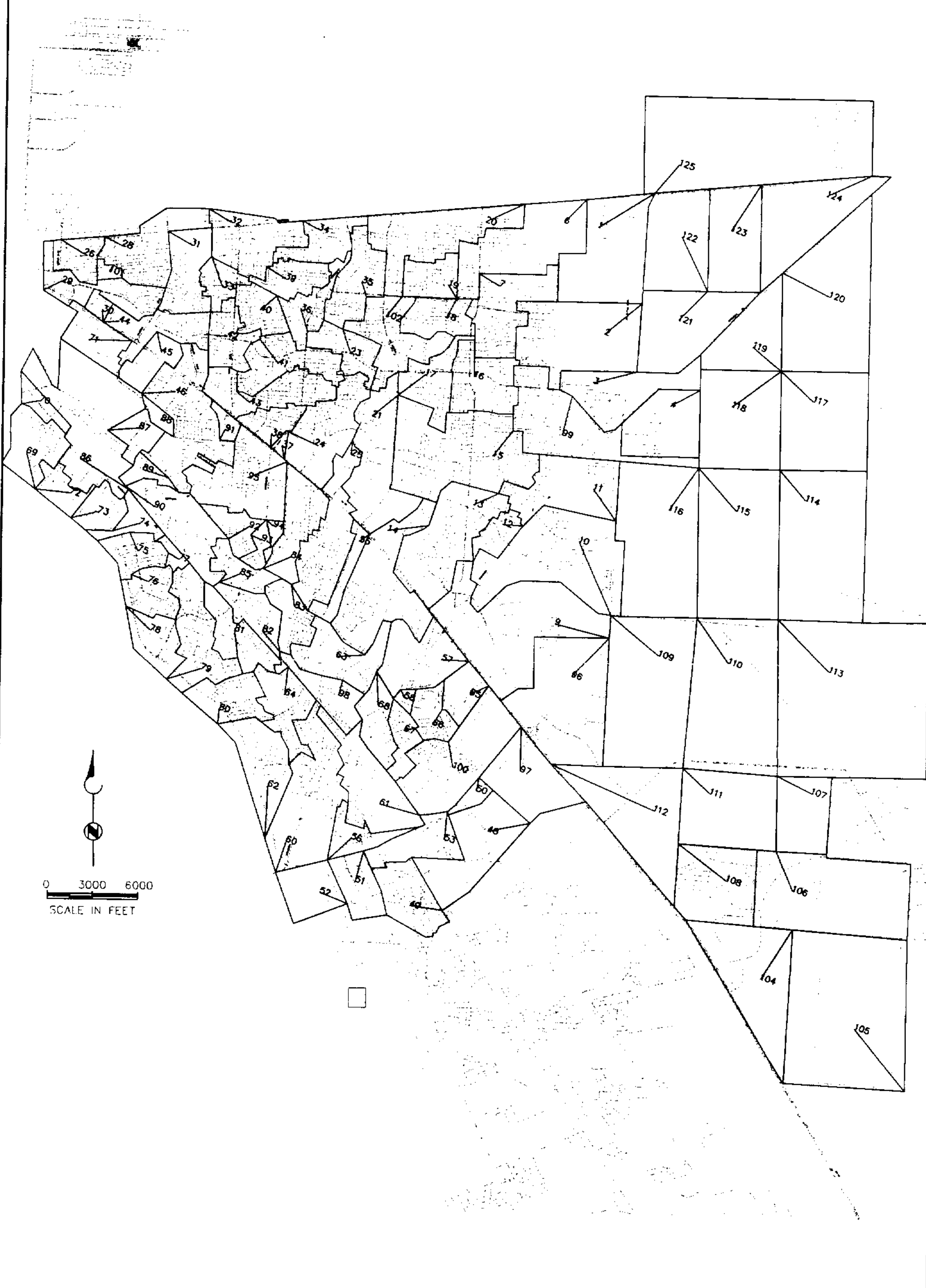
IMPROVEMENT PLAN

FIGURE 9-4



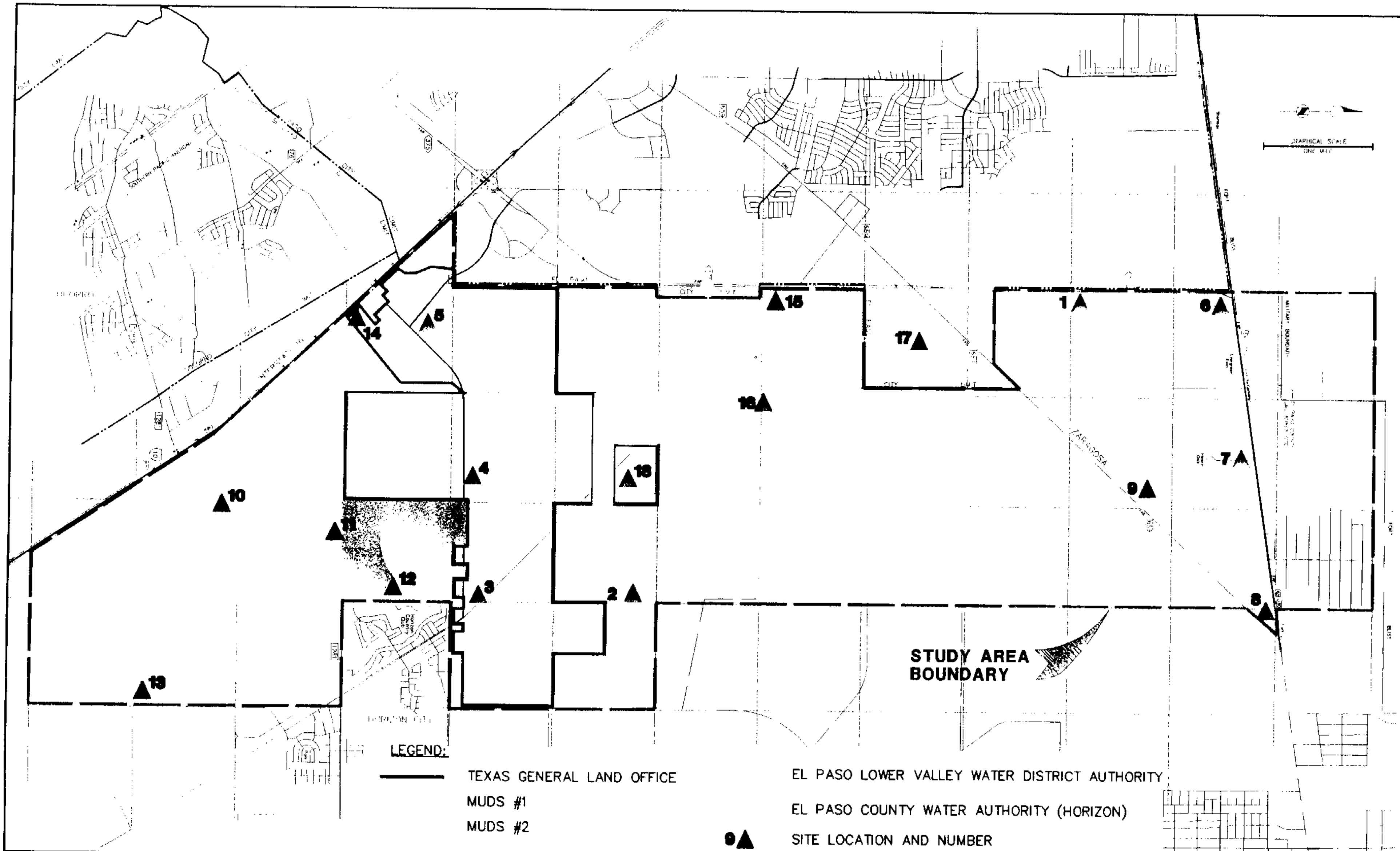
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

POPULATION DISTRIBUTION AREAS
FIGURE A-1



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

SEWER SERVICE AREAS
FIGURE A-2



BROWN AND CALDWELL

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

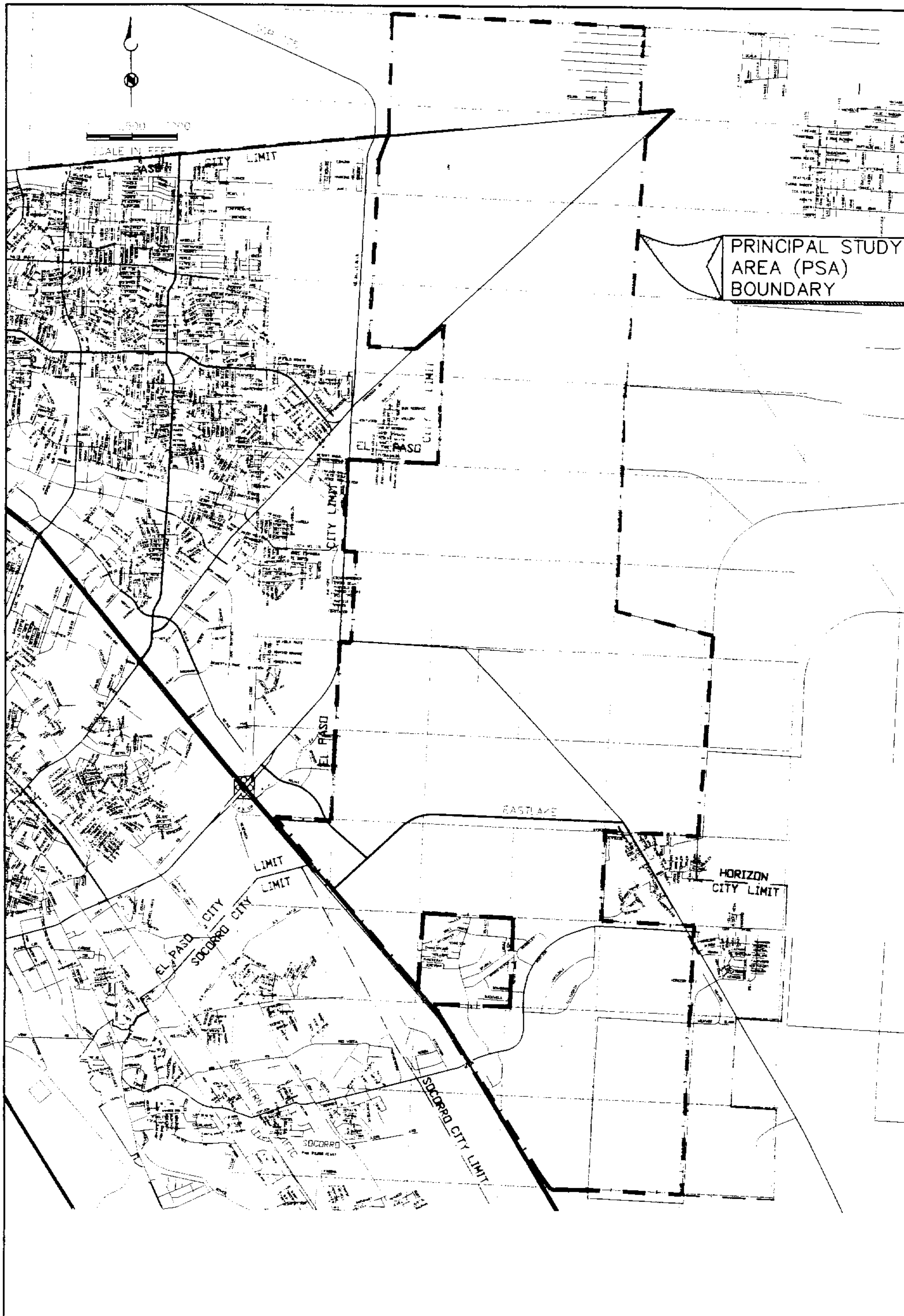
REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

SITES VISITED FOR BIOTIC ASSESSMENT

FIGURE C-1

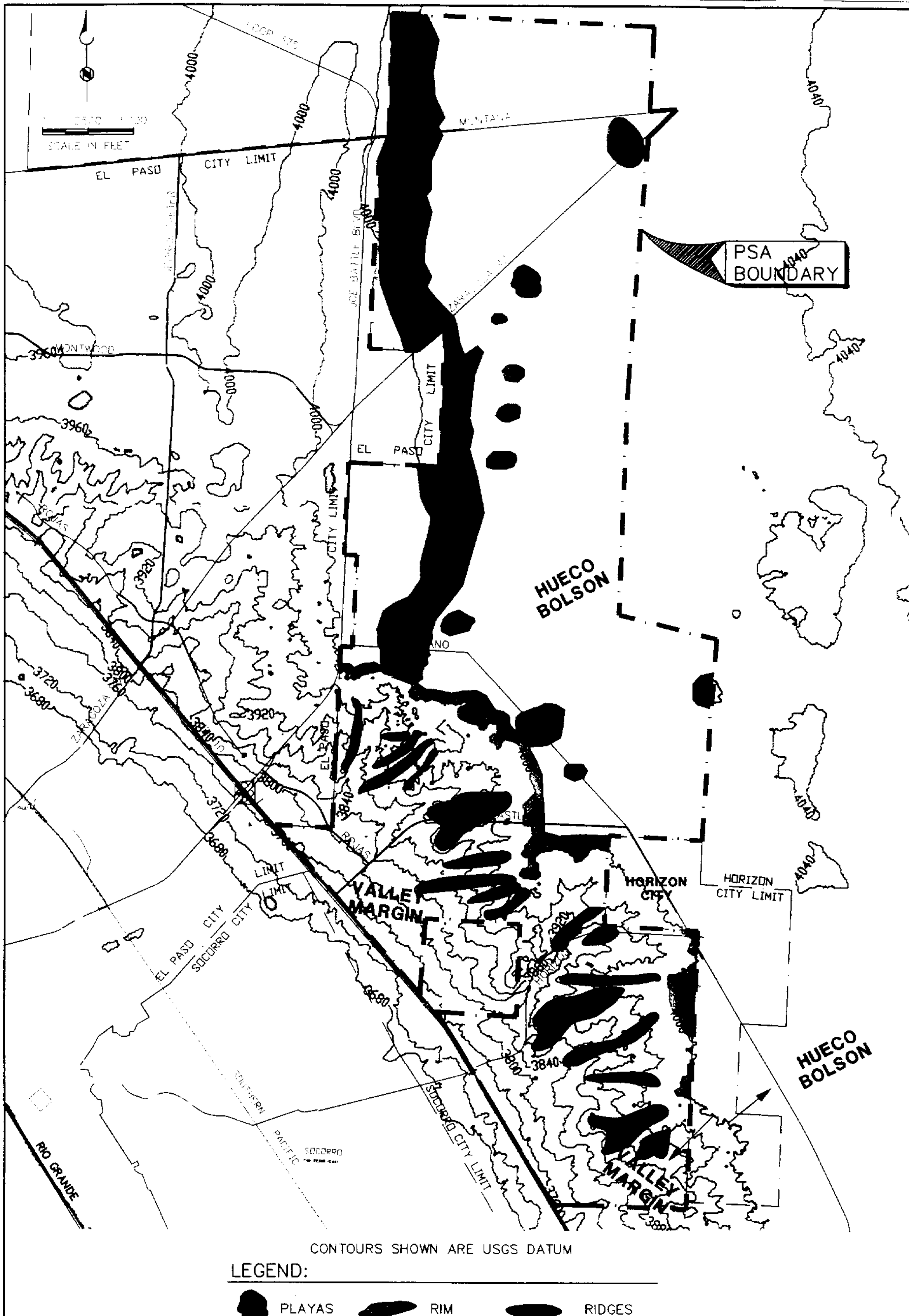
E:\EPWU\3254\FIGD-1 (1=1) 10-23-96 JerryA

EASTBASE



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

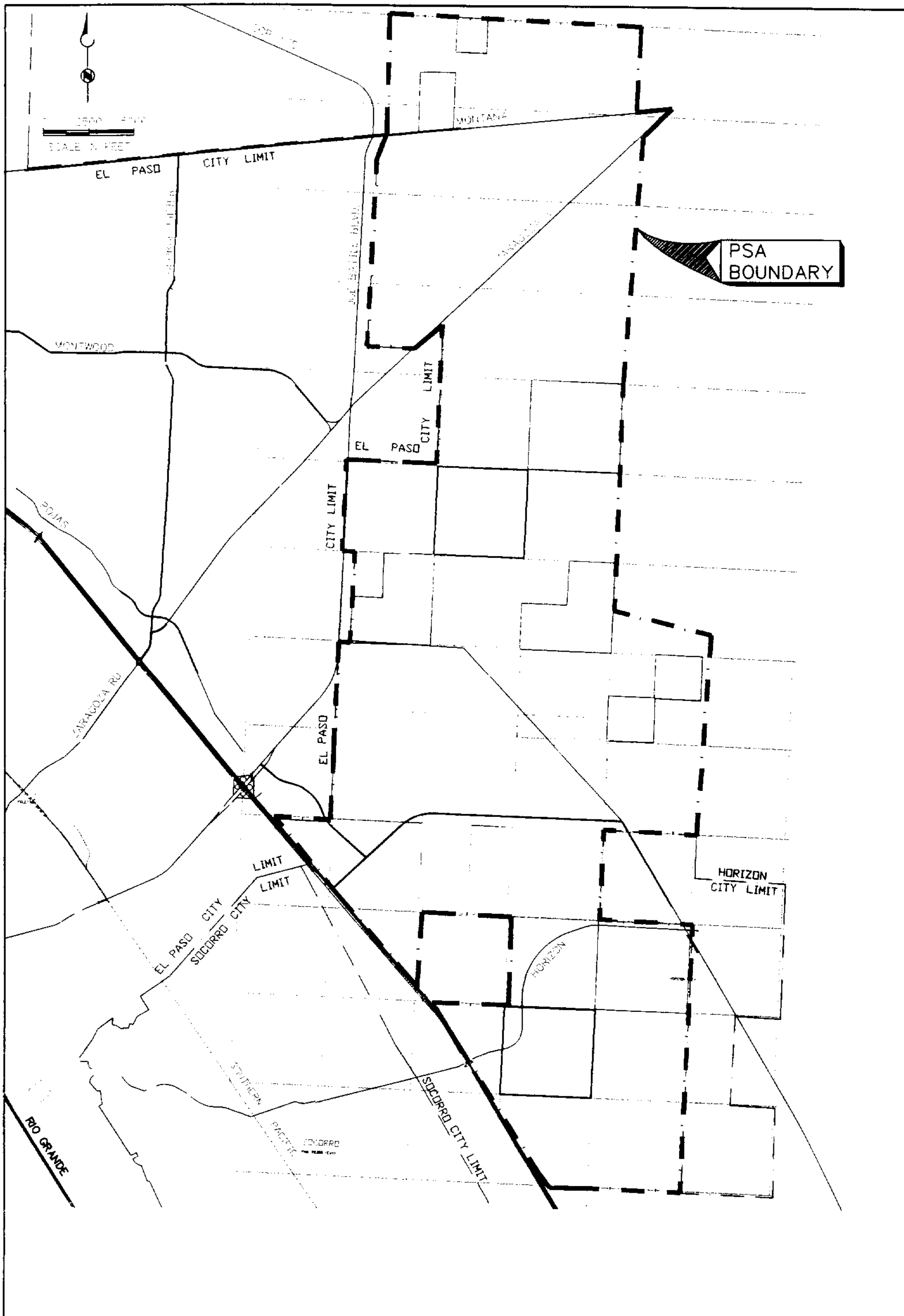
ARCHAEOLOGICAL PRINCIPAL STUDY AREA
FIGURE D-1



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	TOPOGRAPHIC ZONES IN THE PRINCIPAL STUDY AREA FIGURE D-2

E:\EPWU\3254\FIGD-3 (1=1) 10-23-96 JerryA

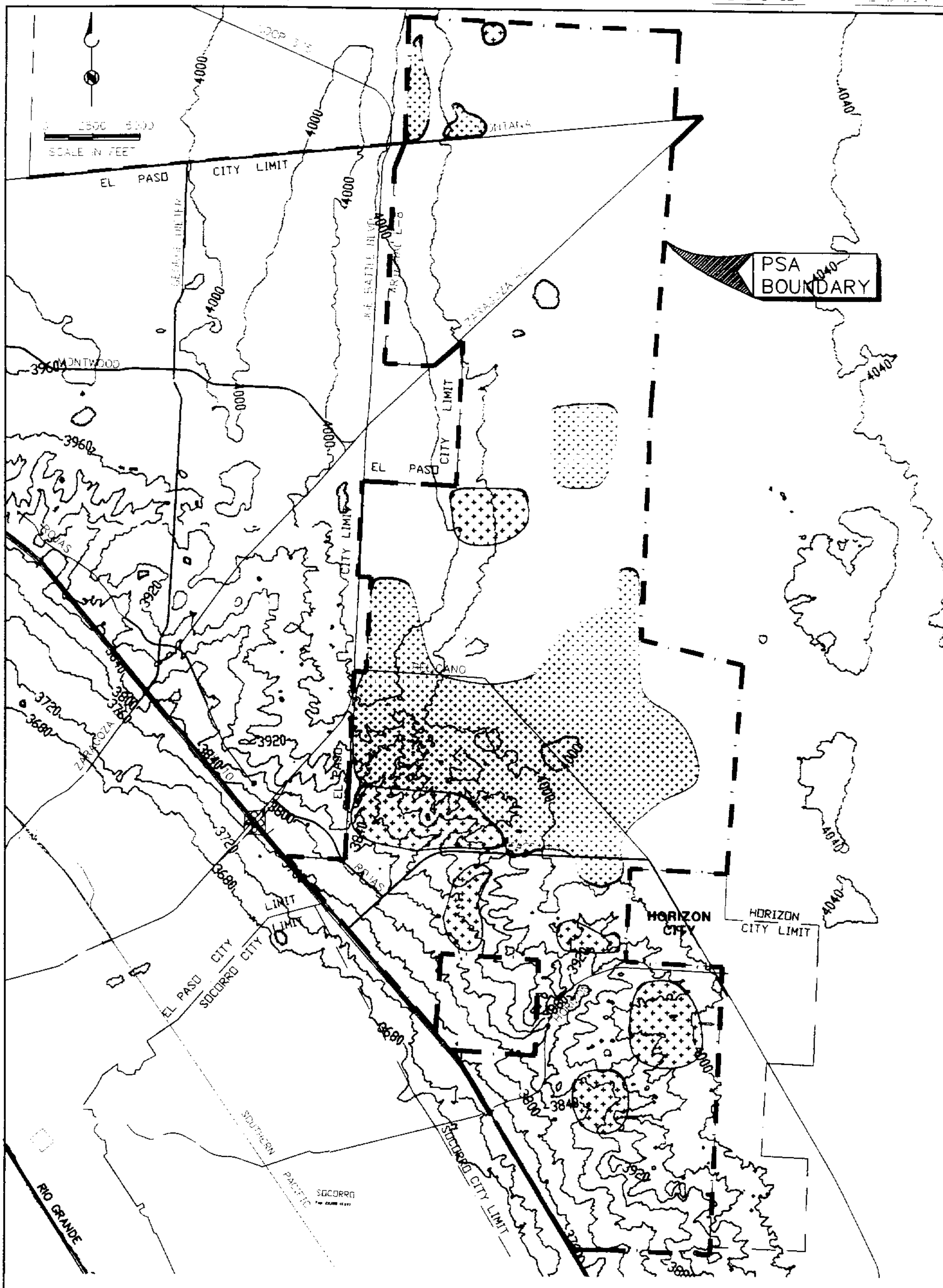
EASTBASE



REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

PREVIOUSLY SURVEYED ARCHAEOLOGICAL AREAS
FIGURE D-3

E:\EPWU\3254\FIGD-4 (1=1) 10-21-96 JerryA



LEGEND:

HIGH DENSITY ARCHAEOLOGICAL SITE FINDINGS

LOW DENSITY ARCHAEOLOGICAL SITE FINDINGS

REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA	LOCATION OF PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES FIGURE D-4

APPENDICES

APPENDIX A

POPULATION DATA

Table A-1 Population Projections Provided by the City Planning Office (See Figure A-1)

Population Area ID	Area acres	1996	2005	2015	Buildout[a]	City Serial Zone ID
2	392.35	3679	3728	3701	3701	232
3	47.89	2	2	2	2	224
4	348.09	2863	2899	2874	2874	233
5	42.32	0	0	0	0	625
7	109.59	0	0	0	0	231
8	100.37	0	0	0	0	236
9	233.57	0	0	0	0	235
12	162.6	470	478	475	475	266
14	32	0	0	0	0	607
15	230	2145	2049	1825	1825	246
16	70.97	576	573	552	552	295
17	56.84	1278	1192	1016	1016	245
18	156.03	101	81	46	46	293
19	233.04	1404	1410	1373	1373	294
20	438.05	4325	4501	4668	4668	244
21	136.74	1477	1530	1574	1574	298
22	70.14	8	8	8	8	297
23	438.85	4898	5146	5414	5414	296
24	599.08	6887	7691	8818	8818	310
25	149.08	1071	1172	1309	1309	311
26	695.48	5542	6934	9068	9068	312
27	151.3	1043	1076	1093	1093	329
28	374.97	3575	4354	5528	5528	330
29	385.65	1212	1402	1679	1679	338
30	135.51	2961	3076	3175	3175	336
31	265.95	907	949	997	997	337
32	183.34	1981	2077	2172	2172	339
33	127.11	498	606	765	765	351
34	629.99	10	7	0	0	340
35	1040.72	0	0	0	0	628
36	369.06	953	1701	2899	2899	610
37	279.82	3136	3399	3740	3740	341
38	198.15	58	77	106	106	342
39	418.94	801	1145	1694	1694	343
40	242.34	542	2339	5280	5280	344
41	429.75	163	910	2136	2136	345
42	398.85	265	293	320	3988.5	614
43	2885.13	1956	4902	9684	29568.98	464
44	3565.76	191	491	1098	36278.34	454
45	4463.64	99	320	683	45515.66	634

Table A-1 Population Projections Provided by the City Planning Office (See Figure A-1)

Population Area ID	Area acres	1996	2005	2015	Buildout[a]	City Serial Zone ID
46	5565.91	0	1977	4634	56772.28	465
47	2974.5	1287	1910	2896	30339.9	636
48	368.31	1024	1103	1177	3756.76	637
49	3585.54	1048	2535	4952	36572.51	468
50	244.6	282	1571	3678	2494.92	475
51	1666.45	599	2188	4371	16997.79	480
52	1077.83	0	2187	5122	10993.87	479
53	2133.53	698	1499	2792	21762.01	481
54	1834.03	551[b]	2056[c]	5390[d]	18707.11	466
55	92.03	329	329	329	329	624
56	79.94	0	0	0	0	253
57	147.58	700	709	703	703	248
58	48.67	527	534	529	529	249
59	154.77	1787	1810	1794	1794	250
60	98.92	987	1003	997	997	252
61	293.59	4544	4819	5141	5141	254
62	108.33	1139	1153	1143	1143	251
63	270.21	3478	3521	3491	3491	255
64	138.09	1618	1971	2501	2501	257
65	196.11	2015	2062	2079	2079	256
66	479.96	5754	6513	7594	7594	258
67	353.43	4552	4655	4689	4689	259
68	488.09	1595	2551	4079	4079	483
69	359.03	1251	2278	3933	3933	477
70	544.43	0	1678	3927	3927	482
71	549.21	469	2625	6147	6147	478
72	563.65	2721	3701	5226	5226	474
73	163.3	1453	2101	3128	3128	470
74	535.87	1809	2196	2778	2778	469
75	480.56	2320	4073	6888	6888	320
76	1300.69	1146	3079	6224	6224	321
77	486.5	2	2	2	2	322
78	544.1	3368	4554	6406	6406	325
79	336.05	58	313	734	734	347
80	220.86	1734	2064	2553	2553	348
81	301.89	5682	6275	7079	7079	326
82	146.45	1528	1562	1572	1572	334
83	301.87	1616	1664	1692	1692	349
84	157.1	289	309	331	331	350
85	173.96	1282	1343	1400	1400	335

Table A-1 Population Projections Provided by the City Planning Office (See Figure A-1)

Population Area ID	Area acres	1996	2005	2015	Buildout[a]	City Serial Zone ID
86	300.57	2462	2499	2490	2490	265
87	126	1423	1440	1428	1428	264
88	155.81	1887	2105	2405	2405	268
89	101.72	1428	1446	1433	1433	269
90	194.49	1884	1908	1892	1892	263
91	80.28	394	399	396	396	274
92	51.61	474	480	476	476	273
93	229.19	2913	2949	2924	2924	262
94	520.03	7390	7483	7419	7419	261
95	619.28	9631	9837	9893	9893	260
96	609.59	5555	6120	6884	6884	476
97	193.59	2918	2962	2948	2948	270
98	37.6	318	322	320	320	271
99	315.4	5008	5062	5011	5011	292
100	113.12	2988	3114	3236	3236	299
101	256.96	1534	1619	1713	1713	309
102	75.7	1363	1411	1454	1454	308
103	85.16	846	883	911	911	300
104	76.5	786	837	892	892	302
105	116.1	1596	2036	2710	2710	301
106	266.43	3513	3576	3574	3574	291
107	187.47	1883	1948	2003	2003	333
108	115.88	1130	1183	1235	1235	331
109	198.72	2398	2648	2989	2989	313
110	230	2092	2209	2331	2331	307
111	190.71	2350	2476	2609	2609	314
112	141.44	315	369	449	449	332
113	308.81	2647	3062	3672	3672	328
114	407.6	2579	3092	3863	3863	327
115	320.73	25	34	46	46	316
116	155.31	2125	2618	3367	3367	315
117	255.44	805	1244	1939	1939	305
118	143.47	991	1029	1066	1066	304
119	241.65	2223	2365	2536	2536	306
120	243.3	2182	2391	2671	2671	303
121	380.37	4360	4663	5037	5037	290
122	609.84	6209	6745	7445	7445	473
123	408.18	5936	6544	7372	7372	472
124	304.48	3597	4064	4729	4729	471
125	256.58	1629	2379	3560	3560	319

Table A-1 Population Projections Provided by the City Planning Office (See Figure A-1)

Population Area ID	Area acres	1996	2005	2015	Buildout[a]	City Serial Zone ID
126	194.51	0	0	0	0	317
127	256.95	3250	3556	3964	3964	318
128	123.71	0	0	0	0	323
129	308.56	2	2	2	2	284
130	286.15	1427	1737	2204	2204	283
131	496.22	5172	5297	5349	5349	282
132	178.6	1224	1272	1316	1316	281
133	100.06	0	0	0	0	324
134	77.71	324	324	324	324	285
135	141.06	494	506	511	511	286
136	256.82	2024	2426	3028	3028	278
137	134.01	926	944	953	953	280
138	137.5	1225	1240	1229	1229	279
139	266.36	3326	3368	3339	3339	277
140	104.11	982	994	986	986	287
141	127.1	2	2	2	2	288
142	98.07	276	296	320	320	289
143	186.78	1614	1634	1620	1620	275
144	104.04	740	749	742	742	272
145	169.99	1313	1329	1318	1318	276
148	130.47	4	4	4	4	211
158	51.78	0	0	0	0	225
159	263.09	3109	3242	3369	3369	267
160	408.34	93	57	0	0	247
161	204.54	1577	1601	1598	1598	234
162	5351.85	35824	52042	74739	90000	666
163	154.23	1761	1783	1780	1780	241
164	245.71	983	995	990	990	240
165	135.25	2585	2617	2612	2612	242
166	371.7	271	274	274	274	243

[a] Buildout populations for the existing PSB service area are assumed to occur in 2015. The remainder the PSA is assumed to have a buildout population based on 10 people per acre.

[b] Assumed 10 percent of the City Planning Office projection for 1996. The city defined area extends beyond the study area.

[c] Assumed 20 percent of the City Planning Office projection for 2005. The city defined area extends beyond the study area.

[d] Assumed 30 percent of the City Planning Office projection for 2015. The city defined area extends beyond the study area.

Table A-2 Population Distribution by Sewer Subarea (See Figure A-2)

Service Subarea ID	Area acres	1996	2005	2015	Buildout
1	783.6	255	2710	6311	6311
2	851.8	3511	5438	8468	8468
3	487.0	1532	2749	4698	4698
4	469.9	172	538	1135	1135
6	716.3	3040	4536	6764	6764
7	495.5	3184	4160	5672	5672
9	1184.2	1287	2533	4543	4543
10	1054.2	3588	6080	10066	10066
11	553.0	3542	4022	4709	4709
12	141.7	1277	1609	2117	2117
13	716.8	4692	5370	6348	6348
14	754.0	2660	3447	4662	4662
15	1057.1	10654	11584	12800	12800
16	391.0	4599	4954	5405	5405
17	296.2	3063	3147	3196	3196
18	246.4	3749	3834	3862	3862
19	214.4	2668	2751	2808	2808
20	655.6	7014	8054	9560	9560
21	621.9	2373	2698	3169	3169
23	232.1	2802	2840	2823	2823
24	512.5	4064	4219	4356	4356
25	523.8	3881	4100	4355	4355
26	179.4	1440	1459	1448	1448
28	448.1	3276	3315	3292	3292
29	333.6	1915	1941	1928	1928
30	49.8	376	382	381	381
31	337.8	2410	2444	2430	2430
32	440.9	4313	4435	4506	4506
33	149.0	1543	1563	1550	1550
34	251.6	3765	4019	4328	4328
35	359.9	4289	4472	4645	4645
36	219.0	2821	2857	2833	2833
37	24.3	97	101	105	105
38	162.4	1235	1250	1239	1239
39	212.6	2637	2670	2647	2647
40	206.8	2212	2240	2221	2221
41	368.3	3415	3458	3428	3428
42	237.7	2419	2542	2673	2673
43	392.1	4042	4110	4104	4104

Table A-2 Population Distribution by Sewer Subarea (See Figure A-2)

Service Subarea ID	Area acres	1996	2005	2015	Buildout
44	309.9	2078	2141	2184	2184
45	193.9	382	392	398	398
46	721.5	8321	8538	8653	8653
48	592.4	995	2797	5736	5736
49	348.0	2808	3235	3853	3853
50	66.0	335	599	1022	1022
51	247.6	369	656	1114	1114
52	289.0	5	4	0	0
53	297.6	1040	1267	1612	1612
55	144.1	1088	1352	1753	1753
56	179.3	1703	1804	1916	1916
57	451.0	2262	2907	3904	3904
58	33.4	374	445	552	552
60	796.3	6403	6734	7094	7094
61	527.2	2956	3154	3381	3381
62	419.0	2753	3314	4156	4156
63	392.6	2594	2976	3530	3530
64	312.8	2677	2867	3092	3092
65	177.2	1083	1464	2059	2059
66	183.5	2252	2626	3172	3172
67	159.0	2313	2532	2824	2824
68	231.0	2144	2305	2507	2507
69	329.4	2881	2997	3107	3107
70	102.4	1347	1301	1188	1188
71	248.5	31	31	31	31
72	149.8	1526	1596	1669	1669
73	175.9	1959	2058	2165	2165
74	129.8	1360	1422	1485	1485
75	202.9	1599	1784	2045	2045
76	231.4	2614	2919	3347	3347
77	48.8	496	549	622	622
78	251.0	2600	3001	3588	3588
79	470.5	3710	4463	5599	5599
80	287.7	2431	3008	3887	3887
81	295.4	2759	3149	3710	3710
82	230.2	2302	2463	2657	2657
83	216.0	2235	2366	2510	2510
84	356.5	3740	4026	4391	4391
85	178.3	2184	2290	2398	2398

Table A-2 Population Distribution by Sewer Subarea (See Figure A-2)

Service Subarea ID	Area acres	1996	2005	2015	Buildout
86	935.9	5030	4959	4700	4700
87	151.6	334	318	283	283
88	55.8	673	702	730	730
89	86.5	534	536	522	522
90	451.9	4710	4894	5056	5056
91	60.4	782	793	789	789
92	160.7	2221	2561	3048	3048
93	70.4	827	964	1160	1160
94	40.0	394	429	473	473
95	581.6	7886	8128	8295	8295
96	1025.5	447	1140	2224	2224
97	484.1	187	959	2224	2224
98	233.8	1943	2202	2573	2573
99	702.6	5620	6697	8307	8307
100	737.7	4160	4919	6041	6041
101	37.7	306	310	307	307
102	434.3	6378	6494	6499	6499
103	5351.8	0	48187	69203	87963
104	847.1	180	479	897	8258
105	1847.0	60	180	479	18241
106	1206.2	180	479	957	12324
107	403.8	0	658	1259	3831
108	613.2	0	0	0	0
109	1275.4	0	419	1019	12315
110	1381.4	0	598	1259	22685
111	738.9	539	1137	2334	7120
112	905.0	479	1137	2093	8796
113	2387.1	0	1137	2037	21111
114	1313.9	0	539	1077	9639
115	1239.4	45	598	1259	11731
116	1203.5	45	598	1380	12093
117	874.7	0	419	897	5981
118	817.0	90	658	1315	7722
119	479.4	90	778	2093	4426
120	1236.3	0	2035	5981	12565
121	668.6	60	1616	3831	6880
122	623.5	180	957	1975	6404
123	561.7	180	778	1616	5326
124	719.9	240	898	1856	7185

Table A-2 Population Distribution by Sewer Subarea (See Figure A-2)

Service Subarea ID	Area acres	1996	2005	2015	Buildout
125	1989.5	419	957	1795	13796

APPENDIX B

CONSTRUCTION COST ESTIMATES

Lift Stations

[a]Cost = [113,600 x Hp^(-0.36)] x Hp

[a]Hp = [(gpm) x (TDH)] / [0.75 x 3960]

Assume : TDH = 50

Flow (MGD)	Flow (gpm)	Hp	Cost	ENR (4279[b]/6000)
0.25	174	3	229,475	160,000
0.5	347	6	357,598	260,000
0.75	521	9	463,547	330,000
1	694	12	557,255	400,000
1.5	1042	18	710,397	510,000
2	1389	23	845,053	600,000
2.5	1736	29	980,196	700,000
3	2083	35	1,105,559	790,000
3.5	2431	41	1,223,376	870,000
4	2778	47	1,335,122	950,000
4.5	3125	53	1,441,833	1,030,000
5	3472	58	1,527,468	1,090,000
5.5	3819	64	1,626,798	1,160,000
6	4167	70	1,722,825	1,230,000
6.5	4514	76	1,815,930	1,300,000
7	4861	82	1,906,423	1,360,000
7.5	5208	88	1,994,561	1,420,000
8	5556	94	2,080,560	1,480,000
8.5	5903	99	2,150,725	1,530,000
9	6250	105	2,233,261	1,590,000
9.5	6597	111	2,314,116	1,650,000
10	6944	117	2,393,411	1,710,000
10.5	7292	123	2,471,255	1,760,000
11	7639	129	2,547,744	1,820,000
11.5	7986	134	2,610,510	1,860,000
12	8333	140	2,684,728	1,910,000
12.5	8681	146	2,757,809	1,970,000
13	9028	152	2,829,816	2,020,000
13.5	9375	158	2,900,807	2,070,000
14	9722	164	2,970,834	2,120,000
14.5	10069	170	3,039,944	2,170,000
15	10417	175	3,096,868	2,210,000

[a] San Diego Metropolitan Sewage System Construction Cost Curves, December 1988, San Diego Wastewater Program Managers.

[b] ENR index used from ENR, December 1995, Albuquerque.

Regional Wastewater Plan for the East El Paso Area

Alternative 1

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2012	Quantity >2015	Cost 2001	Cost 2007	Cost 2012	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	48.00	11000				528,000				528,000
15-inch Sewer	lf	60.00		20000				1,200,000			1,200,000
18-inch Sewer	lf	72.00	9500	17000			684,000	1,224,000			1,908,000
30-inch Sewer	lf	97.00	4500				436,500				436,500
36-inch Sewer	lf	128.00		26000				3,328,000			3,328,000
54-inch Sewer	lf	231.00		13500	17000			3,118,500	3,927,000		7,045,500
8-inch Forcemain	lf	32.00	250	150			8,000	4,800			12,800
10-inch Forcemain	lf	40.00	3500				140,000				140,000
12-inch Forcemain	lf	48.00									0
14-inch Forcemain	lf	50.00									0
16-inch Forcemain	lf	64.00		6000				384,000			384,000
Montwood Reclamation Plant	MGD	(b)									0
Eastside WWTP	MGD	(b)									0
Bustamante WWTP	MGD	(b)	21			14	36,750,000			24,500,000	61,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)									0
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											80,962,800
			Phase Totals				39,446,500	10,769,300	6,247,000		
			Inflated Phase Totals			(d)	44,397,383	14,473,039	9,732,622		
			Present Worth of Phases			(d)	35,166,886	8,081,669	4,061,083		

ALTERNATIVE 1	**Total Cost**	**56,462,800**
	With Inflation	**68,603,044**
	Present Worth	**47,309,638**

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of \$2.50 per gallon for new plant construction and \$1.75 per gallon for plant expansion construction. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for the East El Paso Area

Alternative 1a

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2010	Quantity >2015	Cost 2001	Cost 2007	Cost 2010	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	48.00	11000				528,000				528,000
15-inch Sewer	lf	60.00		20000				1,200,000			1,200,000
18-inch Sewer	lf	72.00	9500	17000			684,000	1,224,000			1,908,000
30-inch Sewer	lf	97.00	4500				436,500				436,500
36-inch Sewer	lf	128.00		26000				3,328,000			3,328,000
54-inch Sewer	lf	231.00		13500	17000			3,118,500	3,927,000		7,045,500
8-inch Forcemain	lf	32.00	250	150			8,000	4,800			12,800
10-inch Forcemain	lf	40.00	3500				140,000				140,000
12-inch Forcemain	lf	48.00									0
14-inch Forcemain	lf	50.00									0
16-inch Forcemain	lf	64.00		6000				384,000			384,000
Montwood Reclamation Plant	MGD	(b)									0
Eastside WWTP	MGD	(b)									0
Bustamante WWTP	MGD	(b)	11		10	14	19,250,000		17,500,000	24,500,000	61,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)									0
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											80,962,800
			Phase Totals				21,946,500	10,769,300	23,747,000		
			Inflated Phase Totals			(d)	24,700,979	14,473,039	34,873,270		
			Present Worth of Phases			(d)	19,565,489	8,081,669	16,349,950		

ALTERNATIVE 1a		
	Total Cost	**56,462,800**
	With Inflation	**74,047,288**
	Present Worth	**43,997,108**

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of $2.50 per gallon for new plant construction and $1.75 per gallon for plant expansion construction. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for the East El Paso Area

Alternative 2a

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2012	Quantity >2015	Cost 2001	Cost 2007	Cost 2012	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	48.00	11000				528,000				528,000
15-inch Sewer	lf	60.00		20000				1,200,000			1,200,000
18-inch Sewer	lf	72.00	5000	17000			360,000	1,224,000			1,584,000
30-inch Sewer	lf	97.00	17000				1,649,000				1,649,000
36-inch Sewer	lf	128.00	4500	27500			576,000	3,520,000			4,096,000
30-inch Outfall Line	lf	97.00	8500				824,500				824,500
8-inch Forcemain	lf	32.00	250				8,000				8,000
10-inch Forcemain	lf	40.00	3500	150			140,000	6,000			146,000
12-inch Forcemain	lf	48.00									0
14-inch Forcemain	lf	50.00									0
16-inch Forcemain	lf	64.00		6000				384,000			384,000
Montwood Reclamation Plant	MGD	(b)									0
Eastside WWTP	MGD	(b)	8			16	20,000,000			36,000,000	56,000,000
Bustamante WWTP	MGD	(b)		11				19,250,000			19,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)	5	8	8		1,090,000	390,000	0		1,480,000
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											91,879,500
			Phase Totals				26,075,500	27,484,000	2,320,000		
			Inflated Phase Totals			(d)	29,348,205	36,936,198	3,614,484		
			Present Worth of Phases			(d)	23,246,527	20,624,980	1,508,198		

ALTERNATIVE 2a		
	Total Cost	**55,879,500**
	With Inflation	**69,898,887**
	Present Worth	**45,379,705**

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of $2.50 per gallon for new plant construction, $2.25 per gallon expansion of new plant, and $1.75 per gallon for construction of Bustamante expansion. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for the East El Paso Area

Alternative 2b

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2012	Quantity >2015	Cost 2001	Cost 2007	Cost 2012	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	48.00	11000				528,000				528,000
15-inch Sewer	lf	60.00		20000				1,200,000			1,200,000
18-inch Sewer	lf	72.00	5000	17000			360,000	1,224,000			1,584,000
30-inch Sewer	lf	97.00	17000				1,649,000				1,649,000
36-inch Sewer	lf	128.00	4500	27500		30500	576,000	3,520,000		3,904,000	8,000,000
30-inch Outfall Line	lf	97.00	8500				824,500				824,500
8-inch Forcemain	lf	32.00	250				8,000				8,000
10-inch Forcemain	lf	40.00	3500	150			140,000	6,000			146,000
12-inch Forcemain	lf	48.00									0
14-inch Forcemain	lf	50.00									0
16-inch Forcemain	lf	64.00		6000				384,000			384,000
Montwood Reclamation Plant	MGD	(b)									0
Eastside WWTP	MGD	(b)	8				20,000,000				20,000,000
Bustamante WWTP	MGD	(b)		11		16		19,250,000		28,000,000	47,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)	5	8	8		1,090,000	390,000	0		1,480,000
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											87,783,500
			Totals				26,075,500	27,484,000	2,320,000		
			Inflated Totals			(d)	29,348,205	36,936,198	3,614,484		
			Present Worth of Inflated Totals			(d)	23,246,527	20,624,980	1,508,198		

ALTERNATIVE 2b		
	Total Cost	55,879,500
	With Inflation	69,898,887
	Present Worth	45,379,705

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of $2.50 per gallon for new plant construction, $2.25 per gallon expansion of new plant, and $1.75 per gallon for construction of Bustamante expansion. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for the East El Paso Area

Alternative 2c

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2010	Quantity >2015	Cost 2001	Cost 2007	Cost 2010	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	48.00	11000				528,000				528,000
15-inch Sewer	lf	60.00		20000				1,200,000			1,200,000
18-inch Sewer	lf	72.00	9500	17000			684,000	1,224,000			1,908,000
30-inch Sewer	lf	97.00	4500				436,500				436,500
36-inch Sewer	lf	128.00		26000				3,328,000			3,328,000
54-inch Sewer	lf	231.00		13500	17000			3,118,500	3,927,000		7,045,500
18-inch GLO Diversion Line	lf	72.00	8500				612,000				612,000
8-inch Forcemain	lf	32.00	250	150			8,000	4,800			12,800
10-inch Forcemain	lf	40.00	3500				140,000				140,000
12-inch Forcemain	lf	48.00									0
14-inch Forcemain	lf	50.00									0
16-inch Forcemain	lf	64.00		6000				384,000			384,000
Montwood Reclamation Plant	MGD	(b)									0
Eastside WWTP	MGD	(b)									0
Bustamante WWTP	MGD	(b)	11		10	14	19,250,000		17,500,000	24,500,000	61,250,000
GLO Reuse Plant	MGD	(b)	2				3,500,000				
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)									0
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											81,574,800
Phase Totals							26,058,500	10,769,300	23,747,000		
Inflated Phase Totals						(d)	29,329,071	14,473,039	34,873,270		
Present Worth of Phases						(d)	23,231,372	8,081,669	16,349,950		

ALTERNATIVE 2c		
	Total Cost	**60,574,800**
	With Inflation	**78,675,380**
	Present Worth	**47,662,991**

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of $1.75 per gallon for new plant construction and $1.75 per gallon for plant expansion. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

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Regional Wastewater Plan for the East El Paso Area

Alternative 3a

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2012	Quantity >2015	Cost 2001	Cost 2007	Cost 2012	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	48.00	11000				528,000				528,000
15-inch Sewer	lf	60.00		20000				1,200,000			1,200,000
18-inch Sewer	lf	72.00	5000	24000			360,000	1,728,000			2,088,000
24-inch Sewer	lf	84.00		20500				1,722,000			1,722,000
30-inch Sewer	lf	97.00	17000				1,649,000				1,649,000
36-inch Sewer	lf	128.00	4500				576,000				576,000
30-inch Outfall Line	lf	97.00	8500				824,500				824,500
8-inch Forcemain	lf	32.00	250				8,000				8,000
10-inch Forcemain	lf	40.00	3500	150			140,000	6,000			146,000
12-inch Forcemain	lf	48.00									0
14-inch Forcemain	lf	56.00									0
16-inch Forcemain	lf	64.00		6000				384,000			384,000
Montwood Reclamation Plant	MGD	(b)				4				10,000,000	10,000,000
Eastside WWTP	MGD	(b)	8			12	20,000,000			27,000,000	47,000,000
Bustamante WWTP	MGD	(b)		11				19,250,000			19,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)	5	8	8		1,090,000	390,000	0		1,480,000
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											91,585,500
			Phase Totals				26,075,500	26,190,000	2,320,000		
			Inflated Phase Totals			(d)	29,348,205	35,197,170	3,614,484		
			Present Worth of Phases			(d)	23,246,527	19,653,916	1,508,198		

ALTERNATIVE 3a		
	Total Cost	**54,585,500**
	With Inflation	**68,159,859**
	Present Worth	**44,408,641**

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of $2.50 per gallon for new plant construction, $2.25 per gallon expansion of new plant, and $1.75 per gallon for construction of Bustamante expansion. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for the East El Paso Area

Alternative 3b

Item	Unit	Unit Cost	Quantity 2001	Quantity 2007	Quantity 2012	Quantity >2015	Cost 2001	Cost 2007	Cost 2012	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer (a)	lf	60.00	11000				660,000				660,000
15-inch Sewer	lf	75.00		20000				1,500,000			1,500,000
18-inch Sewer	lf	90.00	5000	24000			450,000	2,160,000			2,610,000
24-inch Sewer	lf	120.00		20500				2,460,000			2,460,000
30-inch Sewer	lf	150.00	17000			17000	2,550,000			2,550,000	5,100,000
36-inch Sewer	lf	252.00	4500				1,134,000				1,134,000
30-inch Outfall Line	lf	150.00	8500				1,275,000				1,275,000
8-inch Forcemain	lf	40.00	250				10,000				10,000
10-inch Forcemain	lf	50.00	3500	150			175,000	7,500			182,500
12-inch Forcemain	lf	60.00									0
14-inch Forcemain	lf	70.00									0
16-inch Forcemain	lf	80.00		6000				480,000			480,000
Montwood Reclamation Plant	MGD	(b)				4				10,000,000	10,000,000
Eastside WWTP	MGD	(b)	8				20,000,000				20,000,000
Bustamante WWTP	MGD	(b)		11		12		19,250,000		21,000,000	40,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13		510,000	440,000	1,070,000		2,020,000
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6		390,000	120,000	720,000		1,230,000
Rojas Lift Station	MGD	(c)	5	8	8		1,090,000	390,000	0		1,480,000
Peyton Lift Station	MGD	(c)		4	8			950,000	530,000		1,480,000
											91,871,500
			Phase Totals				28,244,000	27,757,500	2,320,000		
			Inflated Phase Totals			(d)	31,788,871	37,303,759	3,614,484		
			Present Worth of Phases			(d)	25,179,763	20,830,224	1,508,198		

ALTERNATIVE 3b		
	Total Cost	**58,321,500**
	With Inflation	**72,707,114**
	Present Worth	**47,518,185**

(a) Based on 1996 Lower Valley Bid Tabulations.
(b) Unit cost of $2.50 per gallon for new plant construction, $2.25 per gallon expansion of new plant, and $1.75 per gallon for construction of Bustamante expansion. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 1

Item	Unit	Unit Cost	Quantity				Cost				Annual O&M Cost
			Initial	Phase 1	Phase 2	Ultimate	Initial	Phase I	Phase 2	Ultimate	Present Day Dollars
12-inch Sewer	lf	0.11	11000				1,232				1,232
15-inch Sewer	lf	0.14		20000				2,800			2,800
18-inch Sewer	lf	0.17	9500	17000			1,615	2,890			4,505
30-inch Sewer	lf	0.28	4500				1,260				1,260
36-inch Sewer	lf	0.34		26000				8,840			8,840
54-inch Sewer	lf	0.50		13500	17000			6,750	8,500		15,250
8-inch Forcemain	lf	0.08	250	150			19	11			30
10-inch Forcemain	lf	0.10	3500				333				333
12-inch Forcemain	lf	0.11									0
14-inch Forcemain	lf										0
16-inch Forcemain	lf			6000				0			0
Phase Totals							4,458	25,750	34,250		
Annual O&M Cost Alternative 1											**34,250**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 1

Phase	Year	Bustamante Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year) Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory	Total	PW
Initial	1997	30.0						$ -	$ -
	1998	31.3						$ -	$ -
	1999	32.5						$ -	$ -
	2000	33.7						$ -	$ -
	2001	35.0						$ -	$ -
	2002	36.2						$ -	$ -
(a)	2003	37.4	$ 5,323	$ 60,897	$ 31,537			$ 97,757	$ 68,914
(a)	2004	38.7	$ 5,483	$ 62,724	$ 64,966			$ 133,172	$ 88,567
(a)	2005	39.9	$ 5,647	$ 64,605	$ 100,372			$ 170,625	$ 107,052
		total	$ 16,453	$ 188,226	$ 196,875	$ -	$ -	$ 401,553	$ 264,534
Phase 1	2006	40.9	$ 33,598	$ 131,782	$ 585,167			$ 750,547	$ 444,247
	2007	42.0	$ 34,606	$ 135,736	$ 637,981			$ 808,322	$ 451,363
	2008	43.0	$ 35,644	$ 139,808	$ 693,437			$ 868,888	$ 457,719
	2009	44.0	$ 36,713	$ 144,002	$ 751,646			$ 932,361	$ 463,355
	2010	45.1	$ 37,815	$ 148,322	$ 812,724			$ 998,860	$ 468,305
		total	$ 178,376	$ 699,649	$ 3,480,953	$ -	$ -	$ 4,358,978	$ 2,284,989
Phase 2	2011	46.1	$ 51,806	$ 269,241	$ 876,789			$ 1,197,837	$ 529,804
	2012	48.5	$ 53,360	$ 277,318	$ 997,542			$ 1,328,220	$ 554,220
	2013	49.5	$ 54,961	$ 285,638	$ 1,071,612			$ 1,412,211	$ 555,912
	2014	50.6	$ 56,610	$ 294,207	$ 1,149,230			$ 1,500,047	$ 557,064
	2015	51.7	$ 58,308	$ 303,033	$ 1,230,540			$ 1,591,881	$ 557,706
		total	$ 275,046	$ 1,429,437	$ 5,325,713	$ -	$ -	$ 7,030,196	$ 2,754,706
								$ 11,790,727	$ 5,304,228

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 1a

Item	Unit	Unit Cost	Quantity				Cost				Annual O&M Cost
			Initial	Phase 1	Phase 2	Ultimate	Initial	Phase I	Phase 2	Ultimate	Present Day Dollars
12-inch Sewer	lf	0.11	11000				1,232				1,232
15-inch Sewer	lf	0.14		20000				2,800			2,800
18-inch Sewer	lf	0.17	9500	17000			1,615	2,890			4,505
30-inch Sewer	lf	0.28	4500				1,260				1,260
36-inch Sewer	lf	0.34		26000				8,840			8,840
54-inch Sewer	lf	0.50		13500	17000			6,750	8,500		15,250
8-inch Forcemain	lf	0.08	250	150			19	11			30
10-inch Forcemain	lf	0.10	3500				333				333
12-inch Forcemain	lf	0.11									0
14-inch Forcemain	lf										0
16-inch Forcemain	lf			6000				0			0
						Phase Totals	4,458	25,750	34,250		
								Annual O&M Cost Alternative 1a			**34,250**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 1a

Phase	Year	Bustamante Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year): Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory	Total	PW
Initial	1997	30.0						$ -	$ -
	1998	31.3						$ -	$ -
	1999	32.5						$ -	$ -
	2000	33.7						$ -	$ -
	2001	35.0						$ -	$ -
	2002	36.2						$ -	$ -
(a)	2003	37.4	$ 5,323	$ 60,897	$ 31,537			$ 97,757	$ 68,914
(a)	2004	38.7	$ 5,483	$ 62,724	$ 64,966			$ 133,172	$ 88,567
(a)	2005	39.9	$ 5,647	$ 64,605	$ 100,372			$ 170,625	$ 107,052
		total	$ 16,453	$ 188,226	$ 196,875	$ -	$ -	$ 401,553	$ 264,534
Phase 1	2006	40.9	$ 33,598	$ 131,782	$ 307,250			$ 472,630	$ 279,749
	2007	42.0	$ 34,606	$ 135,736	$ 351,726			$ 522,068	$ 291,520
	2008	43.0	$ 35,644	$ 139,808	$ 398,595			$ 574,046	$ 302,400
	2009	44.0	$ 36,713	$ 144,002	$ 447,959			$ 628,674	$ 312,432
	2010	45.1	$ 37,815	$ 148,322	$ 499,926			$ 686,063	$ 321,653
		total	$ 178,376	$ 699,649	$ 2,005,456	$ -	$ -	$ 2,883,481	$ 1,507,754
Phase 2	2011	46.1	$ 51,806	$ 269,241	$ 554,608			$ 875,655	$ 387,303
(a)	2012	48.5	$ 53,360	$ 277,318	$ 665,694			$ 996,373	$ 415,752
(a)	2013	49.5	$ 54,961	$ 285,638	$ 729,810			$ 1,070,409	$ 421,362
	2014	50.6	$ 56,610	$ 294,207	$ 1,149,230			$ 1,500,047	$ 557,064
	2015	51.7	$ 58,308	$ 303,033	$ 1,230,540			$ 1,591,881	$ 557,706
		total	$ 275,046	$ 1,429,437	$ 4,329,882	$ -	$ -	$ 6,034,365	$ 2,339,187
								$ 9,319,399	$ 4,111,474

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 2a

Item	Unit	Unit Cost	Quantity					Cost					Annual O&M Cost Present Day Dollars
			Initial	Phase 1	Phase 2	Ultimate		Initial	Phase I	Phase 2	Ultimate		
12-inch Sewer	lf	0.11	11000					1,232					1,232
15-inch Sewer	lf	0.14		20000					2,800				2,800
18-inch Sewer	lf	0.17	5000	17000				850	2,890				3,740
30-inch Sewer	lf	0.28	25500					7,140					7,140
36-inch Sewer	lf	0.34	4500	27500				1,530	9,350				10,880
8-inch Forcemain	lf	0.08	250					19					19
10-inch Forcemain	lf	0.10	3500	150				333	14				347
12-inch Forcemain	lf	0.11											0
14-inch Forcemain	lf												0
16-inch Forcemain	lf			6000					0				0
					Phase Totals			11,103	26,158	26,158			

Annual O&M Cost Alternative 2a **26,158**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

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Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 2a

Phase	Year	Bustamante Flow, mgd	New Plant Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year)					Total	PW
				Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory		
Initial	1997	30.0								
	1998	31.3							$ -	$ -
	1999	32.5							$ -	$ -
	2000	33.7							$ -	$ -
	2001	35.0							$ -	$ -
	2002	36.2							$ -	$ -
	2003	32.0	5.4	$ 13,258	$ 111,047	$ 1,194,691	$358,216	$119,405	$ -	$ -
	2004	32.9	5.7	$ 13,655	$ 114,378	$ 1,279,344		$122,987	$ 1,796,616	$ 1,266,543
	2005	33.8	6.1	$ 14,065	$ 117,810	$ 1,368,001		$126,677	$ 1,530,365	$ 1,017,780
			total	$ 40,978	$ 343,235	$ 3,842,035	$358,216	$369,070	$ 1,626,552	$ 1,020,519
Phase 1	2006	34.4	6.5	$ 34,130	$ 204,849	$ 1,470,212			$ 4,953,533	$ 3,304,843
	2007	35.0	6.9	$ 35,154	$ 210,995	$ 1,577,324		$130,477	$ 1,839,669	$ 1,088,897
	2008	35.6	7.4	$ 36,209	$ 217,325	$ 1,689,540		$134,392	$ 1,957,865	$ 1,093,262
(a)	2009	36.2	7.8	$ 37,295	$ 223,844	$ 1,826,611	$138,423	$138,423	$ 2,219,921	$ 1,169,427
(a)	2010	37.1	8.0	$ 38,414	$ 230,560	$ 1,942,946		$142,576	$ 2,230,326	$ 1,108,404
			total	$181,202	$1,087,573	$ 8,506,633	$138,423	$146,853	$ 2,358,773	$ 1,105,885
Phase 2 (a)	2011	38.1	8.0	$ 39,566	$ 353,946	$ 2,034,598		$692,722	$10,606,554	$ 5,565,874
	2012	40.5	8.0	$ 40,753	$ 364,564	$ 2,251,687		$151,259	$ 2,579,369	$ 1,140,857
	2013	41.5	8.0	$ 41,976	$ 375,501	$ 2,420,745	$160,471	$155,797	$ 2,812,801	$ 1,173,684
	2014	42.6	8.0	$ 43,235	$ 386,766	$ 2,530,338		$160,471	$ 3,159,163	$ 1,243,593
	2015	43.7	8.0	$ 44,532	$ 398,369	$ 2,644,327		$165,285	$ 3,125,624	$ 1,160,746
			total	$210,063	$1,879,147	$ 11,881,694	$160,471	$170,243	$ 3,257,472	$ 1,141,235
								$803,054	$14,934,430	$ 5,860,115
									$30,494,517	$14,730,831

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 2b

Item	Unit	Unit Cost	Quantity				Cost				Annual O&M Cost
			Initial	Phase 1	Phase 2	Ultimate	Initial	Phase I	Phase 2	Ultimate	Present Day Dollars
12-inch Sewer	lf	0.11	11000				1,232				1,232
15-inch Sewer	lf	0.14		20000				2,800			2,800
18-inch Sewer	lf	0.17	5000	17000			850	2,890			3,740
30-inch Sewer	lf	0.28	25500				7,140				7,140
36-inch Sewer	lf	0.34	4500	27500			1,530	9,350			10,880
8-inch Forcemain	lf	0.08	250				19				19
10-inch Forcemain	lf	0.10	3500	150			333	14			347
12-inch Forcemain	lf	0.11									0
14-inch Forcemain	lf										0
16-inch Forcemain	lf			6000				0			0
Phase Totals							11,103	26,158	26,158		

Annual O&M Cost Alternative 2b **26,158**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 2b

				O&M Costs Due to Improvements (Inflated at 3% per year)					Total	PW
Phase	Year	Bustamante Flow, mgd	New Plant Flow, mgd	Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory		
Initial	1997	30.0							$ -	$0.00
	1998	31.3							$ -	$0.00
	1999	32.5							$ -	$0.00
	2000	33.7							$ -	$0.00
	2001	35.0							$ -	$0.00
	2002	36.2							$ -	$ -
	2003	32.0	5.4	$ 13,258	$ 111,047	$ 1,194,691	$ 358,216	$ 119,405	$ 1,796,616	$ 1,266,543
	2004	32.9	5.7	$ 13,655	$ 114,378	$ 1,279,344		$ 122,987	$ 1,530,365	$ 1,017,780
	2005	33.8	6.1	$ 14,065	$ 117,810	$ 1,368,001		$ 126,677	$ 1,626,552	$ 1,020,519
			total	$ 40,978	$ 343,235	$ 3,842,035	$ 358,216	$ 369,070	$ 4,953,533	$ 3,304,843
Phase 1	2006	34.4	6.5	$ 34,130	$ 204,849	$ 1,470,212		$ 130,477	$ 1,839,669	$ 1,088,897
	2007	35.0	6.9	$ 35,154	$ 210,995	$ 1,577,324		$ 134,392	$ 1,957,865	$ 1,093,262
	2008	35.6	7.4	$ 36,209	$ 217,325	$ 1,689,540	$ 138,423	$ 138,423	$ 2,219,921	$ 1,169,427
(a)	2009	36.2	7.8	$ 37,295	$ 223,844	$ 1,826,611		$ 142,576	$ 2,230,326	$ 1,108,404
(a)	2010	37.1	8.0	$ 38,414	$ 230,560	$ 1,942,946		$ 146,853	$ 2,358,773	$ 1,105,885
			total	$ 181,202	$ 1,087,573	$ 8,506,633	$ 138,423	$ 692,722	$ 10,606,554	$ 5,565,874
Phase 2 (a)	2011	38.1	8.0	$ 39,566	$ 353,946	$ 2,034,598		$ 151,259	$ 2,579,369	$ 1,140,857
	2012	40.5	8.0	$ 40,753	$ 364,564	$ 2,251,687		$ 155,797	$ 2,812,801	$ 1,173,684
	2013	41.5	8.0	$ 41,976	$ 375,501	$ 2,420,745	$ 160,471	$ 160,471	$ 3,159,163	$ 1,243,593
	2014	42.6	8.0	$ 43,235	$ 386,766	$ 2,530,338		$ 165,285	$ 3,125,624	$ 1,160,746
	2015	43.7	8.0	$ 44,532	$ 398,369	$ 2,644,327		$ 170,243	$ 3,257,472	$ 1,141,235
			total	$ 210,063	$ 1,879,147	$ 11,881,694	$ 160,471	$ 803,054	$ 14,934,430	$ 5,860,115
									$ 30,494,517	$ 14,730,831

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 2c

Item	Unit	Unit Cost	Quantity: Initial	Quantity: Phase 1	Quantity: Phase 2	Quantity: Ultimate	Cost: Initial	Cost: Phase I	Cost: Phase 2	Cost: Ultimate	Annual O&M Cost Present Day Dollars
12-inch Sewer	lf	0.11	11000				1,232				1,232
15-inch Sewer	lf	0.14		20000				2,800			2,800
18-inch Sewer	lf	0.17	18000	17000			3,060	2,890			5,950
30-inch Sewer	lf	0.28	4500				1,260				1,260
36-inch Sewer	lf	0.34		26000				8,840			8,840
54-inch Sewer	lf	0.50		13500	17000			6,750	8,500		15,250
8-inch Forcemain	lf	0.08	250	150			19	11			30
10-inch Forcemain	lf	0.10	3500				333				333
12-inch Forcemain	lf	0.11									0
14-inch Forcemain	lf										0
16-inch Forcemain	lf			6000				0			0
Phase Totals							5,903	27,195	35,695		
Annual O&M Cost Alternative 2c											**35,695**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 2c

Phase	Year	Bustamante Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year)					Total	PW
			Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory		
Initial	1997	30.0						$ -	$ -
	1998	31.3						$ -	$ -
	1999	32.5						$ -	$ -
	2000	33.7						$ -	$ -
	2001	35.0						$ -	$ -
	2002	36.2						$ -	$ -
(a)	2003	37.4	$ 7,049	$ 83,584	$ 385,679	$ 59,703	$ 29,851	$ 565,865	$ 398,913
(a)	2004	38.7	$ 7,260	$ 86,091	$ 428,786		$ 30,747	$ 552,884	$ 367,700
(a)	2005	39.9	$ 7,478	$ 88,674	$ 474,132		$ 31,669	$ 601,954	$ 377,673
		total	$ 21,787	$ 258,349	$ 1,288,597	$ 59,703	$ 92,267	$ 1,720,703	$ 1,144,286
Phase 1	2006	40.9	$ 37,369	$ 157,878	$ 728,692		$ 32,619	$ 956,557	$ 566,185
	2007	42.0	$ 38,490	$ 162,614	$ 785,811	$ 67,196	$ 33,598	$ 1,087,709	$ 607,371
	2008	43.0	$ 39,644	$ 167,492	$ 845,702		$ 34,606	$ 1,087,445	$ 572,852
	2009	44.0	$ 40,834	$ 172,517	$ 908,480		$ 35,644	$ 1,157,474	$ 575,229
	2010	45.1	$ 42,059	$ 177,693	$ 974,262		$ 36,713	$ 1,230,727	$ 577,013
		total	$ 198,396	$ 838,193	$ 4,242,947	$ 67,196	$ 173,180	$ 5,519,912	$ 2,898,650
Phase 2	2011	46.1	$ 56,178	$ 299,493	$ 1,043,174		$ 37,815	$ 1,436,659	$ 635,436
(a)	2012	48.5	$ 57,863	$ 308,478	$ 1,168,918	$ 77,898	$ 38,949	$ 1,652,106	$ 689,366
(a)	2013	49.5	$ 59,599	$ 317,732	$ 1,248,130		$ 40,118	$ 1,665,578	$ 655,649
	2014	50.6	$ 61,387	$ 327,264	$ 1,683,100		$ 41,321	$ 2,113,071	$ 784,720
	2015	51.7	$ 63,228	$ 337,082	$ 1,780,426		$ 42,561	$ 2,223,297	$ 778,918
		total	$ 298,254	$ 1,590,048	$ 6,923,748	$ 77,898	$ 200,764	$ 9,090,712	$ 3,544,088
								$ 16,331,327	$ 7,587,024

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 3a

Item	Unit	Unit Cost	Quantity				Cost				Annual O&M Cost Present Day Dollars
			Initial	Phase 1	Phase 2	Ultimate	Initial	Phase I	Phase 2	Ultimate	
12-inch Sewer	lf	0.11	11000								
15-inch Sewer	lf	0.14		20000			1,232				1,232
18-inch Sewer	lf	0.17	5000	24000				2,800			2,800
24-inch Sewer	lf	0.23		20500			850	4,080			4,930
30-inch Sewer	lf	0.28	25500					4,613			4,613
36-inch Sewer	lf	0.34	4500				7,140				7,140
							1,530				1,530
8-inch Forcemain	lf	0.08	250								
10-inch Forcemain	lf	0.10	3500	150			19				19
12-inch Forcemain	lf	0.11					333	14			347
14-inch Forcemain	lf										0
16-inch Forcemain	lf			6000							0
								0			0
						Phase Totals	11,103	22,610	22,610		
								Annual O&M Cost Alternative 3a			**22,610**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

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Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 3a

Phase	Year	Bustamante Flow, mgd	New Plant Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year) Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory	Total	PW
Initial	1997	30.0							$ -	$ -
	1998	31.3							$ -	$ -
	1999	32.5							$ -	$ -
	2000	33.7							$ -	$ -
	2001	35.0							$ -	$ -
	2002	36.2							$ -	$ -
	2003	32.0	5.4	$ 13,258	$ 111,047	$ 1,194,691	$ 358,216	$ 119,405	$ 1,796,616	$ 1,266,543
	2004	32.9	5.7	$ 13,655	$ 114,378	$ 1,279,344		$ 122,987	$ 1,530,365	$ 1,017,780
	2005	33.8	6.1	$ 14,065	$ 117,810	$ 1,368,001		$ 126,677	$ 1,626,552	$ 1,020,519
			total	$ 40,978	$ 343,235	$ 3,842,035	$ 358,216	$ 369,070	$ 4,953,533	$ 3,304,843
Phase 1	2006	34.4	6.5	$ 29,501	$ 204,849	$ 1,470,212		$ 130,477	$ 1,835,040	$ 1,086,157
	2007	35.0	6.9	$ 30,386	$ 210,995	$ 1,577,324		$ 134,392	$ 1,953,097	$ 1,090,599
	2008	35.6	7.4	$ 31,298	$ 217,325	$ 1,689,540	$ 138,423	$ 138,423	$ 2,215,010	$ 1,166,839
(a)	2009	36.2	7.8	$ 32,236	$ 223,844	$ 1,826,611		$ 142,576	$ 2,225,268	$ 1,105,890
(a)	2010	37.1	8.0	$ 33,204	$ 230,560	$ 1,942,946		$ 146,853	$ 2,353,562	$ 1,103,442
			total	$ 156,624	$ 1,087,573	$ 8,506,633	$ 138,423	$ 692,722	$ 10,581,976	$ 5,552,927
Phase 2 (a)	2011	38.1	8.0	$ 34,200	$ 353,946	$ 2,034,598		$ 151,259	$ 2,574,002	$ 1,138,484
	2012	40.5	8.0	$ 35,226	$ 364,564	$ 2,251,687		$ 155,797	$ 2,807,273	$ 1,171,377
	2013	41.5	8.0	$ 36,282	$ 375,501	$ 2,420,745	$ 160,471	$ 160,471	$ 3,153,470	$ 1,241,352
	2014	42.6	8.0	$ 37,371	$ 386,766	$ 2,530,338		$ 165,285	$ 3,119,760	$ 1,158,568
	2015	43.7	8.0	$ 38,492	$ 398,369	$ 2,644,327		$ 170,243	$ 3,251,432	$ 1,139,119
			total	$ 181,571	$ 1,879,147	$ 11,881,694	$ 160,471	$ 803,054	$ 14,905,937	$ 5,848,899
									$ 30,441,446	$ 14,706,669

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Alternative 3b

Item	Unit	Unit Cost	Quantity				Cost				Annual O&M Cost
			Initial	Phase 1	Phase 2	Ultimate	Initial	Phase I	Phase 2	Ultimate	Present Day Dollars
12-inch Sewer	lf	0.11	11000				1,232				1,232
15-inch Sewer	lf	0.14		20000				2,800			2,800
18-inch Sewer	lf	0.17	5000	24000			850	4,080			4,930
24-inch Sewer	lf	0.23		20500				4,613			4,613
30-inch Sewer	lf	0.28	25500				7,140				7,140
36-inch Sewer	lf	0.34	4500				1,530				1,530
8-inch Forcemain	lf	0.08	250				19				19
10-inch Forcemain	lf	0.10	3500	150			333	14			347
12-inch Forcemain	lf	0.11									0
14-inch Forcemain	lf										0
16-inch Forcemain	lf			6000				0			0
						Phase Totals	11,103	22,610	22,610		
									Annual O&M Cost Alternative 3b		**22,610**

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Alternative 3b

Phase	Year	Bustamante Flow, mgd	New Plant Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year) Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory	Total	PW
Initial	1997	30.0							$ -	$ -
	1998	31.3							$ -	$ -
	1999	32.5							$ -	$ -
	2000	33.7							$ -	$ -
	2001	35.0							$ -	$ -
	2002	36.2							$ -	$ -
	2003	32.0	5.4	$ 13,258	$ 111,047	$ 1,194,691	$ 358,216	$ 119,405	$ 1,796,616	$ 1,266,543
	2004	32.9	5.7	$ 13,655	$ 114,378	$ 1,279,344		$ 122,987	$ 1,530,365	$ 1,017,780
	2005	33.8	6.1	$ 14,065	$ 117,810	$ 1,368,001		$ 126,677	$ 1,626,552	$ 1,020,519
			total	$ 40,978	$ 343,235	$ 3,842,035	$ 358,216	$ 369,070	$ 4,953,533	$ 3,304,843
Phase 1	2006	34.4	6.5	$ 29,501	$ 204,849	$ 1,470,212		$ 130,477	$ 1,835,040	$ 1,086,157
	2007	35.0	6.9	$ 30,386	$ 210,995	$ 1,577,324		$ 134,392	$ 1,953,097	$ 1,090,599
	2008	35.6	7.4	$ 31,298	$ 217,325	$ 1,689,540	$ 138,423	$ 138,423	$ 2,215,010	$ 1,166,839
(a)	2009	36.2	7.8	$ 32,236	$ 223,844	$ 1,826,611		$ 142,576	$ 2,225,268	$ 1,105,890
(a)	2010	37.1	8.0	$ 33,204	$ 230,560	$ 1,942,946		$ 146,853	$ 2,353,562	$ 1,103,442
			total	$ 156,624	$ 1,087,573	$ 8,506,633	$ 138,423	$ 692,722	$ 10,581,976	$ 5,552,927
Phase 2 (a)	2011	38.1	8.0	$ 34,200	$ 353,946	$ 2,034,598		$ 151,259	$ 2,574,002	$ 1,138,484
	2012	40.5	8.0	$ 35,226	$ 364,564	$ 2,251,687		$ 155,797	$ 2,807,273	$ 1,171,377
	2013	41.5	8.0	$ 36,282	$ 375,501	$ 2,420,745	$ 160,471	$ 160,471	$ 3,153,470	$ 1,241,352
	2014	42.6	8.0	$ 37,371	$ 386,766	$ 2,530,338		$ 165,285	$ 3,119,760	$ 1,158,568
	2015	43.7	8.0	$ 38,492	$ 398,369	$ 2,644,327		$ 170,243	$ 3,251,432	$ 1,139,119
			total	$ 181,571	$ 1,879,147	$ 11,881,694	$ 160,471	$ 803,054	$ 14,905,937	$ 5,848,899
									$ 30,441,446	$ 14,706,669

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

Regional Wastewater Plan for the East El Paso Area

Recommended Plan

Item	Unit	(a) Unit Cost	Quantity 2001	Quantity 2007	Quantity 2010	Quantity 2017	Quantity >2015	Cost 2001	Cost 2007	Cost 2010	Cost 2017	Cost >2015	Total Capital Cost Present Day Dollars
12-inch Sewer	lf	48.00	17200			400		825,600			19,200		
15-inch Sewer	lf	60.00	1900	20000				114,000	1,200,000				844,800
18-inch Sewer	lf	72.00	10300	17000			750	741,600	1,224,000			54,000	1,314,000
24-inch Sewer	lf	84.00	6150	2100		2200		516,600	176,400				1,965,600
30-inch Sewer	lf	97.00	10750			2100		1,042,750			203,700		
36-inch Sewer	lf	128.00		31800					4,070,400				1,042,750
48-inch Sewer	lf	200.00	70					14,000					4,070,400
54-inch Sewer	lf	231.00		13500	17000				3,118,500	3,927,000			
60-inch Sewer	lf	271.00		10600		510			2,872,600		138,210		7,045,500
66-inch Sewer	lf	310.00	1425					441,750					
72-inch Sewer	lf	350.00	425					148,750					
78-inch Sewer	lf	390.00	200					78,000					
18-inch GLO Diversion Line	lf	72.00	8500					612,000					
													612,000
8-inch Forcemain	lf	32.00	250	150				8,000	4,800				
10-inch Forcemain	lf	40.00	3500					140,000					12,800
12-inch Forcemain	lf	48.00											140,000
14-inch Forcemain	lf	50.00											0
16-inch Forcemain	lf	64.00		6000					384,000				0
													384,000
Montwood Reclamation Plant	MGD	(b)											
Eastside WWTP	MGD	(b)											0
Bustamante WWTP	MGD	(b)	11		10		14	19,250,000		17,500,000		24,500,000	0
GLO Reuse Plant	MGD	(b)	2					3,500,000					61,250,000
Arterial E-5 Lift Station	MGD	(c)	1.5	4	13			510,000	440,000	1,070,000			
Arterial E-8 Lift Station	MGD	(c)	1	1.5	6			390,000	120,000	720,000			2,020,000
Rojas Lift Station	MGD	(c)											1,230,000
Peyton Lift Station	MGD	(c)		4	8				950,000	530,000			0
													1,480,000
													83,411,850
Phase Totals								28,333,050	14,560,700	23,747,000			
Inflated Phase Totals							(d)	31,889,097	19,568,363	34,873,270			
Present Worth of Phases							(d)	25,259,152	10,926,872	16,349,950			

ALTERNATIVE 2c

Total Cost	**66,640,750**
With Inflation	**86,330,731**
Present Worth	**52,535,974**

(a) Based on 1996 Lower Valley Bid Tabulations. Some values were extrapolated from this information. Dewatering may increase unit costs.
(b) Unit cost of $1.75 per gallon for new plant construction and $1.75 per gallon for plant expansion. Based on EPWU Construction Costs.
(c) Cost based on estimated Hp for lift station. See attached cost table. Increments take increment amount and subtract previous Phase amount.
(d) Present worth rate of 6% and inflation rate of 3% were used.

Regional Wastewater Plan for East El Paso Area

O&M Costs - Recommended Plan

Item	Unit	Unit Cost	Quantity Initial	Quantity Phase 1	Quantity Phase 2	Quantity Ultimate	Cost Initial	Cost Phase I	Cost Phase 2	Cost Ultimate	Annual O&M Cost Present Day Dollars
12-inch Sewer	lf	0.11	17200		400		1,926		45		1,971
15-inch Sewer	lf	0.14	1900	20000			266	2,800			3,066
18-inch Sewer	lf	0.17	10300	17000			1,751	2,890			4,641
24-inch Sewer	lf	0.22	6150	2100	2200						
30-inch Sewer	lf	0.28	10750		2100		3,010		588		3,598
36-inch Sewer	lf	0.34		31800				10,812			10,812
48-inch Sewer	lf	0.42	70								
54-inch Sewer	lf	0.50		13500	17000			6,750	8,500		15,250
60-inch Sewer	lf	0.55		10600	510						
66-inch Sewer	lf	0.60	1425								
72-inch Sewer	lf	0.65	425								
78-inch Sewer	lf	0.70	200								
8-inch Forcemain	lf	0.08	250	150			19	11			30
10-inch Forcemain	lf	0.10	3500				333				333
12-inch Forcemain	lf	0.11									0
14-inch Forcemain	lf	0.13									0
16-inch Forcemain	lf	0.14		6000				840			840
Phase Totals							7,305	31,408	40,541		
Annual O&M Cost											40,541

(a) Unit costs based on conversations with EPWU personnel.
Costs typical for pipes of same size.

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Regional Wastewater Plan for East El Paso Area
O & M Costs

O&M Summary - Recommended Plan

Phase	Year	Bustamante Flow, mgd	O&M Costs Due to Improvements (Inflated at 3% per year) Pipelines	Lift Stations	Treatment Plants	Permitting	Laboratory	Total	PW
Initial	1997	30.0						$ -	$ -
	1998	31.3						$ -	$ -
	1999	32.5						$ -	$ -
	2000	33.7						$ -	$ -
	2001	35.0						$ -	$ -
	2002	36.2						$ -	$ -
(a)	2003	37.4	$ 8,722	$ 83,584	$ 385,679	$ 59,703	$ 29,851	$ 567,539	$ 400,092
(a)	2004	38.7	$ 8,984	$ 86,091	$ 428,786		$ 30,747	$ 554,608	$ 368,846
(a)	2005	39.9	$ 9,253	$ 88,674	$ 474,132		$ 31,669	$ 603,729	$ 378,787
		total	$ 26,959	$ 258,349	$ 1,288,597	$ 59,703	$ 92,267	$ 1,725,875	$ 1,147,725
Phase 1	2006	40.9	$ 37,369	$ 157,878	$ 728,692		$ 32,619	$ 956,557	$ 566,185
	2007	42.0	$ 38,490	$ 162,614	$ 785,811	$ 67,196	$ 33,598	$ 1,087,709	$ 607,371
	2008	43.0	$ 39,644	$ 167,492	$ 845,702		$ 34,606	$ 1,087,445	$ 572,852
	2009	44.0	$ 40,834	$ 172,517	$ 908,480		$ 35,644	$ 1,157,474	$ 575,229
	2010	45.1	$ 42,059	$ 177,693	$ 974,262		$ 36,713	$ 1,230,727	$ 577,013
		total	$ 198,396	$ 838,193	$ 4,242,947	$ 67,196	$ 173,180	$ 5,519,912	$ 2,898,650
Phase 2	2011	46.1	$ 56,178	$ 299,493	$ 1,043,174		$ 37,815	$ 1,436,659	$ 635,436
(a)	2012	48.5	$ 57,863	$ 308,478	$ 1,168,918	$ 77,898	$ 38,949	$ 1,652,106	$ 689,366
(a)	2013	49.5	$ 59,599	$ 317,732	$ 1,248,130		$ 40,118	$ 1,665,578	$ 655,649
	2014	50.6	$ 61,387	$ 327,264	$ 1,683,100		$ 41,321	$ 2,113,071	$ 784,720
	2015	51.7	$ 63,228	$ 337,082	$ 1,780,426		$ 42,561	$ 2,223,297	$ 778,918
		total	$ 298,254	$ 1,590,048	$ 6,923,748	$ 77,898	$ 200,764	$ 9,090,712	$ 3,544,088
								$ 16,336,500	$ 7,590,464

(a) Treatment Plant O&M Costs for this year is based only on the Power and Chemicals required to treat the additional flow. Labor and Maintenance Costs are incurred when the previous plant capacity is exhausted.

APPENDIX C

BIOTIC ASSESSMENT

BIOTIC ASSESSMENT OF A PORTION OF EAST EL PASO

Compiled by
RICHARD D. WORTHINGTON, Ph.D.

Floristic Inventories of the Southwest Program
P. O. Box 13331, El Paso, TX 79913
April, 1996

INTRODUCTION

This biotic assessment pertains to a tract of land in East El Paso generally situated East of Loop 375 for a distance of three or four miles, and between US 62-180 to the North and I-10 to the south. The area is approximately 38 square miles. Much of the area is already in residential development and large tracts have already been scraped for additional development. Growth from El Paso is rapidly spreading into the area. In the near future it will virtually all become roadways, housing developments, and business properties.

Historically, the Hueco Bolson was a desert grassland (York and Dick-Peddie, 1969). The activities of man before the turn of the century brought about changes that lead to the invasion of shrubs (largely mesquite). It is presently a desert shrub community. Most of it is hummocky mesquite duneland with smaller areas in creosotebush and broom psorothamnus. Accordingly, the site (and almost all of the Hueco Bolson) is a desert shrub disclimax (plagiosere). Most of the flora is native, but diversity has been lost and the proportions of the different species have changed dramatically over the last hundred plus years.

Few threatened or endangered species occur in El Paso County. All but one of those that do, including candidate species, occur in the mountains. Some sensitive bird and bat species migrate through the El Paso area. The Hueco Bolson, mostly a large desert shrub disclimax, has no unique resources or critical habitats. No threatened or endangered species were encountered in this study.

METHODS

The site was visited on 31 March, 6, 7, and 13 April. Stops were made at 17 locations representing all regions of the area to review the community structure and inventory species. Previous studies done all or in part within the area were reviewed. These included a previous environmental study done by Worthington (1982) about West Texas Airport. Work by others is credited in the appropriate sections and complete references are in the literature cited section. Portions of the Resource Collections, Laboratory of Environmental Biology, The University of Texas at El Paso, were searched for records of plants and animals to include in the inventories. Aerial photographs of the entire area published in the El Paso County soil survey (Jaco, 1971) were reviewed to look for habitats that would be worthy of a closer look.

RESULTS

MAMMALS

The mammals of El Paso County, Texas, have been studied by Ederhoff (1971) and Dooley (1974). Schmidley (1977) updated the previous works publishing all available records to that date for all of Trans-Pecos Texas. Worthington (1982) did trapping and made additional observations in the study area about West Texas Airport. The mammalian component of the fauna is well known. No threatened or endangered mammals live on the site. Occasional migratory bats of several sensitive species might fly through the area (Dooley, 1974).

LIST OF MAMMALS

Order: CHIROPTERA

EPTESICUS FUSCUS (Palisot de Beauvois) — Big Brown Bat
NOTE: Ederhoff (1971) considered this species as likely to occur in the area.

ANTROZOUS PALLIDUS (Le Conte) — Desert Pallid Bat
NOTE: Ederhoff (1971) and Dooley (1974) report this species as occurring throughout the county.

Order: LAGOMORPHA

Family: LEPORIDAE

LEPUS CALIFORNICUS Gray ssp. TEXANUS Waterhouse — Black-tailed Jack Rabbit

SYLVILAGUS AUDUBONII (Baird) ssp. MINOR (Mearns) — Desert Cottontail

Order: RODENTIA

Family: SCIURIDAE

SPERMOPHILUS SPILOSMA Bennett ssp. CANESCENS Merriam — Spotted Ground Squirrel

Family: GEOMYIDAE

GEOMYS ARENARIUS Merriam ssp. ARENARIUS — Desert Pocket Gopher
NOTE: Ederhoff (1971) references a collection from Horizon City.

Family: HETEROMYIDAE

DIPODOMYS MERRIAMI Mearns ssp. AMBIGUUS Merriam — Merriam's Kangaroo Rat
NOTE: Ederhoff (1971) cites collections from along US 62-180 and along TX 659 in the area.

DIPODOMYS ORDII Woodhouse ssp. ORDII — Ood's Kangaroo Rat
NOTE: This species has been collected at a number of sites in the area (Ederhoff, 1971)

PEROGNATHUS PENICILLATUS Woodhouse ssp. EREMICUS Mearns — Desert Pocket Mouse
NOTE: A number of collections have been made on the site (Ederhoff, 1971)

Family: CRICETIDAE

NEOTOMA ALBIGULA Hartley ssp. ALBIGULA — White-throated Wood Rat
NOTE: Ederhoff (1971) cites records from the area and says that it is one of the most common mammals in El Paso County.

ONYCHOMYS LEUCOGASTER (Wied-Neuwied) ssp. RUIDOSAE Stone & Rehn — Northern Grasshopper Mouse
NOTE: Ederhoff (1971) cites collections from the area.

PEROMYSCUS MANICULATUS (Wagner) ssp. BLANDUS Osgood — Deer Mouse
NOTE: Ederhoff (1971) cites collections from the study area.

Order: CARNIVORA

Family: CANIDAE

CANIS LATRANS Say ssp. TEXENSIS Baily — Coyote

Family: MUSTELIDAE

TAXIDEA TAXUS (Schreber) ssp. BERLANDIERI Baird — Badger
NOTE: Ederhoff (1971) indicates that the kit fox, bobcat, and striped skunk could occur in the area.

BIRDS

The birds of El Paso County are extremely well known. This is due to the activities of the Audubon Society of El Paso that has been censusing bird populations in the area for decades. Some rare and sensitive species occur in the area, but they are seasonal migrants or are restricted to the riparian habitats and the mountains. No threatened or endangered bird species was seen on the site.

cf. ARCHILOCHUS ALEXANDRI (Bourcier and Mulsant, 1846) — Black-chinned Hummingbird
NOTE: This species was seen at a distance and heard in Horizon City.
AMPHISPIZA BILINEATA (Cassin, 1850) — Black-throated Sparrow
ATHENE CUNICULARIA (Molina, 1782) — Burrowing Owl
CALLIPEPLA GAMBELII (Gambel, 1843) — Gambel's Quail
CALLIPEPLA SQUAMATA (Vigors, 1830) — Scaled Quail
CAMPYLORHYNCHUS BRUNNEICAPILLUM (Lafresnave, 1835) — Cactus Wren
CARDINALIS SINUATUS (Bonaparte, 1839) — Pyrrhuloxia
CARPODACUS MEXICANUS (Muller, 1776) — House Finch
CHORDEILES ACUTIPENNIS (Hermann, 1783) — Lesser Nighthawk
COLUMBA LIVIA Gmelin, 1789 — Domestic Pigeon; Rock Dove
NOTE: This species is now established in the Horizon City Industrial Park.
GEOCOCCYX CALIFORNIANUS (Leeson, 1829) — Greater Roadrunner
HIRUNDO RUSTICA Linnaeus, 1758 — Barn Swallow
NOTE: This species is common in Horizon City.
LANIUS LUDOVICIANUS Linnaeus, 1766 — Loggerhead Shrike
MIMUS POLYGLOTTOS (Linnaeus, 1758) — Mockingbird
PASSER DOMESTICUS Linnaeus, 1758 — House Sparrow; English Sparrow
QUISCALUS MEXICANUS (Gmelin, 1788) — Great-tailed Grackel
NOTE: This species is common about human habitations, especially in Horizon City.
TOXOSTOMA CRISSALE Henry, 1858 — Crissal Thrasher
TYRANNUS VERTICALIS Say, 1823 — Western Kingbird
ZENAIDA ASIATICA (Linnaeus, 1758) — White-winged Dove
ZENAIDURA MACROURA (Linnaeus, 1758) — Mourning Dove
ZONOTRICHIA LEUCOPHRYS (Forster, 1772) — White-crowned Sparrow

AMPHIBIANS AND REPTILES

Since the 1960's, the herpetofauna of El Paso County, Texas, has been extensively sampled and the collections deposited at UTEP. Inventories of the county herpetofauna have been published (Webb, 1968; Worthington, 1975, 1976). Kinniburgh (1972) studied the rattlesnakes in El Paso County utilizing a transect from the Franklin Mountains East across the Hueco Bolson to the Hueco Mountains. His thesis contains records of rattlesnakes from the study area and a description of Hueco Bolson vegetation. Patterson (1971) studied the diet of side-blotched lizards in disturbed and undisturbed habitats at a site in mesquite duneland East of Hwy. 659 (31 DEG 44'N, 106 DEG 17'W). She described the vegetation and made observations on the reptiles present in the area. Worthington (1982) did an environmental assessment of habitat about the West Texas Airport. He described the vegetation and recorded plant and animal species found in the area. The study area contains no threatened, rare or endangered species of reptiles and amphibians.

INVENTORY OF AMPHIBIANS AND REPTILES

Class: AMPHIBIA

Order: ANURA

Family: PELOBATIDAE

SCAPHIOPUS BOMBIFRONS Cope, 1863 — Plains Spadefoot
NOTE: A record from East of Horizon City (UTEP) places this species in the Hueco Bolson and indicates it likely occurs on the site.
SCAPHIOPUS COUCHII Baird, 1854 — Couch's Spadefoot

Class: REPTILIA

Order: SQUAMATA

Suborder: LACERTILIA

Family: IGUANIDAE

COPHOSAURUS TEXANUS Troschel, 1852 — Southwestern Earless Lizard
PHRYNOSOMA CORNUTUM (Harlan, 1825) — Texas Horned Lizard
PHRYNOSOMA MODESTUM Girard, 1852 — Round-tailed Horned Lizard
NOTE: Observed by Worthington (1982) in the area of the West Texas Airport where the caliche flats at the escarpment are a suitable habitat.
SCELOPORUS MAGISTER Hallowell, 1854 ssp. BIMACULOSUS Phelan and Brattstrom, 1955 — Desert Spiny Lizard
SCELOPORUS UNDULATUS (Latreille, 1802) ssp. CONSOBRINUS Baird and Girard, 1854 — Fence Lizard
UTA STANSBURIANA Baird & Girard, 1852 ssp. STEJNEGERI Schmidt, 1921 — Side-blotched Lizard
NOTE: Patterson (1971) studied the diet of this species in disturbed and undisturbed habitats East of Hwy. 659 within the study area.

Family: TEIIDAE

CNEMIDOPHORUS TIGRIS Baird & Girard, 1852 — Western Whiptail

Order: SERPENTES

Family: COLUBRIDAE

ARIZONA ELEGANS Kennicott *in* Baird, 1859 ssp. PHILIPI	Glossy Snake
MASTICOPHIS FLAGELLUM (Shaw, 1852) ssp. TESTACEUS	Western Coachwhip
PITUOPHIS MELANOLEUCUS (Daudin, 1803) ssp. AFFINIS	Southern Gopher Snake
TANTILLA NIGRICEPS Kennicott, 1860 ssp. NIGRICEPS	Plains Black-headed Snake

Family: VIPERIDAE

CROTALUS ATROX Baird & Girard, 1853	Western Diamondback Rattlesnake
CROTALUS VIRIDIS Rafinesque, 1818 ssp. VIRIDIS	Prairie Rattlesnake

NOTE: Kinniburgh (1972) studied the distribution of rattlesnakes in El Paso County. He reports that the prairie rattlesnake is the only species in the mesquite duneland habitat. Both species occur together in the sandy creosotebush habitats at the South end of the study area.

INVERTEBRATES

No comprehensive surveys are available of invertebrates in El Paso County other than mollusks which do not occur on the site. Some conspicuous invertebrates known to occur on the site are the giant desert centipede (Scolopendra heros), desert millipede (Orthophorus ornatus), American tarantula (Eurypelma sp.), sun spider (cf. Eremobates sp.), tenebrionid beetles, harvester ants (Pogonomyrmex sp.), and termites.

FLORA

The Hueco Bolson is known to be a desert shrub disclimax of hummocky mesquite duneland that reproduces itself (York and Dick-Peddie, 1969). Originally a desert grassland community, it has changed to its present composition within historical times by the activities of man. About two-thirds of the study area is mesquite duneland with associated saltbush, yucca and snakeweed. The southern part of the study area contains a caliche escarpment near West Texas Airport that supports some different plants, areas of sandy creosotebush community, and some ridges of looser windblown sand dominated by broom psorothamnus. Disturbance habitats such as roadsides contribute to the diversity. Overall, the plant diversity in the area is low.

Plant coverage in the mesquite duneland is certainly less than 20% and may be closer to only about 10%. Patterson (1971) reported that mesquite accounted for 51-74% of all the plant cover with saltbush contributing 13-19%, creosotebush 5-29% and snakeweed 0.5-9%. Kinniburgh

(1972) studied an area just east of the junction of Hwy. 659 with US 62-180 in the summer after adequate rainfall and reported importance values as follows: mesquite, 106; grasses, 63; composits, 45; spurges, 24; saltbush, 22; snakeweed; 21; yucca, 10; mustards, 8. In the absence of summer annuals, Kinniburgh described a mesquite duneland community with some perennial grasses, atriplex, yucca, and snakeweed present. Worthington (1982) used a simple Braun-Blanquet cover abundance scale to describe plant communities near the West Texas Airport. In an area of deep sand and dunes to 2 m tall, mesquite contributed 5-25% of the cover; saltbush, snakeweed and sand sagebrush were numerous, but contributed less than 5% of the cover; cresotebush was just occasional with small cover. In a creosotebush community with dunes less than 0.5 m, creosotebush contributed 5-25% cover; snakeweed was numerous but less than 5% cover; mesquite was infrequent contributing little cover; saltbush was solitary with little cover.

An inventory of the flora of El Paso County has been published by Worthington (1989). The only endangered plant species in the area is Sneed's Pincushion Cactus which occurs in the Franklin Mountains. Two candidate species are known to occur in the Hueco Mountains, also off the site. The Sand Prickly-pear, Opuntia arenaria, is a candidate species for listing that is known from sandy habitats in El Pao County. The species was not found on the site.

INVENTORY OF FLORA

LICHENS: None.
FUNGI: One unidentified mushroom commonly comes up in sandy deserts. No effort was made to sample for fungi.
MOSSES: None.
LIVERWORTS: None.
PTERIDOPHYTES: None.

GYMNOSPERMS AND FLOWERING PLANTS

AGAVACEAE	**Agave Family**
YUCCA ELATA (Engelm.) Engelm.	Soaptree Yucca
AIZOACEAE	
TRIANTHEMA PORTULACASTRUM L.	Desert Horsepurslane
AMARANTHACEAE	**Amaranth Family**
AMARANTHUS ACANTHOCHITON (Torr.) Sauer.	Greenstripe Amaranth
AMARANTHUS PALMERI Wats.	Palmer Amaranth
TIDESTROEMIA LANUGINOSA (Nutt.) Standl.	Woolly Tidestroemia

APOCYNACEAE — **Dogbane Family**

AMSONIA ARENARIA — Woolly Slimpod
(=A. YOMENTOSA Torr. & Frem. var. STENOPHYLLA K. & P.)

BIGNONIACEAE — **Catalpa Family**

CHILOPSIS LINEARIS (Cav.) Sweet ssp. LINEARIS — Desert Willow
NOTE: This arroyo plant is rare in the area. One was seen on the side of Eastlake Drive.

BORAGINACEAE — **Borage Family**

CRYPTANTHA ANGUSTIFOLIA (Torr.) Greene — Bristlelobe Cryptantha
CRYPTANTHA CRASSISEPALA (T. & G.) Greene — Thicksepal Cryptantha
HELIOTROPIUM CONVOLVULACEUM (Nutt.) Gray — False Morningglory
HELIOTROPIUM CURASSAVICUM L. — Alkali Heliotrope
NOTE: This species was seen growing in watered areas in Horizon City.
HELIOTROPIUM GREGGII Torr. — Fragrant Heliotrope

CACTACEAE — **Cactus Family**

OPUNTIA ENGELMANNII Engelm. Var. ENGELMANNII — Englemann's Prickly Pear
(=O. PHAEACANTHA var. DISCATA)
NOTE: This species and the next were found adjacent to housing in Horizon City.
OPUNTIA IMBRICATA (Haw.) DC. Var. IMBRICATA — Tree Cholla
OPUNTIA MACROCENTRA Engelm — Purple Pricklypear

CAPPARIDACEAE — **Caper Family**

WISLIZENIA REFRACTA Engelm. — Jackass Clover; Spectacle-fruit

CHENOPODIACEAE — **Goosefoot Family**

ATRIPLEX CANESCENS (Pursh) Nutt. — Fourwing Saltbush; Chamisa
CHENOPODIUM sp. — Goosefoot
SALSOLA AUSTRALIS R. Br. — Russian Thistle; Tumbleweed

COMPOSITAE (ASTERACEAE) — **Sunflower Family**

AMBROSIA ACANTHICARPA Hook. — Flatspine Ragweed
APHANOSTEPHUS RAMOSISSIMUS DC. — Plains Dozedaisy
ARTEMISIA FILIFOLIA Torr. — Sand Sagebrush

BAHIA ABSINTHIFOLIA Benth.	Hairyseed Bahia
BAILEYA MULTIRADIATA Harv. & Gray	Desert Baileya
CENTAUREA MELITENSIS L.	Malta Star Thistle
CONYZA CANADENSIS (L.) Cronq.	Horseweed
FLOURENSIA CERNUA DC.	Tarbush
GAILLARDIA PINNATIFIDA torr.	Slender Gaillardia
GUTIERREZIA MICROCEPHALA (DC.) Gray	Threadleaf Snakeweed
GUTIERREZIA SAROTHRAE (Pursh) Britt. & Rusby	Broom Snakeweed
HELIANTHUS PETIOLARIS Nutt.	Prairie Sunflower
HYMENOPAPPUS FLAVESCENS Gray var. CANO-TOMENTOSUS Gray	Yellow Woolly-white
MACHAERANTHERA CANESCENS (Pursh) Gray var. GLABRA Gray	Sand Goldenweed
MACHAERANTHERA PARVIFLORA Gray	
NOTE: This species was located on eroded slopes south of the West Texas Airport.	
MACHAERANTHERA PINNATIFIDA (Hook.) Shinners	
PARTHENIUM CONFERTUM Gray	Lyreleaf Parthenium
NOTE: This species occurs along US 62-180 just east of Loop 375.	
PARTHENIUM INCANUM H.B.K.	Mariola
PECTIS PAPPOSA Harvey & Gray var. GRANDIS Keil	Many-bristle Pectis
PSILOSTROPHE TAGETINA (Nutt.) Greene	Woolly Paperflower
SENECIO FLACCIDUS	Thread Leaf Groundsel
SONCHUS sp.	Sowthistle
STEPHANOMERIA PAUCIFLORA (Torr.) A. Nels.	Desert Straw; Skeleton Plant
TARAXACUM OFFICINALE Weber ex Wiggers	Dandelion
THYMNOPHYLLA PENTACHAETA (DC.) Small	Parralena
VERBESINA ENCELIOIDES (Cav.) Benth. & Hook.	Cowpen Daisy
ZINNIA GRANDIFLORA Nutt.	Plains Zinnia

CRUCIFERAE (BRASSICACEAE) — **Mustard Family**

BRASSICA TOURNEFORTII Gouan	
NOTE: This introduced mustard was found growing at the intersection of Rojas with Eastlake Drive. It also grows along I-10.	
DESCURAINIA PINNATA (Walt.) Britt.	Tansy Mustard
DIMORPHOCARPA WISLIZENII (Engelm.) Roll.	Desert Spectaclepod
LEPIDIUM ALYSSOIDES Gray	Mountain Pepperweed
LEPIDIUM LASIOCARPUM Nutt. var. WRIGHTII (Gray) C.L.Hitchc.	Hairypod Pepperweed
LEPIDIUM OBLONGUM Small	Veiny Pepperweed
NOTE: This species is established on the Horizon City Golf Course.	
NERISYRENIA CAMPORUM (Gray) Greene	Mesa Greggia
SISYMBRIUM IRIO L.	London Rocket

CUCURBITACEAE	**Gourd Family**
CUCURBITA FOETIDISSIMA H.B.K.	Buffalo Gourd
CUSCUTACEAE	**Dodder Family**
CUSCUTA sp.	Dodder
EPHEDRACEAE	**Ephedra Family**
EPHEDRA TRIFURCA Torr.	Longleaf Ephedra; Canatilla
EUPHORBIACEAE	**Spurge Family**
CHAMAESYCE MICROMERA (Boiss.) Woot. & Standl.	Pitseed Euphorbia
CHAMAESYCE SERRULA (Engelm.) Woot. & Standl.	Sawtooth Euphorbia
CROTON DIOICUS Cav.	Grassland Croton
CROTON POTTSII (Kl.) Muell. Arg.	Leatherweed Croton
FOUQUIERIACEAE	**Ocotillo Family**
FOUQUIERIA SPLENDENS Engelm. ssp. SPLENDENS	Ocotillo
NOTE: This species grows on the caliche escarpment South of the West Texas Airport.	
GERANIACEAE	**Geranium Family**
ERODIUM CICUTARIUM (L.) L'Her.	Alfilerillo
GRAMINAE (POACEAE)	**Grass Family**
ARISTIDA PURPUREA Nutt.	Purple Threeawn
BOUTELOUA BARBATA Lag.	Sixweeks Grama
CRITESION MURINUM	Hare Barley
CYNODON DACTYLON (L.) Pers.	Bermudagrass
HORDEUM PUSILLUM Nutt.	Little Barley
MUHLENBERGIA PORTERI Scribn.	Bush Muhly
SCHISMUS BARBATUS (L.) Thell.	Mediterranian Grass
SPOROBOLUS FLEXUOSUS (Thurb.) Rydb.	Mesa Dropseed
HYDROPHYLLACEAE	**Waterleaf Family**
NAMA HISPIDUM Gray	Rough Nama
PHACELIA INTEGRIFOLIA Torr.	Crenate Leaf Phacelia

LEGUMINOSAE (FABACEAE) — **Legume Family**

- ASTRAGALUS WOOTONII Sheld. — Garbancillo
- CAESALPINIA GILLIESII (Hook.) Benth. — Bird of Paradise
  - NOTE: This species has escaped into an arroyo off Ashford Street in Horizon City.
- DALEA FORMOSA Torr. — Feather Plume
- HOFFMANSEGGIA GLAUCA (Ort.) Eifert — Indian Rush-pea
- MEDICAGO SATIVA L. — Alfalfa
- MELILOTUS INDICUS (L.) All. — Annual Yellow Sweetclover
- PROSOPIS GLANDULOSA Torr. var. TORREYANA (L. Benson) M. Johnst. — Mesquite
- PSOROTHAMNUS SCOPARIUM (Gray) Rydb. — Broom Dalea
- SENNA BAUHINIOIDES (Gray) Irwin & Barneby — Shrubby Senna

LOASACEAE — **Stick Leaf Family**

- MENTZELIA MULTIFLORA (Nutt.) Gray — Desert Mentzelia

MALVACEAE — **Mallow Family**

- SPHAERALCEA ANGUSTIFOLIA (Cav.) D. Don — Narrowleaf Globemallow
- SPHAERALCEA INCANA Torr. — Soft Globemallow

NYCTAGINACEAE — **Four O'Clock Family**

- BOERHAVIA sp. — Spiderling

POLEMONIACEAE — **Phlox Family**

- IPOMOPSIS LONGIFLORA (Torr.) V. Grant — Whiteflower Ipomopsis

POLYGONACEAE — **Buckwheat Family**

- ERIOGONUM ROTUNDIFOLIUM Benth. — Roundleaf Wildbuckwheat

RHAMNACEAE — **Buckthorn Family**

- ZIZIPHUS OBTUSIFOLIA (Torr. & Gray) Gray — Lotebush
  - NOTE: This species occurs on the caliche exposed south of the West Texas Airport.

SALICACEAE — **Willow Family**

POPULUS DELTOIDES Marsh. ssp. WISLIZENII (Wats.) Eckenwalder — Cottonwood
NOTE: Cottonwoods have been planted in watered areas in Horizon City. The species has also escaped into one arroyo off Ashford Street.

SCROPHULARIACEAE — **Figwort Family**

MAURANDYA WISLIZENI Engelm. — Baloonsepal Maurandya

SOLANACEAE — **Potato Family**

DATURA WRIGHTII Regel — Sacred Datura; Indian Apple

TAMARICACEAE — **Tamarisk Family**

TAMARIX RAMOSISSIMA Ledebour — Salt Cedar

VERBENACEAE — **Vervain Family**

VERBENA OFFICINALIS L. ssp. HALEI (Small) Barber — Slender Vervain

ZYGOPHYLLACEAE — **Caltrop Family**

LARREA TRIDENTATA (DC.) Coville — Creosotebush
TRIBULUS TERRESTRIS L. — Goat Head

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APPENDIX

LIST OF LOCALITIES VISITED

Site 1. Loop 375 (Joe Battle Blvd.) at future jct. with Pebble Hills. Mesquite duneland to 1.5 m tall; some caliche pebbles in interdune areas; dominant shrubs are mesquite with occasional saltbush; creosotebush sparse; interdunes mostly of Gutierrezia microcephala and Lepidium alyssoides.

Site 2. 1.5 mi. West of West Texas Airport at jct. Road to Horizon City. Mesquite duneland to 1.5 m tall; saltbush and Yucca elata occasional; no creosotebush; interdunes with mostly Gutierrezia microcephala.

Site 3. 0.2 mi. West of Horizon City school on Eastlake Drive. Creosotebush community with dunes to only 1 m; mesquite just occasional; interdunes with Gutierrezia microcephala.

Site 4. About 1.2 road mi. by Eastlake Drive Northeast from the jct. with Rojas. Mostly a flat area of creosotebush with infrequent mesquite and no dunes; an isolated Psorothamnus scoparius seen, but more occur on nearby sandier ridges.

Site 5. Junction of Rojas with Eastlake Drive at Northwest corner. A creosotebush community with no dunes; mesquite, yucca and saltbush present but sparse.

Site 6. Junction of US 62-180 wiith Loop 375. Mesquite duneland to 1.5 m tall with ocasional saltbush; snakeweed in the interdunes; yucca sparse; excavations suggesting badger activity.

Site 7. About 1.8 mi East of Loop 375 along US 62-180. Mesquite duneland to 2 m tall with occasional associated saltbush; interdunes with yucca and snakeweed.

Site 8. Junction of hwy. 659 with US 62-180. Mesquite duneland and associated saltbush to 1 m tall; interdunes with snakeweed; some flatter sandy areas have clumps of mesa dropseed.

Site 9. About 2 road miles Southwest along hwy. 659 from junction with US 62-180. Mesquite duneland with saltbush to 1.5 m; snakeweed with yucca clumps in the interdunes; evidence of woodrats feeding on yucca.

Site 10. About 1.2 rd. mi. North of I-10 on Horizon Blvd. A sandy ridge; mostly a creosotebush community with some dropseed grass clumps, yucca, snkeweed and broom psorothamnus.

Site 11. Arroyo on the Northeast side of the Horizon City wastewater treatment facility. The sandy arroyo has sand sagebrush, mesquite, saltbush, longleaf ephedra and yucca. The arroyo slopes are of creosotebush, saltbush and yucca.

Site 12. Horizon City along Ashford Street and at the Golf Course. These areas adjacent to housing are watered or receive extra runoff from watering. The arroyo supports salt cedar, cottonwood and bird of paradise. The nearby golf course has a number of lawn weeds that thrive in the watered environment. Birds are abundant in the Horizon City area.

Site 13. South of the Horizon City Industrial Park on Kmazo Ave. following a power line 1.4 rd. mi. South of the junction with Darrington. This area has mostly creosotebush with sand dunes to 0.5 m tall; snakeweed occurs in the interdune areas; mesquite is rare.

Site 14. About 2.8 rd. mi. NW alonf I-10 from the junction with Horizon Blvd. A large sandy arroyo with some large desert willows along it as well as sand sagebrush, saltbush, and creosotebush. A large active raptor nest was spotted in a desert willow with a freshly killed cottontail rabbit on the rim of it.

Site 15. About 1.5 mi. South of the junction of Loop 375 with hwy. 659. Mesquite with saltbush dunes to 2 m tall with occasional creosotebush; snakeweed in the interdune area.

Site 16. About 1.5 mi. South of the junction of Loop 375 with hwy. 659 and then 1.0 mi. east. Area of mesquite duneland to 2 m tall; saltbush infrequent; interdunes with snakeweed; an area of dumping and some scrapes that could temporarily hold water.

Site 17. About 0.5 mi. East of Loop 375 on Montwood. Edge of a new housing development on a ridge; creosotebush community with low dunes and infrequent low mesquite.

Site 18. West Texas Airport. Environmental data from Worthington (1982).

APPENDIX D

ARCHAEOLOGICAL ASSESSMENT

THE EASTSIDE MASTER PLAN STUDY AREA
IN EL PASO COUNTY, TEXAS:
A CLASS I CULTURAL RESOURCES OVERVIEW

By

Barbara E. Kauffman
Archaeology and Historic Preservation Consultant

A REPORT PREPARED FOR BROWN AND CALDWELL CONSULTANTS
EL PASO, TEXAS

June 1996

ABSTRACT

Brown and Caldwell Consultants contracted with Barbara Kauffman to perform a Class I overview of prehistoric and historic cultural resources that are known or expected to occur within the boundaries of the Eastside Master Plan Study area. Brown and Caldwell has been engaged by the El Paso Water Utilities/Public Service Board (EPWU/PSB) to prepare a plan for wastewater services for a 39 square mile area proposed for annexation by the City of El Paso. The project area encompasses approximately 7 sections of Texas General Land Office (GLO) land, as well as private and El Paso County land in eastern El Paso County. The project area is bounded by Horizon City on the east, Loop 375 on the west, Interstate Highway 10 on the south, and Ft. Bliss on the north.

Efforts to identify and evaluate historic properties have followed the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation" (48 FR 44716). The purpose of this study is to determine the types and locations of known or expected historic properties that may be adversely affected by development projects resulting from the annexation of land by the City of El Paso, and to suggest mitigative measures that can be taken to minimize or avoid such adverse impacts. In addition, it identifies areas of the project that are considered culturally sensitive, and recommends further measures for identification and evaluation of potential historic properties within these areas.

Political subdivisions of the State of Texas (GLO and EPWU/PSB) are involved in the Master Plan project; therefore, Section 191.092 of the Antiquities Code of Texas is immediately applicable. It is also anticipated that federal involvement in the project will be required in future stages of development, which would necessitate compliance with Section 106 of the National Historic Preservation Act (NHPA; 36 CFR 800), and involvement of the Texas State Historic Preservation Office. For example, the planned development resulting from annexation may necessitate one or more Corps of Engineers Section 404 permits. The GLO and the Department of Antiquities Protection (part of the Texas Historical Commission) have entered into a Memorandum of Understanding which sets out general guidelines for the treatment of archaeological and historical properties on GLO land where development will occur. That Memorandum of Understanding will apply to the present project until control of the land passes out of the GLO.

In addition to these overview and planning documents which cover portions of the Master Plan area, a large-scale cultural resources survey of part of the project area was conducted in 1975 for the General Land Office and the Texas SHPO, and forms the primary database for this overview (Lynn et al. 1975). One hundred ninety-seven (197) prehistoric archaeological sites were recorded within the Master Plan area during this survey. Of these, 83 were recommended by Lynn et al. (1975) as being eligible for listing as State Archaeological Landmarks (SALs), and are thus afforded protection under the Antiquities Code of Texas. The rapid development of El Paso's east side during the past 20 years has also resulted in the cultural resources inventory survey of thousands of acres of land in the immediate project vicinity, and the excavation of a large number of prehistoric sites, adding to our knowledge of the types of sites likely to be encountered in the Master Plan area, their topographic setting, and their degree of preservation or research potential.

Several recent reports of archaeological investigations in the general project vicinity have identified the broken terrain of the valley margins (ridges and arroyo slopes) and the mesquite dunes, grasslands, and playa margins of the southern edge of the Hueco Bolson as the location of significant archaeological resources. Sites identified in these areas are generally visible on the ground surface, but may be wholly or partially buried by sheet sands and stabilized mesquite-anchored coppice dunes. Archaeological sites and significant historic structures have also been recorded in the valley bottom, outside of the present project area to the south and west.

In addition to the literature review, a brief reconnaissance of portions of the project area was conducted during the preparation of this overview. Reconnaissance survey was performed in order to identify the project setting, nature of prior disturbance, and the probability of historic and prehistoric cultural resources.

It is recommended that those portions of the Master Plan area that have not been surveyed by an archaeologist be surveyed prior to development in order to identify and record any archaeological or historical sites which may occur. Portions of the Master Plan area which have already been surveyed do not need to be resurveyed. However, the archaeological sites which have already been recorded within the project area, and those which may be discovered through further survey, will need to be assessed to determine their eligibility or potential eligibility for listing on the National Register of Historic Places, and as Texas State Archaeological Landmarks. Such assessments will require that the previously recorded sites be revisited to determine their present state of preservation and data recovery potential, and may further require archaeological testing to determine their eligibility. All sites which are determined to be eligible for listing on the National Register of Historic Places, or as state Archaeological Landmarks, and which will be directly or indirectly impacted by project development, will need to have the effects of that impact mitigated through a program of data recovery. National Register eligible sites and State Archaeological Landmarks may also be avoided and protected from impact through project redesign.

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PROPOSED ACTION

The El Paso Water Utilities/Public Service Board (EPWU/PSB) has contracted with Brown and Caldwell Consultants to provide a plan for wastewater services within an area proposed for annexation by the City of El Paso. This area encompasses approximately 39 square miles of land adjacent to the City of El Paso's eastern boundary. This plan is called the Eastside Master Plan Study. Barbara Kauffman was contracted by Brown and Caldwell to perform a Class I overview of prehistoric and historic cultural resources that are known or expected to occur within the boundaries of the Eastside Master Plan Study area. The project area encompasses several sections of GLO land in eastern El Paso County, as well as private and county-owned land. It is bounded by Horizon City on the east and Loop 375 on the west, Interstate Highway 10 on the south, and Ft. Bliss on the north (Figure 1).

This cultural resources overview will examine the existing data on known archaeological and historic resources in the Master Plan area, and analyze the potential types of sites, their physical setting, and expression that may occur in areas that have not previously been surveyed or inventoried for cultural resources. It will also provide management recommendations concerning the procedures to be followed to identify potentially significant (i.e., National Register eligible) resources in areas of planned future development, and general guidelines for the treatment of significant known cultural resources sufficient to provide cultural resources clearance prior to ground-disturbing activities.

PROJECT ENVIRONMENT

The project area is located on the northern margin of the Rio Grande Valley in extreme west Texas. The Hueco Bolson lies to the north, and encompasses the northern portion of the project area. The Hueco Bolson is a broad, relatively flat, intermontane basin which extends from central New Mexico into northern Mexico. The Hueco Bolson is bounded on the east by the Hueco, Quitman and Sierra de Amargosa mountain chains and on the west by the Franklin Mountains and Sierra Juarez. The average elevation is approximately 3800 feet above sea level. The average annual rainfall is 8.6 inches, although this has varied tremendously from year to year, from a high of 18.3 inches to a low of 2.2 inches (Knowles and Kennedy 1958).

The Rio Grande River originates in the Rocky Mountains in southern Colorado and flows south, fed by tributaries, into the Gulf of Mexico. The Rio Grande is the only permanent source of water in the south-central New Mexico/west Texas area. Until recently, the course and size of the river varied tremendously not only from year to year but also seasonally. Flooding was an annual event and in more recent times, course changes have actually left lands once situated in Mexico on the United States side of the border (Walz 1951).

Until Middle Pleistocene time the Hueco Bolson was one of a series of closed basins which formed the sump for the Rio Grande drainage in Colorado and New Mexico. About 300,000 to 500,000 years B.P. the Rio Grande overtopped its drainage divides and linked up with the lower Rio Grande near Presidio, Texas. Since that time the Rio Grande has been a through-flowing stream. The river valley generally follows the Mesilla Valley fault zone southward until it shifts to the southeast in El Paso at the Rio Grande rift (Lovejoy 1976).

Alternation between glacial and interglacial climates has caused the Rio Grande to alternately cut and partially refill its floodplain. Entrenchment of the Rio Grande has lowered base levels, causing ephemeral streams to dissect or partially destroy terrace surfaces. As a result, the river valley has two major geomorphic subdivisions: (1) a nearly level valley floor with large areas subject to periodic flooding and (2) complex sideslopes with varying degrees of steepness on the zone of dissected terraces designated "valley borders" (Gile et al. 1981; Ruhe 1962). Above these surfaces is the relatively flat plain of the southern margin of the Hueco Bolson (Figure 2). The valley margins and Hueco Bolson surface will be discussed in more detail in the following sections of the report, as the different topographic zones are important for an understanding of the patterning of archaeological sites within the project area.

Much of the valley fill consists of alluvium: various mixtures of clay, silt, sand and gravel which have reached the El Paso Valley through either deposition of soils during annual flooding or by sediments which were washed down from the nearby mountains (Jaco 1971). The Rio Grande valley floor is formed of river deposits as much as 80 feet deep laid down during and subsequent to the last major episode of valley entrenchment (Gile et al. 1981). The reader is referred to Hall (1993) for a more detailed discussion of the surficial geology and geomorphology of the lower valley, and its importance for the visibility and preservation of archaeological and historic sites within the valley, which is outside of the present project area.

Soils within the project area are separated into two main associations. Bluepoint Association soils occur on the valley margins, just above the Rio Grande floodplain. Included in this association are Bluepoint loamy fine sand (ca. 75%) and Bluepoint gravelly fine sand (ca. 25%). The vegetation community native to this soil group was originally dominated by several varieties of dropseed grasses, which have been degraded through overgrazing. Invasive species common to the area presently include a number of woody species, such as creosotebush, mesquite, yucca, and four-wing saltbush. Bluepoint Association soils are well-drained, with low available moisture capacity. Wind erosion is severe.

In the nearly level upland areas of the project at the edge of the Hueco Bolson, Hueco soils of the Hueco-Wink Association predominate. The Hueco soils are loamy fine sand and fine sandy loam, underlain by massive indurated caliche deposits at a depth of approximately two feet. The native vegetation in the Hueco-Wink Association was originally several varieties of dropseed and grama grasses, but these have been replaced by mesquite, creosotebush, and broom snakeweed through overgrazing (Jaco 1971). These woody species serve as anchors to coppice dunes which have formed in the deteriorated soils.

In addition to the above two soil associations, limited areas of badlands occur within the Master Plan area. Badlands occur at and below the caliche-capped escarpments that separate the Hueco Bolson from the Rio Grande valley margins. Badlands consist of stratified clay and sandy loam, and can be up to 15 feet thick, although caliche ridgetops are also subsumed under the Badlands classification. This land is impervious to water, and except for sparse creosotebush, it is bare of vegetation.

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Dominant vegetation in the project area can be classified as mixed Chihuahuan Desert scrub with creosote (*Larrea tridentata*) dominating. Other taxa present include mesquite (*Prosopis* sp.), snakeweed (*Xanthocephalum* sp.), four-wing saltbush (*Atriplex canescens*), yucca (*Yucca* sp.), lechuguilla (*Agave lechuguilla*), cacti (*Opuntia* spp.) and various native grasses. The vegetation of the adjacent floodplain includes willow (*Salix* spp.) and cottonwood (*Populus fremontii*). The floodplain has been invaded in the recent past by tamarisk (*Tamarix pentandra*). The river floodplain and arroyos are subject to silting, scouring and cutting, causing some areas to be subject to continuously changing conditions which affect the vegetation. Fauna found in the area include jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus audubonii*), coyote (*Canis latrans*), and various species of birds and rodents. Irrigation canals and drainage ditches in the valley provide temporary habitat for migrating waterfowl (O'Laughlin 1977).

The land surrounding the project area has been the site of extensive residential, commercial and agricultural development. Residential and commercial developments already exist in the northern portion of the Master Plan area. Part of the valley floor south of the project area consists of irrigated cropland. There is an increasing trend toward urbanization, with rural farmlands giving way to housing subdivisions, streets and industrial development. The valley borders and Hueco Bolson margins, which had been used as rangeland or left idle, are rapidly becoming the site of extensive residential and commercial development as El Paso expands. Modern refuse dumping is a common occurrence in many areas of the Master Plan project.

ARCHAEOLOGICAL BACKGROUND

The following section offers a brief synthesis of the prehistoric occupation of the Southern Jornada Mogollon culture area of south-central New Mexico and western Texas. For a more detailed analysis, as well as the historical sequence of research projects for the area, the reader is referred to Anschuetz (1990), Carmichael (1985b), Hard (1983a), Miller (1989), O'Laughlin (1980) and Peterson and Brown (1993). Following Lehmer (1948), the prehistoric occupation of the area has been classified into five major cultural-temporal groups. These include the Paleoindian Period (ca. 9000 B.C. - 6000 B.C.), Archaic (c. 6000 B.C. - A.D. 200) and the Formative Period which is divided into the following phases: Mesilla phase (A.D. 200 - A.D. 1100), Dona Ana phase (A.D. 1100 - 1200), and the El Paso phase (A.D. 1200 - 1400).

Paleoindian Period

The earliest known evidence for the human occupation of the Southwest dates to the early Holocene. It is believed that around 9000 B.C. climatic conditions were wetter and cooler than at present (Van Devender 1977a, 1977b). It has been suggested that the environment was probably characterized by open woodlands and savannas with heavily forested mountains (Carmichael 1985b). Large game animals included now extinct mammoth, mastodon, camel, bison and horse. Paleoindian groups are described as mobile bands of hunters and gatherers dependent on large game animals, with a tool assemblage reflective of a hunting culture. Although it is also likely that plants and smaller game were taken, little is known about these components in Paleoindian assemblages. The sporadic occurrence of distinctive projectile point types known as Clovis, Folsom, and Plainview are found in the Southern Jornada Mogollon area.

Isolated Paleoindian projectile points have been found in the southern Tularosa Basin (Krone 1976), the Rio Grande Valley near Hatch (Harkey 1981), and on the leeward slope of the Rio Grande Valley several miles west of the project area in southern New Mexico (O'Laughlin 1980). A Folsom point base was also collected from the Vista Hills site in northeast El Paso (Kauffman 1984). Site types for this period have been described as procurement loci, kill and butchering sites, and logistical camps for specific tasks. These types of sites are typically located in close proximity to ancient playas and ponds and in foothills and canyons of large mountain ranges. Carmichael (1985b) suggested that Folsom remains would be likely to occur in dry caves of the Hueco Bolson. With the onset of a drying trend towards the end of the period there was a greater regional emphasis on site locations with permanent water (Judge and Dawson 1972).

Archaic Period

There have been various paleoclimatic reconstructions by researchers on the close of the Paleoindian period. Van Devender and Spaulding (1979) suggested that a drying trend occurred between 6000 and 2000 B.C. which was characterized by a pattern of increased summer monsoon and decreased winter precipitation. The open woodland and savannas became the xeric desert scrub and grassland seen today. As plants and animals became seasonally available only at specific localities, the human populations had to diversify their subsistence base. Characteristic of Archaic sites is the recovery of many varieties of seeds and plants from cultural deposits, including, in the late Archaic, some cultigens. Late Archaic period sites include numerous cave sites excavated in northeast El Paso County (Cosgrove 1947; Mera 1938; Roberts 1929). Simple horticultural technologies appeared at this time. The earliest known form of corn, chapalote, is found at several sites, including the Keystone Dam site in western El Paso.

Relatively few sites dating to the Archaic period have been located in the Hueco Bolson on the Ft. Bliss Military Reservation. This paucity may be a function, in part, of lack of diagnostic projectile points in lithic scatters. Radiocarbon dates from the Borderstar survey at the adjacent White Sands Missile Range support predominately late Archaic use of the southern Tularosa Basin (Seaman et al. 1988). Archaic period camps and residential sites have been discovered in the vicinity of the present project area, including several sites on Ft. Bliss and within the right-of-way for Loop 375.

Archaic sites reflect a wide use of different environmental zones. In the El Paso area, Archaic sites have been found in both the Upper and Lower Bajada, and in the Leeward Slope zones. They are particularly common on the first terrace above the valley bottom. The use of groundstone indicates plant processing and the use of mesquite and a variety of seed-bearing annuals. Specialized agave gathering camps are thought to be located in the foothills of the Franklin Mountains (O'Laughlin 1977). O'Laughlin et al. (1988) also report several Late Archaic sites from the Loop 375 project area in northeast El Paso, adjacent to the project area. Some of these sites have ephemeral structural remains, and food-processing features with plant remains. Data gathered during the Loop 375 project suggest that sites of this age are common on the eroded valley margin escarpment above the Rio Grande floodplain. Unfortunately, their setting in an erosional area has led to poor preservation of cultural features and the displacement of artifacts on the site surfaces. The short-term occupations of Archaic sites are interpreted as seasonal activities of fairly mobile groups at specific resource locations.

Formative Period

The Archaic period ends in the Hueco Bolson at approximately A.D. 200 - 400. Lehmer (1948) first defined this period in the Mogollon culture on the basis of variability in architecture and ceramics. He subdivided it into northern and southern variants. It is the southern branch of the Jornada Mogollon which is relevant to this discussion. The Mesilla phase was originally thought to begin around A.D. 900 at the earliest (Lehmer 1948), but was later changed to at least A.D. 250. This phase is followed by the Dona Ana phase (A.D. 1100 - 1200). The terms Early and Late Mesilla are now commonly used, with some researchers preferring to incorporate the Dona Ana phase into the Late Mesilla (Thompson and Beckett 1979; Whalen 1978). The last phase before European contact is the El Paso phase (A.D. 1200 - 1400).

Lehmer's (1948) definition of the Formative is the change from hunting and gathering to an increased dependence through time on farming and agricultural pursuits. In his scheme, Formative populations made pottery and settled in sedentary villages. Traditional cultural-historical reconstruction defines Formative period populations as pottery makers, semi-sedentary village dwellers and hunters who used bow and arrow technology. Carmichael (1985a) has suggested that increasing regional population density is a major reason for the greater dependence on agriculture.

Mesilla Phase

The Mesilla phase has been traditionally defined by the appearance of brownware ceramics and pithouse architecture (Lehmer 1948). However, because pithouse architecture was actually constructed in Late Archaic times (Beckett 1973; O'Laughlin 1980), Carmichael (1983a) proposed that the introduction and widespread use of brownware ceramics is a more reliable diagnostic trait to define the phase. Carmichael (1983a) has interpreted the Mesilla phase as basically an Archaic adaptation with the addition of ceramics. Settlement patterns were predominantly represented by small, dispersed artifact scatters and pithouse villages. Carmichael (1983b, 1985a) has argued that these patterns are evidence for high residential mobility and short term special use, with reliance on a wide range of plants and animals. The vast majority of Mesilla phase sites consist of small, dispersed artifact scatters rather than pithouse villages. A six-fold increase in the number of sites dating to the Mesilla Phase suggests population growth during the Formative (Carmichael 1983b).

Several Mesilla phase sites have been investigated along the eastern Franklin Mountains (Aten 1972; Hard 1983a; O'Laughlin and Greiser 1973; Thompson and Beckett 1979), and on the valley borders on the west side of El Paso (Carmichael 1985a). Mesilla phase sites have also been documented throughout a wide range of environmental zones including basin floors, alluvial fans and lower bajada, mountain zones and riverine settings (Miller 1989; O'Leary and Canavan 1989). There appears to be a preference for locating the long-term residential sites at permanent water sources. Most pithouse villages are at the edge of the Rio Grande Valley margin or next to small drainages in the mountains and foothills (Carmichael 1983a: Lehmer 1948; O'Laughlin 1980). Late Mesilla sites occupy alluvial fans at the base of the foothills, which are also preferred locations for pueblos in the later El Paso phase (Carmichael 1983b). Much of the work on Mesilla phase sites has focused on the basin floors in south central New Mexico. Hard's (1983a, 1983b, 1986) settlement model depicts Mesilla phase populations changing seasonally from dispersed patterns in summer when many resources were widely scattered, to congregated winter locations near water and in close proximity to where agricultural products were harvested and stored.

Dona Ana Phase

The Dona Ana phase was originally envisioned by Lehmer (1948) as a transition between the Mesilla and El Paso phases. However, it has been notoriously difficult to distinguish these remains in the field and several researchers have argued against its appropriateness as a distinct cultural period. Miller (1989) provides an excellent review of the contextual and chronological problems associated with the Dona Ana phase designation. It has been characterized by the co-existence of both pithouses and surface adobe rooms as well as a greater diversity of both local and intrusive ceramic types. Definition of the phase by the presence or abundance of certain ceramic types has obscured the differences between the Dona Ana and the later El Paso phase. A large number of Dona Ana phase sites have been recorded in the Tularosa basin. They have also been recorded during several surveys in northeast El Paso (Beckett and Bussey 1977; Gerald 1972, 1975, 1984), on Ft. Bliss (Carmichael 1985b; Whalen 1981) and the lower Rio Grande valley (O'Laughlin 1981). Excavation data on this phase is increasing (Clark 1985; Kauffman 1984; Kegley 1979; Miller 1989).

Though there are differing models of settlement patterns for the development of the Mesilla and later El Paso phase as expressed by Whalen (1980, 1981) vs. Carmichael (1983b, 1985b), they concur that settlements reflect an increased dependence on agriculture and a decline in gathered resources. Both see evidence for increasing social complexity from the Mesilla to the El Paso phase. On the other hand, recent excavations at two large Dona Ana phase sites in northeast El Paso revealed a heavy reliance on gathered foods, and a surprisingly low occurrence of cultigens (Miller 1989, 1991).

El Paso Phase

The El Paso phase is the best documented of all phases for south-central New Mexico and west Texas. Much is known about this period through work done by the El Paso Archeological Society during the 1960s and early 1970s. Marshall (1973) summarized the excavation data for this phase in the Hueco Bolson.

Lehmer (1948) defined the beginning of this phase as a shift to above-ground adobe pueblo architecture and an increase in intrusive ceramic types. Populations resided in permanent villages and were dependent on agriculture. Whalen (1978) interpreted the adaptation as specialized intensive farming. Carmichael (1983b) described populations using a wide variety of crops as well as lesser amounts of wild plants including mesquite, yucca and various cacti. The presence of large quantities of rabbit bones in middens is documented in El Paso phase village sites. Small and large pueblos were occupied as well as many kinds of small non-structural sites. Batcho et al. (1984) reported a well-dated El Paso phase subsurface room along the western margins of the Rio Grande Valley, near Santa Teresa, New Mexico. In addition to corn and beans, large quantities of wild plant foods were also present on this site (Wetterstrom 1983).

Whalen (1981) reported that most of the documented villages are clustered at the base of alluvial fans along the basin edge. Other large villages have also been documented near playas and along the Rio Grande valley margins (Marshall 1973; O'Laughlin 1980). Small artifact scatters with ceramics diagnostic of the period have been interpreted as special activity areas (O'Laughlin 1980). Whalen (1981) has argued that the presence of agave roasting pits and the florescence of rock art is indicative of increased social and ceremonial integration. The wide range of intrusive ceramics in El Paso phase sites suggests trade and interaction with central and northern New Mexico, Arizona and the Casas Grandes culture in Chihuahua, Mexico.

Within the El Paso area there have been several investigations at large pueblo sites. Anapra and Worley pueblos are located on the escarpment of the Mesilla Bolson overlooking the Rio Grande Valley on the west side of El Paso above Sunland Park, New Mexico (Scarborough 1985). La Cabrana Pueblo is on the first terrace on the west bank of the Rio Grande north of Anapra, New Mexico (Foster et al. 1981). The archaeological work done there focused on the reconstruction of subsistence activities. Many riverine resources were recovered including bones representing gar, catfish and turtle. Other El Paso phase habitation sites occur where runoff from the mountains temporarily accumulates (O'Laughlin 1980), and clusters of these late sites are known to occur around the margins of large playas in the southern Hueco Bolson in northeast El Paso and on Fort Bliss.

O'Laughlin (1980) argued that since the Rio Grande is the only secure source of surface water in the area, the near absence of reported residential sites away from the river is an accurate reflection of the actual site distribution. Sites located away from the river are usually situated near playas or at the junction of alluvial slopes and basin floors where rainfall and runoff occur. Local physiographic factors are important to the patterning of Formative sites within the Rio Grande Valley from Anthony to the El Paso lower valley. Areas in south-central New Mexico and west Texas with large alluvial fans and gentle slopes often contain residential sites along the river. Little archaeological survey has been done on the Mexican side of the river near El Paso and thus the archaeological patterning for this large geographic area remains unknown.

The population levels in the Jornada Mogollon increased throughout the El Paso Phase until A.D. 1400 when the region appears to have been abandoned. Archeological evidence for the presence of native groups in the El Paso area after the El Paso phase and before Spanish records is scarce (Batcho 1987; Beckett 1991). Although there is early documentary evidence of native groups in the area in the late sixteenth century, few recognizable archaeological sites have been found that date conclusively to this period.

Theories as to the cause of abandonment are varied. O'Laughlin (1980) argued that long-term agriculture with large populations was too risky, and even minor climatic change could have caused a collapse in population. However, theories of abandonment of the area due to environmental change and failure of the cultural system to adapt have been disqualified by several archaeologists on the basis of lack of environmental data (Tainter 1979; Wimberly 1979). Wimberly (1979) related the abandonment of the area to the decline of the Casas Grandes regional system. Others (Carmichael 1983b; O'Laughlin 1980) suggested that some El Paso populations stayed in the area and returned to the hunting and gathering adaptation used in the past. It was this behavior that was observed in the native population by the Spanish in the early historic period. One reasonable explanation for the lack of sites from the protohistoric period is discussed by Cordell (1983). In general, mobile groups with a generalized subsistence base, from the Archaic to the Formative periods, leave very ephemeral, nondiagnostic sites. The majority of sites in the entire Jornada Mogollon area are small lithic and ceramic scatters, some with ash stains and fire-cracked rock features. Many lack diagnostic artifacts or other chronological markers to date them to a particular period. Thus the hiatus between A.D. 1400 and 1580 could be represented at such sites, but remains unrecognizable except when radiocarbon dates are obtained.

THE PROTOHISTORIC AND HISTORIC PERIODS

In the summer of 1581 the first Spanish explorers reached the El Paso Valley. Captain Francisco Chamuscado and Franciscan Augustin Rodriguez made contact with the Native Americans living there. The Spanish chronicles record the El Paso area as "a valley of swamps which extended over eight leagues" (Walz 1951). Another expedition in 1582-83 reported marshlands and pools in the area (Hammond and Rey 1929). In 1598 Juan de Onate led the first colonizing expedition through the El Paso Valley on his way north. Later this route became known as the Camino Real. It passed though the towns of Ysleta, Socorro and San Elizario. It was Onate who forded the Rio Grande at a site he referred to as "El Paseo del Rio del Norte". The location of the ford is generally agreed to be close to the present campus of the University of Texas at El Paso. This was the first use of the term El Paso (Timmons 1981). The original settlement of El Paso was located on the right bank of the river, at the location of present-day Ciudad Juarez, Chihuahua, Mexico. From its inception, El Paso served as an important nexus of a trade, supply and communication network throughout the Rio Grande Valley from northern New Mexico to Mexico City.

The Native Americans in the area at contact included the Mansos, Sumas, Jumanos and Janos (Hughes 1914). Fray Alonso de Benavides describes the people in 1630 as living in small, semi-permanent or permanent villages (rancherias). They had huts of branches (*jacales*), seasonally occupied pithouses or ephemeral shelters, and used ramadas. Benavides described them cutting meat with knives of flint and eating it raw. The Mansos gave the Spanish fish and mice "which is what they have" (Benavides 1965). Espejo and Perez de Luxan (Hammond and Rey 1929) noted the flexibility of their settlement and subsistence patterns. It is not clear if this group practiced any form of agriculture or were primarily hunter-gatherers, foraging over a wide area, and practicing limited horticulture.

Missionizing work began among the native groups around 1656 and the first mission built was Mission de Nuestra Senora de Guadalupe de los Mansos del Norte in what is now Ciudad Juarez. Walz (1951) maintains that the dedication of the mission was in 1668. The Mansos were first consolidated near the mission and separate missions were built to the south and east along the Rio Grande for other groups, including San Francisco de los Sumas and La Soledad de los Janos.

The establishment of friars, soldiers and colonists necessitated improvements to the area. Although missionizing had a dramatic effect on Native American religious beliefs, the transformation of their way of life by the introduction of European material goods, agricultural practices and livestock made a more profound impact in their daily subsistence. The Spanish military and civil authorities competed for control of the Native Americans throughout New Mexico and in the El Paso area. Over the course of several decades the increased and sometimes conflicting demands on these people to change their religious beliefs and donate their labor fostered rebellion against the Spanish.

In 1680 the Rio Grande Pueblos in northern New Mexico succeeded where earlier Native American rebellions had failed, and the Spanish were forced to leave northern and central New Mexico and flee southward. El Paso became a retreat for the refugees, which also included Native American prisoners and sympathizers from the New Mexican Piro and Tiwa pueblos. Before arriving in Paso del Norte, the refugee group stopped north of the pass at a place referred to as "La Salineta". This spot, approximately 16 km. north of the Guadalupe Mission, is believed to be on the east side of the Rio Grande somewhere between Sunland Park and Canutillo.

The year 1680 was an unsettled time for the people already residing in El Paso and for the refugees who fled there. Hughes (1914) notes a splintering society at El Paso after the revolt, which might have disintegrated further without a forceful Spanish presence and the reinforcement of supplies and men from northern Mexico. The existing facilities in the El Paso area were not adequate for the population influx, and temporary camps were established in the area for the refugees. Most of these camps are thought to have been located to the south and east of the Guadalupe Mission, in what is known locally as the El Paso lower valley, east of central El Paso and Juarez, Mexico. Although the names are documented in the literature, the locations of these large refugee camps are not known and none have been identified archaeologically.

El Paso in the 1700s supported agriculture and stock raising. One of the biggest industries was the growing of grapes and the production of wine. Viticulture was a major economic force in the valley during the 1700s. The products of the vineyards gave the valley a virtual monopoly on wine, vinegar, brandy and raisins (Morrow 1981). Other agricultural produce included fruit such as pears, apples, quince and peaches grown in the Socorro and Ysleta areas. Ranching operations with cattle, goats, sheep and horses expanded to the Hueco Mountains and the slopes of the Franklin Mountains. Farms and ranches grew in size on both sides of the river. During the 1700s however, the only known settlements in the project area occur in the river valley. The Tigua of Ysleta del Sur Pueblo, however, are known to have made frequent trips to the Hueco Tanks area to the northeast of the present project, and claim to have covered a wide area in western Texas, including the Master Plan area, on hunting expeditions.

One serious problem for El Paso area residents in the 1700s and early 1800s was Apache raids. In 1775 Apaches attacked settlements in the area, and five years later the Spanish established a series of presidios or forts stretching from the Gulf of California to the Gulf of Mexico. A presidio at San Elizario, in the lower valley of El Paso, supplied soldiers to protect area residents from attacks by the Apaches. Presidios were built both to defend the settlements and missions and to prevent indigenous revolts (Morrow 1981). Some Apaches were even settled briefly at San Elizario and were given rations. There is some archaeological evidence to suggest that Apaches may have been buried at the San Elizario cemetery (Morrow 1981).

The presidio was staffed with Spanish soldiers until the Mexican War of Independence in 1814, when they were called away to fight in the south. When Mexico won its freedom from Spain in 1821, the El Paso valley became part of the state of Chihuahua. Indian raids on residents of the area by both the Apache and Comanche continued to be a problem until the 1850s.

In 1807 the arrival of Lieutenant Zebulon Pike of the U.S. Army signaled a major change for El Paso for the last half of the century. El Paso was an attractive agricultural valley, situated astride the trade route to Chihuahua, and the United States was keenly interested in its future. John Hughes wrote to the U.S. War Department in 1847 that it "would be charity to rid these people of their present governors, and throw around them the shield of American Protection" (Hughes 1914). In 1846, troops under the command of U.S. Army Colonel Alexander Doniphan routed Mexican forces in the battle of Brazito, north of El Paso, during the Mexican-American War. American domination of the valley began. In the Treaty of Guadalupe Hidalgo, which formally ended the Mexican-American War in 1848, the Rio Grande became the international boundary between the United States and Mexico.

By 1850 El Paso County was formed. The first county seat was at San Elizario, later moved to Ysleta in 1873 and later in 1883 moved to El Paso, which had been incorporated as a city (Morrow 1981). The Butterfield Overland Mail, which ran from Tipton, Missouri, where the rails ended, to San Francisco, California, passed within a mile of the northern border of the project area (Sonnichsen 1968). The Butterfield Trail was in use between 1858 and 1861, when the Civil War closed the enterprise. The route is still visible in aerial photographs and on the ground in some areas.

By 1880, 14,025 acres were under cultivation in El Paso County (Morrow 1981). Alfalfa, introduced around 1860, was a major crop by 1880 (Sonnichsen 1980). By 1881 the first train service had begun, to accommodate trade with Mexico and to link El Paso with other American cities to the east and west. The first railroad bridge across the Rio Grande was constructed by the Southern Pacific Railroad in 1881 just south of the intersection of Executive Center and Paisano Roads, and was replaced in the 1930s by a steel bridge at the same location (Leonard 1981).

OVERVIEW OF PREVIOUS RESEARCH

El Paso County has one of the highest known archaeological site densities in Texas, with approximately 11 sites per square mile (Limp 1989). The City of El Paso Historic Register currently contains over 190 historic properties (El Paso City Historic Preservation Office). The precise number of sites listed in the National Register of Historic Places is difficult to determine since multiple sites can be located in a National Register District or as a thematic nomination, but El Paso County has over forty sites currently on the Register (National Register 1991; Steeley 1984). This figure represents approximately 0.06 to 0.136 sites per square mile (Limp 1989). This concentration of National Register properties reflects the locations of concerted effort to identify and evaluate properties. In this sense it is clearly a phenomenon of where such effort has been applied rather than an indication of the distribution of "important" or "significant" resources. Significance is a legal term that denotes a site that is considered eligible for listing on the National Register of Historic Places, and therefore must be protected, or its scientific data recovered prior to disturbance.

Many more archaeological and historic sites have been located in the county. The Texas Archeological Research Laboratory (TARL) at the University of Texas at Austin lists over

5,000 sites in El Paso County (Carolyn Spock, personal communication, May 1996). Currently, however, no single comprehensive statewide database of all archaeological sites exists. Information on sites in El Paso County are also filed with the State Archeologist and at the Texas Historical Commission (THC) in Austin, Texas. The El Paso Archaeological Society, a local amateur archaeology group, also keeps its own set of site records stemming from the Society's survey activities.

There are several reasons why El Paso County has a high site density. In comparison to other areas of the country, the landscape in the county is relatively open. Except along the river, the ground cover is sparse and the subsurface is exposed by erosion with great regularity. A statistical overview of prehistoric sites by the Texas Historical Commission revealed that more that 90% of sites had erosion disturbance (Biesaart et al. 1985). Thus, the surface visibility for most kinds of archaeological sites in the area is high. Many sites are easily located on survey without extensive testing.

Another reason that El Paso has such a large number of sites can be attributed to the development of the city itself. In 1986 the City of El Paso Historic Preservation Office commissioned an inventory of prehistoric sites within the city limits (Elmore and Foster 1986). It has also been active in the preservation of historic structures within the city. Many nominations to the National Register of Historic Places took place in the early 1970s and continue through the present. Recognition of the value of historic structures to the development of the city has encouraged preservation interests. The Rio Grande Council of Governments, formerly called the West Texas Council of Governments, has produced a valuable historic preservation plan for the Mission Trail in the lower valley of El Paso (Morrow 1981), southeast of the present project area.

The presence of the El Paso Archeological Society (EPAS) has also contributed greatly to the archaeological database. This group of mostly avocational archaeologists, with professional sponsorship since 1927, has been responsible for many surveys and excavations in and around the city. Active today, it publishes a monthly newsletter and professional articles in its journal *The Artifact*. Since 1976, EPAS has provided support to the Wilderness Park Museum, which curates its collections. EPAS volunteers have undertaken several archaeological field schools, participated on surveys, and assisted the University of Texas at El Paso (UTEP) and the Centennial Museum (EPCM) in excavations.

Local universities and private consulting firms have also undertaken several survey and excavation projects in the immediate project area. Batcho & Kauffman Associates has conducted several surveys of large tracts of land in east El Paso for commercial and residential development. These include the survey of approximately 800 acres for the extension of the Vista Hills development 3.5 miles northwest of the project area (Canavan et al. 1990a), survey for the Vista Ridge development and the Vista del Sol Industrial Park 1.5 miles northwest (Canavan et al. 1990b), and a survey of 400 acres 0.25 miles west of the present project area (Stuart 1994). Ten sites were recorded during these surveys. The low site density can partially be explained by the extensive modern disturbance to these parcels resulting from off-road vehicle traffic, sand and gravel quarry operations, and vast areas disturbed by modern refuse disposal. Several of the sites recorded during these surveys are extremely large, however, and consist of continuous scatters of cultural material and as many as 100 prehistoric hearth features. These sites can extend for up to a mile or more along the edge of the valley margins.

Several sites discovered during these surveys have been tested or excavated prior to development (Stuart and Miller 1991). All of the tested sites consist of scatters of ceramics, lithics, groundstone, and burned caliche or fire-cracked rock hearths. A small burned pit structure dating to the Mesilla phase was also excavated on one of the sites. Radiocarbon dates on materials recovered from the features range in age from the Archaic to the early Historic Period. Features are in various states of preservation, although the majority are extremely eroded and lack datable materials or clear feature morphology.

Kauffman (1984) also excavated the Vista Hills Site approximately 4 miles west of the Master Plan area. The site consisted of a low-density scatter of lithic and groundstone artifacts and eroded hearth features in coppice dunes along the valley margin. The site had extremely complex stratigraphy, and was the result of repeated occupations of the same area over thousands of years. Reoccupation of the site surface resulted in the mixing of cultural deposits, and was complicated by repeated episodes of aeolian erosion and deposition. The author concluded that there was little likelihood that the cultural materials recovered from the site were in primary context. Obsidian hydration dates on artifacts recovered from the site dated from the Paleoindian Period to the early Formative Period, with clusters of dates in the late Paleoindian, late Archaic, and early Formative. Radiocarbon dates cluster in the late Archaic and early Formative.

Additional survey in the general vicinity of the project area was conducted by Sudar-Murphy at the Pebble Hills Development (1977a) and for the Golf Resort Joint Venture (1977b). Gerald (1978) also surveyed the corridor of Interstate Highway 10, and recorded similar low-density lithic and lithic/ceramic scatters with fire-cracked hearth features.

One of the largest surveys in the project area encompasses approximately 30% of the Master Plan area (Figure 3). In 1975, Lynn, Baskin, and Hudson surveyed several square mile sections of Public Free School Land for the GLO, within and adjacent to the project area (Lynn et al. 1975). They recorded 246 sites in the sand dunes of the southern edge of the Hueco Bolson and the valley margins. All of these sites consist of low-density scatters of lithic or lithic and ceramic cultural materials of varying extent, most with multiple hearth areas. They also recorded several sites which consisted of clusters of hearths with no associated cultural materials. Most sites were visible in the blow-outs between mesquite-stabilized coppice dunes, and on the ridges and arroyo slopes of the dissected valley margin terrain. Many of these sites occur in close proximity to one another, and appear to represent the same type of cultural phenomenon that Batcho & Kauffman Associates recorded as extensive, continuous scatters of cultural material and features, with areas of higher artifact and feature density separated by low-density areas where sheet sand accumulations are presumed to have buried portions of the often multicomponent sites.

Other sources of archaeological data are the investigations carried out on the Ft. Bliss Military Reservation, located north of the project area. The creation of a Historic Preservation Plan for this huge facility has mandated an inventory of sites. Paleoindian, Archaic and non-ceramic sites account for about 75 percent of the thousands of known sites on Ft. Bliss (Ft. Bliss Historic Preservation Plan 1982). Surveys associated with the extension of Loop 375 through Ft. Bliss also recorded a number of sites within the northwestern corner of the Master Plan area. These sites were mitigated prior to the construction of the highway, (O'Laughlin and Martin 1990).

Several of the larger excavation reports for sites in the immediate project area contain overviews of previous research (e.g. Carmichael 1985a; O'Laughlin 1980). A Class I cultural resources overview similar in scope to the present study was also prepared in 1989 for proposed improvements to agricultural and storm water drains in the City of El Paso (O'Leary and Canavan 1989). This study covered the location of facilities in the lower valley of El Paso and presented a thorough review of recent research, National and State Register properties in El Paso County, and included a pedestrian survey of the drainage ditch rights-of-way. In addition, in 1994 Batcho & Kauffman Associates prepared an overview for the East El Paso Master Plan, a multidisciplinary investigation carried out at the request of the GLO that was also performed as a preliminary planning document for future annexation of land by the City of El Paso. That project area is subsumed in the present Master Plan Study area.

By far the most detailed and up-to-date overview of prehistoric and historic cultural resources and environmental parameters is Peterson and Brown's (1993) *El Valle Bajo* report prepared for the Lower Valley Water District Authority. This document goes into considerable detail concerning previous research in the immediate project area and the adjacent river valley, pulling together the results of archaeological survey and mitigation reports, unpublished El Paso Archaeological Society site data, historic archival sources, and extensive environmental investigations. The authors have also prepared a predictive model of site location, based on the topographic setting of known sites, which is applicable to the current project.

PREHISTORIC SITES WITHIN THE PROJECT AREA

One hundred ninety-seven prehistoric archaeological sites have previously been recorded within the Master Plan area, during Lynn, Baskin, and Hudson's (1975) survey of Public Free School Lands in El Paso County for the GLO. An additional 49 sites were recorded during their survey in adjacent and nearby areas with similar topography and geomorphic settings. Surveys by various individuals and firms have recorded an additional 167 sites within the boundaries of the Master Plan area, for a total of 364 previously recorded archaeological properties (Appendix 1; Figure 4). These additional surveys include those undertaken for the Sparks Subdivision in the southwestern portion of the Master Plan area (Peterson 1991), which recorded two sites, the surveys conducted for the state (Graves et al. 1994) and county jails (Graves and Peterson 1994) in the northern portion of the project area, and the previously noted Loop 375 surveys (O'Laughlin 1987). These four surveys resulted in the discovery of 59 archaeological sites within the present project area. All of these 59 sites have been either mitigated or determined to be not eligible for listing on the National Register, and most have subsequently been destroyed through development activities.

The sites discovered during the Public Free School survey are generally characterized by scatters of lithic tools and chipping debris, ceramics, occasional groundstone, and the remnants of burned caliche or fire-cracked rock hearths. They noted ash and charcoal staining in many of the hearth areas, suggesting that radiocarbon dates might be recoverable from the features. Most of these sites are located in the blowouts between mesquite-anchored coppice dunes, or on gravel ridges and arroyo slopes, and occur both on the heavily dissected, steeply walking distance of permanent or seasonal water sources (the river and the plays in the upland areas).

Site types expected on the valley margin surfaces could cover all time periods and range from artifact scatters resulting from limited raw material or food resource procurement to more long-term sites with hearths or roasting pits and possibly small, ephemeral pithouse structures. Undatable sites, and sites from the Archaic Period and the Mesilla phase are the most common on the valley margin, both within and adjacent to the Master Plan area. Protohistoric and historic period campsites and limited activity sites associated with the use of the area by Mansos, Apaches and the Tiwa and Piro settled in the Ysleta/Socorro area might also be expected. These sites would be detectable by their unique ceramic assemblages, if any are present.

The majority of sites occurring in this zone are largely visible on the surface; therefore, they should be detectable through surface survey. The wind and water erosional processes occurring in this topographic zone, however, often disturb the distribution of artifacts and destroy the contents of hearths which would have provided chronometric and subsistence information. Therefore, fewer sites in this setting are clearly eligible for listing on the National Register, although many may require testing to determine their state of preservation and data potential.

The Hueco Bolson

The second location of expected cultural resources is in and near the edge of the Hueco Bolson, particularly surrounding the numerous playas within the Master Plan area. Three hundred nineteen of the 364 sites (88%) recorded during surveys of this portion of the project area fall within the Hueco Bolson. Lynn et al. (1975) differentiate between sites located around playa margins and those on the Hueco Bolson rim. Playa margins are known throughout the southern Jornada Mogollon area as favored locations of a variety of site types, from a wide range of time periods. The availability of seasonal water and the greater amount of soil moisture enables the short-term abundance of a wider variety of plant and animal species than in the surrounding terrain, and may have permitted horticultural or agricultural pursuits in the past. As mentioned previously, El Paso Phase sites, particularly residential sites, are known to cluster around playas on Ft. Bliss, adjacent to the project area. Therefore, these areas may be the location of a later and more settled component of the prehistoric cultural system than the valley margin terrain. Lynn et al. (1975), however, report few late ceramics on sites which they define as having a playa setting. The largest assemblages of late (El Paso phase) ceramics were noted on sites in dune settings in the Hueco Bolson.

The availability of seasonal water in playas would enable a more sedentary settlement component in this location, which would be expressed archaeologically by sites having more substantial architecture, storage facilities, trash accumulations, and a denser and more extensive scatter of artifactual remains. Expected site types might include pithouse villages or individual pithouses, adobe pueblos, and seasonally reoccupied campsites of more mobile hunter-gatherer groups. These sites would be partially visible on the surface, although dune sands might mask the true extent of subsurface features. All of the extremely large sites (those with 20+ hearths) recorded by Lynn et al. (1975) and other researchers, occur in the Hueco Bolson, especially around the playas and at the escarpment or rim above the valley margin.

sloping valley margins, and on the relatively level upland areas of the adjacent southern Hueco Bolson, particularly along the margins of the playas or ephemeral lakebeds which are located there. Several extremely large sites, with 20 or more hearth areas, are located at the rim or escarpment of the Hueco Bolson, adjacent to the caliche Badlands within the Master Plan area.

The importance of the valley margin area for prehistoric populations lies in its setting at an ecotone between the upland Hueco Bolson, with its relict playas, and the Rio Grande Valley, with its permanent water source and unique biotic community. While sites in this topographic zone appear for the most part to be the remains of short-term campsites and specialized processing facilities, they have the potential to provide significant scientific data concerning prehistoric settlement patterns and adaptive strategies, and may date to the any time between the Archaic and the Historic Periods. Sites on the Hueco Bolson escarpment and those surrounding the playas are generally larger, and have more cultural features than the valley margin sites.

HISTORIC SITES WITHIN THE PROJECT AREA

No historic structures that are eligible for, or currently listed on, the National Register of Historic Places have been identified within the project area. Peterson and Brown (1993) provide a thorough listing of historic sites and structures in the Lower Valley, many associated with the Spanish Colonial, Mexican, and early American Period occupations of the area. No historic sites, however, have been noted in the valley margin or upland areas of the Master Plan area. Expected historic resources may include campsites of Apache, Tigua, Piro, Manso, and other Protohistoric Period and Spanish Colonial Period groups which inhabited the valley or roamed the Hueco Bolson and adjacent areas on hunting, gathering, or other resource procurement forays, or used it as the staging area for raids on El Paso valley communities. The route of the historic Butterfield Trail runs approximately one mile north of the boundaries of the project area.

TOPOGRAPHIC SETTING OF EXPECTED RESOURCES

The Valley Margins

Forty of the 364 known prehistoric sites in the project area (11%) have been recorded on the valley margin surfaces. in arroyo slope and ridge settings (Appendix 1). The relatively small number of sites in this rough and broken terrain may, in part, be a product of the erosional destruction of cultural resources on the eroded valley margin surfaces. Sites located within this setting, however, are often highly visible on the surface, which consists mainly of gravelly ridges and arroyo slopes where artifacts and cultural features are exposed, or preserved as "lag" deposits. Cultural deposits on sites in these settings are rarely more than 0.3 meters in depth, except where they have been covered in part by recent sand accumulations resulting from slopewash and sheet sand accumulations. Prehistoric sites located in this area may have taken advantage of its ecotonal setting, between the Hueco Bolson and the river valley. which provided a concentrated and varied biotic community significant for prehistoric and protohistoric exploitation, and which was located within easy walking distance of permanent or seasonal water sources (the river and the plays in the upland areas).

Site types expected on the valley margin surfaces could cover all time periods and range from artifact scatters resulting from limited raw material or food resource procurement to more long-term sites with hearths or roasting pits and possibly small, ephemeral pithouse structures. Undatable sites, and sites from the Archaic Period and the Mesilla phase are the most common on the valley margin, both within and adjacent to the Master Plan area. Protohistoric and historic period campsites and limited activity sites associated with the use of the area by Mansos, Apaches and the Tiwa and Piro settled in the Ysleta/Socorro area might also be expected. These sites would be detectable by their unique ceramic assemblages, if any are present.

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The availability of seasonal water in playas would enable a more sedentary settlement component in this location, which would be expressed archaeologically by sites having more substantial architecture, storage facilities, trash accumulations, and a denser and more extensive scatter of artifactual remains. Expected site types might include pithouse villages or individual pithouses, adobe pueblos, and seasonally reoccupied campsites of more mobile hunter-gatherer groups. These sites would be partially visible on the surface, although dune sands might mask the true extent of subsurface features. All of the extremely large sites (those with 20+ hearths) recorded by Lynn et al. (1975) and other researchers, occur in the Hueco Bolson, especially around the playas and at the escarpment or rim above the valley margin.

Extremely large sites, which are often multicomponent and cover a long time span, have been found along the Hueco Bolson escarpment in survey areas to the west of the Master Plan area (Canavan et al. 1990). Many of these sites, particularly those located at the escarpment, cover as much as 0.5 to 1.0 square mile. Previous data recovery projects at similar sites in this setting have suggested that these locations are complex conglomerations of artifacts and features which cover a wide time span (Kauffman 1984; Stuart and Miller 1991). They are the product of multiple episodes of reuse of the same area, for similar short-term camps associated with hunting and gathering activities. It is not yet understood what cultural or logistical factors contributed to the preference for, and repeated use of, the escarpment in prehistoric times. It has been suggested that this location provides an extensive vista for hunting or defense, and a stable base camp at the edge of an ecotone.

Both the valley margins and the Hueco Bolson supported a predominantly arid lands grassland in the past. This grassland has since been destroyed, mainly through overgrazing combined with drought, in the late 19th and early 20th centuries. Jaco (1971) notes that small pockets of the native grasses still survive in some parts of the soil associations, which are now characterized by a sparse desert scrub community. The changes in the floral and associated faunal communities due to overgrazing and soil degradation are not so much a complete shift from one vegetation community to another, but a shift in the relative percentages of species in the associations. The soils of these topographic zones therefore supported a floral community which was probably of primary economic importance for the prehistoric hunter-gatherers who inhabited the area.

Besides the more abundant grasses, the soil associations are characterized by mesquite and succulents such as agave and sotol; all are species which have documented ethnographic use as food plants in the southwest. Even late in the prehistoric cultural sequence, settled or semi-sedentary village dwellers during the Dona Ana and El Paso phases relied on gathered wild resources to supplement their agricultural or horticultural diet, especially during lean years when crop yields were low. Animal species common to grassland environments, such as antelope, may also have been more abundant in the past in the Master Plan area, increasing its importance in the prehistoric procurement and settlement system.

SUMMARY AND DISCUSSION

Approximately 30% of the project area was surveyed for cultural resources in 1975, as part of a survey of Public Free School Land in El Paso County for the GLO (Lynn et al. 1975). That survey documented 197 prehistoric archaeological sites within the Eastside Master Plan Study area. These sites largely appear to be temporary campsites, although some are quite large, and may span the entire range of time from the Archaic through the Formative, and possibly into the Protohistoric Period. Legal determinations of the eligibility of these sites for listing on the National Register of Historic Places have not been carried out, so the scientific and legal significance of these sites will need to be assessed prior to any ground-disturbing activities associated with project-related construction that might threaten their integrity. Lynn et al. (1975) recommended that 83 of these sites be listed as Texas State Archaeological Landmarks (Appendix 1), although formal determinations of eligibility were not performed at that time.

If sites within the Master Plan area are found to be eligible for listing as State Archaeological Landmarks, they are afforded protection under the Antiquities Code of Texas. The criteria for listing a site as a State Archaeological Landmark (SAL) are less stringent than those for meeting the requirements of eligibility for the National Register of Historic Places. Therefore, some of the sites which are eligible for listing as SALs may be judged to be not eligible for the National Register during reassessment or testing. Sites which are formally determined to be not eligible for the National Register or as SALs need not be considered further after they have been recorded and discussed in a report of survey investigations.

Fifty-nine of the previously recorded sites have been either mitigated or determined to be not eligible for listing on the National Register during previous project activities within the project area. Most of these sites have been destroyed through subsequent construction and development activities, and do not need to be considered further. All but two of these sites were located in the portion of the project area that lies north of US 62-180 (Montana Avenue).

Based on previous archaeological research and the results of the archival search, two topographic zones that occur within the project area have been identified as the location of expected cultural resources. These are the Hueco Bolson and the valley margin. Brown et al. (1992) also recognize both the valley margin and the Hueco Bolson as areas of high probability for the location of prehistoric archaeological sites. Sites identified in both of these zones may span the entire period of human habitation of the area, from the Archaic Period to the Historic Period, although there is evidence from elsewhere in the Hueco Bolson that there is a tendency for late prehistoric sites (El Paso phase) to cluster around playas in the Hueco Bolson. Previous survey suggests that Archaic and Mesilla phase sites may predominate on the valley margin surfaces. Site types may range from undatable artifact scatters and burned caliche or fire-cracked rock hearths with or without associated artifacts, to prehistoric pithouse villages and adobe pueblos, to historic structures or features.

Particularly sensitive areas within the Hueco Bolson include the escarpment or rim overlooking the Rio Grande Valley and the areas surrounding playas. These locations frequently yield the most extensive and complex cultural remains, as they were the setting for repeated use throughout prehistory. Within the valley margin zone, the areas with the highest likelihood of yielding significant cultural resources are the ridges left between drainage channels that cut through the zone. The probability of discovering intact cultural deposits that could yield significant data concerning prehistoric use of the area in ridge settings is due to a combination of factors. Many of the larger drainage channels probably existed prehistorically, and the ridges between them provided high, stable surfaces for temporary camps and resource procurement activities (especially lithic or stone tool raw material procurement). In addition, ridges have been subjected to less erosional activity that could destroy prehistoric cultural resources, so that the cultural deposits that are left on ridge tops are in a better state of preservation. These areas of heightened cultural sensitivity are highlighted on Figure 2 with special shading.

MANAGEMENT RECOMMENDATIONS

The GLO and the Texas Antiquities Committee have entered into a Memorandum of Understanding which sets out general guidelines for the treatment of archaeological and historical properties on GLO land where development will occur. That Memorandum of Understanding will apply to the present project until control of the land passes out of the GLO.

It is recommended that the following measures be carried out for the East El Paso Master Plan Area. These procedures are very similar to those outlined by Brown et al. (1992), and are consistent with the aforementioned *Plan for the Identification, Evaluation, and Treatment of Historical and Archaeological Properties.*

1. Pedestrian survey of all project areas that have not previously been surveyed should be undertaken, and all sites discovered during those surveys should be recorded on standard State of Texas Site Data Forms. A professional report of investigations should be prepared for each survey undertaken, which meets the Secretary of the Interior's Standards and Guidelines, and the requirements of the Texas Historical Commission.

2. Determinations of eligibility should be made for all sites recorded within the Master Plan Area. The eligibility or potential eligibility of each site for listing on both the National Register of Historic Places and as Texas State Archaeological Landmarks should be determined in accordance with the National Historic Preservation Act and the Texas Antiquities Code, in consultation with the Texas SHPO. It may not be possible to determine the eligibility of all sites based on data recorded during surface survey. Sites which were previously recorded will need to be revisited to assess their present state of preservation, and some sites may need to be subjected to a limited program of archaeological testing to determine their data recovery potential and eligibility.

3. If a site is determined to be **not eligible** for either of the above lists, then no further action needs to be taken with regard to that site.

4. If an historic or prehistoric site within the project area **is** determined to be **eligible or potentially eligible** for listing on the National Register of Historic Places, or as a State Archaeological Landmark, the preferred alternative is avoidance of the site by rerouting construction activities and preserving it from all construction-related impacts. If avoidance is unfeasible, then a suitable program of recordation, testing, and/or mitigation should be prepared in consultation with the Texas SHPO, the GLO archaeologist, the EPCLVWDA if applicable, and any federal agency involved in the undertaking at that time, in order to mitigate the impact of construction on the historic property.

Sites will differ in their data recovery potential due to a number of factors, including the amount and types of cultural features and artifacts present, the amount of erosion or disturbance to the site, and the number of similar sites located within the project boundaries which might provide redundant data. Therefore, not all sites recorded in the project area may need further data recovery or protection through avoidance. It may be feasible and desirable to group National Register and/or SAL eligible sites into categories according to their surface and subsurface characteristics, artifact and feature assemblages, and topographic setting, and choose a sample of sites in each category for further examination through data recovery. All recommendations as to determinations of eligibility, as well as plans for the treatment of eligible historic properties, will need to be coordinated with, and accepted by, the Texas SHPO prior to implementation.

The nature of surficial deposits in some portions of the project area (dune sands) may serve to bury cultural materials, making sites undetectable during surface survey. Therefore, it is also recommended that if any previously unrecorded and/or previously undetected cultural remains are discovered during construction operations, then all work must cease in the immediate area of the exposed resource and the Texas SHPO and the GLO archaeologist or applicable federal agency official, or the archaeological contractor for the EPWU/PSB or other involved public agency, shall be immediately notified so that a suitable course of action can be determined.

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APPENDIX 1.

PREVIOUSLY RECORDED SITES WITHIN THE PROJECT AREA

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
41	Clint NW	dune	SAL Not Eligible	
42	Clint NW	rim	SAL Eligible	
43	Clint NW	dune	SAL Not Eligible	
44	Clint NW	dune	SAL Not Eligible	
45	Clint NW	dune	SAL Not Eligible	
46	Clint NW	ridge	SAL Not Eligible	
47	Clint NW	ridge	SAL Not Eligible	
48	Clint NW	ridge	SAL Not Eligible	
49	Clint NW	arroyo slope	SAL Not Eligible	
50	Clint NW	ridge	SAL Not Eligible	
51	Clint NW	ridge	SAL Eligible	
52	Clint NW	ridge	SAL Not Eligible	
53	Clint NW	ridge	SAL Not Eligible	
54	Clint NW	ridge	SAL Not Eligible	
55	Clint NW	rim	SAL Eligible	
56	Clint NW	dune	SAL Eligible	
57	Clint NW	dune	SAL Eligible	
58	Clint NW	dune	SAL Not Eligible	
59	Clint NW	playa	SAL Eligible	
60	Clint NW	dune	SAL Not Eligible	
61	Clint NW	dune	SAL Not Eligible	
62	Clint NW	dune	SAL Not Eligible	
63	Clint NW	dune	SAL Not Eligible	
64	Clint NW	dune	SAL Eligible	
65	Clint NW	dune	SAL Not Eligible	
66	Clint NW	dune	SAL Eligible	
67	Clint NW	dune	SAL Not Eligible	
68	Clint NW	dune	SAL Not Eligible	
69	Clint NW	ridge	SAL Not Eligible	
70	Clint NW	dune	SAL Eligible	
71	Clint NW	dune	SAL Not Eligible	
72	Clint NW	dune	SAL Not Eligible	
73	Clint NW	dune	SAL Eligible	
74	Clint NW	playa	SAL Not Eligible	
75	Clint NW	playa	SAL Eligible	
76	Clint NW	dune	SAL Eligible	
77	Clint NW	ridge	SAL Not Eligible	
78	Clint NW	ridge	SAL Eligible	
79	Clint NW	arroyo slope	SAL Not Eligible	
80	Clint NW	arroyo slope	SAL Not Eligible	
81	Clint NW	arroyo slope	SAL Not Eligible	
82	Clint NW	arroyo slope	SAL Not Eligible	
83	Clint NW	playa	SAL Eligible	
84	Clint NW	playa	SAL Not Eligible	
85	Clint NW	playa	SAL Eligible	
86	Clint NW	dune	SAL Eligible	
87	Clint NW	dune	SAL Eligible	
88	Clint NW	dune	SAL Not Eligible	
89	Clint NW	dune	SAL Not Eligible	
90	Clint NW	dune	SAL Eligible	
91	Clint NW	dune	SAL Eligible	
92	Clint NW	playa	SAL Not Eligible	
93	Clint NW	dune	SAL Not Eligible	

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
94	Clint NW	dune	SAL Not Eligible	
95	Clint NW	dune	SAL Not Eligible	
96	Clint NW	dune	SAL Not Eligible	
97	Clint NW	dune	SAL Eligible	
98	Clint NW	dune	SAL Not Eligible	
99	Clint NW	dune	SAL Not Eligible	
100	Clint NW	dune	SAL Not Eligible	
101	Clint NW	dune	SAL Eligible	
102	Clint NW	dune	SAL Not Eligible	
103	Clint NW	dune	SAL Not Eligible	
104	Clint NW	dune	SAL Not Eligible	
105	Clint NW	dune	SAL Eligible	
106	Clint NW	dune	SAL Not Eligible	
107	Clint NW	dune	SAL Eligible	
108	Clint NW	dune	SAL Eligible	
109	Clint NW	dune	SAL Not Eligible	
110	Clint NW	dune	SAL Not Eligible	
111	Clint NW	playa	SAL Eligible	
112	Clint NW	dune	SAL Not Eligible	
113	Clint NW	dune	SAL Not Eligible	
114	Clint NW	dune	SAL Eligible	
115	Clint NW	dune	SAL Not Eligible	
116	Clint NW	dune	SAL Eligible	
117	Clint NW	dune	SAL Eligible	
118	Clint NW	dune	SAL Not Eligible	
119	Clint NW	dune	SAL Not Eligible	
120	Clint NW	ridge	SAL Eligible	
121	Clint NW	ridge	SAL Eligible	
122	Clint NW	playa	SAL Not Eligible	
123	Clint NW	dune	SAL Not Eligible	
124	Clint NW	dune	SAL Eligible	
125	Clint NW	dune	SAL Not Eligible	
126	Clint NW	dune	SAL Eligible	
127	Clint NW	dune	SAL Eligible	
128	Clint NW	dune	SAL Eligible	
129	Clint NW	dune	SAL Not Eligible	
130	Clint NW	dune	SAL Eligible	
131	Clint NW	dune	SAL Not Eligible	
132	Clint NW	dune	SAL Not Eligible	
133	Clint NW	dune	SAL Not Eligible	
134	Clint NW	dune	SAL Not Eligible	
135	Clint NW	dune	SAL Not Eligible	
136	Clint NW	dune	SAL Not Eligible	
137	Clint NW	dune	SAL Not Eligible	
138	Clint NW	dune	SAL Eligible	
139	Clint NW	dune	SAL Not Eligible	
140	Clint NW	dune	SAL Not Eligible	
141	Clint NW	dune	SAL Eligible	
142	Clint NW	dune	SAL Eligible	
143	Clint NW	dune	SAL Not Eligible	
144	Clint NW	dune	SAL Eligible	
145	Clint NW	dune	SAL Not Eligible	
146	Clint NW	dune	SAL Eligible	

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
147	Clint NW	dune	SAL Eligible	
148	Clint NW	dune	SAL Not Eligible	
149	Clint NW	dune	SAL Eligible	
150	Clint NW	dune	SAL Not Eligible	
151	Clint NW	dune	SAL Not Eligible	
152	Clint NW	dune	SAL Eligible	
153	Clint NW	dune	SAL Not Eligible	
154	Clint NW	ridge	SAL Eligible	
155	Clint NW	ridge	SAL Eligible	
156	Clint NW	dune	SAL Not Eligible	
157	Clint NW	dune	SAL Eligible	
158	Clint NW	arroyo slope	SAL Not Eligible	
159	Clint NW	arroyo slope	SAL Eligible	
160	Clint NW	arroyo slope	SAL Eligible	
161	Clint NW	arroyo slope	SAL Eligible	
162	Ysleta	dune	SAL Eligible	
163	Ysleta	dune	SAL Eligible	
164	Ysleta	dune	SAL Eligible	
165	Ysleta	dune	SAL Not Eligible	
166	Ysleta	playa	SAL Eligible	
167	Ysleta	dune	SAL Eligible	
168	Ysleta	dune	SAL Eligible	
169	Ysleta	dune	SAL Eligible	
170	Ysleta	dune	SAL Not Eligible	
171	Ysleta	arroyo slope	SAL Eligible	
172	Ysleta	dune	SAL Not Eligible	
173	Ysleta	dune	SAL Eligible	
174	Ysleta	ridge	SAL Eligible	
175	Ysleta	ridge	SAL Eligible	
176	Ysleta	arroyo slope	SAL Eligible	
177	Ysleta	arroyo slope	SAL Not Eligible	
178	Clint NW	arroyo slope	SAL Not Eligible	
179	Ysleta	arroyo slope	SAL Not Eligible	
180	Ysleta	arroyo slope	SAL Not Eligible	
181	Ysleta	arroyo slope	SAL Eligible	
182	Ysleta	arroyo slope	SAL Eligible	
183	Ysleta	arroyo slope	SAL Eligible	
184	Ysleta	arroyo slope	SAL Eligible	
185	Ysleta	arroyo slope	SAL Eligible	
186	Ysleta	arroyo slope	SAL Not Eligible	
187	Ysleta	arroyo slope	SAL Not Eligible	
188	Ysleta	arroyo slope	SAL Not Eligible	
189	Ysleta	arroyo slope	SAL Not Eligible	
190	Clint NW	dune	SAL Eligible	
191	Clint NW	dune	SAL Eligible	
192	Ysleta	dune	SAL Not Eligible	
193	Ysleta	dune	SAL Not Eligible	
194	Ysleta	dune	SAL Eligible	
195	Ysleta	dune	SAL Not Eligible	
196	Ysleta	playa	SAL Not Eligible	
197	Ysleta	playa	SAL Not Eligible	
198	Ysleta	playa	SAL Eligible	
199	Ysleta	playa	SAL Not Eligible	

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
200	Ysleta	dune	SAL Eligible	
201	Clint NW	dune	SAL Not Eligible	
202	Ysleta	dune	SAL Not Eligible	
203	Ysleta	dune	SAL Eligible	
204	Ysleta	dune	SAL Not Eligible	
205	Ysleta	dune	SAL Not Eligible	
206	Ysleta	playa	SAL Not Eligible	
207	Ysleta	playa	SAL Not Eligible	
208	Ysleta	playa	SAL Not Eligible	
257	Clint NW	dune	SAL Eligible	
258	Clint NW	dune	SAL Eligible	
259	Clint NW	dune	SAL Not Eligible	
260	Clint NW	dune	SAL Eligible	
261	Clint NW	dune	SAL Not Eligible	
262	Clint NW	dune	SAL Not Eligible	
263	Clint NW	dune	SAL Not Eligible	
264	Clint NW	dune	SAL Not Eligible	
265	Clint NW	dune	SAL Not Eligible	
266	Clint NW	dune	SAL Not Eligible	
267	Clint NW	dune	SAL Not Eligible	
268	Clint NW	dune	SAL Not Eligible	
269	Clint NW	dune	SAL Not Eligible	
270	Nations South Well	dune	SAL Eligible	
271	Nations South Well	dune	SAL Not Eligible	
272	Nations South Well	playa	SAL Not Eligible	
273	Nations South Well	playa	SAL Eligible	
274	Nations South Well	playa	SAL Eligible	
275	Nations South Well	playa	SAL Not Eligible	
276	Nations South Well	dune	SAL Not Eligible	
277	Nations South Well	dune	SAL Eligible	
278	Nations South Well	dune	SAL Eligible	
279	Nations South Well	playa	SAL Not Eligible	
280	Nations South Well	playa	SAL Eligible	
281	Nations South Well	playa	SAL Eligible	
282	Nations South Well	playa	SAL Not Eligible	
283	Nations South Well	dune	SAL Eligible	
284	Nations South Well	dune	SAL Not Eligible	
285	Nations South Well	playa	SAL Not Eligible	
288	Clint NW	dune	Unknown	
472	Nations South Well	dune		Mitigated
473	Nations South Well	dune		Mitigated
474	Nations South Well	dune		Mitigated
475	Nations South Well	dune		Mitigated
1546	Fort Bliss SE	dune		
1549	Fort Bliss SE	dune		Mitigated
1550	Fort Bliss SE	playa	Unknown	
1552	Fort Bliss SE	playa	NR Not Eligible	
2059	Fort Bliss SE	dune		Mitigated
2371	Clint NW	dune	Unknown	
2372	Clint NW	dune	Unknown	
2373	Clint NW	dune	Unknown	
2374	Clint NW	dune	Unknown	
2375	Clint NW	playa	Unknown	

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
2376	Clint NW	dune	Unknown	
2377	Clint NW	dune	Unknown	
2378	Ysleta	rim	Unknown	
2379	Ysleta	rim	Unknown	
2380	Clint NW	dune	Unknown	
2381	Clint NW	dune	Unknown	
2382	Clint NW	dune	Unknown	
2383	Clint NW	playa	Unknown	
2384	Clint NW	playa	Unknown	
2385	Clint NW	playa	Unknown	
2386	Clint NW	playa	Unknown	
2387	Clint NW	dune	Unknown	
2388	Clint NW	dune	Unknown	
2389	Clint NW	dune	Unknown	
2390	Clint NW	dune	Unknown	
2391	Clint NW	dune	Unknown	
2392	Clint NW	dune	Unknown	
2393	Clint NW	dune	Unknown	
2394	Clint NW	dune	Unknown	
2395	Clint NW	dune	Unknown	
2396	Clint NW	dune	Unknown	
2397	Clint NW	dune	Unknown	
2398	Clint NW	playa	Unknown	
2399	Clint NW	playa	Unknown	
2400	Clint NW	dune	Unknown	
2401	Clint NW	dune	Unknown	
2402	Clint NW	dune	Unknown	
2403	Clint NW	dune	Unknown	
2404	Clint NW	dune	Unknown	
2405	Clint NW	playa	Unknown	
2406	Clint NW	playa	Unknown	
2407	Clint NW	dune	Unknown	
2408	Clint NW	rim	Unknown	
2409	Clint NW	dune	Unknown	
2410	Clint NW	rim	Unknown	
2411	Clint NW	rim	Unknown	
2412	Clint NW	rim	Unknown	
2413	Clint NW	rim	Unknown	
2414	Clint NW	rim	Unknown	
2415	Clint NW	rim	Unknown	
2416	Clint NW	rim	Unknown	
2417	Clint NW	dune	Unknown	
2419	Clint NW	dune	Unknown	
2420	Clint NW	dune	Unknown	
2421	Ysleta	rim	Unknown	
2422	Ysleta	rim	Unknown	
2423	Ysleta	rim	Unknown	
2424	Ysleta	rim	Unknown	
2425	Clint NW	dune	Unknown	
2426	Clint NW	dune	Unknown	
2427	Clint NW	dune	Unknown	
2428	Clint NW	dune	Unknown	
2429	Clint NW	dune	Unknown	

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
2430	Clint NW	dune	Unknown	
2431	Clint NW	dune	Unknown	
2432	Clint NW	dune	Unknown	
2433	Clint NW	dune	Unknown	
2434	Clint NW	dune	Unknown	
2435	Clint NW	dune	Unknown	
2436	Clint NW	dune	Unknown	
2437	Clint NW	dune	Unknown	
2438	Clint NW	dune	Unknown	
2439	Clint NW	dune	Unknown	
2440	Clint NW	dune	Unknown	
2441	Clint NW	dune	Unknown	
2442	Clint NW	dune	Unknown	
2443	Clint NW	dune	Unknown	
2444	Clint NW	dune	Unknown	
2445	Clint NW	dune	Unknown	
2446	Clint NW	dune	Unknown	
2447	Clint NW	dune	Unknown	
2448	Clint NW	dune	Unknown	
2449	Clint NW	dune	Unknown	
2450	Clint NW	dune	Unknown	
2451	Ysleta	dune	Unknown	
2452	Ysleta	dune	Unknown	
2453	Ysleta	dune	Unknown	
2454	Ysleta	rim	Unknown	
2706	Fort Bliss SE	playa		Mitigated
2794	Fort Bliss SE	playa		Mitigated
2795	Fort Bliss SE	playa		Mitigated
2797	Fort Bliss SE	playa		Mitigated
2798	Fort Bliss SE	playa		Mitigated
2799	Fort Bliss SE	playa		Mitigated
2808	Fort Bliss SE	dune		Mitigated
2810	Fort Bliss SE	dune		Mitigated
2811	Fort Bliss SE	dune		Mitigated
2813	Fort Bliss SE	dune		Mitigated
2982	Clint NW	arroyo slope	NR Not Eligible	
2983	Clint NW	arroyo slope	NR Not Eligible	
4769	Fort Bliss SE	dune	NR Not Eligible	
4770	Fort Bliss SE	dune	NR Not Eligible	
4771	Fort Bliss SE	dune	NR Not Eligible	
4772	Fort Bliss SE	dune	NR Not Eligible	
4773	Fort Bliss SE	dune	NR Not Eligible	
4774	Fort Bliss SE	dune	NR Not Eligible	
4775	Fort Bliss SE	dune	NR Not Eligible	
4776	Fort Bliss SE	dune	NR Not Eligible	
4777	Fort Bliss SE	dune	NR Not Eligible	
4778	Fort Bliss SE	dune	NR Not Eligible	
4779	Fort Bliss SE	playa	NR Not Eligible	
4780	Fort Bliss SE	playa	NR Not Eligible	
4781	Fort Bliss SE	playa	NR Not Eligible	
4782	Fort Bliss SE	dune	NR Not Eligible	
4783	Fort Bliss SE	playa	NR Not Eligible	
4784	Fort Bliss SE	dune	NR Not Eligible	

Appendix 1. Previously Recorded Sites Within the Master Plan Area

Site Number (41 EP n)	Quad Sheet	Setting	* NR/SAL Eligible?	** Comments
4785	Fort Bliss SE	dune	NR Not Eligible	
4786	Fort Bliss SE	dune	NR Not Eligible	
4787	Fort Bliss SE	dune	NR Not Eligible	
4788	Fort Bliss SE	dune	NR Not Eligible	
4789	Fort Bliss SE	dune	NR Not Eligible	
4790	Fort Bliss SE	dune	NR Not Eligible	
4791	Fort Bliss SE	dune	NR Not Eligible	
4792	Fort Bliss SE	dune	NR Not Eligible	
4793	Fort Bliss SE	playa	NR Not Eligible	
4794	Fort Bliss SE	playa	NR Not Eligible	
4795	Fort Bliss SE	dune	NR Not Eligible	
4796	Fort Bliss SE	dune	NR Not Eligible	
4797	Fort Bliss SE	playa	NR Not Eligible	
4798	Fort Bliss SE	playa	NR Not Eligible	
4799	Fort Bliss SE	playa	NR Not Eligible	
4800	Fort Bliss SE	playa	NR Not Eligible	
4801	Fort Bliss SE	dune	NR Not Eligible	
4802	Fort Bliss SE	playa	NR Not Eligible	
4803	Fort Bliss SE	dune	NR Not Eligible	
4804	Fort Bliss SE	dune	NR Not Eligible	
4805	Fort Bliss SE	dune	NR Not Eligible	
4806	Fort Bliss SE	dune	NR Not Eligible	
4807	Fort Bliss SE	playa	NR Not Eligible	
4808	Fort Bliss SE	dune	NR Not Eligible	
4809	Fort Bliss SE	playa	NR Not Eligible	
4810	Fort Bliss SE	dune	NR Not Eligible	
4811	Fort Bliss SE	dune	NR Not Eligible	
4812	Fort Bliss SE	dune	NR Not Eligible	
4813	Fort Bliss SE	dune	NR Not Eligible	
4814	Ysleta	rim	Unknown	
4815	Ysleta	rim	Unknown	
5184	Nations South Well	dune	Unknown	
5185	Nations South Well	dune	Unknown	
5186	Nations South Well	dune	Unknown	
5187	Nations South Well	dune	Unknown	
5188	Nations South Well	dune	Unknown	
5189	Nations South Well	playa	Unknown	
5190	Nations South Well	playa	Unknown	
5191	Nations South Well	playa	Unknown	
5192	Nations South Well	dune	Unknown	
5193	Nations South Well	dune	Unknown	
5194	Nations South Well	playa	Unknown	
5195	Nations South Well	playa	Unknown	
5196	Nations South Well	playa	Unknown	
5197	Nations South Well	dune	Unknown	
5198	Nations South Well	dune	Unknown	
5230	Ysleta	arroyo slope	Unknown	

Total 364 Sites Recorded

Note: All site numbers are prefixed by "41 EP"; e.g. 41 EP 41, 41 EP 42, etc.
* SAL & NR recommendations per survey reports for individual projects, where known.
** Sites noted as mitigated (tested, excavated, or determined not eligible) where known.

APPENDIX E

AGENCY COMMENTS

GRAY • JANSING & ASSOCIATES, INC.

November 25, 1996

Mr. David R. Brosman
El Paso Water Utilities Public Service Board
P.O. Box 511
El Paso, Texas 79961-0001

Re: **Review Comments - Regional Wastewater Plan for the East El Paso Area - Draft Report**
GJA No. 1277-7600-54

Dear Mr. Brosman:

On behalf of El Paso County Water Authority (EPCWA) we appreciate the opportunity to review and comment on the above referenced report. Although our comments are minor, we feel that the interests of the EPCWA should be correctly represented for inclusion of any future planning by the El Paso Water Utilities Public Service Board (PSB).

Our review comments are summarized in the following:

1. The use of Horizon City and EPCWA are used interchangeably throughout the report to describe what we understand to be the same area. Horizon City is located within the boundary of EPCWA and receives wastewater collection and treatment from EPCWA. The report prepared by Moreno-Cardenas for EPCWA and referenced in the PSB report, addressed population projections and wastewater treatment expansions for all of EPCWA not just Horizon City. It is requested that reference to Horizon City be revised to EPCWA if indeed our understanding of the study area is correct.

2. On pages 6-7 it is stated that the existing lagoon system will be decommissioned and converted to an effluent storage pond over the next 30 years. The EPCWA plan instead requires the conversion of the lagoons within the 15 year system expansion plan.

3. The EPCWA is referred to in error as the El Paso County Water District on pages 7-2 and 7-3.

4. Our analysis of wastewater flows per capita within the EPCWA area has reflected an average of approximately 77 gpcd. We have likewise determined through similar studies throughout the state that the adjusted flow per capita is generally within the 75 to 85 gpcd range. This observation is offered for comparison with the 108 gpcd used for the planning study. It is our concern that the PSB flows may represent a higher than actual gpcd contribution resulting in larger than necessary facilities and higher projected costs.

Consulting Engineers
3217 Shoal Creek Blvd., Suite 200 Austin, Texas 78757-7592 (512)452-0371 FAX (512)454-9933

We appreciate the opportunity to review and comment on the draft report. We request that you place us on the list (as well as EPCWA) for any additional distributions of the report.

Sincerely,

GRAY ♦ JANSING & ASSOCIATES, INC.

John M. Jansing, Jr., P.E.

cc: Mr. David W. Gray; Gray ♦ Jansing & Associates, Inc.
Mr. David Yohe; El Paso County Water Authority
Board of Directors; El Paso County Water Authority

JMJ:L

EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD

P.O. BOX 511
EL PASO, TX 79961-0001
PHONE: 915-594-5500
FAX: 915-594-5580

February 11, 1997

RECEIVED
FEB 13 1997
BROWN AND CALDWELL
EL PASO

Mr. John M. Jansing
Gary Jansing & Associated, Inc.
8217 Shoal Creek Boulevard, Suite 200
Austin, TX 78757-7592

RE: Regional Wastewater Plan For The East El Paso Area - Your Review Comments

Dear Mr.Jansing:

The purpose of this letter is to address the comments you submitted on subject draft report. I would like to thank you for taking the time to review and comment on the report. The overall intention of the Regional Plan is to provide a technical evaluation of the infrastructure required to provide wastewater service to the Principal Study Area (PSA).

The only technical comment highlighted was that the per capita flow contribution of 108 gallons per capita per day was not representative of the area. The per capita flow contribution represented a combination of residential, commercial, and industrial flows. The use of a combined per capita flow contribution was required to project similar growth in to the Principal Study Area (PSA) since zoning information for the PSA was not available.

If you have any additional comments or require additional information, please call Carlos E. Rubio at (915) 594-5652.

Sincerely,

David R. Brosman, P.E.
Deputy General Manager

cc: Edmund G. Archuleta, General Manager
David Yohe, El Paso County Water Authority
Stuart Oppenheim, Brown and Caldwell

Texas General Land Office
Garry Mauro, Commissioner

Stephen F. Austin Building
1700 North Congress Avenue
Austin, Texas 78701-1495
(512) 463-5001

Christopher K. Price
Deputy Commissioner
Asset Management Division
(512) 463-5010
Fax (512) 463-5098

January 17, 1997

Mr. David R. Brosman
El Paso Water Utilities
Public Service Board
P. O. Box 511
El Paso, TX 79961-0001

Dear Mr. Brosman:

I am writing to comment on the draft "Regional Wastewater Plan for the East El Paso Area" prepared on your behalf by Brown and Caldwell. First I will comment on general statements made in the report.

There are two assumptions that I believe have resulted in higher than likely demand projections for the wastewater system. The ultimate growth of the Principal Service Area (PSA) is based on the assumption that the entire area will be developed and will be occupied to a density that averages to 10 people per acre, based on gross acres. Since there is a significant amount of Permanent School Fund land that will not be developed for habitation in the foreseeable future due to its development for minerals (sand and gravel), the gross developable acres should be adjusted. In addition, the 10 people per acre density seems high on a gross acreage basis, based on our projections. I believe that 6 to 7 people per acre (gross acres) would be a more appropriate assumption.

It is important to recognize that the location of PSB wastewater infrastructure on PSF land will depend entirely on compatibility with actual planned development on the land. The size of the backbone wastewater collection system and treatment facilities will be greatly affected by development assumptions such as those mentioned above and more particularly on whether or not the PSF land will actually be served by a PSB system. If PSB is not serving the PSF land the demand numbers will need to be adjusted significantly.

Mr. David Brosman
January 17, 1997
page 2

I would like to make it clear that the proposed location of a wastewater treatment plant on PSF land fronting IH 10 will not be acceptable because of the importance of this property to the success of the overall development in addition to high value which would challenge financial feasibility.

If you have any specific questions about these comments or our review of the plan please contact Bob Hewgley at 512 463 5013.

Sincerely,

Christopher K. Price

CKP/bh

EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD

P.O. BOX 511
EL PASO, TX 79961-0001
PHONE: 915-594-5500
FAX: 915-594-5699

RECEIVED
FEB 13 1997
BROWN AND CALDWELL
EL PASO

February 11, 1997

Mr. Christopher K. Price
Texas General Land Office
1700 North Congress Avenue
Austin, TX 78701-1495

RE: Regional Wastewater Plan For The East El Paso Area - Your Review Comments

Dear Mr. Price:

The purpose of this letter is to address the comments you submitted on subject draft report. I would like to thank you for taking the time to review and comment on the report. The overall intention of the Regional Plan is to provide a technical evaluation of the infrastructure required to provide wastewater service to the Principal Study Area (PSA).

Your first comment was concerned that the ultimate average population density used was too high. Brown and Caldwell obtained population density data from the City of El Paso Planning Office. The average population density for the existing Bustamante Wastewater Treatment Plant (WWTP) service area was calculated to be 10 people per acre in the year 2015, based on the assumption that it would be built out at this time. This value was used to calculate the ultimate population of the PAS since the pattern of growth was expected to be similar. The ultimate condition was defined to be the final stage of development, meaning zero future growth. No specific date was defined for the ultimate condition since population projections provided by the City Planning Office did not extend beyond 2020. The Regional Plan is expected to be reviewed every five to ten years to re-evaluate the available data and working assumptions.

Your second comment pointed out that a WWTP located on Permanent School Fund (PSF) land would not be available to front IH-10 and the use of PSF land was dependent on whether or not the El Paso Water Utilities (EPWU) provided wastewater service to the PSF land. All flow projections and service alternatives were developed with the assumption the EPWU would serve PSF land. The new WWTP site shown in the Draft Report was used to represent a general location. The specific location of a new WWTP would be determined in a later siting study and is dependent on the availability of land in the PSA.

If you require any additional information, please call Carlos E. Rubio at (915) 594-5652.

Sincerely,

David R Brosman

David R. Brosman, P.E.
Deputy General Manager

cc: Bob Hewgley, Texas General Land Office
Edmund G. Archuleta, General Manager
Stuart Oppenheim, Brown and Caldwell

TEXAS WATER DEVELOPMENT BOARD

February 6, 1997

DRAFT

Mr. Edmund G. Archuleta, P.E.
El Paso Water Utilities Public Service Board
P.O. Box 511
El Paso, Texas 79961-0001

Re: Review Comments for Draft Report Submitted by the El Paso Water Utilities Public Service, TWDB Contract No. 96-483-165

Dear Mr. Archuleta :

Staff members of the Texas Water Development Board have completed a review of the draft report submitted under TWDB Contract No. 96-483-165. It is noted that the subject draft report is incomplete since the chapter containing the "Recommended Program" is not included. Therefore, while the comments in Attachment 1 should be considered before the report is finalized, the comments should be considered to be preliminary until the final draft report is completed and has been reviewed by TWDB staff.

Please contact Mr. Gordon Thom, the Board's Contract Manager, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

cc: Gordon Thom, TWDB

DRAFT

ATTACHMENT 1

The Texas Water Development Board recommends the following additions and changes:

1. The population projections of the TWDB, the El Paso Metropolitan Planning Organization, and the City of El Paso Planning Department are shown in Figure 3-6. It would appear that the TWDB and the City Planning Department population projections are very close, with the Metropolitan Planning Organization's projections becoming increasingly higher after the year 2000. It would be beneficial to have a table of the different population projections so that the differences between the three series of projections could be calculated. It appears that the TWDB population projections presented in Figure 3-6 may be an earlier series of projections rather than the latest 1994 TWDB consensus population projections.

2. On page 3-1 the report indicates that the limits of the area considered in the regional study include "..... the Lower Valley District. ....". The area shown in Figure 3-1 for the LVWD's service area is just a portion of the LVWD's service area. LVWD's service area consists of only a portion of the City of Socorro. The report should clarify what portion of the LVWD's service area is included in the study.

3. The report does not specify if the wastewater flow projections considered all of the LVWD's service area or only the portion shown as being evaluated in this study? The facilities being funded through Board's Economically Distressed Areas Program will convey all of the LVWD's wastewater flows to the Bustamante WWTP, including all the City of Socorro and the Town of San Elizario.

4. The buildout population used in the report appears to be much lower than that used in other studies. The LVWD's approved facility plan report uses a buildout population of 18.28 persons/acre while the regional study indicates the number to be 10 persons/acre. Also, the sewer contributions are considerably higher than previous studies of the region. 108 gpcd versus 75 gpcd used for the LVWD and 80 gpcd used for the El Paso County Water Authority. These estimates need to be reviewed and the differences justified.

5. Table 5-7 on page 5-5 indicates that the Standards for Type II reclaimed water are 30 mg/L for BOD5. State regulations require BOD5 limits of 20 mg/l.

6. The description of additional considerations on Page 7-4 indicates that growth in east El Paso County will most likely go from south to north and from west to east. However, all the alternatives evaluated consider the initial phase of improvements to proceed mostly from north to south leaving the south quadrant without any improvements until after the year 2006. The reasons for this difference need to be clarified.

7. A 12 MGD expansion at the Eastside WWTP beyond the year 2015 is shown in Figure 7-6. However, the text on page 7-9 states that no further expansion of this plant will be required

DRAFT

beyond the 8 MGD initial capacity.

8. Referring to table 8-4, although the total cost for alternatives 2a & 2b is slightly higher than alternatives 3a & 3b, all alternatives are given the same rating score in the final evaluation. This needs clarification.

9. On pages 8-4 & 8-5 the report indicates that alternatives 3a & 3b will maximize the opportunities for cost effective reuse when compared with all the other alternatives evaluated. However, Table 8-4 shows alternatives 3a & 3b rated the same as alternatives 2a & 2b and just one point better than alternative 1. This needs clarification.

10. Construction costs presented in Appendix B are as much as 120% higher than the costs received for comparable projects recently bid in the El Paso area. Although some increase could be expected due to inflation and other factors, the estimated costs presented in the report should be reevaluated.

11 As a feasibility level regional planning study, the draft report provides an adequate background and assessment of biological and archeological/historical (cultural) resources and the results have been incorporated into the evaluation of alternatives.

12. PSB is strongly encouraged to continue close planning coordination with on-going wastewater management activities associated with EPCWA and LVWD.

EL PASO WATER UTILITIES
PUBLIC SERVICE BOARD

EDMUND G. ARCHULETA, P.E.

March 10, 1997

Mr. Tommy Knowles
Deputy Executive Administrator for Planning
Texas Water Development Board
P. O. Box 13231
Austin, Texas 78711-3231

SUBJECT: DRAFT REVIEW COMMENTS FOR DRAFT WASTEWATER PLAN FOR THE EAST EL PASO AREA

Dear Mr. Knowles:

El Paso Water Utilities staff and Brown and Caldwell, the project consulting engineers, have reviewed the draft comments submitted on the "Regional Wastewater Plan for the East El Paso Area" (Plan). Responses to these comments are presented below:

1. The population projections shown in Figure 3-6 will be presented in a table in the Draft Final Report. The Texas Water Development Board (TWDB) population projection values used in Figure 3-6 were extracted from the 1996 TWDB Consensus Water Plan.

2. The language on Page 3-1 describing Figure 3-1 will be changed to clarify the portion of the Lower Valley Water District (LVWD) service area accounted for in the Plan.

3. The portion of the LVWD service area shown in Figure 3-1 does not represent the extent of the service area included in the Plan. The flow projections for the LVWD shown in Table 4-5 represent the contribution of the entire service area.

4. The build-out population density of 10 persons/acre is the average projected population density, when build-out is expected to occur. The difference between the Plan density and the TWDB value of 18.28 persons/acre is that the subject plan includes nonresidential areas in calculation of the Plan density and the assumption is made that the Principal Study Area (PSA) will develop in the same approximate manner as current development in East El Paso (City).

P.O. BOX 511 • EL PASO, TX 79961-0001 • PHONE: 915-594-5501 • FAX: 915-594-5699

The wastewater flow contribution presented in the Plan of 108 gallons per capita per day is a combined value consisting of residential, industrial, and commercial contributions within the Roberto Bustamante Wastewater Treatment Plant (WWTP) service area. It is assumed that the PSA will develop in a similar pattern.

5. This item will be corrected in the Draft Final Report.

6. The pattern of growth was assumed to go from west to east from Loop 375 to Horizon City. As growth progresses east, the assumption is that there will be a higher population density initially in the south, therefore, growth is projected to occur south to north. This item will be clarified in the Draft Final Report.

7. Figure 7-6 will be corrected in the Draft Final Report.

8. The costs presented for Alternatives 2a/2b and Alternative 3a/3b are within 5 percent of each other. These costs will be further refined in the Final Draft Report.

9. Although Alternative 3a and 3b appear to allow for more cost effective reuse within the twenty year study, the savings are accounted for with the use of a smaller diameter interceptor. As you will note, this alternative assumes a reclamation plant in the northern sector of the service area. If a smaller diameter interceptor is constructed, flexibility to either eliminate the north plant, an improvement that is at least 20 years away, or increase the flow to the south plant is not possible. Thus, in reality, a larger diameter line would be constructed in order to maintain a reasonable level of flexibility. Therefore, Alternatives 3a and 3b were evaluated with the same interceptor sizes as shown for Alternatives 2a and 2b and, thus, the same cost for the period of study.

10. This item will be further clarified in the Draft Final Report. Updated pipe cost values will be used.

11. Noted and we concur.

12. A coordination meeting was held with LVWD on February 25th and a similar meeting is planned with El Paso County Water Authority (EPCWA) on March 18, 1997.

If you have any further questions or comments, please contact the Project Engineer, Mr. Carlos Rubio, at (915) 594-5652.

Sincerely,

Edmund G. Archuleta, P.E.
General Manager

CR/ekp

(nvdb.ltr)

TEXAS WATER DEVELOPMENT BOARD

May 2, 1997

RECEIVED MAY 9 1997 E.P.W.U. CENTRAL FILES

RECEIVED MAY 12 1997 BROWN AND CALDWELL EL PASO

Mr. Edmund G. Archuleta, P.E.
General Manager
El Paso Water Utilities Public Service Board
1154 Hawkins Blvd.
El Paso, Texas 79961-0001

Re: Review Comments for Draft Report Submitted by El Paso Water Utilities Public Service Board (PSB), TWDB Contract 95-483-065

Dear Mr. Archuleta :

Staff members of the Texas Water Development Board have completed a review of the draft report under TWDB Contract No. 96-483-165. As stated in the above referenced contract, the PSB will consider incorporating comments from the EXECUTIVE ADMINISTRATOR shown in Attachment 1 and other commentors on the draft final report into a final report. The PSB must include a copy of the EXECUTIVE ADMINISTRATOR's comments in the final report.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, the Board's Contract Manager, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

cc: David R. Brosman, P.E.
Gordon Thorn, TWDB

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ATTACHMENT 1
TEXAS WATER DEVELOPMENT BOARD
Comments on Draft Final Report Submitted by El Paso Water Utilities Public Service Board
Contract No. 96-483-165

The Texas Water Development Board recommends the following additions and changes:

1. A brief description of Alternative 2c needs to be added to page 7-4.
2. Tables 8-3 through 8-5 are referred to but were not included in the updated Chapter 8.
3. Figure 9-2 is referred to but was not included with the updated figures.
4. The site location for the new reclamation plant is not identified in Figure 9-3.
5. The second page of the letter from the El Paso Water Utilities Public Service Board responding to TWDB's comments on the original final draft report was omitted.

APPENDIX F

PUBLIC MEETING MINUTES

EL PASO WATER UTILITIES PUBLIC HEARING

RE: REGIONAL WASTEWATER PLAN FOR THE EAST EL PASO AREA

MARCH 11, 1997

ORIGINAL

MR. BROSMAN: I'M DAVE BROSMAN. I'M THE DEPUTY GENERAL MANAGER FOR EL PASO WATER UTILITIES. I'M GOING TO THANK THOSE WHO ARE ATTENDING THIS MEETING FOR SHOWING AN INTEREST TO COME OUT TO SEE WHAT'S GOING ON IN THE FUTURE AS FAR AS WASTEWATER SERVICE IN THE AREAS OF EAST EL PASO AND AREAS EAST OF EL PASO.

WE HAVE WITH US NAT CAMPOS, WHO'S THE CHIEF PLANNER FOR THE CITY OF EL PASO. I EXPECTED TO HAVE SOMEBODY HERE FROM THE TEXAS WATER DEVELOPMENT BOARD. I HAVE TO -- THEY HAVE FUNDED 50 PERCENT OF THIS STUDY OF THIS PROJECT.

BASICALLY, THE BUSTAMANTE WASTEWATER TREATMENT PLANT WAS CONSTRUCTED HERE AND WENT ON LINE ABOUT 1991, THINKING IT WAS GOING TO LAST FOR QUITE A WHILE. BUT GROWTH CONTINUES TO BE QUITE HEAVY ON THE EAST SIDE OF EL PASO. IT'S ALSO GOING TO SERVE AS THE WHOLESALE PROVIDER OF WASTEWATER SERVICE TO THE LOWER VALLEY WATER DISTRICT AUTHORITY, WHICH ARE NOW CURRENTLY CONSTRUCTING SEWERS TO VARIOUS COLONIAS AREAS AND OTHER AREAS IN THE LOWER VALLEY WATER DISTRICT.

THIS PAST YEAR, WE'VE REACHED 35 PERCENT CAPACITY AT THAT PLANT. AT THAT TIME THE TEXAS NATURAL RESOURCE COMMISSION REQUIRES THAT YOU ENTER INTO A PLANNING PHASE FOR THE NEXT EXPANSION. IN THAT, WE FEEL THAT THAT'S A REGIONAL PLANT. WE STUDIED NOT ONLY WHAT

IS INSIDE THE CITY OF EL PASO BUT FELT LIKE WE HAD TO LOOK TO THE FUTURE, TO SEE WHAT AREAS OUTSIDE THE CURRENT CITY LIMITS THIS PLANT MIGHT SERVE, SO WE SELECTED A RATHER LARGE STUDY AREA.

A LOT OF THE STUDY IS PROBABLY NOT IN THE SUMMARY REPORT. IT'S LOTS OF REPORTS, COMPUTER-GENERATED INFORMATION ON EFFICIENCIES ON OUR EXISTING SEWER SYSTEMS INSIDE THE CITY. THE BASIC THRUST OF TONIGHT'S PRESENTATION IS HOW WILL THIS PLANT SERVE FUTURE AREAS THAT WE EXPECT THE CITY TO EXPAND INTO AS WELL AS OTHER AREAS AND PERHAPS THE CITY MAY NOT EVEN EXPAND INTO, BUT SERVE AS A REGIONAL WASTEWATER TREATMENT PLANT.

TONIGHT WE HAVE STU OPPENHEIM WITH US. HE'S WITH BROWN AND CALDWELL ENGINEERS CONSULTING FIRM, THAT HAS DONE THIS WORK. AGAIN, I'D LIKE TO THANK THE TEXAS WATER DEVELOPMENT BOARD FOR PARTIALLY FUNDING THIS PROJECT.

MR. OPPENHEIM: THANK YOU, DAVE. IN TERMS OF ACKNOWLEDGING THE -- DAVE CASEY IS ALSO THE LEAD PROJECT ENGINEER FOR THE PROJECT, AND ALSO THE LEAD PROJECTIONIST.

AGAIN, AS DAVE INDICATED, THIS IS THE PUBLIC MEETING FOR THE REGIONAL WASTEWATER PLANT FOR THE EAST EL PASO AREA. AND I WANT TO APOLOGIZE. APPARENTLY THE SCREEN WHICH NORMALLY WOULD BE DROPPING AND I'D HAVE TO

BE PROJECTING THAT DIRECTION, WE'RE GOING TO BE PROJECTING IN THIS DIRECTION.

LIKE DAVE INDICATED, THIS IS A PLANNING EFFORT, AND I WANT TO MAKE IT CLEAR, THIS IS A PLANNING EFFORT THAT WAS PERFORMED BY THE EL PASO WATER UTILITIES AND WASTEWATER PLANNING EFFORT ONLY. AS YOU'VE PROBABLY SEEN A LOT OF INFORMATION ABOUT THE CITY ANNEXATION IN THIS AREA, AND THIS IS -- AGAIN, THIS IS A PLANNING EFFORT JUST FOR WASTEWATER. IT DOES NOT INCLUDE WATER OR ANY OF THE ADDITIONAL SERVICES THAT ARE PROVIDED BY THE CITY.

SOME OF THE THINGS THAT ARE INCLUDED IN THIS PROJECT WAS A REVIEW OF THE EXISTING SYSTEM WITHIN THE CITY BOUNDARIES -- REVIEWED THE EXISTING SYSTEM WITHIN THE CITY BOUNDARIES. SO LIKE DAVE MENTIONED, WE DID A LOT OF EFFORT IN CREATING A COMPUTER MODEL THAT LOOKED AT THE COLLECTION SYSTEM AND -- BUILT ALSO HELPS TO IDENTIFY ANY DEFICIENCIES THAT WERE WITHIN THE EXISTING --

THIS PROJECT ALSO INCLUDED DEVELOP REQUIREMENTS FOR AREAS IN THE EAST OF -- EAST OF THE EL PASO CITY LIMITS. AND THE MAIN FUNCTION OF THIS PLAN WAS TO PROVIDE A ROAD MAP INTO THE FUTURE SO THAT GROWTH WILL BE PROPERLY MANAGED.

JUST A COUPLE OF LITTLE SIDELIGHTS ABOUT THE PROJECT HISTORY. IN JANUARY OF '96, THE EL PASO WATER UTILITIES OBTAINED TEXAS WATER DEVELOPMENT BOARD FUNDING,

50 PERCENT FUNDING, THAT DAVE INDICATED. WE ACTUALLY STARTED AND INITIATED OUR PLANNING IN FEBRUARY OF '96. DURING THE COURSE OF THAT EFFORT, WE OBTAINED COMMENTS REGARDING JURISDICTIONAL BOUNDARIES AND CONCERNS AND CONSIDERATIONS FROM A NUMBER OF AGENCIES, AND -- DURING THE WHOLE COURSE OF THE PROJECT, AGENCIES SUCH AS THE TEXAS WATER DEVELOPMENT BOARD. WE ALSO TALKED TO FOLKS FROM THE CITY AS WELL AS THE EL PASO LOWER VALLEY WATER DISTRICT AND THE HORIZON CITY FOLKS.

OCTOBER IN '96 WE PUBLISHED A DRAFT REPORT, AND THAT REPORT WAS DISTRIBUTED TO A NUMBER OF AGENCIES FOR REVIEW AND FOR COMMENT. AND IN THE INTERIM, SINCE OCTOBER, WHAT WE HAVE BEEN DOING HAS BEEN TO GATHER UP THOSE COMMENTS AND TRY TO INCORPORATE THE INFORMATION INTO A REPORT AS WELL AS WORKING WITH THE WATER UTILITY IN TERMS OF GETTING THEIR FEEDBACK.

NOW JUST QUICKLY TO DESCRIBE WHAT IS THE FACILITY PLAN, OR MASTER PLAN THAT WE ARE DOING, WHAT ARE SOME OF THE STEPS. AND AS I GO THROUGH THESE STEPS, WE'RE GOING TO VISIT THOSE -- EACH OF THOSE STEPS IN THE REMAINING PART OF THE PRESENTATION.

ONE OF THE FIRST THINGS THAT WE DO IS ACTUALLY DEFINE THE SERVICE AREA BOUNDARIES. IT'S A 50-SQUARE-MILE AREA THAT WE'RE LOOKING AT. WE HAVE TO MAKE SURE THAT THAT'S CLEARLY DEFINED AS WE DO THE WORK.

WE DEVELOPED POPULATION PROJECTIONS. WORKING WITH NED AND HIS PLANNING DEPARTMENT, WE GATHERED UP THE PROJECTIONS FOR THE POPULATION WITHIN THE BUSTAMANTE SERVICE AREA AS WELL AS THE EAST EL PASO AREA, WHAT WE WOULD CALL THE PRINCIPAL STUDY AREA, PSA.

FROM THAT POPULATION PROJECTIONS, WE WERE ABLE TO DEVELOP FLOWS AND LOADS. NOW THE REASON -- WHAT WE DO WITH A FLOW PROJECTIONS OR THE FLOW CHARACTERISTICS IS WE LOOK AT THE ACTUAL FLOW DATA THAT REACHES THE BUSTAMANTE TREATMENT PLANT. AND THEN WE ALSO ALLOCATE, LOOKING AT LOADS AND THE CHARACTERISTICS GOING INTO THE BUSTAMANTE PLANT, WE'RE ACTUALLY ABLE TO ALLOCATE PER CAPITA FLOWS AND LOADS AND THEN TAKE THE POPULATION PROJECTIONS AND, THROUGH SOME CALCULATIONS, DEVELOP ACTUAL PROJECTED FLOWS TO THE -- WITHIN THE SERVICE AREA.

NOW, THE IMPORTANCE OF DEVELOPING THE FLOW INFORMATION IS USED TO HELP SIZE THE COLLECTION SYSTEM AS WELL AS THE HYDRAULIC CHARACTERISTICS OF THE TREATMENT PLANT. THE LOADS ARE USED TO CALCULATE THE CAPACITY, TREATMENT CAPACITY, OF A TREATMENT PLANT.

ONE OF THE MAJOR EFFORTS THAT WE DID DURING THE DEVELOPMENT OF THIS PROJECT WAS TO ACTUALLY DEVELOP A COMPUTERIZED MODEL OF THE COLLECTION SYSTEM, AND BY DOING THAT, WE WERE ACTUALLY ABLE TO DETERMINE WHAT THE CAPACITY CONSTRAINTS ARE IN THE EXISTING COLLECTION

SYSTEM.

ANOTHER KEY ELEMENT OF THE OVERALL PLANNING PROCESS IS TO DEVELOP AND EVALUATE ALTERNATIVES FOR TREATMENT WITHIN THE SERVICE AREA. AND FINALLY, BASED ON THAT EVALUATION, DEVELOP A RECOMMENDED PLAN.

NOW LET ME JUST BRIEFLY TALK ABOUT THE AREA THAT WE ACTUALLY INCLUDED IN OUR STUDY. YOU CAN SEE IN BROWN, THIS IS THE EXISTING BUSTAMANTE WASTEWATER TREATMENT PLANT SERVICE AREA. THERE'S THE BUSTAMANTE WASTEWATER TREATMENT PLANT ITSELF. THE LOWER VALLEY WATER DISTRICT, WHICH SHARES A BORDER WITH MUCH OF THE SERVICE AREA, IS SHOWN HERE IN GREEN. HORIZON CITY, OR THE EL PASO COUNTY WATER AUTHORITY, IS HERE, AND YOU'RE GOING TO SEE IT IN ANOTHER GRAPHIC, THAT THERE'S ACTUALLY OTHER -- THERE ARE OTHER JURISDICTIONS WITHIN THAT BLUE AREA, WHICH IS THE PRINCIPAL STUDY AREA.

THERE'S A LITTLE BIT OF A DIFFERENT PROJECTION HERE, BUT THIS SHOWS THE VARIOUS JURISDICTIONAL AGENCIES WITHIN THE PRINCIPAL STUDY AREA BOUNDARY. YOU CAN SEE FROM -- THIS IS A BROWN AREA HERE, IS THE LOWER VALLEY WATER DISTRICT, WHICH ALSO IS, FROM THE PREVIOUS SLIDE, SHOWS DOWN IN THIS GENERAL AREA. THE GREEN AREA IS HORIZON CITY, OR THE EL PASO COUNTY WATER AUTHORITY. AND YOU CAN SEE THERE'S BASICALLY A CHECKERBOARD NATURE OF THEIR JURISDICTIONAL AREAS. THERE'S ALSO TWO MUNICIPAL

UTILITY DISTRICT, M.U.D.'S 1 AND 2, WHICH ARE RIGHT NEXT TO HORIZON CITY. AND THEN FINALLY, THE TEXAS GENERAL LAND OFFICE, THE G.L.O., HAS A SIGNIFICANT AMOUNT OF LAND IN THIS AREA, AS WELL.

SO POPULATION PROJECTIONS -- ONE OF THE THINGS, AS I INDICATED EARLIER, IS THAT WE GO THROUGH AND DEVELOP POPULATION PROJECTIONS, AND WE DIVIDED THAT BY WHAT'S THE POPULATION CURRENTLY AND THEN BY THE YEAR 2005, 2015, AND THEN BUILD-OUT, WHICH IS BASICALLY ASSUMING A SATURATED POPULATION IN THE SERVICE AREA.

AND AS YOU CAN SEE, WITHIN THE EXISTING BUSTAMANTE SERVICE AREA, IT'S ABOUT NEARLY 238,000 POPULATION. AND YOU CAN ALSO SEE THAT WITHIN THE STUDY AREA ITSELF -- WE DIVIDED THAT INTO QUADRANTS -- THERE'S ONLY ABOUT 1900 PEOPLE CURRENTLY RESIDING IN THAT AREA. BUT YOU CAN ALSO SEE -- AND IT'S QUITE EVIDENT -- THAT THERE'S A TENFOLD INCREASE IN THAT POPULATION BY THE YEAR 2005. AND YOU CAN SEE THAT THE SATURATED CONDITION, NEARLY 218,000 PEOPLE, WILL BE RESIDING IN THAT AREA.

NOW FLOW PROJECTIONS, AGAIN, THESE ARE IN MILLION GALLONS PER DAY. AND FOR THE YEAR 1996, CURRENT AVERAGE FLOW TO THE BUSTAMANTE PLANT IS 28.6 MILLION GALLONS. I'VE INCLUDED THE LOWER VALLEY HERE, INCLUDING IN THE FLOW PROJECTIONS YOU CAN SEE CURRENTLY THAT'S AT ZERO. WHAT THAT MEANS IS THAT CURRENTLY THEY'RE NOT

CONNECTED TO THE BUSTAMANTE SYSTEM, BUT OVER TIME, YOU CAN SEE THAT UP TO -- PER DAY WILL BE ON LINE BY THE YEAR 2005. AND AGAIN, AS IT RELATES TO THE POPULATION, YOU CAN SEE THAT WITHIN THE STUDY AREA, ONLY ABOUT 200,000 GALLONS PER DAY IS PROJECTED FOR THAT AREA. SINCE IT'S NOT SEWERED, THAT 200,000 GALLONS PER DAY IS PROBABLY MORE ALONG THE SEPTIC OR CESSPOOL SYSTEMS.

WE'VE INCLUDED HORIZON CITY INTO OUR PLANNING, EVEN THOUGH IT'S KNOWN THAT CURRENTLY THAT THE HORIZON CITY HAS THEIR OWN TREATMENT SYSTEM. SO CURRENTLY, THEY'RE AT ABOUT HALF A MILLION GALLONS PER DAY, AND ONE MILLION GALLONS PER DAY IN THE YEAR 2005 AND ONE AND A HALF BY THE YEAR 2015. FOR PLANNING PURPOSES, WE HAVE ASSUMED THAT BY THE YEAR 2012, THE HORIZON CITY WOULD ACTUALLY FLOW TO EL PASO WATER UTILITIES' COLLECTION SYSTEM AND TREATMENT.

ONCE WE GET THE FLOWS AND LOADS AND POPULATION INFORMATION TOGETHER, IT'S TIME TO ACTUALLY START DEVELOPING TREATMENT ALTERNATIVES. FOR THIS PROJECT, WE IDENTIFIED SEVEN VIABLE ALTERNATIVES. AND THERE ARE SOME COMMON ELEMENTS I WANTED TO MENTION OF ALL OF THOSE ALTERNATIVES.

THEY INCLUDED INITIAL PUMPING WITHIN THE PRINCIPAL STUDY AREA, THE PSA, INTO THE EXISTING COLLECTION SYSTEM. MY MODELING SHOWED THERE IS AVAILABLE

CAPACITY IN THE EXISTING COLLECTION SYSTEM. SO AS OPPOSED TO IMMEDIATELY PUTTING IN THE INFRASTRUCTURE AND LARGE PIPELINES, IT'S A LOT MORE COST-EFFECTIVE TO MERELY BUILD A PUMP STATION TO TRANSFER THOSE FLOWS FROM THE PSA INTO THE EXISTING BUSTAMANTE COLLECTION SYSTEM. HOWEVER, AS GROWTH INCREASES IN THE PRINCIPAL STUDY AREA, A COLLECTION SYSTEM WOULD BE REQUIRED, AND SO THAT ALL ALTERNATIVES WOULD HAVE PRETTY MUCH A COMMON BACKBONE FOR THAT INTERCEPTOR SYSTEM.

AND OUR ALTERNATIVES INCLUDED A VARIOUS COMBINATION OF EXPANSION OF THE BUSTAMANTE PLANT AS WELL AS NEW RECLAMATION PLANTS TO BE LOCATED IN THE PRINCIPAL STUDY AREA.

JUST REAL BRIEFLY, TALKING ABOUT ALTERNATIVES, ALTERNATIVE 1 AND 1A HAD IN COMMON THAT THEY ALL CONVEYED ALL OF THE FLOW IN THE PRINCIPAL STUDY AREA TO THE BUSTAMANTE TREATMENT PLANT. THE DIFFERENTIAL BETWEEN 1 AND 1A IS JUST THE SIZE OF THAT EXPANSION TO THE BUSTAMANTE PLANT.

ALTERNATIVES 2A AND 2B HAD FLOWS DIVERTED TO A NEW EAST SIDE RECLAMATION PLANT. AND THE DIFFERENTIAL BETWEEN 2A AND 2B IS THAT IN 2A, THAT EAST SIDE RECLAMATION PLANT WOULD BE EXPANDED BEYOND AN INITIAL EXPANSION. AND 2B, IT WOULD ONLY BE EXPANDED ONCE, RIGHT AT THE INITIAL PHASE. AND WE'LL GET INTO THIS IN A

LITTLE MORE DETAIL LATER.

ALTERNATIVE 2C HAS FLOWS CONVEYED TO THE BUSTAMANTE PLANT AND ONLY A SMALL EAST SIDE RECLAMATION PLANT. AND THE BUSTAMANTE EXPANSION WOULD BE A SMALLER MODULE EQUAL TO THE EXPANSION UNDER ALTERNATIVE 1A.

AND FINALLY 3A AND 3B, THEY'RE FAIRLY SIMILAR TO 2A AND 2B IN THAT THE FLOWS ARE DIVERTED TO RECLAMATION PLANTS IN THE PRINCIPAL STUDY AREA. HOWEVER, ULTIMATELY, THERE WOULD BE AN EAST SIDE PLANT AS WELL AS WHAT WE'VE TERMED MONTWOOD AREA RECLAMATION PLANT. AND THE MONTWOOD PLANT WOULD BE ON THE NORTH SIDE, OR THE NORTH PART OF THE PSA, AND THE EAST SIDE PLANT WOULD BE IN THE SOUTHERN SECTOR.

LET ME BRIEFLY GO THROUGH EACH OF THE ALTERNATIVES. ALTERNATIVE 1, ONE THING I WANTED TO JUST MENTION IS THAT THIS DOES INCLUDE -- YOU CAN SEE HERE, IN RED, IS THE INTERCEPTOR BACKBONE THAT I MENTIONED. AND THAT IS A COMMON ELEMENT TO EACH OF THE ALTERNATIVES.

IN GREEN, IS THE INITIAL IMPROVEMENTS. THIS IS WORK THAT WOULD NEED TO BE ON LINE BY THE YEAR 2005. YOU CAN SEE THIS IS A REPRESENTATION OF A PUMP STATION. YOU CAN SEE THE TWO GREEN PUMP STATIONS UP AT THE NORTHERN END, REPRESENT THE TEMPORARY PUMPING STATIONS OR LIST STATIONS THAT WOULD CONVEY WHAT FLOWS WERE IN THE SERVICE AREA OVER TO THE EXISTING BUSTAMANTE COLLECTION SYSTEM.

AND IT WOULD ALSO BE INITIALLY A SMALL AMOUNT OF ADDITIONAL COLLECTION SYSTEM INFRASTRUCTURE.

IN TERMS OF TREATMENT PLANT CAPACITIES, THE GREEN HERE IS THE INITIAL IMPROVEMENTS, AND THIS IS TO HAVE THE BUSTAMANTE ON LINE NO LATER THAN THE YEAR 2005, AND THAT'S A 21-MILLION-GALLON PER DAY EXPANSION MODULE. AND THEN AN ADDITIONAL CAPACITY BEYOND THAT, WHICH WOULD GET YOU ULTIMATELY BEYOND THE YEAR 2015, OF AN ADDITIONAL 14 MGD OF CAPACITY.

ONE THING TO NOTE WITH THIS ALTERNATIVE IS THAT CURRENTLY, FROM INTERSTATE 10 DOWN TO THE BUSTAMANTE PLANT, THERE'S A SIGNIFICANT INTERCEPTOR SYSTEM ALREADY IN PLACE, AND I THINK THAT ULTIMATELY ENDS UP AS 60-INCH PIPE, 48- AND SO ON. AND WITH THIS ALTERNATIVE, THERE WOULD BE A NEED TO EXPAND OR PARALLEL THE COLLECTION SYSTEM. SO THERE'S A SIGNIFICANT COST ASSOCIATED WITH DOING THAT COLLECTION SYSTEM. AND I'LL GET BACK TO THAT LATER, IN TERMS OF SOME PROS AND CONS.

ALTERNATIVE 1A IS PRETTY MUCH THE SAME ALTERNATIVE, WITH THE EXCEPTION IN THAT THERE ARE SMALLER INCREMENTS OF THE BUSTAMANTE EXPANSION. SO INITIALLY, AN 11 MGD MODULE WOULD BE BUILT, AND THEN THAT WILL BE FOLLOWED, IN THE PHASE 1, BY AN ADDITIONAL 10 MGD, SO WHEREAS ALTERNATIVE 1 WAS 21 MGD, THIS DOES IT IN TWO SLICES. AND THEN FINALLY ULTIMATELY WOULD BE THE SAME;

IT'S A 14 MGD EXPANSION. THE ADVANTAGE OF THIS ALTERNATIVE OVER ALTERNATIVE 1 IS IT'S MORE OF A PAY-AS-YOU-GO, AND YOU DON'T -- YOU DEFER SOME OF THOSE CAPITAL -- MAJOR CAPITAL EXPENSES RIGHT OFF THE START.

ALTERNATIVE 2A WAS AN ALTERNATIVE WHICH INCLUDED A NEW EAST SIDE RECLAMATION PLANT. AGAIN, YOU CAN SEE THAT THE BACKBONE OF THIS ALTERNATIVE IS IDENTICAL TO ALTERNATIVES 1 AND 1A. HOWEVER, YOU CAN ALSO SEE THAT, IF YOU RECALL FROM ALTERNATIVES 1, THERE WAS A PARALLEL PIPELINE HERE. THIS IS NOT REQUIRED UNDER THIS ALTERNATIVE.

NOW, ONE OF THE ELEMENTS ASSOCIATED WITH THIS IS -- THIS ALTERNATIVE IS THE FACT THAT CURRENTLY, TO BUILD A NEW EAST SIDE RECLAMATION PLANT THAT WOULD BE SIZED AT APPROXIMATELY 8 MGD, THERE JUST ISN'T ENOUGH FLOW IN THE SERVICE AREA TO JUSTIFY HAVING THAT 8 MGD. SO WHAT YOU WOULD DO IS DIVERT SOME OF THAT FLOW THAT'S IN THE SERVICE -- EXISTING SERVICE AREA TO THAT EAST SIDE RECLAMATION PLANT. AND WHAT ADVANTAGE THAT HAS, AGAIN, IS THAT IT ALLOWS YOU NOT TO HAVE TO EXPAND BUSTAMANTE UNTIL THE ULTIMATE EXPANSION -- THAT'S WAY BEYOND THE YEAR 2015 -- AS WELL AS SAVING THE CAPITAL COSTS ASSOCIATED WITH HAVING TO PARALLEL THE COLLECTION SYSTEM HERE.

ONE OF THE MAJOR PROBLEMS ASSOCIATED WITH THIS

ALTERNATIVE THAT WOULD HAVE TO BE DEALT WITH IS THAT THE RECLAMATION POTENTIAL IN THIS AREA DOES NOT EQUAL 8 MGD, SO THERE WOULD HAVE TO BE SOME MEANS TO DISPOSE OF THE EFFLUENT. AND SOME OF THE WORK THAT WE DID LOOKED AT VARIOUS ALTERNATIVES, LOOKING AT THE VARIOUS DRAINS, AND I THINK THE SAFEST BET WOULD BE THAT ANY EFFLUENT THAT'S NOT GOING TO RECLAMATION PURPOSES WOULD PROBABLY ULTIMATELY END UP IN THE SAME EFFLUENT LOCATION THAT THE BUSTAMANTE PLANT IS LOCATED.

SO THAT WAS AN ISSUE ASSOCIATED WITH THAT. AND EVEN BEYOND, WHEN THIS PLANT COULD BE EXPANDED UP BY ADDITIONAL 16 MGD TO AN ULTIMATE CAPACITY OF 24 MGD, AGAIN, THAT'S STILL THE SAME ISSUE. IS THERE THE RECLAMATION POTENTIAL IN THAT AREA TO BE ABLE TO JUSTIFY OR BE ABLE TO HAVE AN EFFLUENT DISPOSAL PLAN?

ALTERNATIVE 2B IS QUITE SIMILAR TO ALTERNATIVE 2A, WITH THE EXCEPTION THAT THE EAST SIDE RECLAMATION PLANT WOULD ONLY BE EXPANDED TO 8 MGD AND NOT BEYOND THAT CAPACITY. SO AS A RESULT, YOU CAN AGAIN SEE THAT THERE WOULD HAVE TO BE A PARALLEL LINE TO THE EXISTING INTERCEPTOR SYSTEM. IT WOULD BE SMALLER THAN THE ALTERNATIVES 1 AND 1A, BECAUSE YOU'VE SUBTRACTED 8 MGD FROM THAT TOTAL FLOW. HOWEVER, BECAUSE THIS ONLY GETS EXPANDED TO 8 MGD, THAT MEANS THAT THERE WOULD HAVE TO BE, IN PHASE 1, AN IMPROVEMENT OF 11 MGD AND ANOTHER

EXPANSION ULTIMATELY TO 16 MGD. THIS STILL HAS A SIMILAR ISSUE OF WHAT TO DO WITH THE EFFLUENT FROM THE PLANT BECAUSE IF -- AGAIN, IF THE PLANT EFFLUENT DOES NOT MATCH THE RECLAMATION DEMAND, THEN YOU HAVE TO DISPOSE OF THE EFFLUENT IN SOME MANNER.

ALTERNATIVE 2C IS A HYBRID OPTION THAT MORE OR LESS TAKES THE BEST ELEMENTS OF ALTERNATIVE 1 AND THE BEST ELEMENTS OF ALTERNATIVE 2. AND WHAT THIS INCLUDES IS A SMALLER EAST SIDE RECLAMATION PLANT, SIZED AT APPROXIMATELY 2 MGD, THAT'S MORE OR LESS DESIGNED TO MATCH THE PLANT DEMANDS FOR WATER RECLAMATION. AND, AGAIN, SIMILAR TO THE OTHER ALTERNATIVES, ALTHOUGH SMALLER, THERE WOULD BE A DIVERSION OF WASTEWATER FLOWS FROM THE COLLECTION SYSTEM TO THAT RECLAMATION PLANT.

NOW THIS RECLAMATION PLANT COULD BE SOMETHING THAT WOULD BE MORE OR LESS TURNED ON. YOU COULD SWITCH IT ON WHEN THERE'S RECLAMATION POTENTIAL, OR DURING THE SUMMER, OBVIOUSLY, WHEN THERE'S RECLAMATION DEMANDS, AND THEN DURING THE WINTER, WHEN THOSE DEMANDS ARE REDUCED OR ELIMINATED, THEN YOU TURN THAT OFF, AND IT WOULD FLOW DOWN TO THE BUSTAMANTE PLANT.

ONE THING ASSOCIATED WITH THIS RECLAMATION PLANT IS THAT IT WOULD BE DESIGNED TO BE QUITE SIMPLE IN TERMS OF NOT HAVING TO HAVE SOLIDS TREATMENT FACILITIES. WE WOULD CALL THAT A SCALPING PLANT, AND WHEN YOU DO

THAT, THE SOLIDS WOULD BE DISCHARGED BACK INTO THE COLLECTION SYSTEM AND ULTIMATELY END UP AT THE BUSTAMANTE PLANT.

THE OTHER SIGNIFICANT ADVANTAGE ASSOCIATED WITH THIS ALTERNATIVE IS THE FACT THAT YOU -- IT WOULD BE A ZERO-DISCHARGE PLANT. IN OTHER WORDS, THE DEMAND OF THE FLOW GOING TO THE PLANT WOULD BE -- THE FLOW GOING TO THE PLANT WOULD APPROXIMATELY MATCH THE DEMAND FOR RECLAMATION. SO, AS A RESULT, THERE'S ZERO DISCHARGE, AND THAT MEANS THAT THERE WOULD BE AN EFFLUENT PERMIT ASSOCIATED WITH THAT. AND THAT SIMPLIFIES THE LIFE FOR EVERYBODY, INCLUDING THE REGULATORS, AS WELL AS THE WATER UTILITY.

FINALLY, VERY BRIEFLY, WHAT GOES ON WITH THE COLLECTION SYSTEM AT BUSTAMANTE IS THIS WOULD REQUIRE A PARALLEL OF THE EXISTING COLLECTION SYSTEM, AN 11 MGD EXPANSION OF BUSTAMANTE, A 10 MGD EXPANSION LATER ON IN THE PHASE 1, AND THEN ULTIMATELY, AN ADDITIONAL 14 MGD. IF YOU RECALL, ALTERNATIVE 1A HAD THE SAME MODULES OF EXPANSION, AND THAT'S -- AGAIN, A SMALLER MODULE HELPS DEFRAY SOME OF THE INITIAL CAPITAL COSTS RATHER THAN HAVING TO EXPAND THE PLANT BY 21 MGD RIGHT AWAY.

ALTERNATIVE 3A IS QUITE SIMILAR TO ALTERNATIVE 2A IN THAT THERE IS AN 8 MGD EAST SIDE RECLAMATION PLANT AND ULTIMATELY AN ADDITIONAL MODULE OF FLOW OR OF PLANT

CAPACITY AT THE EAST SIDE. THE DIFFERENCE AGAIN HERE IS THAT THERE WOULD BE A 4 MGD PLANT IN THE NORTHERN PART OF THE SERVICE AREA TO HELP MORE MATCH THE DEMAND FOR RECLAMATION BY HAVING A PLANT CLOSER TO WHERE THOSE DEMANDS ARE.

THE ONE THING, THOUGH, TO NOTICE IS THAT THAT 4 MGD PLANT WOULD NOT COME ON-LINE UNTIL IT WAS NECESSARY IN THE ULTIMATE PHASE. SO THIS DOES HAVE THE ADVANTAGE OF ELIMINATING ALL THOSE EXPANSIONS OF THE BUSTAMANTE SO THAT ONLY AN 11 MGD MODULE WOULD EVER BE REQUIRED DOWN THERE, AND AGAIN SAVES YOU SOME OF THAT COLLECTION SYSTEM WORK. SIMILAR DIVERSION SYSTEM, AS WE SAW IN ALTERNATIVES 2, HOWEVER.

ALTERNATIVE 3B IS DISTINGUISHED ONLY BY THE FACT THAT THE EAST SIDE RECLAMATION PLANT WOULD ONLY BE EXPANDED TO THAT INITIAL 8 MGD CAPACITY. AND AGAIN, THERE'S A NEW MONTWOOD, OR NORTHERN TREATMENT PLANT, THAT'S A 4 MGD MODULE.

AND FINALLY, AGAIN, THERE'S 11 MGD EXPANSION, AND THIS WILL BE IN THE PHASE 1. AND A 12 MGD MODULE FINALLY FOR THE ULTIMATE CONDITION.

NOW ONCE WE IDENTIFY AND START TO DEVELOP THE ALTERNATIVES WHEN WE HAVE TO DEVELOP AN EVALUATION SYSTEM -- AND THE CRITERIA THAT WE USE ASSOCIATED WITH THAT EVALUATION INCLUDES THE CAPITAL AND OPERATIONS AND

MAINTENANCE COSTS. AND PART OF WHAT IS INCORPORATED INTO THE DEVELOPMENT OF THOSE COSTS IS WE DO INFLATION, AND THE WAY THAT WE TAKE ALTERNATIVES THAT HAVE DIFFERING LEVELS OF COST AND OPERATIONS, MAINTENANCE COSTS AND INFLATION IS THAT WE TAKE THOSE INTO A PRESENT-WORTH VALUE. THAT PUTS IT INTO A PRESENT-DAY COST.

ONE OF THE OTHER THINGS THAT WE INCLUDE, JUST TO NOTE IN TERMS OF THE OPERATIONS AND MAINTENANCE COSTS AND CAPITAL COST, WE DO DEVELOP A -- HAVE A DATABASE OF INFORMATION THAT IDENTIFIES CAPITAL COSTS OF VARIOUS FACILITIES, AND WE USE ACTUAL OPERATING MAINTENANCE COSTS AT THE UTILITY TO HELP CLOSELY IDENTIFY THE COSTS. WE INCLUDE COSTS SUCH AS PERMITTING, LABORATORY FEES AND SO ON.

WE ALSO LOOK AT THE ENVIRONMENTAL IMPACT THAT WOULD IMPACT TO CONSTRUCT TREATMENT PLANTS, TO CONSTRUCT INTERCEPTORS AND COLLECTION SYSTEMS. WE ALSO CONSIDER THE ARCHEOLOGICAL IMPACT AS WELL AS ODOR AND NOISE ASSOCIATED WITH BUILDING A TREATMENT PLANT.

KEY ELEMENT OF THE WATER UTILITIES' OVERALL WATER SYSTEM PLANNING IS THE RECLAMATION, SO AN IMPORTANT ELEMENT OF THE EVALUATION IS THE POTENTIAL OF EACH OF THE ALTERNATIVES FOR RECLAMATION.

WE ALSO LOOK AT FLEXIBILITY OR RELIABILITY. FLEXIBILITY BEING THE ABILITY OF AN ALTERNATIVE TO BE

ABLE TO BE ADJUSTED IN THE FUTURE. AS AN IMPORTANT ELEMENT, SUCH AS IF REQUIREMENTS FOR THE EFFLUENT LIMITS MIGHT CHANGE OR THE REGULATIONS CHANGE, AN ALTERNATIVE IS RATED HIGHLY IF IT'S RATHER FLEXIBLE OR HIGHLY FLEXIBLE. RELIABILITY IS MORE OF A MEASURE OF CAN AN ALTERNATIVE RELIABLY TREAT THE WASTEWATER? AND THAT MIGHT INCLUDE SUCH THINGS AS MAJOR FAILURES IN A POWER SUPPLY OR OTHER SUCH EVALUATION CONSIDERATIONS.

OBVIOUSLY, PUBLIC ACCEPTANCE IS A KEY ELEMENT. WE HAVE TO MAKE SURE THAT ANY ALTERNATIVE THAT'S RECOMMENDED IS ACCEPTABLE TO THE PUBLIC. AND PART OF THE -- PART OF THAT PROCESS IS HAVING A PUBLIC MEETING, SUCH AS TODAY'S.

CONSTRUCTIBILITY IS AN IMPORTANT ELEMENT, TOO, BECAUSE THAT HAS AN IMPACT ON, ULTIMATELY, THE COST. CONSTRUCTIBILITY MIGHT CONSIDER SUCH THINGS AS HIGH GROUNDWATER TABLES OR DIFFICULT CONSTRUCTION. THINGS SUCH AS THAT CAN HAVE AN IMPACT ON THE COST OF A PROJECT BECAUSE THEY ADD A LEVEL OF UNKNOWN TO OUR COSTING.

FINALLY, OF COURSE, THE MOST IMPORTANT ELEMENT OF WHAT WE DO IS TO ACTUALLY GET A PROJECT IMPLEMENTED. AND IMPLEMENTATION REALLY INCLUDES ALL OF THESE CONSIDERATIONS BECAUSE, ULTIMATELY, IF WE CAN'T IMPLEMENT IT, THE ALTERNATIVE IS NOT A GOOD ALTERNATIVE.

THIS IS A COST TABLE OF THE CAPITAL COST AS

WELL AS THE TOTAL PRESENT-WORTH COST. PRESENT WORTH AGAIN INCLUDING THE OPERATIONS AND MAINTENANCE OF THE VARIOUS ALTERNATIVES.

AND, AGAIN, I DO WANT TO STRESS THAT THIS IS COSTING FOR WASTEWATER COLLECTION, CONVEYANCE AND TREATMENT ONLY. IT DOES NOT INCLUDE SOME OF THE OTHER ELEMENTS ASSOCIATED WITH WATER SUPPLY OR ANY OF THE OTHER CITY REQUIREMENTS. AND I DO WANT TO ALSO MENTION THAT THIS IS A -- THESE COSTS ARE ASSOCIATED WITH PROVIDING CONVEYANCE AND TREATMENT FOR THE WHOLE PRINCIPAL SERVICE AREA.

ONE THING, IF YOU RECALL, ALTERNATIVES 1 AND 1A DID NOT INCLUDE ANY ELEMENTS OF REUSE ASSOCIATED WITH IT. IN ORDER TO HELP US COMPARE APPLES TO APPLES, WE DID FOOTNOTE HERE THAT FOR THOSE ALTERNATIVES THAT DID NOT INCLUDE AN ELEMENT OF REUSE, WE ADDED -- WE WOULD ADD SIX MILLION DOLLARS IN INITIAL PHASE CAPITAL COSTS AND A 10 MILLION DOLLAR PRESENT-WORTH VALUE. THOSE COSTS ARE ASSOCIATED WITH PROVIDING FILTRATION AND PUMPING AND CONVEYANCE FROM THE BUSTAMANTE PLANT UP TO A REUSE AREA TO THE NORTH OF INTERSTATE 10 WITHIN THE PRINCIPAL STUDY AREA.

YOU CAN SEE FROM THE TABLE THAT, AS WE TALKED ABOUT COMPARING 1 AND 1A, YOU CAN SEE THAT THERE'S INITIALLY SIGNIFICANT DEFERMENT OF CAPITAL COSTS.

THERE'S ALSO A SIGNIFICANT DEFERMENT OF CAPITAL COSTS ASSOCIATED WITH 2C, AS COMPARES TO ALTERNATIVE 1. AND THEN THE PRIMARY DIFFERENCE BETWEEN ALTERNATIVES 1A AND 1C IS ABOUT SIX MILLION DOLLARS, WHICH PRETTY MUCH EQUATES TO THE COST TO PROVIDE REUSE ON TOP OF ALTERNATIVE 1A.

YOU CAN ALSO SEE THAT ALTERNATIVE 2C IS THE LOWEST-COST RECLAMATION ALTERNATIVE. AND, AGAIN, IF YOU WERE TO ADD 10 MILLION DOLLARS TO ALTERNATIVE 1A, THAT WOULD HAVE A TOTAL PRESENT-WORTH VALUE OF 82 AS COMPARED TO 81, FOR ALTERNATIVE 2C.

BASED ON THE NUMBER OF CONSIDERATIONS THAT I ENUMERATED TALKING ABOUT ALTERNATIVE 2C, THAT IS THE RECOMMENDED PLAN FOR THE PRINCIPAL STUDY AREA. THE REASONS FOR THAT INCLUDING, IT IS THE LOWEST-COST ALTERNATIVE WITH RECLAMATION. IT REDUCES THE INITIAL CAPITAL COSTS ASSOCIATED WITH EXPANDING THE BUSTAMANTE PLANT AS COMPARED TO A NUMBER OF THE ALTERNATIVES. IT'S VERY FLEXIBLE. IT DOES NOT ELIMINATE ANY OF THE OTHER ALTERNATIVES. IF YOU RECALL, YOU BUILD AN INITIAL MODULE OF THE RECLAMATION PLANT OF ONLY 2 MGD AND YOU BUILD A SMALL MODULE AT BUSTAMANTE. IF PLANNING WERE TO CHANGE IN THE FUTURE, YOU HAVEN'T ADDED THAT MUCH TO YOUR -- YOU HAVEN'T MADE A COMMITMENT NECESSARILY TO THAT ALTERNATIVE. YOU COULD ENLARGE THE RECLAMATION PLANT,

THE EAST SIDE PLANT. OR, FOR THAT MATTER, IF THERE WAS A HEAVY DEMAND FOR RECLAMATION TO THE NORTH, YOU COULD EVEN CONSTRUCT THE MONTWOOD PLANT, IN FACT. SO IT HAS PLENTY OF FLEXIBILITY, AND THAT'S A REAL ADVANTAGE.

AN ADVANTAGE TO THE WATER UTILITY IS THAT IT CENTRALIZES THEIR FACILITIES. THE WATER UTILITY HAS A NUMBER OF TREATMENT PLANTS, AND IT WAS NOT DESIRABLE TO ADD ANOTHER LARGE FACILITY, A LARGE WASTEWATER TREATMENT PLANT, TO THEIR SYSTEM. SO HAVING A SMALL RECLAMATION PLANT THAT'S PRETTY MUCH DRIVEN BY THE RECLAMATION POTENTIAL IN THE AREA, THAT'S NOT AS BURDENSOME AS BUILDING A LARGE OR A LARGER RECLAMATION FACILITY IN THE PRINCIPAL STUDY AREA.

AND ANOTHER BIG ADVANTAGE IS THERE AREN'T ANY NEW DISCHARGES, BEING A ZERO-DISCHARGE PLANT FOR THE EAST SIDE PLANT.

SO WHAT IS THIS RECOMMENDED PLAN? IT'S AN INITIAL EXPANSION OF BUSTAMANTE BY 11 MGD. IT'S TO PROVIDE TEMPORARY LIFT STATIONS AND FORCE MAINS. TO COLLECT WHAT FLOWS THERE ARE WITHIN THE PRINCIPAL STUDY AREA AND TO CONVEY THEM INTO THE EXISTING COLLECTION SYSTEM. IT'S A 2 MGD EAST SIDE RECLAMATION PLANT, WHICH SITING STUDIES HAVE NOT BEEN DONE YET, BUT IT IS DRIVEN BY THE RECLAMATION POTENTIAL IN THE SERVICE AREA. SO IT'S MORE MARKET-DRIVEN THAN ANYTHING.

THIS PLAN ALSO ADDRESSED EXISTING COLLECTION SYSTEM CAPACITY RESTRICTIONS. I INDICATED EARLIER THAT THERE WAS SOME MODELING DONE. SIGNIFICANT EFFORT DONE BY THAT WAS TO IDENTIFY AREAS IN THE COLLECTION SYSTEM THAT HAD BOTTLENECKS AND THEIR RECOMMENDATIONS TO ADDRESS THAT. ONE OF THE KEY RECOMMENDATIONS THAT WE MADE IS BEFORE GOING AND MAKING INVESTMENTS TO ADDRESS THOSE BOTTLENECKS, THE UTILITY, WE SUGGEST, WOULD DO SOME FLOW MONITORING SO THAT THOSE CAPITAL INVESTMENTS ARE ABSOLUTELY NECESSARY.

NOW IN TERMS OF IMPLEMENTATION, THE INITIAL PHASE, WHICH REQUIRES THAT FACILITIES BE ON-LINE BY THE YEAR 2005, INCLUDE THE EXPANSION OF BUSTAMANTE, NEEDS TO BE ON-LINE BY THE YEAR 2002, AND THAT MEANS IT'S FINISHED WITH THE CONSTRUCTION.

A DIVERSION OF THE CONSTRUCTION, IF YOU RECALL, FOR THE RECLAMATION PLANT, THERE WAS DIVERSION TO GET FLOW TO THE NEW RECLAMATION PLANT. THAT WAS A REQUIREMENT. AND THAT WOULD ONLY BE NECESSARY WHEN GROWTH WITHIN THE SYSTEM AND THE DEMAND FOR RECLAMATION OCCURS.

AGAIN, THE NEW RECLAMATION PLANT IS DRIVEN BY POTENTIAL DEMAND FOR RECLAMATION. SO THE PLANT IS PRETTY MUCH DRIVEN -- THE SIZE IS DRIVEN BY THE DEMAND. AND WE USE TWO MILLION GALLONS PER DAY. BUT WHATEVER THE DEMAND

IS, WE CAN DIVERT WHATEVER FLOW IS REQUIRED.

AND THEN AS I INDICATED EARLIER, SITING IS TO BE DETERMINED ONCE THAT RECLAMATION PLANT DEMAND OCCURS. AGAIN, FLOW MONITORING IN A COLLECTION SYSTEM.

GOING INTO IMPLEMENTATION FOR PHASE 1, CONSTRUCTION OF THE BACKBONE INTERCEPTOR WOULD BE REQUIRED BECAUSE THAT WOULD IMPLY THAT DURING PHASE 1, THERE'S SUFFICIENT FLOW AND POPULATION NECESSARY TO CREATE THAT FLOW TO GET -- IT BECOMES NECESSARY TO BUILD THAT INTERCEPTOR. ASSOCIATED WITH THAT, ALSO, IS THE FACT THAT WITH ANY EXISTING COLLECTION SYSTEM, YOU WOULD ALSO OVERLOAD THE EXISTING SYSTEM BY TRANSFERRING ADDITIONAL FLOWS FROM THE PRINCIPAL STUDY AREA.

PHASE 1 ALSO WOULD IDENTIFY -- THERE ARE A NUMBER OF IMPROVEMENTS TO THE EXISTING COLLECTION SYSTEM THAT WE IDENTIFIED IN OUR MODELING. AND ALSO THE NEXT BUSTAMANTE EXPANSION WOULD HAVE TO BE ON-LINE BY THE YEAR 2012. AND THAT SHOWS YOU THAT THAT'S ABOUT A 10-YEAR GAP BETWEEN THE TIME THAT THE INITIAL CONSTRUCTION IS REQUIRED AND THE PHASE 1 CONSTRUCTION IS REQUIRED.

WITH THAT, THAT'S THE END OF THE FORMAL PRESENTATION. ARE THERE ANY QUESTIONS?

MR. BROSMAN: WE'LL OPEN IT UP FOR QUESTIONS OR COMMENTS FROM THE AUDIENCE. I'D LIKE TO RECOGNIZE MR. GORDON THORN CAME IN FROM THE TEXAS WATER DEVELOPMENT

BOARD. I APPRECIATE YOU BEING HERE. WE DID GIVE YOU PLENTY OF PRAISE BEFORE YOU CAME.

ANY QUESTIONS THAT ANYONE MAY HAVE? THIS IS JUST BIG-PICTURE PLANNING AND DOESN'T GET DOWN TO THE NUTS AND BOLTS OF SPECIFIC LINE EXTENSIONS.

ATTENDEE: I THINK MY QUESTIONS WOULD BE MORE NUTS AND BOLTS. MAYBE ANOTHER TIME. BUT I MEAN LIKE THE FUNDING AND WHAT'S COST OF -- IMPACT FEES. YOU KNOW, IF YOU'RE LOOKING AT IMPACT FEES FROM THE VARIOUS AREAS THAT AREN'T INCLUDED AT THIS TIME, LIKE I SAID, IT'S MORE THE NUTS AND BOLTS TYPE THINGS.

RECLAMATION FACILITY, I'M ASSUMING, THAT'S WATER REUSE FOR IRRIGATION PURPOSE. AND LIKE YOU STATED, YOU DON'T HAVE SITES FOR THAT YET, SO....BUT YOU'RE LOOKING AT AN 8-YEAR PLAN FROM THIS POINT, RIGHT?

MR. OPPENHEIM: WE LOOKED AT GOING OUT --

ATTENDEE: FOR YOUR INITIAL PHASE.

MR. OPPENHEIM: YES. WE LOOKED AT GOING THROUGH, FOR THE INITIAL PHASE, UP TO THE YEAR 2005. AND IN TERMS OF THE RECLAMATION, IT'S MORE DRIVEN BY WHATEVER DEVELOPMENT MIGHT DEMAND, GOLF COURSES, TURF IRRIGATION, MEDIANS, IF THERE'S SOME INDUSTRY IN THE AREA. THEN THAT WOULD HELP THAT DEMAND.

MR. BROSMAN: LET ME SAY SOMETHING ABOUT RECLAMATION. THAT IS DEFINITELY A PART OF OUR WATER

FUTURE OF EL PASO. RIGHT NOW, WE RECYCLE ABOUT SEVEN AND A HALF, EIGHT PERCENT OF OUR LAND, MOSTLY FROM THE FRED HERVEY PLANT. WE ARE CURRENTLY CONSTRUCTING A RECLAMATION SYSTEM -- WELL, WE HAVEN'T STARTED CONSTRUCTING -- WE'RE ABOUT 95 PERCENT DESIGN -- ON THE WEST SIDE, TO PROVIDE RECLAIMED WATER TO AREAS OF THE WEST SIDE. THAT CONSTRUCTION WILL START THIS SUMMER.

WE'RE DOING SOME PRELIMINARY PLANNING IN THE HASKALL TREATMENT PLANT. WE ALSO ARE DOING -- WE'RE ABOUT 95 PERCENT DESIGNED AT THE BUSTAMANTE PLANT, WITH AN INITIAL PHASE OF RECLAMATION THERE. SO AS PART OF OUR OVERALL LONG-RANGE WATER MASTER PLAN, WE MUST MAINTAIN NOT ONLY THE CURRENT EIGHT PERCENT BUT LOOKING OUT 25, 30 YEARS FROM NOW, WE SEE MAYBE 20 PERCENT OF OUR WATER COMING FROM RECLAIMED TREATED WASTEWATER. SO WE'RE VERY MUCH INTERESTED IN PROVIDING SOME RECLAMATION ON THE EAST SIDE. AND WE WILL DO IT AT BOTH BUSTAMANTE AND IF WE CAN BUILD THIS SKIMMER PLANT.

THERE ARE POLICIES IN PLACE THAT ENCOURAGE THAT. FOR EXAMPLE, YOU CANNOT BUILD A NEW GOLF COURSE IN EL PASO UNLESS YOU USE BRACKISH WATER OR RECLAIMED WATER, IF IT'S AVAILABLE. SO THERE WILL BE POLICIES GENERATED TOWARDS THAT.

AS FAR AS IMPACT FEES -- YOU ASKED ABOUT IMPACT FEES -- THAT'S SOMETHING THAT'S PROBABLY GOING TO COME

BACK UP. THE PRESSURES ARE GOING TO BE THERE. WE HAVE -- WE TRIED ONCE. AND THIS AREA HAS VERY LIMITED WATER SUPPLY. SO THE DEVELOPMENT OF THIS AREA IS GOING TO BE DEPENDENT ON ADEQUATE WATER SUPPLY.

ATTENDEE: SURE.

MR. BROSMAN: AND EVEN THOUGH THIS IS A WASTEWATER STUDY, AND THEREFORE -- AND THE INITIAL IMPACT FEES THAT WE DEVELOPED ARE STRICTLY WATER SUPPLY FEES. I CAN PREDICT THAT IT'S GOING TO COME BACK UP SOMETIME. WHEN, I DON'T KNOW. BUT THE EXPANSION IN THIS AREA IS GOING TO BE LIMITED. WE HAVE TO RESOLVE JURISDICTIONAL ISSUES. I DON'T SEE US EXPANDING INTO AREAS SERVED THAT BELONG TO ANOTHER JURISDICTION. WE HAVE TO RESOLVE THAT. WE HAVE TO RESOLVE THE WATER ISSUES IN THIS AREA BEFORE MUCH OF THE GROWTH CAN OCCUR. I ASSUME -- THIS STUDY IS PREDICATED ON THE ASSUMPTION THAT ULTIMATELY THOSE QUESTIONS WILL BE RESOLVED.

ATTENDEE: I KNOW THAT'S NOT THE POINT OF THIS MEETING, BUT IS THERE ANY WATER STUDY STARTING FOR THIS AREA?

MR. BROSMAN: ACTUALLY, THERE IS NOT. WE JUST COMPLETED, SURPRISINGLY, A 20-YEAR WATER FACILITIES MASTER PLAN ABOUT THREE YEARS AGO. WE DID INCLUDE IN THERE WHAT WE CALLED THE TRIANGLE AREA. WE DID INCLUDE -- THIS IS HOW THE DYNAMICS AND THINGS CHANGE.

WE ACTUALLY HAVE DONE SOME PRELIMINARY STUDIES ON THE AREA OWNED BY G.L.O. THEY'VE BEEN TALKING TO US FOR QUITE SOME TIME.

BUT A GOOD PORTION OF THE HEARTLAND OF THAT STUDY AREA THAT YOU SEE UP THERE, WE HAVE NOT DONE COMPREHENSIVE PLANNING FOR INFRASTRUCTURE. OF COURSE, WE KNOW OVERALL DEMAND. WE KNOW THAT WE HAVE TO GET A YEAR-ROUND SUPPLY OF WATER TO THE CITY. JONATHAN ROGERS' PLAN HAS GOT TO BE EXPANDED FOR WATER BULK. WATER IN THAT AREA IS GOING TO COME FROM SURFACE WATER. THESE ARE MAJOR PROBLEMS WE FACE THAT WE HAVE TO SOLVE. THERE'S GOING TO HAVE TO BE SOME WHEELING AND DEALING AND SOME RESOLUTION OVER TIME BEFORE WE CAN GET ALL THESE THINGS RESOLVED.

BUT ULTIMATELY, YOU KNOW, THAT AREA IS GOING TO GROW AND -- SO THIS IS -- IT'S NOT TOTALLY CONNECTED WITH WATER, YOU KNOW.

ATTENDEE: RIGHT.

MR. BROSMAN: WHAT WERE THE OTHER QUESTIONS?

ATTENDEE: I THINK THAT'S IT.

MR. BROSMAN: ANY OTHER COMMENTS OR QUESTIONS? MR. THORN, DO YOU WANT TO SAY ANYTHING?

MR. THORN: I JUST APOLOGIZE FOR BEING LATE. I'M FROM LAS CRUCES, AND AM TRYING TO FIND MORE WATER.

MR. BROSMAN: WE CAN END THE HEARING NOW.

(THE HEARING CONCLUDED AT 7:58 P.M.)

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C E R T I F I C A T E

STATE OF TEXAS)
COUNTY OF EL PASO)

I, SHANNON J. MARTINEZ, REGISTERED MERIT REPORTER, AND CERTIFIED SHORTHAND REPORTER IN AND FOR THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS TRANSCRIPT IS A TRUE RECORD OF THE TESTIMONY GIVEN IN SAID PROCEEDING, AND THAT SAID TRANSCRIPTION IS DONE TO THE BEST OF MY ABILITY.

GIVEN UNDER MY HAND AND SEAL OF OFFICE ON THIS 18th DAY OF March, 1997.

Shannon J. Martinez
SHANNON J. MARTINEZ
CERTIFIED SHORTHAND REPORTER
OF THE STATE OF TEXAS
CERTIFICATION NUMBER 1684
DATE OF EXPIRATION OF
CERTIFICATION: 12/31/97