



APPENDIX D

Biological Survey Report



BIOLOGICAL SURVEY REPORT

SUPPORTING THE

CONSTRUCTION, OPERATION, AND MAINTENANCE

OF TACTICAL INFRASTRUCTURE

USBP RIO GRANDE VALLEY SECTOR, TEXAS

Prepared for

U.S. Customs and Border Protection

Prepared by



engineering-environmental Management, Inc. (e²M)
2751 Prosperity Avenue, Suite 200
Fairfax, VA 22031

e²M Project No.: 4100-989

MAY 2008

ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
BMP	Best Management Practice
BSR	Biological Survey Report
CBP	U.S. Customs and Border Protection
CFR	Code of Federal Regulations
cm	centimeter(s)
CWA	Clean Water Act of 1977
e ² M	engineering-environmental Management, Inc.
EOR	Element Occurrence Record
ESA	Endangered Species Act
FE	Federally Endangered
GIS	Geographic Information SystemGPS
GPS	Global Positioning System
LA	license agreement
LRGV	Lower Rio Grande Valley
LRGVNWR	Lower Rio Grande Valley National Wildlife Refuge
MBTA	Migratory Bird Treaty Act of 1918, as amended
m	meter(s)
m ²	square meters
MJD	Multi-Jurisdictional Dataset
mph	miles per hour
NVCS	National Vegetation Classification Standard
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
ROE	right of entry
ROW	right-of-way
SE	State Endangered
TPWD	Texas Parks and Wildlife Department
TXNDD	Texas Natural Diversity Database
USACE	U.S. Army Corps of Engineers
USBP	U.S. Border Patrol
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USIBWC	U.S. International Boundary and Water Commission
UTM	Universal Transverse Mercator
WMA	Wildlife Management Area

**BIOLOGICAL SURVEY REPORT
FOR
CONSTRUCTION AND OPERATION OF TACTICAL INFRASTRUCTURE
USBP RIO GRANDE VALLEY SECTORS**

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS.....	INSIDE FRONT COVER
1. INTRODUCTION.....	1-1
2. PROJECT DESCRIPTION	2-1
3. SURVEY METHODS	3-1
4. ENVIRONMENTAL SETTING	4-1
5. BIOLOGICAL RESOURCES.....	5-1
5.1 Vegetation Classification for the 150-foot Survey Corridor on the North Side of the Levee	5-1
5.1.1 Tamaulipan Floodplain Ecological System (CES301.990).....	5-4
5.1.2 Tamaulipan Palm Grove Riparian Forest Ecological System (CES301.991)	5-10
5.1.3 Tamaulipan Mesquite Upland Scrub Ecological System (CES301.984)	5-11
5.1.4 Tamaulipan Mixed Deciduous Thornscrub Ecological System (CES301.983)	5-13
5.1.5 Tamaulipan Arroyo Shrubland Ecological System (CES301.992).....	5-14
5.1.6 Tamaulipan Calcareous Thornscrub Ecological System (CES301.986)	5-16
5.1.7 Tamaulipan Savanna Grassland Ecological System (CES301.985).....	5-18
5.1.8 North American Arid West Emergent Marsh Ecological System (CES300.729)	5-19
5.1.9 Nonnative Woodland, Shrubland, and Herbaceous Vegetation Alliances and Associations	5-22
5.2 Vegetation Classification for the South of the Levee Project in Sections O-4 through O-10.....	5-33
5.3 Plant Species Identified	5-44
5.4 Fence Section Characteristics and Description of Habitat Quality	5-66
5.5 Wetlands and Waters of the United States.....	5-79
5.5.1 Field Evaluation Summary	5-81
5.5.2 Wetlands Vegetation Summary	5-82
5.5.3 Wetlands Soil Summary.....	5-88
5.6 Noxious Weeds and Invasive Nonnative Species	5-88
5.7 Wildlife and Wildlife Habitat	5-90
5.7.1 Introduction	5-90
5.7.2 Wildlife and Habitat Overview.....	5-90
5.8 Species Groups and Habitat Affinity	5-101
5.8.1 Mammals.....	5-101
5.8.2 Birds	5-101
5.8.3 Herpetiles	5-103
5.8.4 Invertebrates	5-103
5.9 Prehistoric Humans, Spanish Settlement, and Current Land Conservation.....	5-104
5.10 Habitat Monitoring and Management.....	5-106

5.11	Habitat Restoration	5-108
5.12	Urban Wildlife Habitat	5-108
6.	RARE SPECIES DATA	6-1
7.	PROJECT DATABASE AND INTERACTIVE GIS	7-1
8.	LIST OF PREPARERS	8-1
9.	REFERENCES.....	9-1

ATTACHMENTS

- A. Observation Point Form and Instruction Manual
- B. Description of Federally Listed Species
- C. GIS Products
- D. LRGV Species Lists

FIGURES

5-1. Representative Photographs of Mature Texas Ebony Tree and Woodland Stand5-5

5-2. Representative Photographs of Sugarberry Habitat 5-5

5-3. Representative Photographs of Mexican Ash Habitat 5-6

5-4. Representative Photographs of Honey Mesquite Forest Habitat 5-7

5-5. Representative Photographs of Mule’s Fat Habitat 5-8

5-6. Representative Photographs of Black Willow Habitat 5-8

5-7. Representative Photographs of Giant Reed Habitat 5-9

5-8. Representative Photographs of Common Reed Habitat 5-10

5-9. Representative Photographs of Sabal Palm Forest and Woodland Habitat 5-11

5-10. Representative Photographs of Granjeno Habitat 5-12

5-11. Representative Photographs of Honey Mesquite Woodland Habitat 5-13

5-12. Representative Photographs of Huisache Woodland Habitat 5-14

5-13. Representative Photographs of Honey Mesquite Shrubland Habitat 5-15

5-14. Representative Photographs of Arroyos in Sections O-1 and O-2 5-16

5-15. Representative Photographs of Cenizo – Blackbrush Habitat 5-17

5-16. Representative Photographs of Bristleleaf Dogweed – Woody Tiquilia Habitat 5-18

5-17. Representative Photographs of Retama Habitat 5-19

5-18. Representative Photographs of Tepeguaha Habitat 5-19

5-19. Representative Photographs of Alkali Sacaton Habitat 5-20

5-20. Representative Photographs of Narrowleaf Cattail Habitat 5-21

5-21. Representative Photograph of Smartweed Habitat 5-21

5-22. Representative Photograph of Duckweed Habitat 5-22

5-23. Representative Photographs of Athel Tamarisk Stand 5-23

5-24. Representative Photograph of Chinaberry Habitat 5-23

5-25. Representative Photograph of Castor Bean / Buffelgrass Habitat 5-24

5-26. Representative Photographs of Buffelgrass Habitat 5-25

5-27. Representative Photographs of Switchgrass (Guinea Grass) Habitat 5-26

5-28. Representative Photographs of Silver Bluestem – Buffelgrass Habitat 5-27

5-29. Representative Photographs of Johnsongrass Habitat 5-28

5-30. Representative Photographs of Bermuda Grass Habitat 5-28

5-31. Representative Photographs of Windmill Grass Habitat 5-29

5-32. Representative Photograph of Streambed Bristlegrass Habitat 5-30

5-33. Representative Photographs of Kleberg’s Bluestem Habitat 5-30

5-34. Representative Photograph of Mediterranean Lovegrass, Rough Pigweed Habitat 5-31

5-35. Representative Photograph of Quelite Cenizo - Buffelgrass Habitat 5-31

5-36. Representative Photographs of Prairie Aster Habitat 5-32

5-37. Representative Photograph of False Ragweed Habitat 5-33

TABLES

2-1. Tactical Infrastructure Sections, Rio Grande Valley Sector..... 2-2

3-1. Federal and State Threatened and Endangered Species in Texas, by
County 3-19

5-1. Crosswalk Relationship of USFWS Biotic Communities with NVCS
Ecological Systems and Vegetation Alliances 5-3

5-2. List of Plant Species Identified During Section Surveys 5-45

5-3. Summary of Jurisdictional^(*) and Non-Jurisdictional Wetlands within the
RGV 5-83

5-4. Noxious Weed List for the Project Corridor 5-89

5-5. Wildlife Observed During Natural Resources Surveys Conducted 1–7
October, and 11–14 December 2007 5-92

5-6. Wildlife Habitat Types Observed in the Mapping Corridor..... 5-95

1. INTRODUCTION

This Biological Survey Report (BSR) synthesizes information collected from a variety of literature sources and field surveys to describe the biological resources within the project corridor, provides supporting information from the project region, allows evaluation of the potential impacts of the project on biological resources, and provides the basis of recommendations for avoidance or reduction of those impacts using mitigation, including best management practices (BMP). Information was gathered from publicly available literature, data provided by relevant land management agencies, reviews of aerial photography and U.S. Geological Survey (USGS) topographic maps, data from the State of Texas, data from NatureServe, field surveys of the project corridor conducted in October and December 2007, and a reconnaissance survey for plant communities and land use types in the Hidalgo County sections in March 2008. A 150-foot-wide corridor was surveyed over the approximate 70-mile project corridor. The project will occur within a 60-foot corridor inside the 150-foot survey corridor in Sections O-1 through O-3 and O-11 through O-21 and a 40-foot corridor south of the levee in Sections O-4 through O-10. The construction corridor encompasses approximately 70 miles in length, with approximately 461 acres within the disturbed area. In total, approximately 323 acres of nonnative and native vegetation providing wildlife habitat occurs in the project corridor. The remaining area, 137 acres, supports land use in the form of fallow and irrigated agriculture, urban and residential development, roads, and open water.

Herbaceous vegetation (e.g., grasslands, forblands, emergent wetlands) composes approximately 65% of the impact corridor for a vegetation cover total of approximately 242 acres. Shrublands (dwarf, short, and tall) compose approximately 5% of the impact corridor for a vegetation cover total of 17 acres. Forests and woodlands compose approximately 17% of the impact corridor or 64 acres vegetation cover total. The vegetation represents a combination of mostly nonnative grasses that have become established in dense stands on levee banks, in hay fields, and as forest and woodland understory; shrublands that are invading herbaceous vegetation stands or occur on gravelly upland substrates; and a combination of remnant and planted riparian woodlands and forests.

THIS PAGE INTENTIONALLY LEFT BLANK

2. PROJECT DESCRIPTION

U.S. Customs and Border Protection (CBP) will construct, maintain, and operate tactical infrastructure consisting of pedestrian fence and associated access roads, patrol roads, and lights along the U.S./Mexico international border in the U.S. Border Patrol (USBP), Rio Grande Valley Sector, Texas. The locations of tactical infrastructure are based on a USBP Rio Grande Valley Sector assessment of local operational requirements where it will assist USBP agents in reducing cross-border violator activities. Tactical infrastructure will be constructed in 21 discrete sections along the international border in Starr, Hidalgo, and Cameron counties, Texas (see **Table 2-1**). The individual tactical infrastructure sections range from approximately 1 mile in length to approximately 13 miles in length.

Table 2-1. Tactical Infrastructure Sections, Rio Grande Valley Sector

Fence Section No.	Border Patrol Station	General Location	Approximate Mileage (mi)
O-1	Rio Grande City	Near Roma Port of Entry	3.75
O-2	Rio Grande City	Near Rio Grande City Port of Entry	8.74
O-3	McAllen	Los Ebanos Port of Entry	1.9
O-4	McAllen	From Peñitas to Abram	4.35
O-5	McAllen	Future Anzalduas Port of Entry	1.76
O-6	McAllen	Hidalgo Port of Entry	3.85
O-7	Weslaco	Proposed Donna Port of Entry	0.90
O-8	Weslaco	Retamal Dam	3.25
O-9	Weslaco	West Progreso Port of Entry	3.87
O-10	Weslaco	East Progreso Port of Entry	2.33
O-11	Harlingen	Joe's Bar-Nemo Road	2.31
O-12	Harlingen	Weaver's Mountain	0.92
O-13	Harlingen	West Los Indios Port of Entry	1.58
O-14	Harlingen	East Los Indios Port of Entry	3.59
O-15	Harlingen	Triangle - La Paloma	1.93
O-16	Harlingen	Ho Chi Minh - Estero	3.0
O-17	Brownsville	Proposed Carmen Road Freight Train Bridge	1.61
O-18	Brownsville	Proposed Flor De Mayo Port of Entry to Garden Park	3.58
O-19	Brownsville	B&M Port of Entry to Los Tomates	3.37
O-20	Brownsville	Los Tomates to Veterans International Bridge	0.93
O-21	Fort Brown	Veterans International Bridge to Sea Shell Inn	12.99
Total			71.44

3. SURVEY METHODS

To provide flexibility in placement of tactical infrastructure within the project corridor, and to ensure consideration of impacts due to construction, patrol, and maintenance, surveys were conducted in an area extending 150 feet on the north side (i.e., side away from the Rio Grande) of the 21 individual tactical infrastructure sections and extending at least 0.5 miles past the ends of each section (a total of 1,541 acres). Additionally, a reconnaissance survey was conducted in Hidalgo County on March 6–7, 2008, to determine plant communities and land use types on and south of the USIBWC levee including the levee shoulder, embankment, toe slope, right-of-way (ROW), and adjacent public and private land. The areas thus defined are referred to hereafter as the “survey corridor.”

Intuitive controlled investigations of the survey corridor were conducted by biologists of engineering-environmental Management, Inc. (e²M): Jim Von Loh (senior ecologist), Karen Stackpole (staff biologist), Brent Eastty (staff botanist), Dusty Janeke (staff biologist), Valerie Whalon (staff biologist), Tom Hayes (senior ecologist), and Nancy Hays (senior ecologist). Also participating were Gena Janssen, Dr. Tom Patterson, Dr. Sue Sill, and Dr. Carol Bush (subcontractors to e²M and U.S. Fish and Wildlife Service [USFWS], approved botanists for the Rio Grande Valley). The October and December 2007 surveys examined the project corridor beginning on 2 October and on 10 December 2007. The 2008 surveys were conducted during mid-March. In order to conduct surveys and access properties, rights-of-entry (ROE) approvals and CBP escorts were required.

e²M assigned senior ecologists and biologists familiar with vegetation and wildlife habitat classification, mapping protocols, and field sampling methods to intuitively examine the landscape and project corridor for the approximately 70-mile length. Further, senior e²M natural resources staff teamed with USFWS-approved and experienced South Texas botanists to ensure accurate identification of plant species and competent surveys for rare plants and potential habitat. The surveys were controlled, in that ROEs were approved for a 150-foot corridor width, and survey crews were required to be accompanied by USBP agents who served as guides, shared knowledge of wildlife sightings and other pertinent information, contacted landowners, if necessary, and ensured surveyor safety while in the field. Investigations included observed plant and wildlife species that were individually listed by fence segment, an assessment of habitat and surveys for rare plant and wildlife species, landscape photography points, observation points recording dominant species/location/cover/ environmental conditions/photodocumentation, determination of potential wetlands for future research, and general note-taking of natural resources.

Biologists walked the project corridor for each tactical infrastructure section where approved ROE or a special use permit was obtained. They conducted reconnaissance-level surveys on areas of land use (e.g., agricultural fields and urban areas) and examined in detail areas containing unique species

compositions or habitat that might be conducive to sensitive species (e.g., grasslands, shrublands, woodlands, forests, wetlands, water bodies). Observation data (Universal Transverse Mercator [UTM] coordinates, photographs, field notes, environmental information, vegetation structure, and plant community composition) were recorded at regular intervals along the corridor where vegetation occurred as homogenous stands and also where plant communities presented substantial shifts in species composition. These data were used to generate a vegetation classification and map to facilitate delineation of habitat types, analyses of potential sensitive species occurrences, and analyses of potential project impacts on biological resources (Attachment A). Vegetation type and land use maps were provided as a digital file for this report. Although no protocol surveys were conducted, botanists and wildlife biologists specifically examined habitats to determine the presence of state- and Federal-listed species (see **Tables 3-1 and 3-2**). Descriptions of the federally listed species are provided in Attachment B.

Texas Department of Wildlife and Parks; Texas Natural Diversity Database

The Texas Natural Diversity Database (TXNDD) was established in 1983 and is the Texas Parks and Wildlife Department's (TPWD) most comprehensive source of information related to rare, threatened, and endangered animals, plants, exemplary natural communities, and other significant features. While these data are continually updated, there are gaps in coverage and species information due to lack of access to land for inventory, data from many sources, and a lack of staff and resources to collect and process data for all rare and significant resources. To request information from the TXNDD the following link can be accessed: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species.phtml.

For the project corridor, TXNDD was used to assist with the evaluation of environmental impacts of the sections under consideration. The interpretation and extrapolation of the data included consideration of (1) data gaps that occur because of lack of access to private land, (2) the restriction of data extraction from only public information sources, (3) species and geographic coverage focused on the most-rare species and ecosystems, and (4) the lack of precise locality data in many secondary sources. Because of the small proportion of public land versus private land in Texas, the TXNDD does not include a representative inventory of rare resources in the state. However, it is based on the best data available to TPWD in terms of rare species locations and distributions and the use of qualified biologists to provide onsite inventory and evaluation. The element occurrence records (EORs) for Starr, Hidalgo, Cameron, and Starr counties are summarized by tracked species or plant community in Table 3-1.

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
<i>Awaous banana</i> (River Goby)	H	G5S1; TXT	(1) Southwest of Mission 6 km in the Rio Grande mainstem	(1) Occurred in pool lined with slabby boulders, moderate to swift current, little detritus or sand (EOID 7286)
<i>Hypognathus amarus</i> (Rio Grande Silvery Minnow)	C, S	G1G2SX; FLE; TXE	(1) Rio Grande at Brownsville; (2) Rio Grande downstream of Falcon Dam	(1) Captured in the 1920s, type locality (EOID 2794); (2) Observed in 1961, represents the last collection of the Rio Grande Silvery Minnow (EOID 7508)
<i>Hypopachus variolosus</i> (Sheep Frog)	C, H, S	G5S2; TXT	(1) West of Raymondville, LRGVNWR; (2) Near Brownsville, LRGVNWR; (3) Brownsville; (4) Edinburg; (5) Northwest of Edinburg; (6) West of McAllen; (7) Harlingen; (8) Northeast of Rio Grande City; (9) Near El Sauz; (10) Near Santa Catarina and Santa Anna; (11) East of Bayview; (12) North of Mission; (13) Southwest of Mission	(1) C collected in 1965 (EOID 3099); (2) Observed in 1923 (EOID 3536); (3) Collected in 1955 (EOID 3742); (4) Observed in 1933, collected 22 specimens in 1936 (EOID 4303); (5) Observed in 1934, collected 25 specimens in 1935 (EOID 5122); (6) Collected one specimen in 1949 (EOID 7429); (7) Observed in 2006 in Brush Country vegetation with introduced grasses (EOID 8803); (8) Large chorus heard in 2002 (EOID 8812); (9) Two choruses heard in 2002 and 2006 (EOID 8813); (10) Large choruses were heard in 2002 (EOID 8814); (11) Choruses were heard in 2002 and 2003 (EOID 8815); (12) Choruses heard in 2004 (EOID 8816); (13) Chorus heard in 2004 (EOID 8817)
<i>Leptodactylus fragilis</i> (White-lipped Frog)	H, S	G5S1; TXT	(1) Southeast of Rio Grande City; (2) West of Mission; (3) Southeast of Rio Grande City; (4) Northwest of Rio Grande City; (5) North of Roma and Los Saenz; (6) Near El Sauz	(1) Observed in 1932 (EOID 379); (2) Collected in 1935 (EOID 3108); (3) Collected in 1932 (EOID 4735); (4) Choruses heard and observation made in 2002 (EOID 8821); (5) Choruses heard at two locations in 2002 (EOID 8822); (6) Choruses heard at three locations in 2002 (EOID 8823)
<i>Notophthalmus meridionalis</i> (Black-spotted Newt)	C, H	G1S1; TXT	(1) Near Harlingen; (2) Near Brownsville and Los Fresnos; (3) Brownsville; (4) Southeast of McAllen; (5) East of Harlingen; (6) North of Sal del Ray; (7) Near Brownsville ; (8) Near Harlingen; (9) Bentsen State Park; (10) South of Raymondville; (11) La Joya Lake near Mission; (12) North of Brownsville; (13) Laguna Atascosa NWR; (14) Willacy – Cameron County Line; (15) Sabal Palm Grove Sanctuary	(1) Collected in 1946 (EOID 151); (2) Observations in 1948 and 1949 (EOID 567); (3) N/A (EOID 1378); (4) Two collections in 1962 (EOID 1757); (5) N/A (EOID 2042); (6) Collection in 1966 (EOID 2504); (7) Collection in 1923, topotype (EOID 2616); (8) Collection in 1952 (EOID 2627); (9) Collection of two specimens in 1967 (EOID 3661); (10) N/A (EOID 5489); (11) Collections made in 1939, 1940, 1941, and 1945 (EOID 5794); (12) Collection in 1947 (EOID 6392); (13) Collection of two specimens 1976, observation in 1987, best known meta-population (EOID 6494); (14) Collection in 1977 (EOID 7802); (15) Collection in 1970 (EOID 8166)

¹ Source: TDWP-NDD 2007

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
<i>Rhinophrynus dorsalis</i> (Mexican Burrowing Toad)	S	G5S2; TXT	(1) 8 miles west of Roma; (2) 2 miles west of Rio Grande City; (3) Near Rio Grande City; (4) Twelve miles north of Roma; (5) Northeast of U.S. 83 and FR 2098; (6) South of El Sauz; (7) Six-eight miles north of Rio Grande City; (8) Roma – Los Saenz; (9) Santa Catarina – Santa Ana; (10) Ten miles west of La Gloria; (11) Eleven miles south of El Sauz	(1) Observed in 1966 (EOID 363); (2) Observed in 1966 (EOID 2199); (3) Heard calls on both banks of the Rio Grande in 1966 (EOID 4060); (4) Young toads from stock tank in 1966 (EOID 5982); (5) Weed-filled pond in arroyo in 1966 (EOID 7093); (6) Tadpoles collected and choruses heard at four sites between 1967–2002 (EOID 8217); (7) Choruses heard at four sites in 2002 (EOID 8824); (8) Choruses heard at one site and two adults observed in 2002 (EOID 8825); (9) Choruses heard at one site in 2002 following 11 inches of rain (EOID 8827); (10) One chorus heard at one site in 2002 (EOID 8828); (11) One chorus heard at one site in 2006 (EOID 8824)
<i>Siren</i> sp. 1 (South Texas Siren, Large Form)	C, H, S	GNRQSNR; TXT	(1) Edinberg; (2) South of Mercedes; (3) Sabal Palm Grove Sanctuary; (4) West of La Joya; (5) Southwest of McAllen; (6) Laguna Atascosa NWR; (7) South of San Juan; (8) Near Brownsville; (9) South of Harlingen; (10) Near Sullivan City; (11) Santa Ana NWR; (12) Near Brownsville; (13) South of Harlingen; (14) South of Pharr; (15) Bentsen-Rio Grande Valley State Park; (16) South of Harlingen	(1) Collected specimen from roadside ditch in 1966 (EOID 1591); (2) Observed in 1983 (EOID 1669); (3) Collected specimen in 1960 (EOID 1752); (4) Observed in 1941, specimens collected in 1958 (EOID 1753); (5) Specimens collected in 1960 and 1961 from a salty drainage ditch (EOID 1997); (6) Observation in 1983 (EOID 2018); (7) Observation in 1936 (EOID 2584); (8) Specimens collected, including paratypes in 1950, 1952, and 1960 (EOID 3355); (9) Specimen collected in 1946 (EOID 3471); (10) Specimen collected, paratype in 1951 (EOID 3530); (11) Collections made in 1970 and 1977 (EOID 4856); (12) Specimens collected in 1951 (may contain the type), 1953, 1958, 1964, and 1972 (EOID 5392); (13) Paratype locality (EOID 6353); (14) Specimen collected in 1972 (EOID 7085); (15) Observation made in 1970, specimens collected in 1983 (EOID 7293); (16) Specimens collected from borrow pit in 1946 (EOID 7774)
<i>Smilisca baudinii</i> (Mexican Treefrog)	C	G5S3; TXT	(1) Palo Alto Battlefield National Historic Site; (2) Brownsville; (3) Southmost Ranch Preserve; (4) Near San Benito; (5) East of Bayview; (6) Northeast of San Benito; (7) TPWD Coastal Fisheries Field Station; (8) Near Russelltown	(1) One chorus heard and one specimen collected in 2003, the site was first observed in 1976 (EOID 284); (2) Collection in 1920, observation in 1972 (EOID 3594); (3) Observation in 1976 (EOID 6149); (4) Specimen collected in 1968 (EOID 6940); (5) Choruses were heard at multiple locations in 2002, 2003, and 2004 (EOID 8818); (6) Chorus heard in 2002 (EOID 8819); (7) Large choruses heard in 2002 (EOID 8820); (8) Chorus heard in 2002 (EOID 8826)
<i>Coniophanes imperialis</i> (Black-striped Snake)	C, H	G4G5S2; TXT	(1) North of Brownsville; (2) Fort Brown; (3) East of Brownsville, LRGV NWR; (4) Southmost Ranch Preserve; (5) Near Carricitos; (6)	(1) N/A (EOID 142); (2) Specimen collected in 1954 (EOID 1311); (3) N/A (EOID 2830); (4) Specimen collected in 1980 (EOID 4311); (5) Specimen observed in 1989 (EOID 5000); (6)

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			Brownsville; (7) Northeast of Brownsville; (8) Southeast of Sebastian; (9) West of McAllen	Specimens collected in 1932 and 1952 (EOID 6261); (7) N/A (EOID 6262); (8) One specimen (EOID 7570); (9) One specimen collected in 1949 (EOID 8189)
<i>Crotaphytus reticulatus</i> (Reticulate Collared Lizard)	H, S	G3S2; TXT	(1) Falcon State Park; (2) West of La Joya; (3) Northwest of Roma; (4) Falcon State Park; (5) Near Cuevitas; (6) Falcon State Park; (7) Casas Blancas; (8) North of La Joya	(1) Specimen collected in 1958 (EOID 613); (2) Specimen collected in 1976 (EOID 2336); (3) Specimen collected in 1933 (EOID 3022); (4) Observations recorded in 1965 and 2002, population drought-affected in 2002 (EOID 3666); (5) Specimens collected in 1932 and 1948 in honey mesquite chaparral (EOID 3892); (5) Observed in 1983 (EOID 5240); (6) Observations in 2001 and 2002 (EOID 5482); (7) Observed in 1975 (EOID 5624); (8) Observed in 1977, under rock in chaparral
<i>Drymarchon corais</i> (Indigo Snake)	C, H	G4S3; TXT	(1) Hidalgo; (2) Sabal Palm Grove Sanctuary; (3) Southmost Ranch Preserve; (4) Near Brownsville Ship Channel, LRGVNR; (5) Near Linn Siding	(1) Observed in 1968 (EOID 3445); (2) Observed in 1998 on dirt road (EOID 4511); (3) Observed in 1998, 1999, 2001, and 2002 in herbaceous and brush habitats (EOID 7547); (4) Descriptions of 18 observations from 1998–2002, several habitats and road sightings (EOID 7926); (5) Observed in 2002 in wetland (EOID 8327)
<i>Drymobius margaritiferus</i> (Speckled Racer)	C, H	G5S1; TXT	(1) Sabal Palm Grove Sanctuary; (2) Southmost Ranch Preserve; (3) Southeast of Brownsville; (4) Southmost Ranch Preserve; (5) East of Brownsville; (6) Southeast of Mercedes	(1) Observed in 2000 in leaf litter (EOID 823); (2) Observed in 1999 in leaf litter of sabal palm woodland (EOID 1626); (3) Collected in 1982 (EOID 3087); (4) Observed in 1998 in deep leaf litter of sabal palm woodland (EOID 5630); (5) Collected in 1935 (EOID 5937); (6) N/A (EOID 6820)
<i>Gopherus berlandieri</i> (Texas Tortoise)	C, H, S	G4S3; TXT	(1) La Reforma Training Site; (2) Southmost Ranch Preserve; (3) East of Pinitas; (4) South of Brownsville Ship Channel; (5) Northwest of Brownsville Fishing Harbor; (6) South of Randado; (7) Southmost Ranch Preserve; (8) Near Loma de la Montuosa, LRGVNR; (9) Near San Martin Lake; (10) Near Palmito Hill Battlefield and Tulosa Tract, LRGVNR; (11) Near Loma de la Estrella, LRGVNR; (12) Near Mercedes	(1) Observed in 1994 within cenizo – honey mesquite – granjeno disturbed mixed brush community (EOID 1136); (2) Observed in 1999 on dirt road in sabal palm woodland (EOID 1716); (3) Observed in the 1990s in a go-back pasture (EOID 2644); (4) Observed in 1998 and 2001 on loma in thornscrub (EOID 3544); (5) Observed in 1999 in coastal prairie with scattered Spanish dagger and honey mesquite (EOID 4711); (6) Observed in 1978 (EOID 4734); (7) Observed in 2001 on dirt road in sabal palm grove (EOID 5070); (8) Eight different observations from 1998–2001 on edge of thornscrub loma surrounded by coastal prairie (EOID 5998); (9) Observations in 1998 and 2001 (EOID 8278); (10) Four observations between 1998 and 2001 on edge of thornscrub loma within coastal prairie (EOID 8279); (11) Observed in 2000 in Thornscrub on loma (EOID 8281); (12) Observed in 2006 in mixed non-native grasses and scattered shrubs (EOID 8805)

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
<i>Leptodeira septentrionalis septentrionalis</i> (Northern Cat-eyed Snake)	C	G5T5S2; TXT	(1) North of Edinburg; (2) Near Brownsville	(1) Observed in 1971 (EOID 1708); (2) Observed in 1927 (EOID 4888)
<i>Phrynosoma cornutum</i> (Texas Horned Lizard)	C, H	G4G5S4; TXT	(1) West of Monte Cristo; (2) Sabal Palm Grove Sanctuary; (3) South of Loma del Divisadero; (4) Near Loma de la Montuosa, LRGVNWR; (5) Vista del Mar and Tulosa Ranch, LRGVNWR; (6) Vista del Mar, LRGVNWR; (7) Near Loma del Cenizal; (8) Near Los Ebanos	(1) Observed in 2002 in chaparral (EOID 1333); (2) Observed in 2001 on levee road (EOID 1608); (3) Observed in 1998 on dirt road in coastal prairie; (4) Observations in 1998 and 2001 on dirt road through coastal prairie (EOID 8285); (5) Two observations in 1998 and 1999 on roads through coastal prairie (EOID 8286); (6) Two observations in 1998 on road through coastal prairie and agricultural field (EOID 8287); (7) Two observations in 2001 on dirt road through coastal prairie (EOID 8288); (8) Observation in 1993 in unimproved pasture in farmland (EOID 8307)
<i>Asturina nitida</i> (Gray Hawk)	H	G4G5S2B; TXT	(1) Anzalduas County Park	(1) Observed in 1999, pair fledged one young from a nest in a large cedar elm (EOID 5022)
<i>Buteo albicaudatus</i> (White-tailed Hawk)	C	G4G5S4B; TXT	(1) Brownsville Ship Channel	(1) Observed between 2000–2002, six nests constructed in honey mesquite and Spanish dagger, less than 7 feet tall, several young fledged (EOID 8274)
<i>Charadrius melodus</i> (Piping Plover)	C	G3S2; FLT; TXT	(1) South Bay LRGVNWR; (2) South Padre Island	(1) Observed in 1991 on sand and silt with algal mat (EOID 1152); (2) Observed in 1991 on sand and silt with algal mat (EOID 6545)
<i>Falco femoralis septentrionalis</i> (Northern Aplomado Falcon)	C	G4T2S1; FLE; TXE	(1) Brownsville Ship Channel	(1) Observed from 1995–2002 with five nests constructed on power pole, Spanish dagger, and honey mesquite, several young fledged, some lost to predation (EOID 5542)
<i>Falco peregrinus</i> (Peregrine Falcon)	C	G4S3; TXE, T	(1) South Padre Island; (2) Padre Island; (3) South Bay; (4) Padre Island	(1) Observed in 1991 on bay side flats (EOID 1908); (2) Observed in 1991 on bayside flats (EOID 5425); (3) Observed in 1991 (EOID 6384); (4) Observed in 1991 on bayside flats (EOID 7490);
<i>Pachyrhamphus aglaiae</i> (Rose-throated Becard)	H	G4G5SNA; TXT	(1) Santa Ana NWR; (2) Anzalduas County Park	(1) Nest building activity by unpaired female, observed in 2003 (EOID 235); (2) Pair nesting in cedar elm, abandoned a nest in a Mexican ash tree, observed in 1999 (EOID 4390)
Rookery (Colonial Nesting Birds)	C	GNRSNR	(1) Intracoastal Waterway near Arroyo Colorado; (2) South of Port Isabel; (3) South Padre Island; (4) Near Laguna Atascosa NWR; (5) Green Island; (6) Near Laguna Atascosa	(1) Nesting for 13 species of shore and water birds (EOID 154); (2) Nesting for one species of water bird (EOID 579); (3) Nesting for one species of water bird (EOID 2057); (4) Nesting for one species of shorebird (EOID 4009); (5) Nesting for 11

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			NWR; (7) Near Arroyo Colorado	species of shore and water birds (EIOD 5491); (6) Nesting for 13 species of shore and water birds (EIOD 5886); (7) Nesting for 10 species of shore and water birds (EIOD 7151)
<i>Choeronycteris mexicana</i> (Mexican long-tongued bat)	C	G4S1	(1) Laguna Atascosa NWR	(1) Observed in 1998, dead male occurred under granjeno and thick thornscrub (EIOD 3211)
<i>Herpailurus yaguarondi</i> (Jaguarundi)	C, H, S	G4S1; FLE; TXE	(1) La Coma tract, LRGVNR; (2) El Negro Ranch Road; (3) Falcon State Recreation Area; (4) Five miles north of Los Fresnos; (5) Santa Ana NWR Complex; (6) Boca Chica; (7) Rangerville Tract, LRGVNR and Resaca del Rancho Viejo; (8) Brownsville, two miles east of Keller's Corner; (9) Yturria Tract, LRGVNR, two miles northeast of Sullivan City; (10) Resaca de la Palma WMA – World Birding Center and Olmito State Fish Hatchery; (11) Eight miles southeast of Brownsville on the Rio Grande in the Sabal Palm Grove Sanctuary; (12) Gabrielson Unit, LRGVNR, near Anzalduas Dam, 2 miles south of Madero, Bentsen Rio Grande Valley SP; (13) Laguna Atascosa NWR	(1) One “cat in hand” observation between 1988–1989 (EIOD 1005); (2) One reliable observation in 1992 (EIOD 2074); (3) Six reliable observations between 1992–1993 (EIOD 2286); (4) One reliable observation in 1992 (EIOD 2415); (5) 23 reliable observations between 1987–1993 (EIOD 2582); (6) One reliable observation in 1990 (EIOD 3204); (7) Three reliable observations between 1988–1989 (EIOD 3205); (8) One road-killed individual near a brushy fringe along the Boca Chica Highway that leads to Rio Grande (EIOD 3768); (9) One reliable observation between 1987–1988 (EIOD 6401); (10) Three reliable observations between 1991–1992 (EIOD 6920); (11) Two reliable observations between 1989–1990 (EIOD 7020); (12) Ten reliable observations between 1988–1993 (EIOD 7202); (13) Thirty-two reliable observations between 1987–1993, in Tamaulipan Thornscrub of dense honey mesquite, Texas ebony, and huisache (EIOD 8139)
<i>Lasiurus ega</i> (Southern Yellow Bat)	C	G5S1; TXT	(1) Near Southmost Ranch Preserve; (2) National Audubon Society, Sabal Palm Grove Sanctuary; (3) Southeast of Brownsville	(1) Captured two males in an ornamental palm grove near the Rio Grande; (2) Occur in sabal palm grove adjacent to the Rio Grande (EIOD 4572); (3) N/A (EIOD 6796)
<i>Leopardis pardalis</i> (Ocelot)	C, H	G4S1; FLE; TXE	(1) Eight miles southeast of Brownsville; (2) South of Brownsville; (3) Port of Brownsville to Loma de los Ebanitos, Brownsville Ship Channel, and Holly Beach; (4) Santa Ana NWR Complex; (5) Two miles southwest of Sebastian; (6) Near Hargill; (7) Bentsen Rio Grande Valley SP; (8) Laguna Atascosa NWR and vicinity	(1) Sabal Palm Grove Sanctuary between 1988–1991 (EIOD 697); (2) LRGVNR between 1989–1991 (EIOD 726); (3) Radio-collared male monitored between 1990–1991 (EIOD 881); (4) Seven reliable observations between 1989–1991 (EIOD 2142); (5) Longoria Unit of Las Palomas WMA in 1989 (EIOD 3608); (6) Two individuals were live-trapped between 1980–1984, occupying Tamaulipan Thornscrub of dense honey mesquite, huisache, and Texas ebony (EIOD 5801); (7) Seven reliable observations between 1991–1992 (EIOD 6239); (8) Nine individuals were live-trapped in 1984, 36 observations were recorded between 1989–1993, 16 individuals were live-trapped between 1996–1997, and three observations were recorded in 1991, occupying Thornscrub of dense honey

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
				mesquite, huisache, and Texas ebony (EOID 6268)
<i>Nasua narica</i> (White-nosed Coati)	H, S	G5S2?; TXT	(1) 25 miles north of Edinburg; (2) Five miles east of Roma on the Rio Grande	(1) One coati observed in 1985 (EOID 3096); (2) One coati observed in 1991 (EOID 6009)
<i>Panthera onca</i> (Jaguar)	C	G3SH; FLE; TXE	(1) Near San Benito	(1) Jaguar kill reported in 1946 (EOID 2848).
<i>Adelia vaseyi</i> (Vasey's Adelia)	C, H, S	G2G3S2S3	(1) Brownsville; (2) Near Brownsville; (3) Vela Woods Tract, LRGVNWR; (4) Near Harlingen; (5) Santa Ana NWR Complex; (6) Ranchito Tract, LRGVNWR, (7) Las Palomas WMA; (8) Harlingen; (9) Near Brownsville; (10) Near Santa Rosa; (11) La Puerta Tract, LRGVNWR; (12) Santa Ana NWR Complex; (13) Las Palomas WMA, Noriega Tract LRGVNWR, Resaca de la Palma SP – World Birding Center; (14) Harlingen; (15) Southmost Ranch Preserve; (16) La Coma Tract, LRGVNWR; (17) Near Olmita; (18) Near Mission; (19) Near Progreso; (20) La Puerta Tract, LRGVNWR; (21) Las Palomas WMA; (22) Ranchito Tract, LRGVNWR; (23) Near Rio Hondo; (24) Las Palomas WMA; (25) Near McCook	(1) Observed on one acre in 1938 and 1943 (EOID 327); (2) Observed individual shrub in 2002 (EOID 603); (3) Up to 10 shrubs observed in 1994 (EOID 879); (4) Moderate population in mixed thorn shrubland observed in 2001 (EOID 1335); (5) Observed in blackbrush – cenizo shrubland in 1989 (EOID 1483); (6) Few plants observed in 1993 with Texas ebony woodland (EOID 1688); (7) Observed in 1988 with Texas ebony – anacua woodlands (EOID 1922); (8) Large population in thornscrub, observed in 2002 (EOID 2219); (9) Observed in chaparral thickets in 1942 (EOID 2740); (10) Shrub encountered in mature thornscrub forest, observed in 1989 and 1994 (EOID 3270); (11) Few shrubs observed in 1995 on dry slope of Goliad Formation conglomerate (EOID 3548); (12) Observation on one acre site in 1965 (EOID 4109); (13) Occurrences determined in thornscrub habitats in 1987 and 1994 (EOID 4516); (14) Large stand observed in 1956, 1959, 1964, and 2002 (EOID 4553); (15) Observed on one acre in 1963 (EOID 4915); (16) Few shrubs observed in 1994 with granjeno, Texas ebony, and anacua (EOID 5390); (17) Uncommon on black dry soil in 1926 (EOID 5594); (18) Two populations on sandy hills observed in 1933 and 1937 (EOID 6460); (19) Few shrubs along roadside, observed in 1986 (EOID 6830); (20) Few shrubs on sandy soil, observed in 1994 (EOID 7091); (21) Few shrubs in honey mesquite – granjeno woodland, observed in 1994 (EOID 7281); (22) Populations associated with dense woodland thicket, observed in 1957 and 1994 (EOID 7886); (23) Few shrubs in small disturbed patches of Thornscrub, observed in 2002 (EOID 8301); (24) Small populations in dense Thornscrub and woodland, observed in 2001 (EOID 8302); (25) Small populations in old mixed brush underlain by the Goliad Formation, observed in 1998 and 2003 (EOID 8310)
<i>Ambrosia cheiranthifolia</i>	C	G2S2; FLE;	(1) Near Barreda	(1) Open plain, soil remains dry for long periods, observed in

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
(South Texas Ambrosia)		TXE		1932 through 1938 (EOID 7388)
<i>Ascleoias prostrata</i> (Prostrate Milkweed)	S	G1G2S1S2	(1) Near Falcon State Recreation Area; (2) LRGVNWR, Arroyo Ramirez Tract; (3) North of Roma; (4) North of Roma; (5) West of Rio Grande City; (6) Near Roma	(1) Observed between 1987–1994 on well-drained calcareous sandy loam of the Copita Series overlaying the Yegua Formation (EOID 1572); (2) Observed in 2003 on dirt road (EOID 5533); (3) Observed in 1957, healthy population in 1986, no individuals in 1991 on 5-acre site, disturbed, bladed roadside site dominated by buffelgrass (EOID 6223); (4) Observed from 1966–1993 on one-acre site (EOID 6491); (5) Observed in 2004 in Copita fine sandy loam overlaying Catahoula and Frio formations (EOID 8325); (6) N/A (EOID 8798)
<i>Astrophytum asterias</i> (Star Cactus)	S	G1S1; FLE; TXE	(1) North of Rio Grande City; (2) Near Rio Grande City	(1) Sandy loam on south-facing slope, one acre observed between 1931–1968 (EOID 3563); (2) Gravelly loam, northeast facing slope, scattered brush with past clearing of brush, 30 acres observed in 1959 through 2003 (EOID 4575)
<i>Atriplex klebergorum</i> (Kleberg Saltbush)	S	G2S2S3	(1) Near El Sauz	(1) Observed in saline soil in 1979 (EOID 2898)
<i>Ayenia limitaris</i> (Texas Ayenia)	C, H	G2S1; FLE; TXE	(1) Near Barreda Station; (2) Near Los Fresnos; (3) Harlingen; (4) Near Olmito; (5) Near Progreso; (6) LRGVNWR, Teniente (Rudman) Tract; (7) Brownsville	(1) Observed on one acre from 1932–1939 on dry alluvial soils in thickets (EOID 137); (2) Observed on one acre in 1924 (EOID 1002); (3) Observed in 2001 and 2002 on Mercedes clay of the Rio Grande alluvium, tall thornscrub woodland with litter covered soil (EOID 1992); (4) Observed from 1941–1943 on clay soil of dry chaparral thickets; (5) Observed on one acre from 1977–1988 in deep shade of Texas Ebony – Anacua Woodland (EOID 3631); (6) Observed in 1999 on Willacy fine sandy loam with honey mesquite and granjeno (EOID 7113); (7) Observed under cultivation from 1945–1963 (EOID 7196)
<i>Cardiospermum dissectum</i> (Chihuahua Balloon-vine)	H, S	G2S2	(1) Near Falcon SRA; (2) La Puerta Tract, LRGVNWR; (3) Near Roma; (4) North of Roma; (5) North of Roma; (6) North of Rio Grande City; (7) La Puerta Tract, LRGVNWR; (8) Arroyo Ramirez Tract, LRGVNWR; (9) Chicharra Banco Tract, LRGVNWR; (10) La Reforma Training Area; (11) Near Alto Bonito; (12) Falcon SRA; (13) Los Olmos Tract, LRGVNWR; (14) Near Santa Margarita; (15) Falcon State Park; (16) LRGVNWR; (17) Yturria Brush Tract, LRGVNWR; (18) East of Rio Grande City; (19) Falcon SRA; (20) La	(1) Population observed in 1994 and 2002 in calcareous sandy loam, blackbrush thornscrub possibly in adjacent woodland (EOID 147); (2) Population observed in 1994 on calcareous sandstone and in blackbrush Thornscrub (EOID 581); (3) Observed in 1966 on hills and rocky slopes among shrubs (EOID 989); (4) Small colony in gravelly, Copita soils, observed in 1957 and 2002 (EOID 1173); (5) Observed in 1940 (EOID 1939); (6) Observed in 1951 (EOID 2189); (7) Few individuals in cenizo – blackbrush Thornscrub, observed in 1994 (EOID 2230); (8) Population on sandstone outcrop with blackbrush thornscrub, observed in 2003 (EOID 2596); (9) Uncommon occurrence on plowed upland, observed in 1994 (EOID 3011);

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			Puerta Tract, LRGVNR; (21) North of La Joya; (22) Near La Joya (23) Near Rio Grande City; (24) Near Rio Grande City	(10) Common in honey mesquite – blackbrush – cenizo stand, observed in 1993 (EOID 3070); (11) Occasional plants in disturbed hillcut, observed in 1992 (EOID 5626); (12) Survey of blackbrush Thornscrub in 1990 (EOID 5658); (13) Common on level areas between gravel hills, observed in 1994 (EOID 5938); (14) Few plants on gravel terrace and slope, observed in 1975 (EOID 6004); (15) Observed in 1974 (EOID 6435); (16) Observations made in 1926 (EOID 6631); (17) A few plants observed in upland chaparral in 1994 (EOID 7554); (18) Few plants in arroyo, observed in 2002 (EOID 7555); (19) Blackbrush thornscrub occurs, observed in 1990 (EOID 7609); (20) Plants frequent in open honey mesquite – palo verde woodland, observed in 1994 (EOID 8226); (21) Small population in dense, medium-stature Thornscrub of blackbrush and cenizo, observed in 2003 (EOID 8308); (22) Plants abundant under moderately tall honey mesquite thornscrub, observed in 2003 (EOID 8312); (23) Common in medium-stature thornscrub, observed in 2002 (EOID 8322); (24) Many plants in medium-stature thornscrub, observed in 2002 (EOID 8323)

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
<i>Coryphantha macromeris</i> var. <i>runyonii</i> (Runyon's Cory Cactus)	C, S	G5T2T3S2S3	(1) North of Rio Grande City; (2) Near Junction of Highway 83 and FM 2098; (3) Near Junction of Highway 83 and FM 2098; (4) North of Roma; (5) Near El Sauz; (6) La Puerta Tract, LRGVNWR; (7) Northeast of Rio Grande City; (8) Rio Grande City; (9) Chapeno Tract, LRGVNWR; (10) La Puerta Tract, LRGVNWR; (11) Near Falcon Dam; (12) Brownsville; (13) Near Rio Grande City; (14) Los Olmos Tract, LRGVNWR; (15) Near Roma; (16) Near La Grulla; (17) Near Rio Grande City; (18) Near Rio Grande City	(1) Observed in 1933 (EOID 204); (2) One plant on gravelly eroding slope, observed in 1987 (EOID 311); (3) Several individuals on gravelly gentle slopes, observed in 1987 (EOID 312); (4) Few plants within Thornscrub on gravelly soils, observed in 2002 (EOID 969); (5) An individual on gravelly loam, observed in 1988 (EOID 1559); (6) Several plants in dense shrubland on gravelly soils, observed in 1988 (EOID 2184); (7) Rio Grande plains, observed in 1958 (EOID 3060); (8) Abundant on gravel and sandy hills, type locality, observed in 1918 and 1921 (EOID 3293); (9) Habitat of thorny shrubs on gravelly slope, observed in 1994 (EOID 3490); (10) Habitat of honey mesquite – palo verde woodland observed in 1994 (EOID 4821); (11) Observed in 1963 (EOID 4944); (12) Observed in 1924 (EOID 5304); (13) Few plants on gravelly loam with scattered brush, observed in 1987 (EOID 5673); (14) Several plants on gravelly slopes and drainages with mixed shrubland, observed in 1988 and 1994 (EOID 6370); (15) Habitat of sandy soil observed in 1965 (EOID 7069); (16) Habitat of deep soil supporting honey mesquite and junco observed in 1963 (EOID 7308); (17) Four populations on gravelly soil in native thornscrub, observed in 2002 (EOID 8313); (18) Seven clumps on gravelly soil in native thornscrub, observed in 2002 (EOID 8314)
<i>Echeandra chandleri</i> (Lila de los Llanos)	C	G3S2S3	(1) Playa del Rio, LRGVNWR; (2) Playa del Rio; (3) Near Highway 510 and 100 junction; (4) Playa del Rio, LRGVNWR; (5) Tulosa Ranch Tract, LRGVNWR; (6) Laguna Atascosa NWR; (7) Playa del Rio, LRGVNWR; (8) Near Rio Hondo; (9) Playa del Rio, LRGVNWR; (10) Loma de Estrella, LRGVNWR; (11) Playa del Rio, LRGVNWR; (12) Playa del Rio, LRGVNWR; (13) Playa del Rio, LRGVNWR; (14) Playa del Rio, LRGVNWR; (15) West of Port Isabel; (16) Playa del Rio, LRGVNWR; (17) Loma Preserve, LRGVNWR; (18) Northeast of Brownsville	(1) Large populations in open areas with honey mesquite and trecul yucca, observed in 1987 (EOID 395); (2) Large population in central portion of loma, observed in 1987 (EOID 462); (3) Large population along roadside and adjacent old field, observed in 1972 and 1984 (EOID 891); (4) Moderate population in open grassy areas, observed in 1987 (EOID 1020); (5) Observation of one plant in 1994 (EOID 1835); (6) Present on roadsides (EOID 2093); (7) A small colony observed in 1987 (EOID 2736); (8) Holotype collection in 1913 (EOID 3724); (9) Moderate population in thorn brush grassland, observed in 1987 (EOID 3961); (10) Moderate population on clay dunes, observed in 1973 and 1984 (EOID 4310); (11) Moderate population observed in 1987 and 1994, growing in open grassland (EOID 5582); (12) Eleven small populations in tall grasslands, observed in 1987 (EOID 5583); (13) Three moderate populations in open grassy areas, observed in 1987 (EOID 6669); (14) Ten small to moderate populations in open

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
				disturbed areas observed in 1987 (EOID 7039); (15) One-acre site observed in 1967 (EOID 7046); (16) Four small populations in open grassy areas, observed in 1987 (EOID 7181); (17) Small population on top of bluff and on flats, observed in 1994 (EOID 7600); (18) Small population on clay dunes in pasture, observed in 1923 and 1984 (EOID 7880)
<i>Echeandia texensis</i> (Green Island Echeandia)	C	G1S1	(1) Green Island; (2) Laguna Atascosa NWR; (3) Brownsville	(1) Holotypes and isotypes collected in 1922 (EOID 1011); (2) Observed in 1913 and 1975 on a one-acre tract of clay dunes with chaparral and prairies (EOID 4143); (3) Observed in 1935 and 1967 on clay loam soil (EOID 4505)
<i>Eriogonum greggii</i> (Gregg's Wild-buckwheat)	H, S	G2S1	(1) La Puerta Tract, LRGVNR; (2) Near Highway 83 and FM 2098; (3) La Joya; (4) La Puerta Tract, LRGVNR	(1) Few plants observed in 1995 in nearly barren sandy loam deposited over the Goliad Formation (EOID 1896); (2) Population observed in 1975, census in 1987, and observed in 2001 on gravelly, brushy, eroding slopes (EOID 2572); (3) Observed in 1942 (EOID 5710); (4) Observed in 1994 and considered locally common (EOID 6941)
<i>Frankenia johnstonii</i> (Johnston's Frankenia)	S	G3S3; FLE-PDL; TXE	(1) Near Roma; (2) Near Salineno; (3) Chapeno Tract, LRGVNR; (4) Near El Sauz; (5) Near Roma; (6) Near Rio Grande City; (7) Near El Sauz; (8) Near El Sauz; (9) Near El Sauz; (10) Near El Sauz; (11) North of Roma; (12) N/A; (13) N/A; (14) N/A; (15) N/A	(1) Habitat of open areas with saline soils, observed in 1968 (EOID 842); (2) Population on 25 acres with rocky hill covered with fossil oyster shells, observed in 1974 and 1999 (EOID 1898); (3) Population of gravelly slopes and saline soils, observed in 1986, 1994, and 2000 (EOID 4843); (4) Population on bare ground with severe grazing pressure, soils are clay to clay loam and alkaline, observed in 1966 and 1999 (EOID 6402); (5) Population on 15 acres with Catarina soils, observed in 1999 (EOID 7468); (6) Population on 10 acres with Catarina soils that are strongly alkaline, observed in 1994 and 1999 (EOID 8324); (7) Population on 30 acres with Catarina soils, observed in 1999 (EOID 8329); (8) Population on two acres of Copita soils growing with saladillo, observed in 1994 and 1999 (EOID 8330); (9) Population on 20 acres of Catarina soils observed in 1999 (EOID 8331); (10) Population on 4 acres of Ramadero loam, previously disturbed site supports saladillo, observed in 1994 and 1999 (EOID 8332); (11) Population on 11 acres of Catarina soils observed in 1999 (EOID 8333); (12) Population on 15 acres of Montell clay soils, with saladillo, observed in 1994 and 1999 (EOID 8338); (13) Population of 23 acres with Copita sandy loam soils, observed in 1999 (EOID 8339); (14) Populations on 70 acres of Maverick soils, eroded and Catarina soils, observed in 1999 (EOID 8340);

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
				(15) Populations on 20 acres with Catarina soils, observed in 1997 and 2000 (EOID 8342)
<i>Grindelia oolepis</i> (Plains Gumweed)	C	G2S2	(1) South of Russeltown; (2) Brownsville; (3) Brownsville; (4) Brownsville; (5) Brownsville; (6) Near Los Fresnos	(1) Collected in 1939 on black clay soil in low spots (EOID 797); (2) Observed in 1941 and 1980 not located in 2001 and 2002 (EOID 1352); (3) Three populations observed in 1940, two relocated in 1979, none located in 2001 and 2002 (EOID 3838); (4) Observed as abundant in 2001, occurred in roadside ditch in 2002 (EOID 4326); (5) Type locality sampled in 1923, Harlingen clay soil, gumbo (EOID 4681); (6) Sampled in thicket in 1930 (EOID 6335)
<i>Heteranthera mexicana</i> (Mexican Mud-plantain)	C, H	G2G3S1	(1) Mission; (2) Near Alamo; (3) South of Mercedes; (4) North of Brownsville	(1) Collected in 1936 (EOID 1383); (2) Collected in 1942; (3) Collected in muddy soil of a resaca in 1932 and 1941; (4) Collected in 1928 in black clay soil in low moist places (EOID 7720)
<i>Justicia runyonii</i> (Runyon's Water-willow)	C, H	G2S2	(1) North of Brownsville; (2) Near Lozono; (3) Sabal Palm Grove Sanctuary; (4) Near Santa Rosa; (5) Near Barreda; (6) Santa Ana NWR Complex; (7) Las Palomas WMA; (8) La Paloma Tract, LRGVNR; (9) Brownsville; (10) West of Harlingen; (11) N/A; (12) Arroyo Colorado Unit, Las Palomas WMA; (13) East of Brownsville; (14) Near Olmito; (15) South of Weslaco; (16) Las Palomas WMA and Resaca de la Palma SP – World Birding Center	(1) Observed in black soil in 1923 (EOID 105); (2) Observed on sandy loam of levee in swales with tall brush, documented in 1955 and 1984 (EOID 401); (3) Occurs in shade under sabal palms, observed in 1984 and 1992 (EOID 1331); (4) Large population on sandy clay loam on edge of honey mesquite – mule's fat woodland, observed in 1991 (EOID 1763); (5) Habitat on edge of thicket in clay soil, observed in 1933, 1936, and 1984 (EOID 1813); (6) Observation in 1959 and 1985 (EOID 2801); (7) Population occurs on resaca bank with Texas ebony and cedar elm, observed in 1994 (EOID 3129); (8) Habitat is edge of dense thicket, observed in 1957 (EOID 4023); (9) Observed in 1942 and 1947 (EOID 4130); (10) Observed in 1984 (EOID 4321); (11) Habitat is ephemeral pond margin, observed in 1991 (EOID 4389); (12) Populations in mesic sites and shade of tall subtropical thorn woodlands, observed in 2001 (EOID 4730); (13) Population on resaca banks at edge of thickets, observed in 1922 (EOID 5105); (14) Observed in 1927 (EOID 5720); (15) Habitat of heavy clay with honey mesquite, observed in 1983 (EOID 5890); (16) Populations at resaca edges associated with Texas ebony, snake-eyes, and granjeno woodlands, observed in 1984 and 1987 (EOID 6686)
<i>Manfreda longiflora</i> (St. Joseph's Staff)	C, H, S	G2S2	(1) Near Falcon Village; (2) Cuellar Tract, LRGVNR; (3) Near Roma; (4) Near Sullivan City; (5) Near La Joya; (6) Near Rio Grande City; (7) Near Brownsville; (8) Sam Fordyce	(1) Small population in sandy loam soil adjacent to blackbrush thornscrub, observed in 2002 (EOID 104); (2) Several plants on eroded saline clay soils of slopes observed in 1994 (EOID 304); (3) A single plant on sandy loam observed in 1991 (EOID 489);

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			North Tract, LRGVNWR; (9) La Puerta Tract, LRGVNWR; (10) Los Olmos Tract, LRGVNWR; (11) East of Rio Grande City; (12) Near El Sauz; (13) Near El Sauz; (14) Arroyo Ramirez Tract, LRGVNWR; (15) Near Rio Grande City; (16) North of Roma; (17) Chapeno Tract, LRGVNWR; (18) Near Rio Grande City	(4) Possible occurrence on clay slopes and gravel hills (E)ID 1137; (5) Population in honey mesquite woodland, observed in 1987 (EOID 2499); (6) Populations of gravelly loamy soils with honey mesquite shrubland, observed in 1987 and 2003 (EOID 2863); (7) Observed in 1921 (EOID 3160); (8) Population on shallow calcareous soil in area of old gravel pit, observed in 1994 (EOID 4097); (9) Population on caliche bluffs in blackbrush and cenizo, observed in 1994 (EOID 4098); (10) Population on caliche bluff edge with conglomerate, observed in 1994 (EOID 4263); (11) Observation on gravelly ridge in 1954 (EOID 5796); (12) Population on gravelly loam over calcareous sandstone in honey mesquite shrubland, observed in 1985 and 1988 (EOID 6229); (13) Population of overgrazed and eroding pasture in honey mesquite – grassland habitat, observed in 1985 and 1988 (EOID 6870); (14) Population on ridgetop, observed in 2003 (EOID 7149); (15) Population on deep clay soils and scattered in grasslands, observed in 1988 (EOID 7818); (16) Population on sandy, clayey loam observed in 2002 (EOID 8095); (17) Population in calcareous clay between gravelly slopes observed in 1994 (EOID 8203); (18) Individual under honey mesquite shrub observed in 2002 (EOID 8321)
<i>Manihot walkerae</i> (Walker's Manioc)	H, S	G1S1; FLE; TXE	(1) Near La Joya; (2) Near La Joya; (3) LRGVNWR, Chicharra Banco Tract; (4) Northeast of Peñitas; (5) LRGVNWR, La Puerta Tract; (6) LRGVNWR, Yturria Brush Tract; (7) South of Mission; (8) North of Rio Grande City; (9) Near Peñitas; (10) East of Rio Grande City	(1) Observed between 1997–2001 on knoll of Jimenez-Quemado Complex soils, gravelly (EOID 163); (2) N/A, observed in 1940–1941 (EOID 369); (3) Observed in 1995–1996 (EOID 2674); (4) Observed on one acre from 1990–1992 on fine sandy loam in partial shade of dense native brush (EOID 3041); (5) Observed 1993–1995 in mixed shrubland on McAllen fine sandy loam over Goliad Formation with caliche flat at edge of slope (EOID 3956); (6) Observed from 1995–2002 (EOID 5302); (7) Observed in 1940, holotype (EOID 5411); (8) Observed in 2000 in Zapata soil near native brush rangeland (EOID 6219); (8) Observed from 1997–2002 on Zapata Series calcareous gravelly loam, in medium stature thornscrub (EOID 6220); (9) Observed from 1997–2002 in native brush along a fenceline (EOID 6569); (10) Observed in 1940 (EOID 8235)
<i>Matelea radiata</i> (Falfurrias Milkvine)	H	GSHS	(1) North of La Joya	(1) Observed in 1941 on dry gravel hills, clay soil, 45 meters (EOID 1793)
<i>Physaria thamnophila</i> (Zapata bladderpod)	S	G1S1; FLE; TXE	(1) North of Roma; (2) North of Roma; (3) Cuellar Tract, LRGVNWR; (4) Roma;	(1) Observed in 1994 (EOID 196); (2) Observed on Maverick soil series, Jackson group geology, in 1996, 2000, and 2001

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			(5) Arroyo Ramirez Tract, LRGVNWR; (6) North of Roma	(EIOD 1206); (3) Observed on Catarina Clay, Yegua formation geology, in open thorn shrubland on eroded soil in full sun, in 1994, 1997, 2001, and 2002 (EIOD 2223); (4) No plants observed in 1985 and 1986 (EIOD 5562); (5) Observed on sandstone outcrop on ridge in blackbrush shrubland in 2002 and 2003 with two additional rare species (EIOD 7381); (6) Observed on gravelly slopes of grassy, flat plain of huisache, blackbrush, honey mesquite, and cenizo in 1987, 1996, and 2001 (EIOD 7965)
<i>Thelocactus bicolor</i> var. <i>flavidispinus</i> (Straw-spine Glory-of-Texas)	S	G4T2S2	(1) Near Rio Grande City	(1) Misidentified specimen (EIOD 645)
<i>Thymophylla tephroleuca</i> (Ashy Dogweed)	S	G2S2; FLE; TXE	(1) North of Rio Grande City	(1) Observed in 1932 (EIOD 7995)
<i>Tillandsia baileyi</i> (Bailey's Ballmoss)	C, H	G2G3S2	(1) Near La Joya; (2) South of Weslaco; (3) Noriega Tract, LRGVNWR; (4) Near Los Fresnos; (5) Harlingen; (6) Harlingen; (7) Near Rio Hondo; (8) West of La Paloma; (9) Near Olmito; (10) Laguna Atascosa NWR; (11) South of Weslaco; (12) Resaca del Rancho Viejo, LRGVNWR; (13) Ranchito Tract, LRGVNWR; (14) Santa Ana NWR Complex; (15) LRGVNWR	(1) Specimens collected from two populations in 1940 (EIOD 124); (2) Observation of a Texas ebony host tree in 1941 (EIOD 1180); (3) Observation area of 1 acre with extremely dense Texas ebony – snake-eyes thicket and mature subtropical evergreen woodland (EIOD 2480); (4) Population observed in remnant tall subtropical brush in 2001 (EIOD 3064); (5) Population observed in Texas ebony and other trees and shrubs in 2002 (EIOD 3494); (6) Observed in 1964 and mapped in 2002; (7) Small population in Texas ebony tall shrubs (EIOD 4598); (8) Growing on honey mesquite tree in a thicket, observed in 1940 (EIOD 5170); (9) Individuals growing on introduced trees and shrubs observed in 1927 and 1988 (EIOD 6438); (10) Observed in 1990 on granjeno shrubs in chaparral (EIOD 7080); (11) Observed in 1988 (EIOD 7548); (12) observed in 1984 and 1987 in a densely wooded strip (EIOD 7549); (13) Observed in 1994 in honey mesquite – granjeno woodlands (EIOD 6010); (14) Observed in 1992, plants growing on Texas ebony trees (EIOD 8129); (15) Observed in 1952 on clay dunes growing near ground
<i>Acacia rigidula</i> Series (Blackbrush Series)	S	G5S5	(1) North of Roma; (2) Falcon SRA; (3) Falcon SRA; (4) North of Rio Grande City; (5) North of Rio Grande City	(1) Observed 7,040 acres in 1986, soils are gypsiferous or saline, diverse ridge with honey mesquite, blackbrush, guajillo, kidneywood, some root plowing (EIOD 1126); (2) Observed in 1990, diverse Thornscrub shrubland (EIOD 4918); (3) Observed

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
				in 1990, diverse Thornscrub shrubland (EOID 4919); (4) Observed 25 acres in 1985, Barreta Thornscrub (EOID 4999); (5) Observed 25 acres in 1985, Barreta Thornscrub (EOID 7919)
<i>Pithecellobium ebano</i> – <i>Ehretia anacua</i> Series (Texas Ebony – Anacua Series)	C, H, S	G2S1	(1) Las Palomas WMA; (2) Las Palomas WMA, LRGVNR; (3) Las Palomas WMA, LRGVNR, Resaca de la Palma SP – World Birding Center; (4) Near Garceno; (5) Near Madero, LRGVNR; (6) Las Palomas NWR; (7) Laguna Atascosa NWR; (8) South of Brownsville, LRGVNR; (9) Bentsen – Rio Grande Valley SP; (10) Las Palomas WMA; (11) North of Progreso; (12) South of Abram, LRGVNR; (13) LRGVNR	(1) Observed 50 acres in 1985, Texas ebony, sugarberry, anacua, elm, a few sabal palms, growing near a resaca (EOID 1281); (2) Observed 40 acres in 1985, Texas ebony - anaqua, honey mesquite - anacua, low brush with patchy distribution (EOID 1283); (3) Observed 440 acres in 1985, diverse, little true Texas ebony - anaqua, more Texas ebony - mixed brush with snake-eyes, lotebush, granjeno, excellent brush tract (EOID 2575); (4) Observed 110 acres in 1985, sugarberry, Texas ebony, anaqua, honey mesquite, fairly good quality (EOID 3271); (5) Observed 730 acres in 1985, potential Texas ebony - anaqua, most is potential sugarberry – elm, now elm - anacua – hackberry – Texas bluewood, some Texas ebony on dry sites (EOID 3506); (6) Observed 45 acres in 1985, parts are typical Texas ebony – anaqua pygmy forest, small area of mixed quality (EOID 4272); (7) Observed 45,000 acres in 1986, diverse area of scrub and low woodland scattered among wetlands matrix with Texas ebony, snake-eyes, honey mesquite, Colima, etc. (EOID 5148); (8) 17 acres of go-back brush, not visited, potential is subtropical woodland or shrubland (EOID 5571); (9) Observed in 1985 and 1990, mostly sugarberry, Texas ebony, anacua, bluewood, honey mesquite, elm with much Texas ebony – Anacua, very good site (EOID 5935); (10) Observed 165 acres in 1985, patches of old-growth Texas ebony – anaqua – bluewood – spiny hackberry mixed with planted areas and old fields (EOID 6712); (11) Observed 30 acres in 1985, honey mesquite - Texas ebony - anaqua, catclaw, good patches of Thornscrub and woodland (EOID 6892); (12) Observed 30 acres in 1985, sugarberry - anaqua, huisache go-back fields (EOID 7263); (13) Observed 80 acres in 1985, confusing sugarberry – honey mesquite - Texas ebony with no anaqua (EOID 7948)
<i>Pithecellobium ebano</i> – <i>Phaulothamnus spinescens</i> Series (Texas Ebony – Snake-eyes Series)	C, H	G2S2	(1) East of Loma del Burro, LRGVNR; (2) Four miles south of San Benito; (3) North of Rio Hondo and adjacent to Arroyo Colorado; (4) LRGVNR, south of Brownsville Ship Channel; (5) LRGVNR, South Bay; (6) Loma	(1) Observed in 1956, 63 acres dominated by low tropical shrubs (EOID 377); (2) Observed in 1985, 65 acres dominated by Texas ebony and mixed brush in active cemetery where one acre is cleared each year (EOID 894); (3) Observed in 1985, 65 acres dominated by Texas ebony, blackbrush, snake-eyes, and

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			Preserve, LRGVNR; (7) Near Combes; (8) LRGVNR, South Bay; (9) Las Palomas WMA; (10) LRGVNR, south of Brownsville Ship Channel; (11) LRGVNR, Santa Ana; (12) Las Palomas NMA; (13) Near Combes; (14) Laguna Madre, LRGVNR; (15) Southeast of Highway 281 and 186, LRGVNR; (16) South of Brownsville Ship Channel, LRGVNR	lotebush, patchy distribution (EOID 1800); (4) Observed in 1952, 60 acres (EOID 2741); (5) Observed in 1952, 73 acres dominated by low subtropical shrubs (EOID 2742); (6) Observed in 1952, 50 acres dominated by low subtropical shrubs (EOID 2741); (7) Observed from road in 1985, 25 acres of confusing honey mesquite, sugarberry, mixed brush, possible Texas ebony – anacua (EOID 3593); (8) Observed in 1952, 73 acres dominated by low subtropical shrubs (EOID 4673); (9) Observed in 1985, 70 acres of go-back field dominated by honey mesquite and granjeno (EOID 5145); (10) Observed in 1952, 29 acres dominated by low subtropical shrubs (EOID 5561); (11) Probably a go-back pasture, 20 acres (EOID 5751); (12) Observed in 1988, mixed shrubland with emergent Texas ebony, a portion may be the Cenizo Series and a portion Texas ebony – Anacua Series (EOID 5893); (13) Observed in 1985, 65 acres surveyed from the road, Texas ebony – honey mesquite mixed brush with Texas Ebony – Anacua potential (EOID 6379); (14) Observed in 1952, 68 acres dominated by low subtropical shrubs (EOID 7026); (15) Observed in 1984 and 1985, 1,800 acres dominated by honey mesquite – brush with some huisache – palo verde sites (EOID 8053); (16) Observed in 1952, 13 acres dominated by low subtropical shrubs (EOID 8181);
<i>Pithecellobium ebano</i> – <i>Phaulothamnus spinescens</i> – <i>Citharexylum berlandieri</i> Series (Texas Ebony – Snake-eyes – Berlandier Fiddlewood Series)	C	G2S2	(1) Seven miles inland from Boca Chica Beach	(1) Clay loam hill, associates include running mesquite, cross-thorn, maytenas, brasil, and a variety of subtropical shrubs, observed in 1984 (EOID 895)
<i>Prosopis glandulosa</i> – <i>Acacia smallii</i> Series (Honey Mesquite – Huisache Series)	C, H, S	G5S5	(1) Falcon Reservoir shoreline; (2) Las Palomas WMA, Arroyo Colorado SRA; (3) Bentsen-Rio Grande Valley SP, Rio Grande hiking trail	(1) Recent growth woodland in seasonally flooded saline soils in narrow band on shoreline, observed in 1990 (EOID 1520); (2) Disturbance type in grazed area, not surveyed intensively in 1988 (EOID 3036); (3) Disturbance type with dense herbaceous cover of weedy species, observed in 1990 (EOID 5940)
<i>Sabal texana</i> Series (Texas Palmetto Series)	C	G2S1	(1) Sabal Palm Grove Sanctuary, East of Palm Grove School on Southmost Road; (2) Southmost Ranch Preserve, four miles southeast of Palm Grove School; (3) LRGVNR, one mile south of Palm Grove	(1) Thirty acres observed in 1984 and managed as a nature preserve: sabal palm, Texas ebony, Anacua, Sugarberry, Bluewood subtropical forest, some sites a former tropical plant nursery (EOID 2505); (2) Thirty acres observed in 1986, small, fair quality Texas Palmetto Forest with Texas ebony,

Table 3-1. Summary of Element Occurrence Records for Cameron, Hidalgo, and Starr Counties.¹

Species	County Record	Rank and Status	General Location	Comments
			School	sugarberry, anacua, brasil, tenaza, and diverse shrubs and vines; home to many subtropical birds at the northern edge of their range (EOID 5955; (3) Three-hundred sixty-five acres observed in 1985, mostly cropland with restoration in progress (EOID 7189)
<i>Ulmus americana</i> – <i>Celtis</i> spp. Series (American Elm – Hackberry Series)	C, H	G4S4	(1) Near FM2556 and Highway 281 junction, LRGVNWR	(1) Observed in 1985, fairly good floodplain forest of diverse sugarberry, Mexican ash, elm, and willow, patchy distribution (EOID 2148)
<i>Ulmus crassifolia</i> – <i>Celtis laevigata</i> Series (Cedar Elm – Sugarberry Series)	H, S	G4S4	(1) East of Runn, LRGVNWR; (2) South of Santa Margarita; (3) South of La Joya, LRGVNWR; (4) Bentsen – Rio Grande Valley SP; (5) Las Palomas WMA	(1) Observed 20 acres in 1985, good patches of elm, hackberry, Texas ebony, honey mesquite, and Mexican ash (EOID 2494); (2) Observed 25 acres in 1985, good sugarberry, Mexican ash, willow gallery forest with no elm, intermittent stands to Falcon Dam (EOID 3601); (3) Observed 70 acres in 1985, highly disturbed sugarberry, honey mesquite, granjeno, cedar elm, and Texas bluewood, bank of Rio Grande eroding at this site (EOID 5968); (4) Observed in 1990 (EOID 6515); (5) Observed 45 acres in 1985, internally drained stand of sugarberry, honey mesquite, cedar elm, huisache, and Mexican ash (EOID 7054)
<i>Uniola paniculata</i> – <i>Panicum amarum</i> Series (Sea Oats – Bitter Panicum Series)	C	G4S3	(1) Brazos Island SRA	(1) Dunes elevated to 10–12 feet tall, casual visit in 1991 (EOID 7656)

County lists of rare species were acquired from TPWD and these were consolidated into **Table 3-2**. The county lists include species of conservation concern in Texas. In general, species that appear on county lists do not all share the same probability of occurrence within a county (e.g., some species are migrants or wintering residents and a few species might be historic or considered extirpated within a county). The following are species for which data were available in the TXNDD:

- **Fish:** river goby, Rio Grande silvery minnow.
- **Amphibians:** sheep frog, white-lipped frog, black-spotted newt, Mexican burrowing toad, south Texas siren (large form), Mexican treefrog.
- **Reptiles:** black-striped snake, reticulate collared lizard, indigo snake, speckled racer, Texas tortoise, Texas horned lizard, northern cat-eyed snake.
- **Birds:** gray hawk, white-tailed hawk, piping plover, northern aplomado falcon, peregrine falcon, rose-throated becard, rookery.
- **Mammals:** Mexican long-tongued bat, jaguarundi, southern yellow bat, ocelot, white-nosed coati, jaguar.
- **Plants:** Vasey’s adelia, south Texas ambrosia, prostrate milkweed, star cactus, Kleberg saltbush, Texas ayenia, Chihuahua balloon-vine, Runyon’s cory cactus, lila de los llanos, Green Island echeandia, Gregg’s wild buckwheat, Johnston’s frankenia, plains gumweed, Mexican mud-plantain, Runyon’s water-willow, St. Joseph’s staff, Walker’s manioc, Falfurrias milkvine, Zapata bladderpod, ashy dogweed, Bailey’s ballmoss.
- **Vegetation Types:** Blackbrush Series, Texas Ebony – Anacua Series, Texas Ebony – Snake-eyes Series, Texas Ebony – Snake-eyes – Berlandier Fiddlewood Series, Mesquite – Huisache Series, Texas Palmetto Series, American Elm – Hackberry Series, Cedar Elm – Sugarberry Series, Sea Oats – Bitter Panicum Series.

Table 3-2. Federal- and State-Threatened and Endangered Species in Texas

Common Name	Scientific Name	County	Federal Status	State Status
Fish				
Blackfin goby	<i>Gobionellus atripinnis</i>	C		T
Opossum pipefish	<i>Microphis brachyurus</i>	C		T
Rio Grande silvery minnow	<i>Hybognathus amarus</i>	S, H, C		E
River goby	<i>Awaous banana</i>	H, C		T

Common Name	Scientific Name	County	Federal Status	State Status
Amphibians				
Black spotted newt	<i>Notophthalmus meridionalis</i>	S, H, C		T
Mexican burrowing toad	<i>Rhinophrynus dorsalis</i>	S		T
Mexican treefrog	<i>Smilisca baudinii</i>	S, H, C		T
Sheep frog	<i>Hypopachus variolosus</i>	S, H, C		T
South Texas siren (large form)	<i>Siren sp 1</i>	S, H, C		T
White-lipped frog	<i>Leptodactylus fragilis</i>	S, H, C		T
Reptiles				
Black-striped snake	<i>Coniophanes imperialis</i>	H, C		T
Green sea turtle	<i>Chelonia mydas</i>	C	E	T
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	C	E	E
Kemp's Ridley sea turtle	<i>Lepidochelys kempii</i>	C	E	E
Leatherback sea turtle	<i>Dermochelys coriacea</i>	C	E	E
Loggerhead sea turtle	<i>Caretta caretta</i>	C	T	T
Indigo snake	<i>Drymarchon corais</i>	S, H, C		T
Northern cat-eyed snake	<i>Leptodeira septentrionalis septentrionalis</i>	S, H, C		T
Reticulate collared lizard	<i>Crotaphytus reticulatus</i>	S, H		T
Speckled racer	<i>Drymobius margaritiferus</i>	H, C		T
Texas horned lizard	<i>Phrynosoma cornutum</i>	S, H, C		T
Texas scarlet snake	<i>Cemophora coccinea lineri</i>	C		T
Texas tortoise	<i>Gopherus berlandieri</i>	S, H		T
Birds				
American peregrine falcon	<i>Falco peregrinus anatum</i>	S, H, C		E
Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	S, H, C		T
Brown pelican	<i>Pelecanus occidentalis</i>	C	E	E
Cactus ferruginous pygmy-owl	<i>Glaucidium brasilianum cactorum</i>	S, H, C		T
Common black-hawk	<i>Buteogallus anthracinus</i>	S, H, C		T
Eskimo curlew	<i>Numenius borealis</i>	C		E
Gray hawk	<i>Asturina nitida</i>	S, H, C		T
Least tern	<i>Sterna antillarum</i>	S, H, C	E	E
Mexican hooded oriole	<i>Icterus cucullatus cucullatus</i>	S		T
Northern Aplomado falcon	<i>Falco femoralis septentrionalis</i>	H, C	E	E

Common Name	Scientific Name	County	Federal Status	State Status
Northern beardless-tyrannulet	<i>Camptostoma imberbe</i>	S, H, C		T
Peregrine falcon	<i>Falco peregrinus</i>	S, H, C		E, T
Piping plover	<i>Charadrius melodus</i>	H, C	T	T
Reddish egret	<i>Egretta rufescens</i>	H, C		T
Rose-throated becard	<i>Pachyramphus aglaiae</i>	S, H, C		T
Sooty tern	<i>Sterna fuscata</i>	C		T
Texas Botteri's sparrow	<i>Aimophila botterii texana</i>	H, C		T
Birds (continued)				
Tropical parula	<i>Parula pitiayumi</i>	S, H, C		T
White-faced ibis	<i>Plegadis chihi</i>	H, C		T
White-tailed hawk	<i>Buteo albicaudatus</i>	S, H, C		T
Whooping crane	<i>Grus Americana</i>	S, H, C	E	E
Wood stork	<i>Mycteria americana</i>	S, C		T
Zone-tailed hawk	<i>Buteo albonotatus</i>	S, C		T
Mammals				
Coues' rice rat	<i>Oryzomys couesi</i>	S, H, C		T
Gulf Coast jaguarundi	<i>Herpailurus (=Felis) yaguarondi</i>	S, H, C	E	E
Ocelot	<i>Leopardus (=Felis) pardalis</i>	S, H, C	E	E
Southern yellow bat	<i>Lasiurus ega</i>	H, C		T
White-nosed coati	<i>Nasua narica</i>	S, H, C		T
Plants				
Ashy dogweed	<i>Thymophylla tephroleuca</i>	S	E	E
Johnston's frankenia	<i>Frankenia johnstonii</i>	S	E	E
South Texas ambrosia	<i>Ambrosia cheiranthifolia</i>	C	E	E
Star cactus	<i>Astrophytum asterias</i>	S, H, C	E	E
Texas ayenia	<i>Ayenia limitaris</i>	H, C	E	E
Walker's manioc	<i>Manihot walkerae</i>	S, H	E	E
Zapata bladderpod	<i>Lesquerella thamnophila</i>	S	E	E

Sources: TPWD 2007, USFWS 2007

Notes:

S: Starr County, Texas

H: Hidalgo County, Texas

C: Cameron County, Texas

E = Endangered; T = Threatened

THIS PAGE INTENTIONALLY LEFT BLANK

4. ENVIRONMENTAL SETTING

The project area climate is semiarid-subtropical/subhumid within the Modified Marine climatic type with summers that are long and hot and winters that are short, dry, and mild (Larkin and Bomar 1983, Bailey 1995). The marine climate results from the predominant onshore flow of tropical maritime air from the Gulf of Mexico. Onshore air flow is modified by a decrease in moisture content from east to west and by intermittent seasonal intrusions of continental air.

Average temperatures in Brownsville/McAllen range from a low of 48 degrees Fahrenheit (°F) in January to a low of 75 °F in July, and a high of 69 °F in December to a high of 97 °F in August. Annual low and high temperatures for Brownsville range from 12 °F to 63 °F and 93 °F to 107 °F, respectively. The average annual precipitation of the Rio Grande Delta recorded in Brownsville ranges from 22 to 30 inches (Brownsville recorded 21.68 inches and McAllen 22.6 inches for 2006), and the distribution of rainfall is irregular. Wind speeds are stable ranging from 10.4 miles per hour (mph) to 17.3 mph during the year. A long growing season is experienced for the project region, from 314 to 341 days. The evaporation rate during the summer season is high, about twice the amount of precipitation.

The vegetation of the Rio Grande Delta of southern Texas has generally been classified under the Dry Domain, Tropical/Subtropical Steppe Division of Bailey (1995). The project area is more finely classified as the Southwestern Plateau and Plains Dry Steppe and Shrub Province. (TPWD 2007) provides discussion and describes vegetation geography to biotic provinces and natural regions using topographic features, climate, vegetation types, and terrestrial vertebrates. This system places the project area in the Tamaulipan Biotic Province, South Texas Brush Country (Rio Grande Basin) Natural Region, and the Level III Ecoregions of the Southern Texas Plains and Western Gulf Coastal Plain.

Occurring within the Lower Rio Grande Valley (LRGV) (technically a delta) of southern Texas and northern Mexico, Tamaulipan Brushland represents a unique ecosystem (USFWS 1988). The characteristic natural vegetation is dense and thorny, and plant species distribution can be correlated with geologic formations. The Rio Grande floodplain supports tall, dense riparian forest, woodland, shrubland, and herbaceous vegetation while the xeric upland areas support mostly spiny shrubs, short-stature trees, and dense nonnative grasslands. Between the 1920s and 1980s more than 95% of the native brushland (includes woodlands and forests) and 90% of the riparian vegetation had been converted to agriculture and urban land use (USFWS 1988). In 1988, it was estimated that 98% of the lush, subtropical region of the Rio Grande Delta had been cleared of native vegetation in the United States and a large, but unknown percentage cleared in Mexico.

THIS PAGE INTENTIONALLY LEFT BLANK

5. BIOLOGICAL RESOURCES

5.1 Vegetation Classification for the 150-foot Survey Corridor on the North Side of the Levee

The USFWS (1988) recognized 11 biotic communities in the LRGV using a combination of plant species dominance, wildlife use, topography, hydrology, and geology. There are eight biotic communities that could be associated with the project region: (1) Chihuahuan Thorn Forest, (2) Upper Valley Flood Forest, (3) Barretal, (4) Upland Thornscrub, (5) Mid-Valley Riparian Woodland, (6) Sabal Palm Forest, (7) Mid-Delta Thorn Forest, and (8) Ramadero. Chihuahuan Thorn Forest could occur near the western terminus of Section O-1. Sections O-1 and O-2 lie within the Upper Valley Flood Forest biotic community and adjacent to the Barretal. Sections O-3 and O-4 occur within the Upper Valley Flood Forest and Upland Thornscrub biotic communities. Sections O-4 through O-20 occur primarily within the Mid-Valley Riparian Woodland biotic community, with some vegetative influence from the Mid-Delta Thorn Forest, which occurs to the north. The Sabal Palm Forest biotic community occurs within Section O-21. Ramaderos occur where ridges and slopes are in proximity to the Rio Grande, mostly along Section O-1.

Chihuahuan Thorn Forest is a desert shrub community characterized by upland and riparian components, e.g., sotol, catclaw mimosa, and blackbrush acacia shrublands and black willow, Montezuma baldcypress, Texas ebony, and honey mesquite riparian woodlands and forests. Upper Valley Flood Forest is characterized by honey mesquite and granjeno stands that have become established in the small forested valleys of the Rio Grande between Falcon and Mission. Barretal or thicket is characterized by the native citrus tree, chaparro prieto, Tamaulipan palo verde, chaparro amargosa, and junco that have become established on a narrow band of gravel and caliche ridges that are elevated above the Rio Grande floodplain. Upland Thornscrub, the most widespread of the Tamaulipan Biotic Province communities regionally, has become established on hills, ridges, and slopes at higher elevations than the Rio Grande floodplain terraces and is characterized by anacuahuita and cenizo shrubs. Mid-Valley Riparian Woodland is a bottomland hardwood forest of the Rio Grande floodplain that is characterized by cedar elm, Berlandier ash, and sugarberry trees, often intermixed with honey mesquite and granjeno in the understory. Sabal Palm Forest represents remnant stands of Mexican palmettos or sabal palms associated with tepeguaje, anacua, and Texas ebony trees. Mid-Delta Thorn Forest is located on the Rio Grande delta and is characterized by honey mesquite and granjeno, often in association with Texas ebony, anacua, and brasil. Ramaderos are isolated strips of dense shrubs lining arroyos that have eroded into slopes, are periodically flooded, and are characterized by granjeno, huisache, retama, brasil, and honey mesquite shrubs and small trees.

NatureServe (2007a) has defined ecological systems to represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes such as fire or flooding. Ecological systems represent classification units that are readily identifiable by conservation and resource managers in the field. The ensuing vegetation description for the project area was prepared in the framework of ecological systems that include (1) Tamaulipan Calcareous Thornscrub (CES301.986), (2) Tamaulipan Mesquite Upland Scrub (CES301.984); (3) Tamaulipan Mixed Deciduous Thornscrub (CES301.983), (4) Tamaulipan Savanna Grassland (CES301.985), (5) Tamaulipan Arroyo Shrubland (CES301.992), (6) Tamaulipan Floodplain (CES301.990), (7) Tamaulipan Palm Grove Riparian Forest (CES 301.991), and (8) North American Arid West Emergent Marsh (CES300.729). **Table 5-1** provides a crosswalk between the biotic communities described by the USFWS (1988) and the ecological systems of NatureServe (2008).

Classification of existing vegetation within this corridor was achieved by accessing the project corridor and staging areas as proposed, sampling observation points, and relating them to the NatureServe (2007a) Explorer classification database. At the coarsest level, the eight above-named ecological systems were determined and local vegetation types described using the national system. A finer level of classification equaling or approximating the vegetation alliance level of the National Vegetation Classification System (NatureServe 2007a) was used to prepare the plant community discussions under each ecological system. Vegetation stands and patches that are generally unclassified in the current system and sampled within the corridor typically consisted of nonnative species including Chinaberry (*Koelreuteria* sp.) Woodland, Athel Tamarisk (*Tamarix aphylla*) Woodland, Castor Bean (*Ricinus communis*) / Buffelgrass (*Pennisetum ciliare*) Shrubland, Mediterranean Lovegrass (*Eragrostis* sp.) – Rough Pigweed (*Amaranthus retroflexus*) Herbaceous Vegetation, Johnsongrass (*Sorghum halepense*) Herbaceous Vegetation; Windmill Grass (*Chloris* spp.) Herbaceous Vegetation, Silver Bluestem (*Bothriochloa laguroides*) – Buffelgrass (*Pennisetum ciliare*) Herbaceous Vegetation, Streambed Bristlegrass Herbaceous Vegetation, Kleberg's Bluestem Herbaceous Vegetation, Quelite Cenizo (*Atriplex matamorensis*) – Buffelgrass (*Pennisetum ciliare*) Herbaceous Vegetation, Prairie Aster (*Aster subulatus*) Herbaceous Vegetation, and False Ragweed (*Parthenium confertum*) – Johnsongrass (*Sorghum halepense*) – Windmillgrass (*Chloris cucullata*) Herbaceous Vegetation.

Habitats observed, sampled, and photographed within the project corridor range from upland thornscrub on the western end of Section O-1, upper and mid-valley riparian forest and woodland communities throughout the middle sections, and sabal palm and mid-delta thorn forests within Section O-21. Much of the vegetation cover along the sections consists of nonnative grassland species that are themselves dominant or often support an overstory of honey mesquite, retama, tepeguaje, mule's fat or jara, or huisache shrubs or small trees.

Table 5-1. Crosswalk Relationship of USFWS Biotic Communities with National Vegetation Classification Standard (NVCS) Ecological Systems and Vegetation Alliances

Ecological System (NatureServe 2008) Vegetation Alliance	Biotic Community (USFWS 1988)
Tamaulipan Calcareous Thornscrub -Cenizo – Blackbrush Shrubland -Bristleleaf Dogweed – Woody Tiquilia Dwarf-shrubland	Barretal, Upland Thornscrub
Tamaulipan Mesquite Upland Scrub -Granjeno Woodland and Shrubland -Honey Mesquite Woodland	Chihuahuan Thorn Forest, Upper Valley Flood Forest, Mid-Delta Thorn Forest
Tamaulipan Mixed Deciduous Thornscrub -Huisache Woodland -Honey Mesquite Shrubland	Chihuahuan Thorn Forest, Upland Thornscrub
Tamaulipan Savanna Grassland -Retama Shrubland -Tepeguahe Woodland	Upper Valley Flood Forest, Mid-Valley Riparian Woodland
Tamaulipan Arroyo Shrubland	Ramadero
Tamaulipan Floodplain -Texas Ebony Riparian Forest and Woodland -Sugarberry Riparian Forest and Woodland -Mexican Ash Woodland -Honey Mesquite Riparian Forest, -Mule’s Fat Shrubland -Black Willow Woodland and Shrubland -Giant Reed Herbaceous Vegetation -Common Reed Herbaceous Vegetation	Upper Valley Flood Forest, Mid-Valley Riparian Woodland
Tamaulipan Palm Grove Riparian Forest -Sabal Palm Forest and Woodland	Sabal Palm Forest
North American Arid West Emergent Marsh -Alkali Sacaton Herbaceous Vegetation -Narrowleaf Cattail Herbaceous Vegetation, -Smartweed Herbaceous Vegetation -Duckweed Herbaceous Vegetation	Included among several Biotic Communities

Vegetation cover occupies approximately 63% of the corridor. Agricultural fields occur along much of the corridor and include sugarcane, sorghum, Johnsongrass, sunflowers, cotton, row crop vegetables (particularly onions,

beans, tomatoes, broccoli, corn), citrus trees (grapefruit and orange), or fields that were fallow at the time of the site visit; fields occupy approximately 21% of the corridor. Urban development and private property with single homes occurs adjacent to several sections; along with roads, these land uses occupy approximately 15% of the corridor.

A brief description of each plant community observed within the sections (Sections O-1 through O-21) is provided herein; they are distinguished using the NatureServe Vegetation Alliance level of classification or an approximation. To the extent possible, each community is illustrated and supported by representative ground photographs and foliar cover information for dominant species. Some vegetation patches and stands are introduced nonnative species and do not readily fit into a recognized vegetation alliance or ecological system predominantly designed for native vegetation; they are discussed at the end of this section.

5.1.1 Tamaulipan Floodplain Ecological System (CES301.990)

Texas Ebony Riparian Forest and Woodland

Texas ebony occurred within the project corridor as trees and shrubs typically providing sparse to low cover in other plant communities and as individual large trees. Woodland stands dominated by 5-meter (m) to 15-m-tall Texas ebony trees occurred within the Hidalgo Bend and Tahuachal Banco Units of the Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR) within Sections O-6 and O-16, respectively. Within these stands, sugarberry, tepeguahe, and huisache canopy trees together provided 15% cover and the understory was characterized by moderate to dense cover, up to 80% cover by switchgrass and buffelgrass. As an understory to tepeguaje woodlands in the Phillips Banco tract of the LRGVNWR (Section O-18), Texas ebony trees to 6-m-tall provided up to 5% cover. Particularly large, mature Texas ebony trees that are approximately 20 m–25 m tall occur within floodplain habitat in Section O-2 where they occupy the outer edge (see **Figure 5-1**). The large trees have emerged from an understory of the nonnative perennial grass, buffelgrass, and can exceed 100 years of age (Patterson 2008).

Sugarberry Riparian Forest and Woodland

Sugarberry forest and woodland stands have become established on the outer floodplain and along oxbows of the Rio Grande and were sampled in Sections O-1, O-2, O-3, O-8, O-9, O-10, O-11, O-12, and O-14 (see **Figure 5-2**). Sugarberry stands cover approximately 6 acres within the project corridor and approximately 9.7 acres within the staging area and access road templates. Canopy cover for the mature sugarberry trees (10 m–30 m tall) ranges from 15% to 75%. Honey mesquite trees are commonly present in the canopy layer and provide 5% to 20% cover. A diverse stand occurred along a stream in the Arroyo Ramirez Unit of the LRGVNWR, which supported 6% cover by sugarberry and 8% cover



Figure 5-1. Representative Photographs of Mature Texas Ebony Tree and Woodland Stand



Figure 5-2. Representative Photographs of Sugarberry Habitat

combined for Mexican ash, anacua, honey mesquite, Texas persimmon, Texas ebony, cedar elm, and black willow trees. In one stand, a subcanopy layer of granjeno, huisache, and honey mesquite, from 5 m–10 m tall, provided approximately 20% cover. The herbaceous layer provides low to dense cover, from 5% to 75% cover and includes switchgrass, Bermuda grass, buffelgrass, or giant reed (carrizo). One regional biologist (Patterson 2008) considered the sugarberry riparian forest occurring at the Arroyo Ramirez confluence with the Rio Grande as the best example of riparian woodland that he has observed in Starr County.

Mexican Ash Woodland

Stands of Mexican ash occurred in Section O-12 on a construction staging area at Los Indios and a homestead site (see **Figure 5-3**). In these stands, mature Mexican ash canopy trees were planted in rows in parklike settings, ranged up to 20 m tall, and provided approximately 20% cover. Buffelgrass and Bermuda grass provided moderate herbaceous cover for these stands, up to 35% and were regularly maintained by mowing.



Figure 5-3. Representative Photographs of Mexican Ash Habitat

Honey Mesquite Riparian Forest

Honey mesquite forests characterized by large trees from 10 m–30 m tall occurred on the Rio Grande floodplain margins and were sampled in Sections O-1, O-2, O-6, O-8, O-13, and O-21. Honey mesquite stands cover approximately 44.3 acres within the project corridor and approximately 91.2 acres within the staging areas and access road templates. In the canopy layer, honey mesquite cover ranged from 20% to 60% (see **Figure 5-4**). Associated canopy tree species included sugarberry, retama, and granjeno that provided low cover, from 3% to 15% cover. A subcanopy layer was typically present, provided 10% to 25% cover, and included snake eyes, huisache, retama, granjeno, brasil, Texas ebony, and colima. The tall and short shrub layers (1 m–5 m tall) were occasionally present, provided from 5% to 55% cover, and included Texas prickly pear, snake eyes, cenizo, granjeno, and honey mesquite saplings. The herbaceous layer provided low to dense cover, from 15% to 85% cover, ranged from 0.5 m–2.0 m tall, and included buffelgrass, switchgrass, and a variety of forbs including vines.

Mule's Fat Shrubland

Mule's fat or jara occurred as stands and patches of riparian tall shrubs from 4 m–10 m tall where near-to-surface groundwater or occasional standing water



Figure 5-4. Representative Photographs of Honey Mesquite Forest Habitat

was present within the project region. Mule's fat stands cover approximately 1.6 acres within the project corridor and approximately 1.1 acres within the staging area and access road templates. The densest stands with mule's fat or jara tall shrub foliar cover of up to 55% were recorded in Section O-3 within the Los Ebanos Unit of the LRGVNWR, Section O-13, and Section O-18 within the Phillips Banco Unit (see **Figure 5-5**). Stands can be monotypic in the tall shrub layer, or low cover, less than 10% cover of granjeno, tepeguaje, sugarberry saplings, or black willow, can occur. The herbaceous layer provides moderate to high cover, from 30% to 90% cover, ranges from 0.5 m–2.0 m tall, and includes switchgrass, windmill grass, Johnsongrass, buffelgrass, and prairie aster. The typical succession of abandoned cropland within the Rio Grande floodplain proceeds from annual forbs (Russian-thistle and pigweed) to shrubs (mule's fat) to a final disclimax of honey mesquite and Texas prickly pear (Patterson 2008).

Black Willow Woodland and Shrubland

Black willow tall shrubs or small trees, from 5 m–10 m in height, form narrow bands or linear stands on saturated soil around permanent water bodies including the Rio Grande, canals, drainage ditches, and ponds (see **Figure 5-6**). Representative stands were sampled in Sections O-3, O-8, O-13, O-14, and O-20. Black willow typically provided from 10% to 60% cover in the canopy or tall shrub layer



Figure 5-5. Representative Photographs of Mule's Fat Habitat



Figure 5-6. Representative Photographs of Black Willow Habitat

along with low to moderate cover, less than 10% by granjeno, honey mesquite, mule's fat or jara, and retama. The herbaceous layer provided moderate to high cover, from 15% to 95% cover, ranged from 1 m–10 m tall, and included giant reed, switchgrass, narrowleaf cattail, smartweed, and buffelgrass.

Giant Reed Herbaceous Vegetation

Giant reed or carrizo forms 5 m–10 m tall, linear, dense stands (from 15%–95% cover) on saturated soils of ditch and canal banks, standing water in ditches, and other sites with near-to-surface groundwater. Some stands have apparently become established as a result of irrigation runoff draining from sugarcane and other irrigated agricultural fields. Giant reed stands cover approximately 0.3 acres within the project corridor and approximately 0.3 acres within the staging area and access road templates. The banks of the Rio Grande support dense stands that exceeded 8 m in height (see **Figure 5-7**). Switchgrass is a common associate in giant reed stands providing from 15% to 50% cover and black willow trees to 10 m tall provided approximately 25% cover in one stand. In one stand near Moon Lake in Section O-9, common reed provided cover equal to that of giant reed, e.g., 15% cover for each species of reed. In a recently mown stand in Section O-9, giant reed was dominant, but provided only 4% cover. Representative data were recorded from stands that occurred in Sections O-2, O-9, and O-14.



Figure 5-7. Representative Photographs of Giant Reed Habitat

Common Reed Herbaceous Vegetation

Common reed was rarely observed within the project region, persisting as narrow strips along canal banks that rarely exceeded 25 square meters (m²) in area covered (see **Figure 5-8**). Larger stands were observed outside the project corridor and along the banks of the Rio Grande and its associated oxbows or resacas. One stand along the Rio Grande in the Arroyo Ramirez Unit of the LRGVNR was associated with wetland forbs and grasses including delta arrowhead, erect burhead, fragrant flatsedge, wild cowpea, hachinal, gulf

cockspur, Louisiana cupgrass, water smartweed, water pimpernel, and Mexican buttonbush.



Figure 5-8. Representative Photographs of Common Reed Habitat

5.1.2 Tamaulipan Palm Grove Riparian Forest Ecological System (CES301.991)

Sabal Palm Forest and Woodland

Sabal palms are distributed predominantly in Section O-21 as scattered individuals, small groups, or linear clumps, and patches and stands where they persist as seedlings, tall shrubs (palmettos), and as trees up to 20 m tall (see **Figure 5-9**). Only a few sabal palm trees were observed in other project sections, mostly as palmettos. The USFWS has established the Boscaje de la Palma Unit of the LRGVNR in the southernmost bend of the Rio Grande near Brownsville to preserve sabal palm forest and woodland habitat (USFWS 1988). The sabal palm was common enough in this region, extending to near the Gulf of Mexico at the time of Spanish exploration, that the Rio Grande was first named the Rio de Las Palmas. Sabal palm stands cover approximately 8.3 acres within the project corridor and approximately 11.4 acres within the staging area and access road templates. In sampled stands, the sabal palm ranged from 4 m–10 m tall and provided from 8% to 30% cover. Low cover, less than 10%, was also provided by honey mesquite, tepeguaje, anacua, huisache, sugarberry, and Texas ebony trees and tall shrubs. In the herbaceous layer, the liana ivy treebine or hierba del buey provides up to 50% cover and switchgrass provides from 20%–55% cover. The sabal palm woodland stand located within the Bascaje de la Palma Unit was aggressively treated to eradicate nonnative grasses and shrubs and therefore presented a disturbed understory (see **Figure 5-9**).



Figure 5-9. Representative Photographs of Sabal Palm Forest and Woodland Habitat

5.1.3 Tamaulipan Mesquite Upland Scrub Ecological System (CES301.984)

Granjeno Woodland and Shrubland

Granjeno or spiny hackberry forms stands of moderate-stature trees to 15 m tall or is a dominant understory component in the subcanopy or tall shrub layers, ranging from 3 m–5 m tall. Granjeno stands occupy approximately 2.4 acres within the project corridor and approximately 1.4 acres within staging area and access road templates. Representative stands were sampled in Sections O-1, O-5, O-10, O-13, and O-17 where granjeno cover ranged from 30% to 75% (see **Figure 5–10**). Associated canopy trees provided low cover, up to 20%, and included honey mesquite, huisache, sugarberry, and retama. The herbaceous layer provided low to dense cover, from 5% to 50%, and included the 2 m–8 m tall switchgrass, giant reed, and Johnsongrass. On some small hilltops within the Arroyo Ramirez Unit of the LRGVNR within Section O-1, granjeno tall shrubs provided 10% cover and buffelgrass provided 70% cover; associated short shrubs that together provided 14% cover at this site included Texas prickly-pear, snake eyes, lotebush, colema, and Mexican persimmon.



Figure 5-10. Representative Photographs of Granjeno Habitat

Honey Mesquite Woodland

Honey mesquite woodlands with small trees from 5 m–10 m tall were sampled in Sections O-1, O-2, O-3, O-4, O-5, O-7, O-8, O-9, O-10, O-15, and O-18. Honey mesquite woodland and tall shrub stands (combined herein) cover approximately 5.8 acres within the project corridor and approximately 3.7 acres within the access road template. In the canopy layer, honey mesquite cover ranged from 5% to 55% (see **Figure 5-11**). Associated canopy tree species, when present, included snake eyes, granjeno, retama, huisache, sugarberry, and Texas ebony that provided low to moderately dense cover, from 5% to 40%. The tall and short shrub layers provided low cover, up to 15%, and included snake eyes, Texas prickly pear, blackbrush, cenizo, kidney wood, mule's fat or jara, junco, goatbrush, granjeno, tasajillo, lotebush, bluewood condalia, colima, brasil, and honey mesquite saplings. The herbaceous layer contributed low to high cover, from 5% to 90%, and is dominated by buffelgrass and switchgrass. The vine or liana old man's beard can provide low to moderate cover in this plant community. Revegetation efforts at the Los Ebanos Unit of the LRGVNWR were represented by this type following 5 to 6 years of growth. The typical succession of abandoned cropland within the Rio Grande floodplain proceeds from annual forbs (Russian-thistle and pigweed) to shrubs (mule's fat) to a final disclimax of honey mesquite and Texas prickly pear (Patterson 2008).



Figure 5-11. Representative Photographs of Honey Mesquite Woodland Habitat

5.1.4 Tamaulipan Mixed Deciduous Thornscrub Ecological System (CES301.983)

Huisache Woodland

Huisache typically occurs in the canopy, subcanopy, or as tall shrubs as a component of other plant communities (see **Figure 5-12**). Short-stature huisache woodlands were sampled within Sections O-1, O-2, and O-7 and two short-stature huisache woodland stands were observed in Section O-21. Huisache woodland and tall shrub stands (combined herein) cover approximately 0.1 acre within the project corridor. In the canopy layer, huisache trees from 5 m–10 m tall ranged in cover from 8% to 10%. Additional canopy trees included retama and honey mesquite, which together provided from 5% to 8% cover. The shrub layer was moderately diverse and included Texas prickly-pear, bluewood condalia, cenizo, lotebush, colima, anaqua, and palo verde that together provided up to 6% cover. The understory was characterized by moderately dense to dense stands of the nonnative buffelgrass and switchgrass, which together provided 50% to 80% cover.



Figure 5-12. Representative Photographs of Huisache Woodland Habitat

Honey Mesquite Shrubland

Honey mesquite is distributed throughout the approximately 70-mile corridor and occurs as tall shrubs becoming recently reestablished in nonnative grasslands, as short-stature woodlands where reestablishment in nonnative grasslands has occurred over several years, and as tall forests of mature trees at the edge of the Rio Grande floodplain. The approximate acreage covered by honey mesquite tall shrubs is combined with the woodlands discussion (see above) to provide a more accurate area. Honey mesquite tall shrubs sampled in Section O-1 occur along the high bluffs adjacent to Los Negros Creek and the ridgetops between side arroyos, range from 2 m–5 m in height, and typically provide from 5% to 25% cover (see **Figure 5-13**). Associated tall and short shrubs include Texas prickly pear, tasajillo, blackbrush, cenizo, lotebush, coyotillo, snake-eyes, granjeno, Colima, guayacan, Spanish dagger, coma, Mission fiddlewood, leatherstem, and brasil, which together provide up to 10% cover. The herbaceous layer is typically dominated by buffelgrass, which provides up to 60% cover.

5.1.5 Tamaulipan Arroyo Shrubland Ecological System (CES301.992)

Several arroyos or deep drainages that are intermittently flooded occur primarily within Sections O-1 and O-2 (see **Figure 5-14**). Shrubland stands within arroyos cover approximately 0.9 acres within the project corridor and approximately 0.7 acres within the staging area and access road templates. Characterized primarily by short shrubs that provide up to 20% cover, the arroyos are floristically diverse and each is somewhat unique in terms of species composition. The more common shrubs include blackbrush or chaparro, lotebush, coma, coyotillo, leatherstem, brasil, colima, cenizo, Mexican persimmon, kidney wood, jointfir, snake-eyes, granjeno, Wherry mimosa, oregano, Texas prickly pear, and Texas palo verde. Rarely, tall shrubs of honey mesquite or Spanish dagger can also occur, providing sparse cover. In arroyos associated with Los Negros Creek, large barrel cacti occur on the steep slopes. The herbaceous layer is often sparse and can include the endangered Zapata bladderpod on sandstone



Figure 5-13. Representative Photographs of Honey Mesquite Shrubland Habitat

outcrops or it can provide up to 20% cover by the nonnative buffelgrass. Arroyo habitats have fine clay and sand substrates that are highly erodible and arroyos are subject to disturbance because of steep slopes. The bottom of Los Negros Creek contains a massive, unvegetated fossil reef composed of oyster shells, possibly the largest such reef in Starr County (Patterson 2008).



**Figure 5-14. Representative Photographs of Arroyos
in Sections O-1 and O-2**

5.1.6 Tamaulipan Calcareous Thornscrub Ecological System (CES301.986)

Cenizo – Blackbrush Shrubland

The western portion of Section O-1 and eastern portion of Section O-2 traverse gravel-covered ridges, sandstone bluffs, and hill slopes that support this species rich, predominantly shrub and succulent community. The gravel is small, to 10 centimeters (cm) in diameter, is glazed with desert varnish, and provides nearly 100% armoring of the soil surface. Additional soil armoring is provided by clam shells in some locations and a few bedrock outcrops occur immediately south of Section O-1. Shrublands of this type cover approximately 7.9 acres within the project corridor and approximately 9.7 acres within the staging area and access road templates. One stand of cenizo—blackbrush shrubland approximately 200 m long—is just north of the corridor, at the terminus of Section O-1 and has been recently root-plowed, leaving less than 20% cover by native shrub species while resulting in approximately 50% to 70% cover by the nonnative buffelgrass (see **Figure 5-15**). The short and tall shrub layers provide from 20% to 30% cover in this community, and are characterized by cenizo, blackbrush, honey mesquite, Wherry mimosa, Texas paloverde, Texas prickly pear, tasajillo, kidney wood, coyotillo, junco, oregano, leatherstem, dog cholla, and Spanish dagger.

The herbaceous layer contributes sparse cover, less than 5% cover, in this vegetation type.



Figure 5-15. Representative Photographs of Cenizo – Blackbrush Habitat (Lower two photos represent area that has been root-plowed - fenceline contrast and buffelgrass invasion)

Bristleleaf Dogweed – Woody Tiquilia Dwarf-shrubland

The western portion of Section O-1 and its associated staging areas occur on areas of gravel-covered ridges and hill slopes that support this short-stature, species-rich vegetation stand (see **Figure 5-16**). This stand is small, less than one acre in size under both corridor widths. The substrate consists of bare soil, primarily, and small gravel. A few bedrock outcrops occur in the stand vicinity. A few honey mesquite tall shrubs provide sparse cover while Spanish dagger and blackbrush provide low cover within this stand. The short shrub layer ranges from 2 m–5 m in height, provides up to 10% cover, and is characterized by amargosa, cenizo, lotebush, Texas prickly pear, coyotillo, and tenaza. The dwarf-shrub layer, less than 0.5 m tall, provides low to moderate cover, up to 20%, and is dominated by bristleleaf dogweed (Tiny Tim dogweed) and woody tiquilia (oreja de perro), in addition to sparse cover by pencil cactus. The herbaceous layer

contributes sparse to low cover, less than 10%, and includes the nonnative Mediterranean lovegrass and buffelgrass.



Figure 5-16. Representative Photographs of Bristleleaf Dogweed – Woody Tiquilia Habitat

5.1.7 Tamaulipan Savanna Grassland Ecological System (CES301.985)

Retama Shrubland

Retama has reinvaded nonnative grassland habitat to form shrublands and short-stature woodlands with low to moderately dense cover, from 10% to 40% cover as recorded for Sections O-4, O-6, O-13, O-18, and O-21 (see **Figure 5-17**). Retama stands cover approximately 0.9 acres within the project corridor and approximately 2.8 acres within the staging area and access road templates. Granjeno and honey mesquite tall shrubs can provide up to 10% cover and mule's fat or jara and lotebush can provide up to 8% cover. The herbaceous layer was usually monotypic and could be characterized by buffelgrass, windmill grass, or switchgrass, which provide low to dense cover from 15% to 100%.

Tepeguahe Woodland

A single stand of tepeguahe woodland from 10 m–15 m tall was documented in the Phillips Banco Unit of the LRGVNWR within Section O-18 (see **Figure 5-18**). Tepeguahe stands cover approximately 0.01 acre within the project corridor and approximately 10.6 acres within the staging area and access road templates. Tepeguahe trees occurred on the flat plain beyond the fenceline and provided from 30% to 35% cover with low cover, less than 10%, provided by Texas ebony, sugarberry, and Mexican sabal palm in the subcanopy layer. Near the adjacent levee, on the toeslope, tepeguahe trees and tall shrubs provided 30% cover, while the herbaceous layer was characterized by 1 m–2 m tall switchgrass, which provided approximately 60% cover.



Figure 5-17. Representative Photographs of Retama Habitat



Figure 5-18. Representative Photographs of Tepeguahe Habitat

5.1.8 North American Arid West Emergent Marsh Ecological System (CES300.729)

Alkali Sacaton Herbaceous Vegetation

Two relatively large stands of alkali sacaton were observed and a representative stand sampled in Section O-4 (see **Figure 5-19**). Although the hydrology



Figure 5-19. Representative Photographs of Alkali Sacaton Habitat

supporting this herbaceous wetland type is unknown, the stands occupy shallow depressions that likely capture runoff from the surrounding landscape during precipitation events. Alkali sacaton stands cover approximately 0.6 acres within the access road template. The stands are nearly monotypic with 0.5 m–1.0 m tall alkali sacaton bunchgrass providing up to 75% cover and Bermuda grass, a nonnative, providing sparse cover, less than 5%.

Narrowleaf Cattail Herbaceous Vegetation

Patches and small linear stands of narrowleaf cattail occur along perennial water bodies, particularly on pond shorelines, where the soils are saturated most of the year or where shallow water to 1.0 m deep persists (see **Figure 5-20**). Narrowleaf cattail stands cover 1.2 acres within the project corridor and approximately 1.9 acres within the staging areas and access road templates. Where established, as in Section O-8, narrowleaf cattail stands are monotypic, range from 2 m–4 m tall, form bands approximately 10 m wide, and provide from 60% to 90% cover. The largest ponded area had been excavated historically for gravel extraction to below the groundwater table.



Figure 5-20. Representative Photographs of Narrowleaf Cattail Habitat

Smartweed Herbaceous Vegetation

Smartweed is rare within the corridor and dominates the bottom of one canal or large irrigation ditch within Section O-14 (see **Figure 5-21**). The smartweed stand covers approximately 0.1 acre within the access road template. The stand is narrow and linear, up to 5 m wide and smartweed forbs provide approximately 20% cover. The canal bottom is saturated with occasional pools of standing water. Adjacent banks support 1 m–3 m tall Johnsongrass and switchgrass, primarily. In some locations along the canal or irrigation ditch, an overstory canopy of black willow provides up to 60% cover, which is described more fully under the black willow woodland discussion.



Figure 5-21. Representative Photograph of Smartweed Habitat

Duckweed Herbaceous Vegetation

One small pond in Section O-9, less than 0.1 acre in size, supported approximately 90% cover by the floating aquatic plant species duckweed (see

Figure 5-22). This pond also supported a band of narrowleaf cattail on saturated soil around its margin in addition to black willow tall shrubs.



Figure 5-22. Representative Photograph of Duckweed Habitat

5.1.9 Nonnative Woodland, Shrubland, and Herbaceous Vegetation Alliances and Associations

Athel Tamarisk Woodland

A small stand, less than 0.5 acres in size, of six very large and old Athel tamarisk trees occurs within Section O-2 amid a broader honey mesquite forest and woodland stand (see **Figure 5-23**). These trees are approximately 20 m tall, are multiple branched from low on the trunk, and have very large basal diameters. A few scattered, large Athel tamarisk trees occur elsewhere in this stand and several were observed on the banks of the Rio Grande associated with other sections. This vegetation type occurs within the Tamaulipan Floodplain ecological system of NatureServe (2007a).

Chinaberry Woodland

One stand of Chinaberry, a nonnative ornamental tall shrub or small tree, was documented in Section O-16 (see **Figure 5-24**). In this small stand, which covers approximately 0.3 acres within the project corridor, Chinaberry canopy trees ranged from 6 m–8 m tall and provided approximately 60% cover. Other canopy trees provided 40% cover: honey mesquite (5%), huisache (5%), and retama (15%). Buffelgrass and switchgrass provide moderate to high herbaceous cover for this stand, 50% and 5% cover, respectively.



Figure 5-23. Representative Photographs of Athel Tamarisk Stand



Figure 5-24. Representative Photograph of Chinaberry Habitat

Castor Bean / Buffelgrass Shrubland

One abandoned homestead in Section O-9 supported a tall shrubland, up to 5 m tall, of castor bean, honey mesquite, and mule's fat or jara, which together provide 22% cover (see **Figure 5-25**). The commonly occurring, nonnative buffelgrass contributed 20% cover within this stand. This stand covered less than 0.1 acre within the project corridor.

Buffelgrass Semi-Natural Herbaceous Vegetation

Buffelgrass, a nonnative forage and erosion-control grass introduced from Africa, is the most common vegetation type and ground cover in the project region (see



Figure 5-25. Representative Photograph of Castor Bean / Buffelgrass Habitat

Figure 5-26). Buffelgrass stands cover approximately 135.7 acres within the project corridor and an additional 103.7 acres on staging areas and access roads. Buffelgrass ranges from 0.5 m–1.5 m tall and provides from 25% to 100% cover on levee banks, canal banks, toe slopes, flats, old fields, and pastures to the exclusion of other species. Where native shrubs and trees have been introduced or have otherwise become established (e.g., honey mesquite, granjeno, huisache), buffelgrass characterizes the understory often providing 90% to 100% cover. In some herbaceous stands within the Project region, buffelgrass shares dominance with switchgrass, Johnsongrass, or windmill grass forming mixed stands or a type of ecotone. This vegetation type occurs within all the Tamaulipan ecological systems described by NatureServe (2007) for this region.



Figure 5-26. Representative Photographs of Buffelgrass Habitat

Switchgrass – (Guinea Grass) Herbaceous Vegetation

Panicum spp. (switchgrass and Guinea grass) are common throughout the project corridor on sites that are more mesic (see **Figure 5-27**). Switch and Guinea grasses are bunchgrasses likely introduced to the project region for livestock forage and erosion control. Switchgrass stands cover approximately 35.7 acres within the project corridor and approximately 19.5 acres within the staging area and access road templates. Switchgrass often forms mixed stands with buffelgrass. Switch and Guinea grasses range from 1 m–2 m tall and provide from 40% to 95% cover on levee banks, canal banks, toe slopes, flats, and pastures, sometimes to the exclusion of other species. Where native shrubs and trees have been introduced (as on units of LRGVNR) or have otherwise become established, switch and Guinea grasses can compose the understory providing 25% to 75% cover. In some herbaceous stands within the Project region, switch and Guinea grasses share dominance with buffelgrass, primarily forming mixed stands or a type of ecotone. This vegetation type occurs within all the Tamaulipan ecological systems described by NatureServe (2007) for this region.



Figure 5-27. Representative Photographs of Switchgrass (Guinea Grass) Habitat

Silver Bluestem – Buffelgrass Herbaceous Vegetation

A large patch of silver bluestem and buffelgrass, covering less than 0.3 acres, was sampled on the levee embankment within Section O-5 (see **Figure 5-28**). Silver bluestem provided 50% cover and buffelgrass provided 15% cover. A few shrubs of *Acacia* sp. provide low cover, up to 4%.



Figure 5-28. Representative Photographs of Silver Bluestem – Buffelgrass Habitat

Johnsongrass Semi-Natural Herbaceous Vegetation

Johnsongrass is grown as a pasture grass and to produce cured grass hay for livestock forage. Individual plants and small patches are scattered within most of the sections and a few larger stands were observed, possibly as remnant stands from past farming efforts. Johnsongrass stands cover approximately 1.0 acre within the project corridor. Nearly monotypic stands occur in Sections O-11, O-13, and O-14, with Johnsongrass up to 2 m tall providing 80% to 90% cover (see **Figure 5-29**). In one stand, switchgrass provides up to 5% cover and a few castor bean shrubs provide approximately 2% cover. These large stands are irrigated during the growing season or receive sufficient runoff following precipitation events to survive.



Figure 5-29. Representative Photographs of Johnsongrass Habitat

Bermuda Grass Semi-Natural Herbaceous Vegetation

Small patches and larger stands of Bermuda grass have become established on levee banks, in ditches adjacent to canal banks, and in agricultural fields that have been allowed to go fallow for more than one year (see **Figure 5-30**). Bermuda grass stands cover approximately 2.1 acres within the project corridor and an additional 11.6 acres on staging areas and access roads. Typical stands of this nonnative rhizomatous grass were sampled within Sections O-3, O-6, O-8, and O-15 where Bermuda grass ranged in cover from 15% to 80%. Along Section O-15, heavy and apparently continual grazing by cattle drives the dominance of Bermuda grass. Associated herbaceous species that individually provide 10% cover or less include buffelgrass, switchgrass, windmill grass, sandbur, and morning-glory. In one stand the tall shrub huisache provided 5% cover.



Figure 5-30. Representative Photographs of Bermuda Grass Habitat

Windmill Grass Herbaceous Vegetation

Representative patches and stands of windmill grass were sampled in Sections O-12, O-13, O-19, O-20, and O-21 (see **Figure 5-31**). In some places windmill grass has become the dominant grass forming nearly pure stands on levee banks; however, extensive, monotypic stands occupy fields that were historically cultivated. Windmill grass stands cover approximately 6.4 acres within the project corridor and approximately 1.3 acres within the staging and access road templates. Windmill grass is dense and typically provides 90% to 95% cover. Associated tall shrubs, from 2 m–5 m tall, include mule’s fat or jara, huisache, and retama that together provide from 1% to 25% cover in windmill grass stands and result in a shrub herbaceous classification. Two large stands were mowed annually to acquire grass hay.



Figure 5-31. Representative Photographs of Windmill Grass Habitat

Streambed Bristlegrass Herbaceous Vegetation

A single patch or small stand of streambed bristlegrass, covering less than 5.0 acres, was sampled in Section O-10 (see **Figure 5-32**). The stand occurs at a staging area and had been introduced into a field that is used for overflow parking. In the herbaceous layer, streambed bristlegrass provides up to 80% cover, while windmill grass and false ragweed contribute sparse cover. This stand is maintained by mowing.

Kleberg’s Bluestem Herbaceous Vegetation

Representative stands of Kleberg’s bluestem were sampled in Sections O-7 and O-9 (see **Figure 5-33**). Kleberg’s bluestem provides dense cover, up to 70%, characterizing the herbaceous layer. Other herbaceous species provide low to moderate cover, up to 25% and include Bermuda grass, windmill grass, Guinea grass, buffelgrass, snap-pea, silverleaf nightshade (trompillo), and old man’s beard. Associated tall shrubs, from 2 m–5 m tall, include honey mesquite, sugarberry, lotebush, granjeno, and retama that together provide up to 10% cover.



Figure 5-32. Representative Photograph of Streambed Bristlegrass Habitat



Figure 5-33. Representative Photographs of Kleberg's Bluestem Habitat

Mediterranean Lovegrass – Rough Pigweed Semi-Natural Herbaceous Vegetation

A fallow agricultural field in Section O-2 and a pasture in the Peñitas Unit of the LRGV NWR in Section O-4 supported stands of Mediterranean lovegrass and the tall, coarse forb, rough pigweed (see **Figure 5-34**). These annual stands cover approximately 1.5 acres within the project corridor and approximately 14.2 acres within the staging area and access road templates. The nonnative grasses Mediterranean lovegrass, Bermuda grass, and buffelgrass provided approximately 35% to 45%, 8%, and 3% cover, respectively, and the forbs rough pigweed and annual sunflower provided approximately 15% and 2% cover, respectively, in one stand. This vegetation type would be removed by plowing or tilling if the fields are prepared for future planting. The typical succession of

abandoned cropland within the Rio Grande floodplain proceeds from annual forbs (Russian-thistle and pigweed) to shrubs (mule's fat) to a final disclimax of honey mesquite and Texas prickly pear (Patterson 2008).



Figure 5-34. Representative Photograph of Mediterranean Lovegrass, Rough Pigweed Habitat

Quelite Cenizo – Buffelgrass Semi-Natural Herbaceous Vegetation

One large patch of quelite cenizo forbs, less than 0.1 acre in area, has become established within a buffelgrass matrix on the embankment between the levee road and the adjacent paved highway of Section O-4 near Peñitas. Quelite cenizo, providing up to 65% cover, dominates a short reach of this section and extends from the levee road to the pavement edge (see **Figure 5-35**). This stand occupies approximately 1 acre, supports the nonnative grasses buffelgrass (10% cover) and Johnsongrass (2% cover), and includes a few shrubs of honey mesquite that provide sparse cover, up to 5%.



Figure 5-35. Representative Photograph of Quelite Cenizo - Buffelgrass Habitat

Prairie Aster - (Crucita) Semi-Natural Herbaceous Vegetation

One stand and one large patch of prairie aster forbs have become established on a fallow agricultural field and in a shallow depression that occupy less than 5.0 acres in area. The agricultural field, which was formerly planted to sorghum, will serve as a construction staging area of 2 to 5 acres within Section O-17. The shallow depression occurs within the Phillips Banco Unit of the LRGVNWR in Section O-18 and covers approximately 0.1 acre. Prairie aster, providing up to 45% cover, dominates this type, in addition to low cover up to 7% cover provided by buffelgrass and switchgrass in the herbaceous layer (see **Figure 5-36**). The tall shrub mule's fat or jara provides low cover, from 1% to 5% cover, in the sampled stands of prairie aster herbaceous vegetation. Another small stand of herbaceous vegetation within the Tahuachal Banco Unit of the LRGVNWR in Section O-16 was dominated by crucita (15% cover) with low cover of prairie aster (3% cover). This stand has become established in an abandoned agricultural field where the rows are still obvious.



Figure 5-36. Representative Photographs of Prairie Aster Habitat

False Ragweed – Johnsongrass – Windmill Grass Semi-Natural Herbaceous Vegetation

One stand of false ragweed forbs and the associated nonnative grasses Johnsongrass and windmill grass has become established on an abandoned agriculture field that is partially in use as a parking lot and staging area for a private business. The site would potentially serve as a construction staging area of 2 to 5 acres within Section O-13. False ragweed, providing up to 25% cover, characterizes this type, in addition to moderate cover, up to 25% cover, provided by Johnsongrass, windmill grass, and Bermuda grass in the herbaceous layer (see **Figure 5-37**). This stand is maintained annually by mowing, nearly eliminating cover by shrub species.



Figure 5-37. Representative Photograph of False Ragweed Habitat

5.2 Vegetation Classification for the South of the Levee Project in Sections O-4 through O-10

A reconnaissance survey was conducted in Hidalgo County on March 6–7, 2008, to determine plant communities and land use types on and south of the USIBWC levee including the levee shoulder, embankment, toe slope, ROW, and adjacent public and private land. Plant community observations are summarized by section in Table 5-2 and each community/habitat is further described and illustrated herein. A vegetation and land use map was prepared following this survey to inform document users. An in-depth survey was conducted in late March and early April 2008 to inventory for rare plants and conduct wetland analyses.

Table 5-2. LRGV Resources Summary for Sections O-4 through O-10, South of the Levee Road

Section	Plant Communities Observed – General Location	Comments and Notes
O-4	<ul style="list-style-type: none"> -Seepweed – Buffelgrass Herbaceous Vegetation – Levee Bank and Toe Slope to Boundary -Buffelgrass Herbaceous Vegetation – Levee Bank and Toe Slope to Boundary -Honey Mesquite – Huisache / Texas Prickly pear / Buffelgrass Woodland – LRGV NWR Peñitas, La Pesquera, Chihuahua Woods, Abrams West, Abrams, and TP&WD -Narrowleaf Cattail – Common Reed – Bermuda Grass Herbaceous Vegetation – 	<ul style="list-style-type: none"> -Ponds occur near west end and in the middle of section at the edge of the wall construction footprint -Ditch occurs near west end at edge of proposed limits of construction and is proposed to remain undisturbed by using Bollard fence here instead of retaining wall; supports wetland vegetation to approximately 5 m wide

Table 5-2. LRGV Resources Summary for Sections O-4 through O-10, South of the Levee Road

Section	Plant Communities Observed – General Location	Comments and Notes
	Ponds Abutting Boundary Fence, Ditch, and Canal Banks	<p>-Canal occurs with pump station on western end, is proposed to remain undisturbed until some future project unrelated to this one is approved, and would not be disturbed; banks support wetland vegetation to approximately 4 m wide</p> <p>-Wall installation would require tree removal and branch trimming in the middle to eastern one-half</p>
O-5	<p>-Buffelgrass Herbaceous Vegetation – Levee Bank and Toe Slope to Boundary</p> <p>- Buffelgrass /Honey Mesquite Herbaceous Vegetation – Levee Bank and Toe Slope to Boundary</p> <p>- Bermuda Grass – Common Reed – Narrowleaf Cattail Herbaceous Vegetation</p> <p>- Canal and Overflow Channel Banks</p>	<p>-Canal occurs on western terminus along one-third of the section, located north of levee road and would not be disturbed; banks support wetland vegetation to approximately 2 m wide</p> <p>-Overflow channel occurs on western terminus at edge of proposed limits of construction and could be disturbed; banks support wetland vegetation to approximately 8 m wide</p>
O-6	<p>-Buffelgrass Herbaceous Vegetation - Levee Bank and Toe Slope</p> <p>-Honey Mesquite – Huisache / Buffelgrass Woodland – LRGVNWR Pate Bend and Hidalgo Bend</p> <p>-Giant Reed Herbaceous Vegetation – Near Middle on Levee Bank and Toe</p> <p>-Black Willow / Narrowleaf Cattail Wooded Herbaceous Vegetation – Canal Banks at Toe of Levee</p>	<p>-Canal crosses about half way, the concrete box culvert would be extended to accommodate retaining wall; banks support wetland vegetation to approximately 2 m wide</p> <p>-Ditch supports stand of giant reed near the bridge; occurs adjacent to retaining wall footprint</p> <p>-Canal occurs on eastern end at toe of levee fill; banks support wetland vegetation to approximately 4 m wide</p> <p>-Wall installation would require tree removal and branch trimming in the middle to eastern one-half</p>
O-7	-Buffelgrass Herbaceous Vegetation -	-Wall installation would require

Table 5-2. LRGV Resources Summary for Sections O-4 through O-10, South of the Levee Road

Section	Plant Communities Observed – General Location	Comments and Notes
	Levee Bank and Toe Slope - LRGVNWR Monterrey Banco -Honey Mesquite – Huisache – Granjeno / Buffelgrass Woodland – LRGVNWR Monterrey Banco -Tepeguahe – Honey Mesquite – Huisache / Buffelgrass Woodland – LRGVNWR Monterrey Banco -Bermuda Grass Herbaceous Vegetation - Canal Banks and Roadside -Common Reed – Giant Reed – Castor Bean Herbaceous Vegetation - Canal Banks	limited branch trimming (eastern one-third), possible removal of a few small trees -Wetlands have become established on canal banks, approximately 2 m wide on each bank
O-8	-Buffelgrass Herbaceous Vegetation - Levee Bank and Toe Slope -Honey Mesquite – Huisache / Buffelgrass Woodland – LRGVNWR La Coma -Bermuda Grass – Narrowleaf Cattail – Annual Sunflower Herbaceous Vegetation -Ditch in Middle Portion	-Ditch occurs near middle at edge of proposed limits of construction and could be disturbed; supports wetland vegetation to approximately 4 m wide -Wall installation would require tree removal and branch trimming at the eastern terminus
O-9	-Buffelgrass – Windmillgrass Herbaceous Vegetation – Levee Bank and Toe Slope to Boundary -Huisache – Honey Mesquite / Buffelgrass Woodland – LRGVNWR Llano Grande Banco -Common Reed – Narrowleaf Cattail Herbaceous Vegetation – Halfway, Ditch Adjacent to Ag Field -Giant Reed – Bermuda Grass Herbaceous Vegetation – Canal Banks on Eastern One-Fourth	-Ditch occurs near middle at edge of proposed limits of construction and could be disturbed; supports wetland vegetation to approximately 3 m wide -Ponds occur near middle and would require sheet piling and fill to support wall construction -Canal occurs on eastern one-fourth at toe of levee fill; banks support wetland vegetation to approximately 10 m wide -Wall installation would require tree removal and branch trimming in the eastern one-third
O-10	-Buffelgrass – Windmillgrass Herbaceous Vegetation – Levee Bank and Toe Slope to Boundary -Black Willow / Narrowleaf Cattail –	-Ditch occurs near middle at edge of limits of construction and could be disturbed; supports wetland vegetation to approximately 10 m

Table 5-2. LRGV Resources Summary for Sections O-4 through O-10, South of the Levee Road

Section	Plant Communities Observed – General Location	Comments and Notes
	Bulrush Wooded Herbaceous Vegetation – Wide Ditch -Granjeno – Honey Mesquite – Black Willow / Narrowleaf Cattail Woodland – Shallow Ponds of LRGVNWR Rosario Banco	wide -Ponds occur near east end at the edge of the wall construction footprint -Wall installation will require tree removal and branch trimming in the eastern one-third

Plant Community Descriptions

Ten provisional plant communities were observed during the reconnaissance survey and their photosignatures were identified and labeled on enlarged, true color aerial photography while in the field. This section provides a brief description of each community and one or more characteristic ground photographs. One very large cypress tree known as the whiskey tree occurs within Section O-10 and is located within the project corridor; it has several trunks from a base stump that is in excess of 5 feet in diameter (Figure 5-38).



Figure 5-38. Photograph of the whiskey tree.

Honey Mesquite Woodland (Figure 5-39): most common woodland cover occurs on levee toeslopes to floodplain terraces; typically is associated with other diagnostic woodland species as a dominant; dominates stands in all Sections O-4 through O-10; honey mesquite trees are typically 5-10 m tall and provide cover ranging from 15 to 50%. Associated canopy trees include huisache, granjeno, and retama. The succulent, Texas prickly pear is common along fencelines; the herbaceous layer is characterized by buffelgrass that provides moderate cover. One honey mesquite woodland stand near the east end of Section O-8 had burned with the fire contained in the herbaceous layer.



Figure 5-39. Characteristic photographs of honey mesquite woodland habitat.

Huisache Woodland (Figure 5-40): occurs on floodplain terraces; typically is associated with other diagnostic woodland species and is rarely dominant; dominates stand in Section O-9; huisache are typically 5–8 m tall and provide cover ranging from 5 to 25%. Associated canopy trees include honey mesquite and the succulent Texas prickly pear occurs in the understory. The herbaceous layer is characterized by buffelgrass that provides moderate cover.



Figure 5-40. Characteristic photograph of huisache woodland habitat.

Tepeguahe Woodland (Figure 5-41): occurs on floodplain terraces; typically is associated with other diagnostic woodland species and is rarely dominant; dominates stand in Section O-7; tepeguahe are typically 5–10 m tall and provide cover ranging from 5 to 15%. Associated canopy trees are honey mesquite and huisache and the herbaceous layer is characterized by buffelgrass that provides moderate cover.



Figure 5-41. Characteristic photograph of tepeguahe woodland habitat.

Granjeno Woodland (Figure 5-42): occurs on floodplain terraces and along fencelines; typically is associated with other diagnostic woodland species and is rarely dominant; dominates stand in Section O-10; granjeno are typically 5–8 m tall and provide cover ranging from 20 to 50%. Associated canopy trees are honey mesquite and huisache and the herbaceous layer is characterized by buffelgrass that provides moderate cover.



Figure 5-42. Characteristic photograph of granjeno woodland habitat.

Black Willow Woodland and Shrubland (Figure 5-43): occurs on canal, ditch, pond, lake, and river banks; typically is associated with other diagnostic wetland species as a dominant; dominates stands in Sections O-6 and O-10; black willow canopy trees or tall shrubs are typically 3–8 m tall and provide from 5 to 15% cover. Commonly associated wetland graminoids occurring in shallow water bodies are narrowleaf cattail and bulrush.



Figure 5-43. Characteristic photograph of black willow woodland and shrubland habitat.

Buffelgrass Semi-natural Herbaceous Vegetation (Figure 5-44): most common herbaceous cover occurs on levee shoulders and slopes, toeslopes, ROWs, and as understory in woodland communities; can form monotypes or is associated with other diagnostic species; dominates herbaceous stands in Sections O-4 through O-10; buffelgrass is typically less than 0.5 m tall and provides cover ranging from 5 to 40%. On the western end of Section O-4, buffelgrass is sparse in terms of cover (approximately 5%) and seepweed provides up to 10% cover on the levee slope. In Sections O-9 and O-10, windmillgrass provides low cover within the buffelgrass matrix or is codominant. Buffelgrass is considered a nonnative, invasive species under Texas weed laws.



Figure 5-44. Characteristic photographs of buffelgrass habitat.

Bermuda Grass Semi-natural Herbaceous Vegetation (Figure 5-45): occurs on canal and lake banks primarily; typically forms monotypes of carpetlike grass; dominates stands in Sections O-5, O-7, and O-8; Bermuda grass forms a low sod on canal banks and along some roadways and provides cover ranging from 20 to 60%. Associated species include the castor bean, annual sunflower, common reed, and narrowleaf cattail, which range in height from 1–2 m and provide low cover. Bermuda grass and castor beans are considered nonnative, invasive species under Texas weed laws.



Figure 5-45. Characteristic photograph of Bermuda grass habitat.

Giant Reed Semi-natural Herbaceous Vegetation (Figure 5-46): occurs on seeps and canal, ditch, pond, and lake margins; typically forms monotypes of up to 10 m tall; dominates stands in Sections O-6 and O-9; giant reed provides cover ranging from 50 to 90%. Giant reed stands often support Bermuda grass in the understory, at least along the stand margin. Giant reed is considered a noxious, nonnative, and invasive species under Texas weed laws.



Figure 5-46. Characteristic photograph of giant reed habitat.

Common Reed Herbaceous Vegetation (Figure 5-47): occurs on canal, ditch, pond, and lake margins; typically is associated with other diagnostic wetland species as a dominant; dominates stands in Sections O-7 and O-9; common reed is typically intermixed with other wetland species but can occur as small monotypic patches providing cover from 10 to 25%. Common reed was often codominant with narrowleaf cattail, bulrush, giant reed, and Bermuda grass and occasionally black willow.



Figure 5-47. Common reed habitat.

Narrowleaf Cattail Herbaceous Vegetation (Figure 5-48): occurs in shallow ponds, on pond and lake margins, and along ditches and canals; typically is associated with other diagnostic wetland species as a codominant; dominates

one stand in Section O-4; narrowleaf cattail is typically intermixed with or understory to other wetland species but can occur as small monotypic patches providing cover from 15 to 50%. Narrowleaf cattail was understory to black willow tall shrubs and codominated with common reed, Bermuda grass, and bulrush.



Figure 5-48. Narrowleaf cattail habitat.

Land Use Types

Several land use types were identified, photographed, and delineated for this portion of the project corridor (Figure 5-49). They can provide some habitat value for wildlife and include fallow agricultural fields; cropped agricultural fields (e.g., sugar cane, onions, carrots, cabbage); open water (e.g., ditches, canals, ponds, lakes); highways, roads, and trails; residential and urban development; and miscellaneous other land uses.



Figure 5-49. Characteristic land use types.

5.3 Plant Species Identified

A list of plant species prepared during the field surveys including wetlands indicator status and the tactical infrastructure section in which each species was identified is provided in **Table 5-3**. The number of taxa identified during late summer and fall surveys was 317 with four species occurring in all fence sections. The most diverse of the fence sections was O-1 where 189 plant species were recorded in upland, riparian, and wetlands habitats.

Table 5-3. List of Plant Species Identified During Section Surveys

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Abutilon abutiloides</i> / Berlandier Abutilon	---	X	X																				2
<i>Abutilon fruticosum</i> / Pelotazo	---						X	X			X		X	X		X	X						7
<i>Abutilon trisulcatum</i> / Amantillo	---	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X					15
<i>Acacia berlandieri</i> / Guajillo	---			X				X															2
<i>Acacia farnesiana</i> / Huisache	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
<i>Acacia rigidula</i> / Chaparro Prieto	---	X	X	X	X														X				5
<i>Acacia schaffneri</i> / Huisachillo, Twisted Acacia	---	X				X																	2
<i>Acacia wrightii</i> / Catclaw	---	X	X	X																			3
<i>Acalypha monostachya</i> / Round Copperleaf	---		X																				1
<i>Acleisanthes obtusa</i> / Berlandier Trumpets	---	X				X	X		X		X												5
<i>Adelia vaseyi</i> / Vasey Adelia	---			X																			1
<i>Agave americana</i> / Century Plant	---	X																					1
<i>Allionia incarnata</i> / Trailing Allionia	---	X																					1
<i>Allowissadula lozani</i> / Pseudoabutilon	---							X															1
<i>Aloysia gratissima</i> / Whitebrush	---	X	X																				2
<i>Aloysia macrostachya</i> / Sweet Stem	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Amaranthus</i> sp. / Amaranth	---				X	X	X	X	X	X	X			X									8
<i>Amaranthus palmeri</i> / Palmer Pigweed	FACU	X	X																				2
<i>Amaranthus retroflexus</i> / Rough Pigweed	FACU-		X																				1
<i>Ambrosia</i> sp. / Ragweed	---					X																	1
<i>Ambrosia psilostachya</i> / Western Ragweed	FACU-	X	X																				2
<i>Ampelopsis arborea</i> / Peppervine	FAC						X		X	X	X	X		X	X		X						8
<i>Ancistrocactus sheeri</i> / Fish-hook Cactus	---	X																					1
<i>Andropogon glomeratus</i> / Bushy Bluestem	FACW+																		X				1
<i>Anredera vesicaria</i> / Maderia Vine	---	X																					1
<i>Antigonon leptopus</i> / Queen's Wreath	---	X																					1
<i>Aristida adscencionis</i> / Sixweeks Threeawn	---	X																					1
<i>Aristida purpurea</i> / Purple Threeawn	---	X																					1
<i>Aristolochia pentandra</i> / Dutchman's Pipe	---	X																					1
<i>Arundo donax</i> / Giant Reed, Carrizo	FAC+		X	X		X	X		X	X	X		X	X	X			X	X		X	X	14
<i>Aster spinosus</i> (<i>Leucosyris spinosa</i> , <i>Chloracantha spinosa</i>) / Mexican Devil-weed, Spiny Aster	FACW-	X	X		X	X		X						X	X	X			X				9
<i>Aster subulatus</i> / Prairie Aster	OBL	X	X		X			X						X			X	X	X				8

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Atriplex matamorenensis</i> / Quelite Cenizo, Matamoros Saltbush	---				X																		1
<i>Baccharis neglecta</i> / Jara Dulce, Roosevelt Weed	FAC		X	X						X	X	X		X									6
<i>Baccharis salicifolia</i> / Jara, Mule's Fat	FACW			X			X		X	X	X	X		X			X	X	X				10
<i>Baccharis texana</i> / Baccharis	---																		X			X	2
<i>Baccharis</i> sp. / Seep Willow	---			X				X			X												3
<i>Bahia absinthifolia</i> / Hairy Seed Bahia	---	X																					1
<i>Bauhinia variegata</i> / Purple Orchid Tree	---											X											1
<i>Bastardia viscosa</i> / Mexican Bastardia	---	X	X		X						X			X								X	6
<i>Billieturnera helleri</i> / Copper Sida	---	X																					1
<i>Boerhavia</i> sp. / Boerhavia	---	X				X																	2
<i>Borrichia frutescens</i> / Sea Ox Eye	FACW+				X	X																X	3
<i>Bothriochloa ischamaium</i> / King Ranch Bluestem	---				X	X		X	X		X												5
<i>Bothriochloa laguroides</i> / Silver Bluestem	---					X																	1
<i>Buddleja sessiliflora</i> / Butterfly-bush, Tepozan	---		X																				1
<i>Caesalpinia mexicana</i> / Mexican Caesalpinia	---										X												1
<i>Calyptocarpus vialis</i> / Straggler Daisy	FAC	X				X						X										X	4

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs	
<i>Campsis radicans</i> / Trumpet Creeper	FAC																					X	1	
<i>Capsicum annuum</i> / Chilipiquin	---	X	X				X	X									X							5
<i>Cardiospermum dissectum</i> / Balloon Vine	---	X	X																					2
<i>Cassia</i> sp. / Cassia	---									X														1
<i>Castela erecta</i> (<i>Castela texana</i>) / Amargosa, Goatbush	---	X	X	X																				3
<i>Celosia nitida</i> / Albahaca	---	X																						1
<i>Celtis laevigata</i> / Palo blanco, Texas Sugarberry	FAC	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X				X	18
<i>Celtis pallida</i> / Granjeno, Spiny Hackberry	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	19
<i>Cenchrus ciliaris</i> / Buffelgrass	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
<i>Cenchrus spinifex</i> (<i>Cenchrus insertus</i>) / Common Sandbur	---		X																					1
<i>Cephalanthus salicifolius</i> / Mexican Buttonbush	---	X																						1
<i>Cercidium texanum</i> var. <i>macrum</i> (<i>Parkinsonia texana</i>) / Paloverde	---	X	X																					2
<i>Cestrum</i> sp. / Jessamine	---	X																						1
<i>Cevallia sinuata</i> / Stinging Stickleaf	---	X																						1
<i>Chamaesyce</i> sp. / Mat Spurge	---					X			X			X		X	X	X	X							7
<i>Chenopodium berlandieri</i> / Pitseed Goosefoot	---	X	X																					2

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs	
<i>Chloris cucullata</i> / Hooded Windmill grass	---	X	X																				2	
<i>Chloris</i> sp. / Windmill Grass	---													X	X		X				X			4
<i>Chromolaena odorata</i> / Crucita	---	X	X																					2
<i>Cirsium texanum</i> / Texas Thistle	---				X					X														2
<i>Cissus incisa</i> (<i>Cissus trifoliata</i>) / Hierba del Buey, Ivy Treebine, Possum Grape	FACU-	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X				X	17
<i>Citharexylum berlandieri</i> / Berlandier's Fiddlewood	---		X																		X			2
<i>Citharexylum brachyanthum</i> / Mission Fiddlewood	---	X																						1
<i>Clematis drummondii</i> / Barbas de Chivato, Old Man's Beard	---	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X				18
<i>Cocculus diversifolius</i> / Snail Vine, Correhuela	---	X			X	X	X		X	X	X			X						X			X	10
<i>Colubrina texensis</i> / Hog Plum	---	X																						1
<i>Commelina erecta</i> / Day Flower	---	X	X																				X	3
<i>Condalia hookeri</i> / Brasil, Bluewood Condalia	---	X	X	X	X	X	X	X	X		X						X			X			X	12
<i>Convolvulus equitans</i> / Texas Bindweed	---		X							X	X										X			4
<i>Conyza canadensis</i> / Horsetail, Horse Weed	UPL	X	X																					2
<i>Cordia boissieri</i> / Anacahuita, Mexican Olive	---	X	X	X	X							X								X				6

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Coryphantha macromeris</i> / Dumpling Cactus	---	X																					1
<i>Coryphantha robertii</i> / Runyon's Escobaria	---	X																					1
<i>Croton humilis</i> / Berlandier Croton	---	X																					1
<i>Croton incanus</i> / Vara Blanca	---	X																					1
<i>Croton leucophyllus</i> / Two-color Croton	---		X																				1
<i>Croton lindheimerianus</i> / Three-seed Croton	---	X																					1
<i>Croton</i> sp. / Croton	---	X		X	X				X														4
<i>Cucurbita foetidissima</i> / Coyote Melon	---				X																		1
<i>Cynanchum angustifolium</i> / Climbing Milkweed	OBL				X	X					X												3
<i>Cynanchum barbigerum</i> / Milkweed Vine	---	X	X								X												3
<i>Cynanchum</i> sp. / Milkweed Vine	---					X																	1
<i>Cynodon dactylon</i> / Pato de Gallo, Bermuda Grass	FACU+	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	19
<i>Cyperus odoratus</i> / Fragrant Flat Sedge	FACW	X																					1
<i>Cyperus tenuis</i> / Flat Sedge	FACW					X			X					X									3
<i>Dactyloctenium aegyptium</i> / Durban Crowfootgrass	---	X																					1
<i>Dalea pogonathera</i> / Bearded Dalea	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Datura inoxia</i> / Indian Apple	---	X																					1
<i>Desmanthus obtusus</i> / Bluntpod Bundleflower	---	X																					1
<i>Desmanthus virgatus</i> / Bundleflower	---							X		X													2
<i>Dichanthium annulatum</i> / Kleberg's Bluestem	---							X		X													2
<i>Dicanthium aristatum</i> / Angleton Bluestem	---	X																					1
<i>Digitaria cognata</i> / Fall Witchgrass	---	X																					1
<i>Diospyros texana</i> / Texas Persimmon	---	X										X											2
<i>Ditaxis humilis</i> / Low Wild Mercury	---	X																					1
<i>Dyssodia tenuiloba</i> / Tiny Tim Dogweed	---	X																					1
<i>Echinocactus texensis</i> / Manca Caballo, Horse Crippler	---			X																			1
<i>Echinocereus berlandieri</i> / Berlandier's Alicoche	---			X																			1
<i>Echinocereus enneacanthus</i> / Pitaya, Strawberry Cactus	---	X		X	X																		3
<i>Echinocereus reichenbachii</i> / Rainbow Cactus	---	X																					1
<i>Echinochloa colona</i> / Junglerice	---	X																					1
<i>Echinochloa crusgalli</i> / Barnyardgrass	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Echinochloa crus-pavonis</i> / Gulf Cockspur	---	X																					1
<i>Echinodorus berteroi</i> / Erect Burhead	OBL	X																					1
<i>Ehretia anacua</i> / Anacua	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	20
<i>Ephedra antisyphilitica</i> / Clapweed	---	X																					1
<i>Eragrostis barrelieri</i> / Mediterranean Lovegrass	---	X	X									X		X	X	X	X						7
<i>Eriochloa punctata</i> / Louisiana Cupgrass	---	X																					1
<i>Erioneuron pilosum</i> / Hairy tridens	---	X																					1
<i>Erythrina herbacea</i> / Coral Bean	---																X		X				2
<i>Eupatorium odoratum</i> (<i>Chromolaena odorata</i>) / Crucita, Christmas Bush	---			X			X	X	X		X	X		X			X		X				9
<i>Euphorbia albomarginata</i> / Whitemargin Euphorbia	---	X																					1
<i>Euphorbia glyptosperma</i> / Ridge-seed Euphorbia	---	X																					1
<i>Euphorbia laredana</i> / Laredo Euphorbia	---	X																					1
<i>Euphorbia serpens</i> / Hierba de la Golondrina	---		X																				1
<i>Evolvulus alsinoides</i> / Ojo de Vibora	---	X																					1
<i>Eysenhardtia texana</i> / Vara Dulce, Texas Kidneywood	---	X		X																			2

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Ferocactus hamatacanthus</i> / Rio Grande Valley Barrel Cactus	---	X																					1
<i>Florestina tripteris</i> / Sticky Palafoxia	---	X	X											X					X				4
<i>Forestiera angustifolia</i> / Elbow Bush	---	X	X																				2
<i>Fraxinus berlandieriana</i> / Mexican Ash	FAC	X	X	X	X					X		X	X						X				8
<i>Gaura brachycarpa</i> / Lizard Tail	---						X				X												3
<i>Gaura drummondii</i> / Sweet Gaura	---				X		X	X		X	X												5
<i>Gaura parviflora</i> / Lizard Tail	NI																		X				1
<i>Gaura</i> sp. / Gaura	---														X								1
<i>Glandularia bipinnatifida</i> / Dakota Vervain	---								X														1
<i>Guajacum angustifolium</i> / Guayacan, Soap-bush, Ironwood	---	X	X	X	X			X															5
<i>Gutierrezia texana</i> var. <i>glutinosa</i> / Broomweed	---	X	X																				2
<i>Havardia pallens</i> / Tenaza	---																				X	X	2
<i>Heimia salicifolius</i> / Hachinal	FACW+	X	X																				2
<i>Helenium microcephalum</i> / Smallhead Sneezeweed	---	X																					1
<i>Helianthus annuus</i> / Annual Sunflower	FAC	X	X		X		X	X	X	X	X			X	X		X	X	X		X		14

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Heliotropium angiospermum</i> / Heliotrope	UPL	X	X						X		X				X		X	X	X			X	9
<i>Heliotropium confertifolium</i> / Crowded Heliotrope	---	X																					1
<i>Heliotropium currassavicum</i> / Seaside Heliotrope	FACW				X	X				X													3
<i>Herissantia crista</i> / Netveined Herissantia	---	X																					1
<i>Heterotheca subaxillaris</i> / Camphor Weed	---	X	X																				2
<i>Hibiscus maritanus</i> / Tulipan del Monte	---	X																					1
<i>Ibervillea lindheimeri</i> / Globe Berry	---			X							X												2
<i>Ipomoea amnicola</i> / Morning Glory	FACW-	X	X										X										3
<i>Ipomoea carnea</i> / Tree Morning Glory	---																			X	X		2
<i>Ipomoea rupicola</i> / Cliff Morning Glory	---		X																				1
<i>Ipomoea sinuata</i> (<i>Merremia dissecta</i>) / Alamo Vine	---				X	X	X	X	X	X	X	X		X	X	X	X	X	X		X		15
<i>Ipomoea trichocarpa</i> / Sharppod Morning Glory	FAC														X								1
<i>Ipomoea</i> sp. / Morning Glory	---										X												1
<i>Isocoma coronopifolia</i> / Common Goldenweed	---	X																					1
<i>Jatropha dioica</i> / Leather Stem	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Jefea brevifolia</i> / Shorthorn Zexmenia	---	X																					1
<i>Justicia pilosella</i> / Hairy Tubetongue	---	X																					1
<i>Kallstroemia californica</i> / Texas Tack	---	X																					1
<i>Karwinskia humboldtiana</i> / Coyotillo	---	X	X	X				X	X														5
<i>Koeberlinia spinosa</i> / Junco, Allthorn	---	X		X																			2
<i>Krameria ramosissima</i> / Calderona	---	X																					1
<i>Lantana achyranthifolia</i> / Desert Lantana	---		X																				1
<i>Lantana camara</i> / West Indian Lantana, Afrombrilla	FACU										X		X	X		X	X						5
<i>Lantana urticoides</i> / Texas Lantana	---	X	X															X	X				4
<i>Lemna minuata</i> / Small Duckweed	OBL				X																		1
<i>Lemna</i> sp. / Duckweed	OBL									X													1
<i>Lepidium austrinum</i> / Peppergrass	---								X	X													2
<i>Lesquerella thamnophila</i> / Zapata Bladderpod	---	X																					1
<i>Leucaena leucocephala</i> / Poponac	FACU	X																					1
<i>Leucaena pulverulenta</i> / Tepeguaje, Lead Tree	---		X	X	X	X	X	X		X		X	X		X	X	X					X	14
<i>Leucaena</i> sp. / Lead Tree	---					X																	1
<i>Leucophyllum frutescens</i> / Cenizo, Purple Sage	---	X	X	X			X																4

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Leucosyris spinosa</i> / Spiny Aster	FACW-		X																		X		2
<i>Lippia alba</i> / Brushy Lippia	FAC*						X	X	X		X								X				5
<i>Lippia graveolens</i> / Mexican Oregano	---	X																					1
<i>Lycium berlandieri</i> / Berlandier Wolfberry	---	X	X																				2
<i>Malvastrum americanum</i> / Malva Loca	---							X															1
<i>Malvastrum coromandelianum</i> / Three-lobed False Mallow	---	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X					16
<i>Malvaviscus arboreus</i> var. <i>drummondii</i> / Turk's Cap	---							X				X		X								X	4
<i>Mammillaria heyderi</i> / Bizniga de Chilitos, Nipple Cactus, Little Chilis	---	X		X	X																		3
<i>Manfreda sileri</i> / Manfreda	---			X																			1
<i>Marsilea macropoda</i> / Water-clover	OBL																	X					1
<i>Maurandya antirrhiniflora</i> / Snapdragon Vine	---		X																				1
<i>Melampodium cinereum</i> / Blackfoot Daisy	---	X																					1
<i>Melia azedarach</i> / Paraiso, Chinaberry-tree	---	X					X		X	X	X	X	X	X	X		X	X	X	X			13
<i>Melilotus alba</i> / White Sweet Clover	FACU					X																	1
<i>Melochia pyramidata</i> / Pyramid Flower	FAC-	X	X					X	X								X		X				6

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs	
<i>Mentzelia lindheimeri</i> / Lindheimer Mentzelia	---	X																					1	
<i>Mikania scandens</i> / Climbing Hempweed	FACW+								X		X												2	
<i>Mimosa malacophylla</i> / Raspilla	---	X																					1	
<i>Mimosa pigra</i> var. <i>berlandieri</i> / Zarza	FAC										X				X								2	
<i>Mimosa stringillosa</i> / Powderpuff	---				X	X	X	X	X	X						X	X						X	9
<i>Mimosa texana</i> / Wherry Mimosa	---	X																					X	2
<i>Mimosa</i> sp. / Mimosa	---									X	X													2
<i>Mirabilis jalapa</i> / Four- o'clock	---	X	X																					2
<i>Monarda citridora</i> / Lemon Beebalm	---								X															1
<i>Morus alba</i> / Mulberry	FACU*	X	X									X										X		4
<i>Nerium oleander</i> / Oleander	---											X												1
<i>Nicotiana glauca</i> / Tree Tobacco	FAC	X	X	X																				3
<i>Nyctaginia capitata</i> / Nyctaginia	---	X																						1
<i>Oenothera speciosa</i> / Evening Primrose	---					X			X	X														3
<i>Opuntia engelmannii</i> / Nopal, Texas Prickly Pear	---	X	X	X	X	X	X	X	X	X	X	X		X		X	X						X	16
<i>Opuntia leptocaulis</i> / Tasajillo, Christmas Cactus	---	X	X	X	X																			4
<i>Opuntia schottii</i> / Clavellina, Dog Cholla	---	X		X	X																			3

Scientific Name / Common Name	Wetland Indicator Status	O-0	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Oxalis dichondrifolia</i> / Agrito	---	X																					1
<i>Oxalis drummondii</i> / Wood Sorrel	---														X	X							2
<i>Palafoxia texana</i> var. <i>texana</i> / Texas Palafoxia	---	X	X																				2
<i>Palafoxia texana</i> var. <i>ambigua</i> / Palafoxia	---		X			X								X				X					4
<i>Panicum maximum</i> (<i>Urochloa maxima</i>) / Guinea Grass	FAC-	X	X											X		X	X	X	X	X		X	9
<i>Panicum virgatum</i> / Switchgrass	FACW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
<i>Pappophorum vaginatum</i> / Whiplash Pappusgrass	---	X																					1
<i>Parkinsonia aculeata</i> / Retama	FACW-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
<i>Parkinsonia texana</i> (<i>Cercidium texanum</i>) / Paloverde, Texas Paloverde	---			X	X														X				3
<i>Parthenium confertum</i> / False Ragweed	---	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	18
<i>Parthenium hysterophorus</i> / False Ragweed	---					X																	1
<i>Parthenium incanum</i> / Mariola	---	X																					1
<i>Passiflora foetida</i> / Passion Flower	NI	X	X																				2
<i>Passiflora tenuiloba</i> / Spread-lobe Passion Flower	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Pennisetum ciliare</i> (<i>Cenchrus ciliaris</i>) / Buffelgrass	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
<i>Phaulothamnus</i> <i>spinescens</i> / Snake Eyes	---	X	X	X		X																	4
<i>Phoenix</i> sp. / Date Palm	---									X													1
<i>Phoradendron</i> <i>tomentosum</i> / Mistletoe	---	X	X	X				X															4
<i>Phragmites australis</i> / Common Reed	FACW	X				X				X	X								X				5
<i>Phyla nodiflora</i> / Frog Fruit	FACW				X											X							2
<i>Phyla strigulosa</i> / Frog Fruit	---							X															1
<i>Phyllanthus</i> <i>polygonoides</i> / Knotweed	---	X																					1
<i>Physalis cinerascens</i> / Ground Cherry	---	X	X							X	X		X	X	X			X	X			X	10
<i>Physalis</i> sp. / Ground Cherry	---					X																	1
<i>Pithecellobium ebano</i> (<i>Chloroleucon ebano</i> , <i>Ebanopsis ebano</i>) / Ebano, Texas Ebony	---	X	X	X	X	X	X	X	X	X			X		X		X	X	X		X	X	16
<i>Pithecellobium pallens</i> / Tenaza	---		X																				1
<i>Plumbago scandens</i> / Leadwort	---					X	X																2
<i>Polanisia dodecandra</i> ssp. <i>riograndensis</i> / Clammyweed	FACU	X	X																				2
<i>Polygala glandulosa</i> / Glandular Milkwort	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs	
<i>Polygonum pennsylvanicum</i> / Smartweed	FACW-								X					X	X									3
<i>Polygonum punctatum</i> / Water Smartweed	OBL	X																						1
<i>Populus deltoides</i> / Eastern Cottonwood	FAC													X										1
<i>Portulaca pilosa</i> / Chisme	---	X																						1
<i>Portulaca oleracea</i> / Common Purslane	---					X																		1
<i>Privet ligustrum</i> / Ligustrum	---											X												1
<i>Prosopis glandulosa</i> / Mesquite, Honey Mesquite	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
<i>Prosopis reptans</i> / Tornillo, Screw-bean Mesquite	FAC+	X			X	X	X	X																5
<i>Ratibida columnaris</i> / Mexican Hat	---					X		X		X												X		4
<i>Rhynchosia minima</i> / Least Snoutbean	---								X	X	X	X						X	X	X			X	8
<i>Ricinus communis</i> / Castor Bean	FACU	X	X	X			X	X	X	X	X	X		X	X	X	X	X			X	X		16
<i>Rivina humilis</i> / Coralito, Pigeonberry	---	X				X			X															3
<i>Rubus trivialis</i> / Dewberry	FAC										X	X						X	X			X		5
<i>Ruellia runyonii</i> / Wild Petunia	---														X									1
<i>Ruellia</i> spp. / Ruellia	---	X			X																			2
<i>Sabal</i> sp. / Palmetto	---										X													1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Sabal mexicana</i> / Mexican Palmetto, Sabal Palm	---							X			X						X		X	X		X	6
<i>Sagittaria platyphylla</i> / Delta Arrowhead	OBL	X																					1
<i>Salix nigra</i> / Sauz, Black Willow	FACW+	X		X			X		X	X	X			X	X			X	X			X	11
<i>Salsola australis</i> / Russian-thistle	FACU	X	X		X		X	X	X	X	X												8
<i>Salvia coccinea</i> / Tropical Sage	---	X																	X				2
<i>Samolus ebracteatus</i> / Beach Pimpernel	---					X																	1
<i>Samolus parviflorus</i> / Water Pimpernel	OBL	X																					1
<i>Sanvitalia ocyroides</i> / Sanvitalia	---														X		X						2
<i>Sarcostemma cynanchoides</i> / Climbing Milkweed	---	X	X																X				3
<i>Schaefferia cuneifolia</i> / Desert Yaupon	---	X																					1
<i>Schinus terebinthifolius</i> / Brazilian Pepper	---									X											X		2
<i>Scirpus validus</i> / Softstem Bulrush	OBL				X																		1
<i>Senna bahinioides</i> / Two-leaved Senna	---	X																					1
<i>Senna</i> sp. / Senna	---										X												1
<i>Serjania brachycarpa</i> / Serjania	---	X		X			X			X	X			X			X		X			X	9
<i>Sesuvium sessile</i> / Cenicilla	---				X																		1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Setaria ramiseta</i> / Bristlegrass	---		X																				1
<i>Setaria scheelei</i> / Southwest Bristlegrass	---		X																				1
<i>Setaria texana</i> / Texas Bristlegrass	---		X																				1
<i>Sibara runcinata</i> / Sibara	---	X																					1
<i>Sida abutilifolia</i> / Spreading Sida	---		X									X											2
<i>Sida spinosa</i> / Prickly Sida	UPL				X	X	X	X	X	X	X	X	X	X	X		X						12
<i>Sideroxylon celastrinum</i> / Coma	---	X		X	X		X		X													X	6
<i>Smilax bona-nox</i> / Common Greenbriar	FAC								X													X	2
<i>Solanum elaeagnifolium</i> / Trompillo, Silverleaf Nightshade	---	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	18
<i>Solanum ptycanthum</i> / West Indian Nightshade	---					X																	1
<i>Solanum rostratum</i> / Mala Mujer	---	X																					1
<i>Solanum triquetrum</i> / Texas Nightshade	---								X		X					X							3
<i>Solidago canadensis</i> / Tall Goldenrod	FACU+																				X		1
<i>Sonchus oleraceus</i> / Annual Sow Thistle	UPL*					X			X														2
<i>Sorghum halepense</i> / Johnsongrass	FACU			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	18
<i>Sporobolus airoides</i> / Alkali Sacaton	FAC				X																		1
<i>Sporobolus pyramidatus</i> / Whorled Dropseed	FAC	X			X	X																	3

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Sporobolus wrightii</i> / Big Alkali Sacaton	---	X																					1
<i>Sporobolus</i> sp. / Dropseed	---				X																		1
<i>Suaeda tampicensis</i> / Sea Blite, Coastal Seepweed	---				X					X													2
<i>Suaeda</i> sp. / Suaeda	FACW				X			X															2
<i>Talinum angustissimum</i> / Flame Flower	---	X																					1
<i>Tamarix aphylla</i> / Athel Tamarisk, Saltcedar	FACW		X		X					X													3
<i>Taxodium mucronatum</i> / Montezuma Bald Cypress	OBL										X	X											2
<i>Teucrium cubense</i> / Small Coast Germander	FAC+	X	X				X			X	X												5
<i>Tetradlea coulteri</i> / Stink Weed	---	X																					1
<i>Thamnosma texana</i> / Dutchman's Breeches, Ruda de Monte	---	X																					1
<i>Theolocactus bicolor</i> / Glory of Texas	---	X			X																		2
<i>Theolocactus setispinus</i> / Fishhook Cactus	---	X			X																		2
<i>Thymophylla</i> sp.(<i>Dyssodia</i> sp.) / Dogweed	---					X																	1
<i>Tidestromia lanuginosa</i> / <i>Espanta Vaqueros</i>	---	X	X																				2
<i>Tiquilia canescens</i> / Oreja de Perro	---	X																					1

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs	
<i>Tribulus terrestris</i> / Goathead	---		X																				1	
<i>Trichloris pluriflora</i> / False Rhodegrass	---		X																				1	
<i>Tridens muticus</i> / Slim Tridens	---	X																					1	
<i>Turnera diffusa</i> / Damiana	---	X																					1	
<i>Typha domingensis</i> / Tule, Narrow-leaf Cattail	OBL				X				X		X			X					X			X	6	
<i>Ulmus crassifolia</i> / Cedar Elm	FAC	X																					1	
<i>Verbena canescens</i> / Vervain	---	X																					1	
<i>Verbena halei</i> / Slender Verbain	---	X	X		X	X			X	X													6	
<i>Verbesina encelioides</i> / Cowpen Daisy	FAC		X							X	X						X	X					5	
<i>Verbesina microptera</i> / Capitana, Frostweed	---														X						X	X	3	
<i>Vigna luteola</i> / Wild Cowpea	FACW-	X																					1	
<i>Viguiera stenoloba</i> var. <i>chihuahuensis</i> / Skeleton-leaf Goldeneye	---		X	X																			2	
<i>Vitis mustangus</i> / Mustang Grape	---																					X	1	
<i>Waltheria indica</i> / Hierba del Soldado	---		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	18
<i>Washingtonia robusta</i> / Washingtonia Palm	---									X													1	
<i>Wilcoxia poselgeri</i> / Rat- tail Cactus	---	X																					1	

Scientific Name / Common Name	Wetland Indicator Status	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20	O-21	Total Number of Fence Sections in Which Species Occurs
<i>Yucca treculeana</i> / Palma Pita, Spanish Dagger	---	X													X								2
<i>Zanthoxylum clavaherculis</i> / Pepperbark	---										X												1
<i>Zanthoxylum fagara</i> / Colima	---	X	X				X	X	X	X	X	X	X						X			X	11
<i>Ziziphus obtusifolia</i> / Clepe, Lotebush	---	X	X	X	X	X	X	X	X		X											X	10
Total # of FACW- to OBL species per section		14	8	4	12	7	3	5	7	8	9	4	3	9	5	4	4	6	9	2	3	4	
Total # of taxa per fence section		189	101	55	68	60	50	53	59	60	67	44	27	52	46	28	46	38	52	18	18	47	

5.4 Fence Section Characteristics and Description of Habitat Quality

To ensure the most recent data were acquired for rare species analyses, e²M requested Element Occurrence Data from NatureServe Central Databases in Arlington, Virginia, through a referral from the USFWS (NatureServe 2007a). Additionally, rare species data were acquired from TPWD at the project inception. General descriptions of the habitat quality as it relates to rare plant species and the landscape characteristics of each section were provided by the USFWS approved botanists based on field observations and are provided below.

SECTION O-1

County: Starr

Potential Listed

Plant Occurrence: *Thymophylla tephroleuca* (Ashy dogweed) (federally endangered [FE], state endangered [SE])
Frankenia johnstonii (Johnston's frankenia) (FE, SE)
Astrophytum asterias (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Lesquerella thamnophila (Zapata bladderpod) (FE, SE)

Listed Plants Observed: None

Suitable Listed Plant Habitat Present: Possible for Johnston's frankenia, star cactus, and Zapata bladder pod.

If So, Habitat Quality: High for Zapata bladderpod; low for star cactus, low to medium for Johnston's frankenia.

Section Habitat Description: This section includes approximately 3.75 miles in the area of the Roma Port of Entry. The western portion of Section O-1 traverses a short distance of gravel-covered ridges and hill slopes that support cenizo – blackbrush shrubland, a species rich, predominantly shrub and succulent community. Several arroyos or deep drainages that are intermittently flooded occur within the Section O-1. Construction will not occur within deep arroyos therefore they were not rigorously sampled for classification but they were inspected closely for rare plant occurrence and potential habitat. Arroyos supported a mixture of tree and shrub species that consisted of honey locust, huisache, and granjeno in the tree canopy and subcanopy layers. The tall and short shrub layers are typified by blackbrush or chaparro, Texas prickly pear, brasil, tasajillo, cenizo, lotebush, and junco. Section O-1 lies within the Upper Valley Flood Forest and Ramaderos biotic communities and adjacent to the Barretal.

Ashy dogweed was sought in Section O-1, but was not observed. Ashy dogweed occurs in shallow to deep sand with a dominance of native grasses. The soils of the floodplain sections of Section O-1 are mostly silty clay loams.

Johnston's frankenia occurs in saline gypsum soils and in Starr County it is often associated with outcrops of fossil oyster shells. Fossil oyster shells outcropped adjacent to the sandstone bluffs and also in the eroded arroyos of Section O-1 in and near Roma. Johnston's frankenia was sought in the project corridor but was not observed.

Star cactus occurs in Starr County on gravel-covered saline soils in association with saladillo (*Varilla texana*; Asteraceae), *Billieturnera helleri* (Malvaceae), and with 12 or more species of cacti. In Section O-1, star cactus was sought on gravel-covered ridges. *Billieturnera helleri*, an indicator of saline soils was associated with a number of species of cacti at this site, but absent was saladillo. Star cactus was not observed in the project corridor.

Zapata bladderpod occupies sandy sites eroded from exposed geologic formations. Within Section O-1, slopes and ridges with exposed bedrock were evaluated. Zapata bladderpod was not observed in or near the sandstone outcrops, or anywhere within the survey corridor of Section O-1.

Walker's manioc occurs in Starr County in association with caliche in blackbrush - cenizo shrublands and barretal (*Helietta parvifolia*) associations. Caliche outcrops were not observed in the Section O-1 corridor.

SECTION O-2

County: Starr

Potential Listed

Plant Occurrence: *Thymophylla tephroleuca* (Ashy dogweed) (FE, SE)
Frankenia johnstonii (Johnston's frankenia) (FE, SE)
Astrophytum asterias (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Lesquerella thamnophila (Zapata bladderpod) (FE, SE)

Listed Plants Observed: None

Suitable Listed Plant Habitat Present: No

If So, Habitat Quality: NA

Section Habitat Description: This section includes approximately 8.74 miles near the Rio Grande City, Texas Port of Entry. Several arroyos or deep drainages that are intermittently flooded occur within Section O-2. Construction will not occur within deep arroyos; therefore, they were not rigorously sampled from a classification standpoint, but were examined for rare plant species and habitat. On inspection, they support a mixture of tree and shrub species that consists of honey locust, huisache, and granjeno in the tree canopy and subcanopy layers. The tall and short shrub layers are typified by blackbrush or chaparro, Texas prickly pear, brasil, tasajillo, cenizo, lotebush, and junco. Section O-2 lies within the Upper Valley Flood Forest biotic community and adjacent to the Barretal.

Ashy dogweed occurs in shallow to deep sand with a dominance of native grasses. A sandy area supports woodlands characterized by honey mesquite – Texas prickly pear cactus occurs in this section, probably a secondary succession woodland that has become established on abandoned crop and pastureland. Therefore, it is not suitable ash dogweed habitat. Ashy dogweed was not observed in the project corridor; no rare species were observed in this section, and the habitats known for other rare plant species did not occur.

SECTION O-3

County: Hidalgo
Potential Listed
Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Listed Plants Observed: None
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: This section includes approximately one mile and crosses two tracts of the LRGVNR Los Ebanos Unit, an U.S. International Boundary and Water Commission (USIBWC) easement, residential sites surrounded by mesquite-buffelgrass pastures, and a very small (< 1 acre) brush tract owned by the Mennonite Brothers Church. Both refuge tracts were former agricultural fields that have been revegetated with native trees and shrubs between 2002 and 2003. The revegetation efforts were of limited success and the tracts are characterized by colonizing species including Roosevelt weed, seep willow, lead tree, and honey mesquite, with a dense herbaceous layer dominated by switchgrass and buffelgrass. The USIBWC easement was also previously disturbed and supported a similar plant species composition. The Mennonite Brothers Church tract was heavily browsed and grazed by goats, resulting in dense stands of tasajillo. An interesting assemblage of shrubs occurred including goat-bush, blackbrush, bluewood condalia, coyotillo, allthorn, guayacan, lotebush, seven species of cacti, and manfreda. This brush tract was considered relatively low quality and no rare or listed plant species were observed. Section O-3 occurs within the Upper Valley Flood Forest and Upland Thornscrub biotic communities.

SECTION O-4

County: Hidalgo
Potential Listed
Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No (in both survey corridors north and south of the levee)

If So, Habitat Quality: NA

Section Habitat Description: This section includes approximately 4.35 miles and on the north side of the levee crosses a very small (~1-acre) portion of the TPWD Peñitas tracts, many agricultural fields (some plowed and fallow, some planted to corn and sugarcane), other disturbed tracts in various stages of re-growth, and residential sites. The TPWD tract supported fenceline woodland consisting mostly of honey mesquite and several species of cacti (fishhook, dog cholla, nipple cactus, tasajillo, and prickly pear) that had colonized soil at the base of the tree line. Just beyond the fenceline into the TPWD property was a cleared pipeline ROW. Remaining areas of the section consisted of agricultural fields or disturbed sites that were not considered representative of rare plant habitat. Section O-4 occurs within the Upper Valley Flood Forest, Upland Thornscrub, and Mid-Valley Riparian Woodland biotic communities.

On the southern side of the levee, the westernmost property is managed by TPWD. This area has been scraped and disturbed. The soils are somewhat saline, and there is approximately 30 to 40% bare ground. Scattered woody plants are honey mesquite, clepe, retama, and a few small salt cedar seedlings. Herbaceous species included suaeda, buffelgrass, seaside heliotrope, and sea ox-eye daisy. Also noted were Texas prickly pear, tasajillo, nipple cactus, fishhook cactus, and pitaya. The property is significantly different from most of the adjacent levy tracts given the abundant cacti occurrences. There was no appropriate endangered plant habitat.

Towards the LRGVNR Peñitas tract, the same species assemblage occurs, becomes more dense (less disturbed), and the woody species created a dense stand along the fence line. Common species include honey mesquite, clepe, bluewood condalia, guayacan, spiny hackberry, and blackbrush. There was little to no herbaceous cover, except for the occasional buffelgrass clump from the toe of the levy to the fence line. There was no endangered plant habitat.

In the vicinity of the Hidalgo Pump House the area was scraped of vegetation cover and lay adjacent to active agricultural fields (including sugar cane). From the toe of the levy to the agricultural fields, the area is frequently mowed and maintained. Honey mesquite stump sprouts are prevalent within the buffelgrass and Bermuda grass dominated area. There is a small mesic zone with huisache, retama, cattails, and bulrush in this section. Other species recorded were suaeda, silverleaf nightshade, seaside heliotrope, King Ranch bluestem, and Johnson grass.

At the Texas Nature Conservancy Chihuahua Woods Preserve (no access), there is dense honey mesquite tree growth along the fence line along with clepe, Texas prickly pear, huisache, spiny hackberry, and snail vine. Adjacent to the fenceline is a large pond with large narrowleaf cattail stands. The levee toe to the fenceline is mowed (or bladed) and supports buffelgrass, Bermuda grass, and suaeda. There are large brush piles adjacent to the fenceline towards the

eastern end of this section. Other species observed in the area were seaside heliotrope, sea ox-eye daisy, retama, salt cedar, and ivy treebine. There was no endangered plant habitat.

Near and within the LRGVNR Abrams West tract, there are three large ponds surrounded by Bermuda grass, large stands of narrowleaf cattail with some duckweed, and a dense honey mesquite woodland. There are goats grazing throughout this area and species diversity is low. Additional species include retama, huisache, frog fruit, and climbing milkweed vine. There was no endangered plant habitat within this area.

The eastern portion of Section O-4 consists of a mowed/scraped levy toe area with honey mesquite stump sprouts, buffelgrass, Bermuda grass, suaeda, and powderpuff. The fence line woody species included honey mesquite, retama, and huisache, which were dominant, and the occasional spiny hackberry. There was no endangered plant habitat within this section.

SECTION O-5

County: Hidalgo

Potential Listed

Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: Possible (only within the LRGVNR Granjeno tract north of the levee); no (south of the levee)

If So, Habitat Quality: Low (within the Granjeno tract north of the levee)

Section Habitat Description: On the north side of the levee, this section includes approximately 1.76 miles and crosses the edge of the LRGVNR Granjeno tract. The woodland species included honey mesquite, spiny hackberry, granjeno, sugarberry, anaqua, huisache, and lead tree, with Bermuda grass and switchgrass as the dominant herbaceous cover. The remainder of Section O-5 consisted of residential areas, some agricultural fields, and some small disturbed tracts. There was no potential rare plant habitat identified outside of the Granjeno tract. This section is located primarily within the Mid-Valley Riparian Woodland biotic community.

On the southern side of the levee, Section O-5 is called the Floodway and is characterized by a large flat area bounded by a levee on both sides. The levee sides are steep and portions are armored with large blocks of stone or concrete and vines. This area is frequently mowed and there are many honey mesquite stump sprouts. Other species recorded within the Flood Way were sweet gaura, silverleaf nightshade, Alamo vine, climbing milkvine, slender vervain, buffelgrass, old man's beard, ivy treebine, powderpuff, evening primrose, Bermuda grass, seaside heliotrope, sea ox-eye daisy, false ragweed, beach pimpernel, white

sweet clover, and King Ranch bluestem. There was also a small mesic area with a small occurrence of common reed and giant reed. There is no endangered plant habitat within this section.

SECTION O-6

County: Hidalgo

Potential Listed

Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: No (north and south of the levee)

If So, Habitat Quality: NA

Section Habitat Description: Section O-6 includes approximately 3.85 miles. Within this section north of the levee is a predominantly urban environment that includes urban, industrial, and residential land use within the project corridor. Small acreages of fallow agricultural fields and highly disturbed parcels also occurred. There was no potential rare plant habitat identified. This section is located primarily within the Mid-Valley Riparian Woodland biotic community.

South of the levee, this segment consists primarily of LRGVNWR tracts (Pate Bend and Hidalgo Bend). Along the Pate Bend tract, the levee slope and toe area is mowed and supports buffelgrass, silverleaf nightshade, sweet gaura, and powderpuff. The fence line supports the woody species honey mesquite, clepe, bluewood condalia, huisache, ebony, lime prickly ash, retama, sugarberry, anacua, and spiny hackberry. The understory includes switchgrass and dried amantillo stalks. To the south, the woodland-like expanse opens to a savannah with the same basic species assemblage (with the addition of mule's fat shrubs). There are plow lines visible in this area and the area is notably trashy. At the edge of the Pate Bend tract there is a small mesic ditch supporting giant reed, honey mesquite, sugarberry, huisache, Chinaberry, anacua, castor bean, Johnsongrass, ivy treebine, and some bushy lippia. There is no endangered plant habitat within this area.

Near the eastern edge of the City of Hidalgo the LRGVNWR Hidalgo Bend tract begins and the levee is very close to the property boundary. Trees and tall shrubs within this woodland included honey mesquite, huisache, ebony, anacua, tepeguaje, sugarberry, retama, Chinaberry, and spiny hackberry. There is little to no understory, and abundant bare ground. Additional species observed were switchgrass, buffelgrass, old man's beard, dried amantillo stalks, ivy treebine, peppervine, sweet gaura, and some black willow and giant reed patches near the canals. There was no endangered plant habitat within this section.

SECTION O-7

County: Hidalgo
Potential Listed
Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No (north and south of the levee)
If So, Habitat Quality: NA

Section Habitat Description: This section includes approximately 0.9 miles and north of the levee is entirely adjacent to agricultural land. The fields include plowed, fallow, and crops, e.g., sugarcane and sunflowers. There is no potential rare plant habitat within this section. This section occurs within the Mid-Valley Riparian Woodland biotic community and is adjacent to the Mid-Delta Thorn Forest.

South of the levee, Section 7 abuts the LRGVNR Monterrey Banco tract. The levee slope and toe area is frequently mowed and maintained. This area was characterized by buffelgrass, King Ranch bluestem, switchgrass, sweet gaura, silverleaf nightshade, powderpuff, annual sunflower, Mexican hat, bushy lippia, and clumps of old man's beard. Along the common boundary the adjacent woodland is characterized by honey mesquite, huisache, retama, anacua, spiny hackberry, and scattered Texas prickly pear. There were some palmettos and Turk's cap that appeared to be planted within the tract as was one guajillo. There was no endangered plant habitat within this section or tract.

SECTION O-8

County: Hidalgo
Potential Listed
Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No (north and south of the levee)
If So, Habitat Quality: NA

Section Habitat Description: This section is approximately 3.5 miles long and north of the levee includes agricultural fields (plowed, fallow, sugarcane, sunflowers), primarily. There is one disturbed brushy regrowth area, a small portion of the TPWD Las Palomas wildlife management area (WMA) tract, and a small portion of the LRGVNR La Coma tract traversed by this alignment. The Las Palomas tract boundary supports dense trees and shrubs including retama, honey mesquite, spiny hackberry or granjeno, lime pricklyash, bluewood condalia, sugarberry, hackberry, anaqua, Texas ebony, and Chinaberry. The understory is predominantly leaf litter and woody debris, very dark (shaded), and has bare ground patches supporting sparse cover of pigeonberries. Where the

sun can penetrate the canopy layer, switchgrass composes the herbaceous layer. Rare plant surveys were conducted within the Las Palomas tract with no success. The La Coma tract was disturbed historically by agricultural land use and has little to no rare plant potential. The understory is a dense, tall stand of buffelgrass and switchgrass with scattered shrubs of honey mesquite, huisache, retama, spiny hackberry or granjeno, coma, coyotillo, anaqua, lotebush, and Texas prickly pear. Targeted rare plant species were sought within the La Coma tract, but none were observed. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

To the south of the levee, the western half of Section O-8 parallels open or fallow agricultural fields and some active fields planted to sugar cane and onions. Commonly the levee slope and the toe area are scraped clean and devoid of vegetation. Occasionally the exposed soil supports sparse to low cover of annual sunflower, false ragweed, evening primrose, slender vervain, silverleaf nightshade, least snout bean, prickly sida, amantillo, hierba de Soldado, three-lobed false mallow, peppergrass, trumpets, Texas nightshade, annual sow thistle, Dakota vervain, powderpuff, pyramid flower, and lemon beebalm.

The eastern half of this section supports woodland tracts. The levee slope and mowed toe of this portion supports buffelgrass, Johnsongrass, Bermuda grass, annual sunflower, silverleaf nightshade, and powderpuff. Some areas of the tree line are honey mesquite dominated, while other areas (including the La Coma tract) also support sugarberry, retama, huisache, spiny hackberry, clepe, anacua, and few scattered Texas prickly pear. Additional species that occur in this area included bushy lippia, common greenbrier, old man's beard, amantillo, ivy treebine, and snail vine. There was no endangered plant habitat within this section.

SECTION O-9

County: Hidalgo

Potential Listed

Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: Possible (only north of the levee)

If So, Habitat Quality: Medium (only north of the levee)

Section Habitat Description: Section O-9 includes approximately 3.87 miles that north of the levee is characterized by predominantly agricultural fields (plowed, fallow, corn, sugarcane). There is a small section of residential development and also resacas or cut-off oxbows near a huge, deep ravine lined with towering sugarberry trees located south of the alignment. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

To the south of the levee, the first half of Section O-9 parallels active agricultural fields (e.g., corn, cabbage, carrots). The levee slope and toe is typically scraped bare. Occasionally within the barren toe area there were ground cherry, annual sunflower, powderpuff, old man's beard, least snout bean, seaside heliotrope, germander, silverleaf nightshade, cowpen daisy, Dakota vervain, and Mexican hat.

This portion of the section includes the LRGVNWR Llano Grande Banco tract. It is characterized by an old canal adjacent to the levee. The canal supports giant reed and woody species including black willow, sugarberry, retama, and occasional ebony. The roadside area near the old canal was characterized by Bermuda grass with low cover of evening primrose, Texas thistle, least snout bean, false ragweed, castor bean, peppergrass, and sweet gaura.

The eastern quarter of Section O-9 is a large, flat, low area that is mowed and maintained to the Port of Entry boundary. This area is characterized by buffelgrass and Bermuda grass and the herbaceous flowering species noted above. There is no endangered plant habitat in Segment O-9.

SECTION O-10

County: Hidalgo

Potential Listed

Plant Occurrence: *Astrophytum asterias* (Star Cactus) (FE, SE)
Manihot walkerae (Walker's manioc) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: Possible (only north of the levee)

If So, Habitat Quality: Low (only north of the levee)

Section Habitat Description: Section O-10 includes approximately 2.33 miles that on the northern side of the levee crosses agricultural fields (sugarcane, fallow, plowed), primarily. Canals and stands of giant reed occur throughout the section. The LRGVNWR Rosario Banco tract is crossed by the alignment along this section. Rosario Banco is a previously disturbed site undergoing re-growth; on the easternmost portion of the tract, the buffelgrass and switchgrass stands are dense, tall, and difficult to navigate on foot. Scattered trees and shrubs characterizing this tract include honey mesquite, spiny hackberry or granjeno, retama, sugarberry, Chinaberry, lime pricklyash, and bluewood condalia. Near the western edge of this tract, the woodland stand provides dense cover resulting in bare ground in the understory. Although no rare plant species were observed, a Mexican tree frog occurred on a sugarberry leaf within the Rosario Banco tract. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

On the southern side of the levee in Section O-10, land use consists of mostly agricultural fields with the exception of the LRGVNWR Rosario Banco tract. The

levee slope and toe area are mowed and supports buffelgrass, King Ranch bluestem, and powderpuff. The levee toe to the agricultural fields tends to alternate from a tree line to a mesic area (old canal). The tree lines support honey mesquite, huisache, retama, and some mule's fat. The more mesic sites support giant reed, common reed, black willow, huisache, and mule's fat. At the Rosario Banco tract, there is a large pond adjacent to the fence line and associated woodland. Trees occurring along the fence line were honey mesquite, huisache, anacua, sugarberry, spiny hackberry, pepperbark, zarza, and Mexican caesalpinia. South of the fenceline is a stand of common reed and narrowleaf cattail. Additional plant species that occur in this area were old man's beard, ivy treebine, hierba de Soldado, peppervine, germander, climbing milkvine, climbing hempvine, castor bean, Texas nightshade, and bushy lippia. There was no endangered plant habitat within this section.

SECTION O-11

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-11 includes approximately 2.31 miles and traverses a portion of the TPWD Anaqua WMA. The woodland stands are characterized by lead tree or tepeguahe, spiny hackberry or granjeno, sugarberry, huisache, Chinaberry, anaqua, and lime pricklyash. The understory is characterized by lantana species, Turk's cap, several species of vines or lianas, including the least snoutbean, dewberry, ivy treebine, and peppervine. There was no suitable habitat for listed plant species within this WMA, confirmed by on-the-ground surveys. The remainder of this section outside of the WMA consisted of fallow agricultural fields. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-12

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-12 includes approximately 0.92 miles and is characterized by a large sugarcane field, disturbed brush tract with little floristic diversity (mostly switchgrass and huisache), and the City of Harlingen Canal. The southern portion of the canal was lined with a thin band of tall trees,

primarily anaqua, Chinaberry, spiny hackberry or granjeno, sugarberry, Texas ebony, honey mesquite, huisache, and retama. Rare plant surveys were conducted, but were unsuccessful within this section. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-13

County: Cameron

Potential Listed

Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: No

If So, Habitat Quality: NA

Section Habitat Description: Section O-13 includes approximately 1.58 miles that crosses agricultural fields (sorghum and fallow), primarily. The southern end of the section lies adjacent to LRGVNR tract. There was no listed plant habitat within this section nor were rare plants observed in the on-the-ground survey. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-14

County: Cameron

Potential Listed

Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: No

If So, Habitat Quality: NA

Section Habitat Description: Section O-14 includes approximately 3.59 miles that lie adjacent to and parallels a canal for its entire length. The canal corridor was predominantly lined with Bermuda grass. No rare plant species were observed in this highly disturbed section, nor was suitable habitat observed. This section occurs within the Mid-Valley Riparian Woodland biotic community and is adjacent to the Mid-Delta Thorn Forest.

SECTION O-15

County: Cameron

Potential Listed

Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: No

If So, Habitat Quality: NA

Section Habitat Description: Section O-15 includes approximately 1.93 miles that are characterized largely by agricultural fields (fallow and sugarcane) and residential land use. There was no rare plant habitat within this section, nor were rare plant species observed during on-the-ground surveys. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-16

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-16 includes approximately 2.33 miles characterized by agricultural fields and residential neighborhoods. There was one very small woodland stand or patch, but it was highly disturbed and contained no listed plant species habitat. Surveys were conducted and no rare plant species were observed. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-17

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-17 includes approximately 1.61 miles and crosses agricultural fields, a canal edge, and nearby residential or commercial property containing abandoned vehicles. There was one small shrub herbaceous tract with low species diversity (mostly switchgrass, sparse honey mesquite, retama, spiny hackberry, or granjeno overstory). Within this tract there was an unusual and tiny mesic depression supporting water-clover along the saturated margin. All areas within this section have been disturbed, and there was no listed plant habitat or species observed. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-18

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-18 includes approximately 3.58 miles that cross agricultural land and parcels of revegetated habitat. A single stand of tepeguahue woodland from 10 m–15 m tall was examined, as was a retama shrubland, which has invaded nonnative grassland habitat to form herbaceous shrublands and short-stature woodlands in Section O-18. Suitable habitat for listed plant species does not occur in this section, nor were individual rare plants observed during on-the-ground surveys. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-19

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-19 includes approximately 3.37 miles characterized by extensive hay fields. In some segments of Section O-19, windmill grass has become established as the dominant grass, forming nearly pure stands on levee banks and extensive monotypic stands occupy grass hay pastures. There is no suitable habitat for rare plant species, nor were rare plants observed during on-the-ground surveys. This section occurs within the Mid-Valley Riparian Woodland biotic community and adjacent to the Mid-Delta Thorn Forest.

SECTION O-20

County: Cameron
Potential Listed
Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) (FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)
Suitable Listed Plant Habitat Present: No
If So, Habitat Quality: NA

Section Habitat Description: Section O-20 includes approximately 0.93 miles characterized by pastures. In some segments of Section O-20, windmill grass has become established as the dominant grass, forming nearly pure stands on levee banks and extensive, monotypic stands occupy grass hay pastures. There is no suitable habitat for rare plant species, nor were rare plants observed during on-the-ground surveys. This section occurs within the Mid-Valley Riparian Woodland biotic community and marginally within the Sabal Palm Forest.

SECTION O-21

County: Cameron

Potential Listed

Plant Occurrence: *Ambrosia cheiranthifolia* (South Texas ambrosia) FE, SE)
Ayenia limitaris (Texas ayenia) (FE, SE)

Suitable Listed Plant Habitat Present: Yes

If So, Habitat Quality: Good

Section Habitat Description: Section O-21 includes approximately 12.99 miles through predominantly agricultural land. Sabal palms are common within Section O-21 as scattered individuals, linear clumps, and patches and stands where they persist as seedlings, tall shrubs, and as trees up to 20 m tall. Only a few sabal palm trees were observed in other project sections and those occurred as tall shrubs or palmettos. The LRGVNWR Boscaje de La Palma tract, located in the southernmost bend of the Rio Grande near Brownsville, was established to preserve sabal palm forest and woodland habitat. In addition, two short-stature huisache woodland stands were observed near the eastern end of Section O-21. The rare plant species listed for Cameron County were sought, but were not observed in the project corridor. The sabal palm is itself a species of limited distribution and stands have been mapped to more accurately describe potential project-related impacts. This section occurs within the Sabal Palm Forest and Mid-Valley Riparian Woodland biotic communities.

5.5 Wetlands and Waters of the United States

Wetlands and waters of the United States can be confusing terms and are defined here for the convenience of document users. The U.S. Corps of Engineers (USACE) has jurisdiction to protect wetlands under Section 404 of the Clean Water Act (CWA) using the following definition:

. . . areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 Code of Federal Regulations [CFR] 328.3[b]). Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetlands have three diagnostic characteristics: (1) more than 50% of the dominant species present must be classified as obligate, facultative wetland, or facultative; (2) the soils must be classified as hydric; and (3) the area is either permanently or seasonally inundated (Environmental Laboratory 1987).

Waters of the United States are defined under 33 *United States Code* (U.S.C.) 1344, as follows:

- a. The term "waters of the United States" means
 1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
 2. All interstate waters including interstate wetlands;
 3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
 - i. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
 - ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
 - iii. Which are used or could be used for industrial purpose by industries in interstate commerce;
 4. All impoundments of waters otherwise defined as waters of the United States under the definition;
 5. Tributaries of waters identified in paragraphs (a)(1)-(4) of this section;
 6. The territorial seas;
 7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the Clean Water Act (CWA) (other than cooling ponds as defined in 40 CFR 123.11(m) which also meet the criteria of this definition) are not waters of the United States.
 8. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with the EPA.
- b. The term "wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to

support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

- c. The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are "adjacent wetlands."
- d. The term "high tide line" means the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.
- e. The term "ordinary high water mark" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

The term "tidal waters" means those waters that rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by hydrologic, wind, or other effects.

5.5.1 Field Evaluation Summary

Observations and initial identification of potential wetlands and waters of the United States for the LRGV were recorded and reported daily to USACE wetlands ecologists during the October and December 2007 field inventories. Seventeen of the wetlands habitats located during these field inventory trips had been previously delineated and mapped under the National Wetlands Inventory (NWI) project (covering 7.3 acres in the NWI database); they included three freshwater ponds, nine freshwater emergent wetlands, one lake, two freshwater forested/shrub wetlands, and two riverine sites (USFWS 2007).

During December 2007, wetland ecology teams sampled 62 potential and known wetland sites to determine the wetlands classification, boundary, and jurisdictional status (jurisdictional determination form); record physical site data

(wetland data observation form); and acquire on-the-ground photographs (**Table 5-4**). The teams assessed wetlands and waters of the United States within a 150-foot-wide corridor for the length of the project corridor with the exception of Sections O-17, O-18, and O-19 where access was granted for a narrower, 60-foot-wide corridor survey. Additionally, construction staging areas were assessed for wetlands and waters of the United States in conjunction with the corridor analyses. In general, wetlands of the project corridor have become established on seeps and springs, rivers and creeks, canals and ditches, ponds, and in arroyos and cover approximately 23.8 acres (Table 5-5). A Section 404 permit application was filed indicating approximately 2.77 acres of wetlands will be impacted by the project (**Table 5-5**).

5.5.2 Wetlands Vegetation Summary

Wetlands delineated within the Rio Grande Valley include forest, woodland, shrubland, and herbaceous types. The characteristic species for each wetlands type investigated, sampled, or delineated in the field are presented below by stand physiognomy.

Forest and Woodland

1. Black Willow/ Coyote Willow Riparian Woodland
2. Black Willow /Giant Reed Riparian Woodland
3. Black Willow/ Mexican Ash Riparian Woodland
4. Black Willow/ Narrowleaf Cattail Riparian Woodland
5. Black Willow–Retama/ Narrowleaf Cattail Riparian Woodland
6. Huisache Riparian Woodland
7. Retama Riparian Woodland
8. Retama–Black Willow/ Giant Reed Riparian Woodland
9. Retama/ Giant Reed Riparian Woodland
10. Retama/ Mule’s Fat Riparian Woodland
11. Retama–Sugarberry Riparian Woodland
12. Sugarberry–Mexican Ash Riparian Forest
13. Sugarberry–Mexican Sabal Palm Riparian Forest

Shrubland

1. Coyote Willow–Dewberry Shrubland
2. Coyote Willow/ Narrowleaf Cattail Shrubland
3. Roosevelt Weed– (Mule’s Fat) Shrubland
4. Roosevelt Weed– (Mule’s Fat)/Buffelgrass Shrubland
5. Roosevelt Weed–(Mule’s Fat)/Narrowleaf Cattail Shrubland

Table 5-4. Summary of Jurisdictional and Nonjurisdictional Wetlands within the LRGV

ID	NWI Type	Section	Boundary Flagged in Field	Boundary Determined from Aerial Photos and Ground Truthing	Jurisdictional Determination Form Completed	Routine Data Form Completed	Ground Photos Included	Map Included
*WL1	PEM/PSS	O-10	yes	—	yes	yes	yes	yes
*WL2	PEM	O-9	yes	—	yes	yes	yes	yes
WL3	PEM	O-9	no	yes	yes	no	yes	yes
*WL4	PEM/ Irrigation ditch	O-8	yes	—	yes	yes	yes	yes
WL5	Irrigation ditch	O-6	no	yes	yes	no	yes	yes
*WL6	PEM/POW	O-5	yes	—	yes	yes	yes	yes
WL7	Irrigation ditch	O-5	no	yes	yes	no	yes	yes
*WL8	Stream	O-1	yes	—	yes	no	yes	yes
WL9	Arroyo	O-1	yes	—	yes	no	yes	yes
WL10	Arroyo	O-1	yes	—	yes	no	yes	yes
*WL11	Arroyo	O-1	yes	—	yes	no	yes	yes
*WL12	Arroyo	O-1	no	yes	yes	no	yes	yes
WL13	Arroyo	O-1	yes	—	yes	no	yes	yes
*WL14	PFO/PEM	O-1	yes	—	yes	yes	yes	yes
*WL15	Arroyo	O-1	no	yes	yes	no	yes	yes
*WL16	PFO/PEM	O-2	yes	—	yes	yes	yes	yes

ID	NWI Type	Section	Boundary Flagged in Field	Boundary Determined from Aerial Photos and Ground Truthing	Jurisdictional Determination Form Completed	Routine Data Form Completed	Ground Photos Included	Map Included
WL17	Arroyo	O-19	no	yes	yes	no	yes	yes
*WL18	PSS/PEM	O-20	yes	—	yes	yes	yes	yes
*WL19	PEM/POW	O-17	yes	—	yes	yes	yes	yes
*WL20	PSS/PEM	O-17	yes	—	yes	yes	yes	yes
WL21	Irrigation canal	O-11	yes	—	yes	no	yes	yes
WL22	Irrigation canal	O-11	yes	—	yes	no	yes	yes
*WL23	PFO/ Irrigation ditch	O-11	yes	—	yes	yes	yes	yes
WL24	Irrigation canal	O-11	yes	—	yes	no	yes	yes
*WL25	POW/PFO/ PEM	O-12	yes	—	yes	yes	yes	yes
*WL26	PSS/POW/ PEM	O-13	yes	—	yes	yes	yes	yes
WL27	Irrigation ditch	O-12	yes	—	yes	no	yes	yes
WL28	Irrigation ditch	O-12	no	yes	yes	no	yes	yes
*WL29	PFO/PEM	O-13	yes	—	yes	yes	yes	yes
*WL30	PFO/PSS	O-13	yes	—	yes	yes	yes	yes
*WL31	PSS/PEM	O-13	yes	—	yes	yes	yes	yes

ID	NWI Type	Section	Boundary Flagged in Field	Boundary Determined from Aerial Photos and Ground Truthing	Jurisdictional Determination Form Completed	Routine Data Form Completed	Ground Photos Included	Map Included
*WL32	PEM	O-13	yes	—	yes	yes	yes	yes
*WL33	PEM	O-13	yes	—	yes	yes	yes	yes
WL34	Irrigation ditch	O-13	no	yes	yes	no	yes	yes
WL35	PFO	O-13	yes	—	yes	yes	yes	yes
*WL36	PFO	O-18	yes	—	yes	yes	yes	yes
*WL37	PEM/PSS	O-18	yes	—	yes	yes	yes	yes
*WL38	POW/PEM	O-18	yes	—	yes	yes	yes	yes
WL39	Irrigation ditch	O-18	no	yes	yes	no	no	yes
WL40	PSS/PEM	O-13	yes	—	yes	yes	yes	yes
WL41	Irrigation canal	O-14	no	yes	yes	no	yes	yes
WL42	Irrigation ditch	O-14	no	yes	yes	no	yes	yes
WL43	Irrigation ditch	O-14	no	yes	yes	no	yes	yes
WL44	Irrigation ditch	O-15	yes	—	yes	no	yes	yes
WL45	Irrigation ditch	O-21	yes	—	yes	no	yes	yes
*WL46	PFO/PEM	O-21	yes	—	yes	yes	yes	yes
*WL47	POW/PEM	O-21	yes	—	yes	yes	yes	yes

ID	NWI Type	Section	Boundary Flagged in Field	Boundary Determined from Aerial Photos and Ground Truthing	Jurisdictional Determination Form Completed	Routine Data Form Completed	Ground Photos Included	Map Included
WL48	Dry wash	O-1	no	yes	yes	no	no	yes
WL49	Dry wash	O-1	no	yes	yes	no	no	yes
WL50	Dry wash	O-1	no	yes	yes	no	no	yes
*WL51	PEM	O-2	no	yes	yes	no	no	yes
*WL52	PFO	O-2	no	yes	yes	no	no	yes
*WL53	PFO	O-2	no	yes	yes	no	no	yes
*WL54	PFO	O-2	no	yes	yes	no	no	yes
*WL55	Stream	O-2	no	yes	yes	no	no	yes
*WL56	PFO	O-2	no	yes	yes	no	no	yes
*WL57	PFO	O-20	no	yes	yes	no	no	yes
WL58	Irrigation ditch	O-21	no	yes	yes	no	no	yes
WL59	Irrigation ditch	O-21	no	yes	yes	no	no	yes
WL60	Irrigation ditch	O-21	no	yes	yes	no	no	yes
WL61	Irrigation ditch	O-21	no	yes	yes	no	no	yes
WL62	Irrigation ditch	O-21	no	yes	yes	no	no	yes

Note:

* = Jurisdictional, subject to permitting under Section 404 of the Clean Water Act

PEM = Palustrine Emergent, PFO=Palustrine Forested, POW=Palustrine Open Water, and PSS=Palustrine Scrub/Shrub

Table 5-5. Summary of Jurisdictional Wetlands within the LRGV

WL ID	WL Type	Section	Size (acres)	Impacts (acres)
WL1	PEM/PSS	O-10	0.42	0.02
WL2	PEM	O-9	2.62	0.24
WL4	PEM/ditch	O-8	0.11	0.03
WL6	PEM/POW	O-5	0.38	0
WL8	Stream	O-1	0.36	0.14
WL11	Arroyo	O-1	0.08	0
WL12	Arroyo	O-1	2.85	0
WL14	PFO/PEM	O-1	0.37	0.16
WL15	Arroyo	O-1	0.12	0.05
WL16	PFO/PEM	O-2	0.36	0
WL18	PSS/PEM	O-20	0.02	0
WL19	PEM/POW	O-17	0.5	0
WL20	PSS/PEM	O-17	2.65	0.21
WL23	PFO along ditch	O-11	3.25	0.96
WL25	POW/PFO/PEM	O-12	1.08	0
WL26	PSS/POW/PEM	O-13	0.79	0
WL29	PFO/PEM	O-13	0.09	0
WL30	PFO/PSS	O-13	0.18	0
WL31	PSS/PEM	O-13	0.14	0
WL32	PEM	O-13	0.14	0
WL33	PEM	O-13	0.44	0.08
WL36	PFO	O-18	0.04	0
WL37	PEM/PSS	O-18	0.17	0
WL38	POW/PEM	O-18	0.68	0
WL46	PFO/PEM	O-21	0.27	0
WL47	POW/PEM	O-21	1.82	0
WL51	PEM	O-2	1.6	0
WL52	PFO	O-2	0.25	0.09
WL53	PFO	O-2	0.22	0.13
WL54	PFO	O-2	0.22	0.09
WL55	Stream	O-2	0.04	0.04
WL56	PFO	O-2	1.13	0.53
WL57	PFO	O-20	0.4	0

Total wetland area in acres = 23.8; Total wetland impact area in acres = 2.77

Herbaceous

1. Common Reed Herbaceous Vegetation
2. Common Reed–Switchgrass Herbaceous Vegetation
3. Duckweed Floating Aquatic Herbaceous Vegetation
4. Giant Reed Herbaceous Vegetation
5. Giant Reed–Buffelgrass Herbaceous Vegetation
6. Giant Reed–Common Reed Herbaceous Vegetation
7. Narrowleaf Cattail–Sedge Herbaceous Vegetation
8. Narrowleaf Cattail–Smartweed Herbaceous Vegetation
9. Switchgrass–Bermuda Grass Herbaceous Vegetation

5.5.3 Wetlands Soil Summary

Soils supporting wetlands and waters of the United States within the LRGV included (1) Alluvial Land, (2) Camargo Silt Loam, (3) Camargo Silty Clay Loam, (4) Cameron Silty Clay, (5) Grulla Clay, (6) Laredo Silty Clay Loam, 0%–1% Slopes, (7) Matamoros Silty Clay, (8) Olmito Silty Clay, (9) Reynosa Silty Clay Loam, 0%–1% Slopes, (10) Rio Grande Silt Loam, and (11) Rio Grande Silty Clay Loam. The common soil textures of these Rio Grande floodplain sites are heavy silt loam and silty clay loam. However, one each of wetland stands was rooted in clay loam, silt loam, and mucky peat. The matrix color of the A horizon for LRGV wetland soils was consistently a brown hue (10YR) with the value ranging from 3 to 5 and the chroma ranging from 1 to 6. Wetland soils under long-term standing water or soils saturated by the groundwater table exhibited gleying and a few exhibited mottling. The mottles were typically a brown hue (10YR) or less commonly a yellow hue (2.5YR) and faint in terms of value and chroma.

5.6 Noxious Weeds and Invasive Nonnative Species

The State of Texas maintains a noxious weed definition, species list, and control districts under a legislative determination (TDA 2008). The legislature has determined that (1) noxious weeds are present in this state to a degree that poses a threat to agriculture and is deleterious to the proper use of soil and other natural resources, and (2) reclamation of land from noxious weeds is a public right and duty in the interest of conservation and development of the natural resources of the state (Chapter 388, Acts 1981, Sixty-seventh Legislature). Under Chapter 388 of this act “a weed or plant is considered to be a noxious weed if declared to be a noxious weed by: (1) a law of this state or (2) the department acting under the authority of Chapter 61 of this code or any other law of this state.” This Act is administered by the Texas Department of Agriculture under Title 4, Part 1, Chapter 19, Subchapter T: Noxious and Invasive Plants.

The Act and other legislation provide a list of noxious weed species present and managed within Texas (see **Table 5-6**). Additionally, TPWD has listed the

Brazilian peppertree, observed in Sections O-9 and O-19 in this survey, as a prohibited exotic species. The Web site, Texasinvasives.org, provides a list of 137 plant species considered to be nonnative invasives or noxious weeds within Texas, 14 of which occur within the project corridor and are listed in **Table 5-6**.

Table 5-6. Noxious Weed List for the Project Corridor

Common Name	Scientific Name	Fence Sections Observed
^{1,2} Giant Reed; Carrizo	<i>Arundo donax</i>	O-2, O-3, O-9, O-10, O-12, O-13, O-14, O-17, O-18, O-20, O-21
² Bermuda Grass	<i>Cynodon dactylon</i>	O-1, O-2, O-3, O-4, O-5, O-6, O-7, O-8, O-9, O-10, O-11, O-12, O-13, O-14, O-15, O-16, O-17, O-19, O-21
² Angleton Bluestem	<i>Dicanthium aristatum</i>	O-1
² Poponac	<i>Leucaena leucocephala</i>	O-1
² Chinaberry Tree	<i>Melia azedarach</i>	O-1, O-6, O-8, O-9, O-10, O-11, O-12, O-13, O-14, O-16, O-17, O-18, O-19
² Tree Tobacco	<i>Nicotiana glauca</i>	O-1, O-2, O-3
² Buffelgrass	<i>Pennisetum ciliare</i>	O-1, O-2, O-3, O-4, O-5, O-6, O-7, O-8, O-9, O-10, O-11, O-12, O-13, O-14, O-15, O-16, O-17, O-18, O-19, O-20, O-21
² Castor Bean	<i>Ricinus communis</i>	O-1, O-2, O-3, O-6, O-7, O-8, O-9, O-11, O-13, O-14, O-15, O-16, O-17, O-20, O-21
² Russian-thistle	<i>Salsola tragus</i>	O-1, O-2, O-6, O-7, O-8, O-9, O-10
^{1,2} Brazilian Peppertree	<i>Schinus terbinthifolius</i>	O-9, O-19
² Johnsongrass	<i>Sorghum halepense</i>	O-3, O-4, O-5, O-6, O-7, O-8, O-9, O-10, O-11, O-12, O-13, O-14, O-15, O-16, O-17, O-18, O-19, O-21
^{1,2} Athel Tamarisk	<i>Tamarix aphylla</i>	O-2, O-9
² Goathead	<i>Tribulus terrestris</i>	O-2
² Guineagrass	<i>Urochloa maxima</i>	O-1, O-2, O-13, O-15, O-16, O-17, O-18, O-19, O-21

Source: TIO 2007

Notes: 1 = Noxious, 2 = Nonnative Invasive

In general, nonnative noxious and invasive plant species represent a serious management concern, and their inventory, monitoring, and control is expensive for land managers. Within the project corridor, 14 species of nonnative plants have been identified and 3 of these species (i.e., giant reed, Brazilian peppertree, athel tamarisk) are considered noxious in Texas. Nonnative species usually lower the value of wildlife habitat and compete with agricultural crops resulting in lower forage value and production. Once inventoried, methods commonly used to control nonnative species include biological, mechanical, and chemical. Controls must be ongoing to be effective in reducing, but only rarely eliminating, nonnative plant species.

5.7 Wildlife and Wildlife Habitat

5.7.1 Introduction

The Rio Grande Plain, also known as the South Texas brush country, encompasses about 20.5 million acres in an area extending from Del Rio to San Antonio, and southeast to Rockport. Eleven unique plant and animal communities occur in the four southernmost counties of Texas, and eight of the communities occur within the project corridor (USFWS 1988). These eight communities have been crosswalked to the National Vegetation Classification System at the ecological system level (NatureServe 2008) where eight ecological systems have been described by vegetation alliances and plant associations observed during field studies. Collectively labeled the Tamaulipan Brushland by Texas biogeographers, much of the landscape has been cleared, farmed, developed, grazed by livestock, or planted to nonnative pastures and agricultural crops.

Wildlife flourishes in a wide array of species and large numbers of individuals due to the extant habitat diversity resulting in part from a warm climate year-round, moderate precipitation, and the Rio Grande flowing into the Gulf of Mexico. The economics of Rio Grande Valley wildlife and habitat diversity are important to the international border region as approximately 200,000 tourists annually spend approximately \$150 million. Because approximately 95% of the vegetation in the LRGV has been cleared or altered, National Wildlife Refuges (NWRs), state parks and wildlife areas, properties purchased for conservation by nonprofit organizations, and some private holdings, are important links in the efforts to protect the tremendous biodiversity and related economics of the region. To preserve and manage remnants of these communities and attempt restoration of adjacent disturbed lands, the USFWS has established the LRGVNWR, which consists of numerous parcels that are made up of from 2,000 to 20,000 acres per parcel.

5.7.2 Wildlife and Habitat Overview

The project corridor supports diverse populations and individuals of vertebrate and invertebrate wildlife species (see **Table 5-7**), and unique-to-common native

and nonnative wildlife habitats, described as vegetation alliances, plant associations, and land use types in this BSR (see **Table 5-8**). **Table 5-7** lists wildlife observed during the field surveys. The table can provide a general indication of species richness in each section. **Table 5-8** lists the habitat observed during the surveys, and the estimated acreage in each segment. Along the international border, climate, geology, soils, land forms, geography, precipitation, and plant communities combine to provide excellent habitat diversity. Recent estimates concur that a small area, approximately 5% of the native landscape, remains on the lower Rio Grande and associated terraces and uplands, where it is generally distributed as discontinuous vegetation patches and stands.

However, vegetation and wildlife diversity within these native habitat fragments and nonnative stands totals more than 1,200 species of plants, 700 species of vertebrates (including nearly 500 bird species), and 300 species of butterflies. Within the LRGV project corridor, wildlife species observed and recorded during late summer and fall surveys included 13 species of mammals, 63 species of birds, 6 reptile species, 7 amphibian species, and 2 species of fish. The number of plant taxa observed and providing wildlife habitat within the project corridor was 301.

Within the LRGV project corridor the broad habitat types available to resident and migrating wildlife species include herbaceous vegetation, shrubland, woodland and forest, agriculture, water bodies, and residential and urban types. Most of the available wildlife habitat has become established on floodplain alluvium deposited within the LRGV, but only a few geologic exposures and uplands occur. This section provides a brief summary of wildlife habitats observed and sampled in 2007 (see **Table 5-8**), categorized as follows:

1. Herbaceous Vegetation: this class of wildlife habitat includes annual and perennial species of grasses, forbs, and graminoids, which typically are characterized by no less than 15% cover by shrubs or trees. Stands of herbaceous vegetation range from less than 0.5 up to 10.0 m tall and range from low to dense in terms of cover. Herbaceous wildlife habitat occurs within the entire length of the project corridor, as proposed.

Grasslands – predominantly nonnative grassland habitat characterized by buffelgrass, switchgrass, Guinea grass, windmill grass, and Bermuda grass occurs in patches to extensive stands on approximately 472 acres distributed throughout the project corridor. Occurring as pastures for grazing livestock, grass hay fields, woodland and shrubland clearings, and on the banks of the USIBWC levee, these nonnative grassland habitats typically have low floristic species diversity, provide thick mats of litter as ground cover, and occur as moderate to dense stands in terms of foliar cover. Wildlife species observed within grasslands commonly included the fulvous harvest mouse, blue spiny lizard, and Rio Grande

Table 5-7. Wildlife Observed During Natural Resources Surveys Conducted 1–7 October, and 11–14 December 2007

Common Name / Scientific Name	Status	Section Numbers																				Total Number of Species Occurrences Within Project Corridor Sections		
		O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20		O-21	
Fish																								
Mosquito Fish / <i>Gambusia affinis</i>	C																							1
Texas Cichlid / <i>Herichthys cyanoguttatus</i>	C																							1
Amphibians																								
Giant (Marine) Toad / <i>Bufo marinus</i>	C																							1
Gulf Coast Toad / <i>Bufo valliceps</i>	C																							1
Mexican Burrowing Toad / <i>Rhinophrynus dorsalis</i>	Potential Habitat		x																					1
Mexican Treefrog (2) / <i>Smilisca baudinii</i>	State Threatened Species																							1
Rio Grande Chirping Frog / <i>Eleutherodactylus cystignathoides</i>	C																							2
Rio Grande Leopard Frog / <i>Rana berlandieri</i>	C																							3
White-lipped Frog / <i>Leptodactylus labialis</i>	Potential Habitat																							1
Reptiles																								
Blue Spiny Lizard / <i>Sceloporus serrifer cyanogenys</i>	C	x																						2
Eastern Fence Lizard / <i>Sceloporus undulatus</i>	C		x																					1
Laredo Striped Whiptail / <i>Aspidoscelis laredoensis</i>	C	x	x	x																				8
Prairie Racerunner / <i>Aspidoscelis sexlineatus viridis</i>	C	x																						3
Rio Grande River Cooter / <i>Pseudemys gorzugi</i>	C																							1
Texas Horned Lizard / <i>Phrynosoma cornutum</i>	State Threatened Species		x																					1
Texas Indigo Snake / <i>Drymarchon corais erebennis</i>	State Threatened Species	x																						3
Texas Spiny Softshell Turtle / <i>Apalone spinifera emoryi</i>	C																							1
Birds																								
Altamira Oriole / <i>Icterus gularis</i>	C		x																					1
American Avocet / <i>Recurvirostra americana</i>	C																							1
American Coot / <i>Fulica americana</i>	C																							2
American Kestrel / <i>Falco sparverius</i>	C	x																						8
American White Pelican / <i>Pelicanus erythrorhynchos</i>	C																							2
Anhinga / <i>Anhinga anhinga</i>	C																							1
Barn Owl / <i>Tyto alba</i>	C																							1
Bank Swallow / <i>Riparia riparia</i>	C																							1
Barn Swallow / <i>Hirundo rustica</i>	C	x	x	x	x	x																		8
Bewick's Wren	C																							1
Black Vulture / <i>Coragyps atratus</i>	C	x		x																				2
Black-bellied Whistling Duck / <i>Dendrocygna autumnalis</i>	C																							4
Black-necked Stilt / <i>Himantopus mexicanus</i>	C																							2
Black Phoebe / <i>Sayornis nigricans</i>	C		x																					1
Blue-Gray Gnatcatcher / <i>Poliophtila caerulea</i>	C		x																					2
Brewer's Blackbird / <i>Euphagus cyanocephalus</i>	C		x																					2
Bronzed Cowbird / <i>Molothrus aeneus</i>	C																							1
Brown Jay / <i>Cyanocorax morio</i>	C	x																						1
Brownsville Common Yellowthroat / <i>Geothlypis trichas insperata</i>	State Monitored Species																							1
Brown-crested Flycatcher / <i>Myiarchus tyrannulus</i>	C																							1
Birds (continued)																								
Brown-headed Cowbird / <i>Molothrus ater</i>	C																							3

Common Name / Scientific Name	Status	Section Numbers																				Total Number of Species Occurrences Within Project Corridor Sections	
		O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20		O-21
Cactus Wren / <i>Campylorhynchus brunneicapillus</i>	C	x	x																x				3
Carolina Wren / <i>Thryothorus ludovicianus</i>	C										x												1
Cattle Egret / <i>Bubulcus ibis</i>	C															x							1
Chihuahuan Raven / <i>Corvus cryptoleucus</i>	C	x																					1
Common Ground Dove / <i>Columbina passerina</i>	C		x	x	x	x	x		x	x	x					x	x	x		x		x	13
Couch's Kingbird / <i>Tyrannus couchii</i>	C	x	x	x	x	x	x		x	x	x		x	x	x		x	x	x	x	x	x	18
Crested Caracara / <i>Caracara cheriway</i>	C	x	x														x	x					4
Curved-Billed Thrasher / <i>Toxostoma curvirostre</i>	C	x			x																		2
Double-crested Cormorant / <i>Phalacrocorax auritus</i>	C									x					x							x	3
Eastern Meadowlark / <i>Sturnella magna</i>	C		x										x							x			3
European Starling / <i>Sturnus vulgaris</i>	C								x														1
Golden-fronted Woodpecker / <i>Melanerpes aurifrons</i>	C	x	x		x	x			x	x	x	x	x		x		x		x	x			13
Great Blue Heron / <i>Ardea herodias</i>	C									x		x				x			x		x		5
Great Egret / <i>Ardea alba</i>	C	x				x				x					x	x			x		x	x	8
Great Horned Owl / <i>Bubo virginianus</i>	C		x																				1
Great Kiskadee / <i>Pitangus sulphuratus</i>	C	x	x	x			x				x				x			x				x	8
Greater Roadrunner / <i>Geococcyx californianus</i>	C	x																					1
Greater Yellowlegs / <i>Tringa melanoleuca</i>	C										x												1
Great-tailed Grackle / <i>Quiscalus mexicanus</i>	C	x	x	x	x	x	x	x	x	x	x			x	x			x		x	x	x	17
Green Heron / <i>Butorides virescens</i>	C									x				x									2
Green Jay / <i>Cyanocorax yncas</i>	C	x	x				x				x											x	5
Groove-billed Ani / <i>Crotophaga sulcirostris</i>	C	x	x			x				x	X				x								6
Harris's Hawk / <i>Parabuteo unicinctus</i>	C			x																			1
Hooded Oriole / <i>Icterus cucullatus</i>	C									x													1
House Finch / <i>Carpodacus mexicanus</i>	C	x	x	x	x	x								x	x	x	x		x		x		11
House Sparrow / <i>Passer domesticus</i>	C	x	x												x			x					4
Killdeer / <i>Charadrius vociferous</i>	C	x		x							x					x			x	x			6
Ladder-backed Woodpecker / <i>Picoides scalaris</i>	C																					x	1
Lark Bunting / <i>Calamospiza melanocorys</i>	C																				x		1
Lark Sparrow / <i>Chondestes grammacus</i>	C																					x	1
Lesser Nighthawk / <i>Chordeiles acutipennis</i>	C	x		x																			2
Lesser Yellowlegs / <i>Tringa flavipes</i>	C															x							1
Loggerhead Shrike / <i>Lanius ludovicianus</i>	C		x																				1
Long-billed Curlew / <i>Numenius americanus</i>	C															x							1
Long-billed Dowitcher / <i>Limnodromus scolopaceus</i>	C																			x			1
Long-billed Thrasher / <i>Toxostoma longirostre</i>	C	x	x																				2
Mourning Dove / <i>Zenaida macroura</i>	C	x	x	x	x	x	x			X	x			x	x			x	x	x	x	x	15
Northern Bobwhite / <i>Colinus virginianus</i>	C														x								1
Northern Cardinal / <i>Cardinalis cardinalis</i>	C	x	x		x	x							x	x	x	x			x			x	10
Northern Flicker / <i>Colaptes auratus</i>	C		x	x						x		x		x						x		x	7
Northern Harrier / <i>Circus cyaneus</i>	C		x	x	x					X									x				5
Birds (continued)																							
Northern Mockingbird / <i>Mimus polyglottos</i>	C	x	x		x	x	x	x	x	X	x	x	x		x	x			x	x	x	x	18
Northern Rough-Winged Swallow / <i>Stelgidopteryx serripennis</i>	C										x												1
Olive Sparrow / <i>Arremonops rufivirgatus</i>	C		x			x																	2

Common Name / Scientific Name	Status	Section Numbers																				Total Number of Species Occurrences Within Project Corridor Sections	
		O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20		O-21
Osprey / <i>Pandion haliaetus</i>	C	x																					1
Pied-billed Grebe / <i>Podilymbus podiceps</i>	C																		x				1
Plain Chachalaca / <i>Ortalis vetula</i>	C											x											1
Purple Gallinule / <i>Porphyryla martinica</i>	C																		x				1
Pyrrhuloxia / <i>Cardinalis sinuatus</i>	C	x											x			x			x				4
Red-tailed Hawk / <i>Buteo jamaicensis</i>	C		x	x					x													x	4
Red-winged Blackbird / <i>Agelaius phoeniceus</i>	C	x	x						x		x				x	x			x		x		8
Ringed Kingfisher / <i>Ceryle torquata</i>	C		x																				1
Rock Pigeon / <i>Columba livia</i>	C	x																			x		2
Ruby-crowned Kinglet / <i>Regulus calendula</i>	C	x																					1
Scissor-tailed Flycatcher / <i>Tyrannus forficatus</i>	C	x	x		x		x			x			x	x	x			x		x	x	x	12
Tree Swallow / <i>Tachycineta bicolor</i>	C												x	x	x								1
Turkey Vulture / <i>Cathartes aura</i>	C	x	x	x	x	x	x		x	x	x		x					x		x		x	13
Verdin / <i>Auriparus flaviceps</i>	C	x																					
Vermillion Flycatcher / <i>Pyrocephalus rubinus</i>	C									x													1
Western Sandpiper / <i>Calidris mauri</i>	C																		x				1
Western Yellow-billed Cuckoo / <i>Coccyzus americanus occidentalis</i>	Candidate Species									x													1
White Ibis / <i>Eudocimus albus</i>	C														x	x							2
White-tipped Dove / <i>Leptotila verreauxi</i>	C	x																					1
White-winged Dove / <i>Zenaida asiatica</i>	C		x						x														2
Wood Stork / <i>Mycteria Americana</i>	C														x								1
Yellow-rumped Warbler / <i>Dendroica coronata</i>	C	x																					1
Mammals																							
Black-Tailed Jackrabbit / <i>Lepus californicus</i>	C													x									1
Bobcat / <i>Lynx rufus</i>	C		x																				1
Collared Peccary (Javelina) / <i>Pecari tajacu</i>	C	x	x		x										x								4
Common Gray Fox / <i>Urocyon cinereoargenteus</i>	C														x								1
Common Raccoon / <i>Procyon lotor</i>	C		x																	x			2
Coyote / <i>Canis latrans</i>	C	x	x	x																x		x	5
Desert Cottontail / <i>Sylvilagus audubonii</i>	C	x																					1
Eastern Cottontail / <i>Sylvilagus floridanus</i>	C												x										1
Fulvous Harvest Mouse / <i>Reithrodontomys fulvescens</i>	C	x									x				x								3
Gulf Coast Kangaroo Rat / <i>Dipodomys compactus</i>	C	x																					1
Hispid Cotton Rat / <i>Sigmodon hispidus</i>	C		x	x																			2
Mexican Ground Squirrel / <i>Spermophilus mexicanus</i>	C		x												x						x		3
Nine-banded Armadillo / <i>Dasypus novemcinctus</i>	C	x	x	x									x										4
Striped Skunk / <i>Mephitis mephitis</i>	C								x												x		2
	Total # Species Per Section:	35	34	15	3	13	10	5	14	24	17	4	9	13	25	12	14	10	22	12	8	20	

Note: C = Common

Table 5-8. Wildlife Habitat Types Observed in the Mapping Corridor

Wildlife Habitat Type Observed	Components	Acreage by Section Numbers																				Total Acreage of Wildlife Habitats	Total Acreage of Vegetation	
		O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	O-9	O-10	O-11	O-12	O-13	O-14	O-15	O-16	O-17	O-18	O-19	O-20			O-21
Herbaceous Vegetation	16																							591.2445
Grassland	9	8.6899	31.2863	14.4413	61.6807	19.3424	47.4553	12.3069	14.9582	17.2993	14.9551	16.5890	10.9885	11.5466	27.5391	19.8154	20.2942	11.9101	29.8417	57.7185	10.2791	127.6986	586.6362	
Forbland	3				0.1643																		0.1643	
Emergent Wetland	4				1.9712										1.5815				0.8913				4.444	
Shrubland	8																							48.2063
Dwarf-shrub	1	<1.0																					<1.0	
Short Shrub	2	22.386																					22.386	
Tall Shrub	4			0.1797						0.6155	1.8421			9.1701					4.5172		5.7430		22.0676	
Shrub-Scrub Wetland	1	0.3384								1.9278				0.3684		0.9446						0.1735	3.7527	
Woodland and Forest	12																							343.1813
Upland	1															0.4408							0.4408	
Floodplain High Terrace	4					14.6851	0.3343				1.2256						6.3535	4.4324	4.9253		6.3048	38.261		
Floodplain Low Terrace	6	59.3075	64.8122	15.3256	35.2446	2.5191	3.4666	0.1902	11.1261	8.8722	4.5003	9.5875	8.4699		14.4914	1.7725	6.5703		6.6410	6.3546	0.3401	43.5241	303.1158	
Wooded Wetland	1								0.3341						0.2295						0.8001		1.3637	
Open Water	5																							10.6307
River/Creek/Canal	3		0.3934			0.2834		0.1452		0.0056		1.8758	0.1859	3.3284	0.5941		0.1319	0.9992	0.3261	0.0977		1.2352	9.6019	
Lake/Pond	2						0.1858												0.6244			0.2186	1.0288	
Land Use	6																							547.2158
Agriculture, Irrigated	1	0.1509	44.9461		0.1178		3.4035	12.4756	33.4576	27.5553	10.5534	5.7935	0.1150		1.3686	7.7576						5.5668	153.2617	
Agriculture, Fallow	1	1.4393	16.2957	3.3685	1.0925	3.3336	0.1470		3.6075	7.7982	7.8179	14.7887		12.3178	15.1593	2.3139	15.9866	9.7677	17.9527	0.2217		38.5635	171.9721	
Residential and Urban Development	2	8.7591	6.0813	10.9016	1.4657		16.0869	0.0792	0.9123	6.1304					1.4570	3.6282	1.6004	1.3719	8.4144	27.1158	4.0813	8.5841	106.6696	
Highways/Roads/Trails	2	3.4317	9.8034	1.6703	11.1189	1.3319	4.2190	3.1520	2.6857	5.9341	4.1392	0.8368	1.0325	9.5737	13.6012	1.6163	8.4174	2.1140	4.8982	10.8075	0.7526	14.1760	115.3124	
		Total Acreage																					1540.4786	

leopard frog (when wetlands or water bodies were nearby). Tracks and scat indicate that raccoons, skunks, and coyotes commonly forage in the dense grassland habitat. Species of dove and the northern bobwhite often forage for seeds within and raptors including the Harris's and red-tailed hawks, northern harrier, and American kestrel hunt extensively over grassland habitat. Ground nesting birds, including the eastern meadowlark and lark bunting, rely on grasslands for forage, escape cover, nesting, and brood rearing.

- a. *Forblands* – forbs, including sunflowers, false ragweed, croton, pigweeds, Russian-thistle, and prairie aster are rare dominants within the project corridor, typically becoming established in fallow agricultural fields or in topographic depressions. Forb-dominated habitats occur on less than 1.0 acre within the project corridor and provide quantities of seeds and also limited escape cover for birds and small mammals. Granivores, particularly species of blackbirds, cowbirds, doves, finches, and sparrows feed extensively in forblands. Cottontail rabbits are common herbivores within forblands, as are the predators, coyote and gray fox.
 - b. *Emergent Wetlands* – narrowleaf cattail, common reed, giant reed, smartweed, and sedges occur on the margins of resacas, ponds, canals, and ditches and on riverbanks, occupying approximately 5 acres within the project corridor. Emergent wetlands can be tall, from 2 m–10 m in height and dense, providing habitat for birds, mammals, reptiles, and many invertebrates. Avian species that use emergent wetlands for roosting, nesting and brood rearing; foraging; and as escape cover include the red-winged and Brewer's blackbirds, barn and tree swallows, Brownsville common yellowthroat, and purple gallinule. Vermillion and scissor-tailed flycatchers forage over emergent wetland stands. Adjacent shallow water, when present, is used by wading birds including herons and waterfowl particularly the American coot. Emergent wetlands provide important basking habitat for Texas spiny softshell turtle and the Rio Grande cooter and important escape cover and breeding habitat for the Rio Grande leopard frog.
2. Shrublands: this habitat class is somewhat rare within the project corridor, occupying approximately 39 acres. The characteristic shrubs range from 2 m–10 m tall and include mule's fat, honey mesquite, and a variety of upland thornscrub species. Shrublands provide sparse to dense cover and are more common on the ridges and hills of the western project terminus.
 - a. *Dwarf-shrublands* – one dwarf-shrub stand occurs on less than one acre near the western project terminus and is characterized by bristleleaf dogweed and woody tiqulia that provide limited wildlife habitat. Reptiles including the blue spiny lizard, Laredo striped whiptail, prairie racerunner, and Texas horned lizard often use dwarf-shrub stands for foraging and as escape cover. Avian species likely to forage

- in and over dwarf-shrub stands include the greater roadrunner, loggerhead shrike, species of dove, and raptors.
- b. *Short Shrublands* – stands of short shrubs occur predominantly on gravel-covered ridges and hills of the western project terminus and occupy approximately 19 acres. Short shrub stands are characterized by diverse thornscrub from 2 m–5 m tall that ranges from low to moderate in terms of foliar cover. Reptiles including the blue spiny lizard, Laredo striped whiptail, prairie racerunner, and Texas horned lizard are common to abundant in short shrub stands using them for foraging, breeding, resting, and as escape cover. Birds that commonly forage, breed, rest, and use short shrub habitats as escape cover include ruby-crowned kinglet, pyrrhuloxia, cactus wren, species of doves, and the greater roadrunner. Raptors, including the turkey and black vultures and Chihuahuan raven commonly hunt over short shrub habitats. Cottontail rabbits and coyotes commonly use short-shrub habitats for home ranges.
 - c. *Tall Shrublands* – stands of tall shrubs occur predominantly along the margins of the Rio Grande floodplain on second or third terraces or in topographic depressions. Characterized by retama, granjeno, mule's fat, and honey mesquite tall shrubs from 4 m–10 m tall, this habitat type ranges from moderate to dense in terms of foliar cover and occupies approximately 19 acres within the project corridor. Tall shrubs provide important perching, breeding, nesting, brood rearing, and escape cover for a variety of birds including species of doves, bobwhite quail, northern mockingbird, Couch's kingbird, and species of flycatchers. Mammals commonly use tall shrub habitats for resting, foraging, and as part of home ranges and include javelina, bobcat, coyote, gray fox, raccoon, cottontails, and the fulvous harvest mouse.
 - d. *Shrub-Scrub Wetlands* – this habitat type is rare within the project corridor, occupying less than 5 acres and typically occurs as narrow bands along water bodies or on saturated soils. Composed of mesic shrubs to 10 m tall, stands of shrub-scrub wetlands provide dense foliar cover that provides perching, breeding/nesting/brood rearing sites, and escape cover for species of flycatchers and doves, in particular. Mammals, including the javelina and raccoon prefer these often moist shrub-scrub wetland habitats.
3. Woodlands and Forests: open to closed-canopy stands of trees occupy approximately 276 acres throughout the length of the project corridor. Diverse riparian forests occupy the first terrace of the Rio Grande and woodlands more commonly occur on higher river terraces, in fencerows, and as restoration plantings in old agricultural fields. Woodlands typically provide moderate canopy cover and range between 5 m–15 m tall; dense stands of nonnative grasses, particularly buffelgrass and switchgrass almost always dominate the woodland understory. Forest stands range

between 10 m–25 m tall, provide dense canopy cover, and often have subcanopy and tall shrub layers, which enhance the wildlife habitat value.

- a. *Upland* – open upland woodlands are rare because most of the project corridor lies within the Rio Grande floodplain and associated woodland and forest communities occupy the depositional terrace habitats described below. An upland woodland stand dominated by chinaberry, honey mesquite, huisache, and retama provided perching habitat and escape cover for the ruby-crowned kinglet, brown-headed cowbird, and great-tailed grackle. Crested caracaras, turkey vultures, and the red-tailed hawk were observed foraging in the vicinity. Small mammals, particularly the fulvous harvest mouse and cottontails, occupied the dense nonnative grass
- b. *Floodplain High Terraces* – the second and third terraces of the Rio Grande floodplain support relatively open-canopied woodlands characterized by honey mesquite, Texas ebony, and retama trees. A moderately well-developed subcanopy and dense understory herbaceous layers provide additional wildlife habitat values. Numerous avifauna use the terrace woodland habitat for foraging, breeding, nesting, brood rearing, perching, and escape cover, including the northern flicker, golden-fronted woodpecker, flycatchers, gnatcatchers, doves, finches, sparrows, hooded oriole, northern mockingbird, and lesser nighthawk. Raptors, including hawks, falcons, and vultures perch in the larger floodplain trees and forage in their vicinity. Mammal use is moderate and particularly obvious signs (e.g., burrowing, rooting, bite marks, tracks) of javelinas, raccoon, cottontails, ground squirrels, skunk, coyote, and bobcat are abundant. Moderate to high diversity of invertebrates occurs within these terrace woodlands with bees common, foraging on honey mesquite nectar.
- c. *Floodplain Low Terraces* – the first terrace of the Rio Grande supports nearly closed-canopy forests characterized by sugarberry, Texas ebony, honey mesquite, anacua, and Mexican ash trees. A well-developed subcanopy and understory layers provides additional wildlife habitat values. Numerous avifauna use the floodplain forest habitat for foraging, breeding, nesting, brood rearing, perching, and escape cover, including the plain chachalaca, green jay, hooded oriole, northern rough-winged swallow, golden-fronted woodpecker, northern mockingbird, blue-gray gnatcatcher, groove-billed ani, and Carolina wren. Raptors, including hawks, falcons, and vultures perch in the large riparian trees and forage in their vicinity. Mammal use is high and particularly obvious signs (e.g., burrowing, rooting, bite marks, tracks) of javelinas, raccoon, cottontails, ground squirrels, skunk, coyote, and bobcat are abundant. High diversity of invertebrates occurs within these floodplain forests.
- d. *Wooded Wetlands* – in this region, wooded wetlands are rare, occupying less than 5 acres along flowing or standing water bodies,

range from 5 m–15 m tall, and are characterized by black willow with low cover of retama and tepeguahe. Small wooded wetland stands provide dense foliar cover that provides perching, breeding/nesting/brood rearing sites, and escape cover for species of flycatchers, blackbirds, and doves, in particular and also the northern mockingbird, great kiskadee, and the rare western yellow-billed cuckoo. Mammals, including the javelina and raccoon, prefer these often moist wooded wetlands habitats.

4. Open Water: occupying less than 15 acres within the project corridor, open water habitats are species-rich in terms of wildlife use. Of the avian species observed during the field research, 20 species are waterfowl, wading birds, or shorebirds. Water bodies occur as flowing habitats including the Rio Grande, canals, and ditches and as still habitats including lakes and ponds. The bottom substrate is typically sand and fine sediments in the Rio Grande and fine sediments and mud in canals, ditches, and standing water bodies.
 - a. *Rivers, Creeks, and Canals* – flowing open water habitat includes the Rio Grande; a few tributary creeks, streams, and arroyos; and, more commonly irrigation canals and ditches. Waterfowl species that commonly, use flowing open water to rest and forage include the black-bellied whistling duck and American coot and wading birds including the white ibis, herons, and lesser yellowlegs. Fish, reptiles, and amphibians were less frequently observed in the flowing open water habitats and included the Texas cichlid, Texas spiny softshell turtle, Rio Grande chirping frog, and Rio Grande leopard frog.
 - b. *Lakes and Ponds* – lakes and ponds have formed in resacas, gravel pits, and topographic lows and provide still-water habitat in a variety of depths within the LRGV. The wetland and riparian vegetation surrounding the shoreline and the size of the water body can dictate the species using still open water, which include the American avocet, black-necked stilt, anhinga, pied-billed grebe, American white pelican, ringed kingfisher, great blue heron, and egrets, which feed on a variety of aquatic and wetland vertebrates and invertebrates. The Rio Grande cooter and Rio Grande leopard frog commonly occur in the small lake and pond habitats.
 - c. *Land Use* – large acreages in the project corridor are maintained on a regular basis, ranging from nearly daily maintenance in urban areas to seasonal/annual maintenance on agricultural lands. Even though subject to disturbance these habitats are important to many species of resident and migratory wildlife for all life stages ranging from movement corridors to hiding and breeding sites to important foraging sites.
 - d. *Irrigated Agriculture* – fields actively used to grow crops typically include sorghum, sugarcane, corn, and truck crops such as tomatoes

- and broccoli. The fields under production provide valuable hiding cover, dispersal corridors, roosts, forage, and some nesting habitat. Many individuals of a variety of wildlife species including toads, snakes, harvest mice, cotton rats, and passerine birds can be displaced to surrounding habitats or killed when crops are harvested by mechanical means, leaves are burned from sugarcane stalks, and the ground is tilled post-harvest. Open agricultural fields are commonly used for hunting by the American kestrel, a common winter resident in the LRGV. Cattle egrets often occur in pastures, away from water sources, where they prey on invertebrates exposed by the hooves of cattle, or when a field is being tilled.
- e. *Fallow Agriculture* – fields under seasonal rest often contain waste grain or support annual forbs and grasses that produce quantities of seed used by foraging wildlife. Seeds present on fallow fields attracted the cottontail rabbit and species of doves, blackbirds, meadowlarks, cowbirds, European starlings, quail, ducks, and geese. Turkey vultures, ravens, and other raptor species roosted on the ground in fallow agricultural fields.
 - f. *Residential and Urban Development* – a myriad of habitats and food and water sources are present within residential and urban areas including landscaping, open fields, structures related to buildings and other urban infrastructure, pastures, corrals, and backyard feeding stations for domestic pets and birds. Domestic pets, particularly cats, can kill individuals of small mammals and birds within urban and adjacent rural areas. Wildlife species that use residential and urban habitats regularly include raccoons, skunks, house mice, Norwegian rats, European starlings, house sparrows and finches, mockingbirds, rock doves, mourning doves, and grackles.
 - g. *Highways, Roads, and Trails* – wildlife species use established transportation corridors to move and disperse rapidly across the landscape. As a result, low to moderately high death rates can be experienced depending on adjacent habitat importance to wildlife, population levels, and design speed and safety features of transportation corridors. Wildlife that forage on carrion or are omnivorous, including the turkey vulture, black vulture, crested caracara, raccoon, and coyote can benefit from the presence of road-killed animals. Transportation structures such as bridges can provide hiding and roosting cover for species including owls or nesting sites for swallows and rock doves.

5.8 Species Groups and Habitat Affinity

5.8.1 Mammals

Thirteen species of mammals were observed during late summer to fall field surveys within the project corridor (see Attachment D for a more complete LRGV list). Medium-sized predators included the coyote, bobcat, and common gray fox. The collared peccary was common along the Rio Grande and many habitats within the corridor. The common raccoon, striped skunk, nine-banded armadillo, and eastern and desert cottontails occurred rarely to commonly in the available habitats. Small mammals, including the fulvous harvest mouse, hispid cotton rat, Gulf Coast kangaroo rat, and the Mexican ground squirrel, were occasionally observed.

The federally endangered felines, ocelot and jaguarundi, historically occupied much of the brush-dominated habitats in the central, eastern, and southern portions of Texas. This habitat now occurs as patches and small stands within the LRGV. Potential habitat for ocelot and jaguarundi includes four vegetation types within the LRGV: (1) Mesquite-Granjeno Parks, (2) Mesquite-Blackbrush Brushland, (3) Live Oak Woods/Parks, and (4) Rio Grande Riparian forests. The jaguarundi typically uses dense thornscrub habitats with greater than 95% canopy cover, but forages in adjacent herbaceous vegetation.

5.8.2 Birds

Bird species are diverse because the Central and Mississippi flyways converge in the LRGV and the southernmost tip of Texas is also the northernmost range for many bird species. Nearly 500 avian species, including neotropical migratory birds, shorebirds, raptors, and waterfowl, can occur (Appendix D).

More than 800 species of birds spend all or part of their lives in the United States as they migrate from summer breeding grounds in the north to winter in warmer climates of the south, including Latin America (USFWS 2002). Because migratory birds depend on habitats across many political boundaries, a coordinated conservation effort has been established internationally, with the USFWS being the principal Federal authority in the United States. Large numbers of birds migrate seasonally through or overwinter in the LRGV using natural, managed, and agricultural habitats for forage, roosting, and cover. The rivers and other topographic features can serve as leading lines to guide raptors and neotropical migrants during migration.

Migratory birds are also economically important, e.g., birders recreate in many areas to identify migrant species and some hunters focus on migrating waterfowl, including species of ducks and geese. Organizations such as Ducks Unlimited use donations to protect and restore wetlands and associated riparian and upland systems used by migrating waterfowl and shorebirds, primarily. LRGV habitats including wetlands and riparian resources are a priority for conservation

and management organizations and agencies, including TPWD, USFWS (partnership programs and wildlife refuges), Natural Resources Conservation Service (Wetlands Reserve and Environmental Quality Incentives [EQUIP] programs), and private and nonprofit land managers.

The establishment of the LRGVNWR units, TPWD WMAs, nonprofit-managed lands, and private lands is important to migratory bird management. The primary function of lands managed under the National Wildlife Refuge System is to provide habitat for waterfowl and shorebirds in addition to other wildlife-related benefits. Federal agencies in general are responsible to protect migratory birds under Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. This executive order states that migratory birds are of great ecological and economical value to the United States and to other countries. They contribute to biological diversity and bring tremendous enjoyment to those who study, watch, feed, or hunt them and the critical importance of this shared resource has been recognized through ratification of international, bilateral conventions for migratory bird conservation. A list of all migratory birds included under this executive order is available under 50 CFR 10.13; a focused list for species occurring in the project corridor is presented in Appendix D.

In general, the LRGV represents important and unique habitat for migrant bird species, largely a result of geography, diverse and unique plant communities, and protected lands. This region represents an important bird observation area due to the diversity of habitats and the uniqueness of the birds that occur; at least 485 avian species have been recorded from the LRGV (53% of all bird species recorded in North America). The range of open water, wetlands, riparian, playa, grassland, shrubland, woodland and forest, and agricultural land provide habitats for migrating birds. In addition to being one of the highest density migration pathways in the region, the LRGV provides crucial stopover habitat for more than 200 species of birds from eastern and western North America. These migrants breed in tundra, northern forest, grasslands, subtropical scrub forest, and all suitable habitats north of the international border. In the absence of stopover habitat, migration would be difficult to likely impossible for bird species that require places to rest, feed, and avoid predators. The LRGV functions as the final migratory destination and wintering area for dozens of species including world class aggregations of waterfowl.

Because of its strategic location between tropic and temperate environments, the LRGV represents a migratory crossroad for individuals and flocks of hawks, shorebirds, waterfowl and other waterbirds, hummingbirds, and songbirds. On a daily basis, birders can observe large migrations involving tens of thousands of hawks, pelicans, and other birds. The combination of high species diversity, several rare, threatened, and endangered species, large concentrations of wintering birds, several endemic subspecies, and an important migratory pathway results in the LRGV being an important avian region for North America. Endemic subspecies within this biotic province include the Texas red-shouldered hawk, Zapata Carolina wren, and Brownsville common yellowthroat.

Of great interest to birders are the tropical species that reach their northernmost limit in or just north of the LRGV; birders travel from great distances to observe these special occurrences. Included in this group are the least grebe, muscovy duck, hook-billed kite, gray hawk, white-tailed hawk, aplomado falcon, plain chachalaca, red-billed pigeon, white-tipped dove, green parakeet, red-crowned parrot, groove-billed ani, ferruginous pygmy-owl, pauraque, buff-bellied hummingbird, ringed kingfisher, green kingfisher, northern beardless-tyrannulet, brown-crested flycatcher, great kiskadee, tropical kingbird, Couch's kingbird, green jay, brown jay, Tamaulipas crow, Chihuahuan raven, cave swallow, clay-colored robin, long-billed thrasher, tropical parula, white-collared seedeater, olive sparrow, Botteri's sparrow, Altamira oriole, and Audubon's oriole.

Located within the convergence area for the Central and Mississippi flyways (invisible aerial highways used by migratory bird species) the LRGV represents a popular region for recreational birding. For example, more than 290 bird species have been recorded within the borders of Bentsen-Rio Grande Valley State Park (588 acres). In addition, many species from the tropics occasionally wander to the LRGV, including jabiru, white-cheeked pintail, masked duck, snail kite, crane hawk, roadside hawk, short-tailed hawk, collared forest-falcon, northern jacana, white-crowned pigeon, ruddy ground-dove, ruddy quail-dove, dark-billed cuckoo, mangrove cuckoo, mottled owl, stygian owl, white-collared swift, green violet-ear, green-breasted mango, white-eared hummingbird, elegant trogon, social flycatcher, sulphur-bellied flycatcher, fork-tailed flycatcher, rose-throated becard, masked tityra, yellow-green vireo, black-whiskered vireo, gray-breasted martin, orange-billed nightingale-thrush, white-throated robin, rufous-backed robin, black catbird, gray silky-flycatcher, mangrove yellow warbler, gray-crowned yellowthroat, golden-crowned warbler, rufous-capped warbler, yellow-faced grassquit, crimson-collared grosbeak, blue bunting, and Fuertes orchard oriole.

5.8.3 Herpetiles

More than 200 species of reptiles and amphibians occur in Texas and the habitats composing the Tamaulipan Brushland region typically support 19 species of reptiles (see Attachment D for a more complete list of herpetile species in the LRGV). During late summer and fall field surveys, eight species of reptiles and five species of amphibians were recorded. Uplands provided habitat for reptiles, including the the blue spiny lizard, Laredo striped whiptail, prairie racerunner, and rarely the Texas horned lizard. The Texas spiny softshell turtle and Rio Grande cooter occurred in ponds and flowing water. Mesic and aquatic habitats also supported the amphibian species Rio Grande leopard frog, Rio Grande chirping frog, Mexican treefrog, Gulf Coast toad, and the giant (marine) toad (Attachment D).

5.8.4 Invertebrates

With more than 300 species of butterflies recorded within the LRGV, this region supports the most diverse butterfly fauna known in the United States (see

Attachment D for lists of butterflies, dragonflies, and damselflies). Peak diversity occurs between October and December. Unique and rare species include the pink-spotted swallowtail, pearly-gray hairstreak, green-backed ruby eye, four-spotted sailor, and telea hairstreak. Adult nectar sources including aster, heliotrope, and anacua that flower in the summer to fall seasons are common within the LRGV, along with ground cover species including Texas frog fruit, stonecrop, and the vines or lianas old man's beard, climbing milkweed, and morning glory; these plant species represent important food sources for caterpillars.

5.9 Prehistoric Humans, Spanish Settlement, and Current Land Conservation

Prior to European exploration and settlement in South Texas, the Coahuiltecas and other Indian tribes practiced a hunting/gathering culture within the Rio Grande floodplain and its adjacent uplands (USFWS 2001). The floodplain habitat was likely densely forested with palmetto, sabal palm, sugarberry, Texas ebony, and anaqua trees. The Rio Grande carried larger volumes of water more consistently and was subject to seasonal and periodic overbank flooding that distributed sediments and nutrients across the floodplain. The adjacent uplands were thought to be mixtures of thornscrub and extensive grasslands or prairies.

Some of the first documentation and description of wildlife habitat in South Texas was recorded by early Spanish explorers in the mid to late 1600s. Grasslands apparently dominated the landscape with woody plants (trees and shrubs) present in thickets, on upland sites, in major drainages, and along river bottoms. Honey mesquite was common throughout South Texas, but evidently occurred at much lower densities than presently. Natural fires were an environmental driver that helped to maintain much of the regional wildlife habitat as a savannah, because woody plant densities were controlled by periodic burns.

In 1749, Spanish colonists became established in the Rio Grande Valley under the leadership of José de Escandón who founded the first settlement, Camargo. The Spanish settlers introduced domestic herd animals, e.g., cattle, horses, goats, sheep, and pigs, and they began to clear, plow, and cultivate agricultural plots and small fields within the floodplain. As a result, native humans and sensitive wildlife species, including the bear and jaguar, dispersed to other habitats or were killed by settlers. Soon afterward, the Spanish government awarded land grants for homesteading in the region of South Texas. Interestingly, these grants today play a key role in the USFWS and conservation group efforts to preserve and restore a natural wildlife corridor. The agencies and private organizations/groups on both sides of the international border work together to conserve both a wildlife and heritage corridor centered on the lower Rio Grande.

Additional European settlers arrived in large numbers in South Texas between 1820–1870, resulting in nearly immediate changes in the landscape and

associated plant communities/wildlife habitat. Former grasslands were invaded by species of shrubs or brush, which appeared to intensify more rapidly near centers of populated areas than elsewhere (likely a result of livestock concentration near the towns). Shrub invasion occurred less on larger cattle ranches in the early years of settlement because cattle could move across the open range. However, the invention and introduction of barbed wire resulted in fencing the landscape, thus controlling livestock grazing and distribution, and resulting in overgrazing and shrub invasion of prairies and savannahs.

Following the U.S. annex of the State of Texas in 1845, American steamships sailed the waters of the Lower Rio Grande to trade with and among the small communities. Railroads and steam locomotives replaced steamships as the principal purveyor of transportation, goods, and services in the early 1900s. Additionally, farmers created mechanized irrigation techniques, which increased crop yields and farmed acreages, but also initiated high demand of Rio Grande flows. Falcon Dam, an irrigation structure on the mainstem Rio Grande, was completed in 1953 to provide additional water for farm fields and citrus orchards. The dam resulted in inundating riverine forests and historic towns under the permanent pool.

Conservation of Rio Grande Valley floodplain habitats has become a focus in recent decades. For example, generations of the Yturria and Garcia families were raised on Spanish land grant lands along the Rio Grande since the 1850s. They desired that these land grants become perpetually part of a managed and protected ecosystem, rather than becoming divided and developed. This desire led to a significant conservation acquisition; in 1999 the Yturria and Garcia families and several smaller landowners signed agreements with the USFWS to purchase thousands of Rio Grande floodplain habitat acres that provide important if not critical links in the regional wildlife corridor. These lands are now part of more than 90,000 acres managed as the LRGVNWR, established in 1979 to connect the remaining tracts of native brush land.

From Falcon Dam to the Gulf of Mexico, the LRGVNWR encompasses portions of the terminal 275 river miles of the Rio Grande. Birds using the Central and Mississippi flyways merge within the southern tip of Texas as do many species of birds from more southern latitudes that reach their extreme northernmost range. Additionally, wildlife habitats resulting from subtropical, temperate, coastal, and desert vegetation influences converge, creating an ideal situation for species diversity. A goal of the USFWS is to increase the size of the refuge to approximately 132,000 acres using land purchases (from willing sellers at fair market value) and conservation easements, primarily. The current 100-plus LRGV tracts complement an existing wildlife corridor, lands managed for the benefit of wildlife by the TPWD, National Audubon Society, The Nature Conservancy, private landowners, and the Santa Ana and Laguna Atascosa NWRs.

5.10 Habitat Monitoring and Management

It is important that land managers understand basic ecological principles of plant succession; plant growth; food chains; and water, mineral, and soil nutritive cycles as they affect range, wildlife, and grazing management. Additionally, the basic needs and preferences of the livestock and wildlife species being managed should be well-researched and documented. It is equally important to manage for a high level of plant succession and quality wildlife habitat using the basic tools of grazing, rest, fire, hunting, animal impact, disturbance, and technology. Management using these principles results in high-quality habitat for wildlife and can result in more stable conditions during stress periods such as droughts and during the winter season.

Quality habitats are the key to sustaining wildlife populations; by monitoring the vegetation and soils wildlife managers can assess the overall health of the habitat or ecosystem. Habitat biologists typically observe several components, including (1) diversity of shrub or brush species, (2) browsing pressure, (3) amount of herbaceous cover, (4) water distribution, (5) stocking rates and grazing systems for livestock, (6) deer and other large mammal density, and (7) the use of supplemental forage when assessing wildlife habitats. Low-quality wildlife habitats generally lack good shrub or brush diversity, have sparse grass and forb cover, and the shrubs often have a hedged appearance or browse line. Healthy wildlife habitats are characterized by moderate to high plant species diversity, vegetation structural diversity (grasses and forbs, low-growing shrubs, trees), and moderate to high ground cover.

Wildlife biologists and private landowners implement habitat enhancement techniques or management tools to mimic some of the natural processes that probably occurred prior to European settlement in South Texas. Important to managing natural resources is to use a holistic approach, where several techniques are typically applied to develop and maintain healthy ecosystems. Single species typically deserve less attention, while the system in which they occur requires more attention. During the late 1940s, Aldo Leopold expressed five basic wildlife habitat management tools, axe, cow, plow, fire, and gun, that if used properly in combination would enhance or possibly restore habitats and key species indigenous to the South Texas Brush Country.

The following management observations and points relative to wildlife habitat management tools were provided by TPWD:

- (1) American bison ranged through the area prior to European settlement.
 - a. Large American bison herds moved constantly allowing grazed vegetation to recover.
 - b. The hooves disturbed the soil crust providing bare soil that supported annual forbs and grasses providing forage for herbivores (deer and pronghorn) and granivores (dove and quail).

- c. Cattle can be grazed to mimic American bison herd movement.
- (2) Livestock grazing role in wildlife management is primarily to reduce cover of dense grass monocultures, disturb the soil surface, expose soil to sunlight, and encourage a diversity of forbs and grasses.
- a. Grazing process creates vegetation/habitat structural diversity supporting nesting, brood-rearing, and escape cover.
 - b. Successful grazing management requires stocking rates balanced with available forage.
 - c. Ensure that cattle graze grass species but are moved prior to significant consumption of forbs and browse typically used by wildlife.
 - d. Use rotational grazing that defers pastures to allow recovery (high intensity – low frequency model is most versatile in South Texas).
- (3) Brush management or brush sculpturing intersperses cleared areas within dense shrub stands.
- a. Cleared sites support forb regrowth and production of new browse, while retaining a mosaic of woody cover for hiding and escape, nesting, or protection from wind, rain, and other weather.
 - b. Plant species diversity is higher within a habitat mosaic.
 - c. Method of brush management should improve wildlife habitat and forage supply, i.e., use aeration rather than root-plowing.
 - d. Allow drainages and sensitive habitats/soils to remain intact and buffer them during brush management programs.
 - e. Highly erodible soils and steep topography should not be disturbed.
 - f. Adequate funding should be available to complete the project and to provide site monitoring per the program goals and objectives.
 - g. Always consider prior mechanical treatments applied onsite.
 - h. Plan monitoring and periodic maintenance of treated sites.
- (4) A combination of mechanical treatments (fire, roller-chopping, aeration, disking) are typically used to disturb soils with a goal of increasing water retention, reducing competition from woody vegetation deemed undesirable, and returning the habitat to an early-succession growth stage.
- a. New vegetation growth has increased nutritional value, higher forage production rates, and is more palatable for wildlife.
 - b. Prescribed fire fixes soil nitrogen, suppresses woody species, results in forb establishment (effects depend on timing and severity).
 - c. Prescribed fires can be cool (seldom harm mature trees) or hot (can top-kill mature trees).

- d. Burning schedule during late winter/early spring is most productive for wildlife habitat benefits, planning depends on humidity, wind, and fuel moisture.
- e. Conduct brush removal in strip or mosaic patterns based on topography onsite so that wildlife nesting and escape cover values are met.
- f. Shallow soil disturbance to 6 inches deep suppresses nonnative grasses and increases forage quality, forage quantity, nutrient cycling, moisture infiltration into soil; and allows light penetration to soil surface to enhance forb and browse production.
- g. Soil disturbance exposes the seed bank and results in germination of viable seeds.
- h. Fallow disking encourages growth of forbs, land reseeds from existing soil seed bank (without introducing seeds), and practice commonly results in sunflower, ragweed, and croton establishment.
- i. The fallow disking method can be used to establish wildlife food plots to supplement diets in late winter and early spring by reseeding disturbed soil with a native seed mix.

5.11 Habitat Restoration

A large nursery operation has become operational within Santa Ana NWR and it provides for all aspects of landscape restoration from seed collecting to planting seedlings on the various tracts of the LRGV. Several former agricultural fields that received restoration plantings and other treatments occur within the project corridor and were visited and sampled during field surveys. They ranged from recently planted/treated sites to sites that had recovered from 10 to 15 years. The more mature sites supported trees and tall shrubs of honey mesquite, huisache, Texas ebony, and tepeguahue that exceeded 5 m tall and were providing ground cover and producing seed. However, the understory was often dense stands of nonnative buffelgrass or switchgrass (observed within the Los Ebanos tract, among others) that could carry a very hot fire that would kill small shrubs and trees if burned. Fire appeared to be a management tool used to restore the health of Mexican sabal palm woodlands within the Bascaje de la Palma tract.

5.12 Urban Wildlife Habitat

More than 80% of the Texas population resides in urban areas and the six largest cities together total more than 30% of the state's population. In South Texas towns and cities, the top three sounds that people prefer are natural sounds, including birds singing, wind in the trees, and gently moving water. The least-preferred sounds include urban noise such as vehicle traffic, emergency and enforcement sirens, and automobile backfires or gunfire. As Texas becomes

increasingly urban, the need for nature in towns and cities becomes more important for human health. Habitat fragmentation, habitat alteration, noise, human presence, domestic pets, and the general process of urbanization are major issues facing wildlife populations and individuals in urban areas.

Many people in South Texas society often seek contact with nature and they benefit psychologically and financially from those positive experiences. For example, proximity to natural open space increases property values. A few studies have concluded that injured humans heal faster when natural views occur outside their hospital window. Employee satisfaction has been demonstrated to improve when natural open space is created for daily access on corporate properties. Three programs have been initiated by TPWD to provide guidance and support to Texas urban citizens, they are (1) Texas Master Naturalist Program in South Texas, (2) Texas Wildscapes Program in South Texas, and (3) Wildlife Education Programs.

To assist Texas cities to enhance the livability of urban environments, the TPWD has also assigned wildlife biologists to work in each of the largest urban areas. The duties of urban wildlife biologists include providing opportunities for urban residents to reconnect with natural or semi-natural systems, presenting educational programs for urbanites on a variety of habitat/wildlife issues, serving as technical advisors on multi-agency conservation planning initiatives, and assisting landowners with habitat restoration or enhancement projects. The South Texas Wildlife District of TPWD employs three urban wildlife biologists, one stationed in the Rio Grande Valley and two that reside in San Antonio (USFWS 2007 and TPWD 2007).

6. RARE SPECIES DATA

To ensure the most recent data were acquired for rare species analyses, e²M requested Element Occurrence Data from NatureServe Central Databases in Arlington, Virginia, through a referral from the USFWS (NatureServe 2007a). The data fields requested and geographic scope of this request were as follows:

1. Location and habitat data for endangered, threatened, and candidate species provided in list form by the USFWS and supplemented with online information from the TPWD and information from the NatureServe database.
2. The USFWS requested that all rare species occurring within 25 miles of the international border with Mexico be considered in this data search. Data were therefore requested for the South Texas counties of Brewster, Cameron, Culberson, Dimmitt, Edwards, El Paso, Hidalgo, Hudspeth, Jeff Davis, Jim Hogg, Kinney, Maverick, Pecos, Presidio, Starr, Terrell, Val Verde, Webb, Willacy, Zapata, and Zavala.
3. Data were requested to be delivered electronically in the form of Geographical Information System (GIS) layers depicting population polygons or point locations and Excel tables for species lists/tabular data and narratives of habitat and natural history information.

To protect sensitive data, a license agreement (LA) between NatureServe and e²M was signed in 2007 (NatureServe 2007b). Data covered under the LA reside in a Multi-Jurisdictional Dataset (MJD), which includes all precise species location data for species that are federally listed (listed endangered, listed threatened, or candidate) or are listed under the State of Texas endangered species legislation. Additionally, the license agreement describes a 25-mile occurrence corridor north of the international border between the United States and Mexico as the licensed dataset for this project. Data and text fields delivered by NatureServe under the LA included life history, threats, trends and management recommendations, classification status, confidence extent, county name, element information, U.S. Federal Information Processing Standard code, first observation date, global information, habitat types for animals, observation dates, location information, subnational information, survey information, and species status information (NatureServe 2007b).

The LA provides the following guidelines which stipulate external use of the data:

1. "Named" Locations: species names linked with locations cannot be displayed at a scale of less than 1:100,000 or the precise species location must be randomized within a USGS topographic quadrangle.
2. "Blind" Locations: when species names are not linked with locations, specific locations can be displayed, except when the species records are

flagged “sensitive” or if they can be identified easily by geographic attributes at a particular location.

3. Exceptions: the only allowable exception to the guidelines occurs when data are obtained from a source independent from NatureServe and the member programs.

7. PROJECT DATABASE AND INTERACTIVE GIS

A Microsoft Access database was developed to serve as a centralized storage system for data collected during biological field surveys. The database data entry form closely mimics the field form utilized to record ecological information within the project corridor (Attachment A).

During field surveys, UTM coordinates were collected with Global Positioning System (GPS) receivers to locate observation points, photodocumentation points, and wetlands. The GPS data were post-processed and incorporated into feature classes for use in a GIS. Additional data collected in the field were manually entered into the MS Access database.

The information stored in the database was also linked to an interactive GIS. The interactive file, or published map document, can be viewed with ESRI's ArcReader. The datasets collected and included in the published map are biological survey areas, observation points, NWI wetlands, e²M delineated wetlands, plant communities, wildlife habitats, wildlife areas and refuges, land use, and aerial photography. The observation points are interactively hyperlinked with ground photographs acquired in the field.

8. LIST OF PREPARERS

Domenick Alario

B.A. Geography
Years of Experience: 2

David Boyes, REM, CHMM

B.S. Applied Biology
M.S. Natural Resources
Years of Experience: 31

Carol Bush

B.S. Biology
M.S. Crop Science
Years of Experience: 29

Brent Eastty

B.S. Biology
Years of Experience: 6

Stuart Gottlieb

B.A. Geography
GIS Professional Certificate
Years of Experience: 5

Shawn Gravatt

B.S. Earth Science and Geography
M.S. Environmental Studies
Years of Experience: 10

Brian Hoppy

B.S. Biology
Certified Environmental Manager
Years of Experience: 18

Dusty Janeke

B.S. Zoo Science
M.S. Biology
Years of Experience: 8

Gena Jannsen

B.S. Geography
M.S. Biology
Years of Experience: 17

Ronald E. Lamb

B.A. Political Science
M.S. Environmental Science
M.A. Political Science/International
Economics
Years of Experience: 22

Steve Pyle, J.D.

B.S. Natural Resource Management
J.D. with Certificate in Environmental
Law
Years of Experience: 11

Cheryl Schmidt, Ph.D.

B.S. Biology
M.S. Biology
Ph.D. Biology
Years of Experience: 22

Sue Sill , Ph.D.

B.S. Biology
Ph.D. Botany
Years of Experience: 24

Sarah Spratlen

B.S. Biology
M.S. Engineering
Years of Experience: 5

Karen Stackpole

B.S. Biology
M.S. Environmental Science and
Education
Years of Experience: 9

Tom Patterson, Ph.D.

Ph.D. Botany
Years of Experience: 30

Jim Von Loh

B.S. Biology
M.S. Biology
Years of Experience: 32

Lauri Watson

B.S. Environmental Science
Years of Experience: 5

Valerie Whalon

B.S. Marine Science
M.S. Fisheries Science
Years of Experience: 12

THIS PAGE INTENTIONALLY LEFT BLANK

9. REFERENCES

- Bailey 1995 Bailey, Robert F. 1995. Ecoregions of the United States. U.S. Forest Service. Available online: <<http://www.fs.fed.us/colorimagemap/images/300.html>>. Accessed 23 February 2008.
- Larkin and Bomar 1983 Larkin, Thomas J. and George W. Bomar. 1983. Climatic Atlas of Texas. Texas Department of Water Resources. Austin, TX.
- NatureServe 2007a NatureServe Explorer. 2007. Ecological System Comprehensive Reports. Available online: <<http://www.natureserve.org/explorer/>>. Accessed 23 February 2008.
- NatureServe 2007b NatureServe. 2007. License Agreement between NatureServe and engineering-environmental Management, Incorporated. Arlington, VA and Englewood, CO.
- NatureServe 2008 NatureServe Explorer. 2008. Ecological System Comprehensive Reports, Updates. Available online: <<http://www.natureserve.org/explorer/>>.
- Patterson 2008 Patterson, Thomas, Ph.D. 2008. Biology Department Faculty and Staff South Texas College. Personal Communication with J. Von Loh (e²M). South Texas College. McAllen, TX.
- TDA 2008 Texas Department of Agriculture. 2008. Texas Agriculture Code: Title 4, Part 1, Chapter 19, Subchapter T – Noxious and Invasive Plants. Available online: <<http://tlo2.tlc.state.tx.us/statutes/ag.toc.htm>>. Accessed 23. February 2008.
- TIO 2007 Texasinvasives.org. 2007. *Plant Database*. Available online: <http://www.texasinvasives.org/Invasives_Database/Invasives.html>. Accessed 23 February 2007.
- TPWD 2008 Texas Parks and Wildlife Department. 2008. Natural Diversity Database. Wildlife Diversity Program, Dorinda Scott, Manager. Austin. TX.
- TPWD 2007 Texas Parks and Wildlife Division. 2008. South Texas Wildlife Management. Available online: <www.tpwd.state.tx.us/landwater/land/habitats/southtx_plain>. Accessed 23 February 2008.

- USDA NRCS 2007 U.S. Department of Agriculture, Natural Resources Conservation Service. 2007. PLANTS Database. Available online <<http://plants.usda.gov/>>.
- USFWS 1988 U.S. Department of the Interior, Fish and Wildlife Service. 1988. Tamaulipan Brushland of the Lower Rio Grande Valley of South Texas: Description, Human Impacts, and Management Options. Biological Report 88(36). S. E. Jahradoerfer and D. M. Leslie, Jr. Washington, D.C.
- USFWS 2001 U.S. Department of the Interior, Fish and Wildlife Service. 2001. Lower Rio Grande National Wildlife Refuge. Available online: <<http://www.fws.gov/southwest/refuges/texas/lrgv.html>>. Accessed 24 February 2008.
- USFWS 2002 U. S. Department of the Interior, Fish and Wildlife Service. 2002. 50 CFR 10.13, List of Migratory Birds. Available online: <<http://www.fws.gov/info/>>. Accessed 24 February 2008.
- USFWS 2007 Lower Rio Grande Valley National Wildlife Refuge. Available online: <www.fws.gov/southwest/refuges/texas/lrgv.html>. Accessed 23 February 2008.

ATTACHMENT A
BIOLOGICAL SURVEY
OBSERVATION POINT FORM AND INSTRUCTION MANUAL

OBSERVATION SURVEY FORM

SURVEY AND SITE INFORMATION

Point Code: TX ___ ___ Quad name: _____ BPU Code: _____ Aerial Photo #: _____			
Type of Observation (Please Circle One): VEG/OBS OTHER (Specify) _____			
Site Name _____			
Survey Date _____		Surveyors _____	
Size of Area: _____			
GPS file name _____		Field UTM X _____ m E	
		Field UTM Y _____ m N	
<input type="checkbox"/> Coordinates from USGS Quad Map (if checked enter coordinates under GPS comments)			
Datum NAD 83 Zone: _____		GPS Unit: _____ PDOP: _____	
		3D Differential? Y / N	
GPS Comments: _____		Error: +/- _____ m	
Camera Name and Model: _____			
Roll #	Frame #	Photographer	Direction/Comments

ENVIRONMENTAL DESCRIPTION

Elevation _____ m /ft From: GPS / Map (circle one)		Slope _____ Aspect _____	
Topographic Position: _____			
Landform: _____		Geology: _____	
Cowardin System <input type="checkbox"/> Upland <input type="checkbox"/> Palustrine		Hydrology <input type="checkbox"/> Permanently Flooded <input type="checkbox"/> Unknown <input type="checkbox"/> Seasonally Flooded <input type="checkbox"/> Saturated <input type="checkbox"/> Intermittently Flooded	
Environmental Comments: _____			
Unvegetated Surface: (please use cover scale below)			
<input type="checkbox"/> Bare soil	<input type="checkbox"/> Small rocks (0.2-10cm)	<input type="checkbox"/> Wood (>1cm)	<input type="checkbox"/> Other (describe) _____
<input type="checkbox"/> Bedrock	<input type="checkbox"/> Large rocks (>10cm)	<input type="checkbox"/> Litter / duff	
	<input type="checkbox"/> Sand (0.1-2mm)		

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum) Trees and Shrubs <input type="checkbox"/> Evergreen <input type="checkbox"/> Cold-deciduous <input type="checkbox"/> Mixed evergreen-cold-deciduous Herbs <input type="checkbox"/> Annual <input type="checkbox"/> Perennial	Leaf Type (of dominant stratum) <input type="checkbox"/> Broad-leaved <input type="checkbox"/> Needle-leaved <input type="checkbox"/> Microphyllous <input type="checkbox"/> Graminoid <input type="checkbox"/> Forb <input type="checkbox"/> Pteridophyte <input type="checkbox"/> Non-vascular <input type="checkbox"/> Mixed (describe)	Physiognomic Class <input type="checkbox"/> Forest <input type="checkbox"/> Woodland <input type="checkbox"/> Shrubland <input type="checkbox"/> Wooded Shrubland <input type="checkbox"/> Dwarf Shrubland <input type="checkbox"/> Shrub Herbaceous <input type="checkbox"/> Herbaceous <input type="checkbox"/> Nonvascular <input type="checkbox"/> Sparsely Vegetated <input type="checkbox"/> Wooded herbaceous	Cover scale for strata and unvegetated surfaces: 01 = 0 – 10% 02 = 10 – 25% 03 = 25 – 60% 04 = 60 – 100%
---	---	--	---

OBSERVATION SURVEY FORM

Provisional Community Name: _____ Plot Code: TX _ _ _

	Stratum Height Class	Stratum Cover Class	Dominant Species (mark Diagnostic species with *)	% Cover
T1 Emergent	_____	_____	_____	_____
			_____	_____
			_____	_____
T2 Canopy	_____	_____	_____	_____
			_____	_____
			_____	_____
T3 Sub-canopy	_____	_____	_____	_____
			_____	_____
			_____	_____
S1 Tall shrub (> 2 m)	_____	_____	_____	_____
			_____	_____
			_____	_____
S2 Short Shrub (< 2 m)	_____	_____	_____	_____
			_____	_____
			_____	_____
S3 Dwarf Shrub (< 0.5 m)	_____	_____	_____	_____
			_____	_____
			_____	_____
H Herbaceous	_____	_____	_____	_____
			_____	_____
			_____	_____
			_____	_____
N Non-vascular	_____	_____	_____	_____
			_____	_____
			_____	_____

Height Scale for strata: 01 = < 0.5 m 06 = 10-15m 02 = 0.5-1 m 07 = 15-20m 03 = 1-2 m 08 = 20-35 m 04 = 2-5 m 09 = 35-50 m 05 = 5-10 m 10 = >50 m	Cover scale for strata and unvegetated surfaces: 01 = 0 - 10% 02 = 10 - 25% 03 = 25 - 60% 04 = 60 - 100%
--	---

Vegetation Characterization in Texas OBSERVATION POINT MANUAL - 2007

This document is intended to assist you in collecting observation point data in Texas during the 2007 field season. Detailed, field-by-field instructions for data collection are provided.

VEGETATION DATA COLLECTION INSTRUCTIONS

LOCATING AN OBSERVATION POINT

You will locate sampling points based on homogenous or unique aerial photo signatures and by using site maps, topographic maps, handheld GPS receivers, and/or aerial photos.

- Topography (Topo) maps are useful in identifying the landscape through which you will be navigating, and in determining the elevation of a site.
- Aerial photos aid in navigating through the landscape, and are essential in determining where to sample to inform photo-interpreters (this will be explained in more detail). **Please** record the vegetation, and its condition, that you walk through and sample on the photo or accompanying digital orthophoto. Feel free to write comments regarding unique features as well.

Along the way... look around. Context is everything – you will have a much better sense of how your sample sites represent the landscape if you are always in analysis mode. Keep in mind that the goal of this field work and field work being conducted for vegetation classification is to sample **all** the different vegetation and geologic types that occur at the site.

Special Features... in the process of locating observation points you will encounter unique features or vegetative stands too small to sample, record their coordinates using the GPS receiver and note them on aerial photos and maps. These UTM coordinates may be added to the final production map as “Special Features. Locations of significant weed occurrences (highly invasive species that pose a big threat) and large areas of infestation may also be documented as they may represent a “semi-natural” vegetation type.

OBSERVATION POINT FORM INSTRUCTIONS – 2007

The primary role of Observation Point forms is to inform aerial photo interpretation; a secondary role is to help fill out plant association descriptions and provide distribution information for writing local descriptions of plant associations. They are representative of large and homogenous aerial photo signatures, unusual signatures, confusing signatures, and signatures that are slightly different due to shifts in dominant/understory species composition. The same vegetation type should be sampled where it occurs on different geology, where slope aspect leads to changes in density, and where effects due to fire, landslide, etc. have occurred.

• IDENTIFIERS / LOCATORS SECTION

Observation Point Code

This is a unique identifier you give each sample plot using the format “TX.XXX”. **Please record the observation point code on both sides of the form in the provided field.**

Quad Name

Record the **full name** of the 7.5-minute quadrangle, such as “The Knoll”.

Aerial Photo Number

The photo number is in the upper right hand corner of the photo in the format FLIGHTLINE-FRAME #. Record this number on the form. Locate your observation point on the Mylar overlay of the photo, and mark your location with a dot in a circle and the observation point number. *Again, please draw and comment on the photo overlay regarding the vegetation of the plot and the surroundings.*

County

This field will be completed in the office as part of processing the GPS data.

State

TX

Site Name

This is best determined from a topographic or site map. Select a nearby feature that is an obvious waypoint, such as the name of a canyon, lava flow, etc. This name does not need to be unique. If you sample a number of observation points in a small area, you can use the same site name for all of them.

Survey Date

Date the plot was sampled. Please use this format: Month - Day - Year.

Surveyors

List the last names of the field team members present.

GPS File Name - this is the name you give to the waypoint when you mark the observation point location in your GPS receiver. When logging an observation point, the file name would be "TX" and the number (e.g., TX101 for point #101). Mark the aerial photo with a dot with a circle around it and the observation point number, "TX101.

Datum

ALWAYS check datum settings on your GPS unit at the beginning of each day. It should **always** be NAD83. This information is **CRITICAL** for correctly applying your waypoints to the final vegetation map. If it is anything other than NAD83, **please, please, please** record this on the form. This step will keep your work from being wasted.

UTM Zone

This value is recorded from the GPS unit read-out.

Field UTM X, Field UTM Y

Record the UTM easting and northing you saved as a waypoint in your GPS receiver. Please double-check to make sure that the easting is six digits and the northing is seven digits. If recorded incorrectly, your plot will show up in Venezuela or the middle of Wyoming.

In mountainous or deep canyon country it is often difficult to obtain UTM coordinates from a GPS receiver (your unit has to be able to receive at least three or four satellites). If you are unable to obtain UTM coordinates in the observation point, or if the PDOP is greater than 8 (or EPE is greater than $\pm 50\text{m}$), first try to acquire a signal from a higher point outside (but still close to) the site. If that fails, you will need to estimate the UTM coordinates from the topo map, and manually enter these UTM's into the GPS unit.

Use a map which is in NAD83 if at all possible, since the project standard is the NAD83 datum. However, you may need to use USGS 7.5 minute maps, which use the NAD27 datum, note this.

GPS Unit:

Record the name and model of the GPS receiver being used to record data for the observation point. If a GPS unit was not used to determine UTM's record 'none' here and be sure to complete the 'GPS Comments' field below.

GPS Error

Note the PDOP (or "Estimated Position Error" (EPE), if you're using a Garmin unit) displayed on your GPS unit. The lower the number, the more accurate your reading.

3D Differential?

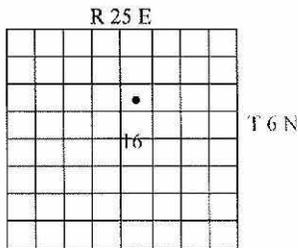
Circle Y or N accordingly. 3D differential is obtained when your GPS unit can "see" a satellite that does nothing but correct the tiny errors in the positioning or clocks of other GPS satellites. This satellite broadcasts a real-time differential correction so that your location coordinates are as accurate as possible. It is in geosynchronous orbit in the southern sky, so if you can see the southern sky, you will generally be able to obtain 3D differential. This system is known as the Wide-Area Augmentation System, or WAAS. The Garmin and Trimble units have a field in their setup pages for turning WAAS on or off. Please make sure that WAAS is always on.

GPS Comments:

VERY IMPORTANT: If you resorted to estimating the observation point location UTM's on the topo map, note that in this field. If you're usual GPS croaked and you had to borrow an old Magellan from a friend, note that. Also, if you left the site to obtain a reading from a high point, record that here, along with the compass bearing and distance of the GPS location from the observation point site (unless you used the offset function on the Trimble GeoXM- in that case, enter "point offset.")

Directions to Observation Point

Give precise directions to the observation point beginning with a landmark (e.g., a named point on the topo map, a major highway, marked trailhead) readily locatable on a 7.5 minute topo map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances and use compass directions. Be aware of the ambiguity of words like "above", "near", "beyond", "on the back side of", "past". Again, using the GPS unit to give distances can be very helpful. If observation point locations lack major landmark features as guides, use township, range and sections from the topo maps. If there are no features within a reasonable distance of your site and writing directions is taking an inordinately long time, you can use a TRS description to the nearest quarter-quarter-quarter section. The TRS for the plot in the section below is "NW4SW4NE4 Sec. 16, T 6 N, R 25 E".



Photos Taken?

Circle Y or N accordingly for observation point photos.

Camera Name and Model

Circle or enter the name and model of your camera

Photos: Type/Roll Number/Frame Number/Photographer/Direction and Comments

For each photo taken at the observation point record the following: *Photo type*: indicate whether photo is a 'stand' or 'landscape' photo. *Photo number*: record photo number. *Photographer*: record last name of person taking photograph.

Directions/Comments: record the direction the photos were taken from and towards (eg. SE→NW) and any other comments to clarify contents of the photo (especially landscape/scenery photos).

Taking photographs

Take one representative digital photo of each observation point. The purpose is to obtain a good representation of the vegetation, not individual species. Try to include a little sky (about 10%) for perspective. Use a chalkboard to record the observation point number and the direction the photo is taken. Thus, for observation point 241, the board in the photo taken from the SE edge, facing NW, will read "SDC241, SE→NW". Take the photograph looking across the contour if site occupies a steep slope. In addition, you will need to keep a photograph log for all photos not taken on observation points.

SDC241 SE→NW

• **ENVIRONMENTAL DESCRIPTION SECTION**

Elevation

Take this measurement from the GPS receiver, in meters. Specify on the data sheet whether the measurement is in feet or meters, and whether your elevation source was the GPS unit or the topo map.

Slope

Measure the slope in degrees using a clinometer. The degree scale is the left-hand scale as you look through the clinometer. If the slope varies, estimate an average. If the observation point is on rolling microtopography, enter "variable." Describe these further under the Environmental Comments section.

Aspect

Measure the site aspect in degrees using a compass (set for local magnetic declination). If the slope is flat, enter "n/a" for aspect. If the site wraps around different aspects on a slope, enter "variable" and describe further under the Environmental Comments section.

Topographic Position

This is the position of the observation point on its related landform. Determining this requires you to think of the landform in cross-section, which is roughly diagramed below. You **must** use the terms listed below:

Interfluvium (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two drainages that sheds water to the drainages.

High slope (shoulder slope, upper slope, convex creep slope). The uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.

High level (mesa, summit). Level top of a plateau.

Midslope (transportational midslope). Intermediate slope position.

Backslope (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments.

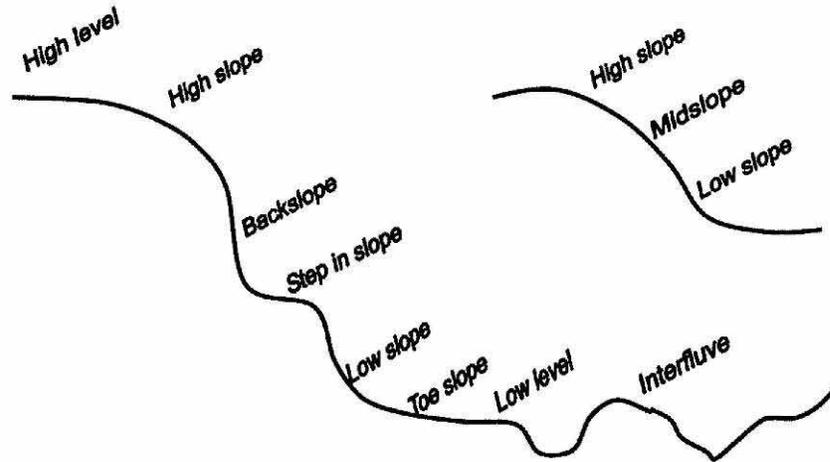
Step in slope (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.

Lowslope (lower slope, foot slope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope, and toeslope.

Toeslope (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, usually gentle, linear and characterized by alluvial deposition.

Low level (terrace). Valley floor or shoreline representing the former position of an alluvial plain, or lake.

TOPOGRAPHIC POSITION



Landform

Enter the landform(s) that describes the site where the plot was sampled. Referring to the topo map for the landscape context may help you decide what landform(s) to choose. Note that the landform choices may describe different scales, or that a landform feature can be described by more than one term. For example, your plot may be on a ledge on the rim of a canyon. A suggested list of landforms and definitions is provided in **APPENDIX 1**.

Note: The topographic position selected above should relate to the scale of the landform chosen here.

Surficial Geology

Note the geologic substrate where the plant community occurs. The geology map should help, but if you can't tell the geology at all or you do not have the geology map with you at the plot, put a general description (e.g., coarse sandstone, green shale, aeolian sands, or obscured by soils).

Cowardin System

The majority of the plots you'll be conducting will be "Uplands". Any wetland plots will be in the Palustrine category. This includes riparian stands. They are all fed by groundwater and support vascular plant communities.

Palustrine: All nontidal wetlands dominated by trees, shrubs, persistent emergent species, emergent mosses, or lichens. This category also includes wetlands lacking such vegetation but with all of the following characteristics: (1) area less than 8 ha; (2) lacking an active wave-formed or bedrock boundary; (3) water depth in the deepest part of the basin less than 2 m (6.6 ft) at low water; and (4) ocean-derived salinities less than 0.5 parts per thousand.

Hydrology

This field will mostly be completed if you are in a wetland, however, some areas considered uplands may be subject to intermittent flooding. Select from the following definitions (from Cowardin et al. 1979):

Permanently flooded. Water covers the land surface at all times of the year in all years.

Semipermanently flooded. Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface.

Seasonally flooded. Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface.

Saturated. Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season.

Temporarily flooded. Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes flood-plain wetlands.

Intermittently flooded. Substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rain storms. This modifier was developed for use in the arid West for water regimes of playa lakes, intermittent streams, and dry washes but can be used in other parts of the U.S. where appropriate. This modifier can be applied to both wetland and non-wetland situations.

Unknown. The water regime of the area is not known. The unit is labeled a non-tidal wetland.

Environmental Comments

Enter any additional noteworthy comments on the environmental setting and its effect on the vegetation. Examples include: "stunted trees due to shallow soils", "vegetation only where pockets of soil occur", or "large colluvial boulders and small rocks litter surface of soil". This field can also be used to describe site history such as fire events. This is an extremely important field for crews to document so please take the time to do a thorough job. Information from this field will be used to prepare local descriptions of the plant community and for photo interpretation.

Ground Cover

Estimate the approximate percentage of the *total* surface area covered by each category. The sum of all fields should equal 100%. A helpful hint in making ocular estimates is that in a 0.5-hectare (1.24-acre) observation point, one 7 x 7m square is equal to 1%. The sum of the cover values should equal 100%. *Notes:* Estimating lichens, dark cyanobacteria and moss also take an extra step in visualization. Also note that it is possible to have bare soil and sand in a plot if sand has blown in, or to have sand on the surface of the site. If a category is present but covers less than 1% (> 0.5%) of the ground, enter a "T" on the line next to it. If a category is present but covers a tiny bit (<0.5%) of ground, enter "t".

Animal Use Evidence

Comment on any evidence of use of the site by non-domestic animals (i.e., tracks, scat, burrows, etc.) and domestic animal use (grazing) under the Environmental Comments.

Natural and Anthropogenic Disturbance

Comment on any evidence of natural or anthropogenic disturbance and specify the source, severity and effects on the vegetation. Common disturbances on sites include gullies, colluvial deposition of rocks on slopes flash flooding and sometimes old tin cans from cowboys or miners. Notes on livestock grazing and other disturbances you may encounter in the buffer include off-road vehicle use, fire, and mass-wasting are valuable. Enter disturbance comments under the Environmental Comments

Other Comments

Record any other comments. What is the extent of the community you sampled? Describe the landscape context of the community. Describe the adjacent plant communities and their relationship to the plot. Are there any other landscape features or processes influencing this community? Is there an important species that occurs in the stand but is not within your plot? Is there a large amount of a dead plant material in the plot? Record these under the Environmental Comments field.

Unvegetated Surface

This field is an ocular estimate of ground cover. Because there is no designated sample size for areas surveyed as Observation Points, you will have to estimate percent covers for whatever size the documented area encompasses. For this estimate, you must use the cover classes listed in the bottom right hand corner of the data sheet. If an unvegetated surface category is not present in your observation point area (e.g., water is very uncommon in the sampling units), leave the corresponding line blank.

• **VEGETATION DESCRIPTION SECTION**

Leaf Phenology

Select the best description for the leaf phenology of the **dominant** stratum. The dominant stratum is the tallest stratum that contains at least 10% cover. Leave blank for non-vascular plots.

Evergreen. Greater than 75% of the total woody cover is never without green foliage. (Some tricky examples: most *Artemisia* and all *Chrysothamnus*)

Cold deciduous. Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

Mixed evergreen - cold deciduous. Evergreen and deciduous species are mixed within the type and generally contribute 25-75% of the total woody cover.

Perennial. Herbaceous vegetation composed of more than 50% perennial species.

Annual. Herbaceous vegetation composed of more than 50% annual species.

Leaf Type

Select the best description for the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% total plot coverage. Within that dominant stratum, the species that makes up greater than 50% of cover defines the leaf type.

Broad-leaved. Woody vegetation that is primarily broad-leaved (Sagebrush, oak, California lilac).

Needle-leaved. Woody vegetation that is primarily needle-leaved (Juniper, pine, spruce, fir, hemlock).

Microphyllous. Woody cover that is primarily microphyllous (*Ephedra*).

Graminoid. Herbaceous vegetation composed of more than 50 percent graminoid species (grasses, sedges, rushes, etc).

Forb (broad-leaf-herbaceous). Herbaceous vegetation composed of more than 50% broad-leaf forb species (*Phlox*, *Astragalus*, *Lupinus*, *Thalictrum*, *Erigeron*, etc).

Pteridophyte. Herbaceous vegetation composed of more than 50 percent ferns or fern allies (scouring rushes).

Non-vascular. Dominated by lichens or mosses.

Mixed. As with leaf phenology, the dominant stratum may be composed approximately equally of species with several different leaf types. Describe the mix briefly or circle leaf types that apply.

Physiognomic Class

This represents what you see when you are standing in the plot looking across at the vegetation. The following definitions can be used as guidelines. For example, areas with scattered pines and junipers may not fit the cover classes below but they would best be described as a woodland.

Forest. Trees with their crowns overlapping (generally forming 60-100% cover).

Woodland. Open stands of trees with crowns not usually touching (generally forming 10-60% cover). Canopy tree cover may be less than 10% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively.

Shrubland. Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 10% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation composed of woody vines is included in this class.

Wooded Shrubland

Trees forming approximately equal cover with a shrub component.

Dwarf-shrubland. Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 10% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively.

Shrub Herbaceous. Low or taller shrubs forming approximately equal cover with a grass or forb component. Individuals or clumps of shrubs generally not touching and usually forming more than 25% cover; trees less than 10% cover. Spaces between shrubs are generally mostly occupied by grasses and/or forbs.

Wooded Herbaceous. Trees forming approximately equal cover with a grass or forb component.

Herbaceous. Perennial herbs (graminoids or forbs) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 10% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively.

Nonvascular. Nonvascular cover (bryophytes, lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular perennial vegetation cover may be less than 25%, as long as it exceeds tree, shrub, dwarf-shrub, and herb cover.

Sparsely Vegetated. Abiotic substrate features dominant. Perennial vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources. Total vegetation cover is typically less than 10% and greater than 2%. Badlands, ash fields, lava beds, or sand dunes supporting communities of annual plants should be included in this category, regardless of cover.

Provisional Community Name

Record the dominant species names creating the association which most closely resembles your observation point. Devise the name based on: (1) the dominant species of the dominant strata (including nonvascular) and (2) indicate the physiognomic class (this must match the physiognomic class checked on the back side of the datasheet). For example, if you are in a P-J woodland with only scattered shrubs but a really nice galleta grass layer, you would use a provisional name like "*Pinus edulis* – *Juniperus osteosperma* / *Pleuraphis jamesii* Woodland". The provisional name is also a great help to the ecologists who will be using your work to construct a classification. Note: this field should be completed only after the entire plot is completed.

• DOMINANT PLANT SPECIES LIST

Species/Strata Data. The form has been developed for recording information on *species* composition and cover and *strata* cover and height. Species lists (diagnostic species) and cover estimates should be completed first; then cover class and height class estimates for strata should be recorded. Write out the complete species name. The main body of the table is dedicated to recording species names and associated cover estimates. To begin, the observer needs to make a species list for the diagnostic species in the stand and assign each species to the appropriate stratum. The next section provides a brief discussion on assigning species to the appropriate strata, followed by instructions for completing the species level information.

Stratum: Species names will be recorded within the appropriate stratum. It is important that all crew members are consistent in assignment of species to strata throughout this project. Following are some guidelines to use in determining strata. Begin by assessing the strata at your site. Trees are defined as single-stemmed woody plants, generally 5 m in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions.

T1 Emergent, T2 Canopy, T3 Subcanopy. A uniform stand of pine or hemlock trees would be a good example of T2 "canopy", but where trees are absent you would begin with the shrubs, or herbaceous species if no shrubs are present. If the tree crowns in your plot are mostly touching and similar in height, but a given tree species is much taller than species would be a T1 "emergent." Occasionally, you will sample an area where there may be several tall, scattered pines and then shorter scattered junipers. In this case, the pines would be your "canopy" and the junipers would be the "subcanopy". You may also have pines listed in the "subcanopy" layer, if there are a number of short saplings in addition to mature tall trees.

The remaining vegetative strata are (remember to check with plant list for consistency):

S1 Tall Shrub. >2 meters tall. For example, *Sambucus racemosa*, *Amelanchier utahensis*, and *Cercocarpus ledifolius*.

S2 Short Shrub. <2 meters tall. For example, *Artemisia tridentata*, all *Symphoricarpos* spp.

S3 Dwarf Shrub. <0.5 meters tall. For example, *Artemisia arbuscula*.

H1 Graminoid. All grass species, including *Carex* spp. and *Juncus* spp.

H2 Forb. All forbs. (*Typha* is a forb.)

H3 Fern or Fern Ally. All ferns, including *Equisetum laevigatum*.

H4 Tree Seedlings. Seedlings are trees with vertical stems less than 1.5 m tall, but that may vary by species.

N Nonvascular. This is mainly mosses and lichens.

V Vine/liana. All vine species.

E Epiphyte. All epiphytic species.

Height can be used to define strata, but is not how species should be placed in strata. **Species characteristically belong to one stratum or another** (e.g., quaking aspen and juniper are canopy (T2), Utah serviceberry is a tall shrub (S1), antelope bitterbrush is a short shrub (S2), low sagebrush is a dwarf-shrub (S3), etc.), **EVEN when unusual environmental circumstances dictate that the plants have an unusually tall or unusually short growth form**. So even if the junipers growing in cracks are only 1.5 m tall, as long as they are mature trees, they are placed in the T2 category. About the only rule regarding height should be that the tree layer is (usually) higher than the tall shrub layer, is taller than the short shrub layer, etc.

The second point is to avoid splitting species between strata. If a few willow have been browsed to <1m tall, but most are 2m tall, they all are placed into the tall shrub stratum. There are two exceptions: (1) each height class covers more than 10% of plot, or (2) there is a reproductive layer of seedling shrubs or young trees.

The third point is how to define some of the "borderline/confusing" species. What we want to avoid is some folks calling *Apocynum* a forb and some calling it a dwarf-shrub or short shrub, for example.

Species / Percent Cover Estimates. Once you have identified your strata, list all diagnostic plant species in that strata and complete cover estimates per the following instructions.

1. **Species Name:** Refer to the plant list you have been provided for plant names used in this area. Always record the full scientific name for each species.
2. **Cover Class:** Estimate the aerial / crown cover of **each** species listed, using the cover class codes for the bottom of the page. These classes are as follows:
01 = 0-10% 02 = 10-25% 03 = 25-60% 04 = 60-100%
3. **% Cover:** Record continuous cover value used to make cover class estimates.

Unknowns. If you can't identify or easily key out the plant at the site, assign a name to it to be recorded on your data sheet. For example, if you know what family it is in or its genus, label it "unknown Asteraceae sp." or "Unk. *Erigeron* sp.". If there is more than one unknown in a family, add a number to the name you give them. If you do not know the family, label the plant "Unknown 1", using consecutive numbers for additional unknowns. Record the cover class and other data for the unknown as you would for any other species. Then, take a sample of the species with as much of the plant as possible, especially intact sexual parts, if present. Place the sample in a plastic baggie, and either label the plant (if you are putting more than one plant in the baggie) or label the baggie with the plot code, the date and the name you gave it on the data form. Plant samples in baggies can be stored in coolers or refrigerators for short periods. If you are not able to key the plant out soon after collecting it, or you intend to keep the sample for the park collection, press the plant and with a label stating the plot or location of its collection (include UTM's if the sample is not from a plot), date, collectors name and name you assigned the plant. Also, thoroughly label any plant specimens collected as proof of plant occurrence for plants not listed on the site plant list.

Strata / Height Class, Cover Class and Diagnostic Species. Once the species list and associated cover data have been completed, the observer should then complete the following fields as specified below.

1. Indicate the average height class of the stratum in the first column, using the Height Scale at the bottom of the form. The height scale for this project is as follows:

2.

01 = <0.5 m	03 = 1- 2 m	05 = 5 - 10 m	07 = 15-20 m	09 = 35 - 50 m
02 = 0.5 - 1 m	04 = 2-5 m	06 = 10-15 m	08 = 20-35 m	10 = > 50 m

3. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale at the bottom of the form (same cover scale as for species above).
4. '**' - This Column is used to indicate which species in the strata are particularly abundant.

Record information on *dominant species only*. There is one column that corresponds to the "Stratum" column in this table:

1. **Height.** Use the number code that best describes the heights of all plant species within a given stratum. The number codes are listed in the bottom left-hand corner of the data sheet.
2. **Cover Class.** For this ocular estimation you are looking at the aerial cover of **all** plants within a given stratum. Use the cover class codes listed in the bottom right hand corner of the data sheet and presented below.

Cover Classes

01	0 - 10%
02	10 - 25%
03	25 - 60%
04	60 - 100%

3. **Dominant Species (Mark species that characterize the stand with a *).** List the plant species using the full scientific name. You may find that there are not enough lines, in which case you can write in the blank area under the stratum name and number codes.
4. **% Cover.** Estimate the percent aerial cover (T-100%) for each diagnostic plant species.

APPENDIX 1: Landform Glossary

(<http://soils.usda.gov/technical/handbook/contents/part629glossary1.html>)

alluvial cone - A semi-conical type of alluvial fan with very steep slopes; it is higher, narrower, and steeper (e.g., > 40% slopes) than a fan, and composed of coarser, and thicker layers of material deposited by a combination of alluvial episodes and to a much lesser degree, landslides (e.g., debris flow). Compare - alluvial fan, talus cone.

alluvial fan - A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream (best expressed in semiarid regions) at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream. It is steepest near its apex which points upstream and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

alluvial flat (a) (colloquial: western US) A nearly level, graded, alluvial surface in bolsons and semi-bolsons which commonly does not manifest traceable channels, terraces or floodplain levels. Compare - flood-plain step, terrace, valley flat. (b) (**not preferred**) A general term for a small flood plain bordering a river, on which alluvium is deposited during floods.

alluvial plain - (a) A large assemblage of fluvial landforms (braided streams, terraces, etc.,) that form low gradient, regional ramps along the flanks of mountains and extend great distances from their sources (e.g., High Plains of North America. SW (b) (not recommended, use flood plain.) An general, informal term for a broad flood plain or a low-gradient delta. Compare - alluvial flat.

alluvial plain remnant - An erosional remnant of an alluvial plain which retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to a present-day stream or drainage network. Compare - alluvial plain, erosional remnant, paleoterrace.

alluvial terrace - (not preferred) refer to stream terrace.

alluvium - Unconsolidated, clastic material subaerially deposited by running water, including gravel, sand, silt, clay, and various mixtures of these. Compare - colluvium, slope alluvium.

anticline - (a) A unit of folded strata that is convex upward and whose core contains the stratigraphically oldest rocks, and occurs at the earth's surface. In a single anticline, beds forming the opposing limbs of the fold dip away from its axial plane. Compare - monocline, syncline, fold. (b) A fold, at any depth, generally convex upward whose core contains the stratigraphically older rocks.

arroyo - (colloquial: southwest A.) The channel of a flat-floored, ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material; sometimes called a wash. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed. Where arroyos intersect zones of ground-water discharge, they are more properly classed as intermittent stream channels.

artificial levee - An artificial embankment constructed along the bank of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel.

backslope - The hillslope profile position that forms the steepest and generally linear, middle portion of the slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below. They may or may not include cliff segments (i.e. free faces). Backslopes are commonly erosional forms produced by mass movement, colluvial action, and running water. Compare - summit, shoulder, footslope, toeslope.

backswamp - A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces. Compare - valley flat.

badlands - A landscape which is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes with narrow interfluves. Badlands develop on surfaces with little or no vegetative cover, overlying unconsolidated or poorly cemented materials (clays, silts, or in some cases sandstones) sometimes with soluble minerals such as gypsum or halite.

bajada - (colloquial: southwestern US.) A broad, gently inclined, alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins. Synonym - coalescent fan piedmont. Compare - colluvial apron.

ballena - (colloquial: western US.) A fan remnant having a distinctively-rounded surface of fan alluvium. The ballena's broadly-rounded shoulders meet from either side to form a narrow summit and merge smoothly with concave sideslopes and then concave, short pediments which form smoothly-rounded drainageways between adjacent ballenas. A partial ballena is a fan remnant large enough to retain some relict fan surface on a remnant summit. Compare - fan remnant.

ballon - (colloquial: western US). A rounded, dome-shaped hill, formed by erosion or uplift.

bar - A general term for a ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition; e.g. a channel bar or a meander bar. A generic term for any of various elongate offshore ridges, banks, or mounds of sand, gravel, or other unconsolidated material submerged at least at high tide, and built up by the action of waves or currents, especially at the mouth of a river or estuary, or at a slight distance offshore from the beach.

barchan dune - A crescent-shaped dune with tips extending leeward (downwind), making this side concave and the windward (upwind) side convex. Barchan dunes tend to be arranged in chains extending in the dominant wind direction. Compare - parabolic dune.

base slope - A geomorphic component of hills consisting of the concave to linear slope (perpendicular to the contour) which, regardless of the lateral shape is an area that forms an apron or wedge at the bottom of a hillside dominated by colluvial and slope wash processes and sediments (e.g., colluvium and slope alluvium). Distal base slope sediments commonly grade to, or interfinger with, alluvial fills, or gradually thin to form pedisegment over residuum. Compare - head slope, side slope, nose slope, interfluvium, free face.

basin - (a) Drainage basin; (b) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated. (c) (colloquial: western US) A general term for the nearly level to gently sloping, bottom surface of an intermontane basin (bolson). Landforms include playas, broad alluvial flats containing ephemeral drainageways, and relict alluvial and lacustrine surfaces that rarely, if ever, are subject to flooding. Where through-drainage systems are well developed, flood plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountainward to distal parts of piedmont slopes.

basin floor - A general term for the nearly level, lower-most part of intermontane basins (i.e. bolsons, semi-bolsons). The floor includes all of the alluvial, eolian, and erosional landforms below the piedmont slope. Compare - basin, piedmont slope.

basin-floor remnant - (colloquial: western US) A flat erosional remnant of any former landform of a basin floor that has been dissected following the incision of an axial stream.

bench - (not preferred) refer to structural bench.

beveled base - The lower portion of a canyon wall or escarpment marked by a sharp reduction in slope gradient from the precipitous cliff above, and characteristically composed of thinly mantled colluvium (e.g. < 1 m) and / or carapaced with a thin surficial mantle of large rock fragments from above, which overly residuum of less resistant rock (e.g., shale) whose thin strata intermittently outcrop at the surface; a zone of erosion and transport common in the canyonlands of the semi-arid, southwestern US. Compare - talus slope.

blowout - A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand, loose soil, or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Commonly small, some blowouts may be large (kilometers in diameter). Compare - deflation basin.

bluff - (a) A high bank or bold headland, with a broad, precipitous, sometimes rounded cliff face overlooking a plain or body of water, especially on the outside of a stream meander; ex. a river bluff. (b) (not preferred) use cliff. Any cliff with a steep, broad face.

bolson - (colloquial: western US.) A landscape term for an internally drained (closed) intermontane basin into which drainages from surrounding mountains converge inward toward a central depression. Bolsons are often tectonically depressed areas and, according to Peterson, include alluvial flat, alluvial plain, beach plain, barrier beach, lake plain, sand sheets, dunes, and playa. The piedmont slope includes slopes of erosional origin adjoining the mountain front (pediments) and complex construction surfaces (fans). A semi-bolson is an externally drained (open) bolson. Synonym - intermontane basin.

borrow pit - An excavated area from which earthy material has been removed typically for construction purposes offsite; also called borrow pit.

bottomland - (not recommended) use flood plain. An obsolete, informal term loosely applied to varying portions of a flood plain.

box canyon - a) A narrow gorge or canyon containing an intermittent stream following a zigzag course, characterized by high, steep rock walls and typically closed upstream by a similar wall, giving the impression, as viewed from its bottom, of being surrounded or "boxed in" by almost vertical walls. b) A steep-walled canyon heading against a cliff a dead-end canyon.

braided stream - A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around inter-channel bars, resembling (in plan view) the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload, non-cohesive bank material, and a steep gradient. At bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams. Compare - meandering channel, flood-plain landforms.

break - (slopes) An abrupt change or inflection in a slope or profile. Compare - knickpoint, shoulder, escarpment. (geomorphology) A marked variation of topography, or a tract of land distinct from adjacent land, or an irregular or rough piece of ground. Compare - breaks.

breaks - (colloquial: western US) A landscape or large tract of steep, rough or broken land dissected by ravines and gullies and marks a sudden change in topography as from an elevated plain to lower hilly terrain, or a line of irregular cliffs at the edge of a mesa or a river (e.g., the Missouri River breaks).

butte - An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks. Compare - mesa, plateau, cuesta.

caldera - A large, more or less circular depression, formed by explosion and/or collapse, which surrounds a volcanic vent or vents, and whose diameter is many times greater than that of the included vent, or vents. Compare - crater.

canyon - A long, deep, narrow, very steep-sided valley cut primarily in bedrock with high and precipitous walls in an area of high local relief (e.g., mountain or high plateau terrain), often with a perennial stream at the bottom; similar to but larger than a gorge. Compare - gorge, box canyon, slot canyon.

canyon bench - One of a series of relatively narrow, flat landforms occurring along a canyon wall and caused by differential erosion of alternating strong and weak horizontal strata; a type of structural bench.

canyonlands - A deeply and extensively dissected landscape composed predominantly of relatively narrow, steep-walled valleys with small flood plains or valley floors; commonly with considerable outcrops of hard bedrock on steep slopes, ledges, or cliffs, and with broader summits or interfluvies than found in badlands. Sideslopes exhibit extensive erosion, active back-wearing, and relatively sparse vegetation.

channel - (a) The hollow bed where a natural body of surface water flows or may flow. The deepest or central part of the bed of a stream, containing the main current and occupied more or less continuously by water. (b) (colloquial: western US.) The bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and include bars and mounds of cobbles and stones. (c) Small, trough-like, arcuate or sinuous channels separated by small bars or ridges, caused by fluvial processes; common to flood plains and young alluvial terraces; a constituent part of *bar and channel* topography.

cinder cone - A conical hill formed by the accumulation of cinders and other pyroclastics, normally basaltic or andesitic composition. Slopes generally exceed 20 percent.

cliff - Any high, very steep to perpendicular or overhanging face of rock or earth; a precipice. Compare - bluff.

climbing dune - A dune formed by the piling-up of sand by wind against a cliff or mountain slope; very common in arid regions with substantial local relief and strong winds. Compare - sand ramp.

closed depression - A generic name for an enclosed area that has no surface drainage outlet and from which water escapes only by evaporation or subsurface drainage; an area of low ground indicated on a topographic map by a hachured contour line forming a closed loop. Compare - open basin.

collapse sinkhole - A type of sinkhole that is formed by collapse of a cave within the underlying soluble bedrock (e.g., limestone, gypsum, salt). Compare - solution sinkhole.

colluvium - Unconsolidated, unsorted material being transported or deposited on sideslopes and/or at the base of slopes by mass movement (e.g. direct gravitational action) and by local, unconcentrated runoff. Compare - alluvium, slope alluvium, scree, talus, mass movement.

complex landslide - A category of mass movement processes, associated sediments (complex landslide deposit) or resultant landforms characterized by a composite of several mass movement processes none of which dominates or leaves a prevailing landform. Numerous types of complex landslides can be specified by naming the constituent processes evident (e.g. a complex earth spread - earth flow landslide). Compare - fall, topple, slide, lateral spread, flow, landslide.

crest - (a) The commonly linear, narrow top of a ridge, hill, or mountain. It is appropriately applied to elevated areas where retreating backslopes are converging such that these high areas are almost exclusively composed of convex shoulders; (b) (not preferred) Sometimes used as an alternative for the hillslope component *summit*. Compare - summit (*part b*), saddle.

cuesta - An asymmetric, homoclinal ridge capped by resistant rock layers of slight to moderate dip (commonly less than 15 percent); produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the other side has a relatively short and steep or cliff-like slope (scarp) that cuts through the tilted rocks. Compare - hogback, mesa, dipslope, scarp slope, cuesta valley.

cuesta valley - A low relief, low angle, asymmetrical depression which lies parallel to the strike of underlying strata; a type of strike valley. It's formed by the differential erosion of weaker strata interbedded with more resistant bedrock. It may or may not contain a local drainage network and commonly lies above and is not connected to the regional drainage system. Compare - cuesta, valley, trough, hanging valley.

debris fall - The process, associated sediments (debris fall deposit) or resultant landform characterized by a rapid type of *fall* involving the relatively free, downslope movement or collapse of detached, unconsolidated material which falls freely through the air (lacks an underlying slip face); sediments have substantial proportions of both fine earth and coarse fragments; common along undercut stream banks. Compare - rock fall, soil fall, landslide.

debris flow - The process, associated sediments (debris flow deposit) or landform resulting from a very rapid type of *flow* dominated by a sudden downslope movement of a mass of rock, soil, and mud (more than 50% of the particles are > 2mm), and whether saturated or comparatively dry, behaves much as a viscous fluid when moving. Compare - lahar, mudflow, landslide.

deflation basin - A topographic basin excavated and maintained by wind erosion which removes unconsolidated material and commonly leaves a rim of resistant material surrounding the depression. Unlike a blowout, a deflation basin does not include adjacent deposits derived from the basin. Compare - blowout.

depression - Any relatively sunken part of the Earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage (e.g. a sinkhole). An open depression has a natural outlet for surface drainage. Compare - closed depression, open depression.

desert pavement - A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments, mantling a desert surface. It is formed where wind action and sheetwash have removed all smaller particles or where coarse fragments have migrated upward through sediments to the surface. It usually protects the underlying, finer-grained material from further deflation. The coarse fragments commonly are cemented by mineral matter. Compare - erosion pavement, stone line.

dike - A tabular igneous intrusion that cuts across the bedding or foliation of the country rock. Compare - sill.

dip - A geomorphic component (characteristic piece) of flat plains (e.g., lake plain, low coastal plain, low-relief till plain) consisting of a shallow and typically closed depression that tends to be an area of focused groundwater recharge but not a permanent water body and that lies slightly lower and is wetter than the adjacent talf, and favors the accumulation of fine sediments and organic materials.

ditch - An open and usually unpaved (unlined), channel or trench excavated to convey water for drainage (removal) or irrigation (addition) to or from a landscape; smaller than a canal; some ditches are modified natural waterways.

divide - (a) The line of separation; (b) The summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins; it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction. Compare - interfluv.

dome - (a) An uplift or anticlinal structure, either circular or elliptical in outline, in which the rocks dip gently away in all directions. A dome may be small (e.g. a salt dome) or many kilometers in diameter. (b) A smoothly rounded landform of rock mass such as a rock-capped mountain summit, that roughly resembles the dome of a building. (e.g. the rounded granite peaks of Yosemite, CA).

drainageway - (a) A general term for a course or channel along which water moves in draining an area. (b) a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g. head slope, swale) or have a small, defined channel (e.g. low order streams).

draw - A small, natural watercourse cut in unconsolidated materials, generally more open with a broader floor and more gently sloping sides than an arroyo, ravine or gulch, and whose present stream channel may appear inadequate to have cut the drainageway that it occupies.

dune - A low mound, ridge, bank or hill of loose, windblown, subaerially deposited granular material (generally sand), either barren and capable of movement from place to place, or covered and stabilized with vegetation, but retaining its characteristic shape. (See barchan dune, parabolic dune, parna dune, shrub-coppice dune, seif dune, transverse dune).

dune field - An assemblage of moving and/or stabilized dunes, together with sand plains, interdune areas, and the ponds, lakes, or swamps produced by the blocking of streams by the sand. See dune lake.

earthflow - The process, associated sediments (earthflow deposit) or resultant landforms characterized by slow to rapid types of flow dominated by downslope movement of soil, rock, and mud (more than 50% of the particles are < 2 mm), and whether saturated or comparatively dry, behaves as a viscous fluid when moving. Compare - debris flow (coarser, less fluid), mudflow (finer, more fluid).

eolian deposit - Sand, silt or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess. Conventionally, primary volcanic deposits (e.g. tephra) are handled separately. Compare - loess, parna, beach sands.

eolian sands - Sand-sized, clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sand sheet. Compare - beach sands.

ephemeral stream - Generally a small stream, or upper reach of a stream, that flows only in direct response to precipitation. It receives no protracted water supply from melting snow or other sources and its channel is above the water table at all times. Compare - arroyo, intermittent stream, perennial stream.

eroded fan remnant - All, or a portion of an alluvial fan that is much more extensively eroded and dissected than a fan remnant; sometimes called an *erosional fan remnant*. It consists primarily of a) eroded and highly dissected sides (*eroded fan-remnant sideslopes*) dominated by hillslope positions (shoulder, backslope, etc.), and b) to a lesser extent an intact, relatively planar, relict alluvial fan "summit" area best described as a tread.

eroded fan-remnant sideslope - A rough or broken margin of an *eroded fan remnant* highly dissected by ravines and gullies that can be just a fringe or make up a large part of an eroded alluvial fan; its bounding escarpments (risers), originally formed by inset channels, have become highly dissected and irregular such that terrace components (tread and riser) have been consumed or modified and replaced by hillslope positions and components (shoulder, backslope, footslope, etc.); sometimes referred to as *fan remnant sideslopes*. Compare - eroded fan remnant.

escarpment - A continuous, steep slope or cliff produced by erosion or faulting and that topographically interrupts or breaks the general continuity of more gently sloping land surfaces. The term is most commonly applied to cliffs produced by differential erosion. Synonym = scarp.

falling dune - An accumulation of sand that is formed as sand is blown off a mesa top or over a cliff face or steep slope, forming a solid wall, sloping at the angle of repose of dry sand, or a fan extending downward from a re-entrant in the mesa wall. Compare - climbing dune, sand ramp.

fan - (a) A gently sloping, fan-shaped mass of detritus forming a section of a low-angle cone commonly at a place where there is a notable decrease in gradient; specifically an alluvial fan (not preferred - use alluvial fan). Compare - alluvial fan, alluvial cone. (b) A fan-shaped mass of congealed lava that formed on a steep slope by the continually changing direction of flow.

fan apron - A sheet-like mantle of relatively young alluvium and soils covering part of an older fan piedmont (and occasionally alluvial fan) surface, commonly thicker and further down slope (e.g., mid-fan or mid-fan piedmont) than a fan collar. It somewhere

buries an older soil that can be traced to the edge of the fan apron where the older soil emerges as the land surface, or relict soil. No buried soils should occur within a fan-apron mantle itself. Compare - fan collar.

fan collar - A landform comprised of a thin, short, relatively young mantle of alluvium along the very upper margin (near the proximal end or apex) of a major alluvial fan. The young mantle somewhere buries an older soil that can be traced to the edge of the collar where the older soil emerges at the land surface as a relict soil. Compare - fan apron.

fan remnant - A general term for landforms that are the remaining parts of older fan-landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (nonburied fan-remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan-surface. A nonburied fan-remnant is a relict surface in its entirety. Compare - eroded fan remnant, ballena.

fan skirt - The zone of smooth, laterally-coalescing, small alluvial fans that issue from gullies cut into the fan piedmont of a basin or that are coalescing extensions of the inset fans of the fan piedmont, and that merge with the basin floor at their toeslopes. These are generally younger fans which onlap older fan surfaces.

fault-line scarp - (a) A steep slope or cliff formed by differential erosion along a fault line, as by the more rapid erosion of soft rock on the side of a fault as compared to that of more resistant rock on the other side; e.g. the east face of the Sierra Nevada in California. (b) (not recommended) A fault scarp that has been modified by erosion. This usage is not recommended because the scarp is usually not located on the fault line.

fen - Waterlogged, spongy ground containing alkaline decaying vegetation, characterized by reeds, that develops into peat. It sometimes occurs in sinkholes of karst regions. Compare - bog, marsh, swamp.

finger ridge - One in a group of small, tertiary spur ridges that form crudely palmate extensions of erosional remnants along the flanks or nose of larger ridges. Compare - ballena, rib.

flat - (a) (adjective) Said of an area characterized by a continuous surface or stretch of land that is smooth, even, or horizontal, or nearly so, and that lacks any significant curvature, slope, elevations, or depressions. (b) (noun) An informal, generic term for a level or nearly level surface or small area of land marked by little or no local relief. Compare - mud flat. (c) (not recommended) A nearly level region that visibly displays less relief than its surroundings.

flood plain - The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams.

foothills - A steeply sloping upland composed of hills with relief of 30 up to 300 meters and fringes a mountain range or high-plateau escarpment. Compare - hill, mountain, plateau. SW &

footslope - The hillslope profile position that forms the concave surface at the base of a hillslope. It is a transition zone between upslope sites of erosion and transport (shoulder, backslope) and downslope sites of deposition (toeslope). Compare - summit, shoulder, backslope, and toeslope.

free face - A geomorphic component of hills and mountains consisting of an outcrop of bare rock that sheds rock fragments and other sediments to, and commonly stands more steeply than the angle of repose of, the colluvial slope immediately below; most commonly found on shoulder and backslope positions, and can comprise part or all of a nose slope or side slope. Compare - interfluvium, crest, nose slope, side slope, head slope, base slope.

gorge - (a) A narrow, deep valley with nearly vertical, rocky walls, smaller than a canyon, and more steep-sided than a ravine; especially a restricted, steep-walled part of a canyon. (b) A narrow defile or passage between hills or mountains.

graben - An elongate trough or basin bounded on both sides by high-angle, normal faults that dip towards the interior of the trough. It is a structural form that may or may not be geomorphically expressed as a rift valley. Compare - horst.

gravel pit - A depression, ditch or pit excavated to furnish gravel for roads or other construction purposes; a type of borrow pit.

ground soil - Any soil at the present-day land surface and actively undergoing pedogenesis.

gulch - (colloquial: western US.; not preferred - refer to ravine) A small stream channel, narrow and steep-sided in cross section, and larger than a gully, cut in unconsolidated materials. General synonym - ravine. Compare - arroyo, draw, gully, wash.

gully - A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water usually during and immediately following heavy rains or ice / snow melt. A gully generally is an obstacle to wheeled vehicles and too deep (e.g., > 0.5 m) to be obliterated by ordinary tillage; (a rill is of lesser depth and can be smoothed over by ordinary tillage). Compare - rill, ravine, arroyo, swale, draw.

hanging valley - A tributary valley whose floor at the lower end is notably higher than the floor of the main valley in the area of junction.

head slope - A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway, resulting in converging overland water flow (e.g. sheet wash); head slopes are dominated by colluvium and slope wash sediments (e.g., slope alluvium); contour lines form concave curves. Slope complexity (downslope shape) can range from simple to complex. Headslopes are comparatively moister portions of hillslopes and tend to accumulate sediments (e.g., cummulic profiles) where they are not directly contributing materials to channel flow. Compare - side slope, nose slope, free face, interfluvium, crest, base slope.

headwall - A steep slope at the head of a valley; e.g. the rock cliff at the back of a cirque. Compare - cirque headwall.

high hill - A generic name for an elevated, generally rounded land surface with high local relief, rising between 90 meters (approx. 300 ft.) to as much as 300 m (approx. 1000 ft.) above surrounding lowlands. Compare - low hill, hill, hillock.

hill - A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: *low hill* (30 - 90 m) or *high hill* (90 - 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention. Compare - hillock, plateau, mountain, foothills, hills.

hillock - A generic name for a small, low hill, generally between 3 - 30 m in height and slopes between 5 and 50% (e.g., bigger than a mound but smaller than a hill); commonly considered a microfeature. Compare - mound, hill.

hillslope - A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill. Compare - mountain slope.

hogback - A sharp-crested, symmetric (homoclinal) ridge formed by highly tilted resistant rock layers; produced by differential erosion of interlayered resistant and weak rocks with dips greater than about 25 degrees (45 percent). Compare - cuesta.

hoodoo - A bizarrely shaped column, pinnacle, or pillar of rock produced by differential weathering or erosion in a region of sporadically heavy rainfall. Formation is facilitated by joints and layers of varying hardness. Compare - earth pillar.

horst - An elongate block that is bounded on both sides by normal faults that dip away from the interior of the horst. It is a structural form and may or may not be expressed geomorphically.

hummock - (a) (not preferred - see hillock). An imprecise, general term for a rounded or conical mound or other small elevation. (b) (not preferred) A slight rise of ground above a level surface.

impact crater - a) A generally circular or elliptical depression formed by hypervelocity impact of an experimental projectile or ordinance into earthy or rock material. Compare - caldera, crater, meteorite crater. SW; b) (not recommended - use meteorite crater) A generally circular crater formed by the impact of an interplanetary body (projectile) on a planetary surface.

inset fan - (colloquial; western US) The flood plain of an ephemeral stream that is confined between fan remnants, ballenas, basin-floor remnants, or closely-opposed fan toeslopes of a basin.

interdune - The relatively flat surface, whether sand-free or sand-covered, between dunes. GG

interfluvium - A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways. Compare - divide.

intermittent stream - A stream, or reach of a stream, that does not flow year-round (commonly dry for 3 or more months out of 12) and whose channel is generally below the local water table; it flows only when it receives a base flow (i.e. solely during wet periods),

or b) ground-water discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources. Compare - ephemeral stream.

island - (a) Land completely surrounded by water; (b) An elevated area of land surrounded by swamp, or marsh, or isolated at high water or during floods. Compare - barrier island.

knob - (a) A rounded eminence, a small hill or mountain; especially a prominent or isolated hill with steep sides, commonly found in the Southern United States. (b) A peak or other projection from the top of a hill or mountain. Also, a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain. Compare - stack.

knoll - A small, low, rounded hill rising above adjacent landforms.

lake - An inland body of permanent standing water, fresh or saline, occupying a depression, generally of appreciable size (larger than a pond) and too deep to permit vegetation (excluding subaqueous vegetation) to take not completely across the expanse of water.

lakebed - (a) The flat to gently undulating ground underlain or composed of fine-grained sediments deposited in a former lake. (b) The bottom of a lake; a lake basin.

lakeshore - The narrow strip of land in contact with or bordering a lake; especially a beach.

landslide - A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials, caused by gravitational forces and which may or may not involve saturated materials. Names of landslide types generally reflect the dominant process and/or the resultant landform. The main operational categories of mass movement are *fall* (rockfall, soil fall, topple), *slide* (rotational landslide, block glide, debris slide, lateral spread), *flow* [rock fragment flow (especially rockfall avalanche), debris avalanche, debris flow (e.g., lahar), earthflow, (creep, mudflow)], and *complex landslides*. Compare - solifluction.

ledge - (a) A narrow shelf or projection of rock, much longer than wide, formed on a rock wall or cliff face, as along a coast by differential wave action on softer rocks; erosion is by combined biological and chemical weathering. (b) A rocky outcrop; solid rock. (c) A shelf-like quarry exposure or natural rock outcrop. Compare - structural bench.

levee - An artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel. Compare artificial levee, natural levee.

longitudinal dune - A long, narrow sand dune, usually symmetrical in cross profile, oriented parallel to the prevailing wind direction; it is wider and steeper on the windward side but tapers to a point on the lee side. It commonly forms behind an obstacle in an area where sand is abundant and the wind is strong and constant. Such dunes can be a few meters high and up to 100 km long. Compare - seif dune, transverse dune.

low hill - A generic name for an elevated, generally rounded land surface with low local relief, rising between 30 meters (100 ft.) to as much as 90 m (approx. 300 ft.) above surrounding lowlands. Compare - high hill, hill, hillock.

lowland - (a) A generic, imprecise term for low-lying land or an extensive region of low-lying land, especially near a coast and including the extended plains or country lying not far above tide level. (b) (not preferred) A generic, imprecise term for a landscape of low, comparatively level ground of a region or local area, in contrast with the adjacent higher country. (c) (not recommended - use valley, bolson, etc.) A generic term for a large valley. Compare - upland.

marsh - Periodically wet or continually flooded areas with the surface not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants. Compare - salt marsh, swamp, bog, fen.

meander belt - The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops. Landform components of the meander-belt surface are produced by a combination of gradual (lateral and down-valley) migration of meander loops and avulsive channel shifts causing abrupt cut-offs of loop segments. Landforms flanking the sinuous stream channel include: point bars, abandoned meanders, meander scrolls, oxbow lakes, natural levees, and flood-plain splays. Meander belts may not exhibit prominent natural levee or splay forms. Flood plains of broad valleys may contain one or more abandoned meander belts in addition to the zone flanking the active stream channel.

meander scar - (a) A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream which impinged upon and undercut the bluff; if it's no longer adjacent to the modern stream channel it indicates an

abandoned route of the stream; (b) (not recommended - refer to oxbow) An abandoned meander, commonly filled in by deposition and vegetation, but still discernable.

meander scroll - (a) One of a series of long, parallel, close fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank. Compare - meander belt, point bar. (b) (not recommended; refer to oxbow lake) - A small, elongate lake on a flood plain in a well-defined part of an abandoned stream channel.

mesa - A broad, nearly flat-topped, and usually isolated landmass bounded by steep slopes or precipitous cliff and capped by layers of resistant, nearly horizontal, rocky summit width greater than the height of bounding escarpments. (Colloquial: western US; not preferred) Also used to designate broad structural benches and alluvial terraces that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys. Compare - butte, plateau, cuesta.

monocline - (a) A unit of folded strata that dips from the horizontal in one direction only, is not part of an anticline or syncline, and occurs at the earth's surface. This structure is typically present in plateau areas where nearly flat strata locally assume steep dips caused by differential vertical movements without faulting. Compare - anticline, syncline, fold. (b) - A local steepening in an otherwise uniform gentle dip.

mountain - A generic term for an elevated area of the land surface, rising more than 300 meters above surrounding lowlands, usually with a nominal summit area relative to bounding slopes and generally with steep sides (greater than 25 percent slope) with or without considerable bare-rock exposed. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by tectonic activity and/or volcanic action and secondarily by differential erosion. Compare - hill, hillock, plateau, foothills, mountains.

natural levee - A long, broad low ridge or embankment of sand and coarse silt, built by a stream on its flood plain and along both sides of its channel, especially in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load. It has a gentle slope away from the river and toward the surrounding floodplain, and its highest elevation is closest to the river bank. Compare - levee, artificial levee, meander belt.

open depression - A generic name for any enclosed or low area that has a surface drainage outlet whereby surface water can leave the enclosure; an area of lower ground indicated on a topographic map by contour lines forming an incomplete loop or basin indicating at least one surface exit. Compare - closed basin.

overbank deposit - Fine-grained sediments (silt and clay) deposited from suspension on a flood plain by floodwaters that cannot be contained within the stream channel.

overflow stream channel - A watercourse that is generally dry but conducts flood waters that have overflowed the banks of a river, commonly from large storms or annual meltwater.

oxbow - A closely looping stream meander having an extreme curvature such that only a neck of land is left between the two parts of the stream. (colloquial: northeastern A.) the land enclosed, or partly enclosed, within an oxbow. Compare - meander belt, oxbow lake, bayou.

oxbow lake - The crescent-shaped, often ephemeral body of standing water situated by the side of a stream in the abandoned channel (oxbow) of a meander after the stream formed a neck cutoff and the ends of the original bend were silted up. Compare - meander belt, oxbow.

parabolic dune - A sand dune with a long, scoop-shaped form, convex in the downwind direction so that its horns point upwind, whose ground plan, when perfectly developed, approximates the form of a parabola.

peak - Sharp or rugged upward extension of a ridge chain, usually at the junction of two or more ridges; the prominent highest point of a summit area.

pediment - A gently sloping erosional surface at the foot of a receding hill or mountain slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands; or it may be thinly mantled with alluvium and colluvium, ultimately in transit from upland front to basin or valley lowland. In hill-foot slope terrain the mantle is designated "pedis sediment." The term has been used in several geomorphic contexts: Pediments may be classed with respect to (a) landscape positions, for example, intermontane-basin piedmont or valley-border footslope surfaces (respectively, apron and terrace pediments); (b) type of material eroded, bedrock or regolith; or (c) combinations of the above. Compare - Piedmont slope.

perennial stream - A stream or reach of a stream that flows continuously throughout the year and whose surface is generally lower than the water table adjacent to the region adjoining the stream. Compare - Ephemeral stream, Intermittent stream.

piedmont - (adjective) Lying or formed at the base of a mountain or mountain range; e.g., a piedmont terrace or a piedmont pediment. (noun) An area, plain, slope, glacier, or other feature at the base of a mountain; e.g., a foothill or a bajada. In the United States, the Piedmont is a low plateau extending from New Jersey to Alabama and lying east of the Appalachian Mountains.

piedmont slope - (colloquial - western US) The dominant gentle slope at the foot of a mountain; generally used in terms of intermontane-basin terrain in arid to subhumid regions. Main components include: (a) An erosional surface on bedrock adjacent to the receding mountain front (pediment, rock pediment); (b) A constructional surface comprising individual alluvial fans and interfan valleys, also near the mountain front; and (c) A distal complex of coalescent fans (bajada), and alluvial slopes without fan form. Piedmont slopes grade to basin-floor depressions with alluvial and temporary lake plains or to surfaces associated with through drainage (e.g., axial streams). Compare - bolson, fan piedmont.

plain - A general term referring to any flat, lowland area, large or small, at a low elevation. Specifically, any extensive region of comparatively smooth and level gently undulating land. A plain has few or no prominent hills or valleys but sometimes has considerable slope, and usually occurs at low elevation relative to surrounding areas. Where dissected, remnants of a plain can form the local uplands. A plain may be forested or bare of trees and may be formed by deposition or erosion. Compare - lowland, plateau.

plateau - A comparatively flat area of great extent and elevation; specifically an extensive land region considerably elevated (more than 100 meters) above adjacent lower-lying terrain, and is commonly limited on at least one side by an abrupt descent, has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level. Compare - hill, foothill, mountain, mesa, plain.

playa - The usually dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those occurring on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation-runoff events. Playa deposits are fine grained and may or may not have high water table and saline conditions.

point bar - One of a series of low, arcuate ridges of sand and gravel developed on the inside of a growing meander by the slow addition of individual accretions accompanying migration of the channel toward the outer bank. Compare - meander scroll.

pond - (a) A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool. (b) A small artificial body of water, used as a source of water. Compare - salt pond.

pool - A small, natural body of standing water, usually fresh; e.g. a stagnant body of water in a marsh, or a transient puddle in a depression following a rain.

quarry - Excavation areas, open to the sky, usually for the extraction of stone.

ravine - A small stream channel; narrow, steep-sided, commonly V-shaped in cross section and larger than a gully, cut in unconsolidated materials. General synonym (not preferred) - gulch. Compare - arroyo, draw, gully.

reef - (a) A ridge-like or mound-like structure, layered or massive, built by sedentary calcareous organisms, especially corals, and consisting mostly of their remains; it is wave-resistant and stands above the surrounding contemporaneously deposited sediment. Also, such a structure built in the geologic past and now enclosed in rock, commonly of differing lithology. (b) A mass or ridge of rocks, especially coral and sometimes sand, gravel, or shells, rising above the surrounding sea or lake bottom to or nearly to the surface, and dangerous to navigation; specifically such a feature at 10 fathoms (18.3 m) or less, formerly 6 fathoms (11 m).

ridge - A long, narrow elevation of the land, usually sharp crested with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief.

rill - A very small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water, usually during and immediately following moderate rains or after ice/snow melt. Generally, a rill is not an obstacle to wheeled vehicles and is shallow enough to be obliterated by ordinary tillage. Compare - gully.

rim - The border, margin, edge, or face of a landform, such as the curved brim surrounding the top part of a crater or caldera; specifically the rimrock of a plateau or canyon.

rise - (refer to lake plain) (a) A general term for a slight increase in slope and elevation of the land surface, usually with a broad summit and gently sloping sides. (b) same as (a) but the term is restricted to microfeatures in areas of very low relief such as lake plains or coastal plains.

river - (a) A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea. (b) (not recommended: colloquial - New England, US) A small watercourse which elsewhere in the US is known as a *creek*. Compare - stream.

river valley - an elongate depression of the Earth's surface; carved by a river during the course of its development. Compare - valley side, valley floor.

rockfall - The process, associated sediments (rockfall deposit) or resultant landform characterized by a very rapid type of *fall* dominated by downslope movement of detached rock bodies which fall freely through the air or by leaps and bounds (lacks an underlying slip face); also spelled rock fall. Compare - debris fall, soil fall, landslide.

rock pediment - An erosion surface of low relief, cut directly into and across bedrock and composed of either bare rock or thinly veneered pediment or residuum (e.g. < 1.5 m) over bedrock; it occurs along the flanks of mountain fronts, or at the base of mountains or high hills. Its surface grades to the backwearing mountain slopes or hillslopes above, and generally grades down to and merges with a lower-lying alluvial plain, piedmont slope or valley floor below.

rotational slide - The process, associated sediments (rotational landslide deposit) or resultant landforms characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely soil-rock materials, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare - rotational debris slide, rotational earth slide, rotational rock slide, translational slide, lateral spread, landslide.

rubble - An accumulation of loose angular rock fragments, commonly overlying outcropping rock; the unconsolidated equivalent of a breccia. Compare - scree, talus.

saddle - A low point on a ridge or interfluvium, generally a divide (pass, col) between the heads of streams flowing in opposite directions. Compare - summit, crest.

sandhills - A region of semi-stabilized sand dunes or sandy hills, either covered with vegetation or bare, as in north-central Nebraska and the midlands of the Carolinas.

sand plain - (a) A sand-covered plain which may originate by deflation of sand dunes, and whose lower limit of erosion is governed by the ground-water level. Also spelled *sandplain*. (b) (not preferred - refer to *sandy* outwash plain) A small outwash plain composed chiefly of sand deposited by meltwater streams flowing from a glacier.

sand ramp - A sand sheet blown up onto the lower slopes of a bedrock hill or mountain and forming an inclined plane, sometimes filling small mountain-side valleys and even crossing low passes. Compare - climbing dune, sand sheet.

sand sheet - A large, irregularly shaped, commonly thin, surficial mantle of eolian sand, lacking the discernible slip faces that are common on dunes.

scarp - An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or structural bench. A scarp may be of any height. Compare - escarpment.

scarp slope - The relatively steeper face of a cuesta, facing in a direction opposite to the dip of the strata. Compare - dip slope.

scree - A collective term for an accumulation of coarse rock debris or a sheet of coarse debris mantling a slope. Scree is not a synonym of talus, as scree includes loose, coarse fragment material on slopes without cliffs. Compare - talus, colluvium, mass movement.

scree slope - A portion of a hillside or mountainslope mantled by scree and lacking an up-slope rockfall source (i.e. cliff). Compare - talus slope, scree, talus.

seep - (noun) An area, generally small, where water or oil percolates slowly to the land surface. For water, it may be considered as a seepage spring, but it is used by some for flows too small to be considered as springs.

shoulder - The hillslope profile position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from summit to backslope. Compare - summit, crest, backslope, footslope, and toeslope.

shrub-coppice dune - A small, streamlined dune that forms around brush and clump vegetation.

side slope - A laterally planar area of a hillside, resulting in predominantly parallel overland water flow (e.g., sheet wash); contour lines generally form straight lines. Side slopes are dominated by colluvium and slope wash sediments. Slope complexity (downslope shape) can range from simple to complex. Compare - head slope, nose slope, free face, interfluvium, crest, base slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluvium. It is generally linear along the slope width.

slide - (a) Mass movement processes, associated sediments (slide deposit) or resultant landforms (e.g., rotational, translational, and snow slide) characterized by a failure of earth, snow, or rock under shear stress along one or several surfaces that are either visible or may reasonably be inferred. The moving mass may or may not be greatly deformed, and movement may be rotational (rotational slide) or planar (translational slide). A slide can result from lateral erosion, lateral pressure, weight of overlying material, accumulation of moisture, earthquakes, expansion owing to freeze-thaw of water in cracks, regional tilting, undermining, fire, and human agencies. Compare - fall, topple, lateral spread, flow, complex landslide. (b) The track of bare rock or furrowed earth left by a slide. (c) The mass of material moved by or deposited by a slide.

slip face - The steeply sloping surface of a dune, standing at or near the angle of repose of loose sand, and advancing downwind by a succession of slides wherever that angle is exceeded.

slope - (also called slope gradient or gradient) The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100.

slope alluvium - Sediment gradually transported down mountain or hill slopes primarily by non-channel alluvial processes (i.e., slope wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of coarse fragments and may be separated by stone lines. Sorting of pebbles or cobbles and burnished peds distinguish these materials from unsorted colluvial deposits. Compare - colluvium, slope wash.

slope wash - A collective term for non-fluvial, incipient alluvial processes (e.g. overland flow, minor rills) that detach, transport, and deposit sediments down hill and mountain slopes. Related sediments (*slope alluvium*) exhibit nominal sorting or rounding of particles, peds, etc., and lateral sorting downslope on long slopes; stratification is crude and intermittent and readily destroyed by pedoturbation and frost action. Also called *slope wash processes*. Compare - slope alluvium, colluvium, valley-side alluvium.

slot canyon - A long, narrow, deep and tortuous channel or drainageway with sheer rock walls eroded into sandstone or other sedimentary rocks, especially in the semi-arid western US (e.g. Colorado Plateau); subject to flash flood events; depth to width ratios exceed 10:1 over most of its length and can approach 100:1; commonly containing unique ecological communities distinct from the adjacent, drier uplands.

strath terrace - A type of stream terrace, formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

stream - (a) A body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the ground surface, in a subterranean cavern, or beneath or in a glacier. It is a mixture of water and dissolved, suspended, or entrained matter. (b) A term used in quantitative geomorphology interchangeably with channel. Compare - river.

stream terrace - One or a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition (i.e., currently very rarely or never floods; inactive cut and fill and/or scour and fill processes). Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called "strath terraces." Remnants of constructional valley floors thickly mantled with alluvium are called alluvial terraces. Compare - alluvial terrace, flood-plain step, strath terrace, terrace.

strike valley - A subsequent valley eroded in, and developed parallel to the strike of, underlying weak strata; such as a cuesta; a valley that often, but not necessarily contains a strike valley.

structural bench - A platform-like, nearly level to gently inclined erosional surface developed on resistant strata in areas where valleys are cut in alternating strong and weak layers with an essentially horizontal attitude. Structural benches are bedrock controlled,

and in contrast to stream terraces, have no geomorphic implication of former, partial erosion cycles and base-level controls, nor do they represent a stage of flood-plain development following an episode of valley trenching. Compare - pediment, ledge; see scarp.

summit - (a) The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. Compare - shoulder, backslope, footslope, and toeslope, crest. (b) A general term for the top, or highest area of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluvial area of relatively gentle slope that is flanked by steeper slopes, e.g., mountain fronts or tableland escarpments.

swale - (a) A shallow, open depression in unconsolidated materials which lacks a defined channel but can funnel overland or subsurface flow into a drainageway. Soils in swales tend to be more moist and thicker (cummulic) compared to surrounding soils. (b) A small, shallow, typically closed depression in an undulating ground moraine formed by uneven glacial deposition; Compare - swell-and-swale topography. (c) (not preferred; refer to interdune) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.

syncline - (a) A unit of folded strata that is concave upward whose core contains the stratigraphically younger rocks, and occurs at the earth's surface. In a single syncline, beds forming the opposing limbs of the fold dip toward its axial plane. Compare - monocline, syncline, fold. (b) A fold, at any depth, generally concave upward whose core contains the stratigraphically younger rocks.

tableland - A term for a broad upland with an extensive, nearly level or undulating summit area and steep side slopes descending to surrounding lowlands. Compare - plateau, mesa, cuesta.

talus - Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of loose broken rock formed chiefly by falling, rolling, or sliding. Compare - talus slope, colluvium, mass movement, scree.

talus cone - A small, steep, cone-shaped landform at the base of a cliff or escarpment, that heads in a relatively small declivity or ravine, and composed of poorly sorted rock and soil debris that has accumulated primarily by episodic rockfall or, to a lesser degree, by slope wash. Not to be confused with an *alluvial cone*; a similar feature but of fluvial origin, composed of better stratified and more sorted material, and that tapers up into a more extensive drainageway. Compare - alluvial cone, beveled base, talus slope.

talus slope - a portion of a hillslope or mountainslope mantled by talus and lying below a rockfall source (e.g. cliff). Compare - scree slope, scree, talus. Compare - beveled base.

tank - (colloquial: southwestern US) A natural depression or cavity in impervious rocks in which water collects and remains for the greater part of the year.

terrace - A step-like surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, or lake or sea shore. The term is usually applied to both the relatively flat summit surface (tread), cut or built by stream or wave action, and the steeper slope (scarp, riser), descending to a lower base level. Compare - stream terrace, flood-plain step. Practically, terraces are considered to be generally flat alluvial areas above the 100 yr. flood stage.

terraces - Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock such as sheep or cattle. Synonyms (not preferred) - catstep, sheep or cattle track.

toeslope - The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hill-slope continuum that grades to valley or closed-depression floors. Compare - summit, shoulder, backslope, footslope, valley floor.

translational slide - A category of mass movement processes, associated sediments (translational slide deposit) or resultant landforms characterized by the extremely slow to moderately rapid downslope displacement of comparatively dry soil-rock material on a surface (slip face) that is roughly parallel to the general ground surface, in contrast to falls, topples, and rotational slides. The term includes such diverse *slide* types as translational debris slides, translational earth slide, translational rock slide, block glides, and slab or flake slides. Compare - rotational slide, slide, landslide.

transverse dune - A very asymmetric sand dune elongated perpendicular to the prevailing wind direction, having a gentle windward slope and a steep leeward slope standing at or near the angle of repose of sand; it generally forms in areas of sparse vegetation. Compare - longitudinal dune.

valley - An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity. Compare - basin.

valley floor - A general term for the nearly level to gently sloping, lowest surface of a valley. Landforms include axial stream channels, the flood plain, flood-plain steps, and, in some areas, low terrace surfaces. Compare - flood-plain landforms, meander, braided channel, valley side.

valley side - The sloping to very steep surfaces between the valley floor and summits of adjacent uplands. Well-defined, steep valley sides have been termed valley walls (not recommended). Note: Scale, relief, and perspective may require use of closely related terms such as hill slope or mountain slope.

wash (dry wash) - (colloquial: western US.) The broad, flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium. Note: When channels reach intersect zones of ground-water discharge they are more properly classed as "intermittent stream" channels. Synonym - arroyo. Compare - gully.

zibar - A small, low-relief sand dune that lacks discernible slip faces and commonly occurs on sand sheets, in interdune areas, or in corridors between larger dunes. Zibar spacing can range from 50-400 m with local relief < 10 m. Unlike coppice dunes, zibars are unrelated to deposition around vegetation. Generally dominated by coarse sand. Compare - dune, coppice dune.

CONSIDERATIONS FOR PLANNING

Planning for the day:

1. Safety and sustenance: Plenty of food, water, first-aid kit, raingear, sunscreen.
2. Field communications:
 - a. Develop a plan with team-mate for check-in time.
 - b. Does park staff know the area in which you will be working?
3. Make sure you have the right maps and photos.
4. Check your GPS receiver (Datum set to NAD83? WAAS on? Needs new batteries?).
5. Plan the day's mission before departing using a) USGS quads, b) aerial photos, c) Park/BLM/FS maps.
6. Considerations for mission planning:
 - a. Plan travel based on topography, best access routes, density and complexity of vegetation (more time for forest and woodland sites, less for herbaceous and shrub).
 - b. Plan data collection based on priority needs; new types get higher priority.
 - c. Communicate to make sure you aren't duplicating effort when unnecessary.

Planning for the Week (do this on the first day of the trip)

1. Do you have all appropriate maps, photos?
2. Develop a reasonable estimate of the number of plots for each team broken up by day and based on an estimate of individual team's travel logistics for the week.
3. Develop plan of attack for the week to capture all essential associations in the work area.
4. Balance points two and three above with the expected work schedule of the teams and ensure adequate time-off and reduce over-time concerns.
5. Do you have all necessary information and backups for the week's planning? E.g., blank field forms, film, plenty of batteries.

Wrapup

1. Clean, recharge and repair equipment.
2. Hold brief meeting to discuss data collection issues, things that came up during the day/week, and plan for next days activities.
3. Edit field forms and file them systematically.
4. Re-file the aerial photos and maps.
5. Download flashcards.
6. Key unknown plants.
7. Enter edited data into database.

Communicate among teams / Topics for wrap-up meetings.

1. What were your questions about the sites visited daily/weekly?
2. Do you have any questions about the forms or fields?
3. What was accomplished, what was not accomplished?
4. Pass on developments and questions, e.g., were there problems with interpreting the aerial photos, or are there personnel issues, problems in consistency in interpreting the forms, or with park-related logistics?

Materials Checklist

- Site research permit
- Topo maps
- Site maps for general navigation
- Digital orthophoto for easy reference
- Geology map
- Aerial photos
- Compass with adjustable declination
- Clinometer
- GPS receiver
- Plenty of AA batteries for GPS receivers, walkie talkies, etc.
- Radio or walkie talkie and/or cell phone
- Digital camera and flash cards
- Baggies for temporary storage of unknown plants, and masking tape for labeling
- Plant press & paper
- Plant Keys / Flora(s)
- Pens / sharpies
- Forms: observation point
- Clipboard/forms holder
- Pens, pencils, pencil lead, slate board, chalk, and chalkboard eraser
- Most recent version of provisional classification of the park
- All ancillary information (cheat sheet, species list, floras, main sampling protocol).
- First aid kit, personal gear (food, water, rain gear, etc.)

ATTACHMENT B
DESCRIPTION OF FEDERALLY LISTED SPECIES

Brown pelican (*Pelecanus occidentalis*)

Cameron County

The brown pelican was listed as endangered on October 13, 1970.

Distribution: The brown pelican historical range included the Atlantic and Gulf coasts from South Carolina to Florida and west to Texas. Currently, the brown pelican occurs throughout its historic range but in greatly reduced numbers. Within Texas, numbers dropped drastically from an estimated 5,000 birds in 1918 to less than 100 individuals and only 10 breeding pairs in 1974. According to a 2003 survey, there were 8 colonies and 3,895 active nests in Texas. Today, brown pelicans occur along the Texas coast from Chambers County on the upper coast to Cameron County on the lower coast. Most of the breeding birds nest on Pelican Island in Corpus Christi Bay and Sundown Island near Port O'Connor.

Natural History:

Habitat: The brown pelican is a coastal bird that is rarely seen inland or far out at sea. They feed in shallow estuarine waters usually less than 40 miles from shore. Pelicans use sand spits, offshore sand bars, and islets for roosting and loafing.

Breeding: Egg laying varies by location; in Texas, brown pelican populations nest irregularly usually beginning in late fall and extending through June. The clutch size averages 2–3 eggs and incubation lasts 28–30 days. The young pelicans leave the nests around 35 days after hatching, fledge around 63 days after hatching, and fly around 71–88 days after hatching. Reproductive success is highly variable and susceptible to disturbance by humans, starvation of young, and/or flooding of nests. In Texas, brown pelicans build their nests on small isolated coastal islands that are safe from predators such as raccoons and coyotes.

Diet: The brown pelican is a piscivore that primarily feeds upon menhaden and mullet in Texas. They spot the fish from above and the dive beak-first into the water to scoop up the fish.

Threats: The brown pelican has undergone several sharp population declines in Texas. The first decline occurred in the 1920–30s when local fishermen would kill the birds because of incorrect assumptions that the brown pelican competed with humans for fish. The second sharp decline occurred in the 1960s and 1970s when the brown pelican would eat menhaden containing the pesticides DDT and Endrin. Pesticide ingestion caused a severe decline in brown pelican reproductive success. Currently, human encroachment and development of the Texas coast provides the most significant threat to brown pelican populations.

Green sea turtle (*Chelonia mydas*)

Cameron County

The green sea turtle was listed as endangered on July 28, 1978.

Distribution: The green sea turtle occurs in tropical waters of the Atlantic, Pacific, and Indian Oceans. Their main nesting grounds occur on Aves Island in Costa Rica and Surinam. Green sea turtles have rarely been observed nesting in Texas one sighting of a single female was recently observed in Kenedy County, Texas. Juveniles occupy offshore areas from Texas to Massachusetts (NatureServe 2007).

Natural History:

Habitat: Hatchlings are typically restricted to floating in masses of sea plants in the convergence zone while juveniles roam into temperate waters. Adults stay in the coral reefs and rocky outcrops near feeding pastures in tropical waters (NatureServe 2007).

Breeding: The green sea turtle nests from March to October in the Gulf of Mexico region with the peak between May and June. The female lays 1–8 clutches of 90–140 eggs. The incubation period is 1.5–3 months and the hatchlings emerge between early June and late December (NatureServe 2007).

Diet: The green sea turtle feeds in shallow waters with abundant submerged vegetation. The adults are herbivorous and eat seagrass, macroalgae, and other marine plants while the juveniles are more invertivorous and prey on mollusks, sponges, crustaceans, and jellyfish (NatureServe 2007).

Threats: The major threats to green sea turtle populations are degradation of nesting habitat, collection of nesting females and eggs for human consumption, mortality in fishing gear (nets, etc.), and contact with pollution (NatureServe 2007).

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: October 17, 2007).

Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*)

Cameron, Hidalgo, and Starr Counties

The Gulf Coast jaguarundi was listed as endangered on June 14, 1976.

Distribution: Because of the secretive nature of the jaguarundi, little is known about its exact distribution within Texas. The only documented sighting of a jaguarundi in Texas was a road killed specimen found in Cameron County. Possible counties where the jaguarundi may exist include Cameron, Duval, Hidalgo, Jim Wells, Kenedy, Kleberg, Live Oak, Nueces, San Patricio, Starr, Willacy, and Zapata. Jaguarundi occurs in Central and South America in greater numbers than occur in the United States (USFWS 1990).

Natural History:

Habitat: The habitat of the jaguarundi includes the Tamaulipan Biotic Province and Texas Thornscrub and brushland. Potential habitat includes four vegetation types within the LRGV: Mesquite-Granjeno Parks, Mesquite-Blackbrush Brush, Live Oak Woods/Parks, and Rio Grande Riparian. Jaguarundi prefers dense thornscrub habitats with greater than 95% canopy cover, but will forage in associated herbaceous communities. Their minimal home range is about 40 ha (USFWS 1990).

Breeding: The jaguarundi mates in November or December and gestation lasts 9–10 weeks. There may be two litters of 1–4 (average 2) young per year. In Mexico, the young are born between March and August. Little is known of the breeding habits within the United States.

Diet: The jaguarundi is active at night and preys primarily on birds, small rodents, and rabbits.

Threats: The largest threat to jaguarundi populations in the United States is habitat loss and fragmentation in southern Texas. The jaguarundi requires a large hunting area and appropriate habitat is being lost to development and agriculture. Habitat loss creates islands of habitat with insufficient connecting corridors and jaguarundi cannot travel from area-to-area thus exposing them to predation.

U.S. Fish and Wildlife Service. 1990. Listed Cats of Texas and Arizona Recovery Plan (With Emphasis on the Ocelot). U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 131 pp.

Hawksbill sea turtle (*Eretmochelys imbricata*)

Cameron County

Distribution: The hawksbill sea turtle occurs in tropical and sub-tropical seas of the Atlantic, Pacific, and Indian Oceans. It is widely distributed in the Caribbean Sea and western Atlantic Ocean. The sea turtle utilizes the northern Gulf of Mexico (especially near Texas) for some life history stages (NMFS and USFWS 1993).

Natural History:

Habitat: Hawksbill habitat use depends on the life stage. Posthatchling hawksbills occupy the pelagic environment, hiding from predators in communities of marine algae, eelgrass, etc. Juveniles swim to coastal waters with coral reefs a preferred habitat for foraging for juveniles, sub-adults, and adults (NMFS and USFWS 1993).

Breeding: The hawksbill chooses low- and high-energy beaches in tropical oceans of the world for nests. The hawksbill has a 6 month nesting season with the peak season depending on location. The courtship and mating occurs during migration or near the nesting beach. They nest from 4 to 5 times per season and not every attempt is successful. Clutch size averages 140 eggs with some variation (NMFS and USFWS 1993).

Diet: The diet of posthatchling hawksbills is largely unknown. Eggs of pelagic fish and pelagic species of *Sargassum* have been found in their gut contents. Adults feed primarily on sponges (NMFS and USFWS 1993).

Threats: Threats to hawksbill populations are split into those that affect their nesting sites and those that affect their feeding sites in the ocean. Nesting sites are threatened by poaching, beach erosion, erosion control measures, sand mining, and use of off-road vehicles on beaches. Threats to their marine environment include entanglement in nets, ingestion of marine debris, and the loss and/or degradation of coral reefs (NMFS and USFWS 1993).

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Florida.

Kemp's ridley sea turtle (*Lepidochelys kempii*)

Cameron County

Kemp's ridley sea turtle was listed as endangered on December 2, 1970.

Distribution: Kemp's ridley sea turtle has a restricted breeding range, the most restricted nesting distribution of any sea turtle, with one nesting beach that receives the majority of the nesting females. This beach is located near Rancho Nuevo in southern Tamaulipas, Mexico. An attempt has been made to create another nesting site on San Padre Island, Texas. Adults are essentially restricted to the Gulf of Mexico while juveniles also inhabit the U.S. Atlantic coast (USFWS and NMFS 1992).

Natural History:

Habitat: The sea turtles usually remain in the Gulf of Mexico. Young sea turtles frequent bays, coastal lagoons, and river mouths while the adults are found near the Mississippi River mouth and the Campeche Banks (USFWS and NMFS 1992).

Breeding: Courtship and mating areas of the ridley sea turtle are not well known. Nesting occurs from April into July and is restricted to the beaches of the western Gulf of Mexico, primarily the state of Tamaulipas, Mexico. The clutch averages 101 eggs and the incubation period is 45–58 days.

Diet: Posthatchling ridley sea turtles likely feed on the available *Sargassum* spp. (brown algae) and associated fauna and other epipelagic species within the Gulf of Mexico. Juveniles and adults appear to be shallow water, benthic feeders whose diet is composed primarily of crabs with a preference for portunid crabs (USFWS and NMFS 1992).

Threats: Before the ridley's sea turtle was protected, eggs were removed from the Rancho Nuevo nesting beach from the 1940s to early 1960s. Another threat to ridley sea turtle populations is the trawling industry within the Gulf of Mexico which caught turtles in their trawls and decimated ridley sea turtle populations (USFWS and NMFS 1992).

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1992. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Florida.

Leatherback sea turtle (*Dermochelys coriacea*)

Cameron County

The leatherback sea turtle was listed as endangered on June 2, 1970.

Distribution: The leatherback sea turtle is a circumglobal species that forages in temperate waters. It nests on the beaches of the Atlantic, Indian, and Pacific Oceans in tropical and sub-tropical latitudes. Historically, nesting sites occurred along the coast of Texas, but none have been reported recently (NatureServe 2007).

Natural History:

Habitat: The leatherback usually occupies habitats along the continental shelf and pelagic environments. It also occurs in seas, gulfs, bays, and estuaries (NMFS and USFWS 1998).

Breeding: The female lays over 10 clutches of 50–170 eggs at 1–2 week intervals. The female nests at night from March–August and the incubation period is 8–10 days. There are no known nesting sites in the United States. The greatest number of leatherback sea turtles nest on the Pacific coast of Mexico, mostly in the states of Michoacán, Guerrero, and Oaxaca (NMFS and USFWS 1998).

Diet: The leatherback's diet consists of medusa, siphonophores, and salpae in temperate and boreal latitudes with jellyfish as their primary prey (NatureServe 2007).

Threats: The greatest threat to the leatherback sea turtle is disruption to their nesting sites, especially those along the Pacific coast of Mexico. Increased human presence and construction and the corresponding habitat loss or degradation occurs along many coastal Pacific areas. Harvest of sea turtles and/or eggs for food remains a threat. Incidental take by commercial fishing boats also poses a great threat to the leatherback sea turtle (NMFS and USFWS 1998).

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (*Dermochelys coriacea*).

National Marine Fisheries Service, Silver Spring, MD.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: October 17, 2007).

Loggerhead sea turtle (*Caretta caretta*)

Cameron County

The loggerhead sea turtle was listed as endangered on July 28, 1978.

Distribution: The loggerhead sea turtle occupies the warmer parts of the Atlantic, Pacific, and Indian oceans and range into temperate zones to feed in the summer. Major nesting sites include the southeastern U.S., Mexico, Oman, and South Africa. A few nests have been established on the barrier islands along the Texas coast. The waters of the Gulf of Mexico are used for feeding during non-breeding times (NatureServe 2007).

Natural History:

Habitat: The loggerhead sea turtle occupies the open seas up to 500 miles from the shore primarily over the continental shelf, in bays, estuaries, lagoons, creeks, and the mouths of rivers. Nesting occurs on open, sandy beaches above the high-tide mark (NatureServe 2007).

Breeding: In the southeastern United States, mating occurs in late March to early June with the female laying 1–9 clutches of 45–200 eggs from late April to early September. Incubation requires 7–11 weeks with the hatchlings emerging from the nests after a few days (NatureServe 2007).

Diet: The loggerhead sea turtle feeds on a variety of invertebrates including crustaceans, mollusks, sponges, cnidaria, and echinoderms. They also eat plants and fish. Adults forage on the bottom while the young feed on prey concentrated at the surface (NatureServe 2007).

Threats: The loggerhead turtle is threatened by collection of adult turtles and eggs for food, drowning by entanglement in shrimp trawls, and by habitat degradation from beach development (NatureServe 2007).

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: October 17, 2007).

Northern aplomado falcon (*Falco femoralis septentrionalis*)

Cameron and Hidalgo Counties

The northern aplomado falcon was designated as a federally endangered species on March 27, 1986.

Distribution: The geographic distribution of the northern aplomado falcon includes most of South America from Tierra del Fuego to Ecuador and from sea level to 3,000 m in the Andes. The falcon also inhabits most of Central America and Mexico. The historic range includes areas of Texas, New Mexico, and Arizona. In Texas, northern aplomado falcons occur in south Texas and the Trans-Pecos region (USFWS 1990).

Natural History:

Habitat: In populations within the United States, northern aplomado falcons inhabit yucca-covered sand ridges in coastal prairies, riparian woodlands in open grasslands, and in desert grasslands with scattered curly-mesquite (*Hilaria belangeri*) and yucca. They do not construct nests and must use abandoned nests of other species including the Swainson's hawk (*Buteo swainsoni*), crested caracara (*Caracara cheriway*), and the Chihuahuan raven (*Corvus cryptoleucus*) (USFWS 1990).

Breeding: Most clutches are laid during April and May with a clutch size of 2–3 eggs. The incubation period is 31–32 days. The nestlings fledge at 32–40 days and are dependent on the adults for an additional four weeks after fledging (USFWS 1990).

Diet: Northern aplomado falcons prey on a variety of small birds, insects, rodents, and reptiles. Preferred bird species include doves, cuckoos, woodpeckers, blackbirds, flycatchers, thrushes, and other fringillids that feed in trees. Common insect species include grasshoppers, beetles, dragonflies, cicadas, crickets, butterflies, moths, wasps, and bees (USFWS 1990).

Threats: Populations in the United States experienced a severe decline due to loss of habitat from over-grazing and encroachment of agricultural lands on traditional northern aplomado falcon habitat. The use of DDT during the 1970s also caused a decline in populations due to the inability for falcons to produce viable eggs. Overall, the greatest threat to populations in the United States is habitat loss through development (USFWS 1990).

U.S. Fish and Wildlife Service. 1990. Northern aplomado falcon recovery plan.

U.S. Fish and Wildlife Service. Albuquerque, New Mexico. 56pp.

Ocelot (*Leopardus (=Felis) pardalis*)

Cameron, Hidalgo, and Starr Counties

The ocelot was listed as endangered on March 28, 1972.

Distribution: The ocelot is found from northern Mexico into the southern extremes of Texas and Arizona to northern Argentina, Paraguay, and Uruguay. Little is known of the exact distribution of the ocelot in Texas. Ocelots recorded by trapping or photo documentation include several areas within five counties: Cameron, Willacy, Kenedy, Jim Wells, and Hidalgo. Areas that have been identified as having potential ocelot habitat include Cameron, Duval, Hidalgo, Jim Wells, Kenedy, Kleberg, Live Oak, Nueces, San Patricio, Starr, Willacy, and Zapata (USFWS 1990).

Natural History:

Habitat: The ocelot occurs within the Tamaulipan Biotic Province of Texas, which includes several variations of sub-tropical thornscrub and brushland. Potential habitat includes four vegetation types within the Lower Rio Grande Valley: Mesquite-Granjeno Parks, Mesquite-Blackbrush Brush, Live Oak Woods/Parks, and Rio Grande Riparian. Ocelots prefer dense thornscrub habitats with greater than 95% canopy cover. Their average home range is about 15 km² (USFWS 1990).

Breeding: In Texas, the ocelot breeds in late summer with gestation lasting about 70 days. Births occur in fall and winter and the litter size is 2–4. Dens are found in caves, hollow trees, thickets, or the spaces between closed buttress roots of large trees (NatureServe). Juveniles appear to travel with their mother even following lactation and one study found two young females up to 2 years old with home ranges that significantly overlapped their mother's home range (USFWS 1990).

Diet: The ocelot is active at night and preys primarily on birds, small rodents, and rabbits, but may also include reptiles, fish and invertebrates. Other potential prey species include opossum, raccoon, javelina, white-tailed deer, skunks, nine-banded armadillo, feral swine, poultry, quail, doves, chachalaca, numerous passerine birds and waterfowl, snakes, and lizards.

Threats: Habitat loss and fragmentation especially along the Rio Grande pose a critical threat to the long term survival of the ocelot. Efforts need to be taken to preserve key habitat and biological corridors necessary for ocelot survival (USFWS 1990).

U.S. Fish and Wildlife Service. 1990. Listed Cats of Texas and Arizona Recovery Plan (With Emphasis on the Ocelot). U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 131 pp.

Piping plover (*Charadrius melodus*)

Cameron County

The piping plover was listed as endangered on July 10, 1986.

Distribution: The piping plover is a migratory bird that breeds on coastal beaches from Newfoundland to North Carolina and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast including the coast of Texas, and in the Caribbean (USFWS 1996).

Natural History:

Habitat: Piping plovers choose the accreting ends of barrier islands, sandy peninsulas, and coastal inlets for their winter grounds. In the winter, they prefer sandflats adjacent to inlets or passes, sandy mudflats along prograding spits, and overwash areas for foraging (USFWS 1996).

Breeding: Piping plover nests are located above the high tide line on coastal beaches, sandflats, foredunes, and washover areas cut into or between dunes. Eggs are laid from mid-April to late July and clutch size is usually four eggs. Incubation time averages 27–30 days and the chicks fledge in 25–35 days. Piping plovers migrate to their breeding grounds in late February through early April and return to their winter grounds from late July to September (USFWS 1996).

Diet: The piping plover feeds on invertebrates including marine worms, fly larvae, beetles, crustaceans, and mollusks. They feed along the intertidal portions of ocean beaches, and the shorelines of coastal ponds, lagoons, or salt marshes (USFWS 1996).

Threats: The piping plover's winter grounds have been threatened by recreational activities (both motorized and pedestrian), inlet and shoreline stabilization, dredging of inlets, beach maintenance and renourishment, and pollution (USFWS 1996).

U.S. Fish and Wildlife Service. 1996. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp.

South Texas ambrosia (*Ambrosia cheiranthifolia*)

Cameron County

The south Texas ambrosia was listed as endangered on September 23, 1994.

Distribution: The South Texas ambrosia is a species endemic to southern Texas and northern Mexico that historically occupied areas of Cameron, Jim Wells, Kleberg, and Nueces Counties in Texas, and the state of Tamaulipas in Mexico. Three populations are currently known including two populations in Nueces County and one in Kleberg County.

Natural History:

Morphology: The south Texas ambrosia is a perennial herb that is a member of the aster family. It is erect, has a silvery to grayish-green appearance, and is 10–30 cm tall. It has simple, opposite leaves on the lower stem, which transition to alternate near the inflorescence. The flowers are dioecious with the staminate flowers on terminal racemes and the pistillate flowers in small clusters along the leaf axils.

Habitat: The south Texas ambrosia grows on open clay-loam to sandy-loam prairies and savannas. Associated native grasses include Texas grama (*Bouteloua rigidiseta*), buffalo grass (*Buchloe dactyloides*), Texas speargrass (*Stipa leucotricha*), and tobosa (*Hilaria mutica*).

Threats: The native habitat for the south Texas ambrosia has largely been converted to agricultural fields, improved pastures, or urban areas. Humans have also altered the fire regime of these grasslands allowing thorny shrub and tree species to invade the grasslands.

Star cactus (*Astrophytum asterias*)

Cameron, Hidalgo, and Starr Counties

The star cactus was listed as endangered on October 18, 1993.

Distribution: The star cactus is a species endemic to southern Texas and northern Mexico with historical range that includes Hidalgo, Starr, Zapata, and possibly Cameron counties in Texas and the states of Nuevo Leon and Tamaulipas in Mexico. Known populations occur on private land in Starr County, Texas, Tamaulipas, Mexico, and Nuevo Leon, Mexico. Other populations likely occur but remain unknown because of difficulty surveying private lands (USFWS 2003).

Natural History:

Morphology: The star cactus is a disk or dome-shaped member of the cactus family that is spineless. It is 2–15 cm across and up to 7 cm tall. The color is dull green-to-brown and the plant is often covered in tiny white scales. The star cactus is divided into eight, vaguely triangular sections. The flowers are yellow with orange centers and up to 15 cm in diameter while the fruits are green to grayish-red and fleshy when mature. Star cactus flower from March through May with fruiting between April and June (USFWS 2003).

Habitat: The star cactus occupies sparse, open thorn shrub and grasslands in a warm-temperate, sub-tropical steppe climate in the United States and dry, hot thornscrub in Mexico. These habitats are characterized by scattered mesquite and grasses on sandy soils and thorn brush on heavier soils (USFWS 2003).

Threats: The star cactus is threatened by habitat destruction and modification, collection, and decreased population numbers.

U.S. Fish and Wildlife Service. 2003. Recovery Plan for Star Cactus (*Astrophytum asterias*). U.S. DOI Fish and Wildlife Service, Albuquerque, New Mexico. i-vii + 38pp., A1-19, B-1-8.

Texas ayenia (*Ayenia limitaris*)

Cameron and Hidalgo Counties

The Texas ayenia was listed as endangered on September 23, 1994.

Distribution: The Texas ayenia is an endemic species of southern Texas and northern Mexico with a historical range including Cameron and Hidalgo Counties, Texas, and the states of Coahuila, Nuevo Leon, and Tamaulipas in Mexico. The status of Mexican populations is unknown and the only confirmed population of the Texas ayenia occurs on private property within Hidalgo County.

Natural History:

Morphology: The Texas ayenia is a sub-shrub with pubescent leaves and stems from 60 cm to 150 cm long. The leaves are alternate and simple. The flowers are axillary with up to four per node and their color ranges between green, pink, and cream.

Habitat: The Texas ayenia occupies dense sub-tropical woodland communities at low elevations. The current population occupies a Texas Ebony – Anacua (*Pithecellobium ebano-Ehretia anacua*) plant community. This woodland community occurs on well-drained riparian terraces with canopy cover close to 95%. Additional plant species occurring within this community includes bumelia (*Bumelia celastrina*), brasil (*Condalia hookeri*), granjeno (*Celtis pallida*), and snake-eyes (*Phaulothamnus spinescens*).

Threats: Habitat loss and degradation from agriculture or urban development have reduced the Texas Ebony – Anacua vegetation community by greater than 95%. The species has been reduced to one known population of 20 individuals that is extremely vulnerable to extinction.

Walker's manioc (*Manihot walkerae*)

Hidalgo and Starr Counties

Walker's manioc was listed as endangered on October 2, 1991.

Distribution:Historically, Walker's manioc was known from the Lower Rio Grande Valley of Texas (Hidalgo and Starr counties) and northern Tamaulipas, Mexico. Until recently, it was believed that this species was represented in the U.S. by a single plant in the wild, discovered in Hidalgo County in 1990. In 1995, Walker's manioc was located in three different areas on the Lower Rio Grande National Wildlife Refuge in Starr and Hidalgo Counties (TPWD web site).

Natural History:

Morphology: Walker's manioc is a perennial, branched herb that is about 0.5 m in height. The leaves are alternate, deeply incised, and palmately five-lobed. Flowers are dioecious with staminate flowers tubular and light purplish. Pistillate flowers are white and purple. The known Texas plant flowers in late spring and autumn in response to seasonal rainfall (USFWS 1993).

Habitat: Walker's manioc usually grows among low shrubs, native grasses and herbaceous plants, either in full sunlight, or in partial shade of shrubs. It is found in sandy, calcareous soil, shallowly overlying indurated caliche and conglomerate of the Goliad Formation on rather xeric slopes and uplands, or over limestone.

Threats: Over 95% of Walker's manioc native brush habitat has been cleared in the United States for agriculture, urban development, and recreation. The U.S. population has been reduced to a few locations that makes the species extremely vulnerable to extinction in the United States (USFWS 1993).

U.S. Fish and Wildlife Service. 1993. Walker's Manioc (*Manihot walkerae*) Recovery Plan. USD1 Fish and Wildlife Service, Albuquerque, New Mexico. 57 pp.

Ashy dogweed (*Thymophylla tephroleuca*)

Starr County

The ashy dogweed was listed as endangered on July 19, 1984.

Distribution: The ashy dogweed is a relict species, the only known population occurs on 1 acre in Zapata County, Texas. The population includes approximately 1,300 individuals.

Natural History:

Morphology: The ashy dogweed is a perennial herb with erect stems up to 30 cm in height. The leaves are linear and covered with soft, woolly, white hairs that emit a pungent odor when crushed. The flower heads are yellow and flowering occurs from March to May.

Habitat: The ashy dogweed grows on fine, sandy-loam soils in open areas of a grassland-shrub community. The dominant genera of shrub herbaceous stands include: *Costela*, *Cordia*, *Prosopis*, *Microrhamnus*, *Leucophyllum*, *Cercidium*, and *Yucca*.

Threats: The existence of this species is endangered by overgrazing, habitat loss through roadside blading and brush clearing, oil and gas development, and possible collecting or vandalism.

Johnston's frankenia (*Frankenia johnstonii*)

Starr County

Johnston's frankenia was listed as endangered on August 7, 1984; however, it has been proposed for delisting.

Distribution: Johnston's frankenia is an endemic species of southern Texas and northern Mexico. When it was first listed as an endangered species five populations were known in Texas and another population occurred near Monterrey, Mexico. However, Johnston's frankenia has been found on 30 additional sites in Starr and Zapata counties in Texas (NatureServe 2007).

Natural History:

Morphology: Johnston's frankenia is a member of the Frankeniaceae. The plant is blue-green with a wiry appearance. The branches appear hedged possibly from browsing by large herbivores. It is a perennial shrub that grows up to 62 cm. The leaves and stems are grayish- or bluish-green from a dense covering of short-whitish hairs. The shrub flowers from September to May.

Habitat: Johnston's frankenia grows on rocky flats or slopes of open thorn shrublands. The soils are saline, sometimes with high gypsum content (NatureServe 2007).

Threats: The species remains threatened by brush clearing and oil and gas development, but conservation agreements are being signed by private landowners to protect the species (NatureServe 2007).

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: October 16, 2007).

Least tern (*Sterna antillarum*)

Starr County

The interior population of the least tern was listed as endangered on June 27, 1985.

Distribution: The historic breeding range of the least tern included the Mississippi River, Red River, and Rio Grande. The breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana. Currently, the least tern maintains breeding grounds on all these river systems although suitable habitat has dwindled. In Texas, populations have been observed on the Red River system and along the Texas/Oklahoma border as far east as Burkburnett, Texas. Least terns have been observed on three reservoirs (including Amistad Reservoir in Val Verde County) along the Rio Grande and along the Pecos River at the Bitter Lake National Wildlife Refuge, New Mexico (USFWS 1990).

Natural History:

Habitat: Within systems such as the Rio Grande, least terns nest on sparsely vegetated sand and gravel bars deposited along a wide, unobstructed river channel or on salt flats along lake shorelines. Least terns also nest on artificial habitats such as sand and gravel pits and dredge islands (USFWS 1990).

Breeding: Least terns form colonies on the breeding grounds for 4–5 months arriving from late April to early June. Nests are shallow depressions in open, sandy areas, gravelly patches, or exposed flats. The tern nests in colonies. Clutch size is usually 2–3 eggs and the eggs are laid by late May. Incubation lasts 20–25 days and fledgling occurs after three weeks. Parental attention continues until migration at the end of the breeding season (USFWS 1990).

Diet: The least tern is a fish-eater (piscivore) that hunts in the shallow waters of rivers, streams and lakes. Fish prey is small-sized and include the following genera: *Fundulus*, *Notropis*, *Campostoma*, *Pimephales*, *Gambusia*, *Blonesox*, *Morone*, *Dorosoma*, *Lepomis*, and *Carpoides*. Terns usually hunt near their nesting sites (USFWS 1990).

Threats: The damming of river systems for irrigation, navigation, hydroelectric power, and recreation has altered the river channels that the least tern depends on for breeding grounds. Stabilized river systems eliminate most of the sandbars that terns utilize for breeding grounds by channeling wide, braided rivers into single, narrow navigation channels.

U. S. Fish and Wildlife Service. 1990. Recovery plan for the interior population of the least tern (*Sterna antillarum*). U. S. Fish and Wildlife Service, Twin Cities, Minnesota. 90 pp.

Zapata bladderpod (*Lesquerella thamnophila*)

Starr County

The Zapata bladderpod was listed as endangered on November 22, 1999

Distribution: The Zapata bladderpod is endemic to southern Texas and possibly northern Mexico. Four populations occur in Starr County. Of these, two populations occur within the Lower Rio Grande Valley National Wildlife Refuge and two occur on private land. Three populations are known from Zapata County; two occur within highway rights-of-way between the towns of Zapata and Falcon and another occurs near Falcon Lake (USFWS 2004).

Natural History:

Morphology: The Zapata bladderpod is a pubescent, silvery-green perennial plant of the Mustard Family. It has sprawling stems 43–85 cm long and the basal leaves are narrowly elliptical to oblanceolate and acute with entire or slightly toothed margins. The leaves have stellate trichomes that give the plant its silvery-green appearance. The inflorescence is a loose raceme of bright, yellow flowers. The plant flowers at all times of the year depending on weather conditions (USFWS 2004).

Habitat: The Zapata bladderpod occurs on graveled to sandy-loam upland terraces above the Rio Grande floodplain. It is associated with highly calcareous sandstones and clays. The bladderpod is a component of an open *Leucophyllum frutescens* – *Acacia berlanderi* shrubland alliance. The shrublands are sparsely vegetated and include the following species *Acacia ridigula*, *Prosopis* sp., *Celtis pallida*, *Yucca treculeana*, *Zizyphus obtusifolia*, and *Guaiacum angustifolium* (USFWS 2004).

Threats: Habitat modification and destruction from increased road and highway construction and urban development, increased oil and gas exploration and development, and conversion of plant communities to improve pastures, overgrazing and vulnerability due to low population numbers are all threats to the Zapata bladderpod

U.S. Fish and Wildlife Service. 2004. Zapata Bladderpod (*Lesquerella thamnophila*) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. i-vii + 30 pp., Appendices A-B.

ATTACHMENT C
GIS PRODUCTS

GIS PRODUCTS

- ❖ GIS Interactive File
- ❖ Access Database for PF225
- ❖ GIS Layer: Vegetation Database
- ❖ Maps Including Vegetation Layer
- ❖ Field Photographs

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT D
LRGV SPECIES LISTS

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Accipitridae				
<i>Accipiter cooperii</i>	Cooper's Hawk	G5/S4		
<i>Accipiter striatus</i>	Sharp-shinned Hawk	G5/S2		
<i>Aquila chrysaetos</i>	Golden Eagle	G5/S3		
<i>Asturina (Buteo) nitidus</i>	Gray Hawk	G5/S2		
<i>Buteo albicaudatus</i>	White-tailed Hawk	G4G5/S4	Threatened	
<i>Buteo albonotatus</i>	Zone-tailed Hawk	G4/S3	Threatened	
<i>Buteo brachyurus</i>	Short-tailed Hawk	G4G5/No TX Record		
<i>Buteo jamaicensis</i>	Red-tailed Hawk	G5/S5		
<i>Buteo lineatus</i>	Red-shouldered Hawk	G5/S4		
<i>Buteo magnirostris</i>	Roadside Hawk	No NS Record		
<i>Buteo playpterus</i>	Broad-winged Hawk	G5/S3		
<i>Buteo regalis</i>	Ferruginous Hawk	G4/S2		
<i>Buteo swainsoni</i>	Swainson's Hawk	G5/S4		
<i>Buteogallus anthracinus</i>	Common Black-Hawk	G4G5/S2	Threatened	
<i>Chondrohierax uncinatus</i>	Hook-billed Kite	G4/S2		
<i>Circus cyaneus</i>	Northern Harrier	G5/S2		
<i>Elanoides forficatus</i>	Swallow-tailed Kite	G5/S2	Threatened	
<i>Elanus leucurus</i>	White-tailed Kite	G5/S4		
<i>Geranospiza caerulescens</i>	Crane Hawk	No NS Record		
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G5/S3	Threatened	

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Ictinia mississippiensis</i>	Mississippi Kite	G5/S4		
<i>Pandion haliaetus</i>	Osprey	G5/S4		
<i>Parabuteo unicinctus</i>	Harris's Hawk	G5/S3		
<i>Rostrhamus sociabilis</i>	Snail Kite	G4G5/No TX Record		
Alaudidae				
<i>Eremophila alpestris</i>	Horned Lark	G5/S5		
Alcedinidae				
<i>Ceryle (Megaceryle) alcyon</i>	Belted Kingfisher	G5/S5		
<i>Ceryle (Megaceryle) torquata</i>	Ringed Kingfisher	G5/S3		
<i>Chloroceryle americana</i>	Green Kingfisher	G5/S4		
Anatidae				
<i>Aix sponsa</i>	Wood Duck	G5/S4		
<i>Anas acuta</i>	Northern Pintail	G5/S3		
<i>Anas americana</i>	American Wigeon	G5/S3		
<i>Anas bahamensis</i>	White-cheeked Pintail	No TX Record		
<i>Anas clypeata</i>	Northern Shoveler	G5/S3		
<i>Anas crecca</i>	Green-winged Teal	G5/S2		
<i>Anas cyanoptera</i>	Cinnamon Teal	G5/S3		
<i>Anas discors</i>	Blue-winged Teal	G5/S3		
<i>Anas fulvigula</i>	Mottled Duck	G4/S4		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Anas penelope</i>	Eurasian Wigeon	G5/No TX Record		
<i>Anas platyrhynchos</i>	Mallard	G5/S3		
<i>Anas platyrhynchos novimexicanus</i>	Mexican Duck	No TX Record		
<i>Anas strepera</i>	Gadwall	G5/S3		
<i>Anser albifrons</i>	Greater White-fronted Goose	G5/S5		
<i>Aythya affinis</i>	Lesser Scaup	G5/S3		
<i>Aythya americana</i>	Redhead	G5/S3		
<i>Aythya collaris</i>	Ring-necked Duck	G5/No TX Record		
<i>Aythya marila</i>	Greater Scaup	G5/No TX Record		
<i>Aythya valisineria</i>	Canvasback	G5/S4		
<i>Branta bernicla</i>	Brant	G5/S2		
<i>Branta canadensis</i>	Canada Goose	G5/S5		
<i>Bucephala albeola</i>	Bufflehead	G5/No TX Record		
<i>Bucephala clangula</i>	Common Goldeneye	G5/No TX Record		
<i>Cairina moschata</i>	Muscovy Duck	G4/S3		
<i>Chen caerulescens</i>	Snow Goose	G5/S5		
<i>Chen rossii</i>	Ross' Goose	G4/S3		
<i>Clangula hyemalis</i>	Long-tailed Duck	G5/No TX Record		
<i>Cygnus buccinator</i>	Trumpeter Swan	G4/No TX Record		
<i>Cygnus columbianus</i>	Tundra Swan	G5/No TX Record		
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck	G5/S5		
<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck	G5/S4		
<i>Histrionicus histrionicus</i>	Harlequin Duck	G4/No TX Record		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Lophodytes cucullatus</i>	Hooded Merganser	G5/S3		
<i>Melanitta fusca</i>	White-winged Scoter	G5/No TX Record		
<i>Melanitta perspicillata</i>	Surf Scoter	G5/No TX Record		
<i>Mergus merganser</i>	Common Merganser	G5/No TX Record		
<i>Mergus serrator</i>	Red-breasted Merganser	G5/No TX Record		
<i>Nomonyx dominicus</i>	Masked Duck	G5/S3		
<i>Oxyura jamaicensis</i>	Ruddy Duck	G5/S3		
Anhingidae				
<i>Anhinga anhinga</i>	Anhinga	G5/S4		
Apodidae				
<i>Chaetura pelagica</i>	Chimney Swift	G5/S3		
<i>Streptoprocne zonaris</i>	White-collared Swift	No NS Record		
Ardeidae				
<i>Ardea albus</i>	Great Egret	G5/S5		
<i>Ardea herodias</i>	Great Blue Heron	G5/S5		
<i>Botaurus lentiginosus</i>	American Bittern	G4/S3		
<i>Bubulcus ibis</i>	Cattle Egret	G5/Exotic		
<i>Butorides virescens</i>	Green Heron	G5/S5		
<i>Egretta caerulea</i>	Little Blue Heron	G5/S5		
<i>Egretta rufescens</i>	Reddish Egret	G4/S3	Threatened	

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Egretta thula</i>	Snowy Egret	G5/S5		
<i>Egretta tricolor</i>	Tricolored Heron	G5/S5		
<i>Ixobrychus exilis</i>	Least Bittern	G5/S4		
<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron	G5/S4		
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	G5/S4		
Bombycillidae				
<i>Bombycilla cedrorum</i>	Cedar Waxwing	G5/N5		
Caprimulgidae				
<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	G5/S3		
<i>Caprimulgus vociferous</i>	Whip-poor-will	G5/S4		
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	G5/S4		
<i>Chordeiles minor</i>	Common Nighthawk	G5/S4		
<i>Nyctidromus albicollis</i>	Common Pauraque	G5/S5		
<i>Phalaenoptilus nuttallii</i>	Common Poorwill	G5/S4		
Cardinalidae				
<i>Cardinalis cardinalis</i>	Northern Cardinal	G5/S5		
<i>Cardinalis sinuatus</i>	Pyrrhuloxia	G5/S4		
<i>Cyanocompsa parellina</i>	Blue Bunting	No NS Record		
<i>Passerina amoena</i>	Lazuli Bunting	G5/S3		
<i>Passerina caerulea</i>	Blue Grosbeak	G5/S4		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Passerina ciris</i>	Painted Bunting	G5/S4		
<i>Passerina cyanea</i>	Indigo Bunting	G5/S5		
<i>Passerina versicolor</i>	Varied Bunting	G5/S4		
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	G5/S4		
<i>Pheucticus melanocephalus</i>	Black-headed Grosbeak	G5/S4		
<i>Rhodothraupis celaeno</i>	Crimson-collared Grosbeak	No NS Record		
<i>Spiza americana</i>	Dickcissel	G5/S4		
Cathartidae				
<i>Cathartes aura</i>	Turkey Vulture	G5/S5		
<i>Coragyps atratus</i>	Black Vulture	G5/S5		
Certhiidae				
<i>Certhia americana</i>	Brown Creeper	G5/S4		
Charadriidae				
<i>Charadrius alexandrius</i>	Snowy Plover	G4/S3		
<i>Charadrius melodus</i>	Piping Plover	G3/S2	Threatened	Threatened
<i>Charadrius montanus</i>	Mountain Plover	G2/S2		
<i>Charadrius semipalmatus</i>	Semipalmated Plover	G5/S4		
<i>Charadrius vociferous</i>	Killdeer	G5/S5		
<i>Charadrius wilsonia</i>	Wilson's Plover	G5/S4		
<i>Pluvialis dominicus</i>	American Golden-Plover	G5/S3		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Pluvialis squatarola</i>	Black-bellied Plover	G5/S4		
Ciconiidae				
<i>Jabiru mycteria</i>	Jabiru	No NS Record		
<i>Mycteria americana</i>	Wood Stork	G4/SH	Threatened	
Columbidae				
<i>Columba flavirostris</i>	Red-billed Pigeon	No NS Record		
<i>Columba leucocephala</i>	White-crowned Pigeon	No NS Record		
<i>Columba livia</i>	Rock Dove	G5/Exotic		
<i>Columbina inca</i>	Inca Dove	G5/S5		
<i>Columbina passerine</i>	Common Ground-Dove	G5/S4		
<i>Columbina talpacoti</i>	Ruddy Ground-Dove	G5/No TX Record		
<i>Geotrygon montana</i>	Ruddy Quail-Dove	No NS Record		
<i>Leptotila verreauxi</i>	White-tipped Dove	G5/S4		
<i>Streptopelia decaucto</i>	Eurasian Collared-Dove	G5/Exotic		
<i>Zenaida asiatica</i>	White-winged Dove	G5/S5		
<i>Zenaida macroura</i>	Mourning Dove	G5/S5		
Corvidae				
<i>Cyanocitta cristata</i>	Blue Jay	G5/S5		
<i>Corvus cryptoleucus</i>	Chihuahuan Raven	G5/S4		
<i>Corvus imparatus</i>	Tamaulipas Crow	G5/S3		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Cyanocorax morio</i>	Brown Jay	G5/S2		
<i>Cyanocorax yncas</i>	Green Jay	G5/No TX Record		
Cracidae				
<i>Ortalis vetula</i>	Plain Chachalaca	G5/S3		
Cuculidae				
<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	G5/S3		
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	G5/S4		
<i>Coccyzus melacoryphus</i>	Dark-billed Cuckoo	No NS Record		
<i>Coccyzus minor</i>	Mangrove Cuckoo	G5/No TX Record		
<i>Crotophaga sulcirostris</i>	Groove-billed Ani	G5/S4		
<i>Geococcyx californianus</i>	Greater Roadrunner	G5/S4		
Diomedidae				
<i>Thalassarche chlororhynchus</i>	Yellow-nosed Albatross	No NS Record		
Emberizidae				
<i>Sporophila torqueola</i>	White-collared Seedeater	G5/S1		
<i>Aimophila botterii</i>	Botteri's Sparrow	G4/S3		
<i>Aimophila cassinii</i>	Cassin's Sparrow	G5/S4		
<i>Aimophila ruficeps</i>	Rufous-crowned Sparrow	G5/S4		
<i>Ammodramus bairdi</i>	Baird's Sparrow	G4/S2		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Ammodramus leconteii</i>	Le Conte's Sparrow	G4/S3		
<i>Ammodramus maritimus</i>	Seaside Sparrow	G4/S4		
<i>Ammodramus nelsoni</i>	Nelson's Sharp-tailed Sparrow	G5/No TX Record		
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5/S3		
<i>Amphispiza bilineata</i>	Black-throated Sparrow	G5/S4		
<i>Arremonops rufivirgatus</i>	Olive Sparrow	G5/S4		
<i>Calamospiza melanocorys</i>	Lark Bunting	G5/S4		
<i>Calcarius ornatus</i>	Chestnut-collared Longspur	G5/S3		
<i>Chondestes grammacus</i>	Lark Sparrow	G5/S4		
<i>Junco hyemalis</i>	Dark-eyed Junco	G5/S5		
<i>Melospiza georgiana</i>	Swamp Sparrow	G5/S4		
<i>Melospiza lincolnii</i>	Lincoln's Sparrow	G5/S5		
<i>Melospiza melodia</i>	Song Sparrow	G5/S5		
<i>Passerculus sandwichensis</i>	Savannah Sparrow	G5/S4		
<i>Pipilo arcticus</i>	Spotted Towhee	No NS Record		
<i>Pipilo chlorurus</i>	Green-tailed Towhee	G5/S4		
<i>Pipilo erythrophthalmus</i>	Eastern Towhee	G5/S2		
<i>Plectrophenax nivalis</i>	Snow Bunting	G5/No TX Record		
<i>Pooecetes gramineus</i>	Vesper Sparrow	G5/S5		
<i>Spizella arborea</i>	American Tree Sparrow	G5/No TX Record		
<i>Spizella breweri</i>	Brewer's Sparrow	G5/S4		
<i>Spizella pallida</i>	Clay-colored Sparrow	G5/S4		
<i>Spizella passerine</i>	Chipping Sparrow	G5/S4		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Spizella pusilla</i>	Field Sparrow	G5/S5		
<i>Tiaris olivaceus</i>	Yellow-faced Grassquit	G5/No TX Record		
<i>Zonotrichia albicollis</i>	White-throated Sparrow	G5/No TX Record		
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow	G5/S5		
<i>Zonotrichia querula</i>	Harris's Sparrow	G5/S4		
Falconidae				
<i>Caracara plancus</i>	Crested Caracara	G5/S4		
<i>Falco columbarius</i>	Merlin	G5/No NS Record		
<i>Falco femoralis</i>	Aplomado Falcon	G4/S1	Endangered	Endangered
<i>Falco mexicanus</i>	Prairie Falcon	G5/S3		
<i>Falco peregrinus</i>	Peregrine Falcon	G4/S3	Endangered, Threatened	
<i>Falco sparverius</i>	American Kestrel	G5/S4		
<i>Micrastur semitorquatus</i>	Collared Forest-Falcon	No NS Record		
Fregatidae				
<i>Fregata magnificens</i>	Magnificent Frigatebird	G5/No TX Record		
Fringillidae				
<i>Carduelis flammæa</i>	Common Redpoll	G5/No TX Record		
<i>Carduelis pinus</i>	Pine Siskin	G5/S2		
<i>Carduelis psaltria</i>	Lesser Goldfinch	G5/S5		
<i>Carduelis tristis</i>	American Goldfinch	G5/S2		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Carpodacus mexicanus</i>	House Finch	G5/S5		
<i>Carpodacus purpureus</i>	Purple Finch	G5/S4		
<i>Loxia curvirostra</i>	Red Crossbill	G5/S3		
Gaviidae				
<i>Gavia adamsii</i>	Yellow-billed Loon	G4/No Tx Record		
<i>Gavia immer</i>	Common Loon	G5/No Tx Record		
<i>Gavia pacifica</i>	Pacific Loon	G5/No Tx Record		
Gruidae				
<i>Grus americana</i>	Whooping Crane	G1/S1	Endangered	Endangered
<i>Grus canadensis</i>	Sandhill Crane	G5/S5		
Haematopodidae				
<i>Haematopus palliatus</i>	American Oystercatcher	G5/S3		
Hirundinidae				
<i>Progne subis</i>	Purple Martin	G5/S5		
<i>Hirundo rustica</i>	Barn Swallow	G5/S5		
<i>Petrochelidon fulva</i>	Cave Swallow	G5/S4		
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	G5/S4		
<i>Progne chalybea</i>	Gray-breasted Martin	No NS Record		
<i>Riparia riparia</i>	Bank Swallow	G5/S2		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	G5/S3		
<i>Tachycineta bicolor</i>	Tree Swallow	G5/S3		
<i>Tachycineta thalassina</i>	Violet-green Swallow	G5/S4		
Hydrobatidae				
<i>Oceanodroma castro</i>	Band-rumped Storm-Petrel	G4/No TX Record		
<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel	G5/No TX Record		
Icteridae				
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	G5/S5		
<i>Dolichonyx oryzivorus</i>	Bobolink	G5/S3		
<i>Euphagus carolinus</i>	Rusty Blackbird	G4/S3		
<i>Euphagus cyanocephalus</i>	Brewer's Blackbird	G5/S5		
<i>Icterus bullockii</i>	Bullock's Oriole	G5/S4		
<i>Icterus cucullatus</i>	Hooded Oriole	G5/S4		
<i>Icterus galbula</i>	Baltimore Oriole	G5/S4		
<i>Icterus graduacauda</i>	Audubon's Oriole	G5/S4		
<i>Icterus gularis</i>	Altamira Oriole	G5/S3		
<i>Icterus parisorum</i>	Scott's Oriole	G5/S3		
<i>Icterus spurius</i>	Orchard Oriole	G5/S4		
<i>Icterus spurius fuertesi</i>	Fuerte's Orchard Oriole	No NS Record		
<i>Molothrus aeneus</i>	Bronzed Cowbird	G5/S5		
<i>Molothrus ater</i>	Brown-headed Cowbird	G5/S5		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Molothrus bonariensis</i>	Shiny Cowbird	G5/No TX Record		
<i>Quiscalus major</i>	Boat-tailed Grackle	G5/S4		
<i>Quiscalus mexicanus</i>	Great-tailed Grackle	G5/S5		
<i>Quiscalus quiscula</i>	Common Grackle	G5/S5		
<i>Sturnella magna</i>	Eastern Meadowlark	G5/S5		
<i>Sturnella neglecta</i>	Western Meadowlark	G5/S5		
<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird	G5/S3		
Jacanidae				
<i>Jacana spinosa</i>	Northern Jacana	No NS Record		
Laniidae				
<i>Lanius ludovicianus</i>	Loggerhead Shrike	G4/S4		
Laridae				
<i>Anous stolidus</i>	Brown Noddy	G5/No TX Record		
<i>Catharacta skua</i>	South Polar Skua	G4G5/No TX Record		
<i>Chlidonias niger</i>	Black Tern	G4/S3		
<i>Larus argentatus</i>	Herring Gull	G5/S5		
<i>Larus atricilla</i>	Laughing Gull	G5/S5		
<i>Larus californicus</i>	California Gull	G5/No TX Record		
<i>Larus crassirostris</i>	Black-tailed Gull	No NS Record		
<i>Larus delawarensis</i>	Ring-billed Gull	G5/S5		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Larus fuscus</i>	Lesser Black-backed Gull	G5/No TX Record		
<i>Larus glaucooides</i>	Iceland Gull	G5/No TX Record		
<i>Larus hyperboreus</i>	Glaucous Gull	G5/No TX Record		
<i>Larus marinus</i>	Great Black-backed Gull	G5/No TX Record		
<i>Larus occidentalis</i>	Western Gull	G5/No TX Record		
<i>Larus philadelphia</i>	Bonaparte's Gull	G5/S4		
<i>Larus pipixcan</i>	Franklin's Gull	G4G5/S2		
<i>Larus ridibundus</i>	Black-headed Gull	G5/No TX Record		
<i>Larus schistisagus</i>	Slaty-backed Gull	G5/No TX Record		
<i>Larus thayeri</i>	Thayer's Gull	G5/No TX Record		
<i>Rissa tridactyla</i>	Black-legged Kittiwake	G5/No TX Record		
<i>Rynchops niger</i>	Black Skimmer	G5/S4		
<i>Stercorarius longicaudus</i>	Long-tailed Jaeger	G5/No TX Record		
<i>Stercorarius parasiticus</i>	Parasitic Jaeger	G5/No TX Record		
<i>Stercorarius pomarinus</i>	Pomarine Jaeger	G5/No TX Record		
<i>Sterna anaethetus</i>	Bridled Tern	No NS Record		
<i>Sterna antillarum</i>	Least Tern	No NS Record		
<i>Sterna caspia</i>	Caspian Tern	No NS Record		
<i>Sterna forsteri</i>	Forster's Tern	G5/S5		
<i>Sterna fuscata</i>	Sooty Tern	No NS Record	Threatened	
<i>Sterna hirundo</i>	Common Tern	G5/S1		
<i>Sterna maxima</i>	Royal Tern	No NS Record		
<i>Sterna nilotica</i>	Gull-billed Tern	No NS Record		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Sterna sandvicensis</i>	Sandwich Tern	No NS Record		
<i>Xema sabini</i>	Sabine's Gull	G5/No TX Record		
Mimidae				
<i>Dumetella carolinensis</i>	Gray Catbird	G5/S4		
<i>Melanoptila glabrirostris</i>	Black Catbird	No NS Record		
<i>Melanotix caerulescens</i>	Blue Mockingbird	No NS Record		
<i>Mimus polyglottos</i>	Northern Mockingbird	G5/S5		
<i>Oreoscoptes montanus</i>	Sage Thrasher	G5/No NS Record		
<i>Toxostoma curvirostre</i>	Curve-billed Thrasher	G5/S4		
<i>Toxostoma longirostre</i>	Long-billed Thrasher	G5/S4		
<i>Toxostoma rufum</i>	Brown Thrasher	G5/S4		
Motacillidae				
<i>Arthus rubescens</i>	American Pipit	G5/S4		
<i>Arthus spragueii</i>	Sprague's Pipit	G4/No TX Record		
Odontophoridae				
<i>Callipepla squamata</i>	Scaled Quail	G5/S4		
<i>Colinus virginianus</i>	Northern Bobwhite	G5/S4		
Paridae				
<i>Baeolophus atricristatus</i>	Black-crested Titmouse	G5/S5		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Parus (Poecile) carolinensis</i>	Carolina Chickadee	G5/S5		
Parulidae				
<i>Basileuterus culicivorus</i>	Golden-crowned Warbler	No NS Record		
<i>Basileuterus rufifrons</i>	Rufous-capped Warbler	No NS Record		
<i>Cardellina rubrifrons</i>	Red-faced Warbler	G5/No TX Record		
<i>Dendroica caerulescens</i>	Black-throated Blue Warbler	G5/S3		
<i>Dendroica castanea</i>	Bay-breasted Warbler	G5/S4		
<i>Dendroica cerulean</i>	Cerulean Warbler	G4/SH		
<i>Dendroica chrysoparia</i>	Golden-cheeked Warbler	G2/S2	Endangered	Endangered
<i>Dendroica coronata auduboni</i>	Audubon's Yellow-rumped Warbler	G5T5/No TX Record		
<i>Dendroica coronata coronata</i>	Myrtle Yellow-rumped Warbler	G5T4/No TX Record		
<i>Dendroica discolor</i>	Prairie Warbler	G5/S3		
<i>Dendroica dominica</i>	Yellow-throated Warbler	G5/S4		
<i>Dendroica fusca</i>	Blackburnian Warbler	G5/S3		
<i>Dendroica magnolia</i>	Magnolia Warbler	G5/S4		
<i>Dendroica nigrescens</i>	Black-throated Gray Warbler	G5/SH		
<i>Dendroica occidentalis</i>	Hermit Warbler	G4G5/S3		
<i>Dendroica palmarum</i>	Palm Warbler	G5/S3		
<i>Dendroica pennsylvanica</i>	Chestnut-sided Warbler	G5/No TX Record		
<i>Dendroica petechia</i>	Yellow Warbler	G5/S2		
<i>Dendroica petechia bryanti</i>	Mangrove Yellow Warbler	No NS Record		
<i>Dendroica pinus</i>	Pine Warbler	G5/S5		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Dendroica striata</i>	Blackpoll Warbler	G5/S3		
<i>Dendroica tigrina</i>	Cape May Warbler	G5/S2		
<i>Dendroica townsendi</i>	Townsend's Warbler	G5/S4		
<i>Dendroica virens</i>	Black-throated Green Warbler	G5/S4		
<i>Geothlypis poliocephala</i>	Gray-crowned Yellowthroat	No NS Record		
<i>Geothlypis trichas</i>	Common Yellowthroat	G5/S5		
<i>Helmitheros vermivorus</i>	Worm-eating Warbler	G5/S3		
<i>Icteria virens</i>	Yellow-breasted Chat	G5/S5		
<i>Limnothlypis swainsonii</i>	Swainson's Warbler	G4/S3		
<i>Mniotilta varia</i>	Black-and-white Warbler	G5/S4		
<i>Myioborus miniatus</i>	Slate-throated Redstart	No NS Record		
<i>Myioborus pictus</i>	Painted Redstart	G5/S3		
<i>Oporornis formosus</i>	Kentucky Warbler	G5/S3		
<i>Oporornis philadelphia</i>	Mourning Warbler	G5/S4		
<i>Oporornis tolmiei</i>	MacGillivray's Warbler	G5/S4		
<i>Parula americana</i>	Northern Parula	G5/S4		
<i>Parula pitayumi</i>	Tropical Parula	G5/S3	Threatened	
<i>Protonotaria citrea</i>	Prothonotary Warbler	G5/S3		
<i>Seiurus aurocapillus</i>	Ovenbird	G5/S4		
<i>Seiurus motacilla</i>	Louisiana Waterthrush	G5/S3		
<i>Seiurus noveboracensis</i>	Northern Waterthrush	G5/S4		
<i>Setophaga ruticilla</i>	American Redstart	G5/S2		
<i>Vermivora celata</i>	Orange-crowned Warbler	G5/S4		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Vermivora chrysoptera</i>	Golden-winged Warbler	G4/S3		
<i>Vermivora crissalis</i>	Colima Warbler	G3G4/S3		
<i>Vermivora peregrine</i>	Tennessee Warbler	G5/S4		
<i>Vermivora pinus</i>	Blue-winged Warbler	G5/S4		
<i>Vermivora ruficapilla</i>	Nashville Warbler	G5/S5		
<i>Vermivora virginiae</i>	Virginia's Warbler	G5/S3		
<i>Wilsonia canadensis</i>	Canada Warbler	G5/S4		
<i>Wilsonia citrine</i>	Hooded Warbler	G5/S5		
<i>Wilsonia pusilla</i>	Wilson's Warbler	G5/S4		
Passeridae				
<i>Passer domesticus</i>	House Sparrow	G5/Exotic		
Pelecanidae				
<i>Pelecanus erythrorhynchos</i>	American White Pelican	G3/S2		
<i>Pelecanus occidentalis</i>	Brown Pelican	G4/S3	Endangered	Endangered
Phaethontidae				
<i>Phaethon aethereus</i>	Red-billed Tropicbird	G5/No TX Record		
Phalacrocoracidae				
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	G5/S3		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant	G5/S4		
Phasianidae				
<i>Meleagris gallopavo</i>	Wild Turkey	G5/S5		
Phoenicopteridae				
<i>Phoenicopterus ruber</i>	Greater Flamingo	G3/No TX Record		
Picidae				
<i>Colaptes auratus</i>	Northern Flicker	G5/S3		
<i>Melanerpes aurifrons</i>	Golden-fronted Woodpecker	G5/S5		
<i>Melanerpes carolinus</i>	Red-bellied Woodpecker	G5/S5		
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	G5/S3		
<i>Melanerpes formicivorus</i>	Acorn Woodpecker	G5/S4		
<i>Picoides pubescens</i>	Downy Woodpecker	G5/S4		
<i>Picoides scalaris</i>	Ladder-backed Woodpecker	G5/S5		
<i>Sphyrapicus nuchalis</i>	Red-naped Sapsucker	G5/S3		
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	G5/No TX Record		
Podicipedidae				
<i>Aechmophorus occidentalis</i>	Western Grebe	G5/S3		
<i>Podiceps auritus</i>	Horned Grebe	G5/No Tx Record		
<i>Podiceps nigricollis</i>	Eared Grebe	G5/S3		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Podilymbus podiceps</i>	Pied-billed Grebe	G5/S5		
<i>Tachybaptus dominicus</i>	Least Grebe	G5/S3		
Procellariidae				
<i>Calonectris diomedea</i>	Cory's Shearwater	G5/No TX Record		
<i>Puffinus gravis</i>	Greater Shearwater	G5/No TX Record		
<i>Puffinus griseus</i>	Sooty Shearwater	G5/No TX Record		
<i>Puffinus lherminieri</i>	Audubon's Shearwater	G4G5/No TX Record		
<i>Puffinus puffinus</i>	Manx Shearwater	G5/No TX Record		
Psittacidae				
<i>Amazona viridigenalis</i>	Red-crowned Parrot	G2/S2		
<i>Aratinga holochlora</i>	Green Parakeet	G3/S3		
Ptilonotidae				
<i>Phainopepla nitens</i>	Phainopepla	G5/S4		
<i>Ptilonotus cinereus</i>	Gray Silky-flycatcher	No NS Record		
Rallidae				
<i>Coturnicops noveboracensis</i>	Yellow Rail	G4/No TX Record		
<i>Fulica americana</i>	American Coot	G5/S4		
<i>Gallinula chloropus</i>	Common Moorhen	G5/S4		
<i>Laterallus jamaicensis</i>	Black Rail	G4/S2		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Porphyrio martinica</i>	Purple Gallinule	G5/S4		
<i>Porzana carolina</i>	Sora	G5/S3		
<i>Rallus elegans</i>	King Rail	G4/S3		
<i>Rallus limicola</i>	Virginia Rail	G5/S3		
Recurvirostridae				
<i>Himantopus mexicanus</i>	Black-necked Stilt	G5/S5		
<i>Recurvirostra americana</i>	American Avocet	G5/S4		
Regulidae				
<i>Regulus calendula</i>	Ruby-crowned Kinglet	G5/S5		
<i>Regulus satrapa</i>	Golden-crowned Kinglet	G5/No TX Record		
Remizidae				
<i>Auriparus flaviceps</i>	Verdin	G5/S4		
Scolopacidae				
<i>Actitis macularia</i>	Spotted Sandpiper	G5/S3		
<i>Arenaria interpres</i>	Ruddy Turnstone	G5/S5		
<i>Bartramia longicauda</i>	Upland Sandpiper	G5/S3		
<i>Calidris alba</i>	Sanderling	G5/S5		
<i>Calidris alpina</i>	Dunlin	G5/S4		
<i>Calidris bairdii</i>	Baird's Sandpiper	G5/S3		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Calidris canutus</i>	Red Knot	G4/No TX Record		
<i>Calidris ferruginea</i>	Curlew Sandpiper	G5?/No TX Record		
<i>Calidris fuscicollis</i>	White-rumped Sandpiper	G5/S3		
<i>Calidris himantopus</i>	Stilt Sandpiper	G5/S3		
<i>Calidris maritima</i>	Purple Sandpiper	G5/No TX Record		
<i>Calidris mauri</i>	Western Sandpiper	G5/S5		
<i>Calidris melanotos</i>	Pectoral Sandpiper	G5/S4		
<i>Calidris minutilla</i>	Least Sandpiper	G5/S5		
<i>Calidris pusilla</i>	Semipalmated Sandpiper	G5/S5		
<i>Catoptrophorus semipalmatus</i>	Willet	G5/S5		
<i>Gallinago delicata</i>	Wilson's Snipe	No NS Record		
<i>Heteroscelus incanus</i>	Wandering Tattler	G5/No TX Record		
<i>Limnodromus griseus</i>	Short-billed Dowitcher	G5/S3		
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	G5/S4		
<i>Limosa fedoa</i>	Marbled Godwit	G5/S4		
<i>Limosa haemastica</i>	Hudsonian Godwit	G4/S2		
<i>Numenius americanus</i>	Long-billed Curlew	G5/S3		
<i>Numenius borealis</i>	Eskimo Curlew	GH/SH	Endangered	Endangered
<i>Numenius phaeopus</i>	Whimbrel	G5/S4		
<i>Phalaropus fulicarius</i>	Red Phalarope	G5/No TX Record		
<i>Phalaropus tricolor</i>	Wilson's Phalarope	G5/S3		
<i>Phalaropus lobatus</i>	Red-necked Phalarope	G4G5/No TX Record		
<i>Philomachus pugnax</i>	Ruff	G5/No TX Record		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Scolopax minor</i>	American Woodcock	G5/S2		
<i>Tringa flavipes</i>	Lesser Yellowlegs	G5/S5		
<i>Tringa melanoleuca</i>	Greater Yellowlegs	G5/S5		
<i>Tringa solitaria</i>	Solitary Sandpiper	G5/S5		
<i>Tryngites subruficollis</i>	Ruff-breasted Sandpiper	G4/S2		
Sittidae				
<i>Sitta canadensis</i>	Red-breasted Nutchatch	G5/S2		
Strigidae				
<i>Asio flammeus</i>	Short-eared Owl	G5/No TX Record		
<i>Asio otus</i>	Long-eared Owl	G5/S2		
<i>Asio stygius</i>	Stygian Owl	No NS Record		
<i>Athene cunicularia</i>	Burrowing Owl	G4/S3		
<i>Bubo virginianus</i>	Great Horned Owl	G5/S5		
<i>Ciccaba virgata</i>	Mottled Owl	No NS Record		
<i>Glaucidium brasilianum</i>	Ferruginous Pygmy-Owl	G5/S3		
<i>Micrathene whitneyi</i>	Elf Owl	G5/S4		
<i>Otus asio</i>	Eastern Screech-Owl	G5/S2		
<i>Otus flammeolus</i>	Flammulated Owl	G4/S3		
<i>Strix varia</i>	Barred Owl	G5/S5		
Stumidae				

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Sturnus vulgaris</i>	European Starling	G5/Exotic		
Sulidae				
<i>Morus bassanus</i>	Northern Gannet	G5/No TX Record		
<i>Sula dactylatra</i>	Masked Booby	G5/S3		
<i>Sula leucogaster</i>	Brown Booby	G5/No TX Record		
Sylviidae				
<i>Polioptila caerulea</i>	Blue-gray Gnatcatcher	G5/S3		
<i>Polioptila melanura</i>	Black-tailed Gnatcatcher	G5/S4		
Thraupidae				
<i>Piranga bidentata</i>	Flame-colored Tanager	No NS Record		
<i>Piranga flava</i>	Hepatic Tanager	G5/S4		
<i>Piranga ludoviciana</i>	Western Tanager	G5/S4		
<i>Piranga olivacea</i>	Scarlet Tanager	G5/S4		
<i>Piranga rubra</i>	Summer Tanager	G5/S5		
Threskiornithidae				
<i>Eudocimus albus</i>	White Ibis	G5/S4		
<i>Platalea ajaja</i>	Roseate Spoonbill	G5/S4		
<i>Plegadis falcinellus</i>	Glossy Ibis	G5/S3		
<i>Plegadis chihi</i>	White-faced Ibis	G5/S4	Threatened	

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Trochilidae				
<i>Amazilia violiceps</i>	Violet-crowned Hummingbird	G5/No TX Record		
<i>Amazilia yucatanensis</i>	Buff-bellied Hummingbird	G4/S3		
<i>Arthrocothorax prevostii</i>	Green-breasted Mango	No NS Record		
<i>Archilochus colubris</i>	Ruby-throated Hummingbird	G5/S4		
<i>Archilocus alexandri</i>	Black-chinned Hummingbird	G5/S5		
<i>Calypte anna</i>	Anna's Hummingbird	G5/No TX Record		
<i>Colibri thalassinus</i>	Green Violet-ear	G5/S3		
<i>Cynanthus latirostris</i>	Broad-billed Hummingbird	G4/SH		
<i>Hylocharis leucotis</i>	White-eared Hummingbird	G5/No TX Record		
<i>Lampornis clemenciae</i>	Blue-throated Hummingbird	G5/S3		
<i>Sealsphorus rufus</i>	Rufous Hummingbird	G5/No TX Record		
<i>Selasphorus platycercus</i>	Broad-tailed Hummingbird	G5/S3		
Troglodytidae				
<i>Campylorhynchus brunneicapillus</i>	Cactus Wren	G5/S4		
<i>Cistothorus palustris</i>	Marsh Wren	G5/S4		
<i>Cistothorus platensis</i>	Sedge Wren	G5/S4		
<i>Salpinctes obsoletus</i>	Rock Wren	G5/S5		
<i>Thryomanes bewickii</i>	Bewick's Wren	G5/S5		
<i>Thryothorus ludovicianus</i>	Carolina Wren	G5/S5		
<i>Troglodytes aedon</i>	House Wren	G5/S2		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Troglodytes troglodytes</i>	Winter Wren	G5/No TX Record		
Turdidae				
<i>Catharus aurantiirostris</i>	Orange-billed Nightingale-Thrush	No NS Record		
<i>Catharus fuscescens</i>	Veery	G5/No TX Record		
<i>Catharus guttatus</i>	Hermit Thrush	G5/S4		
<i>Catharus mexicanus</i>	Black-headed Nightingale-Thrush	No NS Record		
<i>Catharus minimus</i>	Gray-cheeked Thrush	G5/S4		
<i>Catharus ustulatus</i>	Swainson's Thrush	G5/S4		
<i>Hylocichla mustelina</i>	Wood Thrush	G5/S4		
<i>Ixoreus naevius</i>	Varied Thrush	G5/No TX Record		
<i>Miadestes townsendi</i>	Townsend's Solitaire	G5/No TX Record		
<i>Oenanthe oenanthe</i>	Northern Weatear	G5/No TX Record		
<i>Sialia currucoides</i>	Mountain Bluebird	G5/S3		
<i>Sialia sialis</i>	Eastern Bluebird	G5/S5		
<i>Turdus assimilis</i>	White-throated Robin	No NS Record		
<i>Turdus grayi</i>	Clay-colored Robin	G5/S2		
<i>Turdus migratorius</i>	American Robin	G5/S4		
<i>Turdus rufopalliatus</i>	Rufous-backed Robin	G5/No TX Record		
Tytonidae				
<i>Tyto alba</i>	Barn Owl	G5/S5		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Tyrannidae				
<i>Campostoma imberbe</i>	Northern Beardless-Tyrannulet	G5/S3	Threatened	
<i>Contopus cooperi</i>	Olive-sided Flycatcher	G4/S3		
<i>Contopus pertinax</i>	Greater Pewee	G5/No TX Record		
<i>Contopus sordidulus</i>	Western Wood-Pewee	G5/S4		
<i>Contopus virens</i>	Eastern Wood-Pewee	G5/S4		
<i>Empidonax alnorum</i>	Alder Flycatcher	G5/S4		
<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher	G5/No TX Record		
<i>Empidonax hammondi</i>	Hammond's Flycatcher	G5/S3		
<i>Empidonax minimus</i>	Least Flycatcher	G5/S5		
<i>Empidonax traillii</i>	Willow Flycatcher	G5/S1		
<i>Empidonax virescens</i>	Acadian Flycatcher	G5/S4		
<i>Legatus leucophaeus</i>	Piratic Flycatcher	No NS Record		
<i>Myiarchus cinerascens</i>	Ash-throated Flycatcher	G5/S3		
<i>Myiarchus crinitus</i>	Great Crested Flycatcher	G5/S4		
<i>Myiarchus tuberculifer lawrencei</i>	Dusky-capped Flycatcher	G5/No TX Record		
<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher	G5/S4		
<i>Myiodynastes luteiventris</i>	Sulphur-bellied Flycatcher	G5/No TX Record		
<i>Myiozetetes similis</i>	Social Flycatcher	No NS Record		
<i>Pachyramphus aglaiae</i>	Rose-throated Becard	G4G5/No Tx Record	Threatened	
<i>Pitangus sulphuratus</i>	Great Kiskadee	G5/S4		
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher	G5/S4		
<i>Sayornis nigricans</i>	Black Phoebe	G5/S4		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Sayornis phoebe</i>	Eastern Phoebe	G5/S4		
<i>Sayornis saya</i>	Say's Phoebe	G5/S4		
<i>Tityra semifasciata</i>	Masked Tityra	No NS Record		
<i>Tyrannus couchii</i>	Couch's Kingbird	G5/S4		
<i>Tyrannus dominicensis</i>	Gray Kingbird	G5/No TX Record		
<i>Tyrannus forficatus</i>	Scissor-tailed Flycatcher	G5/S3		
<i>Tyrannus melancholicus</i>	Tropical Kingbird	G5/S1		
<i>Tyrannus savanna</i>	Fork-tailed Flycatcher	No NS Record		
<i>Tyrannus tyrannus</i>	Eastern Kingbird	G5/S4		
<i>Tyrannus verticalis</i>	Western Kingbird	G5/S3		
<i>Tyrannus vociferans</i>	Cassin's Kingbird	G5/S3		
Vireonidae				
<i>Vireo altiloquus</i>	Black-whiskered Vireo	G5/No TX Record		
<i>Vireo atricapillus</i>	Black-capped Vireo	G2G3/S2	Endangered	Endangered
<i>Vireo bellii</i>	Bell's Vireo	G5/S3		
<i>Vireo cassinii</i>	Cassin's Vireo	G5/No TX Record		
<i>Vireo flavifrons</i>	Yellow-throated Vireo	G5/S4		
<i>Vireo flavoviridis</i>	Yellow-green Vireo	G5/S2		
<i>Vireo gilvus</i>	Warbling Vireo	G5/S3		
<i>Vireo griseus</i>	White-eyed Vireo	G5/S5		
<i>Vireo olivaceus</i>	Red-eyed Vireo	G5/S5		
<i>Vireo philadelphicus</i>	Philadelphia Vireo	G5/S4		

Birds				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Vireo solitarius</i>	Blue-headed Vireo	G5/No TX Record		

THIS PAGE INTENTIONALLY LEFT BLANK

Mammals				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
MARSUPIALS				
Didelphidae				
<i>Didelphis virginiana californica</i>	Virginia Opossum	G5/S5		
INSECTIVORES				
Soricidae				
<i>Cryptotis parva berlandieri</i>	Least Shrew	G5/S4		
BATS				
Molossidae				
<i>Tadarida brasiliensis mexicana</i>	Mexican Free-tailed Bat	No NS Record		
Mormoopidae				
<i>Mormoops megalophylla</i>	Peter's Ghost-faced Bat	G4/S2		
Phyllostomidae				
<i>Choeronycteris mexicana</i>	Mexican Long-tongued Bat	G4/S1		

Mammals				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Vespertilionidae				
<i>Myotis velifer incautus</i>	Cave Myotis	G5/S4		
<i>Artrozous pallidus obscurus</i>	Pallid Bat	G5/S5		
<i>Eptesicus fuscus fuscus</i>	Big Brown Bat	G5/S5		
<i>Lasiurus borealis borealis</i>	Red Bat	G5/S4		
<i>Lasiurus cinereus cinereus</i>	Hoary Bat	G5T5/No Ranking		
<i>Lasiurus intermedius intermedius</i>	Northern Yellow Bat	G4G5/S4		
<i>Nycticeius humeralis mexicanus</i>	Evening Bat	G5/S5		
<i>Pipistrellus subflavus subflavus</i>	Eastern Pipistrelle	No NS Record		
Molossidae				
<i>Tadarida brasiliensis mexicana</i>	Mexican Free-tailed Bat	No NS Record		
ARMADILLOS				
Dasypodidae				
<i>Dasyopus novemcinctus mexicanus</i>	Nine-banded Armadillo	G5/S5		
HARES and RABBITS				
Leporidae				
<i>Lepus californicus merriami</i>	Black-tailed Jackrabbit	G5/S5		
<i>Sylvilagus floridanus chapmani</i>	Eastern Cottontail	G5/No TX Record		

Mammals				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
RODENTS				
Castoridae				
<i>Castor canadensis mexicanus</i>	Beaver	G5/S5		
<i>Oryzomys palustris couesi</i>	Coues' Rice Rat	No NS Record		
Cricetidae				
<i>Baiomys taylori taylori</i>	Northern Pygmy Mouse	G4G5/S4		
<i>Neotoma micropus micropus</i>	South Plains Wood Rat	G5/S5		
<i>Peromyscus leucopus texanus</i>	White-footed Mouse	G5/S5		
<i>Reithrodontomys fulvescens</i>	Fulvous Harvest Mouse	G5/S5		
<i>Sigmodon hispidus berlandieri</i>	Hispid Cotton Rat	G5/S5		
Heteromyidae				
<i>Chaetodipus hispidus hispidus</i>	Hispid Pocket Mouse	G5/S5		
<i>Liomys irroratus texensis</i>	Mexican Spiny Pocket Mouse	G5/S3		
Muridae				
<i>Mus musculus</i>	House Mouse	G5/Exotic		
<i>Rattus norvegicus</i>	Norway Rat	G5/Exotic		
<i>Rattus rattus</i>	Black Rat	G5/Exotic		

Mammals				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Myocastoridae				
<i>Myocastor coypus</i>	Coypu	G5/Exotic		
Sciuridae				
<i>Sciurus niger</i>	Fox Squirrel	G5/S5		
<i>Spermophilus mexicanus parvidens</i>	Mexican Ground Squirrel	G5/S5		
CARNIVORES				
Canidae				
<i>Canis latrans microdon</i>	Coyote	G5/S5		
<i>Urocyon cinereoargenteus scottii</i>	Gray Fox	G5/S5		
Felidae				
<i>Felis concolor</i>	Mountain Lion	G5/S2		
<i>Felis rufus texensis</i>	Bobcat	G5/S5		
<i>Felis yagouaroundi cacomiltli</i>	Jaguarundi	G4T3/S1	Endangered	Endangered
<i>Leopardus pardalis albescens</i>	Ocelot	G4/S1	Endangered	Endangered
Mephitidae				
<i>Mephitis mephitis varians</i>	Striped Skunk	G5/S5		
<i>Spilogale putorius interrupta</i>	Eastern Spotted Skunk	G5T4		

Mammals				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Mustelidae				
<i>Mustela frenata frenata</i>	Long-tailed Weasel	G5/S5		
<i>Taxidea taxus berlandieri</i>	Badger	G5T5/No TX Record		
Procyonidae				
<i>Bassariscus astutus flavus</i>	Ringtail	G5/S4		
<i>Procyon lotor fuscipes</i>	Raccoon	G5/S5		
HOVED MAMMALS				
Suidae				
<i>Sus scrofa</i>	Feral Hog	G5/Exotic		
Tayassuidae				
<i>Dicotyles (Tyassu) tajacu</i>	Collared Peccary, Javelina	G5/S5		

THIS PAGE INTENTIONALLY LEFT BLANK

Reptiles

Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
-----------------	-------------	----------------------	--------------	----------------

TURTLES

Emyidae

<i>Terrapene ornata ornata</i>	Ornate Box Turtle	G5T5/No TX Record		
<i>Trachemys scripta elegans</i>	Red-eared Slider	G5T5/No TX Record		

Kinosternidae

<i>Kinosternon flavescens flavescens</i>	Yellow Mud Turtle	G5T5/No TX Record		
--	-------------------	-------------------	--	--

Testudinidae

<i>Gopherus berlandieri</i>	Texas Tortoise	G4/T3	Threatened	
-----------------------------	----------------	-------	------------	--

Trionychidae

<i>Trionyx (Apalone) spiniferus emoryi</i>	Texas Spiny Softshell	G5T4/No ranking		
--	-----------------------	-----------------	--	--

LIZARDS

Gekkonidae

<i>Hemidactylus turcicus</i>	Mediterranean Gecko	G5/Exotic		
------------------------------	---------------------	-----------	--	--

Phrynosomatidae

Reptiles				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Phrynosoma cornutum</i>	Texas Horned Lizard	G4G5/S4	Threatened	
<i>Sceloporus olivaceus</i>	Texas Spiny Lizard	G5/S5		
<i>Sceloporus undulates consbrinus</i>	Southern Prairie Lizard	G5T5/No ranking		
<i>Sceloporus variabilis marmoratus</i>	Rosebelly Lizard	G5T5/No ranking		
<i>Sceloporus grammicus</i>	Mesquite Lizard	No NS Record		
Polychrotidae				
<i>Anolis carolinensis</i>	Green Anole	G5/S5		
Scincidae				
<i>Eumeces tetragrammus</i>	Four-lined Skink	G5/S5		
<i>Scincella lateralis</i>	Ground Skink	G5/S5		
Teiidae				
<i>Cnemidophorus gularis gularis</i>	Texas Spotted Whiptail	No NS Record		
<i>Cnemidophorus laredoensis</i>	Laredo Striped Whiptail	No NS Record		
SNAKES				
Colubridae				
<i>Arizona elegans arenicola</i>	Texas Glossy Snake	No NS Record		
<i>Coluber constrictor oaxaca</i>	Mexican Racer	G5T4/No ranking		
<i>Coniophanes imperialis imperialis</i>	Black-Striped Snake	G4G5T4?/No ranking	Threatened	

Reptiles				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Drymarchon corais erebennus</i>	Texas Indigo Snake	G5T4/No ranking	Threatened	
<i>Drymobius margaritiferus</i>	Speckled Racer	No NS Record	Threatened	
<i>Elaphe guttata emoryi</i>	Great Plains Rat Snake	G5/No TX Record		
<i>Ficimia streckeri</i>	Mexican Hooknose Snake	G4/S4		
<i>Masticophis flagellum testaceus</i>	Western Coachwhip	G5/No TX Record		
<i>Masticophis taeniatus ruthveni</i>	Ruthven's Whipsnake	G5T5/No TX Record		
<i>Nerodia rhombifera rhombifera</i>	Diamondback Water Snake	G5T5/No TX Record		
<i>Opheodrys aestivus majalis</i>	Western Rough Green Snake	G5/S5		
<i>Pituophis melanoleucus sayi</i>	Bullsnake	No NS Record		
<i>Salvadora grahamiae lineata</i>	Texas Patchnose Snake	G5/S5		
<i>Sonora semiannulata taylori</i>	Taylor's Ground Snake	G5/No TX Record		
<i>Sotoreria dekayi texana</i>	Texas Brown Snake	No NS Record		
<i>Thamnophis marcianus marcianus</i>	Checkered Garter Snake	G5/S5		
<i>Thamnophis proximus orarius</i>	Gulf Coast Ribbon Snake	G5T4/No TX Record		
Elapidae				
<i>Micrurus fulvius tenere</i>	Texas Coral Snake	G5/S5		
Leptotyphlopidae				
<i>Leptotyphlops dulcis dulcis</i>	Plains Blind Snake	G5/S5		

THIS PAGE INTENTIONALLY LEFT BLANK

Amphibians				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
Bufo				
<i>Bufo marinus</i>	Giant (Marine) Toad	G5/S2		
<i>Bufo speciosus</i>	Texas Toad	G5/S5		
<i>Bufo valliceps valliceps</i>	Gulf Coast Toad	No NS Record		
Hyla				
<i>Hyla cinerea</i>	Green Treefrog	G5/S5		
<i>Smilisca baudinii</i>	Mexican Treefrog	G5/S3	Threatened	
Microhylidae				
<i>Gastrophryne olivacea</i>	Great Plains Narrowmouth Toad	G5/S5		
<i>Hypopachus variolosus</i>	Sheep Frog	G5/S2	Threatened	
Rana				
<i>Rana berlandieri</i>	Rio Grande Leopard Frog	G5/S5		
Salamandridae				
<i>Notophthalmus meridionalis</i>	Black-spotted Newt	G1/S1	Threatened	
Scaphiopodidae				
<i>Scaphiopus couchii</i>	Couch's Spadefoot	G5/S5		

Amphibians				
Scientific Name	Common Name	Natureserve Rankings	State Status	Federal Status
<i>Syrrophus cystignathoides campi</i>	Rio Grande Chirping Frog	No NS Record		
Sirenidae				
<i>Siren intermedia texana</i>	Rio Grande Lesser Siren	G5/S5		

Butterflies

Scientific Name	Common Name	Natureserve Rankings	
<i>Achalarus jalapus</i>	Jalapus Cloudywing	No NS record	
<i>Achalarus toxeus</i>	Coyote Cloudywing	G5/SNR/SU	
<i>Achlyodes pallida</i>	Pale Sicklewing	No NS record	
<i>Achlyodes thraso</i>	Sickle-winged Skipper	No NS record	
<i>Adelpha basiloides</i>	Spot-celled Sister	No NS record	
<i>Adelpha bredowii</i>	California Sister	G5/SNR/SU	
<i>Adelpha fessonia</i>	Band-celled Sister	G5/No TX record	
<i>Agraulis vanillae</i>	Gulf Fritillary	G5/SNR/SU	
<i>Aguna asander</i>	Gold-spotted Aguna	No NS record	
<i>Aguna claxon</i>	Emerald Aguna	No NS record	
<i>Aguna metophis</i>	Tailed Aguna	No NS record	
<i>Allosmaitia strophius</i>	Strophius Hairstreak	No NS record	
<i>Amblyscirtes celia</i>	Celia's Roadside-Skipper	G4/S4	
<i>Amblyscirtes eos</i>	Dotted Roadside-Skipper	G5/SNR/SU	
<i>Amblyscirtes nysa</i>	Nysa Roadside-Skipper	G5/SNR/SU	
<i>Anaea (Memphis) forreri</i>	Guatemalan Leafwing	No NS record	1st. U.S. Record 11/17/07
<i>Anaea aidea</i>	Tropical Leafwing	No NS record	
<i>Anaea andria</i>	Goatweed Leafwing	G5/SNR/SU	
<i>Anaea glycerium</i>	Angled Leafwing	G5/SNR/SU	
<i>Anaea pithyusa</i>	Pale-spotted Leafwing	No NS record	
<i>Anartia fatima</i>	Banded Peacock	No NS record	
<i>Anartia jatrophae</i>	White Peacock	G5/SNR/SU	
<i>Anastrus sempiternus</i>	Common Bluevent	No NS record	

Butterflies			
Scientific Name	Common Name	Natureserve Rankings	
<i>Anatrytone logan</i>	Delaware Skipper	G5/SNR/SU	
<i>Anatrytone mazai</i>	Glowing Skipper	No NS record	
<i>Ancyloxypha arene</i>	Tropical Least Skipper	G5/SNR/SU	
<i>Ancyloxypha numitor</i>	Least Skipper	G5/SNR/SU	
<i>Arteos clorinde</i>	White Angled-Sulphur	No NS record	
<i>Arteos maerula</i>	Yellow Angled-Sulphur	No NS record	
<i>Anthocharis midea</i>	Falcate Orangetip	G4G5/S4	
<i>Artigonus erosus</i>	Dusted Spurwing	No NS record	
<i>Apodemia multiplaga</i>	Narrow-winged Metalmark	No NS record	
<i>Apodemia walkeri</i>	Walker's Metalmark	No NS record	
<i>Appias drusilla</i>	Florida White	G5/No TX record	
<i>Archaeoprepona demophon</i>	One-spotted Prepona	No NS record	1st. U.S. Record 11/18/07
<i>Arteurotia tractipennis</i>	Starred Skipper	No NS record	
<i>Ascia monuste</i>	Great Southern White	G5/SNR/SU	
<i>Asterocampa celtis</i>	Hackberry Emperor	G5/SNR/SU	
<i>Asterocampa clyton</i>	Tawny Emperor	G5/SNR/SU	
<i>Asterocampa leilia</i>	Empress Leilia	G5/SNR/SU	
<i>Astraptes alardus</i>	Frosted Flasher	No NS record	
<i>Astraptes anaphus</i>	Yellow-tipped Flasher	No NS record	
<i>Astraptes egregius</i>	Small-spotted Flasher	No NS record	
<i>Astraptes fulgerator</i>	Two-barred Flasher	No NS record	
<i>Astraptes gilberti</i>	Gilbert's Flasher	No NS record	
<i>Atalopedes campestris</i>	Sachem	G5/SNR/SU	

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Atides halesus</i>	Great Purple Hairstreak	G5/SNR/SU
<i>Battus philenor</i>	Pipevine Swallowtail	G5/S5
<i>Battus polydamas</i>	Polydamas Swallowtail	G5/No TX record
<i>Biblis hyperia</i>	Red Rim	No NS record
<i>Bolla brennus</i>	Obscure Bolla	No NS record
<i>Bolla clytius</i>	Mottled Bolla	No NS record
<i>Brephidium exile</i>	Western Pygmy-Blue	G5/SNR/SU
<i>Cabares potrillo</i>	Potrillo Skipper	G4G5/SNR/SU
<i>Calephelis nemesis</i>	Fatal Metalmark	G5/SNR/SU
<i>Calephelis perditalis</i>	Rounded Metalmark	G3G4/SNR/SU
<i>Calephelis rawsoni</i>	Rawson's Metalmark	G4/SNR/SU
<i>Callophrys xami</i>	Xami Hairstreak	G4/SNR/SU
<i>Calpodus ethlius</i>	Brazilian Skipper	G5/SNR/SU
<i>Calycopis isobea</i>	Dusky-blue Groundstreak	G5/SNR/SU
<i>Caria ino</i>	Red-bordered Metalmark	G5/SNR/SU
<i>Carrhenes canescens</i>	Hoary Skipper	No NS record
<i>Catasticta nimbice</i>	Mexican Dartwhite	No NS record
<i>Celaenorrhinus fritzgaertneri</i>	Fritzgaertner's Flat	No NS record
<i>Celaenorrhinus stallingsi</i>	Stallings' Flat	No NS record
<i>Celotes nesus</i>	Common Streaky-Skipper	G5/SNR/SU
<i>Chioides catillus</i>	White-striped Longtail	No NS record
<i>Chioides zilpa</i>	Zilpa Longtail	No NS record
<i>Chiomara asychis</i>	White-patched Skipper	G5/SNR/SU

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Chlorostrymon simaethis</i>	Silver-banded Hairstreak	G5/SNR/SU
<i>Chlorostrymon telea</i>	Telea Hairstreak	No NS record
<i>Chlosyne definita</i>	Definite Patch	G3G4/SNR/SU
<i>Chlosyne ehrenbergii</i>	White-rayed Patch	No NS record
<i>Chlosyne endeis</i>	Banded Patch	GN4/No TX Record
<i>Chlosyne janais</i>	Crimson Patch	No NS record
<i>Chlosyne lacinia</i>	Bordered Patch	G5/SNR/SU
<i>Chlosyne marina</i>	Red-spotted Patch	No NS record
<i>Chlosyne rosita</i>	Rosita Patch	No NS record
<i>Chlosyne theona</i>	Theona Checkerspot	G5/SNR/SU
<i>Codatractus alcaeus</i>	White-crescent Longtail	No NS record
<i>Cogia calchas</i>	Mimosa Skipper	G5/SNR/SU
<i>Cogia hippalus</i>	Acacia Skipper	G5/SNR/SU
<i>Cogia outis</i>	Outis Skipper	G3G4/SNR/SU
<i>Colias cesonia</i>	Southern Dogface	No NS record
<i>Colias eurytheme</i>	Orange Sulphur	G5/S5
<i>Conga chydæa</i>	Hidden Ray Skipper	No NS record
<i>Copaeodes aurantiacus</i>	Orange Skipperling	G5/S5
<i>Copaeodes minimus</i>	Southern Skipperling	G5/S5
<i>Corticea corticea</i>	Redundant Skipper	No NS record
<i>Cupido (Everes) comyntas</i>	Eastern Tailed-Blue	G5/SNR/SU
<i>Cyanophrys goodsoni</i>	Goodson's Greenstreak	G3G5/No TX record
<i>Cyanophrys herodotus</i>	Tropical Greenstreak	No NS record

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Cyanophrys miserabilis</i>	Clench's Greenstreak	G4/SNR/SU
<i>Cyllopsis gemma</i>	Gemmed Satyr	G5/S5
<i>Cymaenes odilia</i>	Fawn-spotted Skipper	No NS record
<i>Danaus eresimus</i>	Soldier	G5/SNR/SU
<i>Danaus gilippus</i>	Queen	G5/SNR/SU
<i>Danaus plexippus</i>	Monarch	G5/S4
<i>Decinea percosius</i>	Double-dotted Skipper	G1G3/SNR/SU
<i>Dione moneta</i>	Mexican Silverspot	No NS record
<i>Dircenna klugii</i>	Klug's Clearwing	No NS record
<i>Doxocopa laure</i>	Silver Emperor	No NS record
<i>Doxocopa pavon</i>	Pavon Emperor	No NS record
<i>Dryadula phaetusa</i>	Banded Orange Heliconian	No NS record
<i>Dryas iulia</i>	Julia Heliconian	G5/SNR/SU
<i>Dymasia dymas</i>	Tiny Checkerspot	G5/SNR/SU
<i>Dynamine dyonis</i>	Blue-eyed Sailor	No NS record
<i>Dynamine postverta</i>	Four-spotted Sailor	No NS record
<i>Electrostrymon canus</i>	Muted Hairstreak	No NS record
<i>Electrostrymon sangala</i>	Ruddy Hairstreak	G5/SNR/SU
<i>Emesis emesia</i>	Curve-winged Metalmark	No NS record
<i>Emesis tenedia</i>	Falcate Metalmark	G5/No TX record
<i>Enantia albania</i>	Costa-spotted Mimic-White	No NS record
<i>Epargyreus clarus</i>	Silver-spotted Skipper	G5/SNR/SU
<i>Epargyreus exadeus</i>	Broken Silverdrop	No NS record

Butterflies

Scientific Name	Common Name	Natureserve Rankings
<i>Epiphile adrasta</i>	Common Banner	No NS record
<i>Erynnis funeralis</i>	Funereal Duskywing	G5/SNR/SU
<i>Erynnis horatius</i>	Horace's Duskywing	G5/SNR/SU
<i>Erynnis tristis</i>	Mournful Duskywing	G5/SNR/SU
<i>Eueides isabella</i>	Isabella's Heliconian	No NS record
<i>Eunica monima</i>	Dingy Purplewing	G5/No TX record
<i>Eunica tatila</i>	Florida Purplewing	G5/No TX record
<i>Euphyes vestris</i>	Dun Skipper	G5/SNR/SU
<i>Euptoieta claudia</i>	Variiegated Fritillary	G5/S5
<i>Euptoieta hegesia</i>	Mexican Fritillary	No NS record
<i>Eurema albula</i>	Ghost Yellow	No NS record
<i>Eurema boisduvaliana</i>	Boisduval's Yellow	No NS record
<i>Eurema दौरa</i>	Barred Yellow	G5/No TX record
<i>Eurema dina</i>	Dina Yellow	No NS record
<i>Eurema lisa</i>	Little Yellow	No NS record
<i>Eurema mexicana</i>	Mexican Yellow	G5/SNR/SU
<i>Eurema nicippe</i>	Sleepy Orange	No NS record
<i>Eurema nise</i>	Mimosa Yellow	No NS record
<i>Eurema proterpia</i>	Tailed Orange	No NS record
<i>Eurema salome</i>	Salome Yellow	No NS record
<i>Eurytides philolaus</i>	Dark Kite-Swallowtail	No NS record
<i>Feniseca tarquinius</i>	Harvester	G4/SNR/SU
<i>Ganyra josephina</i>	Giant White	No NS record

Butterflies

Scientific Name	Common Name	Natureserve Rankings
<i>Gesta gesta</i>	False Duskywing	G5/SNR/SU
<i>Gorgythion begga</i>	Variiegated Skipper	No NS record
<i>Grais stigmatica</i>	Hermit Skipper	No NS record
<i>Greta morgane</i>	Thick-tipped Greta	No NS record
<i>Hamadryas amphinome</i>	Red Cracker	No NS record
<i>Hamadryas februa</i>	Gray Cracker	No NS record
<i>Hamadryas feronia</i>	Variable Cracker	No NS record
<i>Hamadryas guatemalena</i>	Guatemalan Cracker	No NS record
<i>Heliconius charithonia</i>	Zebra Heliconian	G5/SNR/SU
<i>Heliconius erato</i>	Erato Heliconian	No NS record
<i>Heliopetes arsalte</i>	Veined White-Skipper	No NS record
<i>Heliopetes domicella</i>	Erichson's White Skipper	No NS record
<i>Heliopetes laviana</i>	Laviana White-Skipper	G5/SNR/SU
<i>Heliopetes macaira</i>	Turk's-cap White-Skipper	G5/SNR/SU
<i>Heliopetes sublinea</i>	East-Mexican White-Skipper	No NS record
<i>Hemiargus ceraunus</i>	Ceraunus Blue	G5/SNR/SU
<i>Hemiargus isola</i>	Reakirt's Blue	No NS record
<i>Hermeuptychia sosybius</i>	Carolina Satyr	G5/SNR/SU
<i>Hesperopsis alpheus</i>	Saltbush Sootywing	G4/SNR/SU
<i>Hylephila phyleus</i>	Fiery Skipper	G5/SNR/SU
<i>Hypanartia lethe</i>	Orange Mapwing	No NS record
<i>Hypolimnas misippus</i>	Mimic	No NS record
<i>Itaballia demophile</i>	Cross-barred White	No NS record

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Junonia coenia</i>	Common Buckeye	G5/S5
<i>Junonia evarate</i>	Mangrove Buckeye	G4G5/SNR/SU
<i>Junonia genoveva</i>	Tropical Buckeye	G5/SNR/SU
<i>Kricogonia lyside</i>	Lyside Sulphur	G5/SNR/SU
<i>Lasaia sula</i>	Blue Metalmark	G5/SNR/SU
<i>Leptophobia aripa</i>	Common Greeneyed-White	No NS record
<i>Leptotes cassius</i>	Cassius Blue	G5/SNR/SU
<i>Leptotes marina</i>	Marine Blue	G5/No TX record
<i>Lerema accius</i>	Clouded Skipper	G5/S5
<i>Lerema liris</i>	Liris Skipper	No NS record
<i>Lerodea arabus</i>	Violet-clouded Skipper	G5/SNR/SU
<i>Lerodea dysaules</i>	Olive-clouded Skipper	No NS record
<i>Lerodea eufala</i>	Eufala Skipper	G5/S5
<i>Libytheana carinenta</i>	American Snout	G5/SNR/SU
<i>Limenitis archippus</i>	Viceroy	G5/SNR/SU
<i>Limenitis arthemis</i>	Red-spotted Admiral	G5/SNR/SU
<i>Lycorea cleobaea</i>	Tiger Mimic-Queen	No NS record
<i>Marpesia chiron</i>	Many-banded Daggerwing	G5/No TX record
<i>Marpesia coresia</i>	Waiter Daggerwing	No NS record
<i>Marpesia petreus</i>	Ruddy Daggerwing	G5/No TX record
<i>Megathymus yuccae</i>	Yucca Giant-Skipper	G5/SNR/SU
<i>Melanis pike</i>	Red-bordered Pixie	G5/SNR/SU
<i>Melete lycimnia isandra</i>	Common Melwhite	No NS record

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Mestra anymone</i>	Common Mestra	G5/SNR/SU
<i>Microtia elva</i>	Elf	No NS record
<i>Ministrymon azia</i>	Gray Ministreak	G5/No TX record
<i>Ministrymon clytie</i>	Clytie Ministreak	G5/SNR/SU
<i>Monca tyrtaeus</i>	Violet-patched Skipper	G47/SNR/SU
<i>Myscelia cyananthe</i>	Blackened Bluewing	No NS record
<i>Myscelia ethusa</i>	Mexican Bluewing	G5/SNR/SU
<i>Nastra lherminier</i>	Swarthy Skipper	G5/SNR/SU
<i>Nastra julia</i>	Julia's Skipper	G5/SNR/SU
<i>Nathalis iole</i>	Dainty Sulphur	G5/SNR/SU
<i>Nisoniades rubescens</i>	Purplish-black Skipper	No NS record
<i>Noctuana stator</i>	Red-studded Skipper	No NS record
<i>Nyctelius nyctelius</i>	Violet-banded Skipper	No NS record
<i>Nymphalis antiopa</i>	Mourning Cloak	G5/SNR/SU
<i>Ocaria ocrisia</i>	Black Hairstreak	No NS record
<i>Oenomaus ortygnus</i>	Aquamarine Hairstreak	No NS record
<i>Panoquina fusina</i>	Evans' Skipper	No NS record
<i>Panoquina hecebola</i>	Hecebola Skipper	No NS record
<i>Panoquina ocola</i>	Ocola Skipper	G5/SNR/SU
<i>Panoquina panoquinoides</i>	Obscure Skipper	G5/SNR/SU
<i>Panoquina sylvicola</i>	Purple-washed Skipper	No NS record
<i>Papilio anchisiades</i>	Ruby-spotted Swallowtail	G5/SNR/SU
<i>Papilio astyalus</i>	Broad-banded Swallowtail	No NS record

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Papilio cressphontes</i>	Giant Swallowtail	G5/SNR/SU
<i>Papilio garamas</i>	Magnificent Swallowtail	No NS record
<i>Papilio glaucus</i>	Eastern Tiger Swallowtail	G5/SNR/SU
<i>Papilio ornythion</i>	Ornythion Swallowtail	No NS record
<i>Papilio palamedes</i>	Palamedes Swallowtail	G4/SNR/SU
<i>Papilio pharnaces</i>	Pink-spotted Swallowtail	No NS record
<i>Papilio pilumnus</i>	Three-tailed Swallowtail	No NS record
<i>Papilio polyxenes</i>	Black Swallowtail	G5/S5
<i>Papilio thoas</i>	Thoas Swallowtail	No NS record
<i>Papilio victorinus</i>	Victorine Swallowtail	No NS record
<i>Pellicia angra</i>	Confused Pellicia	No NS record
<i>Pellicia arina</i>	Glazed Pellicia	No NS record
<i>Pellicia dimidiata</i>	Morning Glory Pellicia	No NS record
<i>Perichares philetas</i>	Green-backed Ruby-eye	No NS record
<i>Phocides belus</i>	Beautiful Beamer	No NS record
<i>Phocides polybius</i>	Guava Skipper	No NS record
<i>Phoebis agarithe</i>	Large Orange Sulphur	G5/SNR/SU
<i>Phoebis neocypris</i>	Tailed Sulphur	No NS record
<i>Phoebis philea</i>	Orange-barred Sulphur	G5/SNR/SU
<i>Phoebis sennae</i>	Cloudless Sulphur	G5/SNR/SU
<i>Phoebis statira</i>	Statira Sulphur	No NS record
<i>Pholisora catullus</i>	Common Sootywing	G5/SNR/SU
<i>Pholisora meijicana</i>	Mexican Sootywing	G5/No TX record

Butterflies

Scientific Name	Common Name	Natureserve Rankings
<i>Phyciodes argentea</i>	Chestnut Crescent	No NS record
<i>Phyciodes phaon</i>	Phaon Crescent	G5/SNR/SU
<i>Phyciodes ptolyca</i>	Black Crescent	No NS record
<i>Phyciodes texana</i>	Texan Crescent	G5/SNR/SU
<i>Phyciodes tharos</i>	Pearl Crescent	G5/SNR/SU
<i>Phyciodes tulcis</i>	Pale-banded Crescent	No NS record
<i>Phyciodes vesta</i>	Vesta Crescent	No NS record
<i>Pieriballia viardi</i>	Painted White	No NS record
<i>Pieris rapae</i>	Cabbage White	G5/Exotic
<i>Polites vibex</i>	Whirlabout	G5/SNR/SU
<i>Polygonia interrogationis</i>	Question Mark	G5/S5
<i>Polygonus leo</i>	Hammock Skipper	No NS record
<i>Polygonus manueli</i>	Manuel's Skipper	No NS record
<i>Polythrix mexicanus</i>	Mexican Longtail	No NS record
<i>Polythrix octomaculata</i>	Eight-spotted Longtail	No NS record
<i>Pontia protodice</i>	Checkered White	G4/S4
<i>Proteides mercurius</i>	Mercurial Skipper	No NS record
<i>Pteronymia cottyto</i>	Broad-tipped Clearwing	No NS record
<i>Pyrgus albescens</i>	White Checkered-Skipper	G5/SNR/SU
<i>Pyrgus communis</i>	Common Checkered-Skipper	G5/S5
<i>Pyrgus oileus</i>	Tropical Checkered-Skipper	G5/SNR/SU
<i>Pyrgus philetas</i>	Desert Checkered-Skipper	G5/SNR/SU
<i>Quasimellana eulogius</i>	Common Mellana	No NS record

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Rekoa marius</i>	Marius Hairstreak	No NS record
<i>Rekoa palegon</i>	Gold-bordered Hairstreak	No NS record
<i>Rekoa stagira</i>	Smudged Hairstreak	No NS record
<i>Rhinthon osca</i>	Oasca Skipper	No NS record
<i>Satyrium favonius</i>	Oak Hairstreak	G4/SNR/SU
<i>Siderus tephraeus</i>	Pearly-gray Hairstreak	No NS record
<i>Siproeta epaphus</i>	Rusty-tipped Page	No NS record
<i>Siproeta stelenes</i>	Malachite	G5/No TX record
<i>Smyrna blomfieldia</i>	Blomfield's Beauty	No NS record
<i>Sostrata bifasciata</i>	Blue-Studded Skipper	No NS record
<i>Spathilepia clonius</i>	Falcate Skipper	No NS record
<i>Stallingsia maculosa</i>	Manfreda Giant-Skipper	No NS record
<i>Staphylus ceos</i>	Golden-headed Scallopwing	G5/SNR/SU
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing	G5/SNR/SU
<i>Staphylus mazans</i>	Mazan's Scallopwing	G5/S4
<i>Strymon albata</i>	White Scrub-Hairstreak	No NS record
<i>Strymon alea</i>	Lacey's Scrub-Hairstreak	G3G4/SNR/SU
<i>Strymon bazochii</i>	Lantana Scrub-Hairstreak	G5/No TX record
<i>Strymon bebrycia</i>	Red-lined Scrub-Hairstreak	No NS record
<i>Strymon cestri</i>	Tailless Scrub-Hairstreak	No NS record
<i>Strymon istapa</i>	Mallow Scrub-Hairstreak	G5/SNR/SU
<i>Strymon melinus</i>	Gray Hairstreak	G5/SNR/SU
<i>Strymon rufusca</i>	Red-crescent Scrub-Hairstreak	No NS record

Butterflies		
Scientific Name	Common Name	Natureserve Rankings
<i>Strymon yojoa</i>	Yojoa Scrub-Hairstreak	No NS record
<i>Synapte malitiosa</i>	Malicious Skipper	No NS record
<i>Synapte salenus</i>	Salenus Skipper	No NS record
<i>Systasea pulverulenta</i>	Texas Powdered-Skipper	G5/SNR/SU
<i>Temenis lachoe</i>	Orange Banner	No NS record
<i>Texola elada</i>	Elada Checkerspot	G5/SNR/SU
<i>Thespies macareus</i>	Chestnut-marked Skipper	No NS record
<i>Thorybes pylades</i>	Northern Cloudywing	G5/SNR/SU
<i>Timochares rufifasciatus</i>	Brown-banded Skipper	G5/SNR/SU
<i>Tmolus echion</i>	Red-spotted Hairstreak	G5/No TX record
<i>Typhedanus undulatus</i>	Mottled Longtail	No NS record
<i>Urbanus belli</i>	Double-striped Longtail	No NS record
<i>Urbanus dorantes</i>	Dorantes Longtail	G5/SNR/SU
<i>Urbanus doryssus</i>	White-tailed Longtail	No NS record
<i>Urbanus esmeraldus</i>	Esmeralda Longtail	No NS record
<i>Urbanus evona</i>	Turquoise Longtail	No NS record
<i>Urbanus procne</i>	Brown Longtail	G5/SNR/SU
<i>Urbanus pronus</i>	Pronus Longtail	No NS record
<i>Urbanus proteus</i>	Long-tailed Skipper	G5/SNR/SU
<i>Urbanus simplicius</i>	Plain Longtail	No NS record
<i>Urbanus tanna</i>	Tanna Longtail	No NS record
<i>Urbanus teleus</i>	Teleus Longtail	G5/SNR/SU
<i>Vanessa annabella</i>	West Coast Lady	G5/No TX record

Butterflies

Scientific Name	Common Name	Natureserve Rankings
<i>Vanessa atalanta</i>	Red Admiral	G5/S5
<i>Vanessa cardui</i>	Painted Lady	G5/S5
<i>Vanessa virginiensis</i>	American Lady	G5/S5
<i>Vettius fantasos</i>	Fantastic Skipper	No NS record
<i>Vidius perigenes</i>	Pale-rayed Skipper	G5/SNR/SU
<i>Wallengrenia otho</i>	Southern Broken-Dash	G5/S5
<i>Xenophanes tryxus</i>	Glassy-winged Skipper	No NS record
<i>Ziegleria guzanta</i>	Orange-crescent Groundstreak	GNR/SNR/SU
<i>Zizula cyna</i>	Cyna Blue	G4G5/SNR/SU

Damsel Flies			
Scientific Name	Common Name	Status	County
Damselflies			
<i>Acanthagrion quadratum</i>	Mexican Wedgetail	G5/SNR/SU	C
<i>Argia apicalis</i>	Blue-fronted Dancer	G5/SNR/SU	C, H, S
<i>Argia immunda</i>	Kiowa Dancer	G5/SNR/SU	C, H, S
<i>Argia moesta</i>	Powdered Dancer	G5/SNR/SU	C, H, S
<i>Argia plana</i>	Springwater Dancer	No NS record for TX	C
<i>Argia rhoadsi</i>	Golden-winged Dancer	G3/SNR/SU	C, H
<i>Argia sedula</i>	Blue-ringed Dancer	G5/SNR/SU	C, H, S
<i>Argia translata</i>	Dusky Dancer	G5/SNR/SU	C, H
<i>Enallagma basidens</i>	Double-striped Bluet	G5/SNR/SU	C, H, S
<i>Enallagma civile</i>	Familiar Bluet	G5/SNR/SU	C, H, S
<i>Enallagma durum</i>	Big Bluet	G5/SNR/SU	C, H, S
<i>Enallagma novaehispaniae</i>	Neotropical Bluet	G5/SNR/SU	C, H, S
<i>Enallagma signatum</i>	Orange Bluet	G5/SNR/SU	C, H, S
<i>Hetaerina americana</i>	American Rubyspot	G5/SNR/SU	C, H, S
<i>Hetaerina titia</i>	Smokey Rubyspot	G5/SNR/SU	C, H, S
<i>Ischnura hastata</i>	Citrine Forktail	G5/SNR/SU	C, H, S
<i>Ischnura posita</i>	Fragile Forktail	G5/SNR/SU	C, H
<i>Ischnura ramburii</i>	Rambur's Forktail	G5/SNR/SU	C, H, S
<i>Leptobasis melinogaster</i>	Cream-tipped Swampdamselfly	No NS record	C, H

Damsel Flies			
Scientific Name	Common Name	Status	County
<i>Lestes alacer</i>	Plateau Spreadwing	G5/SNR/SU	C, H
<i>Lestes australis</i>	Southern Spreadwing	G5/SNR/SU	C, H
<i>Lestes forficula</i>	Rainpool Spreadwing	G5/SNR/SU	C, H, S
<i>Lestes sigma</i>	Chalky Spreadwing	G5/SNR/SU	C, H, S
<i>Neoerythromma cutellatum</i>	Caribbean Yellowface	G5/No TX record	C, H
<i>Neoneura aaroni</i>	Coral-fronted Threadtail	G4?/SNR/SU	H
<i>Neoneura amelia</i>	Amelia's Threadtail	G4?/SNR/SU	C, H
<i>Protoneura cara</i>	Orange-striped Threadtail	G4?/SNR/SU	H
<i>Telebasis salva</i>	Desert Firetail	G5/SNR/SU	C, H
Dragonflies			
<i>Anax amazili</i>	Amazon Darner	G5/SNR/SU	C, H
<i>Anax concolor</i>	Blue-spotted Comet Darner	No NS record	H
<i>Anax longipes</i>	Comet Darner	G5/SNR/SU	C, H
<i>Aphylla angustifolia</i>	Broad-striped Forceptail	G4/SNR/SU	C, H, S
<i>Aphylla protracta</i>	Narrow-striped Forceptail	G5/SNR/SU	C, H, S
<i>Brachymesia furcata</i>	Red-tailed Pennant	G5/SNR/SU	C, H, S
<i>Brachymesia gravida</i>	Four-spotted Pennant	G5/SNR/SU	C, H, S
<i>Brachymesia herbida</i>	Tawny Pennant	G5/SNR/SU	C, H, S
<i>Brechmorhoga mendax</i>	Pale-faced Clubskimmer	G5/SNR/SU	H
<i>Cannaphila insularis funerea</i>	Gray-waisted Skimmer	G5/SNR/SU	C, H
<i>Cellithemis eponina</i>	Halloween Pennant	G5/SNR/SU	C, H

Damsel Flies			
Scientific Name	Common Name	Status	County
<i>Coryphaeschna adnexa</i>	Blue-faced Darner	G5/SNR/SU	C, H
<i>Coryphaeschna ingens</i>	Regal Darner	G5/SNR/SU	C
<i>Dromogomphus spoliatus</i>	Flag-tailed Spinyleg	No NS record	C, H, S
<i>Dythemis fugax</i>	Checkered Setwing	G5/SNR/SU	C, H
<i>Dythemis nigrescens</i>	Black Setwing	G5/SNR/SU	C, H, S
<i>Dythemis velox</i>	Swift Setwing	G5/SNR/SU	H, S
<i>Epitheca (Epicordulia) princeps</i>	Prince Baketail	G5/SNR/SU	C, H, S
<i>Erpetogomphus designatus</i>	Eastern Ringtail	G5/SNR/SU	H, S
<i>Erythemis mithroides</i>	Claret Pondhawk	No NS record	C, H
<i>Erythemis plebeja</i>	Pin-tailed Pondhawk	G5/SNR/SU	C, H, S
<i>Erythemis simplicicollis simplicicollis</i>	Eastern Pondhawk	G5/SNR/SU	C, H, S
<i>Erythemis vesiculosa</i>	Great Pondhawk	G5/SNR/SU	C, H, S
<i>Erythrodiplax berenice</i>	Seaside Dragonlet	G5/SNR/SU	C, H
<i>Erythrodiplax minuscula</i>	Little Blue Dragonlet	G5/SNR/SU	C, H
<i>Erythrodiplax umbrata</i>	Band-winged Dragonlet	G5/SNR/SU	C, H, S
<i>Gomphus gonzalezi</i>	Tamaulipan Clubtail	G2/SNR/SU	C, H, S
<i>Gomphus militaris</i>	Sulphur-tipped Clubtail	G5/SNR/SU	C, H, S
<i>Gynacantha mexicana</i>	Bar-sided Darner	No NS record	C, H
<i>Libellula comanche</i>	Comanche Skimmer	G5/SNR/SU	H
<i>Libellula croceipennis</i>	Neon Skimmer	G5/SNR/SU	S
<i>Libellula needhami</i>	Needham's Skimmer	G5/SNR/SU	C, H, S
<i>Libellula pulchella</i>	Twelve-spotted Skimmer	G5/SNR/SU	C, H

Damsel Flies			
Scientific Name	Common Name	Status	County
<i>Libellula saturata</i>	Flame Skimmer	G5/SNR/SU	H, S
<i>Macrodiplax baiteata</i>	Marl Pennant	G5/SNR/SU	C, H, S
<i>Macromia annulata</i>	Bronzed River Cruiser	G5/SNR/SU	H
<i>Macrothemis inacuta</i>	Straw-colored Sylph	G5/SNR/SU	C, H, S
<i>Miathyria marcella</i>	Hyacinth Glider	G5/SNR/SU	C, H, S
<i>Micrathyria aequalis</i>	Spot-tailed Dasher	G5/SNR/SU	C, H
<i>Micrathyria didyma</i>	Three-striped Dasher	G5/SNR/SU	C, H
<i>Micrathyria hagenii</i>	Thornbush Dasher	G5/SNR/SU	C, H, S
<i>Orthemis discolor</i>	Carmine Skimmer	G5/SNR/SU	C, H
<i>Orthemis ferruginea</i>	Roseate Skimmer	G5/SNR/SU	C, H, S
<i>Pachydiplax longipennis</i>	Blue Dasher	G5/SNR/SU	C, H, S
<i>Pantala flavescens</i>	Wandering Glider	G5/SNR/SU	C, H, S
<i>Pantala hymenaea</i>	Spot-winged Glider	G5/SNR/SU	C, H, S
<i>Perithemis domitia</i>	Slough Amberwing	G5/SNR/SU	C, H
<i>Perithemis tenera</i>	Eastern Amberwing	G5/SNR/SU	C, H, S
<i>Phyllocycla breviphylla</i>	Ringed Forceptail	No NS record	H, S
<i>Phyllogomphoides albrighti</i>	Five-striped Leaf-tail	G4/SNR/SU	C, H, S
<i>Plathemis lydia</i>	Common Whitetail	G5/SNR/SU	H
<i>Pseudoleon superbus</i>	Filigree Skimmer	G5/SNR/SU	C, H, S
<i>Rhionaeschna dugesi</i>	Arroyo Darner	G4/SNR/SU	C, H
<i>Rhionaeschna psilus</i>	Turquoise-tipped Darner	G5/SNR/SU	C, H, S
<i>Stylurus plagiatus</i>	Russet-tipped Clubtail	G5/SNR/SU	H, S

Damsel Flies			
Scientific Name	Common Name	Status	County
<i>Sympetrum corruptum</i>	Variegated Meadowhawk	G5/SNR/SU	C, H, S
<i>Tauriphila azteca</i>	Aztec Glider	G4/SNR/SU	C
<i>Tholymis citrina</i>	Evening Skimmer	G5/SNR/SU	C, H
<i>Tamea abdominalis</i>	Vermilion Saddlebags	No NS TX record	H
<i>Tamea calverti</i>	Striped Saddlebags	G5/SNR/SU	C, H, S
<i>Tamea lacerata</i>	Black Saddlebags	G5/SNR/SU	C, H, S
<i>Tamea onusta</i>	Red Saddlebags	G5/SNR/SU	C, H, S
<i>Triacanthagyna septima</i>	Pale-green Darner	No NS record	C, H

THIS PAGE INTENTIONALLY LEFT BLANK