BIOLOGICAL ASSESSMENT

USIBWC RIO GRANDE PROJECTS: AMERICAN DAM TO FORT QUITMAN, TEXAS

Prepared for:

United States Section,
International Boundary and Water Commission (USIBWC)

Prepared by:

Parsons Engineering Science, Inc.
Austin, Texas

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

Ac-ft	Acre feet
AWP	Aransas-Wood Buffalo Population
BA	Biological assessment
BOTA	Bridge of the Americas
BPP	Boundary preservation project
cfs	Cubic feet per second
EA	Environmental assessment
EIS	Environmental impact statement
EPWU/PSB	El Paso Water Utilities/Public Services Board
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FR	Federal Register
GIS	Geographic information system
HU	Habitat units
km	Kilometer
MGD	Million gallons per day
MU	Management units
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service (formerly SCS)
O&M	Operation and maintenance
PL	Public law
RGACE	Rio Grande American Canal Extension
RMP	River management plan
ROW	Right-of-way
SCS	Soil Conservation Service
SOC	Species of concern
Study area	The United States portion of a 91.03-mile segment of the Rio Grande extending from American Dam, south to Fort Quitman, Texas
SWEC	Southwest Environmental Center
T&E	Threatened and endangered
TPWD	Texas Parks and Wildlife Department
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
USIBWC	United States Section, International Boundary and Water Commission
UTEP	University of Texas at El Paso
yd^3	cubic yards

SECTION 1
INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this Biological Assessment (BA) is to evaluate the effects of river maintenance practices (the federal action) conducted within the Study area on species listed under the Endangered Species Act (ESA). The Study area is identified as the United States portion of a 91.03-mile segment of the Rio Grande maintained and operated by the United States Section, International Boundary and Water Commission (USIBWC) that extends from American Dam, downstream to Fort Quitman, Texas. The report is initiated in response to a 1999 Memorandum of Understanding between USIBWC Commissioner, and Southwest Environmental Center (SWEC). This report will assist the USIBWC to comply with the following federal and state laws and regulations:

a. National Environmental Policy Act (NEPA) (Public Law [PL] 91-190, 42 United States Code 4321 *et seq.*),
b. Endangered Species Act of 1973 (PL 93-205) and amendments of 1988 (PL 100-478), and
c. Chapters 67 and 68 of the Texas Parks and Wildlife (TPWD) Code, and Section 65.171-65.184 of Title 31 of the Texas Administrative Code.

1.2 REPORT ORGANIZATION AND CONTENT

The BA is organized into seven sections,

a. Introduction - Describes the Study area location, purpose, and requirements.
b. Description of the Federal Action - Describes the current Operation and Maintenance (O&M) practices. Includes major activities, and a summary of the international agreement with Mexico.
c. Interrelated Studies- Includes a summary of major studies conducted in and relating to the Study area.
d. Ecological Setting - Provides a review of the historical setting, existing conditions, and summary of major anthropomorphic actions contributing to the decline of fish and wildlife habitat in the Study area and middle Rio Grande as a whole.
e. Methodology - Describes methods used for determining the effects of the federal action on threatened and endangered (T&E) species.
f. Results – Describes the results of literature review, habitat analyses and field studies.
g. Effects Determination – Includes a review of T&E species status and distribution, life history, habitat requirements, and effects determination of the federal action.

While the purpose of the BA is to address the effects of maintenance practices on T&E species, the report also includes ancillary information. The additional information addresses topics ranging from historical habitat conditions of the region to qualitative descriptions of the aquatic and terrestrial system (*e.g.* survey species lists). The addition of ancillary information within the BA serves the following purposes:

a. Provides a better understanding of the Study area, environmental conditions, and constraints.

b. Provides context in which to view the project within the system's historic anthropogenic impacts.

c. Contributes to the overall body of knowledge for the area even though the species lists compiled during surveys are not exhaustive.

1.3 STUDY AREA LOCATION

The Study area encompasses 91.03 miles of the Rio Grande from El Paso to Fort Quitman, Texas and includes several interrelated USIBWC projects (Table 1.1). The project referred to as the Rectification Project represents the majority of the Study area and is the focus of the BA (Figure 1.1).

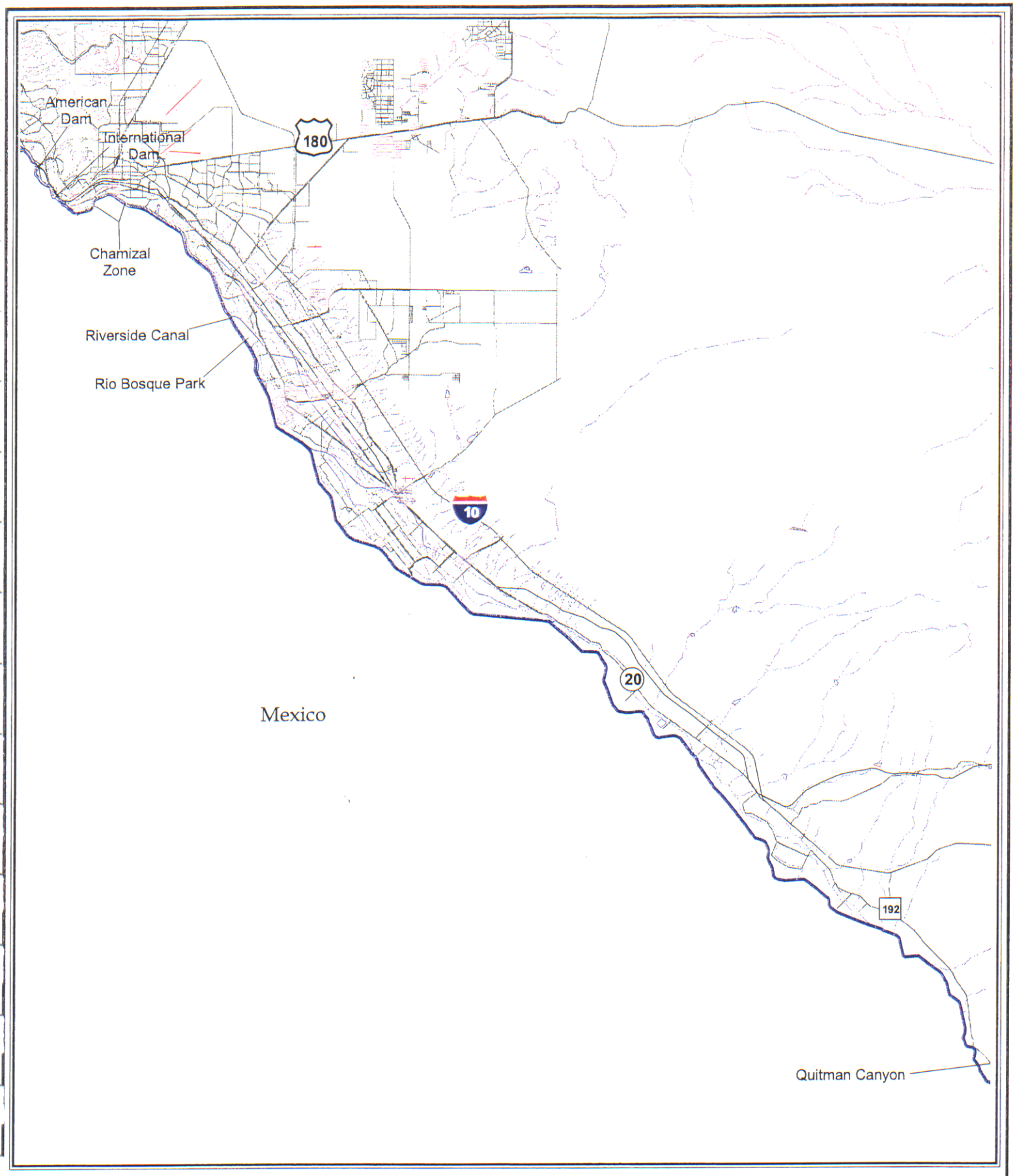
Table 1.1
USIBWC Projects Within the Study Area

Project	Length (miles)
American Dam to International Dam	2.11
International Dam to Beginning of Chamizal Channel	1.43
Chamizal Channel	4.35
Rectification Project	83.14
Total	**91.03**

1.3.1 American Dam to International Dam

Located approximately 200 feet upstream from the intersection of the international land boundary with the Rio Grande, the American Dam and Canal were authorized by the Act approved by Congress on August 29, 1935, 49 Stat. 961. Construction began in January 1937 and was completed in June 1938.

The American Dam is 284 feet wide between abutments and has 13 radial gates; each gate is 7.56 feet high by 20 feet long. Water enters the American Canal over the 250 foot long weir which extends upstream from the left abutment of the dam. Two 11x20 foot radial gates that have a design capacity of 12,000 cfs regulate flows into the canal.



5 0 5 10 Miles

Figure 1.1

Location Map
USIBWC Rio Grande Study Area
El Paso and Hudspeth Counties, Texas

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1.3.2 International Dam to Beginning of Chamizal Channel

The International Dam, initially constructed by Mexico, was reconstructed by the United States in 1940 to enable Mexico to divert allotted irrigation water into the Acequia Madre. The stretch includes International Dam and 1.43 miles of maintained river channel.

1.3.3 Chamizal Channel

Construction of the concrete channel (4.35 miles) was completed in 1969 and provided for a narrow right-of-way and improved flood control in a heavily urbanized section. The trapezoidal concrete channel has a bottom width of 116 feet, a top width of 167 feet, and a maximum depth of 19.7 feet. The design capacity of the channel is 24,000 cfs with 3 feet of freeboard. The Chamizal Convention of 1964 provided for channel relocation, land transfer between the United States and Mexico (net transfer of land to Mexico of 437.18 acres), and replacement of six bridges. Figure 1.2 depicts the location of the Chamizal Channel.

1.3.4 Rectification Project

The Rectification Project was implemented between 1934 and 1938 in compliance with the Convention of February 1, 1933 between the United States and Mexico. The purpose of the project was to stabilize the international river boundary between the two countries and provide flood protection for adjacent suburban and agricultural lands. The project included development of a floodway by construction of levees on both sides of the river. The United States levee is 85.44 miles in length, has a crown width of 16 feet to 29 feet, an average height of 7.2 feet, and side slopes of 2-1/2:1. The Mexican levee is 83.74 miles in length, has a crown width of 16.4 feet, and side slopes of 2-1/2:1. The designed freeboard for a flood of 11,000 cfs is 2 feet.

Also as part of the Rectification Project, 100,000 acre-feet of flood control storage was provided at Caballo Dam, located 108 miles upstream of El Paso. Hydrologic studies demonstrated that construction of Caballo Dam in New Mexico would reduce the design flood for the project from 18,000 to 11,000 cfs. Construction of Caballo Dam was performed under the direction of the U.S. Bureau of Reclamation (USBR). An agreement between the USBR and USIBWC provides that all flood control capacity may be used as recapture storage except during the months of June, July, August, September, and October when 100,000 ac-ft of flood storage must be left available for storm runoff.

Initial construction began in March 1934 and was completed in 1938. The Rectification Project straightened the river, and in the process shortened its meander length from 155 miles to 86 miles (Figure 1.3). In construction of the new channel, land parcels were exchanged between the U.S. and Mexico to circumvent net loss of territory from either country. The rectified channel was constructed so that the areas cut from the United States equaled the amount cut from Mexico. In all, 178 of these areas, known as "parcels," were created, and 85 ceded by the United States to Mexico, 69 were ceded by Mexico to the United States and 24 remained in the floodway channel. The parcels ceded to the United States were subsequently transferred to municipal agencies or sold to private individuals.

1000 0 1000 2000 Feet

Figure 1.2

USIBWC Study Area
Digital Orthoimagery Showing
Chamizal Zone

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1000 0 1000 2000 Feet

Figure 1.3

USIBWC Study Area
Example of Channel Rectification

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Supplemental work conducted from 1943 through 1950 consisted of raising levees, revetting levees opposite to arroyo entrances, revetting channel banks, and leveling floodways. Major structure work included construction of three toll-free bridges, modification of the Riverside Canal Heading for grade control, and construction of four concrete grade structures. In addition nine control dams were constructed on five arroyos to reduce peak runoff rates to the Rio Grande.

An upstream portion of the Rectification Project was modified by construction of the Chamizal Channel. The channel length was shortened from 85.6 miles to the current 83.14 miles from the downstream end of the Chamizal Channel to the downstream end of the Rectification Project (Figure 1.3). Table 1.2 shows the overall length of the rectified stream segments.

Table 1.2
Length of Rectified Portions of the Rectification Project

Year	Length of Area Rectified (miles)
1935	10.0
1936	32.1
1937	26.8
1938	4.4
1939	12.1
Total rectified by 1939	**85.6**
Length after Chamizal Channel Construction in 1969	**83.14**

1.4 PURPOSE OF USIBWC STUDY AREA PROJECTS

The primary purposes of the USIBWC projects are:

a. International boundary preservation,
b. Flood protection, and
c. Water delivery (United States and Mexico).

1.4.1 International Boundary Preservation

The majority of the Study area borders the international boundary between the United States and Mexico. Maintaining the border is a primary function of the Study area. Stabilization of the international boundary line in the El Paso/Juárez Valley was initiated in 1927 by the International Boundary Commission prior to the name change to International

Boundary and Water Commission as a result of the 1944 Water Treaty. Agreements with Mexico are described by the Commission's Minute No. 165 of August 13, 1938 and are discussed in Section 2 of this report. Issues relating to international agreements can interject significant complexity and to an extent, overriding consideration when dealing with project operations.

1.4.2 Flood Control

An extensive levee system and upstream reservoirs maintain flood control. Before construction of both Elephant Butte and Caballo Dams, the maximum-recorded flood at El Paso, Texas was about 24,000 cfs on June 12, 1905. After construction of Elephant Butte Dam in 1916, the peak discharge at El Paso, Texas was approximately 13,500 cfs. The design flood for the Rio Grande within the Study area increases to nearly 18,000 cfs by an assumed spill of approximately 6,000 cfs at Elephant Butte Dam, and a reduction to 11,000 cfs by the construction of Caballo Dam (constructed as part of the Rectification Project appropriations). The 11,000 cfs flow has a frequency of occurring once in 50 years.

1.4.3 Water Delivery

Water delivery to the U.S. and Mexico is accomplished by diversions at the American Dam, International Dam and Riverside Dam. Water released upstream from the Study area at Elephant Butte Dam (a large portion of this flow is diverted to irrigate croplands in New Mexico) and return flow waters reach El Paso, Texas at an annual rate of 444,000 ac-ft. As the flow reaches American Diversion Dam, 269,000 ac-ft is diverted annually to the American Canal which is the main supply canal for the El Paso Valley. The diversion to Mexico is, according to treaty, 60,000 ac-ft annually at International Dam, which is used to irrigate the Juárez Valley along with shallow groundwater and municipal sewage. After diversion at the International Dam, the average flow of the Rio Grande is reduced to 126,000 ac-ft annually. The flow gradually increases again due to collection of the return flow and treated municipal sewage water discharged from several plants in El Paso, Texas and adjacent communities. The sewage water from the City of Juárez, Mexico is discharged into irrigation canals and, to a limited extent, to drainage ditches, but not directly into the Rio Grande. When the flow reaches Fort Quitman, Texas storm runoff from small creeks is added to the flow of the Rio Grande.

SECTION 2
DESCRIPTION OF THE FEDERAL ACTION

The federal action includes a variety of O&M activities associated with the USIBWC projects within the Study area. The O&M activities are conducted in accordance with article 11 of the February 1, 1933 convention. The O&M activities are under the direction of the USIBWC El Paso Projects office at American Dam, with field maintenance carried out by the El Paso Projects Office and the Zacarias R. Dominguez, Jr. Field Office in Fort Hancock, Texas. It is the primary maintenance activities (as it relates to impacts on T&E species) associated with projects which are the focus of the BA. The primary activities include:

a. Sediment removal and disposal
b. Floodway leveling
c. Vegetation management
d. Levee roads works, and
e. Channel bank protection

Secondary activities include basic O&M of structures, bridges and other infrastructure. Secondary activities are described, however, the activities are not considered in the analyses of potential T&E impacts. Secondary activities include inspection and minor repair of:

a. Dams
b. Bridges
c. Grade control structures, and
d. Irrigation structures

Any major repairs or construction activities have been addressed, and will be in the future, in appropriate NEPA documentation.

The O&M program is designed to provide safe and adequate passage of floods with attendant protection of life and property, compliance with international treaties, and continued stabilization of the boundary between the United States and Mexico. Project maintenance is described in the O&M manual (USIBWC 1972). More recently, the Rio Grande Management Plan was developed with a detailed discussion of the O&M procedures (USIBWC 1994). These documents cover the current O&M procedures for the Study area projects. Maintenance activities are undertaken to ensure that flood control and water delivery objectives of the projects can be met.

2.1 OPERATION

Project works are inspected at least weekly to ensure proper operation and safety. Operation activities include making routine patrols for encroachments, reporting vandalism, general inspection of infrastructure, and engineering. Stream gauging stations are operated from above American Dam to Fort Quitman, Texas to provide information on water deliveries and the passage of floodwaters.

2.1.1 Security Patrols

Periodic patrols are made to assure that vegetation is not encroaching in the floodway and obstructions such as snags and debris are clear of the channel. Levees and levee gates are routinely inspected to ensure operational integrity.

2.1.2 Engineering Surveys

Engineering field surveys are made periodically to obtain cross-sections of the channel and floodway and profiles of the levees and normal flow channel. These data are used to evaluate project maintenance needs in terms of work necessary to maintain the water carrying capacity of the project.

2.1.3 American Canal

The American Canal gates at the entrance can be preset to automatically close during floods to maintain flows less than 1,350 cfs. These gates are normally operated manually.

2.1.4 Hydrologic Gauging Stations

Hydrologic gauging stations consisting of a cableway, a gravity well, and a water-stage recorder are located on the river and canals. The uppermost station is located 1.7 miles above American Dam; the second is 0.6 miles downstream of American Dam; the third station is about 4 miles south-southwest of Clint, Texas, and 27.1 miles below American Dam (abandoned, no longer in use); the fourth near Acala is 0.8 miles below the El Paso-Hudspeth County line, and 47.2 miles downstream from American Dam (abandoned, no longer in use); the last station (Fort Quitman) is located 1.5 miles below Old Fort Quitman and 80.7 miles below American Dam and 10.29 miles upstream from the end of the Rectification Project. Gauging stations are operated on the American Canal by both the USIBWC and the El Paso County Water Improvement District No. 1, and on the Acequia Madre by the Mexican Section of the International Boundary and Water Commission.

2.1.5 Delivery of Water to Mexico

Water scheduled for delivery to Mexico under the provisions of the 1906 Treaty is released from Caballo Reservoir in accordance with the delivery schedule provided to the USBR by the USIBWC. This release is conveyed through the Canalization Project (located

upstream of the Study area) and released through American Dam (Figure 2.1) into the river for diversion by Mexico into Acequia Madre at International Dam, located 2.1 miles downstream from American Dam.

2.2 MAINTENANCE

The USIBWC program for the projects includes: removal of sediments from portions of the normal flow channel and the lower end of arroyos; floodway leveling; vegetation management program along the channel bank, floodway and levee; levee road shaping and resurfacing; replacement of channel bank rock protection on the U.S. side; cleaning, painting, and rebuilding of levee structures; inspection and repair of International Dam; inspection and repair of American Dam and Canal; and jointly with Mexico, inspection and repair of international bridges, and care and maintenance of four grade control structures.

2.2.1 Primary Maintenance Activities

Primary maintenance activities include actions that impact vegetation, river sedimentation processes or modify the general form and structure of the projects. These activities include sediment removal and disposal, floodway leveling, vegetation management, levee roads work and channel bank protection.

2.2.1.1 Sediment Removal and Disposal

Debris and accretions such as sand bars, weeds, and brush are removed from portions of the low flow channel to facilitate the conveyance of return-flow water from Mexico and United States lands, as well as for passage of floodwater. Also, any major deposits or channel closures caused by flows from arroyos are removed.

Channel Sediment Removal

Channel excavation is performed between October and March (non-irrigation season) for the American Dam to Riverside Heading reach, since irrigation water is not being released from Caballo Reservoir and there is little or no return flow water in that reach of the channel. From March to September (irrigation season) channel excavation can be performed from Riverside Heading to Fort Quitman, Texas (flows that might be present within the channel are return flows and storm water runoff). With regard to sediment removal in the low flow or pilot channel, the Mexican Section, IBWC, is responsible for the sediment removal from Riverside Dam downstream to the Alamo Grade Control Structure; and the USIBWC is responsible for the sediment removal from the Alamo Grade Control Structure downstream to the end of the Project. The small drainage flow that may be present is diverted to one side of the channel while work is performed on the remainder of the channel to prevent increased flow turbidity. Sand and gravel deposited in the Rio Grande by arroyo flows are removed from the normal flow channel using scrapers and bulldozers and deposited in various spoil areas established for that purpose along the Study area.

500 0 500 1000 1500 Feet

Figure 2.1

USIBWC Study Area
Digital Orthoimagery Showing American Dam and International Dam

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Sediment is generally not removed from the same channel locations each year. The excavation is scheduled on the basis of surveys of the channel, and the indicated reductions in channel carrying capacity.

Accordingly, individual disposal sites may not be used each year, and there may be intervals of several years between disposal operations at any given site. Depending upon available funding and specific project needs, 100,000 to 2,000,000 cubic yards (yds^3) of deposited sediment are removed from the channel each year. During the last 8 to 10 years, the amount of deposited material removed has been reduced significantly. The failure of Riverside Dam in August 1987 substantially reduced the amount of sediment deposited downstream of the dam.

Arroyo Earthwork

Arroyo earthwork includes removal of sand and gravel from the mouths of arroyos and river channel excavation at the arroyo entrances to avoid the formation of deltas which would reduce flood capacity and also direct floodwaters against the levee on the opposite side.

Disposal Sites

Sediment removed from the channel is disposed on sites located within the project(s) rights-of-way or on other nearby federal land, and occasionally on adjacent private property, usually at the owner's request. Spoils are not placed in wetlands, either in or adjacent to the Study area.

2.2.1.2 Floodway Leveling

Prior to floodway mowing or special works projects, portions of the floodway may be leveled where necessary by using a motor grader, scraper, bulldozer, or farm tractor pulling a drag. Leveling is required to correct the effects of wind erosion and/or depositions, flood-caused erosion or deposition; and to eliminate any obstruction that would hinder or prevent efficient clearing operations.

2.2.1.3 Vegetation Management

The primary function of the vegetative management program is to provide an unobstructed path for the movement of large flood flows. Vegetative management consists of mowing on the channel bank, levee slopes, and floodway to a height of about 8 to 10 inches above the ground. Mowing is usually started in early May and completed in October. Most areas in the project are mowed at least once a year, with some areas mowed again in late summer. Unless they present an obstruction to flood flows, mature trees, especially cottonwood (*Populus fremontii*) and willow (*Salix goodingii*), are avoided during maintenance mowing operations. Mature cottonwood trees are scattered throughout the Study area and occasionally found in small groves in the overbank floodway. These trees

have been de-limbed up to a height of about 6 feet off the ground to remove any potential obstruction to flood flows and mowing operations.

Previously the vegetation management program included annual tree planting from 1968 until about 1978. Trees were planted for the purposes of providing sanctuary and breeding habitat for birds, shade in recreational areas, and for overall project appearance. Trees (primarily cottonwoods) were planted in rows parallel to the river and in arranged triangular groups of three trees.

In addition, occasional unregulated burning of the Study area occurs. The USIBWC does not conduct or encourage prescribed burns. Figure 2.2 shows a recent example of an unregulated burn.

Figure 2.2
Burn Scar Resulting from Unregulated Fire

Channel Banks and Levee Slopes

The annual channel bank mowing is generally conducted using a tractor equipped with a rotary mower. The few segments of banks that cannot be mowed are cleaned with a drag line. Slopes on each side of the levees are mowed at least once each year by rotary mowers pulled by tractors. The mowers are 5 feet in diameter and are usually arranged in groupings of three or four mowers in order to mow 15 or 20 feet widths. An important function of this mowing is to limit growth of Russian thistle (*Salsola kali*, also known as tumbleweed), which retains sediments and forms sediment plugs when blown into the normal flow channel. Figure 2.3 provides an example of a levee located south of the Fabens Port of Entry.

Figure 2.3
An Example of the Levee

Floodway

Mowing of the floodway is conducted at least once each year prior to mid-July to ensure safe passage of design flood flows. The mowers are 15 feet in diameter and are usually arranged in groupings of two or three mowers in order to mow 30 or 45 foot widths. Mowers are set to cut growth about 6 to 8 inches above the ground. Mowing prevents the growth and expansion of salt cedar (*Tamarix ramosissima*) and other vegetation over the floodway. If the floodway were not mowed on a regular basis, shrubs would become too large in diameter to mow and would require alternative woody vegetation control such as root plows.

2.2.1.4 Levee Roads

Levees have crown widths which vary from 16 to 29 feet, 3:1 slopes on the river side and 2½:1 slopes on the land side. Levees have a graded gravel surface roadway for passage of O&M personnel and equipment. Levee roads are not intended for public use and signs are posted against trespass and encroachment; however, there are some access roads which still allow entry to the levee. The roads remain unpaved since gravel roadways are adequate for maintenance purposes.

Approximately 40 to 50 miles of levee road are graded annually, and the remaining levee road is kept in an adequate state of repair for the passage of O&M personnel and equipment. An average of about 4 miles of levee roads is resurfaced with 4 inches of gravel annually. The resurfacing is done more frequently for those segments receiving more vehicular traffic. All levee roads are scheduled for resurfacing on a 20-year cycle, depending on availability of funds. Resurfacing consists of applying a 4 to 6 inch layer of flexible base material. The levee road is closed to the public during resurfacing, and a water truck sprinkles the levee haul roads

to control dust. One mile of levee can be resurfaced in approximately 6 days. Figure 2.4 shows an example of a portion of the levee road just south of the Ysleta/Zaragoza river crossing facing Mexico.

Figure 2.4
An Example of Rectification Project Levee Roads

2.2.1.5 Channel Bank Protection

Approximately 86 miles (of a 166.3-mile total) of river channel banks are protected with rock revetment and jetties. Rock revetment and jetties minimize erosion and prevent channel encroachment that could compromise levee integrity. Water- and wind-deposited sand has covered most revetment and jetties, resulting in a natural appearance. Since 1961, rock work performed on the United States side has been minimal.

Table 2.1 summarizes the primary maintenance activities for the Study area. The totals represent current estimates based on the best professional judgment of maintenance staff. The listed activities were reviewed for potential impacts to T&E species.

Table 2.1
Primary Maintenance Activities Conducted Annually in the Study Area

Description	Units/Year	Quantity
Sediment Removal and Disposal	cubic feet	60,000
Floodway Leveling	miles	5-10
Vegetation Management	acres	4,200
Levee Roads Management	miles	50
Channel Bank Protection	linear feet	200

2.2.2 Secondary Maintenance Activities

A number of secondary maintenance activities are conducted throughout the year. These activities include basic infrastructure maintenance such as painting, cleaning and removing obstructions from dams and bridges among other actions. The secondary maintenance activities are listed below.

2.2.2.1 American Dam and Canal

Normal maintenance for the American Dam and Canal is done annually during the non-irrigation period between late September and early March. Maintenance includes lubricating, cleaning, and painting the gates; and removal of sediment from the channel above American Dam and from the American Canal. All gates are lubricated every 6 months or more frequently, if needed. The banks of the American Canal above the concrete lining are cleared of vegetation each summer (Figure 2.1).

2.2.2.2 International Dam

Normal maintenance for the International Dam is performed annually during the non-irrigation period between late September and early March. Maintenance includes lubricating, cleaning, and painting the gates, and removal of sediment from the channel above the dam (Figure 2.1).

2.2.2.3 Bridges

Eight bridges cross the USIBWC right-of-way along the length of the Study area. Table 2.2 lists the bridges and their locations in miles below American Dam. Natural gas, petroleum, water, and other utility lines also cross the river in various locations. Several older bridges present obstructions to design flood flows due to their span or height.

The Bridge of Americas, Guadalupe-Tornillo Bridge, and the Fort Hancock-El Porvenir Bridge are international bridges and, as such, are jointly maintained by the Mexican and U.S. Sections of the International Boundary and Water Commission. The Ysleta-Zaragoza

Bridge is owned by the City of El Paso. The Bridge of the Americas (Cordova) is required by law to be inspected bi-yearly and repairs made. Bridge maintenance consists of painting and repair of all metal work, repair of all deteriorated concrete and stucco, removal of debris and trash from pilings during and after floods, and placement of sand and/or salt on the roadways during freezing weather. Normal maintenance, such as the weekly cleaning of the bridge deck and pedestrian walkways and painting and restoration of deteriorated concrete, is performed throughout the year. Appendix G indicates the locations of the bridges.

Table 2.2
Bridges Crossing the Study Area

Bridge	Location Below American Dam (miles)
Railroad Bridge	3.68
Paso del Norte	3.78
Railroad Bridge	3.87
Good Neighbor Bridge	4.00
Bridge of Americas	6.32
Ysleta-Zaragosa Bridge (recently replaced)	15.59
Guadalupe-Tornillo Bridge (Fabens Bridge)	36.92
El Porvenir-Ft Hancock Bridge	59.61

2.2.2.4 Grade Control Structures

There are six grade control structures in the Study area (Table 2.3). Maintenance of these structures consists of painting of the flash board guides, walkways, and exposed sheet piling supporting the parapet walls on each side. Sufficient flash boards are on hand during the irrigation season to assure that United States and Mexico users may divert water from the river at these locations, consistent with flood operations of the Project. The structures are kept free from debris during the flood season. Normal maintenance is performed between September 15th and the following March.

2.2.2.5 Levee Structures

There are approximately 34 concrete and metal culverts and one timber bridge across drains and diversions within the Study area. Normal maintenance of levee structures, such as cleaning and painting, is performed annually between September 15th and the following March. Flap gates and manually operated gates and valves on structures are examined, oiled, and trial operated at least twice a year, with one of those times occurring just prior to the beginning of the irrigation season.

Table 2.3
Gradient Control Structures in USIBWC Right-of-Way

Grade Control Structure	Location Below American Dam (miles)	Operation
International Dam	2.11	USIBWC
Riverside Diversion Structure (Declared an obstruction by US and Mexico)	16.69	USBR/ El Paso Co. Water Improvement District #1
Island Grade Control Structure	32.36	USIBWC
Tornillo Grade Control Structure	40.05	USIBWC
Alamo Grade Control Structure	53.14	USIBWC
Guayuco Grade Control Structure	74,44	USIBWC

2.2.3 Irrigation Structures

The canals leading from the diversion dams provide irrigation water to surrounding agricultural land by way of a wide network of canals and laterals. Water is removed from the agricultural land by a series of drainage canals and spillways that eventually flow back into the Rio Grande. The drains and spillways enter the USIBWC right-of-way by passing through the flood protection levees. Some drains are equipped with gate valves or control structures at the levee crossing which regulate water level in the drains. The gate valves and control structures are designed to be closed during a flood to prevent water from backing into the canal system and flooding land outside the levees.

USIBWC coordinates with El Paso County Water Improvement District #1 and Hudspeth County Conservation and Reclamation District #1 in reporting maintenance needs on their structures (e.g., spillway outfalls). If inspections uncover any problems on these structures which impact USIBWC projects, the problems are reported to the districts, who perform their own maintenance and/or repairs.

2.3 INTERNATIONAL MAINTENANCE AGREEMENT WITH MEXICO

The division of maintenance work for the Rectification Project is set forth in the International Boundary Commission Minute No. 165 dated August 13, 1930 (prior to the 1944 Water Treaty which, in part, changed the name of the commission to, International Boundary and Water Commission. The Minute provides appropriate rules for maintenance and preservation of the Project. Maintenance work in the International and American Dam was addressed in the preceding sections.

2.3.1 Floodways

"Rule No. I – The International Boundary Commission shall keep the floodway clear of vegetation. The United States Section shall be responsible for and perform the labor required on the portion comprised between the pilot channel and the left or northerly levee,

and the Mexican Section shall be responsible for and perform the labor required on the portion comprised between the pilot channel and the right or southerly levee. The expenses of clearing shall be borne respectively by each Section."

2.3.2 Pilot Channel

"Rule No. II – The International Boundary Commission shall maintain the pilot channel reasonably parallel to the rectification levees, preventing the formation of sharp curves. Each Section of the International Boundary Commission shall bear half the cost of these works."

2.3.3 Levees

"Rule No. III – The United States Section of the International Boundary Commission shall maintain at its cost the left or northerly rectification levee to the established grade, but shall have the right to increase the levee section on the land side. The Mexican Section of the International Boundary Commission shall maintain at its cost the right or southerly rectification levee to the established grade, but shall have the right to increase the levee section on the land side."

2.3.4 Structures

"Rule No. IV – The structures located in, on, or across the floodway shall be maintained in good condition by work performed jointly by the International Boundary Commission, and half the cost thereof shall be borne by each section."

2.4 ADDITIONAL ACTIVITIES BY OTHER AGENCIES

2.4.1 Immigration and Naturalization Service

As an international boundary, the Study area is under constant surveillance by the Immigration and Naturalization Service (INS). This surveillance is heaviest within the El Paso, Texas city limits, with a lower but constant level of patrolling along the river to the south and east of El Paso, Texas. INS vehicles use the levee roads and floodway for travel and for stationary patrol sites. INS agents also create "drag roads," usually parallel to the levee toe on the riverside. A drag road is a cleared area, which is dragged smooth, e.g., with chains, then checked later for footprints or other signs of use. The INS has a wide range of options for improving visibility in the floodway in order to conduct its mission.

2.4.2 Rio Bosque Wetland Project

The Rio Bosque Wetland Refuge encompasses 318 acres of land in El Paso County, Texas, about 10 miles southeast of the city center. The refuge is located between 185 acres of settling ponds at the R. Bustamante wastewater treatment plant, and 230 acres of adjacent ponds used as a regulating reservoir for the El Paso County Water Improvement District No. 1. This refuge was built as mitigation for construction of the American Canal Extension

Project (see Section 3). The University of Texas at El Paso (UTEP) in accordance with an agreement with the City of El Paso, Texas signed November 19, 1996 manages the refuge. USIBWC began construction on the project April 7, 1997, and signed over management of the refuge to UTEP on September 12, 1997.

2.4.3 Sediment Dams

In 1960 the USIBWC requested the SCS, now renamed the Natural Resources Conservation Service (NRCS), to make studies of means for controlling the sediment inflow from tributary streams to the Rio Grande in the Canalization Project and Rectification Project. The SCS determined that sediment dams in tributary arroyos could be considered under the Watershed Protection and Flood Protection Act of 1954. Between 1969 and 1975, nine dams were constructed on five tributaries to the Rio Grande Rectification Project at Alamo Arroyo (three dams), Camp Rice Arroyo (one dam), Diablo Arroyo (two dams), Macho Arroyo (one dam), and Madden Arroyo (two dams). The NRCS is responsible for maintenance work on the dams and associated access roads in the Rectification Project (USIBWC 1994).

2.4.4 Annual Cattle Drive

The Southwestern International Livestock Show and Rodeo, Inc. sponsors an annual cattle drive on the levee road and flood plain of the Rio Grande Rectification Project from Riverside Dam to Fonseca Road. In most cases the activities begin in late January or early February in conjunction with the El Paso Rodeo. It is usually a 2-day activity. An overnight camping area is established in the vicinity of Riverside Dam to include a temporary holding pen for 50 or so cattle. On the following day the cattle are moved (typical Texas cattle drive) upstream along the floodway to Fonseca Road, where they are loaded onto cattle trucks to be driven to the El Paso Coliseum. Approximately 300 individuals participate.

2.4.5 Ysleta del Sur Pueblo Annual Ceremonial Activities

Members from the Ysleta del Sur Pueblo have been conducting religious ceremonies and collecting materials at historic sacred sites along the Rio Grande each year since establishment of the pueblo in the Paso del Norte area after the Pueblo Revolt in 1680. The precise location of these sites, the Spiritual Activity Area, and practices associated with the ceremonies are secret. In general terms, the Spiritual Activity Area is a reach of the Rio Grande extending about 5/8ths of a mile upstream from the Ysleta-Zaragosa Bridge to a point at the eastern boundary of the Ysleta Grant just over 1 mile downstream from Riverside Dam.

SECTION 3
INTERRELATED STUDIES

A number of studies have been conducted on projects within and in proximity to the Study area. This section contains a summary of major environmental studies, and NEPA-related documents with information relevant to potential impacts of T&E species as well as the environmental conditions in the Study area.

3.1 BOUNDARY ASSESSMENT PROJECTS, ASSESSMENT OF VEGETATION AND TERRESTRIAL VERTEBRATES

The USIBWC Boundary Preservation Project (BPP) includes the dredging and widening of the Rio Grande between Fort Quitman and Presidio, Texas. The area is adjacent and south of the Study area. The project was designed to prevent significant movement of the river channel and remove plugs that impede river flow. As part of the BPP, two year-long assessments of flora and fauna in the project area were conducted to compare before and after populations and assess the effectiveness of mitigation efforts. Reports on these studies were completed in 1978 and 1993 (Engel-Wilson and Ohmart 1978; Ohmart *et al.* 1993).

The study found that native trees (*e.g.,* cottonwoods and willows) virtually disappeared from the BPP area between 1978 and 1993. It was recommended that stands of native tree seedlings be left undisturbed, if feasible. The study also found that the river channel in parts of the BPP was perched above the flood plain due to siltation and impeded flow, resulting in inundation and build-up of salts which favor exotic salt cedar over native vegetation.

The Engel-Wilson and Ohmart study (1978) did not directly address T&E species, but did find that bird use was much higher in cotton-willow (*Populus-Salix*) and screwbean mesquite-wolfberry (*Prosopis pubescens-Lycium pallidum*) associations over stands of exotic trees. No T&E bird species were observed in either study. By the time of the Ohmart *et al.* study (1993), the willow-cottonwood community was virtually gone, indicating a reduction in favorable bird habitat. The studies also noted that waterfowl density was associated with pond margins and intermittent wetlands. Wetland habitat is extremely rare in the BPP area.

3.2 ENVIRONMENTAL ASSESSMENT FOR OPERATION AND MAINTENANCE OF THE RECTIFICATION PROJECT

In March 1979, USIBWC prepared an environmental assessment (EA) for the annual O&M of the Rectification Project (USIBWC 1979). The EA concluded that O&M activities do not impact endangered species or adversely affect any critical habitat, and that the annual O&M work does not constitute a major federal action which would cause significant local, regional, or national impact on the environment.

3.3 BRIDGE OF AMERICAS REPLACEMENT EA

A 1992 EA of the Bridge of the Americas concluded that construction of the bridge would not significantly impact natural and cultural resources (USIBWC 1993a). The bridge is located in a reach of the Rio Grande which is confined to a concrete channel 4.4 miles long. This concrete channel did not provide habitat for T&E species. Notice of availability of the Final EA and Finding of No Significant Impacts (FONSI) was published in the Federal Register July 14, 1993 (FR 1993c).

3.4 RIO GRANDE MANAGEMENT PLAN

On July 18, 1994 the USIBWC submitted the Rio Grande Management Plan to fulfill a special condition of the Clean Water Act Section 404 permit issued by the United States Army Corps of Engineers (USACE) for dredge and fill activities associated with the annual maintenance on the Rectification Project and three other USIBWC projects (the Presidio/Ojinaga Flood Control Project, the Rio Grande Boundary Preservation Project, and the Rio Grande Canalization Project). The purpose of the management plan was to identify opportunities for preservation and enhancement of riparian habitat and to identify possible mitigation measures for unavoidable impacts (USIBWC 1994).

3.5 BIOLOGICAL ASSESSMENT OF SPOIL REMOVAL IN THE CANALIZATION PROJECT AREA

A BA was prepared in 1994 (Ohmart 1994) on spoil removal in the Canalization Project located north of the Study area. The report separately evaluated each arroyo in the Canalization Project and recommended ways to minimize impacts. The study indicated that the bald eagle (*Haliacetus leucocephalus*), interior least tern (*Sterna antillarum*), and whooping crane (*Grus americana*) could potentially occur as transients in the Canalization Project. These species were not expected to be impacted due to the limited disturbance by spoil removal and timing of the activity. The northern aplomado falcon *(Falco femoralis septentrionalis*), the southwestern willow flycatcher (*Empidonax traillii extimus*), and Sneed pincushion cactus (*Loryphantha sneedii* var. *sneedii*) were not expected to occur due to lack of suitable habitat. The BA determined that impacts on T&E species would be insignificant due to lack of habitat.

3.6 AMERICAN CANAL EXTENSION PROJECT EA

The Rio Grande American Canal Extension (RGACE) included rehabilitation of a portion of the existing Franklin Canal, construction of a new, reinforced concrete-lined canal, and other associated works. The EA concluded that the project would benefit fish and wildlife by implementation of mitigation plans to provide wetlands (USIBWC 1993b).

Notice of availability of the Final Environmental Assessment and a FONSI was published in the Federal Register January 7, 1994 (FR 1994a). This publication included a report by the US Fish and Wildlife Service, with Texas Parks and Wildlife Department, prepared under authority of the Fish and Wildlife Coordination Act. The Fish and Wildlife

report recommended creation of 30 acres of wetlands as mitigation for losses to wetland habitat associated with construction of the project. The Rio Bosque Park was suggested as a location for the wetlands mitigation site.

3.7 RIO GRANDE RECTIFICATION PROJECT MITIGATION ASSESSMENT

In 1995, the USIBWC completed a mitigation assessment as a requirement for Special Condition No. 2 in the Department of the Army Permit No. TX-91-50426 for four potential mitigation opportunities along the Rio Grande Rectification Project (USIBWC 1995). The USIBWC determined that potential mitigation opportunities could be accomplished with existing resources available to the USIBWC. Other opportunities would be accomplished as funding and new information became available. Four mitigation opportunities were considered, Rio Bosque Park Wetland (Figure 3.1), seeding denuded areas, tree planting, and preservation of snags in the floodway. These mitigation opportunities were intended to address lack of habitat in the Rio Grande Rectification Project area.

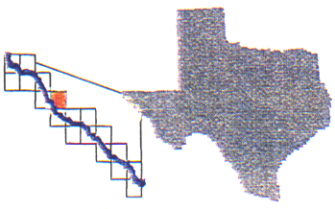
3.8 RECONSTRUCTION OF THE AMERICAN CANAL PROJECT EA

A draft EA for the proposed action of reconstruction of the existing American Canal was published October 2000 (USIBWC 2000). The proposed project for rehabilitation and enlargement of the 1.98-mile-long American Canal (also known as Reach F of the RGACE) included demolishing the deteriorating concrete open channel segments of the canal and replacing them with reinforced concrete-lined canal segments. No T&E species were observed in this study and no potential T&E habitat was affected by the action. The EA concluded that this activity was not a major federal action that would have a significant adverse effect on the quality of the human environment

3.9 EIS FOR EL PASO-LAS CRUCES SUSTAINABLE WATER PROJECT

In December 2000, an environmental impact statement (EIS) was completed for the Regional Sustainable Water Project, an initiative to secure Rio Grande water as a long-term drinking water supply for the Cities of El Paso and Las Cruces (USIBWC and EPWU/PSB 2000). This project requires water transfer using diversion structures and aqueducts whose area of influence overlaps with that of the Rectification Project.

The "River with Local Plants" was identified as the Preferred Alternative for the project. This alternative includes expansion of an existing water treatment plant, construction of four new plants, and construction of four permanent diversion structures on the Rio Grande. Water will be conveyed through underground pipelines. The EIS includes Standard Construction and Operating Procedures, Best Management Practices, and recommended environmental enhancements and impact avoidance.



1000 0 1000 2000 Feet

Figure 3.1

USIBWC Study Area
Digital Orthoimagery Showing
Rio Bosque Park and Riverside Dam

PARSONS ENGINEERING SCIENCE, INC.

T&E studies done for this EIS included habitat studies and reconnaissance-level surveys for birds, amphibians and reptiles, and mammals. No suitable habitat was observed for the Gila trout (*Oncorhynchus gilae*). Based on literature reviews and habitat evaluations, the bald eagle, southwestern willow flycatcher, interior least tern, and whooping crane potentially use or migrate through the area. The bald eagle and southwestern willow flycatcher were observed during field surveys. Bald eagles were observed along the Rio Grande in Doña Ana County, New Mexico; southwestern willow flycatchers were observed in Selden Canyon.

3.10 FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE EL LPASO-LAS CRUCES REGIONAL SUSTAINABLE WATER PROJECT

The Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) directs the federal action agency to consult with the USFWS for purposes of "preventing a net loss of and damage to wildlife resources." It further directs the action agency to give wildlife conservation measures equal consideration to features of water resource development.

In March, 2001, the USFWS published the final Fish and Wildlife Coordination Act Report for the El Paso-Las Cruces Regional Sustainable Water Project (USFWS 2001). Based upon the evaluation of fish and wildlife impacts, and the existing ecosystem condition of the Rio Grande from Elephant Butte Reservoir to El Paso, the USFWS made several recommendations to mitigate for expected impacts of all alternatives proposed in the El Paso-Las Cruces Regional Sustainable Water Project EIS. The USFWS compared and ranked alternatives based on their potential impacts on aquatic and terrestrial resources, and rated those alternatives in terms of their potential to enhance aquatic and terrestrial communities. The USFWS stated that one benefit of the preferred alternative for the Rio Grande fisheries and other aquatic-dependent species is the contribution to a more year-round flow regime that would be necessary before effective enhancements to the riverine ecosystem could be considered (USFWS 2001).

3.11 BIOLOGICAL ASSESSMENT FOR THE EL PASO-LAS CRUCES REGIONAL SUSTAINABLE WATER PROJECT

In May 2001, a BA was completed for the Regional Sustainable Water Project (USIBWC and EPWU/PSB 2001). The BA addressed the presence of potentially suitable habitat for T&E species, results of field surveys, and effects determination for species with potential to occur in the Study area. The BA found that potential habitat existed in the Rio Grande corridor for the brown pelican (*Pelecanus occidentalis*), whooping crane, bald eagle, southwestern willow flycatcher (Selden Canyon only), and interior least tern. The BA concluded that the effect of the project on these species was "may affect, not likely to adversely affect." The BA provided recommendations for mitigation and enhancement of wildlife habitat. Recommendations included control of exotic species, channel enhancements (embayments, backwaters and sloughs), native riparian vegetation plantings, and watershed management measures.

3.12 CANALIZATION PROJECT THREATENED AND ENDANGERED SPECIES SURVEY TECHNICAL REPORT

In April 2001, a report on T&E species was prepared for the Canalization Project (Parsons 2001). That report describes the results of T&E habitat surveys and T&E species presence/absence surveys conducted in the Canalization Project (April 2000, September 2000, November-December 2000, and January 2001). The only T&E species observed during field surveys was the interior least tern. No suitable nesting habitat for T&E bird species was observed, although there was limited habitat to potentially attract migratory birds such as the interior least tern and piping plover (*Charadrius melodus*), for feeding and resting. No aquatic species nor suitable habitat for aquatic T&E species was observed (Parsons 2001).

SECTION 4
ECOLOGICAL SETTING

This section describes the Study area in terms of its historic and existing condition. Reasons of ecosystem degradation are identified to establish a context from which the reader can assess report findings.

4.1 HISTORICAL CONDITIONS

When the Spanish arrived in the 16th century, the bank, sand bars, and adjacent flood plain areas of the Rio Grande were vegetated with scattered bosques of varying age valley cottonwood, with a willow and saltgrass (*Distichlis spicata*) dominated understory (Scurlock 1998). Open, grassy areas, or vegas, were also present. Cattails (*Typha latifolia*) and other wetland species grew in and around ponds, marshes, and swampy sites. Other major plant species associated with bosques included New Mexico olive (*Forestiera neomexicana*), baccharis (*Baccharis emoryi*), false indigo bush (*Amorpha fruticosa*), wolfberry (*Prosopis pubescens*), and in southern reaches, mesquite (*Prosopis* spp.). All these plant communities were considerably modified by human activity during the historic period (Crawford *et al.* 1993, and Dick-Peddie 1993). Fossil evidence traces the bosque community back 2 million years (Crawford *et al.* 1996). Bosques were dynamic, growing, and spreading when weather was favorable, and dying off during periods of prolonged drought or prolonged floods. The communities ranged from old growth to pioneer species, providing varied and diverse habitat for native wildlife.

Wetlands were abundant in the Rio Grande flood plain (Stotz 2000), evidence of a shallow water table and dynamic shifting river. The early Spanish explorers throughout El Paso and Mesilla Valley observed numerous oxbows and pools. The wetlands provided habitat and refuge for wildlife during low flows of the river (Ackerly 1998).

Numerous floods resulting in a highly variable river channel characterized the flow regime. Snowmelt, widespread summer rains, and localized heavy thunderstorms caused floods (Scurlock 1998). The river course frequently changed, meandering throughout the valley. Minor lateral shifts were frequent and even large-scale changes in the channel occurred. Channel width varied considerably; historical reports described the river width ranging from 600 feet wide to virtually a trickle full of sandbars (Stotz 2000).

4.2 EXISTING CONDITIONS

Existing conditions of the Study area are described through a brief review of current climatic, hydrologic, geomorphic and biotic conditions.

4.2.1 Climate

The climate throughout the Study area is classified as semi-arid continental, characterized by fairly hot summers, mild winters, and short temperate spring and fall seasons. The average frost-free period for the Study area is approximately 231 days, usually beginning mid-March and lasting through mid-November. The average annual temperature is 62° F with recorded temperature extremes of 109 °F and -8 °F (USDA 1971).

Precipitation averages 7.7 inches annually. Approximately 60 percent of the annual precipitation occurs from July through October. Although summer rains normally occur in the form of local thundershowers, heavy general precipitation can occur late in the summer with the arrival of tropical air masses from off the West Coast of Mexico (USDA 1971).

Evaporation rates vary from 90 to 100 inches per year. These high evaporation rates are the result of the low relative humidity, often as low as five to ten percent during the summer afternoons with high temperatures and winds (USDA 1971).

4.2.2 Topography

The El Paso-Juárez Valley is in a river flood plain, which is relatively flat with a gentle down river slope 2 to 3 feet per mile. The flood plain is crossed by canals, drainage ditches, roads, old segments of the Rio Grande channel, and by arroyos below American Dam. Sloping to rugged hills flanks both sides of the flood plain.

4.2.3 Watersheds

Sloping to rugged hills flanks both sides of the Study area flood plain. Arroyos from these areas discharge to the flood plain, and some discharge directly to the river. These watersheds range in elevation from 4,500 feet to over 7,000 feet mean sea level. Arroyo gradients in the steeper portions of these watersheds attain a fall of several hundred feet per mile. The United States tributary with the largest watershed is Guayuco Arroyo in Hudspeth County, near the downstream end of the project.

In 1960, the USIBWC requested that the Soil Conservation Service (SCS) conduct studies of means for controlling the sediment inflow from tributary streams to the Rectification Project in Hudspeth County, Texas, for the purpose of lowering annual maintenance costs. The SCS determined that flood and sediment retarding dams for several arroyos tributary to the Rio Grande in the identified reaches could be considered under the Watershed Protection and Flood Protection Act of 1954 (68 Stat. 666), as amended. Between 1969 and 1975, dams were constructed on five tributaries to the Rio Grande at Alamo (three dams), Camp Rice (one dam), Diablo (two dams, Macho (one dam), and Madden (two dams) arroyos.

4.2.4 Hydrology

The Rio Grande basin consists of two major watersheds. One originates from the southern slopes of the Colorado Mountains and Northern New Mexico, the other from the mountain ranges of Chihuahua, Mexico and the Pecos Basin of southern New Mexico and far west Texas. Although the Rio Grande is shown as a continuous river, the flow from the Colorado Mountains at times diminishes near Fort Quitman, Texas. The new perennial flow begins at the confluence of the Rio Conchos from the Mexican side.

The flow of the Rio Grande that originates from the watersheds in the southern slopes of the Colorado Mountains and the mountain ranges of Northern New Mexico is stored at Elephant Butte Dam. The water is used to irrigate the Mesilla, El Paso, and Juárez Valleys.

Water released from Elephant Butte Dam has averaged 682,000 ac-ft annually. A large portion of this flow (~ 495,000 ac-ft) is diverted to irrigate croplands in New Mexico. The remainder and return flow then reach El Paso at an annual rate of 187,000 ac-ft. As the flow reaches American Diversion Dam, 269,000 ac-ft has been diverted annually to the American Canal which is the main supply canal for the El Paso Valley. The diversion to Mexico has amounted to 60,000 ac-ft annually which is used to irrigate the Juárez Valley along with shallow groundwater and municipal sewage.

Elephant Butte Reservoir operations are based on average historic losses and evaporation rates for Elephant Butte and Caballo Reservoirs. Scheduled outflow from Elephant Butte and Caballo is based on average irrigation demands for years with a full water supply.

4.2.5 Geomorphic Characteristics

Physically, the channel is engineered with sloped sides rather than the more vertical channel banks of a developed natural stream. Any maintenance of the channel to maintain the engineered configuration discourages establishment of vegetation cover and root mass that would normally stabilize a vertical stream bank. Furthermore, flood control levees and irrigation flow regimes have kept the channel from developing the meanders and ponded characteristics historically documented. The plant community is maintained at a state similar to early successional riparian communities. The practice of leveling the floodway encourages invasion of cleared areas by pioneer species or invasive plants such as salt cedar and Russian thistle. Mowing suppresses woody vegetation in the flood plain.

4.2.6 Soils and Geology

Intermontane sediments known locally as bolson deposits underlie most of El Paso County, Texas. These sediments washed down from nearby mountains and filled the basin that was formed during the uplift of the mountains and the faulting that occurred in the Tertiary period and continued into the Quaternary. The basin in El Paso County, Texas, known as the Hueco Bolson, was enclosed at first but was later drained when the Rio

Grande made its present course. Since then, water from precipitation and runoff has leached the carbonates in the parent material and formed layers of caliche at various depths below the surface (USDA 1971).

Soils on the flood plain of the Rio Grande formed in alluvium recently deposited by the river. At the landscape level, flood plain soils are characterized as the Harkey-Glendale association by the NRCS (USDA 1971). This association is made up of deep, nearly level calcareous soils. Surface soils are typically silty clay loams over stratified layers of loamy soils and fine sand. This series consists of soil materials, chiefly from Gila soils, which are silty clay loam, fine sandy loam, and sand, in texture. The soil is made of recently deposited alluvial material, which has been moved and shaped for construction of levees and for relocation and straightening of the river channel.

Most of the Rio Grande flood plain soils within the region are used for irrigated farmland. Cultivated areas are leveled and commonly graded into benches. Soils were formerly subject to flooding from the river but are now well protected outside the USIBWC levees.

4.2.7 Vegetation Communities

The Chihuahuan Desert can be subdivided into three regions (Schmidt 1979; Henrickson and Straw 1976; Brown 1982): the northern Trans-Pecos region; the middle Mapimian region; and the southern Saladan region (MacMahon 1988). The area of the Study area is included in the northern Trans-Pecos region of the Chihuahuan Desert. This region includes all sections of the Chihuahuan Desert in the U.S. and the northernmost sections of the desert of Mexico.

The Trans-Pecos region of the Chihuahuan Desert is historically a mosaic of grasslands and desert shrublands (Burgess 1995, MacMahon 1988, McClaran 1995). The grassland areas are dominated by tobosa (*Pleuraphis mutica*), black grama (*Bouteloua eriopoda*), and other grass species. The dominant desert shrub species are either creosote bush (*Larrea divaricata*) or tarbush (*Flourensia cernua*) or a mixture of the two. Other shrub species and succulents are also present in this area. In areas where washes or rivers are present, riparian vegetation is dominated by willows (*Salix* spp.), cottonwood (*Populus fremontii*), and mesquite (*Prosopis* spp.). Other species such as ash (*Fraxinus* spp.) and desert willow (*Chilopis linearis*) may also be present. In the recent past riparian areas have been degraded, and the invasive salt cedar has attained dominance in many locations.

Based on the Texas Natural Heritage Program vegetation classification system (Diamond *et al.* 1987), scrubland in this region falls into the creosotebush series (*Larrea tridentata*); and the Rio Grande system falls into the Cottonwood-Willow series (*Populus* spp.-*Salix* spp.). Historically, riparian plant communities would have been classified as bosque or deciduous forest, of cottonwoods and willows, with Berlandier ash (*Fraxinus berlandieri*), netleaf hackberry (*Celtis reticulata*), and little walnut (*Juglans microcarpa*) often present as components of the community. Fossil evidence traces this community back 2 million years (Crawford, *et al.* 1996). Riparian communities were dynamic, growing and

spreading when weather was favorable, and dying off during periods of prolonged drought or prolonged floods. A wide range of age classifications, from old-growth to pioneer communities, provided a varied and diverse habitat.

Vegetation varies considerably with water availability. The sites vary from those with saturated riverbank soil to dry sites on mesa slopes and uplands. During the off-irrigation season, the flood plain is underlain by a shallow water table that can result in moist sites within the floodway. Occasional communities of mesquite, cottonwood, and salt cedar trees are found on the flood plain or arroyo alluvium between the maintained floodway and mesa slope.

4.2.8 Avians

The Rio Grande is a major migratory flyway for numerous bird species, particularly waterfowl, shore birds, and those associated with riparian habitats. The cleared flood plain also provides suitable hunting for raptors. Of the great variety of birds found in the area, some common species include the great blue heron, red-winged blackbird, western kingbird, burrowing owl, gadwall, mourning dove, and turkey vulture. Bird species expected to occur, and those observed in the Study area, are listed in Appendix C.

4.2.9 Mammals

Terrestrial game animals are sparse due to intensive land use and insufficient food and cover at many locations. The mule deer is the only large game animal known to occur in the region. The species of mammals expected to occur in the Study area are listed in Appendix D.

Principal non-game mammals are coyote, bobcat, spotted skunk, striped skunk, desert cottontail, black-tailed jackrabbit, porcupine, gopher, several species of bats, and several species of rats and mice. Furbearers include the kit fox, gray fox, long-tailed weasel, raccoon, ringtail, badger, beaver, nutria, and muskrat.

4.2.10 Reptile and Amphibian Species

As in the case of mammals, a small number of reptile and amphibian species are expected in the Study area due to intensive land use and insufficient food and cover at many locations. Reptile and amphibian species that could be present in the Study area are listed in Appendix D.

4.3 ECOSYSTEM DEGRADATION

Riparian ecosystems in the southwest are declining due to anthropogenic disturbances (Szaro 1989, Briggs 1995, 1996, Crawford *et al.* 1996, Patten 1999). Degradation has been a result of direct impacts as well as the cumulative effect of numerous, indirect impacts. Activities which have negativly impacted riparian systems in the Study area mirror those throughout the southwest. Causes of decline, either separately or in combination, include

altered hydrology, establishment of exotic species (e.g., *Tamarix* spp.), overgrazing, flood plain reduction, and land use practices (Everitt 1998; DeBano and Schmidt 1989; Schmidly and Ditton 1978).

4.3.1 Hydrologic Modifications

Impacts of dams and water control structures include modifications to historic hydro periods, reduction in suspended sediments, and increased rate of channelization and incision. Altered stream hydrology has been at least one major cause of the decline of native bosques creating conditions favorable for salt cedar establishment and eventual dominance within locations previously characterized as cottonwood-willow communities (Stromberg 1998). Four interrelated but separate modifications include changes in 1) peak flow characteristics, 2) total runoff, 3) water quality, and 4) aesthetic characteristics.

4.3.2 Dam Construction

Construction of Elephant Butte Reservoir in 1915 ended seasonal floods driving the dynamic equilibrium of the river. Impacts included changes in riparian communities, sediment deposition, flow patterns, reduced water volume, and seasonal variations. Current irrigation flows in conjunction with flood control have severely altered the complexion of the river as well as the associated vegetation communities.

4.3.3 Channelization and Channel Straightening

Channelization is the process whereby the channel bed and banks are modified, and roughness is reduced so that floodwaters pass more quickly and the channel conveys greater flood peaks without overtopping the stream banks. Scouring and sedimentation in the channel are major maintenance concerns because the river will naturally move within the flood plain in response to impeded flows from sediment accumulation. Over 60 miles of river length were removed by straightening bends and meanders in the Study area.

4.3.4 Flood Plain Reduction

The flood plain area of the Rio Grande was reduced by construction of flood control levees designed to protect agricultural land and real estate property. This had the effect of raising the water surface elevation during flood flows and increasing the potential for downstream flooding. Reduction of the flood plain also reduced or eliminated periodic inundation of wetland areas adjacent to the river.

4.3.4.1 Modification of Sedimentation Processes

Development of levees for flood control allowed for large-scale conversion of the flood plain for agriculture and development. Traditional flood control practices require maintaining levees and channels in a manner that most efficiently transfers water. As a result, the river flood plain and riparian corridor, and the natural nutrient replenishment process once provided by flooding, have disappeared.

Hydrologic processes are driven by the flow of water and sediments through the system (Stotz 2000). Changes in hydro periods as a result of dam operations altered sediment accumulation and reduced transportation of sediments downstream. Extensive sediment load, coupled with a low-gradient flow for much of the Study area created a braided, sinuous channel meandering through a wide flood plain. Sedimentation is now restricted within the narrow confines of the leveed channel presenting potential flood control problems only partially controlled by channelization. Sediment loads are currently managed through construction of sediment dams along arroyos in the upper portions of the Study area. Extensive deposits of sediment accumulate at arroyo mouths and diversion dams. Diversion dams reduce water velocity resulting in accumulation of sediments upstream and reduction of sediments below dams. Sediments must be removed by mechanical methods.

4.3.4.2 Land Use Changes

The term "land use" encompasses many activities which can affect stream resources directly through destruction of habitat as well as by influence on watershed processes, which govern water yield, water regimen, and sediment production. Major land use changes include conversion to agriculture, grazing, urbanization, and project maintenance practices.

Conversion to Agriculture

Conversion to agriculture has the immediate effect of removing native habitat from the system and the systemic influence of areas outside the converted lands through water diversion, hydro period modification (irrigation flow periods), water quality impact, etc. Converted land historically has greater economic value than the natural flood plain, and additional cumulative impacts such as levee construction and arroyo water diversion are implemented for flood protection. The storage and withdrawal of water for irrigation has played a major role in shaping the river channel and riparian area. Depletion of stream flow during the spring runoff period reduces the stream power available for transporting deposited sediments and seeds.

Grazing

Grazing is very limited within the Study area. However, where practiced, livestock grazing can impact riparian ecosystems in several ways, including altering vegetation diversity and density, stream channel morphology, water quality, and riparian soil characteristics (Kauffman and Krueger 1984). In addition, hoof action can alter riparian soil structure through compaction and streamside erosion. Compacted soils have less water-holding capacity inhibiting deep percolation of water into the soil profile (McBryde 1998).

Urbanization

Urbanization, including development of roads, buildings, other municipal or industrial structures, parking lots, etc., can have significant effects on the hydrology of a watershed. Development within the watershed directly and indirectly impacts the Study area's riparian and aquatic habitats. Direct removal of vegetation is the most obvious; however, cumulative impacts to water quality and associated flood management controls to protect developed sites within the watershed are potentially the most deleterious.

Invasive Species

Several species of salt cedar were introduced into the United States from southern Europe and the eastern Mediterranean region in the late 1800s. Many of these species escaped cultivation and spread rapidly throughout the riparian areas of the southwest. Salt cedar has several characteristics that make it well suited to the desert regions of the southwest.

Salt cedar is considered a facultative phreatophyte and is able to survive in conditions where groundwater is depleted and the soil is unsaturated (DiTomaso 1998). It can survive drought conditions longer than cottonwoods and willows, and can then rapidly respond to the presence of water (Devitt *et al.* 1997) and may desiccate water courses (Vitousek 1990; DiTomaso 1998). In addition to the ability of salt cedar to tolerate drought and saline conditions, there is some evidence that the fire regime of these riparian areas may be altered by the presence of salt cedar (Bock and Bock 1990; Smith *et al.* 1998). Salt cedar is relatively tolerant of fire, while most native riparian species are not. Salt cedar is the dominant woody species found in the Study area.

The Russian olive (*Elaeagnus angustifolia*) has also become established within many riparian areas of the southwest. Russian olive was introduced into the United States in the late 1800s, and subsequently escaped cultivation (Olson and Knopf 1986). Russian olive is a rapidly growing plant with a deep taproot and extensive lateral branching (Borell 1971). The Russian olive can effectively compete with native species for space and water and is a superior competitor on bare mineral substrates due to nitrogen fixing root nodules (Plant Conservation Alliance 1997). Russian olive is considered relatively salt tolerant, although not as salt tolerant as salt cedar (Olson and Knopf 1986; Vines 1971), and is often found as a co-dominant species with willow. Its value to wildlife is generally considered inferior to native riparian species (Olson and Knopf 1986).

Russian thistle was introduced into the United States in the late 1800s. It has colonized extensive areas within the Study area, particularly in disturbed sites in response to grazing and mowing. Seeds of Russian thistle are dispersed when the plant dries and wind tumbles the dried plant to a new location. Russian thistle is a particular problem in agricultural areas because of its extensive seed bank and water use. Research in croplands indicates that Russian thistle may be able to extract water from deep in the soil profile (Schillinger and Young 1999) potentially lowering the water table.

SECTION 5
METHODOLOGY

This section describes the methods for determining the presence of potential T&E species habitat, and effects determination.

5.1 ASSUMPTIONS

The following assumptions formed the basis of determining the presence of potential T&E species and effects determinations:

a. The likelihood for T&E species to occur in the Study area could be substantially determined from literature reviews.

b. Analyses of aerial photography and development of land cover classes could be used to concentrate field surveys in areas containing possible T&E habitat.

c. Field surveys were the basis for determining whether suitable T&E habitat occurred and were representative of the Study area. Although the likelihood of actually observing a rare species in the course of field surveys was low, suitability of habitat was readily identified in the field.

d. Species-specific surveys were required only if suitable habitat was found or if a species was actually observed in proximity to the Study area (based on reports, previous surveys, *etc.*).

e. Habitat surveys can provide general qualitative information about the Study area flora and fauna necessary to describe the overall conditions and natural resources of the area.

5.2 PROCESS

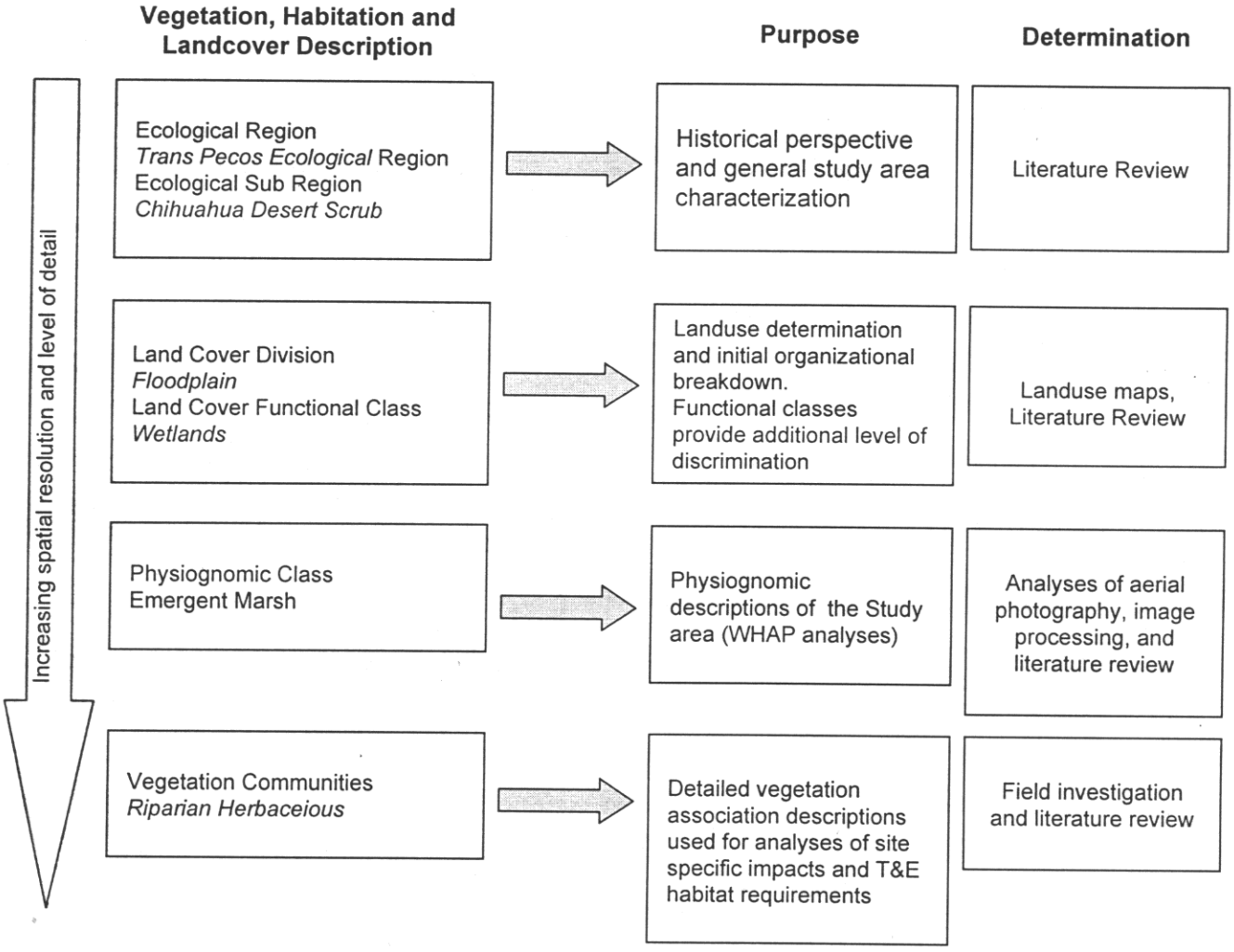
A stepwise process was used for assessing the 93.04-mile Study area and is described below. Figure 5.1 illustrates the process.

a. **Literature Review:** The USFWS and TPWD were contacted to obtain current county species lists and literature was reviewed, including previous BA's and other reports.

b. **Habitat Requirements Determination:** Habitat requirements were determined for species specific to the Study area, including aquatic habitat requirements, vegetation types, species composition, and physiognomic structure.

c. **Study Area Land Cover Class Determination:** Land cover classes for the Study area were determined and correlated with T&E habitat requirements to determine if potential habitat could be present in the Study area. Land cover classes, which could support potential T&E habitat, were targeted for subsequent field surveys.

Figure 5.1
Land Classes Analyses Process



Detailed Habitat Field Surveys: Surveys were conducted to collect detailed information on vegetation community types and aquatic river segments to suitability of potential T&E habitat. If suitable T&E habitat was found during field surveys, a species-specific survey was conducted to determine the presence or absence of T&E species. If established protocols exist, species-specific surveys were based on those protocols.

d. **Presence/Absence Surveys:** When appropriate, T&E species presence/absence surveys were conducted.

e. **Effects Determination:** Effects of the federal action on T&E species were determined (Section 7) by comparing habitat requirements against literature reviews, field surveys, and habitat analysis.

5.2.1 Literature Review and Habitat Requirements Determinations

The El Paso/Las Cruces Regional Sustainable Water Project EIS (USIBWC and EPWU/PSB 2000), scientific journal articles, textbooks, and other published sources were consulted to provide information on previous work conducted within the Study area. Several of the environmental documents reviewed for this report are summarized in Section 3.

5.2.2 Land Class Cover Determination

The purpose of defining land cover classes within the Study area was to identify areas where subsequent field surveys could best be conducted within the 93.04 mile river length. A modified version of the TPWD vegetation classification system (Hinson and Pulich 1995) was used to describe current land classes (Table 5.1). Appendix A summarizes the classification scheme and class definitions. Estimates of land cover classes, acreage, and distribution were determined from color infrared orthoimages. Images were displayed using ArcView® GIS and evaluated based on spectral reflectance, texture, and juxtaposition of features within the image.

Table 5.1
Land Cover Classification Scheme

Functional Class/Division		Physiognomic Class	
1.0	**Developed Lands**	1.1	Developed Lands
2.0	**Submerged Lands**	2.1	Open Water
		2.2	Unconsolidated Shore/Sandbar
3.0	**Transitional Lands**	3.1	Woodland
		3.2	Shrubland
		3.3	Herbaceous
		3.4	Exposed Ground
		3.5	Agriculture
4.0	**Wetlands**	4.1	Palustrine Woodland
		4.2	Palustrine Shrubland
		4.3	Emergent Marsh
5.0	**Upland**	5.1	Herbaceous
		5.2	Woody/Shrub-scrub
		5.3	Exposed/Bare Ground

5.2.3 Field Surveys

A workplan was completed in April 2000 and approved by USIBWC. The workplan was provided to the USFWS Austin Regional Office, the TPWD Resource Protection Division, Austin, Texas, and SWEC, Las Cruces, New Mexico. The original workplan was amended to include an interior least tern survey, an aquatic survey, and a fall avian survey. The amended surveys were conducted in response to recommendations by USFWS and written comments by TPWD to augment the original survey with additional field observation data.

The following surveys were conducted in accordance with the approved workplan:

a. Spring Survey - Conducted to assess overall vegetation communities, potential T&E species habitat, and presence or absence of T&E species. Also provided the vegetation community baseline.

b. Interior Least Tern Survey - Conducted to specifically address presence or absence of interior lest tern nesting habitat along exposed sandbars and unvegetated areas.

The survey was conducted in response to USFWS comments concerning potential habitat during low flow periods.

c. Aquatic Characterization Survey - Conducted to assess overall aquatic habitat and substantiate conclusions from the literature review on the lack of potential T&E aquatic habitat.

d. Winter Survey - Conducted to evaluate avian migration (interior least terns, hawks and falcons) of the Study area.

Surveys were intended to evaluate the presence or absence of suitable T&E habitat and form the basis of the analyses as the probability of observing migratory T&E species was low; surveys were timed to maximize a chance encounter. Information on T&E species habitat requirements was analyzed in conjunction with the land cover classification developed for the Study area (Figure 5.1). The analysis was used to determine which land cover class represented potential T&E species habitat and thus merited more detailed field surveys.

5.2.4 Effects Determination

An effects determination was made for species with potential to occur in the Study area. The effects determination contains the following information:

a. Status and Distribution of Species: information on listing status and population numbers.

b. Life History and Ecology: species description and information on diet and reproduction.

c. Habitat Description: detailed discussion of habitat requirements.

d. Reasons for Decline: description of reasons the species and/or its habitat is threatened.

e. Effects Determination: information on suitable habitat, if any, occurring in the Study area; the quality of this habitat versus requirements of the species; and potential impacts of O&M practices on the species and habitat.

5.3 SCHEDULE

Survey times were scheduled to maximize the likelihood of observing T&E species as well as coordinating with O&M activities along the Rio Grande corridor. Survey times were conducted as follows:

- Habitat Survey: April 17 – 21, 2000
- Interior Least Tern Survey: July 24 – 28, 2000
- Aquatic Characterization Survey: October 20 – 22, 2000
- Avian Survey: January 16 and 17, 2001

5.4 STAFF

The staff used to perform surveys, identify terrestrial and aquatic flora and fauna, and perform GIS analyses are identified in Table 5.2.

Table 5.2
List of Preparers

Staff	Expertise
R.C. Wooten, Ph.D.	Project Principal, NEPA, and technical direction
Carlos Victoria-Rueda, Ph.D.	Documentation technical review
James Hinson, M.S.	Habitat analyses
Rick Billings, M.S.	Southwestern aquatic systems
John Sigler, Ph.D.	Southwestern aquatic systems
Patty Phillips, M.S.	Ornithology, southwestern vegetation
Mike Sipos, M.S.	Mammalogy, ornithology, GIS, GPS
Chris Westerman, M.S.	Wetlands, southwestern vegetation

SECTION 6
RESULTS

6.1 LITERATURE REVIEW AND HABITAT REQUIREMENTS

Habitat requirements of T&E are summarized in Table 6.1. If habitat was not found in the Study area (*e.g.* coniferous forest, high altitude desert, or desert grassland), associated species were ruled out as potentially occurring. Species not occurring in the Study area included all listed plants and aquatic species. Species associated with habitat potentially occurring in the Study area included five avian species, the interior least tern, southwestern willow flycatcher, whooping crane, bald eagle, and piping plover.

6.2 LAND COVER ANALYSES

Table 6.2 provides the acreage estimates by land cover class and Figure 6.1 provides an example of physiognomic class delineation. The majority of the Study area (> 58 percent) was composed of the transitional herbaceous class dominated by bermudagrass, saltgrass, and forbs. Transitional herbaceous lands did not provide suitable T&E species habitat.

The open water/unconsolidated class accounted for approximately 19 percent of the Study area. Depending on flow regimes, the open water/unconsolidated class percentages can vary considerably. The unconsolidated shore class included sandbars, which were the focus of interior least tern surveys.

Woodland/shrubland communities accounted for over 10 percent of the Study area and were typically characterized as low quality wildlife habitat dominated by salt cedar. Native woodland (cottonwood/willow) communities were rare, and when found, were isolated and narrow in width. Woodland classes, specifically the transitional shrubland class, were originally considered as potential southwestern willow flycatcher habitat.

Wetland habitat (excluding the Rio Bosque Park Wetland Park, which was outside the USIBWC ROW) was limited. Less then 30 acres were estimated to exist inside the ROW.

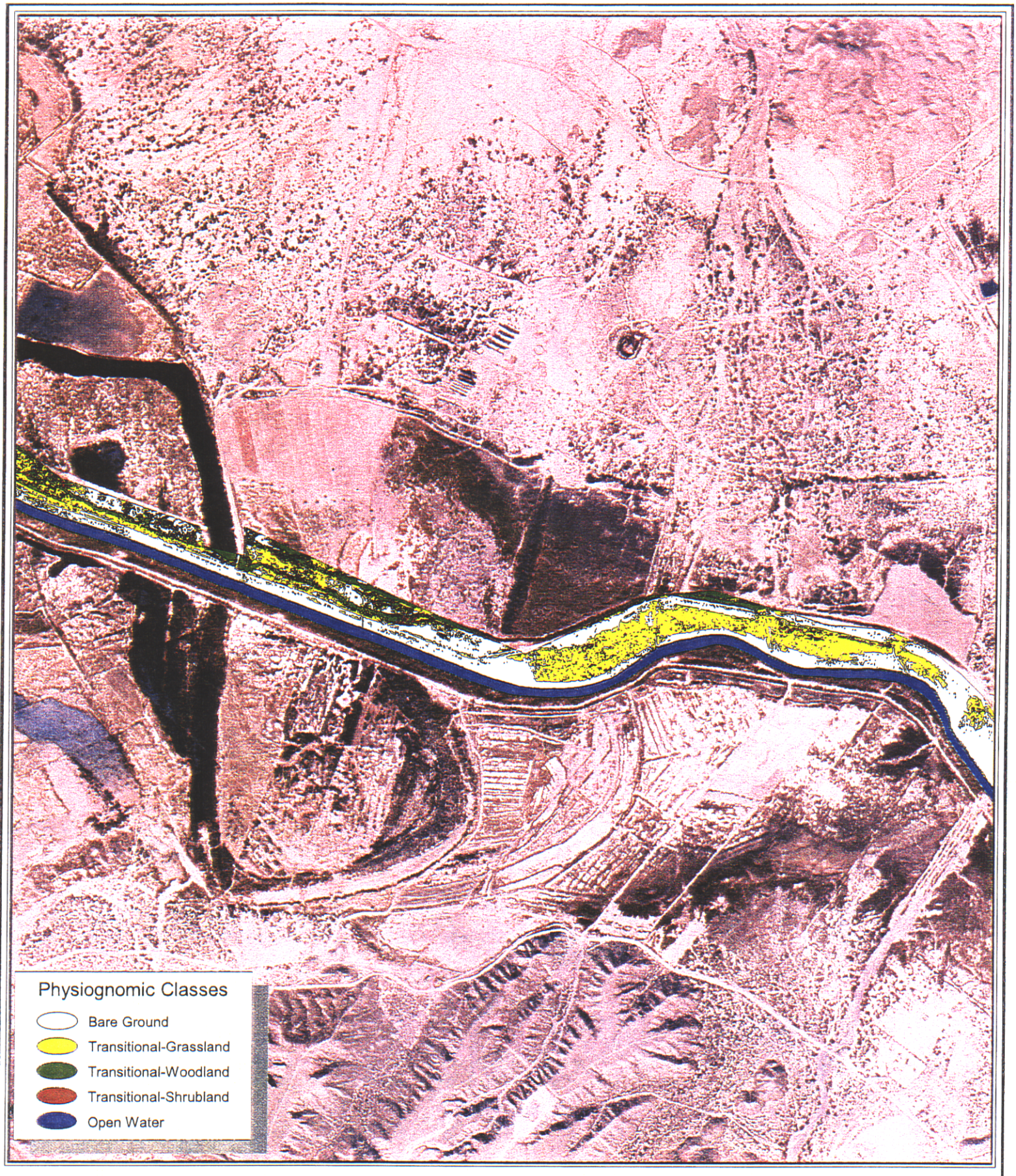
Table 6.1
Habitat Requirements for T&E Species Potentially Occurring in the Study Area

Common Name	Scientific Name	Listing Status		Required Habitat	Physiognomic Land Cover Class	Potential Habitat Present (Yes/No)
		State	Federal			
El Paso County, TX						
Interior least tern	Sterna antillarum	E	E	River sandbars and beaches	Unconsolidated Shore/Sandbar	Yes
Northern aplomado falcon	Falco femoralis septentrionalis	E	E	Brushy prairie and yucca flats	N/A	No
Southwestern willow flycatcher	Empidonax traillii extimus	E	E	Brushy fields, thickets along streams	Transitional Shrubland	Yes
Sneed pincushion cactus	Coryphantha sneedii var. sneedii	E	E	Limestone ledges in the Chihuahuan desert and grassland at 1,290 to 1,620 m	N/A	No
Mexican spotted owl	Strix occidentalis lucida	T	T	Dense coniferous forest	N/A	No
Hudspeth County, TX						
Northern aplomado falcon	Falco femoralis septentrionalis	E	E	Brushy prairie and yucca flats	N/A	No
Southwestern willow flycatcher	Empidonax traillii extimus	E	E	Brushy fields, thickets along streams	Transitional Shrubland	Yes
Mexican spotted owl	Strix occidentalis lucida	Sensitive	E	Dense coniferous forest	N/A	No
Migratory Species Common to Many or All Counties						
Interior least tern	Sterna antillarum	E	E	River sandbars and beaches	Unconsolidated Shore/Sandbar	Yes
Whooping crane	Grus americana	E	E	Summer-marshes and prairie pothole; winter-coastal marshes and prairies	Emergent Marsh	Yes
Bald eagle	Haliaetus leucocephalus	T	T	Prefer timbered areas along coasts, large lakes, and rivers	Transitional Woodland	Yes
Piping plover	Charadruis melodus	T	T	Flat, sparsely vegetated sandy beaches	Unconsolidated Shore/Sandbar	Yes

Table 6.2
Estimated Area of Land Cover Classes

Functional/Physiognomic Classes				Total Area (Acres)	Percent
1.0	**Developed**	1.1	Developed Lands*	27	0.8
2.0	**Submerged Lands**	2.1	Open Water	480	14.5
		2.2	Unconsolidated Shore	120	3.6
3.0	**Transitional**	3.1	Woodland	40.5	1.2
		3.2	Shrubland	270	8.2
		3.3	Herbaceous	1944	58.9
		3.4	Exposed Ground	135	4.1
4.0	**Wetland**	4.2	Palustrine Shrubland	13.5	0.4
		4.3	Emergent Marsh	13.5	0.4
5.0	**Upland**	5.1	Herbaceous	67.5	2.0
		5.2	Woody/Shrub-scrub	67.5	2.0
		5.3	Exposed Ground	121.5	3.7
			TOTAL:	** 3,300	100.0

* Developed lands in the project represent the concrete lined portion of the river.
** Total includes only lands inside the levees.



500 0 500 1000 Feet

Figure 6.1

Example of
USIBWC Study Area
Physiognomic Classes

PARSONS ENGINEERING SCIENCE, INC.

6.3 FIELD SURVEYS

Field surveys were used to evaluate the suitability of potential T&E habitat and in the case of the interior least tern, a species-specific survey (Parsons 2000a; 2000b). The determination of suitable habitat was based on comparing detailed survey with T&E habitat requirements. Table 6.4 lists the results of the habitat analyses.

6.3.1 Vegetation Surveys

Field survey results were categorized at the vegetation community level: Vegetation communities included salt cedar, bosque, cottonwood, upland woodland, arroyo, transitional herbaceous, cropland, willow, seep willow, wetland, riparian herbaceous, and spillway. Vegetation community descriptions are provided in Appendix A and species list is found in Appendix E. Table 6.3 describes how the vegetation communities are organized into respective land cover classes

Characterizing vegetation at the community level (as opposed to the more general land cover class) provided a direct comparison of vegetation observed and correspondence to T&E habitat requirements. A total of 42 locations were surveyed (Figure 6.2), none were characteristic of suitable nesting habitat for T&E species. However, because interior least terns were observed adjacent to the Study area in habitat that was not generally considered suitable, an additional interior least terns survey was conducted.

6.3.2 Avian Surveys

Pedestrian avian surveys were conducted along the entire length of the Study area. Results of the avian surveys are reported in Appendix C. The results of the interior least tern survey (conducted to determine the presence or absence of suitable nesting habitat) was initially reported in the USIBWC Spring Biological Survey Technical Report (Parsons 2000a). No suitable nesting habitat for the interior least tern was found within the Study area.

Overall, suitable habitat required for nesting T&E species was not present, however marginal habitat for migrant T&E species exists in restricted areas. For instance, sandbars and beaches along the river, many of which become exposed during periods of low flow, provide limited waterfowl habitat and possibly migrant interior least tern habitat. Based on analyses of literature review and field surveys, the use of the Study area by migrant T&E species is uncommon but can not be completely ruled out. Table 6.4 shows the preferred habitat, land cover classes, method of survey, and the potential for suitable habitat within the study for the interior least tern, southwestern willow flycatcher, bald eagle, whooping crane and piping plover. Section 7 has detailed descriptions of T&E species habitat requirements, their presence/absence in the Study area, and effects determinations.

Table 6.3
Classification Scheme with Vegetation Community

Division		Physiognomic Class		Vegetation Community
1.0	**Developed Lands**	1.1	Developed Lands	NA
2.0	**Submerged Lands**	2.1	Open Water	NA
		2.2	Unconsolidated Shore/Sandbar	
		3.1	Woodland	Salt cedar Bosque Cottonwood
		3.2	Shrubland	Upland Woodland Arroyo
3.0	**Transitional Lands**	3.3	Herbaceous	Upland Herbaceous
		3.4	Exposed Ground	---
		3.5	Agriculture	Cropland
		4.1	Palustrine Woodland	Willow/Seepwillow
4.0	**Wetlands**	4.3	Emergent Marsh	Wetland Riparian Herbaceous Spillway
5.0	**Upland**	5.1	Herbaceous	---
		5.2	Woody/Shrub-scrub	---
		5.3	Exposed/Bare Ground	---

Figure 6.2

Survey Locations Map
USIBWC Rio Grande Study Area
El Paso and Hudspeth Counties, Texas

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Table 6.4
Habitat Analysis and Results

Species Potentially Present* Analysis/Comments	Land Cover Classes Associated with each Species	Vegetation Community Described During Field Survey	Method of Survey	Results
Interior Least Tern (*Sterna antillarum*)				
Prefers river sandbars and beaches	Unconsolidated Shore/Sandbars	Unvegetated Sandbars	Survey of channel and pedestrian survey. Methodology was prescribed by USFWS	Marginal Habitat for overwintering. A fall channel survey conducted with no individuals observed
Southwestern Willow Flycatcher (*Empidonax trailii extimus*)				
Prefers brushy fields and thickets along streams. Potential habitat is nonexistent within Study area. Thickets of willow and/or salt cedar are not dense enough and do not meet the 10m (30 feet) wide criteria. Vertical structure of thickets is not suitable, and the hydrologic regime is inappropriate and does not provide for saturated soils.	Transitional Shrubland	Salt cedar, Bosque, Cottonwood	Survey of vegetation communities with potential for species specific surveys using existing protocols. Staff is trained to survey for this species.	No habitat. Species specific survey not required.
Bald Eagle (*Haliaetus leucocephalus*)				
Prefers timbered areas along coasts, lakes, and rivers	Transitional Woodland	Salt cedar, Cottonwood	General pedestrian surveys	Marginal to no habitat. Winter avian survey found no evidence of use.
Whooping Crane (*Grus americana*)				
Prefers marshes and prairie potholes in summer and winters in coastal marshes. Documented north of Study area at Bosque Del Apache NWR (experimental population).	Emergent Marsh	Wetland, Riparian Herbaceous, Spillway	Conducted during general pedestrian surveys and detailed vegetation surveys to delineate cover types	No habitat.
Piping Plover (*Charadruis melodi*)				
Prefers river sandbars and beaches	Unconsolidated Shore / Sandbars	Unvegetated Sandbars	Survey of channel and pedestrian survey.	Marginal Habitat for overwintering. A fall channel survey conducted with no individuals.

* Derived from Table 6.1

6.4 AQUATIC HABITAT CHARACTERIZATION

An evaluation of the aquatic habitat was completed in 2000. This characterization was based on two field visits: one during spring 2000 and one during fall 2000. Data collected provided information on elements of the aquatic habitat, and the biotic and abiotic elements of the ecosystem.

6.4.1 Biotic Elements

Habitat areas representative of the Study area were surveyed for fish species during fall 2000. Fish were collected from the main channel and from irrigation return flows or other off-channel features. Collection methods included electrofishing and seining with small mesh seines. A list of the fish species captured is included in Appendix F.

Shoreline vegetation, which has an effect on aquatic habitat, was restricted to a narrow band of willows, salt cedar and herbaceous species. In many areas, no woody vegetation was present. Limited terrestrial habitat structure contributes to a lack of diversity in the aquatic habitat. However, dense vegetation classified as transitional woodland was noted along irrigation return flows and other off-channel structures.

6.4.2 Abiotic Elements

Unconsolidated sand constituted the majority of the bottom type throughout the Study area. Localized areas of cobble and small boulders existed at several locations, but these materials were considered to be imported and not naturally occurring. Few islands or side channel features were noted.

Below American Dam, flows were less than 25 cfs to the El Paso wastewater treatment plant outfall. Flows during the fall 2000 survey were estimated at over 350 cfs and water level was above the nominal flow area, creating significant shallow habitat along vegetated shoreline areas. The majority of this flow was due to the El Paso wastewater treatment plant discharge.

Additional return flows on the Mexican side were noted upstream of the Fort Hancock, Texas port of entry. These flows evidenced high amounts of detergent, indicating insufficient treatment. These return flows contributed an additional 40 to 60 cfs collectively.

6.5 ANALYSES OF MAINTENANCE ACTIVITIES AND POTENTIAL IMPACTS TO T&E HABITAT

Primary maintenance activities were examined individually to determine the potential impacts on T&E species and habitat for each one. Effects of these activities are summarized in Table 6.5.

Table 6.5
Effects of Primary Maintenance Activities on T&E Species Habitat

Primary Maintenance Activity	Potential Impacts				
	Type of Habitat Affected	Habitat Quality	Frequency of Impact	Duration of Impact	Species Potentially Affected
Sediment Removal/ Disposal	Unconsolidated shore/sandbar	Nesting/ Wintering: marginal	Less than annual	Long Term	Interior least tern Piping plover
Floodway Leveling	Transitional shrubland Transitional woodland	Nesting/ wintering: marginal to none	Less than annual	Herbaceous vegetation - ~6 months Woody vegetation - long term	Bald eagle
Vegetation Management	Unconsolidated shore Transitional shrubland Transitional woodland	Nesting/ wintering: marginal	Annual	Herbaceous vegetation - ~3 months Woody vegetation - long term	Interior least tern Piping plover Bald eagle
Levee Road Works	None - but cause disturbance due to noise and dust	N/A	Less than annual	6 days/mile	Interior least tern Piping plover Bald eagle
Channel Bank Protection	Unconsolidated shore Transitional shrubland Transitional woodland	Nesting/ wintering: marginal to none	Infrequent (minimal since 1961)	Long term	Interior least tern Piping plover Bald eagle

As shown in this table, different maintenance activities potentially affect different T&E habitat types. Unconsolidated shore/sandbar habitat is potentially affected by sediment removal/disposal, vegetation management, and channel bank protection. Transitional shrubland and transitional woodland are potentially affected by floodway leveling, vegetation management, and channel bank protection. Levee road works do not affect T&E species habitat, but cause short term disturbance due to noise and dust which potentially affects any species except those tolerant of human activity.

Vegetation management is the maintenance activity which has the greatest overall impact on T&E species and habitat. Vegetation management affects all habitat types within the floodway, due to the frequency (generally annual), and duration (the impacts are long term since maintenance is continual and has been conducted since 1938). Sediment removal/disposal also has major impacts on T&E species, since it causes loss of habitat known to be used by waterfowl, as well as potentially used by the interior least tern.

SECTION 7
EFFECTS DETERMINATION

Federally listed species potentially occur in El Paso and Hudspeth Counties, Texas (see Table 6.1) as migrants utilizing marginally suitable habitat (see Table 6.4). The following effects determinations are discussed for all federally listed species.

7.1 INTERIOR LEAST TERN

7.1.1 Status and Distribution

The interior population of the interior least tern (*Sterna antillarum*) was listed as an endangered species May 28, 1985 (FR 1985b) without critical habitat. Historically in Texas, interior least terns breed on sandbars on the Canadian, Red, and Rio Grande River systems. They now occur as remnant colonies within their historic distribution. Interior least terns nest in three reservoirs along the Rio Grande: Falcon, Amistad, and Lake Casa Blanca. The adult populations in these reservoirs ranged from 64 to 525 birds between 1985 and 1988 (USFWS 1990a).

The winter home of the interior least tern is not known, but probably includes coastal areas of Central and South America; sightings have been made in Guyana and El Salvador. A recovery plan has been developed (USFWS 1990a).

7.1.2 Life History and Ecology

Interior least terns are 8 to 9 inches long and have a black crown on the head, a white underside and forehead, grayish back and wings, orange legs, and a yellow bill with a black tip. Their diet consists of small fish which they catch in shallow waters of lakes or streams.

Nesting areas are used from late April to August. Interior least terns nest in small colonies in sparsely vegetated sandbars along rivers, sand and gravel pits, lakes, or reservoirs. The nest is a shallow depression scraped in an open sandy area, gravelly patch, or barren flat. The chicks leave the nest a few days after hatching, but parental attention continues until migration in early September (USFWS 1990a).

7.1.3 Habitat Description

Habitat requirements center around three ecological factors: presence of bare or nearly bare alluvial islands or sandbars, favorable water levels during nesting season, and food availability (mainly fish). Nesting habitat is sparsely vegetated beaches and sandbars along rivers, sand and gravel pits, lakes or reservoirs. Wide river channels with scattered sandbars are the preferred habitat. With loss of natural habitat, interior least terns are shifting to the use of sand and gravel pits and dredge islands.

7.1.4 Reasons for Decline

Interior least terns were nearly exterminated by plume hunters. The USFWS stated that threats and reasons for decline of the interior least tern included: (1) permanent inundation or destruction of nesting areas by reservoirs and channelization projects; (2) alteration of natural river or lake dynamics, causing unfavorable vegetation succession on remaining islands; (3) recreational use of sandbars; (4) nest inundation by reservoir water releases and annual spring floods; (5) water pollution; and (6) predation (Arroyo 1992). The primary threat to the interior least tern is loss and degradation of habitat. Dams, reservoirs, and other alterations to river systems have reduced their preferred sandbar nesting habitat. Fluctuating water levels in streams may cause scouring of sandbars or high flows which wash away chicks and nests. Increased recreational use of beaches and sandbars results in reduced use of such areas by interior least terns.

7.1.5 Effects Determination

Limited marginal habitat (beaches and sandbars) occurs in the Rectification Project area which may serve as resting and feeding sites for interior least terns during migration. Suitable nesting habitat does not occur in the Study area. USIBWC practice of removing accumulated sediment in the river channel may reduce resting and feeding habitat by reducing the numbers of sandbars and beaches in the Study area.

Determination: The species is not likely to be adversely affected.

7.2 PIPING PLOVER

7.2.1 Status and Distribution

The piping plover (*Charadrius melodus*) was listed as endangered in the Great Lakes watershed, threatened in the remainder of its range on December 11, 1985 (FR 1985a), without critical habitat. In 1996, an extensive census of piping plovers accounted for 5,837 breeding plovers. The Texas coast has almost 1,900 wintering individuals (TPWD 1999d).

7.2.2 Life History and Ecology

The piping plover is a small shorebird about 7 inches long with a wingspan of 15 inches. A black band across the forehead over the eye, and a black ring around the base of the neck are distinguishing marks in adults during the summer, but are obscure during the winter. The bird's name reflects its plaintive bell-like "peep-lo" whistle. It's diet consists of insects, crustaceans, mollusks, and small marine invertebrates.

Piping plovers arrive on their breeding ground in late March or early April. Following establishment of nesting territories and courtship rituals, the pair form a depression in the sand generally on the upper beach close to the dunes. The female normally lays four eggs, which both parents incubate. The females commonly leave when the brood is 14-20 days old, but the male will stay with the offspring until they can fly.

7.2.3 Habitat Description

Piping plovers nest along the sandy beaches of the Atlantic Coast, the gravelly shorelines of the Great Lakes, and on river sandbars and alkali wetlands throughout the Great Plains region. They prefer to nest in sparsely vegetated areas that are slightly raised in elevation (beach berm). Wintering sites includes beaches, sand and mudflats and dunes along the Gulf Coast.

7.2.4 Reasons for Decline

The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. Recreational and commercial development and dune stabilization have contributed greatly to the loss of piping plover breeding habitat along the Atlantic Coast and Great Lakes. In the Great Plains region, damming and channelization of rivers have also eliminated sandbar nesting habitat. Wintering habitat is being lost to coastal development, and inlet and shoreline stabilization features.

Human presence can indirectly lower productivity by disrupting territorial establishment, courtship, egg laying, and incubation activities. Foot traffic, dune buggies, and other vehicles (including raking of beaches for trash) can directly crush eggs or chicks, and the ruts left by off-road vehicles can trap flightless chicks. Increased predation by skunks, raccoons, and gulls are also attributed to human development and disturbance.

7.2.5 Effects Determination

Limited marginal habitat (beaches and sandbars) occurs in the Rectification Project which may serve as resting and feeding sites for piping plovers during migration. Suitable nesting habitat does not occur in the Study area. USIBWC practice of removing accumulated sediment in the river channel may reduce resting and feeding habitat by reducing the numbers of sandbars and beaches in the Study area.

Determination: The species is not likely to be adversely affected

7.3 NORTHERN APLOMADO FALCON

7.3.1 Status and Distribution

The northern aplomado falcon (*Falco femoralis septentrionalis*) was listed as an endangered species in 1986 (FR 1986) without critical habitat. The falcon's historic range included southeastern Arizona, southern New Mexico, and western Texas. Although no nests have been verified in the U.S. since 1952, the species is being reintroduced into the Laguna Atascosa National Wildlife Refuge and the King Ranch, Texas. Nesting populations occur in the Mexican states of Veracruz, Chiapas, Campeche, Chihuahua, Tamualipas, and Tabasco. A recovery plan has been developed (USFWS 1990b).

7.3.2 Life History and Ecology

The northern aplomado falcon is smaller than the peregrine falcon and larger than the kestrel. It is characterized by rufous underparts, a gray back, a long and banded tail, and a distinctive black and white facial pattern.

The northern aplomado falcon nests in trees or shrubs, laying eggs between the months of March and June. They do not build their own nests, but use stick nests built by other birds. The falcon's diet consists primarily of small to medium-sized birds, supplemented by insects, small snakes, lizards, and rodents.

7.3.3 Habitat Description

The falcon's habitat consists of open desert terrain with scattered trees, relatively low ground cover, an abundance of small to medium-sized birds, a supply of previously constructed nests, and above ground nesting substrate such as yucca and mesquite. Some components of suitable habitat include inter-tree distances of 30m, average tree densities of 19 trees/100 acres, and average tree heights of 30 feet (USFWS 1990b).

7.3.4 Reasons for Decline

The primary threats to the northern aplomado falcon are habitat alterations due to brush encroachment, grassland degradation from overgrazing, conversion of habitat to agriculture, and organochlorine pesticide contamination such as DDT.

7.3.5 Effects Determination

This habitat type does not occur in the Study area; therefore USIBWC maintenance practices are not expected to affect this species.

Determination: The species is not likely to be adversely affected.

7.4 MEXICAN SPOTTED OWL

7.4.1 Status and Description

The Mexican spotted owl (*Strix occidentalis lucida*) was listed as threatened in April 1993 (FR 1993a). As of 1993, the Mexican spotted owl population was estimated at 2,160 individuals. They are extremely rare and local in Texas.

7.4.2 Life History and Ecology

Spotted owls are 16-18 inches in height and weigh between 1 and 2 pounds. Most spotted owls are chocolate to chestnut brown in appearance with round to elliptical white spots on head, neck, back, and underparts. However, the Mexican spotted owl is lighter brown, and smaller than other subspecies. These owls have a round face and large dark eyes but lack ear tufts. Spotted owls have yellowish green bills. They are distinguished from

barred owls (*Strix varia*) by a slightly smaller size, lack of horizontal bars on breast, lack of vertical streaks on abdomen, and darker appearance.

Small mammals dominate the diet of spotted owls, with wood rats (*Neotoma* spp.) and white-footed mice (*Peromyscus* spp.) being the most important. However, spotted owls are known to eat many species of birds, reptiles, and insects.

Spotted owls nest in trees, crevices, or small caves and tend to prefer north-facing slopes (FR 1994c). Spotted owls are monogamous and pairs begin roosting and interacting for about 4-6 weeks before egg laying (February-March). One to three eggs are laid in the nest, where the female will incubate them. Incubation period is approximately 30 days and most eggs hatch by the end of May. The young will fledge (will be covered with feathers instead of down) 34-36 days after hatching. Both parents care for and roost near young through August, about 60-90 days post-fledging.

7.4.3 Habitat Description

Spotted owls occur primarily in forested and canyon habitats from central Utah and Colorado, south through New Mexico, Arizona, and western Texas, and into the mountains of northern and central Mexico. In Texas, spotted owls nest on cliffs at 5,000 to 7,000 feet elevation in deep, cool canyons (TPWD 1999b).

The preferred habitat is mixed conifer and ponderosa pine (*Pinus ponderosa*)-Gambel's oak (*Quercus gambelii*) forests in mountains and canyons in the southwestern U.S. and northern Mexico (FR 1994c). Habitat characteristics highly sought by Mexican spotted owls include high canopy closure, high stand density, a multi-layered canopy, uneven-aged stands, numerous snags, and downed woody matter. These habitats are best expressed in old-growth mixed conifer forests (usually more than 200 years old) (Ganey and Balda 1994).

Spotted owls have a low tolerance to heat. This is believed to explain the owl's preference for mature and old growth forests and north facing slopes.

7.4.4 Reasons for Decline

The primary threat to spotted owls is loss and degradation of habitat (USFWS 2000b). Other threats include malicious killing of owls in timber areas, automobile collisions, or flying into tree limbs. Primary causes of mortality for juvenile spotted owls are starvation and predation by great horned owls (*Buteo virginianus*) and northern goshawks (*Accipiter gentilis*). Adult spotted owls can also fall prey to great horned owls.

7.4.5 Effects Determination

The federal action is not expected to affect the Mexican spotted owl because the owls have been observed only in or near the Davis Mountains or Guadalupe Mountains. There is no suitable habitat for Mexican spotted owls in the Study area.

Determination: The species is not likely to be adversely affected.

7.5 SOUTHWESTERN WILLOW FLYCATCHER

7.5.1 Status and Distribution

The southwestern willow flycatcher (*Empidonax trailii extimus*) was put on the federal endangered species list on February 17, 1995 (FR 1995a). Critical habitat was designated on July 22, 1997; however, there is no recovery plan in place. The southwestern willow flycatcher is also classified as endangered by the State of Texas. Historically, the southwestern willow flycatcher was widely distributed and fairly common throughout its range, especially in southern California and Arizona (Unitt 1987). However, southwestern willow flycatcher populations have apparently declined. In 1993, USFWS estimated that only 230 to 500 nesting pairs existed throughout its entire range (FR 1993b). The bird has been sighted in Texas at Fort Hancock, in the Guadalupe Mountains, the Davis Mountains, and unspecified locations in Brewster County (USFWS 2000a).

7.5.2 Life History and Ecology

The southwestern willow flycatcher (Order Passerifomes; Family Tyrannidae) is a subspecies of one of the ten North American species in the genus *Empidonax*. The *Empidonax* flycatchers are renowned as one of the most difficult groups of birds to distinguish by sight. Phillips (1948) described the southwestern willow flycatcher as generally paler than other willow flycatcher subspecies, although this difference is indistinguishable without considerable experience and training. The southwestern species differs in morphology (primarily wing formula) but not overall size. The southwestern willow flycatcher's diet is composed mainly of aerial insects. Flycatchers catch their food on the wing and will glean them from leaves. Foraging occurs within and above dense riparian vegetation, water edges, backwaters, and sandbars, adjacent to nest sites. Details on specific prey items are not currently known (Tibbitts *et al.* 1994).

Southwestern willow flycatchers begin arriving along the Rio Grande before breeding in mid-May. Southwestern willow flycatcher territory size, as defined by song locations of territorial birds, probably changes with population density, habitat quality, and nesting stage. Early in the season, territorial flycatchers may move several hundred meters between singing locations. It is not known whether these movements represent polyterritorial behavior or active defense of the entire area encompassed by singing locations. However, during incubation and nestling phases, territory size, or at least the activity centers of pairs, can be very small and restricted to an area less than 1.2 acres. For example, a breeding territory size of 0.5 acres was estimated for a pair of flycatchers occupying a 1.5 acre patch

on the Colorado River. Activity centers may expand after young are fledged but still dependent on adults.

Once a territory and a mate is defined, nest building and egg laying will occur. The nest site plant community is typically even-aged, structurally homogenous, and dense (Brown 1988). Nests are usually found in the fork of a shrub or tree from 4 to 25 feet above the ground (Unitt 1987; Tibbitts *et al.* 1994). Nests are typically made of a collection of grasses and forbs lined with small fibers. Typically, only one clutch of three to four eggs is laid. If something happens to the first clutch (parasitism or loss of young), a pair may lay another clutch later in the season. The female will incubate the eggs for approximately 12 days and the young fledge (are fully feathered) approximately 13 days after hatching (King 1955). The young fledge by late June or early July (Tibbitts *et al.* 1994). Flycatchers begin to migrate back to their winter habitat around September.

7.5.3 Habitat Description

The southwestern willow flycatcher breeds in dense riparian habitats along river, streams, or other wetlands. Vegetation can be dominated by dense growth of willows (*Salix* spp.), seepwillow (*Baccharis* spp.), or other shrubs and medium sized trees. Almost all southwestern willow flycatcher breeding habitats are within close proximity (less than 20 yards) of water or very saturated soil. Nesting habitat for the willow flycatcher varies greatly by survey location and includes such species as cottonwood, willow, salt cedar, box elder (*Acer negundo*), and Russian olive. Species composition, however, appears less important than plant and twig structure.

Four main "types" of preferred habitat have been described. They are as follows (adapted from Sogge *et al.* 1997):

a. Monotypic high - elevation willow: nearly monotypic stands of willow, 10-23 feet in height with no distinct overstay layer; often associated with sedges, rushes, nettles, and other herbaceous wetland plants; usually very dense structure in the lower 6.5 feet; live foliage density is high from the ground to the canopy.

b. Monotypic exotic - nearly monotypic, dense stands of exotics such as salt cedar or Russian olive, 13 to 53 feet in height forming a nearly continuous, closed canopy (with no distinct overstory layer); lower 6.5 feet often difficult to penetrate due to branches; however, live foliage density may be relatively low, 3 to 6 feet above ground but increases higher in the canopy; canopy density uniformly high.

c. Native broadleaf dominated - composed of single species or mixtures of native broadleaf trees and shrubs, including cottonwood, willows, box elder, ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus* spp.), height from 10-49 feet; characterized by trees of different size classes; often a distinct overstory of cottonwood, willow, or other broadleaf tree, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in the understory.

d. Mixed native/exotic - Dense mixtures of native broadleaf trees and shrubs mixed with exotic/introduced species such as salt cedar or Russian olive; exotics are often

primarily in the understory, but may be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular survey location may be dominated primarily by natives or exotics, or be a more-or-less equal mixture.

7.5.4 Reasons for Decline

The most significant historical factor in the decline of the southwestern willow flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat. Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats of the southwestern willow flycatcher (Johnson *et al.* 1987, Unitt 1987). Changes in the riparian plant community have reduced, degraded, and eliminated nesting habitat for the southwestern willow flycatcher, curtailing its distribution and numbers (Cannon and Knopf 1984, Taylor and Littlefield 1986, Unitt 1987).

Habitat losses and changes have occurred (and continue to occur) because of urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species. Hydrological changes, natural or human-induced, can greatly reduce the quality and extent of flycatcher habitat. Although riparian areas are often not considered as fire-prone, several survey locations with relatively large numbers of breeding willow flycatchers were recently destroyed by fire (Paxton *et al.* 1996), and many others are at risk to similar catastrophic loss. Fire danger in these riparian systems may be exacerbated by conversion from native to exotic vegetation (such as salt cedar) (Bock and Bock 1990), diversions or reductions of surface water, and drawdown of local water tables.

7.5.5 Effects Determination

The federal action is not expected to affect the southwestern willow flycatcher because there is no suitable habitat in the Study area. Although salt cedar does exist along the river banks, these communities do not meet the minimum patch size and density requirements for the southwestern willow flycatcher.

Determination: The species is not likely to be adversely affected.

7.6 BALD EAGLE

7.6.1 Status and Distribution

Historically, the bald eagle (*Haliaetus leucocephalus*) ranged throughout North America except northern Alaska and Canada and central and southern Mexico. Bald eagles nest on both coasts from Florida to Baja California, in the south, and from Labrador to the western Aleutian Islands, Alaska, in the north (Gerrard and Bortolotti 1988).

In 1978, in response to lowering population and reproductive success, USFWS listed the bald eagle throughout the lower 48 states as endangered except in Michigan, Minnesota,

Wisconsin, Washington, and Oregon, where it was designated as threatened (FR 1978, February 14, 1978). In the 21 years since it was listed, the bald eagle population has clearly increased in number and expanded its range. This improvement is a direct result of the banning of DDT and other persistent organochlorines, habitat protection and from other recovery efforts (FR 1995b, July 12, 1995). On August 11, 1995, USFWS reclassified the bald eagle from endangered to threatened in the lower 48 states. In 1982, a recovery plan was developed specifically for the southwestern bald eagle. The geographic boundaries of this population as defined by the recovery plan includes Arizona, New Mexico, portions of Texas and Oklahoma west of the 100th meridian and southeast California within 10 miles of the Colorado River or its reservoirs. The southeastern recovery plan, published in 1984, covers eastern Texas and the southeastern states.

Since the development and implementation of the recovery plans, the bald eagle's population growth has exceeded most of the goals established in the various plans. In 1994, about 4,450 occupied breeding areas were reported with an estimated average young per occupied territory of 1.16. Compared to surveys conducted in 1974, the number of occupied breeding areas in 1994 in the lower 48 States had increased by 462 percent. Between 1990 and 1994, there was a 47 percent increase (FR 1999).

The bald eagle was reclassified in 1995 from endangered to threatened as a result of the significant increase in numbers of nesting pairs, increased productivity and expanded distribution (FR 1995b).

The current nesting population in the lower 48 States constitutes more than a tenfold increase from the known population level in 1963. USFWS estimates that the breeding population exceeded 5,748 occupied breeding areas in 1998. The bald eagle population has essentially doubled every 7 to 8 years during the past 30 years (FR 1999). Due to the bald eagle's significant recovery, it was proposed to be removed from the endangered species list by the USFWS in 1999 (FR 1999).

7.6.2 Life History and Ecology

In Texas, the bald eagle primarily breeds in the eastern third of the state (mostly east of IH-35). The eagle normally nests in large trees, although cliffs are occasionally used. Two eggs are normally laid in December. The eggs are incubated approximately 35 days, and fledging takes place at 11 to 12 weeks of age. Parental care may extend 4 to 11 weeks after fledging. Adults tend to return to the same breeding areas year after year. Bald eagles feed primarily on fish, but also consume waterfowl, seagulls, and carrion (FR 1999, TPWD 1999a, 2000).

7.6.3 Habitat Description

The bald eagle is a bird of aquatic ecosystems. It prefers estuaries, large lakes, reservoirs, major rivers, and coastal habitats. Nest sites are usually large trees along shorelines in relatively remote areas that are free from human disturbance. The trees must be sufficiently sturdy and open to support a nest which may be up to 5 feet wide and 3 feet deep (USFWS 1982).

7.6.4 Reasons for Decline

The bald eagle was primarily threatened by the extensive use of persistent organochlorine pesticides, particularly DDT. As discussed above, the banning of DDT led to recovery of bald eagle populations. Other threats included shooting and poisoning by hunters and ranchers, and habitat loss.

7.6.5 Effects Determination

The federal action is not expected to affect the bald eagle. Because the Study area contains extremely few large trees, bald eagles would not be expected to utilize the area for nesting or roosting. In addition, the Rio Grande in the Study area does not offer an abundant supply of fish to attract the eagles to the area.

Determination: The species is not likely to be adversely affected.

7.7 WHOOPING CRANE

7.7.1 Status and Distribution

The whooping crane (*Grus americana*) was listed as endangered on March 11, 1967 (FR 1967). Over 10 years later critical habitat was designated for the whooping crane (FR 1975). As of 1996 the adult whooping crane population numbered 205 in the wild (Meine and Archibald 1996). This is up from the all time population low of 15 birds in the winter of 1941-42. Today, this population of migrating cranes is found between Wood Buffalo National Park, Canada (breeding range) and Aransas National Wildlife Refuge, Texas, U.S.A. (wintering range). This Aransas-Wood Buffalo Population (AWP) remains the only self-sustaining wild population of whooping cranes.

In the nineteenth century, the principal breeding range extended from central Illinois northwest through northern Iowa, western Minnesota, northeastern North Dakota, southern Manitoba, and Saskatchewan to the vicinity of Edmonton, Alberta. A nonmigratory population of whooping cranes existed in Louisiana until they were extirpated in the 1940's.

In 1975, experimental efforts to establish a second migratory flock through cross-fostering began at Grays Lake National Wildlife Refuge in southeastern Idaho. Eggs were transferred from the nests of AWP whooping cranes to nests of greater sandhill cranes. Sandhill crane "foster parents" raised the whooping cranes and taught them their traditional migration route to wintering grounds along the middle Rio Grande Valley in New Mexico.

These fostered cranes did not form pair-bonds and therefore did not breed. Due to the failure of the experiment and other extenuating factors the foster program was halted. There are only three whooping cranes left in the New Mexico foster population (State of New Mexico 1997). Due to the failure of the experiment, the USFWS proposed to designate the whooping crane population in the Rocky Mountains (New Mexico) as an experimental nonessential population and to remove whooping crane critical habitat designations from four national wildlife refuges; Bosque del Apache in New Mexico, Monte Vista and Alamosa in Colorado, and Grays Lake in Idaho (FR 1996b). There is a reintroduced population in Florida consisting of 26 subadult captive-produced whooping cranes released in 1993-1995, in the Kissimmee Prairie. This population is considered an experimental nonessential population (FR 1997).

7.7.2 Life History and Ecology

The whooping crane is one of 15 species of cranes found on the planet. Whooping cranes are the tallest birds in North America with males averaging heights of 1.5 m. These birds can weigh up to 7.5 kg, and have a wingspan up to 2.5 m wide.

Whooping cranes eat snails, larval insects, leeches, frogs, minnows, small rodents, and berries. They may scavenge dead ducks, marsh birds or muskrats. During migration they stop to eat aquatic animals, roots and waste grain in stubble fields. At their wintering grounds, they eat shellfish, snakes, acorns, small fish and wild fruit.

Whooping cranes mate for life. Adult birds are able to breed in their third or forth year. In early spring, adults display elaborate courtship rituals, bobbing, weaving, jumping and calling with their mates. Experienced pairs may not breed every year, especially when habitat conditions are poor. The female lays two large eggs and both adults incubate them for the next month. The eggs will hatch at different times and the second chick is often pushed out of the nest or starves. Pairs will renest if their first clutch is destroyed or lost before mid-incubation.

7.7.3 Habitat Description

The nesting grounds of the AWP within Wood Buffalo National Park are in poorly drained areas where muskeg and boreal forest intermix. Nesting territories range widely in size from 1.3 to 47.1 km^2. Whooping cranes nest along the marshy areas among bulrushes, cattails, and sedges that provide food and protection from predators.

Most of the winter is spent in Texas in brackish bays, estuarine marshes, and tidal flats of the Gulf of Mexico in and near Aransas National Wildlife Refuge. Saltgrass, cordgrass, and other aquatic vegetation dominate these areas.

7.7.4 Reasons for Decline

Whooping cranes rapidly declined in the late 1800s and early 1900s as a result of hunting, collecting (eggs and feathers), and the conversion of their habitat to agriculture. Habitat loss and alteration is the greatest threat to these birds, especially at Aransas Wildlife Refuge. Pollution, waterway construction, oil drilling, and human recreational activities are threats whooping cranes face today. The number one cause of death of adult cranes is collisions with power lines or fences during migration. Also, shooting (accidental) of whoopers is a cause of death for these protected birds when they are mistaken for sandhill cranes during sandhill crane hunting season. Loss of genetic diversity and subsequent inbreeding depression are general concerns for the small and narrowly based whooping crane population (Mirande *et al.* 1993).

7.7.5 Effects Determination

The federal action is not expected to affect the whooping crane because they are unlikely to occur and have not been observed in the Study area. The whooping crane's preferred habitat of marshes and prairie potholes is virtually non-existent in the Study area. There are no prairie potholes, and marsh vegetation is generally confined to small sand bar islands, arroyo mouths, and spillways.

Determination: The species is not likely to be adversely affected.

7.8 SNEED PINCUSHION CACTUS

7.8.1 Status and Distribution

The Sneed pincushion cactus (*Coryphantha sneedii* var. *sneedii*) was listed as an endangered species November 7, 1979 (FR 1979) without critical habitat. It is also considered an endangered species by the State of Texas since April 29, 1983. Its range includes El Paso County, Texas and southern New Mexico. Populations occur in about 10 sites in Texas, many within Franklin Mountains State Park (TPWD 1999e). A recovery plan has been developed for the cactus (USFWS 1986).

7.8.2 Life History and Ecology

The Sneed pincushion cactus is a multi-stemmed cactus forming dense clusters to 5 inches high and over 1 foot in diameter. The cylindrical stems branch profusely and cluster to form masses of as many 100 heads on an old plant. It blooms April through September, with the fruit maturing June through October. Flowers are pink to pale rose.

7.8.3 Habitat Description

The Sneed pincushion cactus is found in grasslands or lechuguilla-sotol shrublands on limestone outcrops and rocky slopes of mountains within the Chihuahuan Desert. The cactus is found in the Franklin Mountains and Bishop's Cap in El Paso County, Texas.

7.8.4 Reasons for Decline

The primary threats include over collection and urban and suburban encroachment.

7.8.5 Effects Determination

The federal action is not expected to affect the Sneed pincushion cactus because the cactus does not occur in the Study area. This cactus is found in the limestone ledges in the Chihuahuan Desert at 4,300 to 5,400 feet in elevation.

Determination: The species is not likely to be adversely affected.

7.9 WESTERN BURROWING OWL

7.9.1 Status and Distribution

One SOC, the western burrowing owl, was observed during the field survey. The owl was observed in three locations within the Rectification Project area. The western burrowing owl is a federally listed Candidate Category 2 species (FR 1994b). Burrowing owls are found throughout grasslands and deserts in western portions of North America and in drier region of Central and South America. These owls winter throughout Texas and commonly breed in the Panhandle and West Texas.

7.9.2 Life History and Ecology

The burrowing owl is a ground-dwelling bird with distinctive long legs and a short tail. The feathers are brown with spots and have bars. Burrowing owls most often use burrows dug by mammals such as ground squirrels, badgers, prairie dogs, skunks, armadillos, kangaroo rats, and tortoises. Burrowing owls are opportunistic feeders eating a wide variety of prey items, primarily arthropods, small mammals, and birds. The burrowing owl is a semi-colonial species, often forming loose colonies.

In Texas, breeding begins in early-April and lasts until late-July. The number of eggs laid can range from four to 12, but the clutch size normally varies from six to eight eggs. Once incubation is complete, the owlets hatch some time between March and July.

7.9.3 Habitat Description

Overall, this species is associated with open grasslands, especially prairies, plains, and savannas, and increasingly in open areas such as vacant lots near human habitation or the open areas associated with airports.

7.9.4 Reasons for Decline

Intensive cultivation of grasslands and native prairies has long been recognized as a cause of declining western burrowing owl populations. Additional evidence of population

decline can be attributed to habitat destruction, pesticides, predators, human disturbance (shooting/trapping), destruction of colonial residents, and vehicle collisions.

7.9.5 Effects Determination

The federal action may affect but is not likely to adversely affect the western burrowing owl. Burrowing owls were observed in the Study area during the field surveys. These owls prefer open areas and open disturbed places such as found near airports, vacant lots, and agricultural lands. The current O&M of the floodway (federal action) provide suitable habitat for these birds. These birds will also tolerate a certain amount of human disturbance, such as traffic on levee roads, agricultural and urban settings. The Burrowing Owl Consortium has set up some management recommendations, including 1) providing uncultivated plots to supply habitat for rodent/insect prey and (2) maintenance of pesticide- and herbicide-free areas of at least a 1,968.6 feet radius around nest burrows. In addition, the following measures have all been suggested as management strategies:

- protection of burrowing mammal populations;
- wood or plastic nest boxes and tunnels placed underground;
- artificial perches which provide hunting and predator observation sites; and vegetation management through fire or grazing.

Special preservation techniques for the western burrowing owl include passive relocation. Passive relocation has been defined as "encouraging owls to move from occupied burrows to alternate natural or artificial burrows."

7.10 MIGRATORY BIRDS

As discussed for the interior least tern and piping plover, limited marginal habitat exists within the Study area which provides resting and feeding sites for waterfowl and shorebirds. USIBWC maintenance practices may affect these birds by reducing the amount of available beach and sandbar habitat. It is also possible that migratory birds may be temporarily displaced while maintenance activities are occurring. However, there is no suitable nesting habitat for the majority of migratory birds due to high levels of disturbance from O&M activities in the floodway and levees.

Determination: Migratory birds are not likely to be adversely affected.

SECTION 8
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APPENDIX A
STUDY AREA
LAND COVER CLASSES

Five major divisions were defined in Table 5.1: Developed, submerged lands, transitional lands, wetlands, and uplands, which are divided into 14 classes. Submerged lands are further divided into open water and unconsolidated shore/sandbars, which may or may not be present year round and remain unvegetated. Transitional lands comprise a variable land cover type within the Study area which has temporary characteristics of both wetlands and uplands depending on recent hydrologic regimes. Wetlands consist of three classes: palustrine woodland, palustrine shrubland, and emergent marsh. These areas are limited in abundance throughout the Study area. The submerged lands, transitional lands, and wetlands divisions typically represent areas within the flood plain inside the USIBWC right-of-way (ROW). The Uplands division consists of three classes: woodland/shrub-scrub, herbaceous, and exposed/bare ground. The uplands and developed divisions represent areas outside levees and often outside the USIBWC ROW.

Developed Lands

This class includes areas of intensive anthropogenic use. Much of the land is covered by structures and impervious surfaces. Developed lands are defined in the GIS by manual delineation of the imagery.

Submerged Lands

Open Water: open water surface area.

Unconsolidated Shore/Sandbar: shores or sandbars resulting from sediment deposition and not vegetated. These areas may or may not be visible year round.

Transitional Lands

Transitional lands closely follow the descriptions of White and Calnan (1990). The vegetation is a mosaic of hydric and upland vegetation largely influenced by the previous season's moisture regimes. Transitional Lands are typically classed as either uplands or occasionally Palustrine Emergent Marsh by USFWS National Wetlands Inventory program.

Woodland: woody vegetation mostly >9 feet in height and >20 percent canopy cover. This class is used primarily to distinguish between rapidly invading woody vegetation and true riparian woody classes.

Shrubland: woody vegetation mostly <9 feet in height and >20 percent canopy cover. Shrublands are separated from woodlands in GIS by spectral signature.

Herbaceous: all non-woody vegetation including grasses and forbs. Herbaceous areas are composed of <20 percent woody cover.

Exposed Ground: bare soil, sand, silt, and gravel. Defined by the absence of vegetation without regard to inherent ability to support life. Vegetation, if present, is sparser than in vegetated classes.

Agriculture: herbaceous crops, pecans, and fallow fields. Seasonal spectral signatures, geometric field patterns, and road network patterns are used to identify this land cover type.

Wetlands

Wetlands are lands where saturation with water is the dominant factor determining soil development and the types of plants and animal communities living in the soil and on its surface (Cowardin *et al.* 1979).

Palustrine Woodland: woody wetlands dominated by facultative to obligate wetland woody vegetation.

Palustrine Shrubland: wet woodlands often found in disturbed areas and fallow agricultural sites. These areas are generally characterized by invasive species.

Emergent Marsh: dominated by herbaceous vegetation; hydrology is a function of rainfall, episodic flooding, and depth of water table.

Uplands

Woodland: includes non-agricultural (orchards, etc.) trees but will occasionally include drier former agricultural lands dominated by woody vegetation (>20 percent woody coverage).

Shrubland: woody vegetation mostly <9 feet in height and >20 percent canopy cover. Shrublands are separated from woodlands spectrally.

Herbaceous: all non-woody vegetation including grasses and forbs. Herbaceous areas are composed of <20 percent woody cover.

Exposed Ground: bare soil, sand, silt, and gravel. Exposed ground is defined by absence of vegetation without regard to inherent ability to support life. Vegetation, if present, is sparser than in vegetated classes.

STUDY AREA LAND COVER CLASSES

		Vegetation Community/Physiognomic Class	
Sites*	**Comments**	**Riparian Margin**	**Floodway**
1	Riparian margin (channel bank) approximately 10-15' wide. ~Riparian: 99% salt cedar, <5 ft. tall, appears to be mowed. Occasional curly dock, little barley, oleander. Floodway and levee bank: dominated by bermudagrass, occasional fourwing saltbush, tamarisk, mesquite; total live cover approx. 60 percent.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
2	Riparian vegetation dominated by common reed. Floodway has small mowed salt cedar and fourwing saltbush.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
3	Elm (probably Siberian) in floodway, salt cedar dominant.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
4	Ditch draining to river. Little vegetation in floodway.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
5	Channel concrete lined, completely developed. Area of concrete lining noted on map.	Developed/ Developed	Developed/ Developed
6	Just downstream of end of concrete area. Vegetation on slope dominated by salt cedar, similar to survey location 1.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
7	Downstream of Fort Hancock crossing. In this area, slopes gently from river to levee road, no flat floodway. Approx. 85 percent live cover on slope, dominated by bermudagrass, occasional squirreltail. Near arroyo - thick tamarisk in flood plain.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
8	Drainage way in arroyo. Herbaceous vegetation appears stressed.	N/A	Desert scrub/ Upland Woody Shrub-scrub
9	Arroyo, dominant vegetation is windmillgrass, galleta, sand dropseed, salt cedar. Occasional mesquite.	N/A	Desert scrub
10	On bank of levee - bermudagrass, Russian thistle, grasses. River bank - bermudagrass, occ. dandelion.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
11	Floodway unusually wide in this area. Grassed area dominated by bermudagrass and Russian thistle. Beaver and harrier (hunting behavior) observed at this site.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland

		Vegetation Community/Physiognomic Class	
Sites*	**Comments**	**Riparian Margin**	**Floodway**
12	Grass-dominated site similar to Site 11. River bank dominated by sedges. Floodway: bermudagrass, with some sand dropseed, alkali sacaton, peppergrass and Russian thistle. Large (~16 inch diameter) dead cottonwood trees observed in this part of floodway.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
13	Ditch inside floodway contains large tamarisk. May be too steep-sloped to mow.	Salt cedar/ Transitional Woodland	Herbaceous Transitional Grassland
14	Debris weir. Just downstream is sand beach. Wide beach formed in this area, margin dominated by sedge and cattail. Also native grasses: bristlegrass, rabbitfoot grass, rush; as bank slopes up, dominant becomes salt cedar.	Two zones: lower is Herbaceous/ Emergent marsh, upper is Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
15	Fence outside levee road begins here. Floodway dominated by bermudagrass, occasional Russian thistle and salt cedar. Cow signs observed. River bank steep here, bermudagrass and sedge at water's edge.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
16	Dominant vegetation bermudagrass, seep willow, salt cedar. Little vegetation in floodway, possibly inhibited by vehicle traffic.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
17	Bermudagrass, curly dock, salt cedar at river's edge. Little vegetation in floodway.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
18	Arroyo dominated by salt cedar.	N/A	Desert scrub/ Woody/Shrub-Scrub
19	Riverbank vegetation dominated by salt cedar and seep willow. Floodway sparsely vegetated, primarily Russian thistle and bermudagrass.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
20	Weir between two spillways.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
21	Seep willow, some salt cedar, bermudagrass in floodway. Very low stature vegetation due to mowing.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland

		Vegetation Community/Physiognomic Class	
Sites*	**Comments**	**Riparian Margin**	**Floodway**
22	Sand bars in river channel. Area appears to be recently mowed. Primarily bermudagrass along river. Floodway: seep willow, salt cedar, and an acacia.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
23	Return water apparently flows overland at this site; note salt cedars beginning to establish in moist soil.. Sparse vegetation along river, some willow seedlings.	Willow-seepwillow/ Palustrine Woodland	Herbaceous// Transitional Grassland
24	Riparian zone dominated by willow, bermudagrass.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
25	Willows give way to herbaceous species, occ. cottonwood seedlings. Cattle egrets observed at this site.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
26	Riparian zone small willows and common reed. Floodway - bermudagrass and salt cedar.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
27	Riparian zone small willows and common reed. Floodway - bermudagrass and some alkali sacaton.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
28	Few trees; wide floodway in this area. Sparse vegetation in floodway, may be recently disturbed.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
29	Willows along river. Floodway: mowed seep willow, Russian thistle, alkali sacaton, bermudagrass, forbs.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
30	Willows along river. Floodway sparsely vegetated - mowed seep willow and Russian thistle.	Willow-seepwillow/ Palustrine Woodland	Herbaceous/ Transitional Grassland
31	Along river - curly dock, alkali sacaton. In floodway - mowed, acacia, alkali sacaton, globe mallow, four-wing saltbush.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
32	Riparian zone dominated by salt cedar and seep willow. Floodway: Russian thistle, alkali sacaton.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
33		Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
34	Floodway very wide in this area, virtually no vegetation.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland

		Vegetation Community/Physiognomic Class	
Sites*	**Comments**	**Riparian Margin**	**Floodway**
35	Floodway - no vegetation except salt cedar seedlings. Along river - salt cedar.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
36	Area appears to be frequently flooded or backed-up with water.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
37	Floodway dominated by aster species. Soil moisture is greater than in other locations surveyed.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
38		Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
39	Dry river bed. No trees along bank.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
40	American Highway at Yarbrough. Few trees, come common reed along river. Floodway - bermudagrass, aster, occasional silverleaf nightshade, occasional cottonwood.	Herbaceous/ Emergent Marsh	Herbaceous/ Transitional Grassland
41	Riparian zone - occasional salt cedar.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland
42	Floodway - only silverleaf nightshade. Along river - salt cedar, bermudagrass, aster, a single Russian olive.	Salt cedar/ Transitional Woodland	Herbaceous/ Transitional Grassland

* Sites in bold face type indicate that a representative photo is included in Appendix B

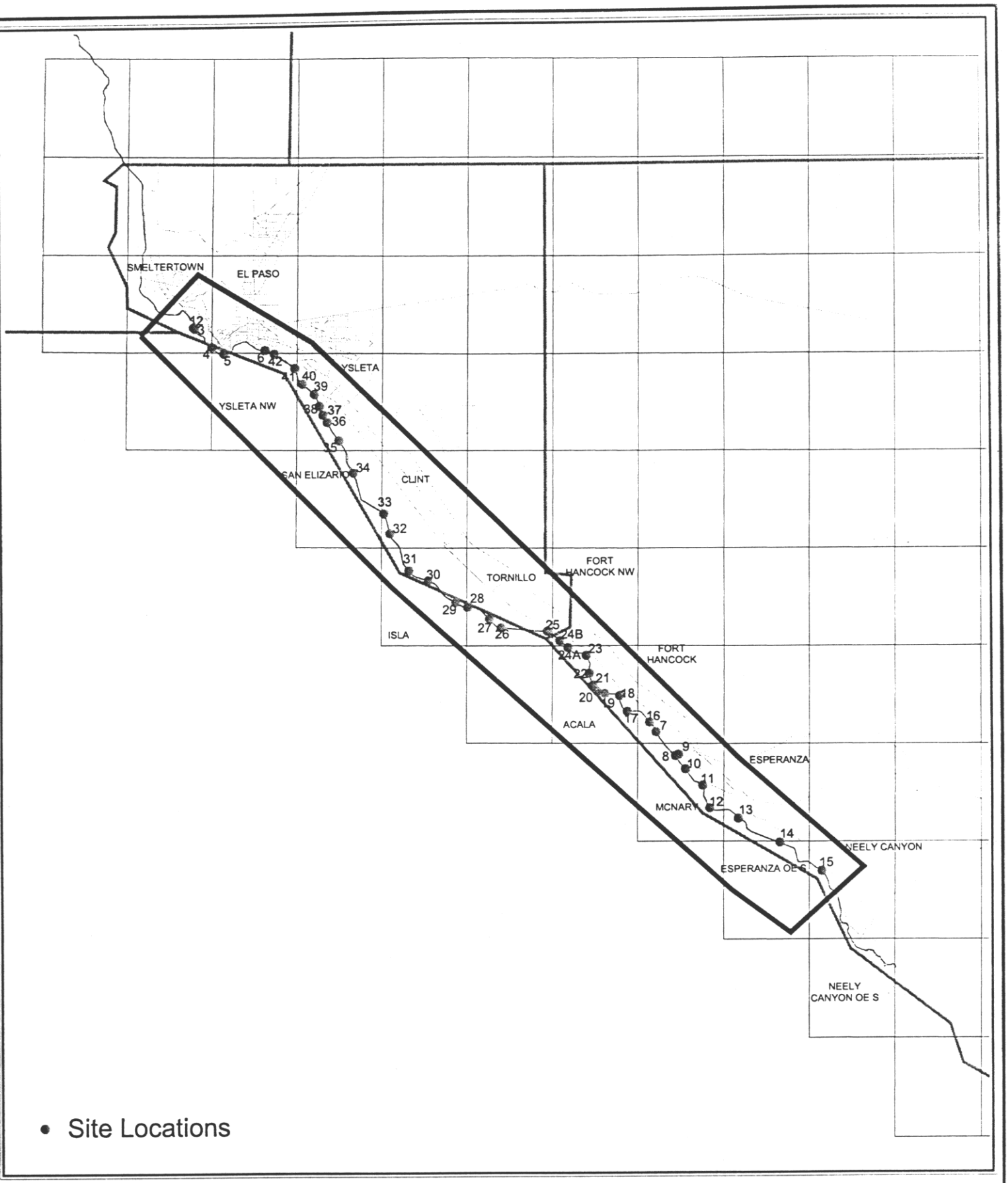
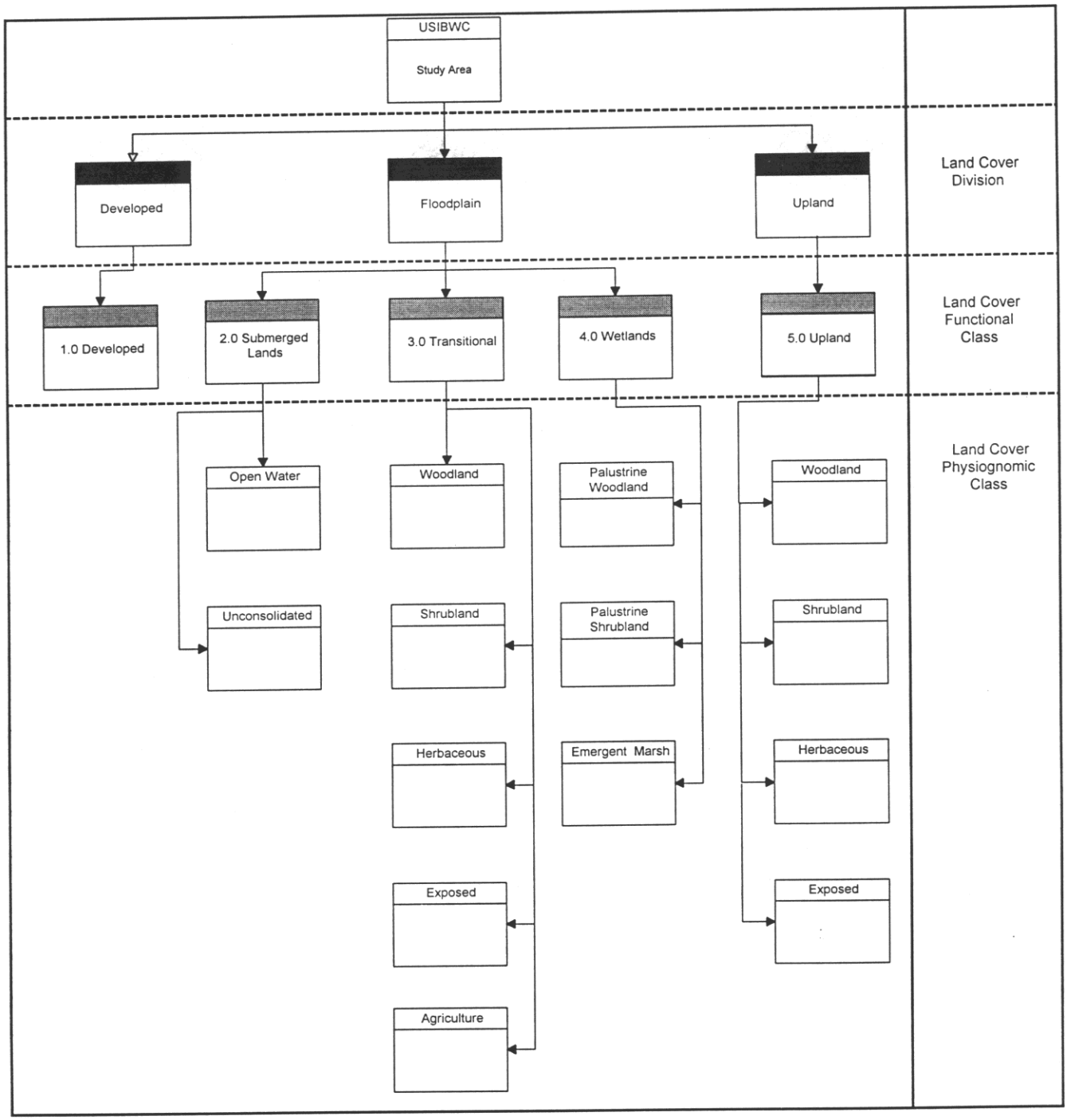


Figure A.1

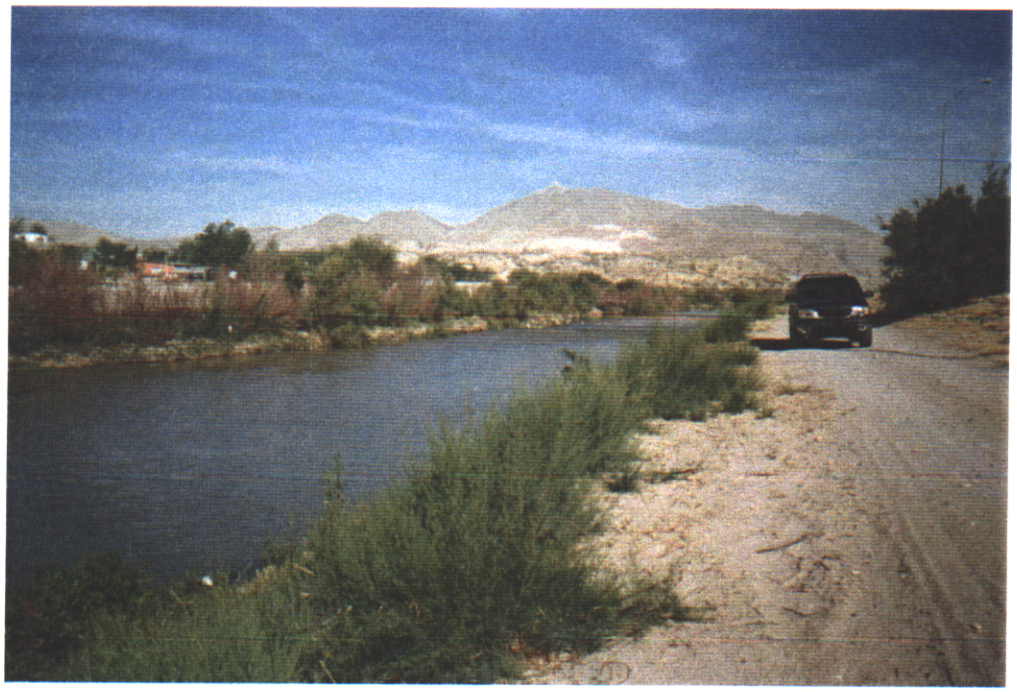
Survey Locations Map
USIBWC Rio Grande Study Area
El Paso and Hudspeth Counties, Texas

PARSONS ENGINEERING SCIENCE, INC.

Figure A-2
Example of USIBWC Study Area Physiognomic Classes



APPENDIX B
PHOTO LOG



Site 1 is a typical riparian margin (channel bank) approximately 10 to 15 feet wide. The margin consists of greater than 90 percent salt cedar (less than 5 feet tall) with occasional curly dock, little barley, and oleander. The floodway and levee bank is dominated by bermudagrass. Four-wing saltbush, salt cedar, and mesquite occur within the floodway and on the levee bank as well.

Site 11 is dominated by bermudagrass and Russian thistle within the floodway and along the levee bank. The riparian margin is dominated by salt cedar.

Site 14 is located just upstream of Fort Quitman, Texas. The floodway is dominated by bermudagrass, Russian thistle and salt cedar. There is evidence of livestock grazing in the area. The river bank is steeply incised and dominated by bermudagrass and sedge.

Site 20 is an example of a typical riparian margin dominated by salt cedar.

Site 22 is typical of unvegetated sandbars which may provide suitable habitat for shorebirds. This area is dominated by bermudagrass and salt cedar.

Site 24 is typical of riparian margins dominated by willow and bermudagrass. This riparian margin is approximately 15 feet wide.

Site 29 consists of a riparian margin dominated by willow, baccharis, and common reed. Grasses in the floodway include sand dropseed and bermudagrass.

Site 31 is typical of herbaceous riparian zones dominated by curly dock and spiny aster. The floodway is dominated by alkali sacaton, globe mallow, four-wing saltbush, and whitethorn acacia.

A pond at **Site 36** is in an area recently disturbed by construction of the American Canal extension. Vegetation community is not well developed.

The floodway at **Site 37** is wide and exhibits greater soil moisture than other areas surveyed. It is dominated by an aster species. Well established cottonwoods are present.

APPENDIX C
AVIAN SPECIES EXPECTED TO OCCUR AND OBSERVED IN STUDY AREA FIELD SURVEYS

Common Name	Scientific Name	Observed in Interior Least Tern Survey (week of July 24, 2000)	Observed in Winter Survey January 16 and 17, 2001	
			Study Area	Rio Bosque Wetland Refuge
Pied-billed grebe	*Podilymbus podiceps*			X
Eared grebe	*Podiceps nigricollis*			X
Double-crested cormorant	*Phalacrocorax auritus*			
Least bittern	*Ixobrychus exilis*			
American bittern	*Botaurus lentiginosus*			
Great blue heron	*Ardea herodias*	X	X	
Great egret	*Ardea albus*			X
Snowy egret	*Egretta thula*			X
Little blue heron	*Egretta caerulea*	X		
Cattle egret	*Bubulcus ibis*	X		
Green heron	*Butorides virescens*	X		
Black-crowned night heron	*Nycticorax nycticorax*	X		
White-faced ibis	*Plegadis chihi*			
Black vulture	*Coragyps atratus*			
Turkey vulture	*Cathartes aura*	X	X	
Gadwall	*Anas strepera*	X	X	X
American wigeon	*Anas americana*			X
Mallard	*Anas platyrhynchos*	X	X	
Blue-winged teal	*Anas discors*			
Cinnamon teal	*Anas cyanoptera*			X
Northern shoveler	*Anas clypeata*			X
Northern pintail	*Anas acuta*			X
Green-winged teal	*Anas crecca*			X
Canvasback	*Aythya valisineria*			X
Ring-necked duck	*Aythya collaris*			X
Bufflehead	*Bucephala albeola*			
Osprey	*Pandion haliaetus*			

Common Name	Scientific Name	Observed in Interior Least Tern Survey (week of July 24, 2000)	Observed in Winter Survey January 16 and 17, 2001	
			Study Area	Rio Bosque Wetland Refuge
Northern harrier	*Circus cyaneus*		X	
Sharp-shinned hawk	*Accipiter striatus*			
Cooper's hawk	*Accipiter cooperii*			
Swainson's hawk	*Buteo swainsoni*		X	
White-tailed hawk	*Buteo albicaudatus*			
Zone-tailed hawk	*Buteo albonotatus*			X
Red-tailed hawk	*Buteo jamaicensis*	X		X
Ferruginous hawk	*Buteo regalis*		X	
Golden eagle	*Aquila chrysaetos*			
American kestrel	*Falco sparverius*	X	X	
Scaled quail	*Callipepla squamota*			
Gambel's quail	*Callipepla gambeii*	X		X
Virginia rail	*Rallus limicola*			
Sora	*Porzana carolina*			
Common moorhen	*Gallinula chloropus*		X	
American coot	*Fulica americana*			X
Sandhill crane	*Grus canandensis*			
Killdeer	*Charadrius vociferous*	X		X
Black-necked stilt	*Himantopus mexicanus*	X		
Greater yellowlegs	*Tringa flavipes*			X
Solitary sandpiper	*Tringa solitaria*			
Willet	*Catoptrophorus semipalmatus*			
Spotted sandpiper	*Actitus macularia*			X
Least sandpiper	*Calidris minutilla*			
Western sandpiper	*Calidris mauri*	X		
Long-billed dowitcher	*Limnodromus scolopaceus*			X
Ring-billed gull	*Larus delawarensis*			X
Herring gull	*Larus argentatus*			
Least tern	*Sterna antillarum*			
Band-tailed pigeon	*Columba fasciata*			

Common Name	Scientific Name	Observed in Interior Least Tern Survey (week of July 24, 2000)	Observed in Winter Survey January 16 and 17, 2001	
			Study Area	Rio Bosque Wetland Refuge
Rock dove	*Columba livia*			
White-winged dove	*Zenaida asiatica*			
Inca dove	*Columbina inca*			
Common ground dove	*Columbina passerina*		X	
Mourning dove	*Zenaida macroura*	X	X	
Yellow-billed cuckoo	*Coccyzus americanus*			
Greater roadrunner	*Geococcyx californianus*			
Barn owl	*Tyto alba*			
Great horned owl	*Bubo virginianus*			
Burrowing owl	*Athene cunicularia*	X		
Lesser nighthawk	*Chordeiles acutipennis*			
White-throated swift	*Aeronautes saxatalis*			X
Black-chinned hummingbird	*Archilochus alexandri*			
Broad-tailed hummingbird	*Selasphorus rufus*			
Belted kingfisher	*Ceryle alcyon*		X	
Ladder-backed woodpecker	*Picoides scalaris*			
Common flicker	*Colaptes auratus*			
Northern flicker	*Drycopus pileatus*		X	
Ash-throated flycatcher	*Myiarchus cinerascens*			
Western kingbird	*Tyrannus verticalis*	X		
Black phoebe	*Sayornis nigricans*			
Say's phoebe	*Sayornis saya*			X
Vermilion flycatcher	*Pyrocephalus rubinus*			
Loggerhead shrike	*Lanius ludovicianus*		X	
Scrub jay	*Aphelocoma coerulescens*			
American crow	*Corvus brachyrhynchos*			X
Chihuahuan raven	*Corvus verticalis*			X
Northern rough-winged swallow	*Stelgidopteryx serripennis*			

Common Name	Scientific Name	Observed in Interior Least Tern Survey (week of July 24, 2000)	Observed in Winter Survey January 16 and 17, 2001	
			Study Area	Rio Bosque Wetland Refuge
Bank swallow	*Riparia riparia*			
Barn swallow	*Hirundo rustica*	X		
Cliff swallow	*Petrochelidon pyrrohonata*	X		
Verdin	*Auriparus flaviceps*			
Bushtit	*Psaltriparus minimus*			
Cactus wren	*Campylorhynchus brunneicapillus*			
Rock wren	*Salpinctes obsoletus*			
Bewick's wren	*Thryomanes bewickii*			
Marsh wren	*Cistothorus palustris*			
Ruby-crowned kinglet	*Regulus calendula*			
Black-tailed gnatcatcher	*Polioptila melanura*			
Hermit thrush	*Catharus guttatus*			
American robin	*Turdus migratorius*			
Northern mockingbird	*Mimus polyglottos*	X		
Curve-billed thrasher	*Toxostoma curvirostre*			
Crissal thrasher	*Toxostoma crissale*			
European starling	*Sturnus vulgaris*			
Phainopepla	*Phainopepla nitens*			
Orange-crowned warbler	*Vermivora peregrina*			
Lucy's warbler	*Vermivora luciae*			
Yellow-rumped warbler	*Dendroica coronata*			
Yellow warbler	*Dendroica petechia*			
Common yellowthroat	*Geothlypis trichas*	X		
Yellow-breasted chat	*Icteria virens*			
Summer tanager	*Piranga rubra*			
Green-tailed towhee	*Pipilo chlorurus*			
Spotted towhee	*Pipilo maculatus*		X	
Rufous-sided towhee	*Pipilo erythrophthalmus*			
Brown towhee	*Pipilo fuscus*			
Cassin's sparrow	*Aimophila cassinii*			

Common Name	Scientific Name	Observed in Interior Least Tern Survey (week of July 24, 2000)	Observed in Winter Survey January 16 and 17, 2001	
			Study Area	Rio Bosque Wetland Refuge
Chipping sparrow	*Spizella passerina*			X
Clay-colored sparrow	*Spizella pallida*			
Vesper sparrow	*Pooecetes gramineus*		X	
Black-throated sparrow	*Amphispiza bilineata*			
Lark sparrow	*Calamospiza melanocorys*			
Savannah sparrow	*Passerculus sandwichensis*			X
White-crowned sparrow	*Zonotrichia leucophrys*		X	
Dark-eyed junco	*Junco hyemalis*		X	
Northern cardinal	*Cardinalis cardinalis*			
Pyrrhuloxia	*Cardinalis sinuatus*			
Blue grosbeak	*Guiraca caerulea*			
Varied bunting	*Passerina versicolor*			
Painted bunting	*Passerina ciris*			
Red-winged blackbird	*Agleaius phoeniceus*	X		X
Western meadowlark	*Sturnella neglecta*		X	
Brewer's blackbird	*Euphagus cyanocephalus*			X
Great-tailed grackle	*Quiscalus mexicanus*	X		X
Brown-headed cowbird	*Molothrus ater*			
Bullock's oriole	*Icterus bullockii*			
House finch	*Carpodacus mexicanus*		X	
House sparrow	*Passer domesticus*			

APPENDIX D
MAMMAL, REPTILE AND AMPHIBIAN SPECIES EXPECTED TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name
MAMMALS	
Bats	
Big brown bat	*Eptesicus fuscus*
Big free-tailed bat	*Taradida macrotis*
Brazilian free-tailed bat	*Taradida brasiliensis*
Cave myotis	*Myotis velifer*
Fringed myotis	*Myotis thysanodes*
Hoary bat	*Lasiurus cinereus*
Pallid bat	*Antrozous pallidus*
Red bat	*Lasiurus borealis*
Spotted bat	*Euderma maculatum*
Yuma myotis	*Bubulcus ibis*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*
Beaver	*Caster canadensis*
Black rat	*Rattus rattus*
Black-tailed jackrabbit	*Lepus californicus*
Black-tailed prairie dog	*Cynomys ludovicianus*
Botta's pocket gopher	*Thomomys bottae*
Cactus mouse	*Peromyscus eremicus*
Cottontail	*Sylvilagus auduboni*
Deer mouse	*Peromyscus maniculatus*
Desert pocket gopher	*Geomys arenarius*
Hispid cotton rat	*Sigmodon hispidus*
Hispid pocket mouse	*Perognathus hispidus*
House mouse	*Mus musculus**
Merriam's kangaroo rat	*Dipodomys merriami*
Northern grasshopper mouse	*Onychomys leucogaster*
Norway rat	*Rattus norvegicus**
Ord's kangaroo rat	*Dipodomys ordii*

Common Name	Scientific Name
Porcupine	*Erethizon dorsatum*
Rock pocket mouse	*Perognathus intermedius*
Rock squirrel	*Spermophilus variegates*
Silky pocket mouse	*Perognathus flavus*
Spotted ground squirrel	*Spermophilus spilosoma*
Texas antelope squirrel	*Ammopermophilus interpres*
Western harvest mouse	*Reithrodontomys megalotis*
Western spotted skunk	*Spilogale gracilis*
White-footed mouse	*Peromyscus leucopus*
White-throated woodrat	*Neotoma albigula*
Ungulates	
Feral pig	*Sus scrofa**
Mule deer	*Odocoileus hemionus*
White-tailed deer	*Odocoileus virginianus*
Marsupials	
Opossum	*Dipelphis virginiana*
Carnivores and Insectivores	
Badger	*Taxidea taxus*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*
Desert shrew	*Notiosorex crawfordi*
Gray fox	*Urocyon cinereoargenteus*
Hog-nosed skunk	*Conepatus mesoleucus*
Kit fox	*Vulpes macrotis*
Long-tailed weasel	*Mustela frenata*
Mountain lion	*Felis concolor*
Raccoon	*Procyon lotor*
Ringtail	*Bassariscus astutus*
Striped skunk	*Mephitis mephitis*

Common Name	Scientific Name
AMPHIBIANS	
Bullfrog	*Rana catesbeiana*
Canyon treefrog	*Hyla arenicolor*
Couch's spadefoot	*Scaphiopus couchii*
Great plains narrow-mouth toad	*Gastrophryne olivacea*
Great plans toad	*Bufo cognatus*
Green toad	*Bufo debillis*
New Mexico spadefoot	*Spea multiplicata*
Northern leopard frog	*Rana pipiens*
Plans spadefoot	*Spea bombifrons*
Red-spotted toad	*Bufo punctatus*
Rio Grande leopard frog	*Rana berlandieri*
Texas toad	*Bufo speciosus*
Tiger salamander	*Ambystoma tigrinum*
Woodhouse's toad	*Bufo woodhousii*
REPTILES	
Turtles	
Ornate box turtle	*Terrapene ornate*
Painted turtle	*Chrysemys picta*
Spiny softshell turtle	*Srionyx spiniferus*
Yellow mud turtle	*Kinosternon flavescens*
Lizards	
Canyon lizard	*Sceloporus merriami*
Chihuahuan spotted whiptail	*Cnemidophorus exsanguis*
Colorado checkered whiptail	*Cnemidophorus tesselatus*
Crevice spiny lizard	*Sceloporus poinsetti*
Desert grassland whiptail	*Cnemidophorus uniparens*
Desert spiny lizard	*Sceloporus magister*
Eastern collared lizard	*Crotaphytus collaris*
Fence lizard	*Sceloporus undulatus*
Four-lined skink	*Eumeces tetragrammus*

Common Name	Scientific Name
Greater earless lizard	*Cophosaurus texanus*
Great plains skink	*Eumeces obsoletus*
Lesser earless lizard	*Holbrookia maculata*
Little striped whiptail	*Cnemidophorus inornatus*
Longnose leopard lizard	*Gambelia wislizeni*
Many-lined skink	*Eumeces multivirgatus*
Mediterranean gecko	*Hemidactylus turcicus**
New Mexico whiptail	*Cnemidophorus neomexicanus*
Plateau spotted whiptail	*Cnemidophorus septemvittatus*
Roundtail horned lizard	*Phrynosoma modestum*
Short-horned lizard	*Phrynosoma douglassi*
Side-blotched lizard	*Uta stansburiana*
Texas banded gecko	*Coleonyx brevis*
Texas horned lizard	*Phrynosoma cornutum*
Texas spotted whiptail	*Cnemidophorus gularis*
Tree lizard	*Urosaurus ornatus*
Western whiptail	*Cnemidophorus tigris*
Snakes	
Blackneck garter snake	*Thamnophis cyrtopsis*
Blacktail rattlesnake	*Crotalus molossus*
Bullsnake	*Pituophis melanoleucus*
Checkered garter snake	*Thamnophis marcianus*
Coachwhip	*Masticophis flagellum*
Common garter snake	*Thamnophis sirtalis*
Common kingsnake	*Lampropeltis getula*
Corn snake	*Elaphe guttata*
Eastern glossy snake	*Arizona elegans*
Gray-banded kingsnake	*Lampropeltis alterna*
Ground snake	*Sonora semiannulata*
Longnose snake	*Rhinocheilus lecontei*
Massasauga	*Sistrurus catentus*
Milk snake	*Lampropeltis triangulum*

Common Name	Scientific Name
Mojave rattlesnake	*Crotalus scutulatus*
Night snake	*Hypsiglena torquata*
Ringneck snake	*Diadophis punctatus*
Rough earth snake	*Virginia striatula*
Southwestern blackhead snake	*Tantilla hobartsmithi*
Striped whipsnake	*Masticophis taeniatus*
Texas blind snake	*Leptotyphlops dulcis*
Texas lyre snake	*Trimporphodon vilkinsoni*
Trans-Pecos rat snake	*Bogertophis subocularis*
Western blind snake	*Leptotyphlops humulis*
Western diamonback rattlesnake	*Crotalus atrox*
Western hognose snake	*Heterodon nasicus*
Western rattlesnake	*Crotalus viridis*

* Introduced species

APPENDIX E
VEGETATION SPECIES LIST

Common Name	Scientific Name	Observed in Study Area
Family: Agavaceae		
Narrowleaf yucca	*Yucca constricta*	
Soapweed yucca	*Yucca glauca*	
Sotol	*Dasylirion wheeleri*	X
Spanish dagger	*Yucca torreyi*	
Family: Amaranthaceae		
Carelessweed	*Amaranthus palmeri*	
Family: Anacardiaceae		
Skunkbush	*Rhus trilobata*	
Family: Asclepiadaceae		
Milkweed vine	*Sarcostemma* sp.	X
Poison milkweed	*Asclepias subverticillata*	
Family: Asteraceae		
Arrowweed	*Pluchea sericea*	
Baccharis	*Baccharis emoryi*	X
Bigleaf brickelbush	*Brickellia floribunda*	
Burrobrush	*Hymenoclea monogyra*	
Cocklebur	*Xanthium strumarium*	X
Cutleaf brickelbush	*Brickellia laciniata*	X
Desert marigold	*Baileya multiradiata*	
Firewheel	*Gaillardia pulchella*	
Fleabane	*Erigeron* sp.	
Goldenrod	*Solidago* sp.	X
Groundsel	*Senecio* spp.	
Gumweed	*Grindelia microcephala*	
Hierba del marrano	*Aster subulatus*	X
Purple aster	*Machaeranthera canesens*	X
Rubber rabbitbrush	*Chrysothamnus nauseosus*	
Sand sage	*Artemisia filifolia*	
Seepwillow	*Baccharis glutinosa*	X
Sneezeweed	*Helenium autumnale*	

Common Name	Scientific Name	Observed in Study Area
Family: Bignoniaceae		
Desert willow	*Chilopsis linearis*	X
Family: Brassicaceae		
Flixweed	*Descurainia sophia*	X
Mountain pepperweed	*Lepidium montanum*	X
Rocket mustard	*Sisymbrium irio*	X
Shepherd's purse	*Capsella bursa-pastoris*	
Spectaclepod	*Dimorphocarpa wislizeni*	
Family: Boraginaceae		
Salt heliotrope	*Heliotropium curassavicum*	X
Family: Cactaceae		
Cholla	*Opuntia* sp.	X
Prickly pear	*Opuntia* sp.	X
Family: Chenopodiaceae		
Annual atriplex	*Atriplex* -	X
Desert seepweed	*Suaeda suffrutescens*	X
Fourwing saltbush	*Atriplex canescens*	X
Russian thistle	*Salsola kali**	X
Summer cypress	*Kochia scoparia**	
Family: Convolvulaceae		
Bindweed	*Convolvulus arvensis*	
Family: Cucurbitaceae		
Buffalo gourd	*Cucurbita foetidissima*	X
Family: Cyperaceae		
Bulrush	*Schoenoplectus acutus*	X
Nutsedge	*Cyperus rotundus*	X
Sedge	*Carex* sp.	X
Spikerush	*Eliocharis* sp.	X
Family: Ephedraceae		
Torrey joint-fir	*Ephedra torreyana*	X
Family: Equisetaceae		
Horsetail	*Equisetum* spp.	X

Family: Euphorbiaceae		
Leatherstem	*Jatropha dioica*	
Prostrate euphorbia	*Euphorbia* sp.	X
Family: Fabaceae		
Catclaw acacia	*Acacia greggii*	
False indigo	*Amorpha fruticosa*	
Hog plant	*Hoffmanseggia glauca*	
Honey mesquite	*Prosopis glandulosa*	X
Illinois bundleflower	*Desmanthus illinoensis*	
Nutall's sophora	*Sophora nutalliana*	X
Paloverde	*Parkinsonia aculeata*	X
Purple sage	*Psorothamnus scoparius*	
Red bladderpod	*Sphaerophysa salsula*	
Retama	*Parkinsonia aculeata*	
Riverhemp	*Sesbania macrocarpa*	
Screwbean mesquite	*Prosopis pubescens*	X
White sweet clover	*Melilotus albus*	
Whitethorn acacia	*Acacia constricta*	X
Wild licorice	*Glycyrrhiza lepidota*	X
Family: Fagaceae		
Live oak	*Quercus virginana*	
Family: Fourquieriaceae		
Ocotillo	*Fourquieria splendens*	X
Family: Hydrophyllaceae		
Scorpionweed	*Phacelia integrifolia*	X
Family: Juglandaceae		
Arizona walnut	*Juglans major*	
Little walnut	*J. microcarpa*	
Family: Juncaceae		
Woodrush	*Luzula* sp.	
Family: Koeberliniaceae		
Allthorn	*Koeberlina spinosa*	
Family: Lamiaceae		
Rosemary mint	*Poliomintha incana*	X
Family: Loasaceae		

Stickleaf	*Mentzelia multiflora* var. *multiflora*	X
Stinging cevallia	*Cevallia sinuata*	X
Family: Malvaceae		
Alkali mallow	*Sida hederacea*	
Anoda	*Anoda cristata*	
Soft globe mallow	*Sphaeralcea incana*	X
Family: Moraceae		
White mulberry	*Morus alba*	X
Family: Nyctaginaceae		
Windmill	*Allonia incarnata*	
Family: Onagraceae		
Small-flowered gaura	*Guara parviflora*	
Pink evening primrose	*Oenothera coronopifolia*	X
Primrose	*Oenothera albicaulis*	X
Family: Oleaceae		
Green ash	*Fraxinus pensylvanica*	
Narrow-leafed forestiera	*Forestiera angustifolia*	
New Mexico olive	*Forestiera neomexicana*	
Russian olive	*Eleagnus angustifolia**	X
Family: Pinaceae		
Afghan pine	*Pinus eldarica**	X
Family: Platanaceae		
Arizona sycamore	*Platanus wrightii*	
Family: Poaceae		
Alkali sacaton	*Sporobolus airoides*	X
Annual bluegrass	*Poa annua**	
Black grama	*Bouteloua*	
Barnyard grass	*Echinochloa crus-galli**	X
Bermudagrass	*Cynodon dactylon**	X
Black grama	*Bouteloua eriopoda*	
Bush muhly	*Muhlenbergia porteri*	
Brome	*Bromus tectorum**	
Canada wildrye	*Elymus canadensis*	
Cane bluestem	*Bothriochloa barbinodis*	
Common reed	*Phragmites australis*	X
Common witchgrass	*Panicum capillare*	

Fall witchgrass	*Leptoloma cognatum*	X
Giant dropseed	*Sporobolus giganteus*	
Green sprangletop	*Leptochloa dubia*	X
Hairy grama	*Bouteloua hisuta*	
Halls panicum	*Panicum hallii*	
Johnsongrass	*Sorghum halepense**	X
Longleaf squirreltail	*Elymus longifolius*	X
Mexican sprangletop	*Leptochloa uninervia*	X
Needle grama	*Bouteloua*	
Rabbitfoot grass	*Polypogon monspeliensis*	X
Rice cutgrass	*Leersia oryzoides*	
Saltgrass	*Distichlis spicata*	X
Sand dropseed	*Sporobolus cryptandrus*	X
Sideoats grama	*Bouteloua curtipendula*	
Threeawn	*Aristida* sp.	X
Tobosa	*Pleuraphis mutica*	X
Windmillgrass	*Chloris* sp.	X
Yellow bristlegrass	*Setaria geniculata*	X
Family: Polygonaceae		
Amamastla	*Rumex mexicanus*	
Curly dock	*Rumex crispus**	X
Swamp knotweed	*Polygonum amphibium*	
Wild buckwheat	*Eriogonum* sp.	
Family: Portulaceae		
Purslane	*Portulaca* sp.	X
Family: Ranunculaceae		
Texas virgin bower	*Clematis drummondii*	
Family: Rhamnaceae		
Birchleaf buckthorn	*Rhamnus betulaefolia*	
Family: Rosaceae		
Apache plume	*Fallugia paradoxa*	
Family: Salicaceae		
Coyote willow	*Salix exigua*	
Peachleaf willow	*Salix amygdiloides*	
Rio Grande cottonwood	*Populus wislizenii*	X
Southwestern black willow	*Salix gooddingii*	X

Family: Sapindaceae		
Western soapberry	*Sapindus saponaria*	
Family: Scophulariaceae		
Speedwell	*Veronica* sp.	
Family: Simaroubaceae		
Tree of heaven	*Ailanthus altissima**	X
Family: Solanaceae		
Groundcherry	*Physalis virginiana*	X
Jimsonweed	*Datura stramonium**	
Pale wolfberry	*Lycium torreyi*	X
Silver-leaf nightshade	*Solanum elaeagnifolium*	X
Family: Tamaricaceae		
Salt cedar	*Tamarix ramosissima**	X
Family: Typhaceae		
Common cattail	*Typha latifolia*	X
Family: Ulmaceae		
Netleaf hackberry	*Celtis reticulata*	
Siberian elm	*Ulmus pumila**	X
Family: Verbenaceae		
Chaste tree	*Vitex agnus-castus**	X
Frogfruit	*Phyla incisa*	X
Family: Viscaceae		
Mistletoe	*Phoradendron* sp.	X
Family: Vitaceae		
Arizona grape	*Vitis arizonica*	
Family: Zygophyllaceae		
Creosote bush	*Larrea tridentata*	X

* Introduced species

APPENDIX F
FISH SPECIES COLLECTED DURING FIELD SURVEYS

COMMON NAME	SCIENTIFIC NAME	DISTRIBUTION NOTES
Gizzard shad	*Dorosoma cepedianum*	Multiple size classes
River carpsucker	*Carpoides carpio*	Several size classes noted
Longear sunfish	*Lepomis megalotis*	May be a hybrid
Channel catfish	*Ictalurus punctatus*	Several size classes noted
Red shiner	*Cyprinella lutrensis*	Present in multiple locations
Western mosquitofish	*Gambusia affinis*	Present at all locations
Common carp	*Cyprinus carpio*	Several age classes noted
Bullhead minnow	*Pimephales vigilax*	Nearly ubiquitous

APPENDIX G
BRIDGE LOCATION MAP

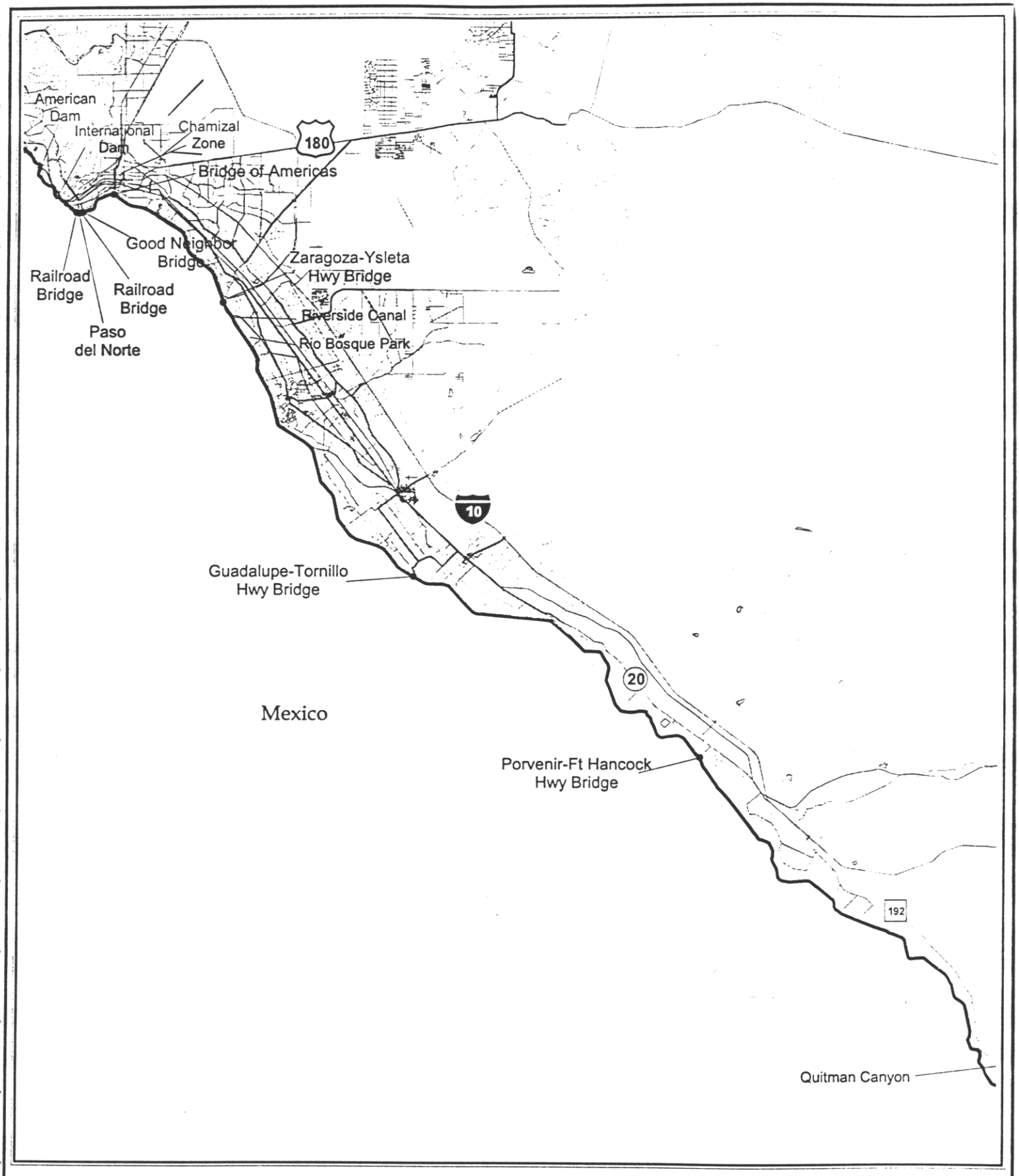


Figure G

Bridge Location Map
USIBWC Rio Grande Study Area
El Paso and Hudspeth Counties, Texas

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