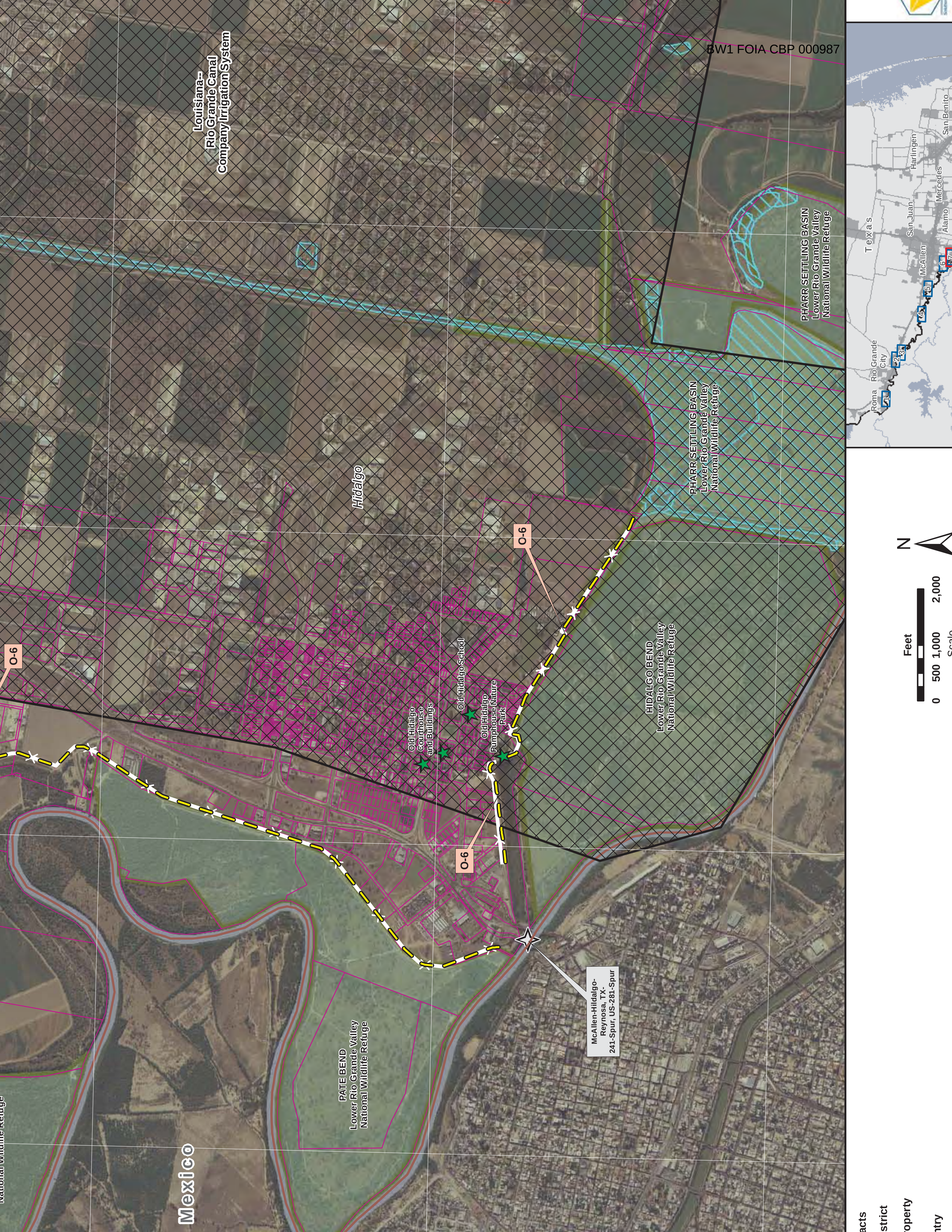
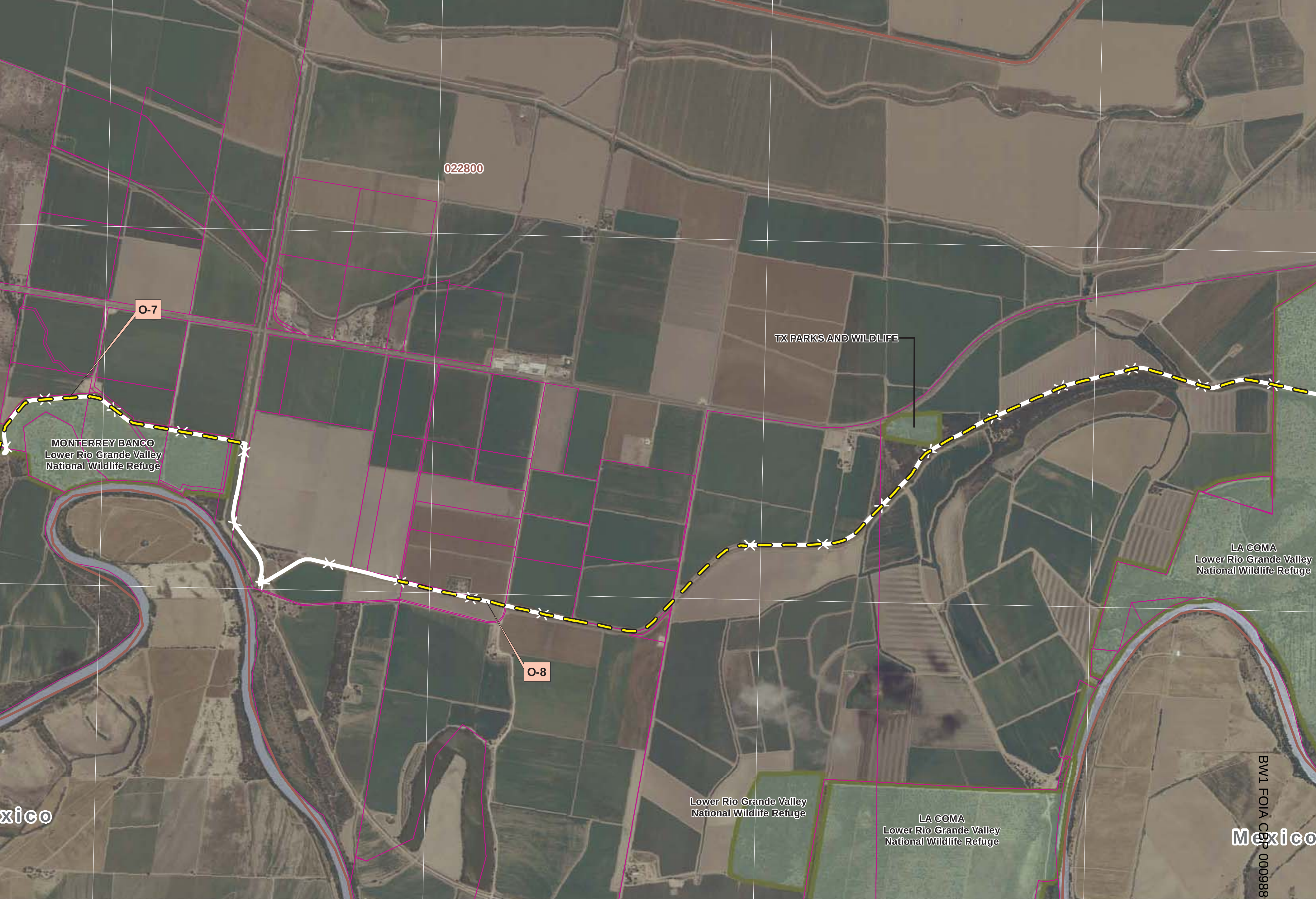
acts
strict
roperty
ntry

Feet
0 500 1,000 2,000
Scale

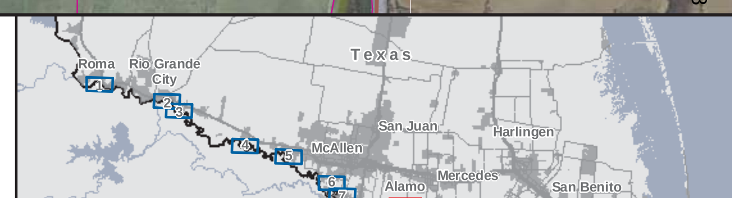
N

BW1 FOIA CBP 000987

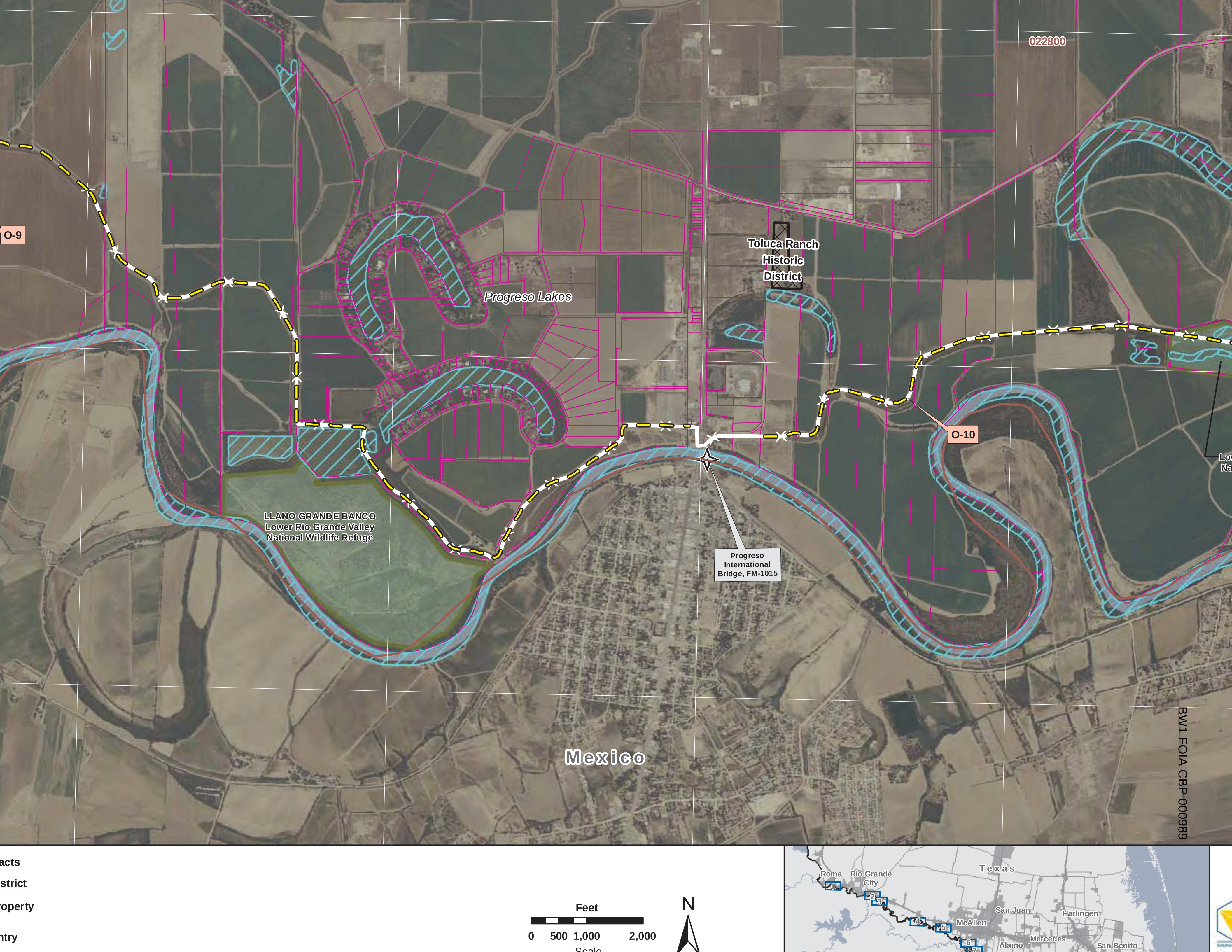




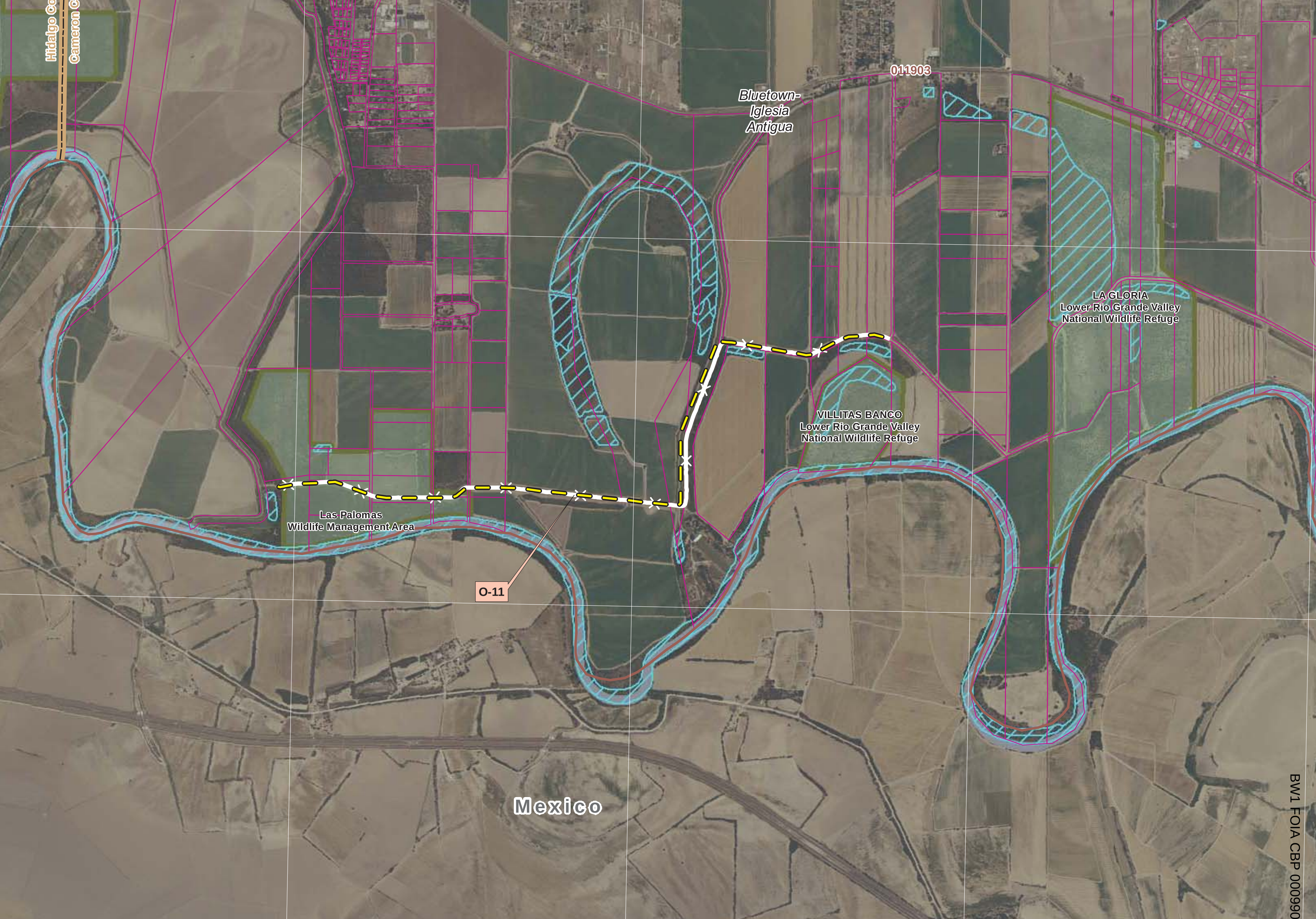
acts
strict
roperty
ntry



BW1 FOIA CBP 000988

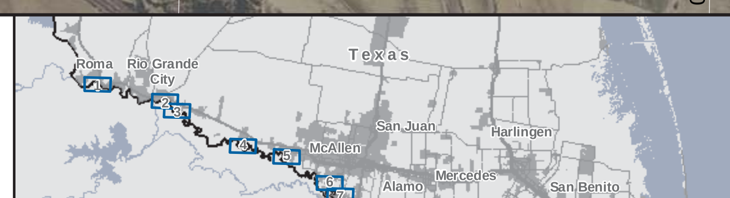


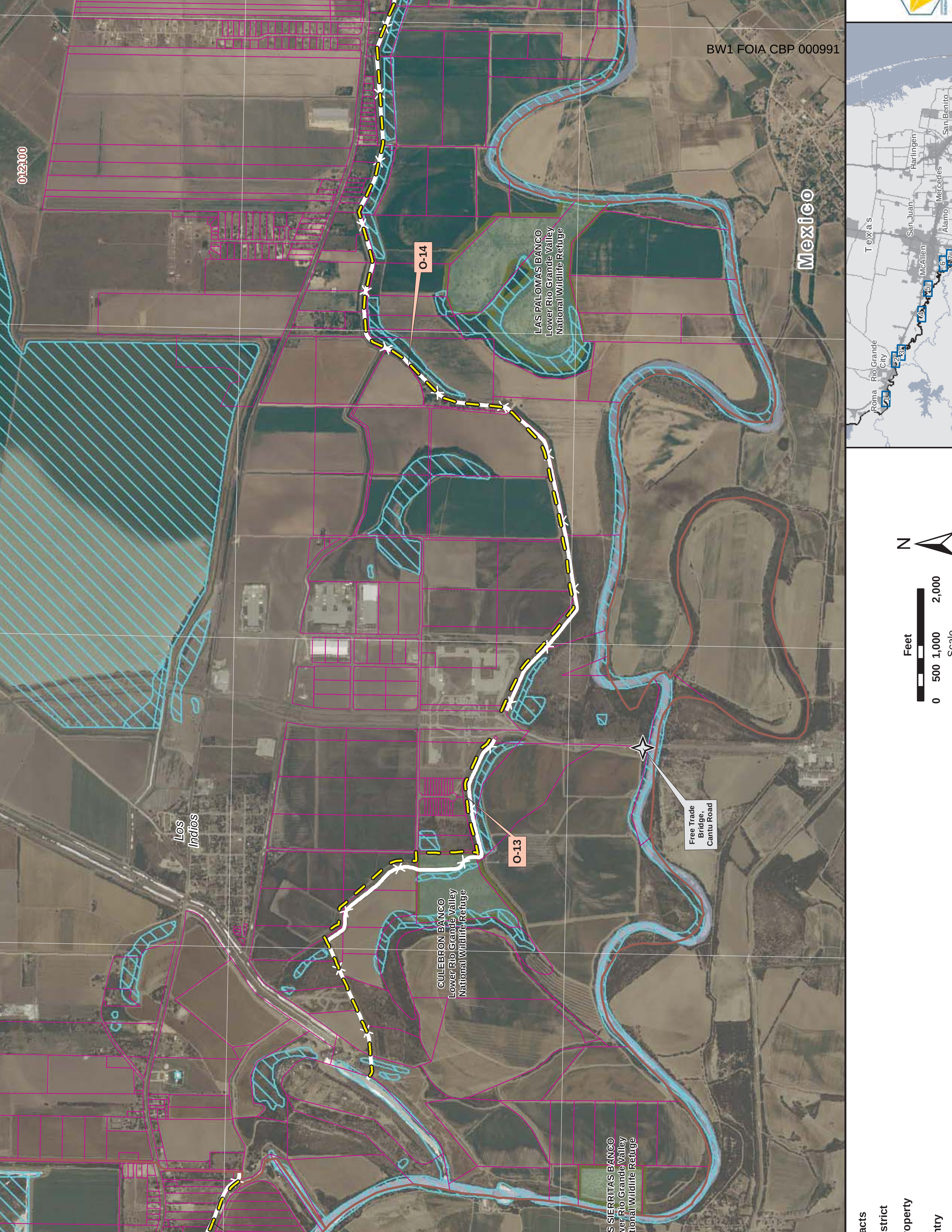
022800
O-9
O-10
Toluca Ranch
Historic
District
Progreso Lakes
LLANO GRANDE BANCO
Lower Rio Grande Valley
National Wildlife Refuge
Progreso
International
Bridge, FM-1015
Mexico
acts
strict
roperty
ntry
Feet
0 500 1,000 2,000
N
Texas
Roma
Rio Grande
City
San Juan
Harlingen
McAllen
Alamo
Mercedes
San Benito

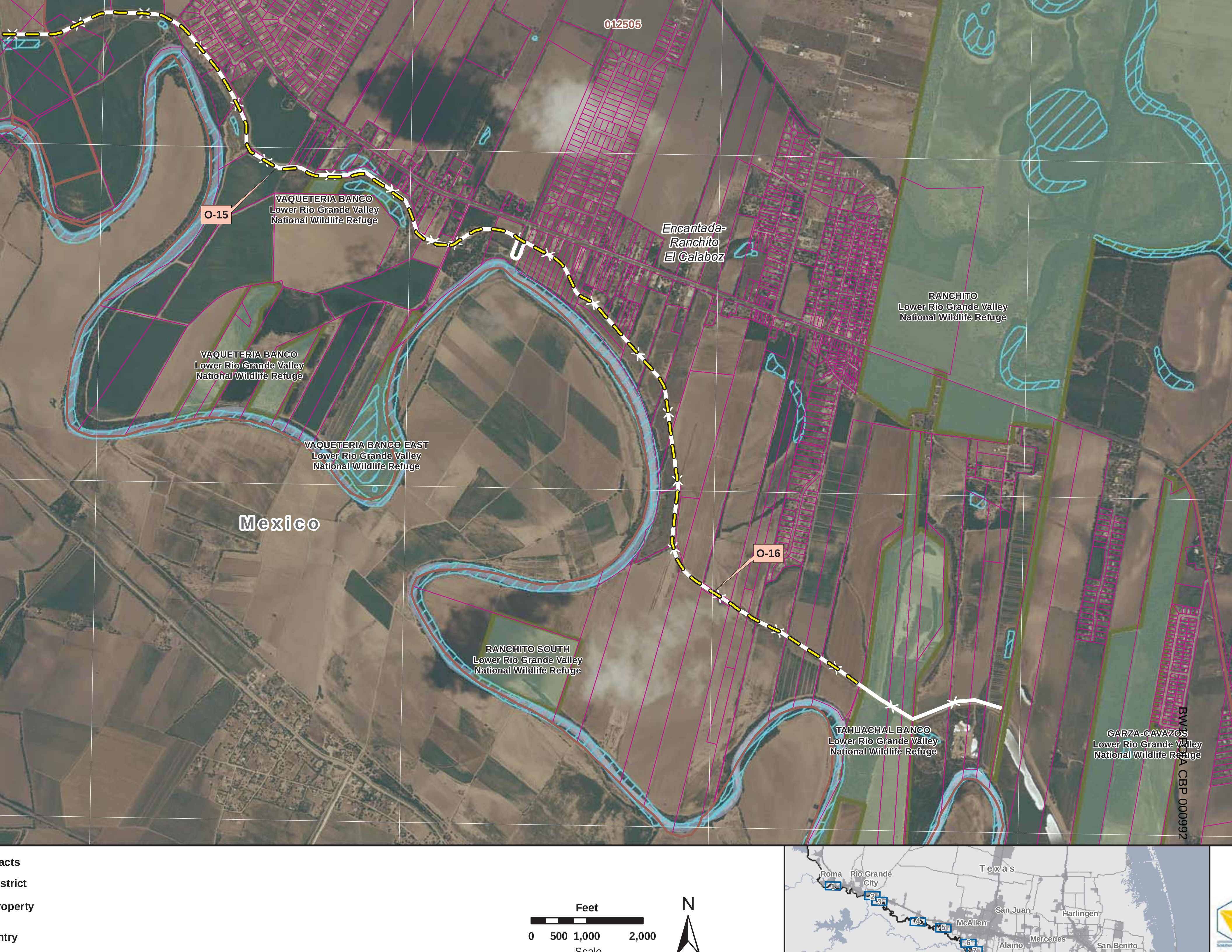


acts
strict
roperty
ntry

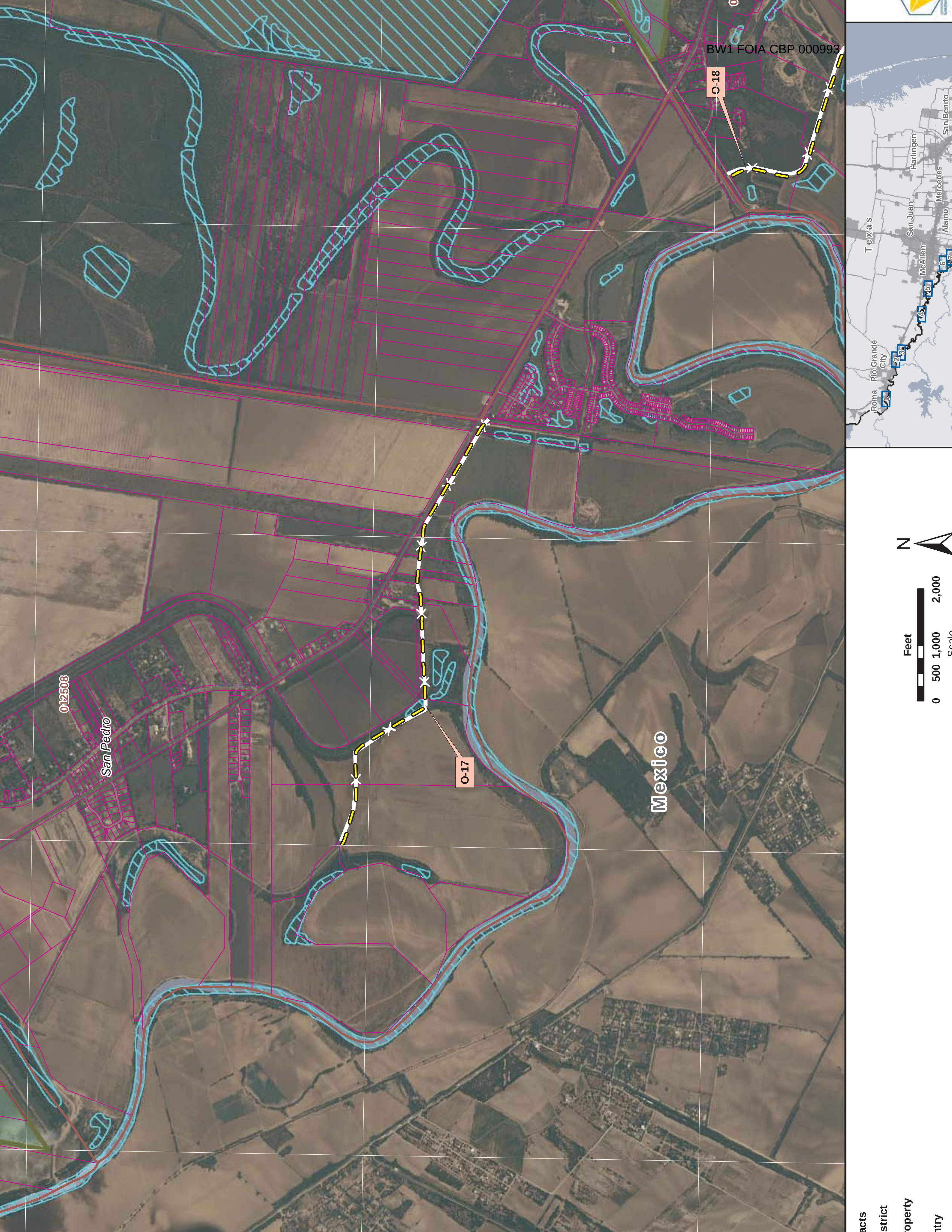
Feet
0 500 1,000 2,000
Scale
N



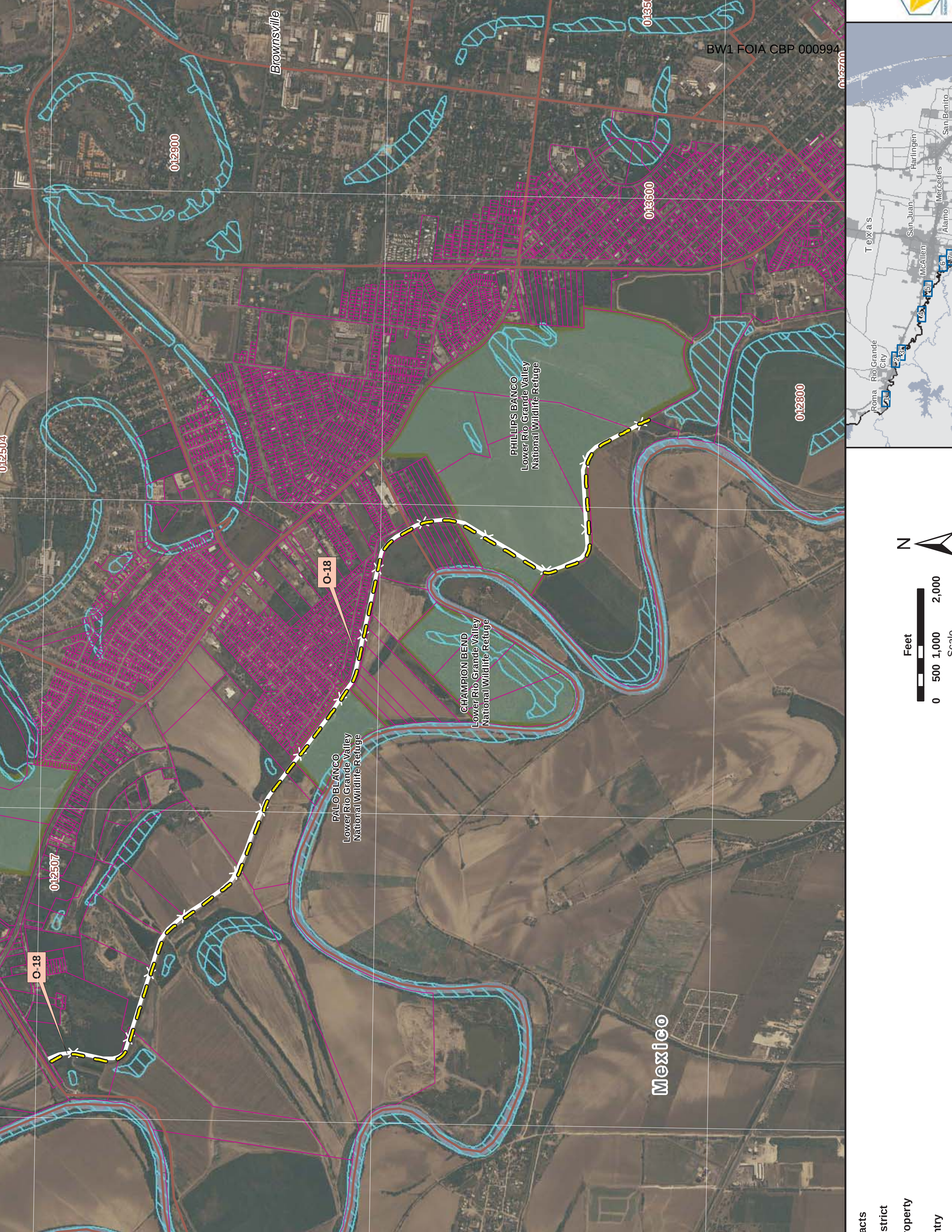

O-14
LAS PALOMAS BANCO
Lower Rio Grande Valley
National Wildlife Refuge
O-13
CULEBRON BANCO
Lower Rio Grande Valley
National Wildlife Refuge
Lower Rio Grande Valley
National Wildlife Refuge
Los Indios
Free Trade Bridge, Cantu Road
Mexico
Feet
0 500 1,000 2,000
N
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Alamo
Mercedes
San Benito

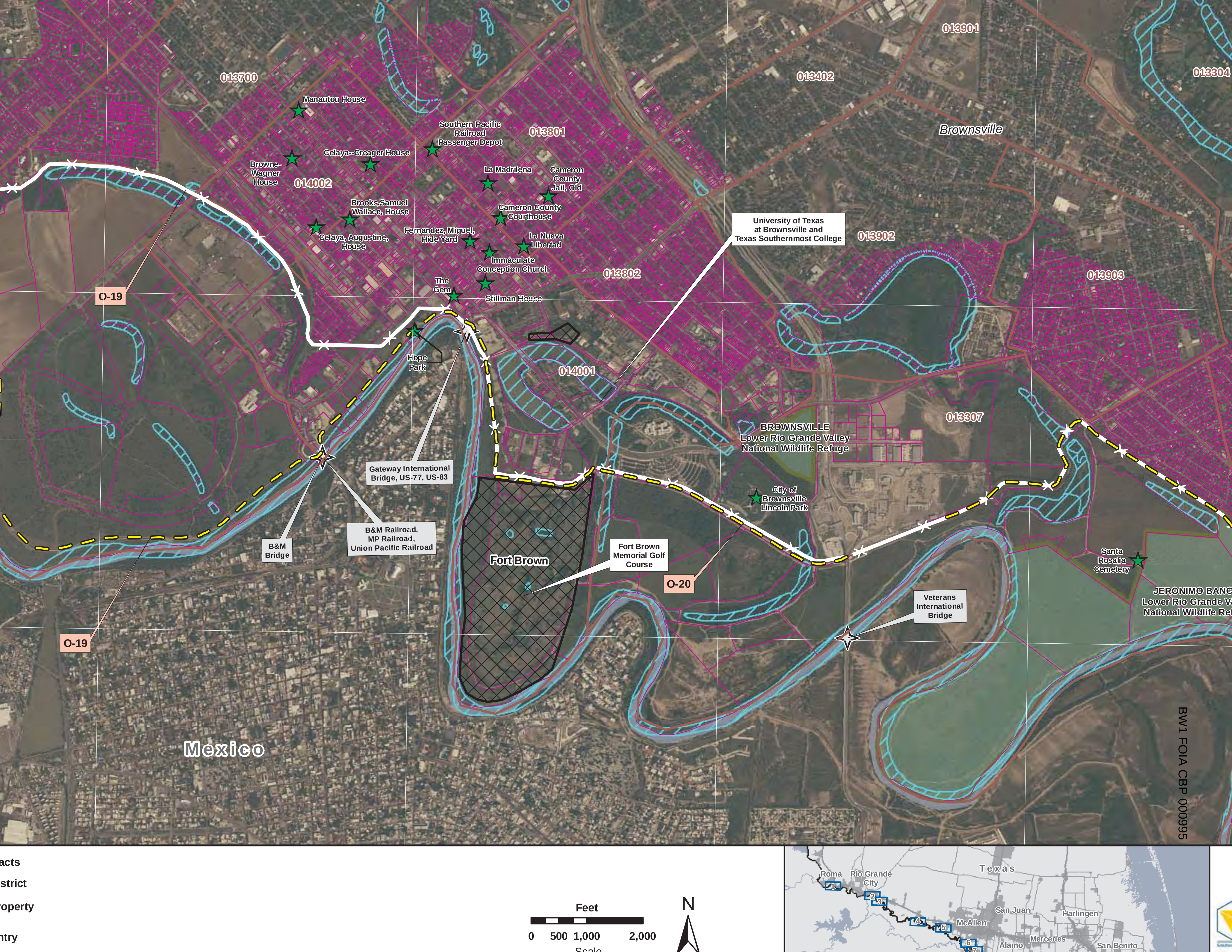


012505
O-15
VAQUETERIA BANCO
Lower Rio Grande Valley
National Wildlife Refuge
Encantada-
Ranchito
El Calaboz
RANCHITO
Lower Rio Grande Valley
National Wildlife Refuge
VAQUETERIA BANCO
Lower Rio Grande Valley
National Wildlife Refuge
VAQUETERIA BANCO EAST
Lower Rio Grande Valley
National Wildlife Refuge
Mexico
O-16
RANCHITO SOUTH
Lower Rio Grande Valley
National Wildlife Refuge
TAHUACHAL BANCO
Lower Rio Grande Valley
National Wildlife Refuge
GARZA-CAVAZOS
Lower Rio Grande Valley
National Wildlife Refuge
acts
strict
roperty
ntry
Feet
0 500 1,000 2,000
N
Texas
Roma
Rio Grande City
San Juan
Harlingen
McAllen
Alamo
Mercedes
San Benito
1
2
3
4
5
6
7



O-18
O-17
012508
San Pedro
Mexico
Texas
Roma
Rio Grande City
San Juan
McAllen
Alamo
Mercedes
Harlingen
San Benito
N
Feet
0 500 1,000 2,000

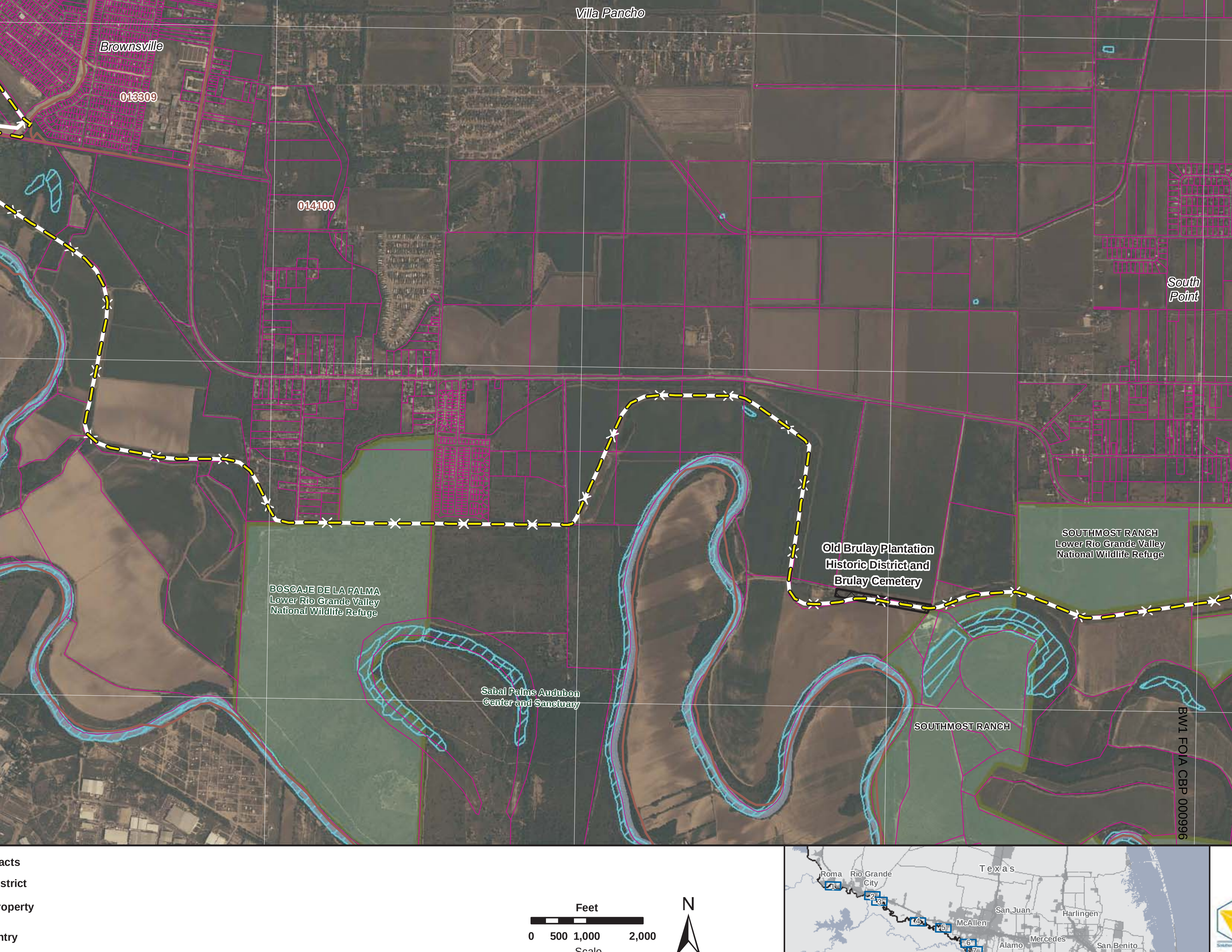

Brownsville
012300
013600
012800
012504
012507
O-18
O-18
PHILLIPS BANCO
Lower Rio Grande Valley
National Wildlife Refuge
CHAMPION BEND
Lower Rio Grande Valley
National Wildlife Refuge
PALO BLANCO
Lower Rio Grande Valley
National Wildlife Refuge
Mexico
N
Feet
0 500 1,000 2,000
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Mercedes
Alamo
San Benito

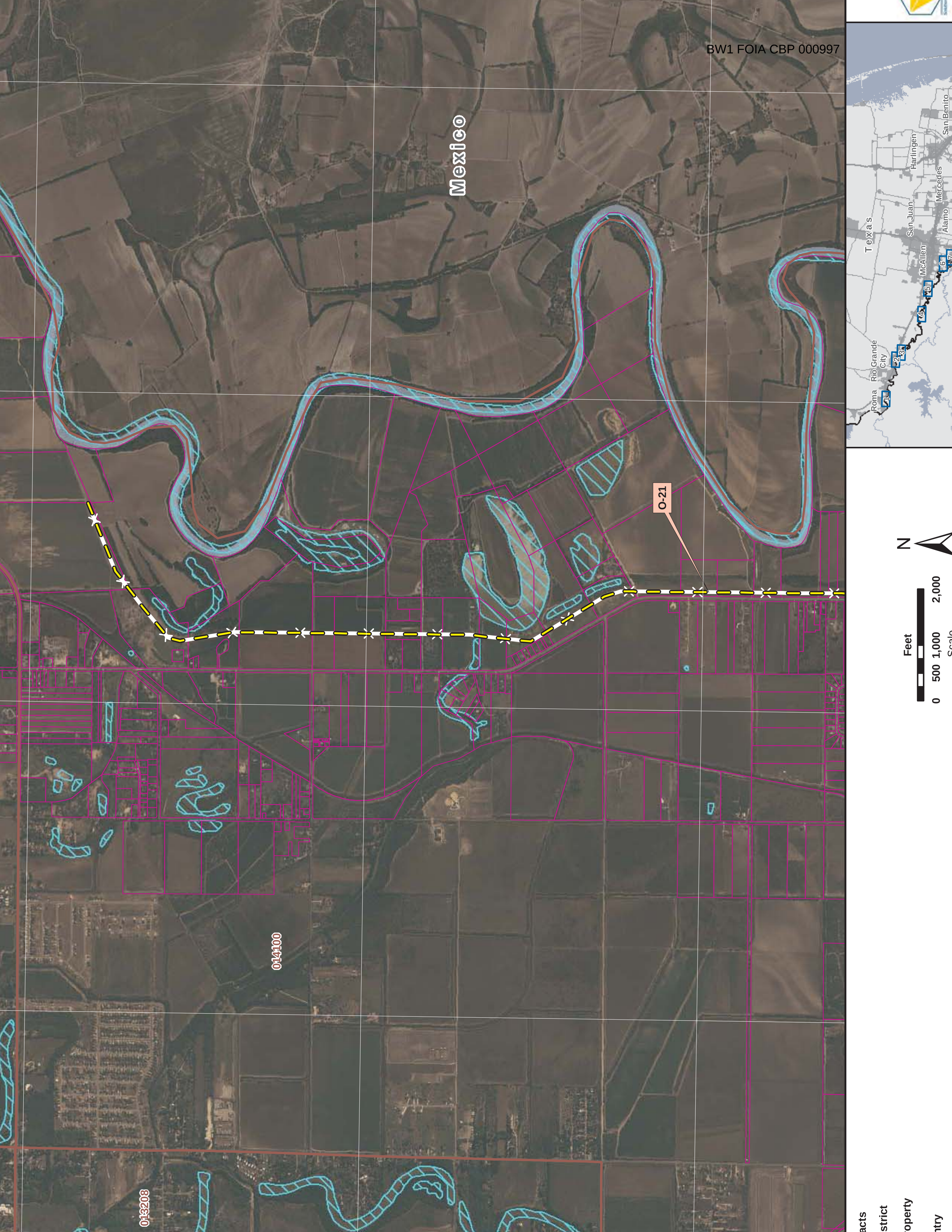


BW1 FOIA CBP 000995

acts
strict
roperty
ntry

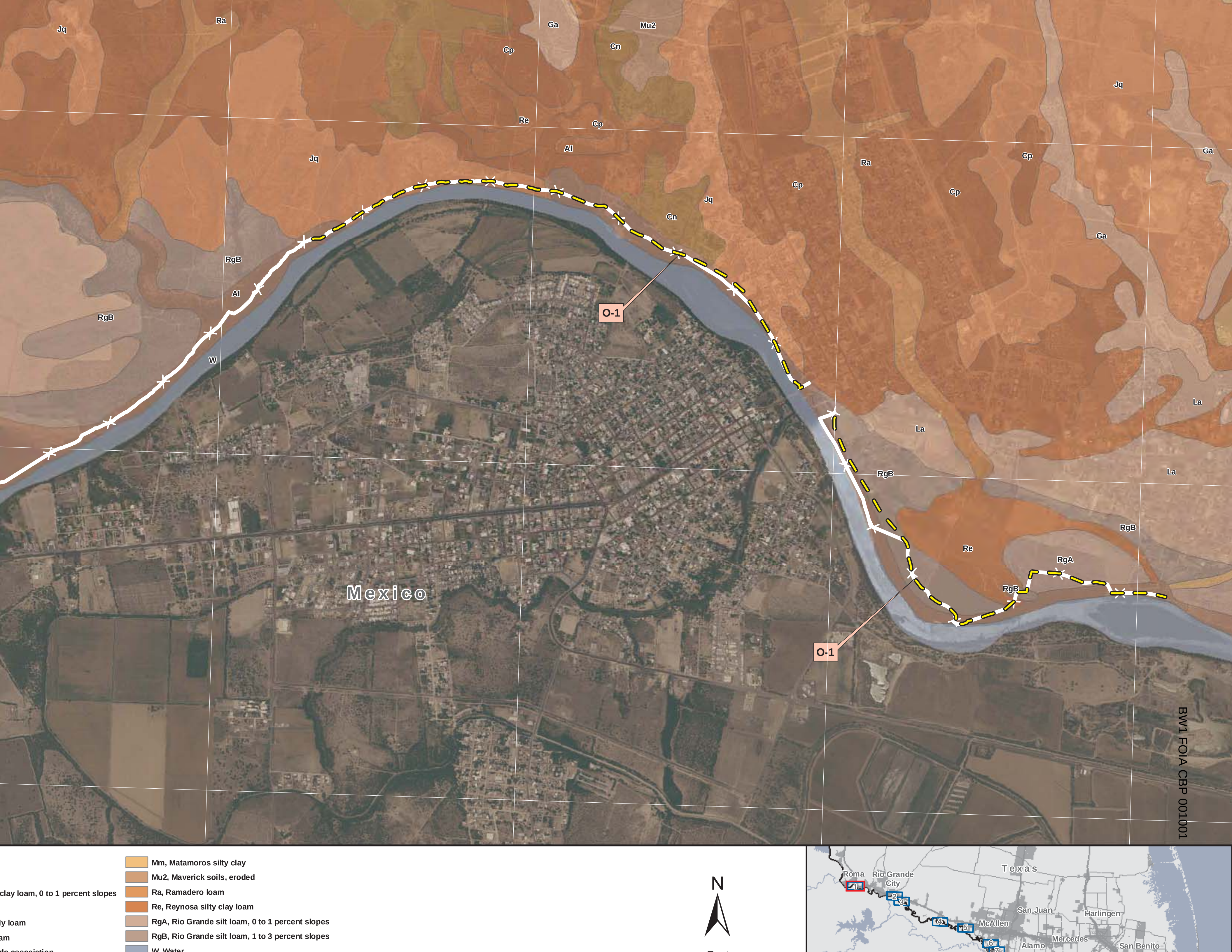
BW1 FOIA CBP 000996

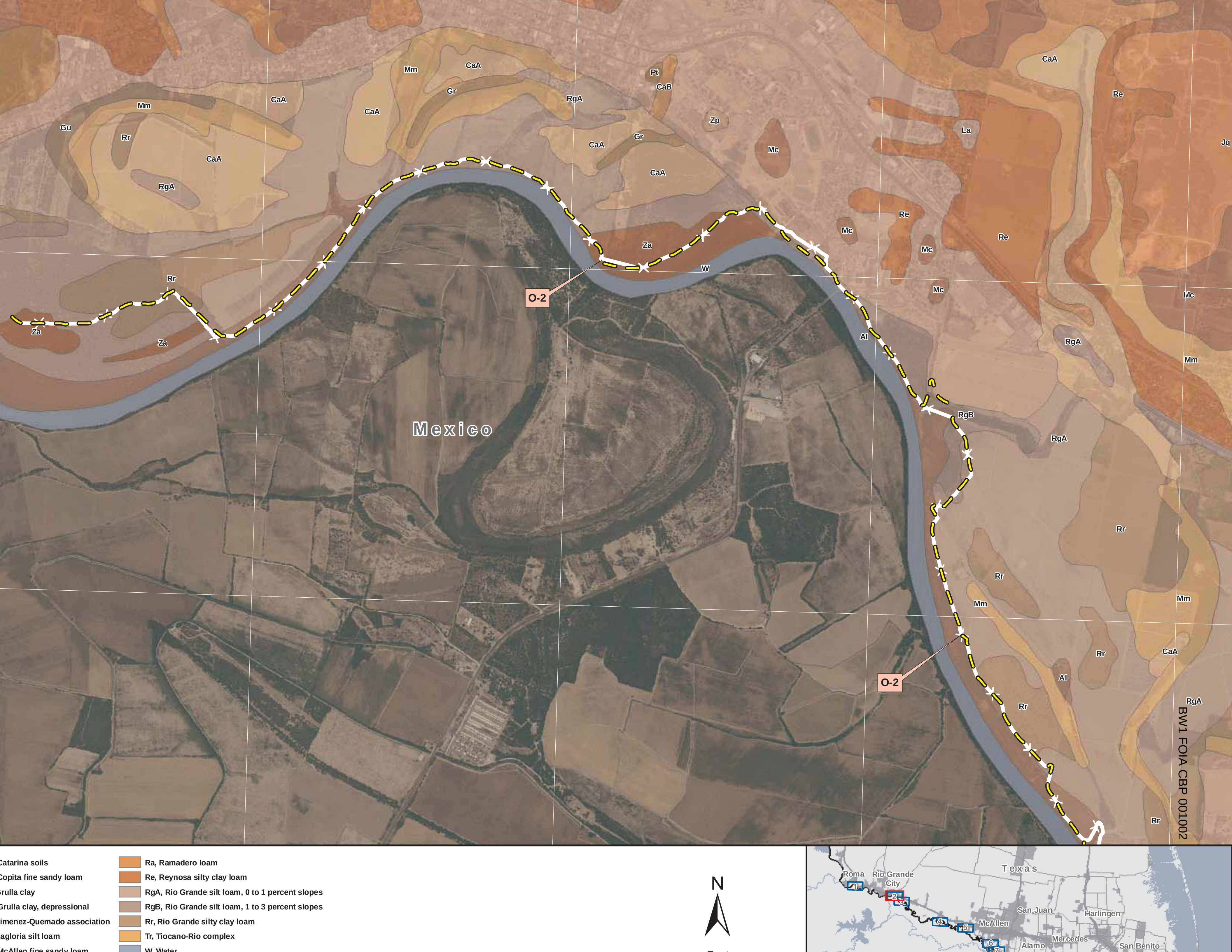



Mexico
O-21
014100
013208
Texas
Roma
Rio Grande City
McAllen
San Juan
Alamo
Mercedes
Harlingen
San Benito
N
Feet
0 500 1,000 2,000
Scale

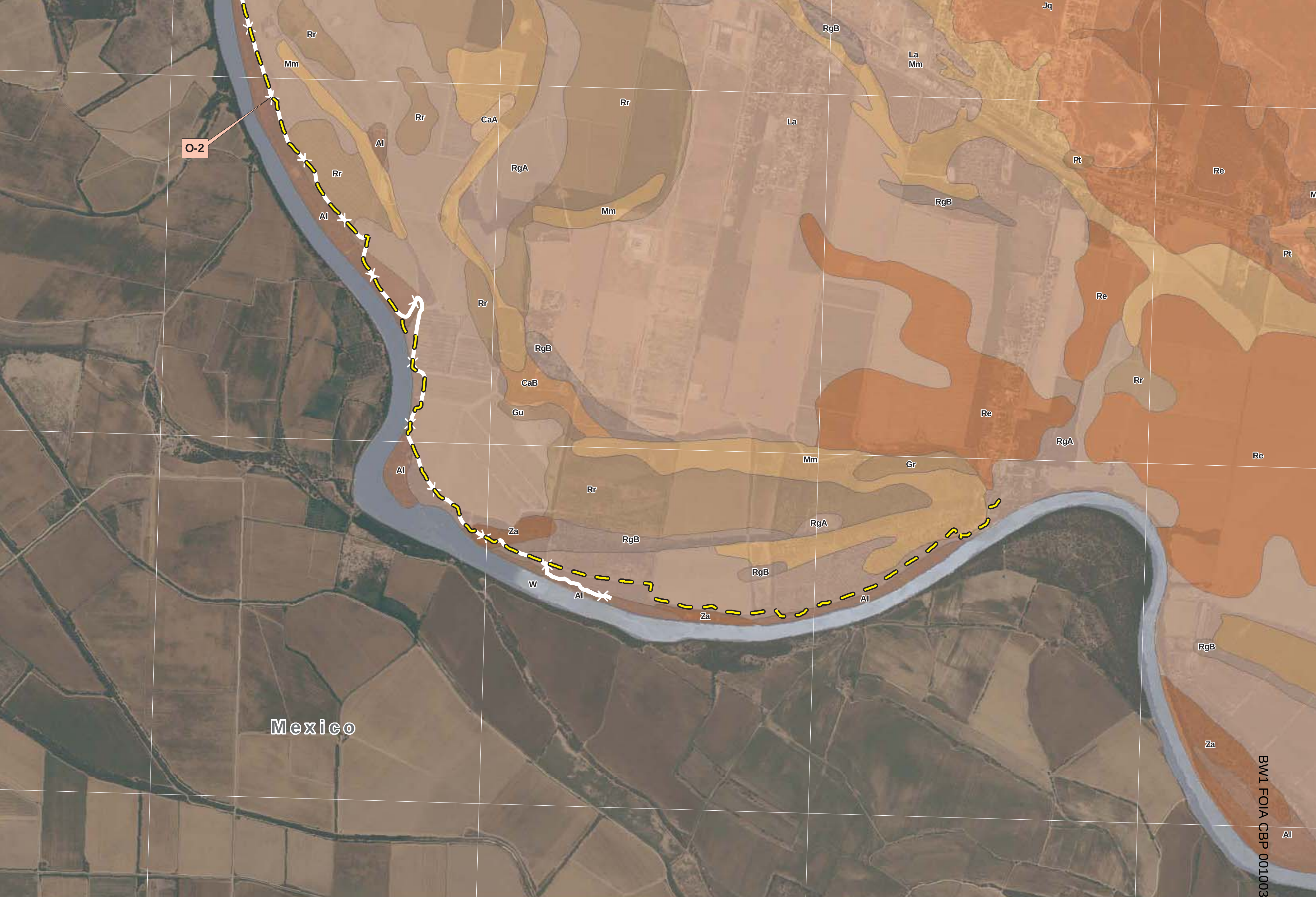
APPENDIX G

Detailed Maps of the Proposed Fence Sections Showing Soils


O-1
O-1
Mexico
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Mercedes
Alamo
San Benito
N
Mm, Matamoros silty clay
Mu2, Maverick soils, eroded
Ra, Ramadero loam
Re, Reynosa silty clay loam
RgA, Rio Grande silt loam, 0 to 1 percent slopes
RgB, Rio Grande silt loam, 1 to 3 percent slopes
clay loam, 0 to 1 percent slopes

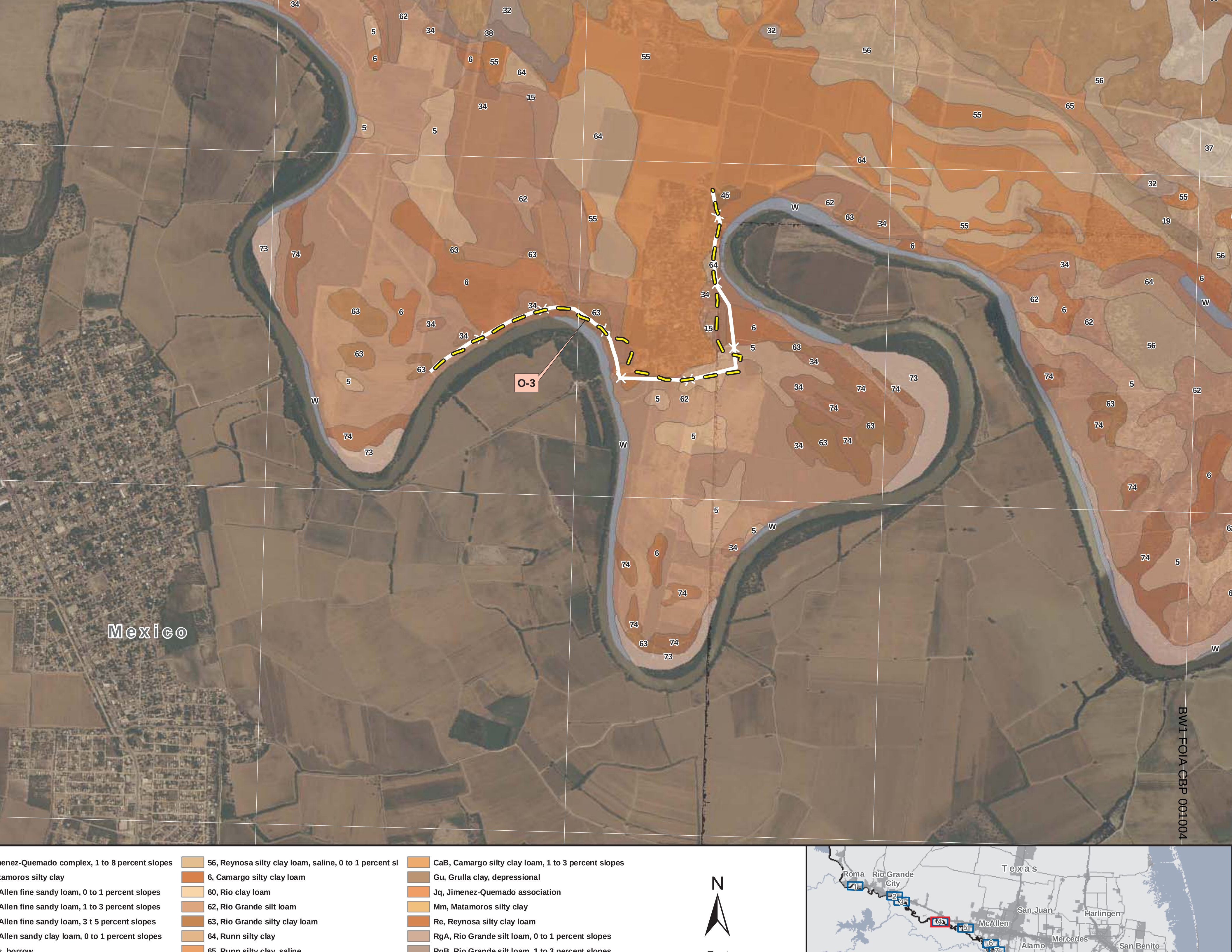


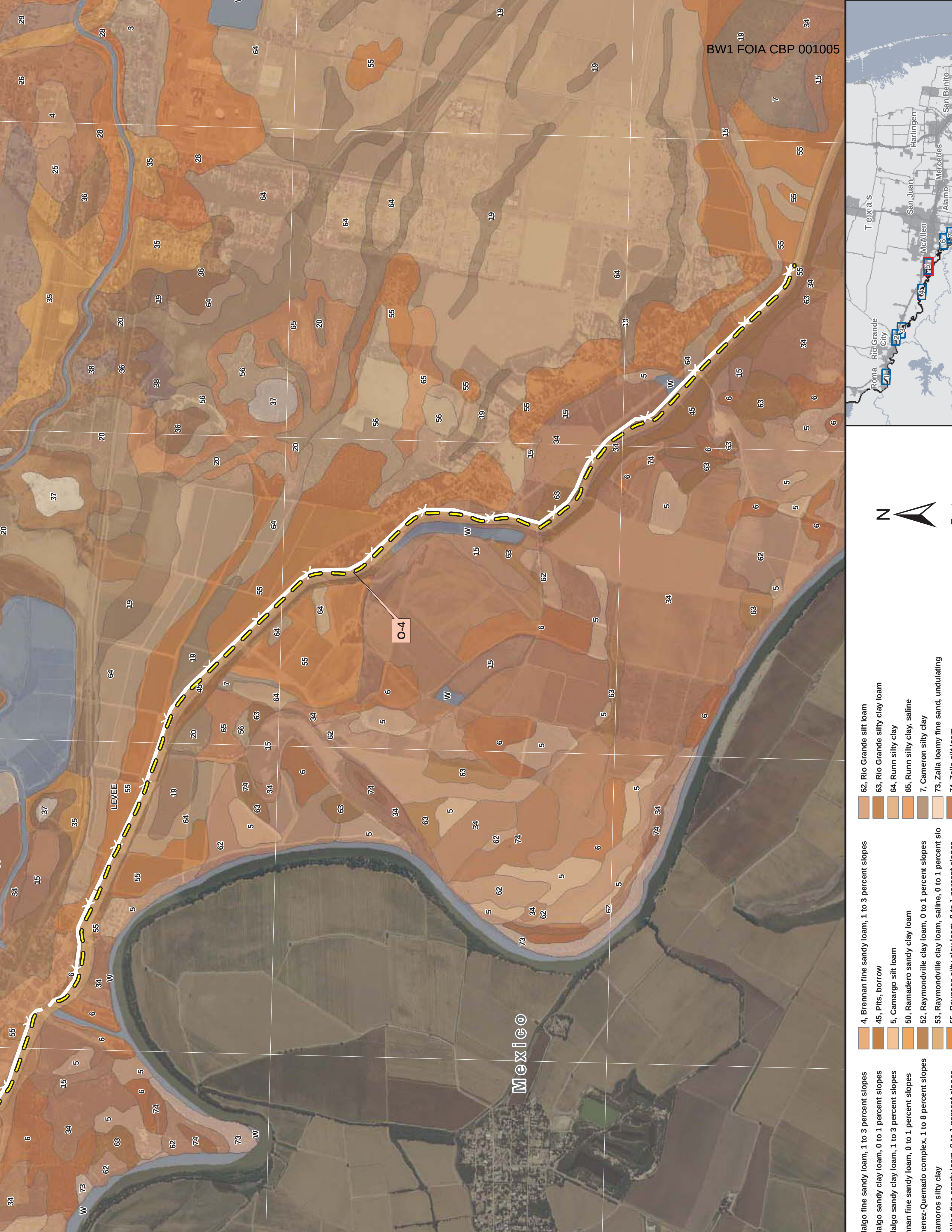
BW1 FOIA CBP 001002

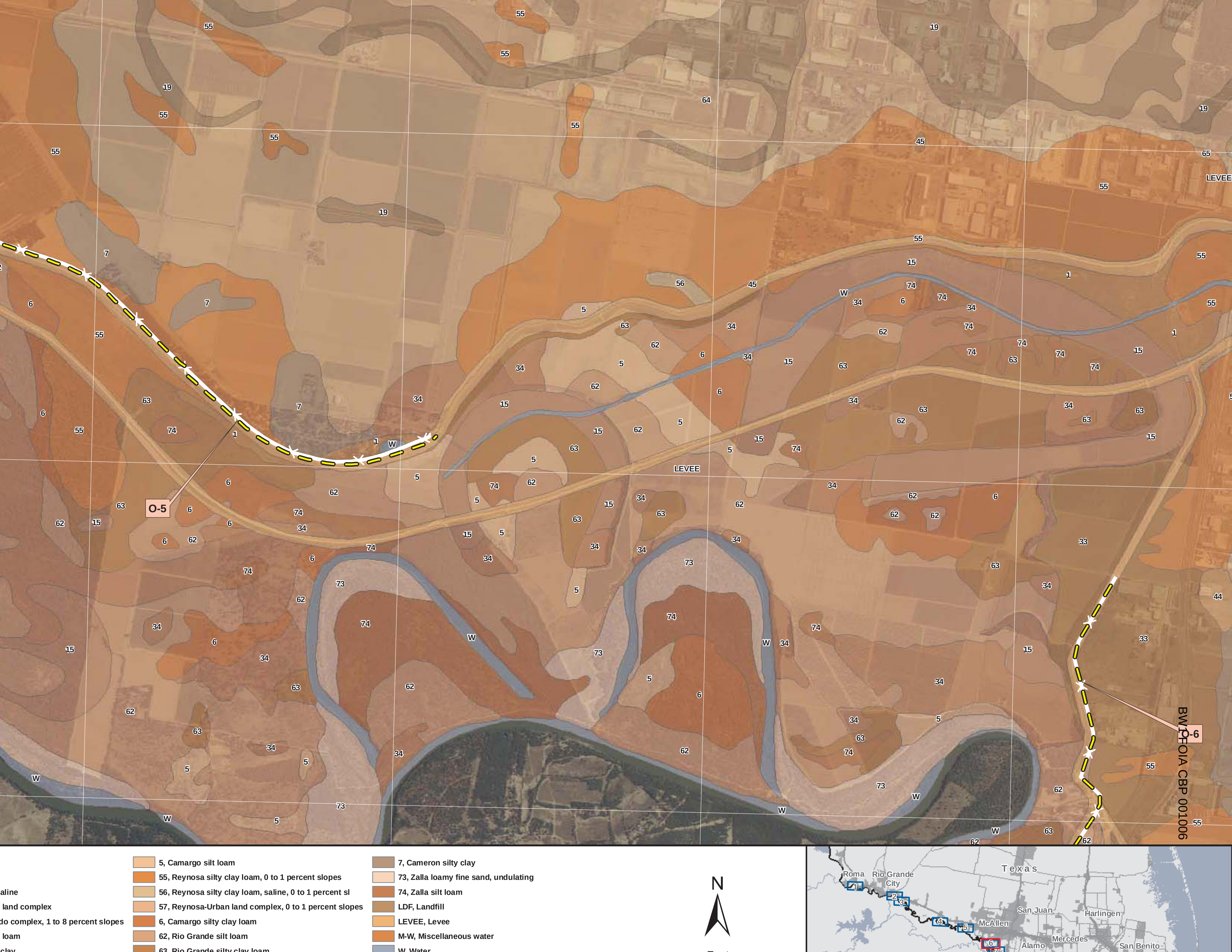


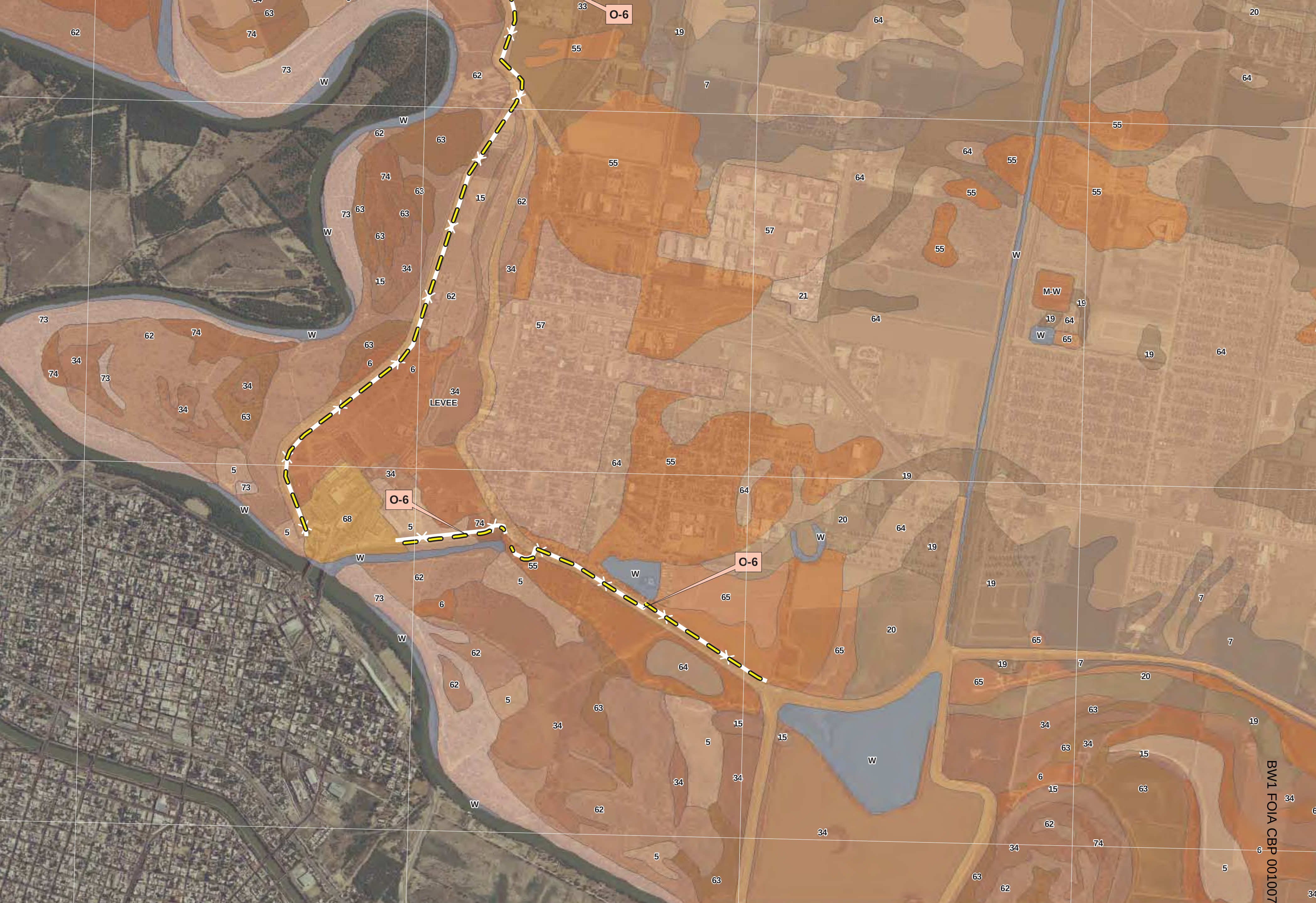
Camargo silty clay loam, 1 to 3 percent slopes
Copita fine sandy loam
, Dams
rulla clay
Grulla clay, depressional
imenez-Quemado association
agloria silt loam

Pt, Pits
Re, Reynosa silty clay loam
RgA, Rio Grande silt loam, 0 to 1 percent slopes
RgB, Rio Grande silt loam, 1 to 3 percent slopes
Rr, Rio Grande silty clay loam
W, Water
Za, Zalla loamy fine sand


O-3
Mexico
W
...enez-Quemado complex, 1 to 8 percent slopes
...tamoros silty clay
...Allen fine sandy loam, 0 to 1 percent slopes
...Allen fine sandy loam, 1 to 3 percent slopes
...Allen fine sandy loam, 3 t 5 percent slopes
...Allen sandy clay loam, 0 to 1 percent slopes
...s, borrow
56, Reynosa silty clay loam, saline, 0 to 1 percent sl
6, Camargo silty clay loam
60, Rio clay loam
62, Rio Grande silt loam
63, Rio Grande silty clay loam
64, Runn silty clay
65, Runn silty clay, saline
CaB, Camargo silty clay loam, 1 to 3 percent slopes
Gu, Grulla clay, depressional
Jq, Jimenez-Quemado association
Mm, Matamoros silty clay
Re, Reynosa silty clay loam
RgA, Rio Grande silt loam, 0 to 1 percent slopes
RgB, Rio Grande silt loam, 1 to 3 percent slopes
N
Texas
Roma
Rio Grande City
San Juan
Harlingen
McAllen
Alamo
Mercedes
San Benito
BW1 FOIA CBP 001004


Mexico
O-4
LEVEE
Texas
Roma
Rio Grande City
McAllen
San Juan
Alamo
Mercedes
Harlingen
San Benito
N
4, Brennan fine sandy loam, 1 to 3 percent slopes
45, Pits, borrow
5, Camargo silt loam
50, Ramadero sandy clay loam
52, Raymondville clay loam, 0 to 1 percent slopes
53, Raymondville clay loam, saline, 0 to 1 percent slo
62, Rio Grande silt loam
63, Rio Grande silty clay loam
64, Runn silty clay
65, Runn silty clay, saline
7, Cameron silty clay
73, Zalla loamy fine sand, undulating

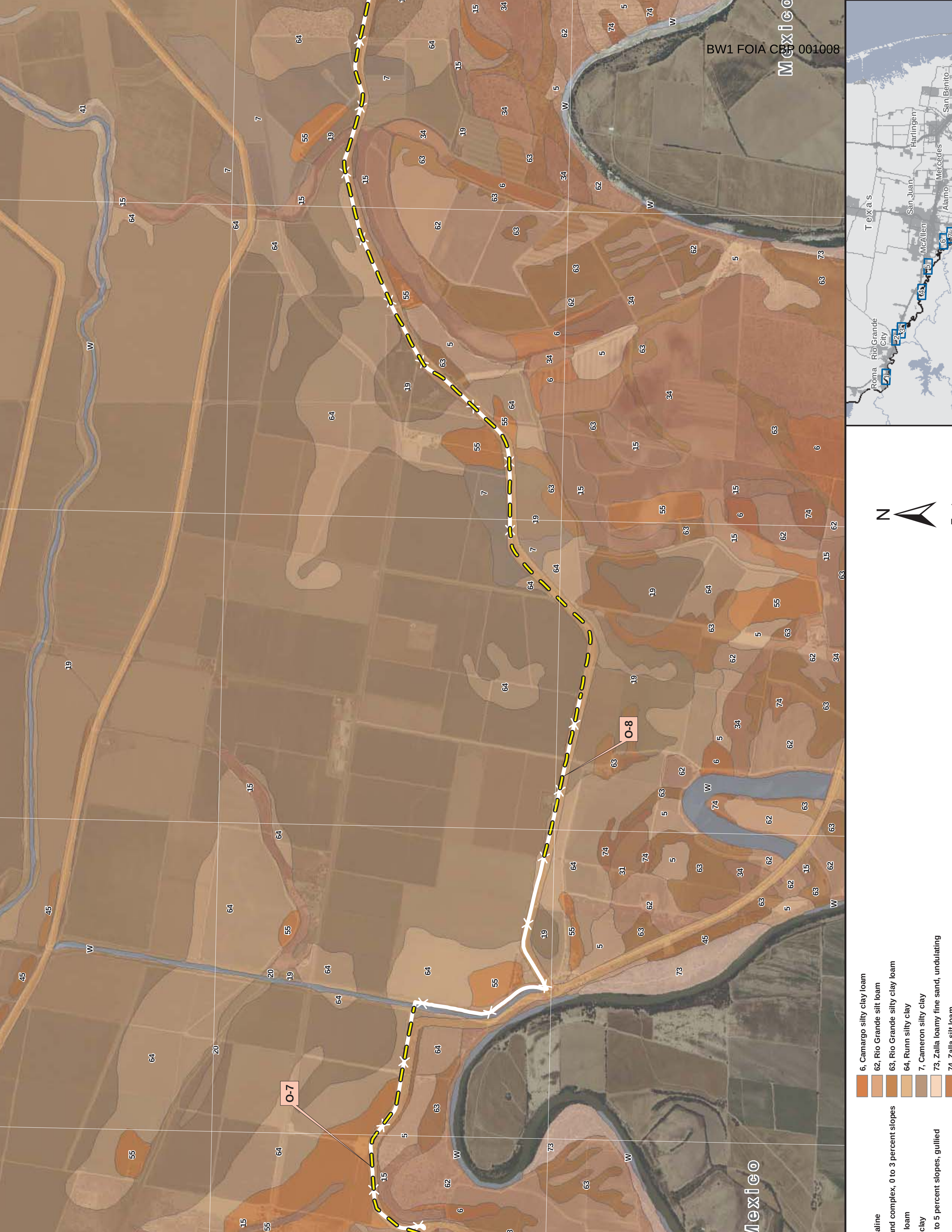

O-5
O-6
LEVEE
5, Camargo silt loam
55, Reynosa silty clay loam, 0 to 1 percent slopes
56, Reynosa silty clay loam, saline, 0 to 1 percent sl
57, Reynosa-Urban land complex, 0 to 1 percent slopes
6, Camargo silty clay loam
62, Rio Grande silt loam
7, Cameron silty clay
73, Zalla loamy fine sand, undulating
74, Zalla silt loam
LDF, Landfill
LEVEE, Levee
M-W, Miscellaneous water
N
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Mercedes
Alamo
San Benito



aline
land complex
loam
clay

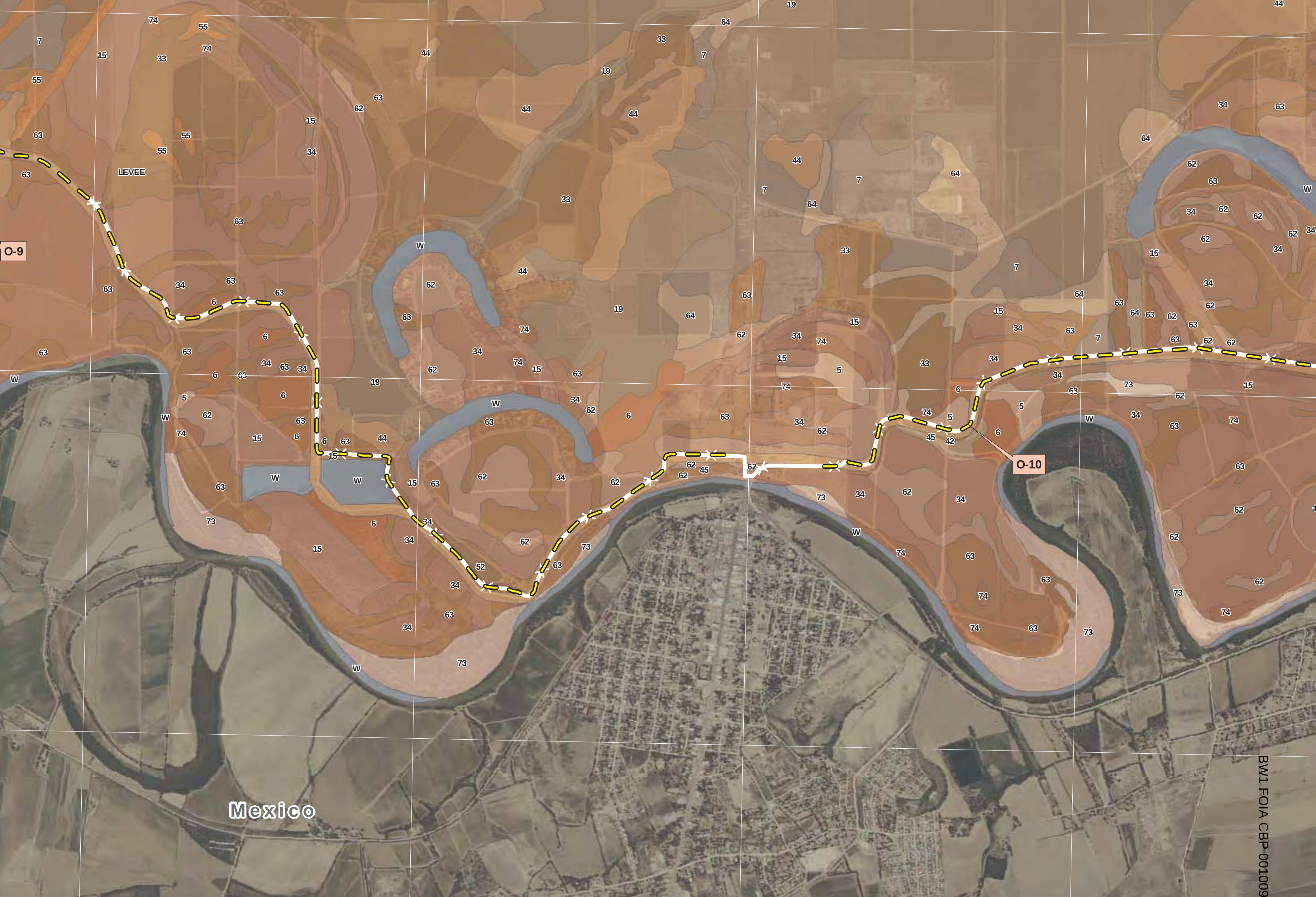
- 5, Camargo silt loam
- 55, Reynosa silty clay loam, 0 to 1 percent slopes
- 57, Reynosa-Urban land complex, 0 to 1 percent slopes
- 6, Camargo silty clay loam
- 62, Rio Grande silt loam
- 63, Rio Grande silty clay loam
- 64, Runn silty clay
- 68, Urban land
- 7, Cameron silty clay
- 73, Zalla loamy fine sand, undulating
- 74, Zalla silt loam
- LEVEE, Levee
- M-W, Miscellaneous water
- W, Water

N



BW1 FOIA CBP 001008

BW1 FOIA CBP 001009



loam

clay

lay loam, 0 to 1 percent slopes

d, 0 to 3 percent slopes

6, Camargo silty clay loam

62, Rio Grande silt loam

63, Rio Grande silty clay loam

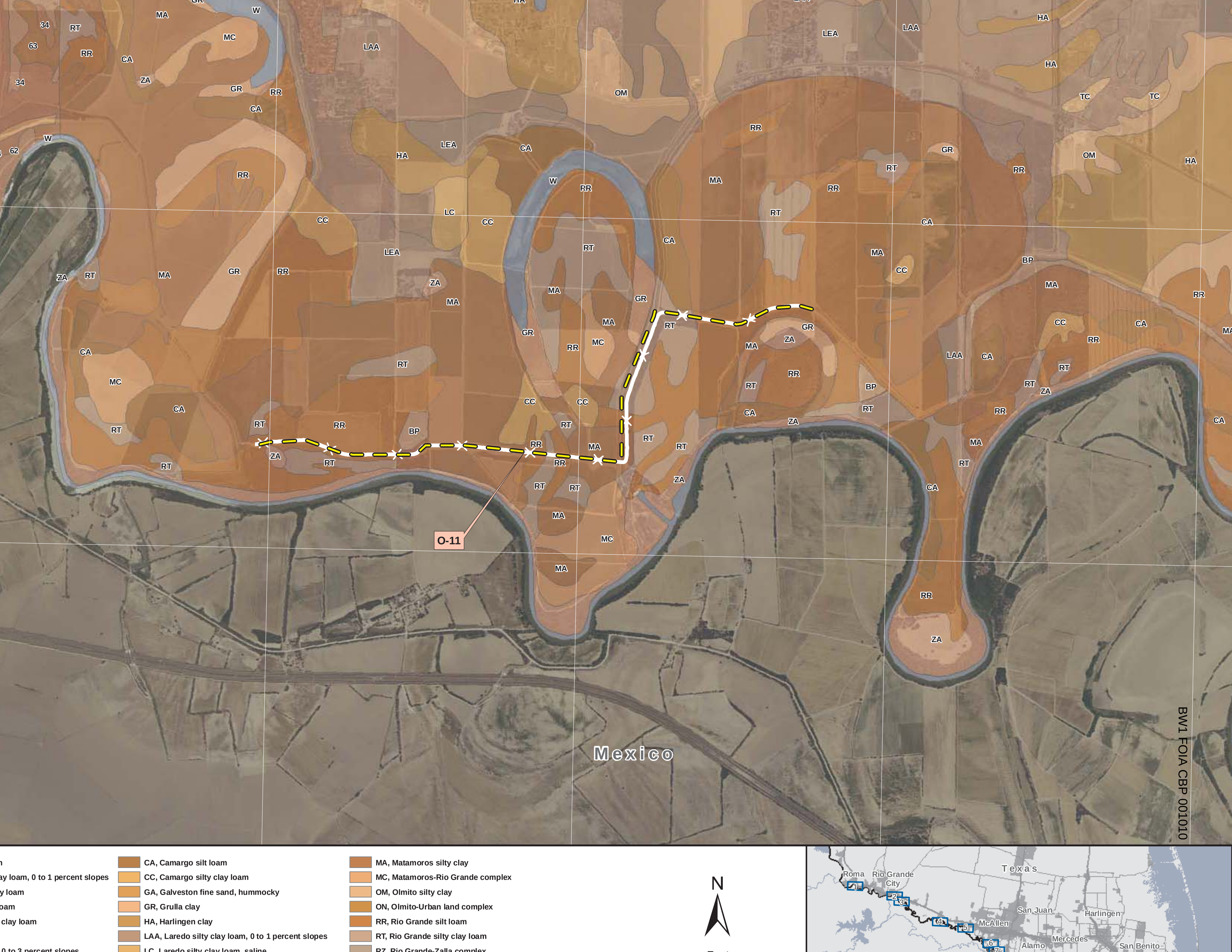
64, Runn silty clay

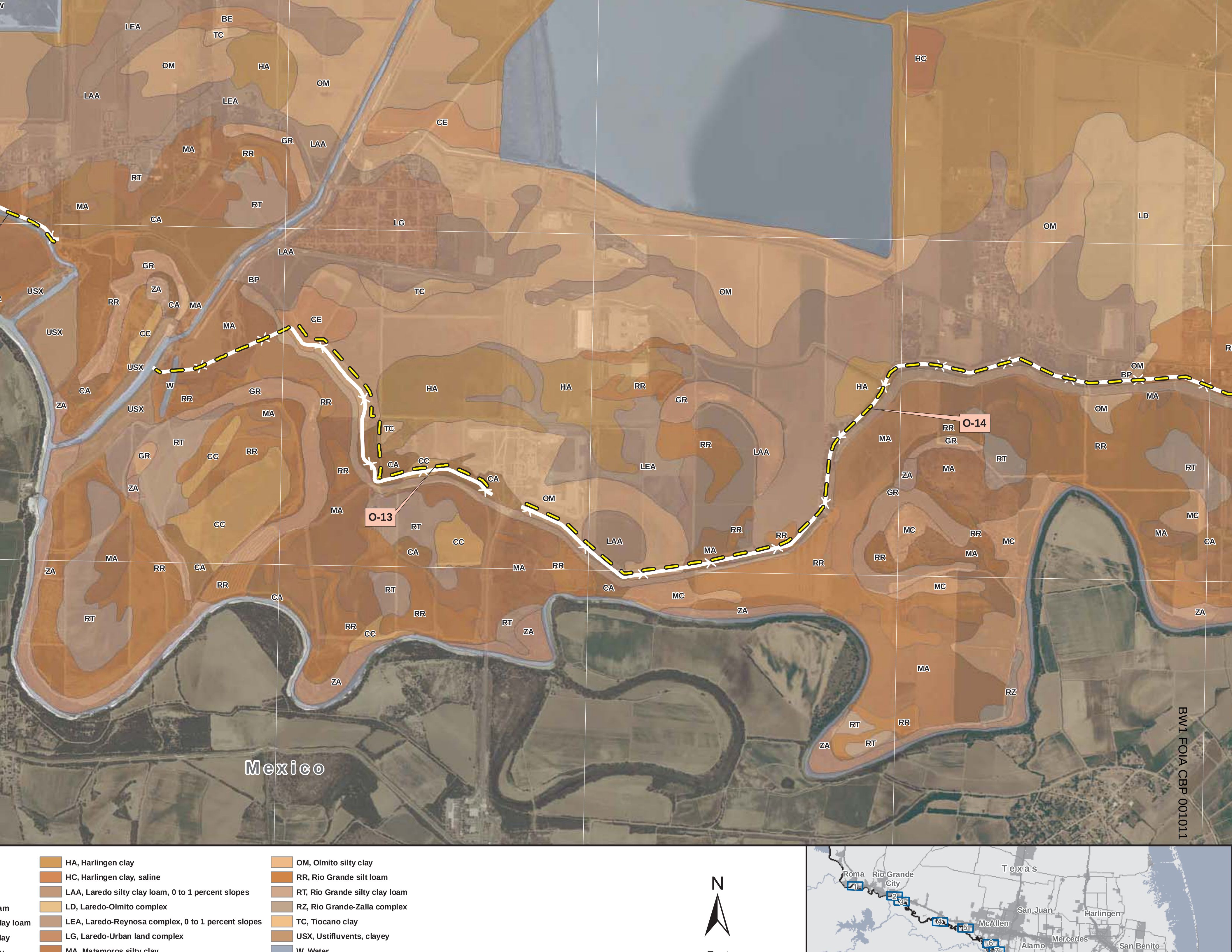
65, Runn silty clay, saline

7, Cameron silty clay

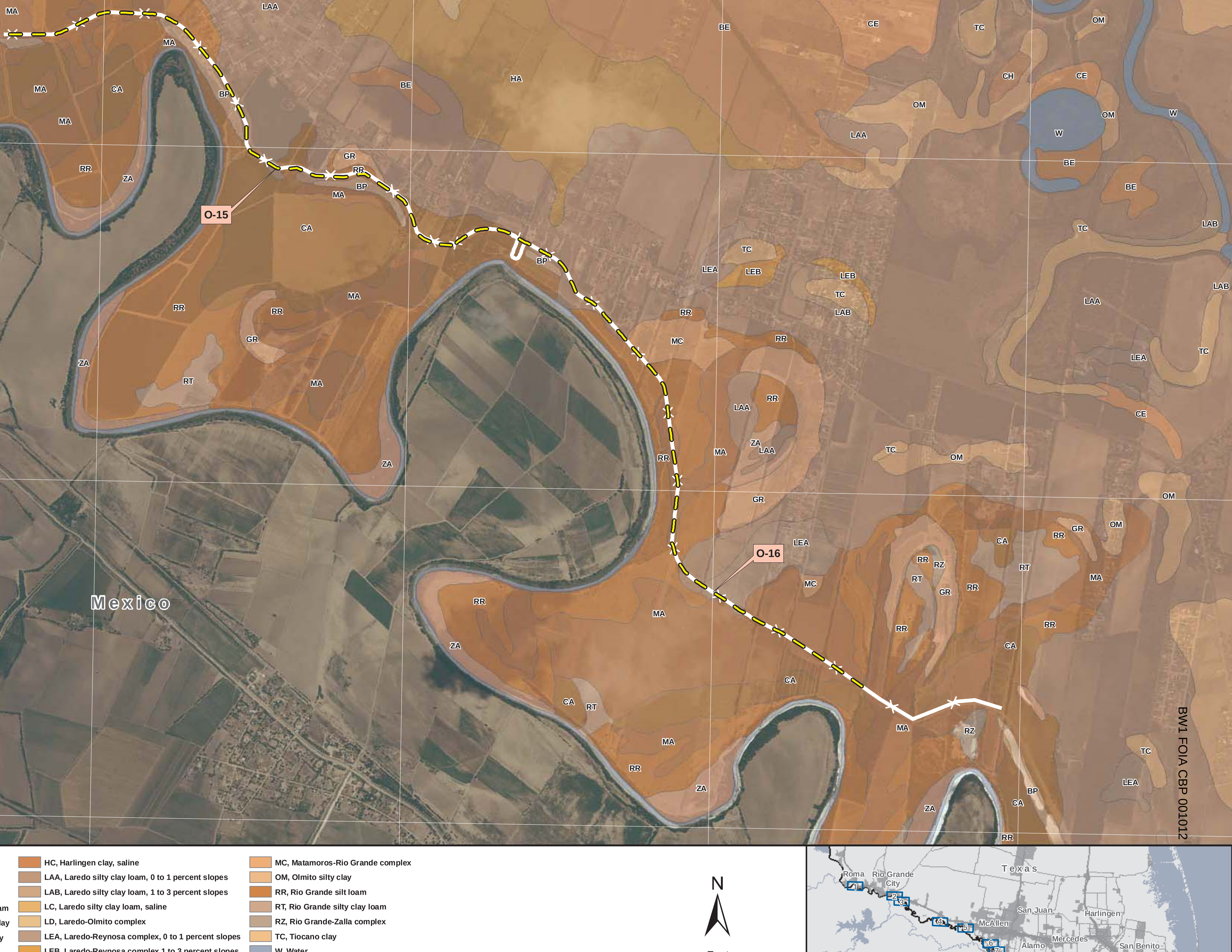
73, Zalla loamy fine sand, undulating

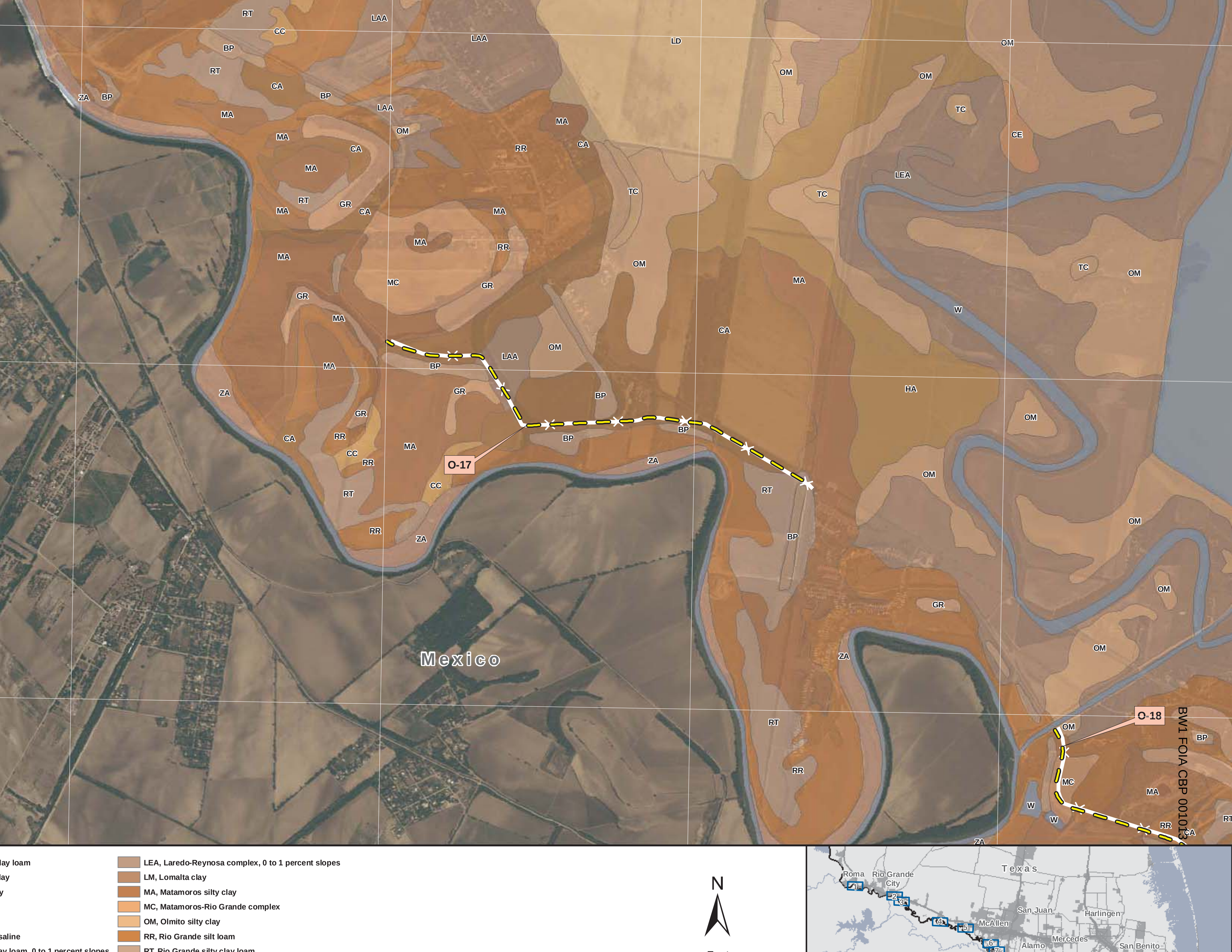
N


O-11
Mexico
CA, Camargo silt loam
CC, Camargo silty clay loam
GA, Galveston fine sand, hummocky
GR, Grulla clay
HA, Harlingen clay
LAA, Laredo silty clay loam, 0 to 1 percent slopes
MA, Matamoros silty clay
MC, Matamoros-Rio Grande complex
OM, Olmito silty clay
ON, Olmito-Urban land complex
RR, Rio Grande silt loam
RT, Rio Grande silty clay loam
N
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Alamo
Mercedes
San Benito



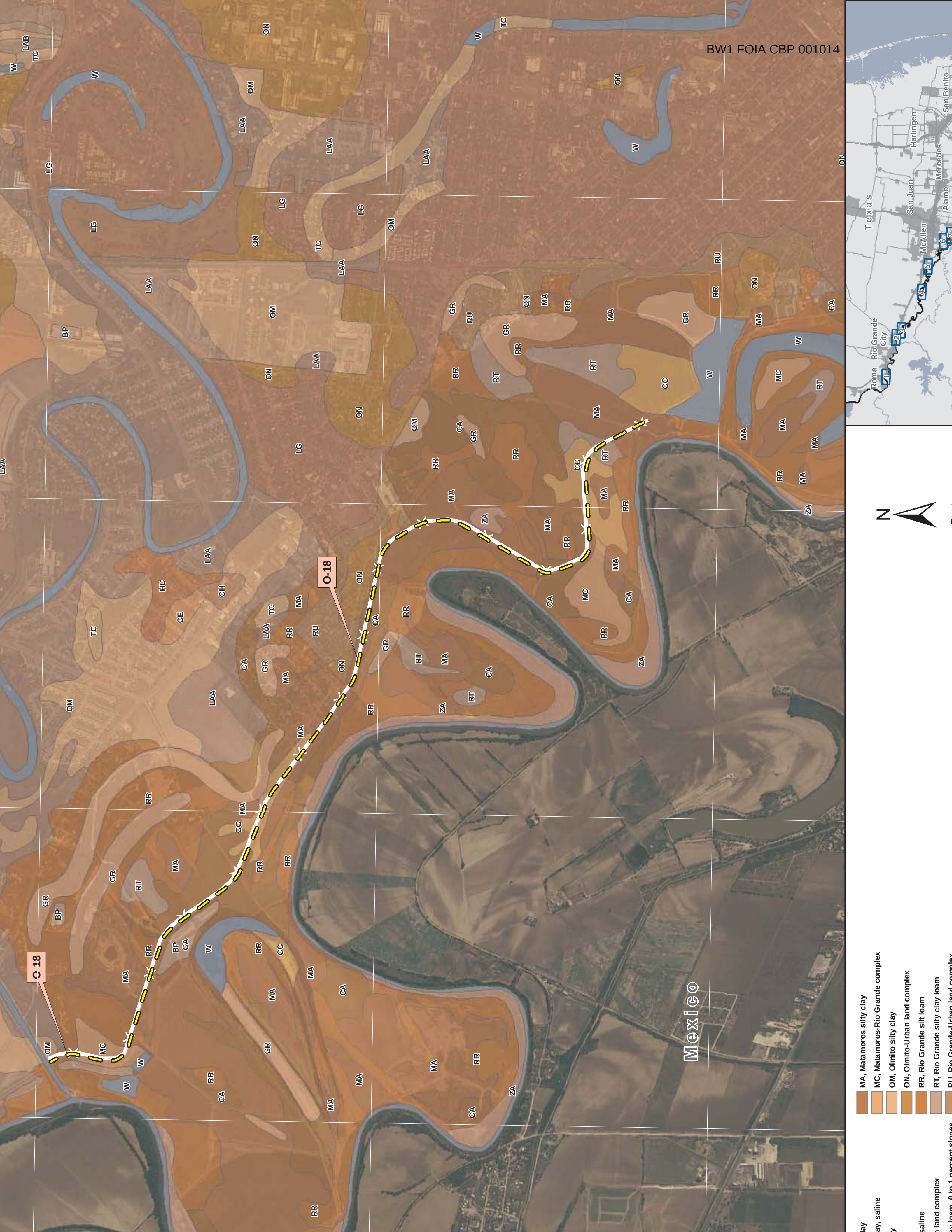
BW1 FOIA CBP 001011

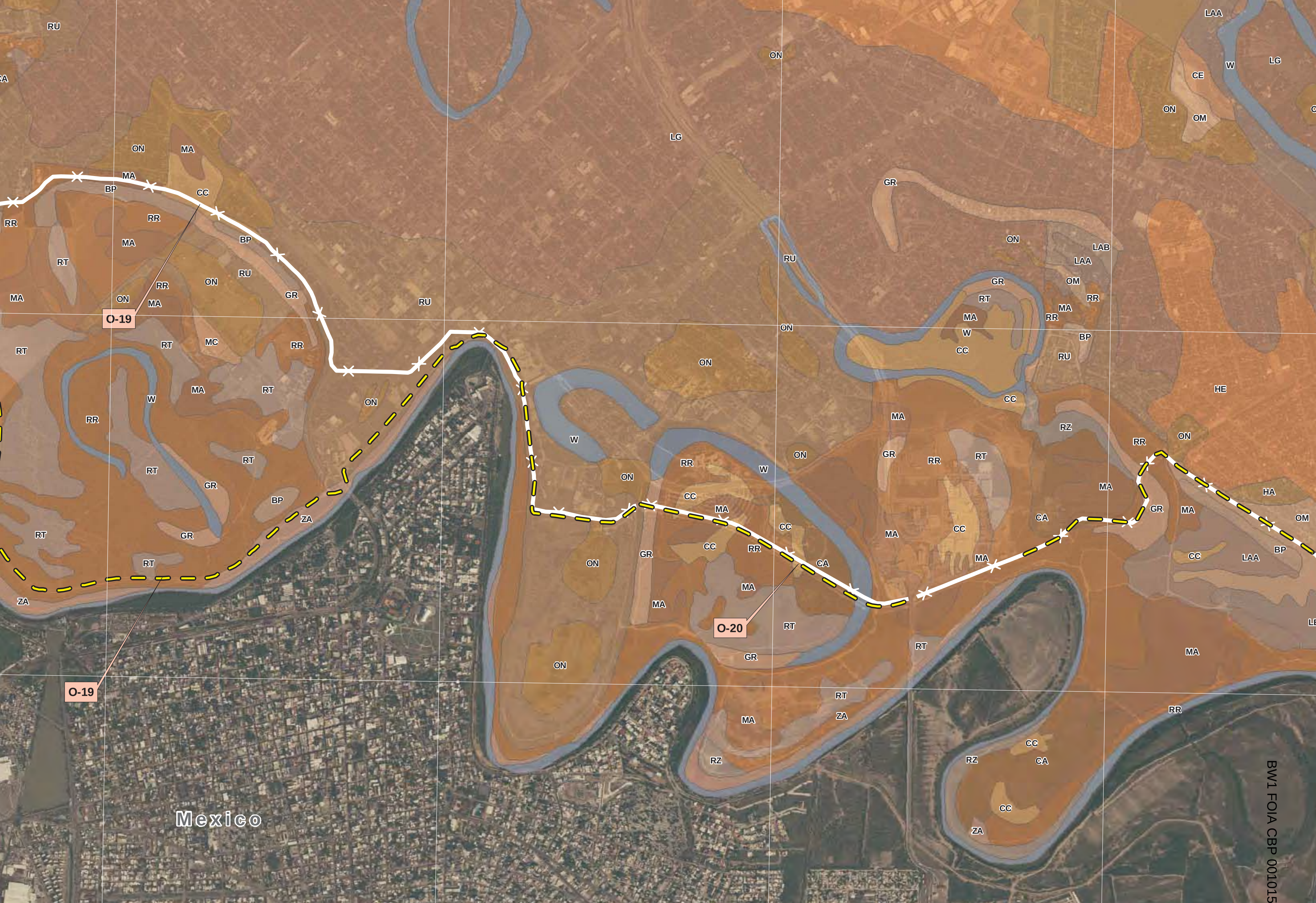

O-15
O-16
Mexico
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Alamo
Mercedes
San Benito
N
HC, Harlingen clay, saline
LAA, Laredo silty clay loam, 0 to 1 percent slopes
LAB, Laredo silty clay loam, 1 to 3 percent slopes
LC, Laredo silty clay loam, saline
LD, Laredo-Olmito complex
LEA, Laredo-Reynosa complex, 0 to 1 percent slopes
MC, Matamoros-Rio Grande complex
OM, Olmito silty clay
RR, Rio Grande silt loam
RT, Rio Grande silty clay loam
RZ, Rio Grande-Zalla complex
TC, Tiocano clay
W, Water



Mexico
Texas
O-17
O-18
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Alamo
Mercedes
San Benito
N
lay loam
lay
y
saline
ay loam, 0 to 1 percent slopes
LEA, Laredo-Reynosa complex, 0 to 1 percent slopes
LM, Lomalta clay
MA, Matamoros silty clay
MC, Matamoros-Rio Grande complex
OM, Olmito silty clay
RR, Rio Grande silt loam
RT, Rio Grande silty clay loam

BW1 FOIA CBP 001014



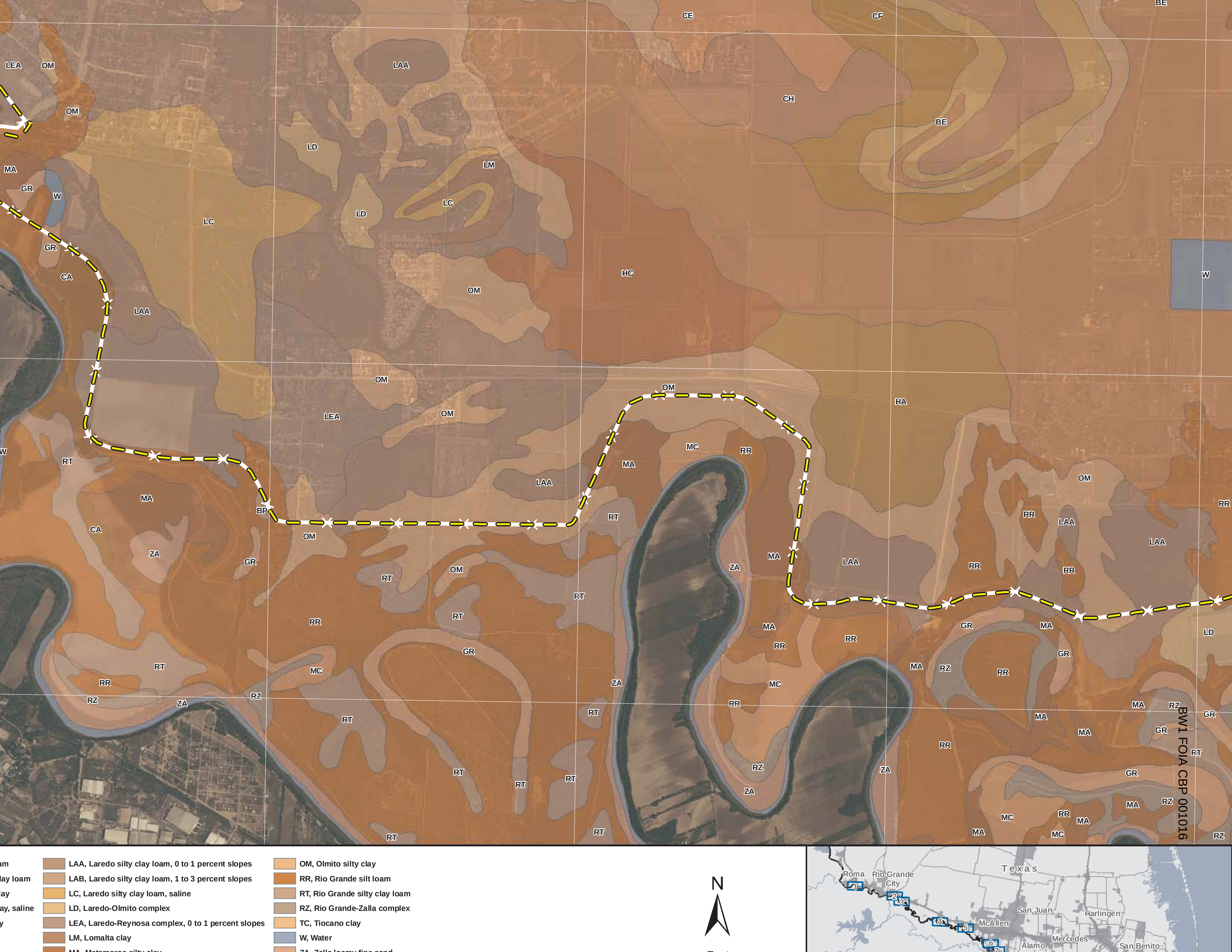


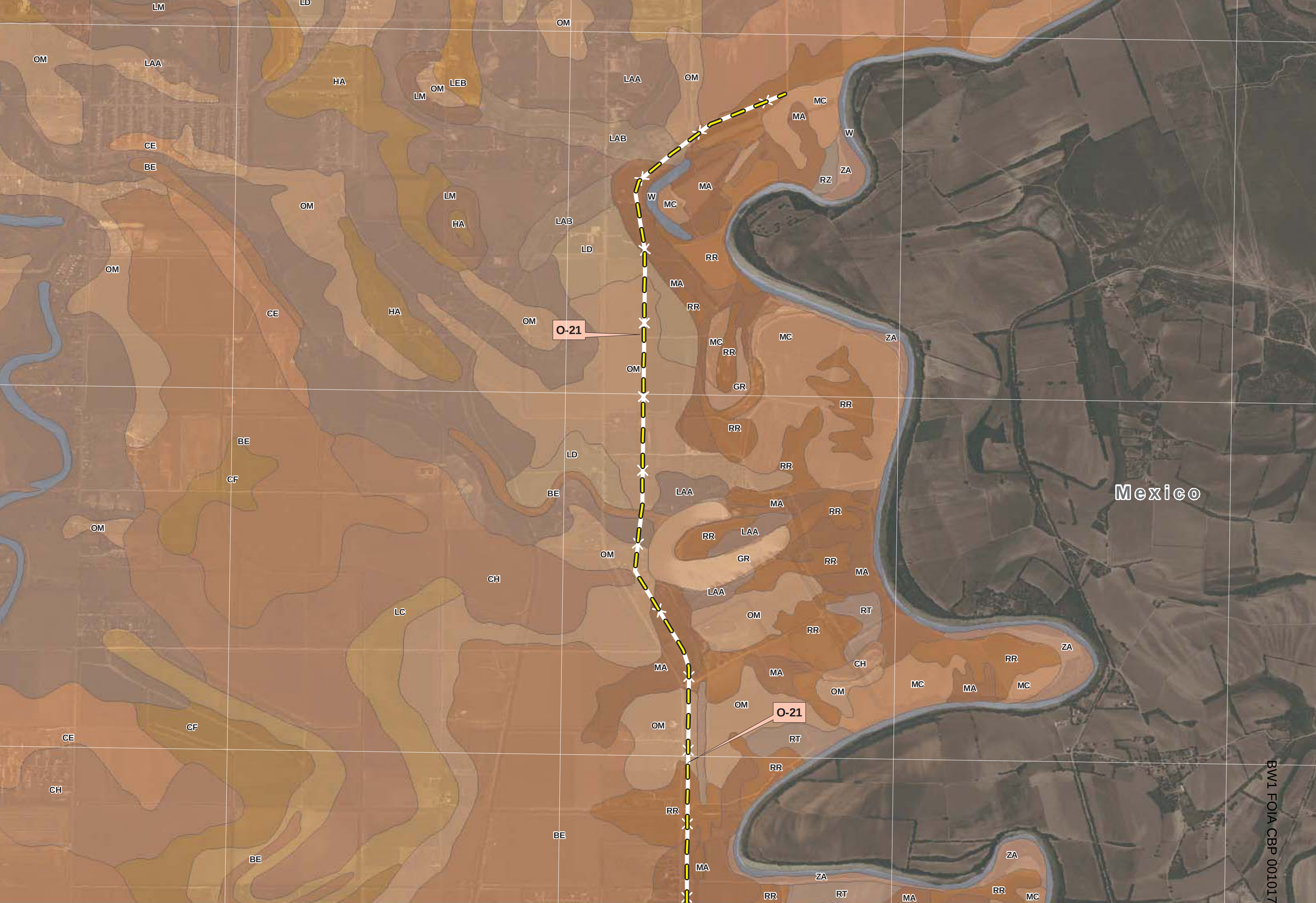
am
lay loam
lay
y
land complex

LC, Laredo silty clay loam, saline
LD, Laredo-Olmito complex
LEA, Laredo-Reynosa complex, 0 to 1 percent slopes
LEB, Laredo-Reynosa complex 1 to 3 percent slopes
LG, Laredo-Urban land complex
LM, Lomalta clay
MA, Matamoros silty clay

ON, Olmito-Urban land complex
RR, Rio Grande silt loam
RT, Rio Grande silty clay loam
RU, Rio Grande-Urban land complex
RZ, Rio Grande-Zalla complex
TC, Tiocano clay
W, Water

N


LAA, Laredo silty clay loam, 0 to 1 percent slopes
LAB, Laredo silty clay loam, 1 to 3 percent slopes
LC, Laredo silty clay loam, saline
LD, Laredo-Olmito complex
LEA, Laredo-Reynosa complex, 0 to 1 percent slopes
LM, Lomalta clay
OM, Olmito silty clay
RR, Rio Grande silt loam
RT, Rio Grande silty clay loam
RZ, Rio Grande-Zalla complex
TC, Tiocano clay
W, Water
N
Texas
Roma
Rio Grande City
San Juan
McAllen
Harlingen
Alamo
Mercedes
San Benito



nd complex
lay loam
lay
ay, saline
y

LAB, Laredo silty clay loam, 1 to 3 percent slopes
LC, Laredo silty clay loam, saline
LD, Laredo-Olmito complex
LEA, Laredo-Reynosa complex, 0 to 1 percent slopes
LEB, Laredo-Reynosa complex 1 to 3 percent slopes
LG, Laredo-Urban land complex
LM, Lomalta clay

MC, Matamoros-Rio Grande complex
OM, Olmito silty clay
ON, Olmito-Urban land complex
RR, Rio Grande silt loam
RT, Rio Grande silty clay loam
RZ, Rio Grande-Zalla complex
SE, Sejita silty clay loam

N

APPENDIX H

Soils Properties for Starr, Hidalgo, and Cameron Counties

Table H-1. Properties of the Soil Map Units in Starr County

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Alluvial Land	Al	Silt loam	0-8 percent	Well drained	NA	NA	Occur on nearly level, active floodplains of the Rio Grande and its tributaries.
Catarina	Cn	Clay	0-5 percent	Moderately well drained	No	None	Occur on uplands. Very slowly permeable.
Copita	Cp	Fine sandy loam	0-3 percent	Well drained	No	None	Occur on uplands. Moderately permeable.
Jimenez-Quemado association	Jq	Very gravelly loam	3-8 percent	Well drained	No	None	Jimenez soils occur on gently sloping to steep uplands. Quemado soils occur on nearly level to moderately sloping uplands. Moderately permeable.
Lagloria	La	Silt loam	0-2 percent	Well drained	No	None	Occur on nearly level to gently sloping stream terraces. Moderately permeable.
Matamoros	Mm	Silty clay	0-1 percent	Moderately well drained	No	None	Occur on nearly level bottomlands. Slowly permeable.
Reynosa	Re	Silty clay loam	0-2 percent	Well drained	No	None	Occur on nearly level to gently sloping stream terraces. Moderately permeable.

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Rio Grande	RgA	Silt loam	0-1 percent	Well drained	No	None	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.
Rio Grande	RgB	Silt loam	1-3 percent	Well drained	No	None	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.
Rio Grande	Rr	Silty clay loam	0-1 percent	Well drained	No	None	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.
Zalla	Za	Loamy fine sand	0-3 percent	Somewhat excessively drained	No	None	Occur on nearly level to gently sloping bottomlands. Rapidly permeable.

Source: NRCS 2007

Note: [a] No = Not listed as a hydric soil for Starr County, TX; Yes = Listed as a hydric soil for Starr County, TX; Partially = Listed as a partially hydric soil for Starr County, TX

Table H-2. Properties of the Soil Map Units in Hidalgo County

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Arents, loamy	1	Sandy clay loam	0- 1 percent	Well drained	No	Prime, if irrigated	Occur on alluvial floodplains of the Rio Grande and its tributaries.
Camargo	5	Silt loam	0-1 percent	Well drained	No	Prime	Occur on nearly level, active floodplains of the Rio Grande and its tributaries. Moderately permeable.
Camargo	6	Silty clay loam	0-1 percent	Well drained	No	Prime	Occur on nearly level, active floodplains of the Rio Grande and its tributaries. Moderately permeable.
Cameron	7	Silty clay	0-1 percent	Moderately well drained	No	Prime	Occur on nearly level bottomlands. Moderately slowly permeable.
Grulla	15	Clay	0-1 percent	Somewhat poorly drained	Partially	None	Occur in oxbows and sloughs. Very slowly permeable.
Harlingen	19	Clay	0-1 percent	Moderately well drained	No	None	Occur on nearly level stream terraces. Very slowly permeable.
Laredo	33	Silty clay loam	0-1 percent	Well drained	No	Prime	Occur on nearly level to gently sloping deltas and Holocene stream terraces. Moderately permeable.

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Matamoros	34	Silty clay	0-1 percent	Moderately well drained	No	Prime	Occur on nearly level bottomlands. Slowly permeable.
Olmito	44	Sandy clay	0-1 percent	Moderately well drained	No	Prime	Occur on nearly level stream terraces. Slowly permeable.
Pits, borrow	45	NA	1-30 percent	Well drained	No	None	NA
Raymondville	52	Clay loam	0-1 percent	Moderately well drained	No	Prime, if irrigated	Occur on nearly level to gently sloping uplands. Slowly permeable.
Reynosa	55	Silty clay loam	0-1 percent	Well drained	No	Prime	Occur on nearly level to gently sloping stream terraces. Moderately permeable.
Reynosa-Urban land complex	57	Silt loam	0-1 percent	Well drained	No	None	Reynosa soils occur on nearly level to gently sloping terraces of the Rio Grande. Urban land consists of disturbed soils of developed areas. Reynosa soils are moderately rapidly permeable.
Rio Grande	62	Silt loam	0-1 percent	Well drained	No	Prime	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Rio Grande	63	Silty clay loam	0-1 percent	Well drained	No	Prime	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.
Runn	64	Silty clay	0-1 percent	Moderately well drained	No	Prime	Occur on nearly level stream terraces. Slowly permeable.
Runn	65	Silty clay, saline	0-1 percent	Moderately well drained	No	None	Occur on nearly level stream terraces. Slowly permeable.
Urban land	68	NA	NA	NA	No	None	Urban land consists of disturbed soils of developed areas.
Zalla	74	Silt loam	0-1 percent	Somewhat excessively drained	No	None	Occur on nearly level to gently sloping bottomlands. Rapidly permeable.

Source: NRCS 2007

Note: [a] No = Not listed as a hydric soil for Hidalgo County, TX; Yes = Listed as a hydric soil for Hidalgo County, TX; Partially = Listed as a partially hydric soil for Hidalgo County, TX

Table H-3. Properties of the Soil Map Units in Cameron County

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Borrow pits	BP	NA	NA	NA	No	None	NA
Camargo	CA	Silt loam	0-1 percent	Well drained	No	Prime	Occur on nearly level, active floodplains of the Rio Grande and its tributaries. Moderately permeable.
Camargo	CC	Silty clay loam	0-1 percent	Well drained	No	Prime	Occur on nearly level, active floodplains of the Rio Grande and its tributaries. Moderately permeable.
Cameron	CE	Silty clay	0-1 percent	Moderately well drained	No	Prime	Occur on nearly level bottomlands. Moderately slowly permeable.
Chargo	CH	Silty clay	0-1 percent	Moderately well drained	Partially	None	Occur on nearly level ancient stream terraces. Slowly permeable.
Grulla	GR	Clay	0-1 percent	Somewhat poorly drained	Partially	None	Occur in oxbows and sloughs. Very slowly permeable.
Harlingen	HA	Clay	0-1 percent	Moderately well drained	No	Prime, if irrigated	Occur on nearly level stream terraces. Very slowly permeable.
Laredo	LAA	Silty clay loam	0-1 percent	Well drained	No	Prime	Occur on nearly level to gently sloping deltas and Holocene stream terraces. Moderately permeable.

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Laredo-Olmito complex	LD	Silty clay	0-1 percent	Moderatelywell drained	No	Prime, if irrigated	Laredo soils occur on nearly level to gently sloping deltas and Holocene stream terraces. Olmito soils occur on nearly level stream terraces. Laredo soils are moderately permeable, Olmito soils slowly permeable.
Laredo-Reynosa complex	LEA	Silty loam	0-1 percent	Well drained	No	Prime	Laredo soils occur on nearly level to gently sloping deltas and Holocene stream terraces. Reynosa soils occur on nearly level to gently sloping stream terraces. Both are moderately permeable.
Matamoros	MA	Silty clay	0-1 percent	Moderately well drained	No	Prime	Occuron nearly level bottomlands. Slowly permeable.
Matamoros-Rio Grande complex	MC	Silt loam	0-1 percent	Moderately well drained	No	Prime	Matamoros soils occur on nearly level bottomlands, Rio Grande soils occur on nearly level to gently sloping terraces of the Rio Grande. Matamoros soils are slowly permeable, Rio Grande moderately rapidly permeable.
Olmito	OM	Sandy clay	0-1 percent	Moderately well drained	No	Prime	Occur on nearly level stream terraces. Slowly permeable.
Olmito-Urban land complex	ON	Silty clay	0-1 percent	Moderately well drained	No	None	Olmito soils occur on nearly level stream terraces. Urban land consists of disturbed soils of developed areas. Olmito soils are slowly permeable.

Name	Map Unit Symbol	Type	Slope	Drainage	Hydric[a]	Farmland Importance	Properties
Rio Grande	RR	Silt loam	0-1 percent	Well drained	No	Prime	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.
Rio Grande	RT	Silty clay loam	1-3 percent	Well drained	No	Prime	Occur on nearly level to gently sloping terraces of the Rio Grande. Moderately rapidly permeable.
Rio Grande-Urban land complex	RU	Very fine sandy loam	0-1 percent	Well drained	No	None	Rio Grande soils occur on nearly level to gently sloping terraces of the Rio Grande. Urban land consists of disturbed soils of developed areas. Rio Grande soils are moderately rapidly permeable.
Sejita	SE	Silty clay loam	0-1 percent	Poorly drained	Yes	None	Occur on nearly level low coastal terraces. Moderately slowly permeable.
Tiocano	TC	Clay	0-1 percent	Somewhat poorly drained	Partially	None	Occur in nearly level slight depressions. Very slowly permeable soils.
Ustifluvents	USX	Clay	0-25 percent	Somewhat poorly drained	Partially	None	NA
Zalla	ZA	Loamy fine sand	0-1 percent	Somewhat excessively drained	No	None	Occur on nearly level to gently sloping bottomlands. Rapidly permeable.

Source: NRCS 2007

Note: a No = Not listed as a hydric soil for Cameron County, TX; Yes = Listed as a hydric soil for Cameron County, TX; Partially = Listed as a partially hydric soil for Cameron County, TX

APPENDIX I

Draft Biological Survey Report

DRAFT

BIOLOGICAL SURVEY REPORT

FOR

CONSTRUCTION, MAINTENANCE, AND OPERATION OF TACTICAL INFRASTRUCTURE RIO GRANDE VALLEY SECTOR, TEXAS

USBP RIO GRANDE VALLEY SECTIONS

U.S. DEPARTMENT OF HOMELAND SECURITY
CUSTOMS AND BORDER PROTECTION
U.S. BORDER PATROL
RIO GRANDE VALLEY SECTOR, TEXAS

Prepared by

e2M

Solutions Today for a Sustainable Tomorrow

NOVEMBER 2007

ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
BMP	Best Management Practice
BO	Biological Opinion
CBP	U.S. Customs and Border Protection
CFR	Code of Federal Regulations
CWA	Clean Water Act
DHS	U.S. Department of Homeland Security
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FE	Federally Endangered
IBWC	International Boundary and Water Commission
LRGVNWR	Lower Rio Grande Valley National Wildlife Refuge
MBTA	Migratory Bird Treaty Act
mph	miles per hour
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
POE	Port of Entry
ROE	Right of entry
ROW	right-of-way
SE	State Endangered
SFA	Secure Fence Act
USACE	U.S. Army Corps of Engineers
USBP	U.S. Border Patrol
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

DRAFT BIOLOGICAL SURVEY REPORT FOR PROPOSED CONSTRUCTION AND OPERATION OF TACTICAL INFRASTRUCTURE USBP RIO GRANDE VALLEY SECTIONS

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1. Introduction

This Biological Survey Report synthesizes information collected from a variety of sources to describe the biological resources within the proposed project corridor, the potential impacts of the proposed project on those biological resources, and recommendations for avoidance or reduction of those impacts. Information was gathered from publicly available literature, data provided by relevant land management agencies, review of aerial photography and U.S. Geological Survey (USGS) topographic maps, data from the State of Texas, NatureServe, and initial field surveys conducted on October 1 through October 7, 2007.

This Report was developed to support National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) requirements for analysis of potential impacts on biological resources resulting from the construction, operation, and maintenance of the proposed tactical infrastructure. This Report was developed as an independent document but will be included as an appendix in the Environmental Impact Statement developed for this project.

2. Project Description

U.S. Customs and Border Protection (CBP) proposes to 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 proposed locations of tactical infrastructure are based on a USBP Rio Grande Valley Sector assessment of local operational requirements where it would assist USBP agents in reducing cross-border violator activities. Proposed tactical infrastructure would be constructed in 21 discrete sections along the international border within the USBP Rio Grande Valley Sector in Starr, Hidalgo, and Cameron counties, Texas (see **Table 2-1)**. The proposed individual tactical infrastructure sections range from approximately 1 mile in length to more than 13 miles in length.

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

Fence Section Number	Border Patrol Station	General Location	Approx. Mileage (Route B) (mi)
O-1	Rio Grande City	Near Roma Port of Entry	3.75
O-2	Rio Grande City	Near RGC Port of Entry	8.74
O-3	McAllen	Los Ebanos Port of Entry	1.0 (estimated)
O-4	McAllen	From Penitas 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	W Los Indios Port of Entry	1.58
O-14	Harlingen	E Los Indios Port of Entry	3.59
O-15	Harlingen	Triangle - La Paloma	1.93
O-16	Harlingen	Ho Chi Minh - Estero	2.33
O-17	Brownsville	Proposed Carmen Road Freight Train Bridge	1.61
O-18	Brownsville	Proposed Flor De Mayo POE 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	**69.84**

3. Survey Methods and Limitations

To provide flexibility in placement of tactical infrastructure within the proposed project corridor, and to ensure consideration of potential impacts due to construction and to use, surveys were conducted in an area extending 150 feet on the north side (i.e., side away from the Rio Grande) of the 21 proposed individual tactical infrastructure sections and extending at least 0.5 miles past the proposed ends of each section. The areas thus defined are referred to hereafter as the "survey corridor."

Intuitive controlled investigations of the survey corridor were conducted by James Von Loh (Senior Ecologist, e²M), Valerie Whalon (Biologist, e²M), Tom Hayes (Senior Ecologist, e²M), and Nancy Hays (Senior Ecologist, e²M), and Gena Janssen of Janssen Biological (subcontractor to e²M and U.S. Fish and Wildlife Service [USFWS] approved botanist for the Rio Grande Valley). The October 2007 surveys covered as much of the proposed project corridor known as of 2 October 2007, as well as the local CBP agents' understanding of the proposed project corridor at the time of the survey. The proposed project corridor identified as Route B was surveyed. Surveyors walked the entire length of the proposed project corridor for each tactical infrastructure section, and examined in more detail areas containing unique species compositions or habitat that might be conducive to sensitive species. Plot data (GPS coordinates, photographs, and plant community composition) were recorded at regular intervals along the corridor and where plant communities presented substantial shifts in species composition. These data will be used to generate vegetation classifications and maps to support delineation of habitat types, analysis of potential sensitive species occurrences, and analysis of potential project impacts on biological resources. These maps will be included in the Final Report. Although no protocol surveys were conducted, surveyors did specifically look for evidence indicating the presence of state- and Federal-listed species (see **Table 3-1**), and habitats that might support them. Descriptions of the federally listed species are provided in **Appendix A**.

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

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

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

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

4. Environmental Setting

The project area climate is semiarid-subtropical/subhumid within the Modified Marine climatic type, e.g., summers are long and hot and winters 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 range from a low of 50 degrees Fahrenheit [°F] in January to a low of 76 °F in July, and a high of 64 °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 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 proposed 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. The Texas Parks and Wildlife Department (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 (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 percent of the native brushland and 90 percent of the riparian vegetation had been converted to agriculture and urban land use (USFWS 1988). In 1988, it was estimated that 98 percent 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.

5. Biological Resources

5.1 Vegetation Classification

The USFWS (1988) recognized 11 biotic communities in the Lower Rio Grande Valley using a combination of plant species dominance, wildlife use, topography, hydrology, and geology. There are seven 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, and (7) Mid-Delta Thorn Forest. Chihuahuan Thorn Forest could occur near the western terminus of proposed Section O-1. Proposed SectionsO-1 and O-2 lie within the Upper Valley Flood Forest biotic community and adjacent to the Barretal. Proposed Sections O-3 and O-4 occur within the Upper Valley Flood Forest and Upland Thornscrub biotic communities. Proposed SectionsO-4 through O-20 are 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 proposed Section O-21.

NatureServe (2007) 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).

Classification of existing vegetation within this corridor was achieved by accessing nearly the entire corridor as proposed, sampling observation points, and relating them to the NatureServe Explorer classification database (2007). At the coarsest level, the eight above-named ecological systems were determined and local vegetation types placed into the national system. A finer level of classification equaling or approximating the vegetation alliance level of the National Vegetation Classification System (NatureServe 2007) was used to prepare the plant community discussions under each ecological system. Unclassifiable vegetation stands and patches sampled within the proposed 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 halapense*) Herbaceous Vegetation; Windmill Grass (*Chloris* spp.) Herbaceous Vegetation; Silver Bluestem (*Bothriochloa laguroides*) – Buffelgrass (*Pennisetum ciliare*) Herbaceous Vegetation; and Quelite Cenizo (*Atriplex matamorensis*) – Buffelgrass (*Pennisetum ciliare*) Herbaceous Vegetation.

Habitats observed, sampled, and photographed within the project corridor range from upland thorn-scrub on the western end of Section O-1, upper and mid-valley riparian forest and woodland communities throughout the proposed 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 they often support an overstory of honey mesquite, retama, or huisache shrubs or small trees. Agricultural fields occur along much of the corridor as proposed and include sugar cane, sorghum, Johnsongrass, sunflowers, cotton, row crop vegetables particularly onions, citrus trees (grapefruit and orange), or fields that were fallow at the time of site visit. Urban development and private property with single homes occurs adjacent to several proposed sections.

A brief description of each plant community observed within the proposed sections 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 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 providing sparse to low cover in other plant communities and as individual large trees. Stands dominated by Texas ebony were not encountered, per se. Particularly large, mature Texas ebony trees that are approximately 20–25 meters 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 2007).

Figure 5-1. Representative Photograph of Mature Texas Ebony Tree

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-2, O-3, O-8, O-10, O-11, O-12, and O-14 (see **Figure 5-2**). Canopy cover for the mature sugarberry trees (15–30 meters tall) ranges from 30-75 percent. Honey mesquite trees are commonly present in the canopy layer and provide 5–20 percent cover. In one stand a subcanopy layer of granjeno, huisache, and honey mesquite, from 5–10 meters tall, provided approximately 20 percent cover. The herbaceous layer provides low to dense cover, from 5–75 percent cover and includes switchgrass, Bermuda grass, and buffelgrass.

Figure 5-2. Representative Photographs of Sugarberry Habitat

Honey Mesquite Riparian Forest

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

Figure 5-3. Representative Photographs of Honey Mesquite Forest Habitat

Mule's Fat Shrubland

Mule's fat occurs as stands and patches of riparian tall shrubs from 4–10 meters tall where near-to-surface ground water or occasional standing water is present within the project region as proposed. The densest stands with Mule's fat tall shrub foliar cover of up to 55 percent were recorded in Section O-3 within the Los Ebanos Unit of the Lower Rio Grande Valley National Wildlife Refuge and in Section O-13 (see **Figure 5-4**). Stands can be monotypic in the tall shrub layer, or low cover, less than 10 percent cover of granjeno, tepeguaje, sugarberry saplings, or black willow can occur. The herbaceous layer provides moderate to high cover, from 30-90 percent cover, ranges from 0.5–2 meters tall, and includes switchgrass, windmill grass, Johnsongrass, and buffelgrass.

Figure 5-4. Representative Photographs of Mule's Fat Habitat

Black Willow Woodland and Shrubland

Black willow tall shrubs or small trees, from 5–10 meters 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 5-5**). Representative stands were sampled in Sections O-3, O-8, O-13, O-14, and O-20. Black willow typically provides from 10–60 percent cover in the canopy or tall shrub layer along with low to moderate cover, less than 10 percent by granjeno, honey mesquite, and retama. The herbaceous layer provides moderate to high cover, from 15-95 percent cover, ranges from 1–10 meters tall, and includes giant reed, switchgrass, narrowleaf cattail, smartweed, and buffelgrass.

Giant Reed Herbaceous Vegetation

Giant reed or Carrizo forms 5–10 meters tall, linear, dense stands (from 40–95 percent cover) on saturated soils of ditch and canal banks, standing water in ditches, and other sites with near-to-surface ground water. Some stands have apparently become established as a result of irrigation runoff draining from sugar cane and other irrigated agricultural fields. The banks of the Rio Grande support dense stands that exceed 8 meters in height (see **Figure 5-6**). Switchgrass is a common associate in giant reed stands providing from 15–50 percent cover and black willow trees to 10 meters tall provided approximately 25 percent cover in one stand. Representative data were recorded from stands that occur in Sections O-2, O-9, and O-14.

Figure 5-5. Representative Photographs of Black Willow Habitat

Figure 5-6. 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 exceed 25 square meters (m^2) in area covered (see **Figure 5-7**). Larger stands were observed outside the project corridor, as proposed, and along the banks of the Rio Grande and its associated oxbows.

Figure 5-7. 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 and as trees up to 20 meters tall (see **Figure 5-8**). Only a few sabal palm trees were observed in other proposed project sections. The USFWS has established the Boscaje de la Palma tract 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. In sampled stands the sabal palm ranged from 4–10 meters tall and provided from 15–30 percent cover. Low cover, less than 10 percent, was also provided by honey mesquite, tepehuaje, anacua, and Texas ebony trees and tall shrubs. In the herbaceous layer, the liana ivy treebine or hierba del buey provides up to 50 percent cover and switchgrass, up to 2 meters tall, provides from 20–55 percent cover.

Figure 5-8. 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 meters tall or is a dominant understory component in the subcanopy or tall shrub layers, ranging from 3–5 meters tall. Representative stands were sampled in proposed Sections O-5, O-10, and O-17 where granjeno cover ranged from 30–75 percent (see **Figure 5-9**). Associated canopy trees provide low cover, up to 20 percent, and include honey mesquite, huisache, and retama. The herbaceous layer provides low to dense cover, from 5–50 percent, and includes the 2–8 meters tall switchgrass, giant reed, and Johnsongrass.

Figure 5-9. Representative Photographs of Granjeno Habitat

Honey Mesquite Woodland

Honey mesquite woodlands with small trees from 5–10 meters tall were sampled in Sections O-1, O-2, O-3, O-4, O-8, O-10, and O-18. In the canopy layer, honey mesquite cover ranged from 15–55 percent (see **Figure 5-10**). Associated canopy tree species, when present, included snake eyes, granjeno, retama, huisache, and Texas ebony that provided low to moderately dense cover, from 5–40 percent. The tall and short shrub layers provided low cover, up to 15 percent, and included snake eyes, Texas prickly pear, blackbrush, cenizo, kidney wood, mule's fat, junco, goatbrush, granjeno, tasajillo, and honey mesquite saplings. The herbaceous layer contributes low to high cover, from 5–90 percent, and is dominated by buffelgrass and switchgrass. Revegetation efforts at Los Ebanos National Wildlife Refuge (NWR) were represented by this type following 5 to 6 years of growth.

Figure 5-10. 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 5-11**). However, two short-stature huisache woodland stands were observed in Section O-21 that could not be sampled due to lack of rights of entry. Huisache trees in the observed stands were of uniform height (approximately 4–5 meters tall) and were moderately dense providing approximately 30–45 percent cover. The understory was dominated by moderately dense stands of the nonnative buffelgrass.

Figure 5-11. Representative Photograph of Huisache Woodland Habitat

Honey Mesquite Shrubland

Honey mesquite is distributed throughout the approximately 70-mile study corridor and occurs as tall shrubs becoming recently reestablished in nonnative grasslands, short 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. Honey mesquite tall shrubs sampled in Section O-1 range from 2–5 meters in height and typically provide from 5–25 percent cover (see **Figure 5-12**). Associated tall and short shrubs include Texas prickly pear, tasajillo, blackbrush, cenizo, Spanish dagger, and brasil, which together provide up to 10 percent cover. The herbaceous layer is typically dominated by buffelgrass, which provides up to 60 percent 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 5-13**). Construction is not proposed within deep arroyos therefore they were not rigorously sampled. On inspection they support a mixture of tree and shrub species that consists of honey locust, huisache, and granjeno in the tree and tall shrub layers. The tall and short shrub layers are typified by blackbrush or chaparro, Texas prickly pear, brasil, tasajillo, cenizo, lotebush, and junco.

Figure 5-12. Representative Photographs of Honey Mesquite Shrubland Habitat

Figure 5-13. Representative Photograph of Arroyos in Section 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 traverses a short distance of gravel-covered ridges and hill slopes that support this species rich, predominantly shrub and succulent community. The gravel is small, to 10 centimeters in diameter, is glazed with desert varnish, and provides nearly 100 percent 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. One stand of cenizo – blackbrush shrubland approximately 200 meters long is at the terminus of Section O-1 and has been recently root-plowed, leaving less than 20 percent cover by native shrub species while resulting in approximately 50–70 percent cover by the nonnative buffelgrass (see **Figure 5-14**). The short and tall shrub layers provide from 20–30 percent cover in this community and are characterized by cenizo, blackbrush, honey mesquite, Texas prickly pear, tasajillo, kidney wood, coyotillo, junco, and Spanish dagger. The herbaceous layer contributes sparse cover, less than 5 percent cover, in this vegetation type.

Figure 5-14. Representative Photographs of Cenizo – Blackbrush Habitat (Lower two photos represent area that has been root-plowed - fenceline contrast and buffelgrass invasion)

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 dense cover, from 10–40 percent cover as recorded for Sections O-6, O-13, and O-18 (see **Figure 5-15**). Granjeno tall shrubs provided 10 percent cover in one stand and mule's fat provided 5 percent cover in another. The herbaceous layer is usually monotypic and can be dominated by buffelgrass, windmill grass, or switchgrass, which provide low to dense cover from 15–100 percent.

Tepeguahe Woodland

A single stand of tepeguahe woodland from 10–15 meters tall was documented in Section O-18 (see **Figure 5-16**). Tepeguahe trees on the flat plain beyond the fenceline provided approximately 80 percent cover with low cover, less than 10 percent, provided by retama and huisache in the canopy layer. Near the adjacent levee, toeslope tepeguahe trees provided 30 percent cover, while the herbaceous layer was dominated by 1–2 meters tall switchgrass, which provided approximately 60 percent cover.

Figure 5-15. Representative Photographs of Retama Habitat

Figure 5-16. Representative Photograph 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 5-17**). Although the hydrology supporting this herbaceous wetland type is unknown, the stands occupy shallow depressions that likely capture runoff from the surrounding landscape during precipitation events. The stands are nearly monotypic with 0.5–1 meters tall alkali sacaton bunchgrass providing up to 75 percent cover and Bermuda grass, a nonnative, providing sparse cover, less than 5 percent.

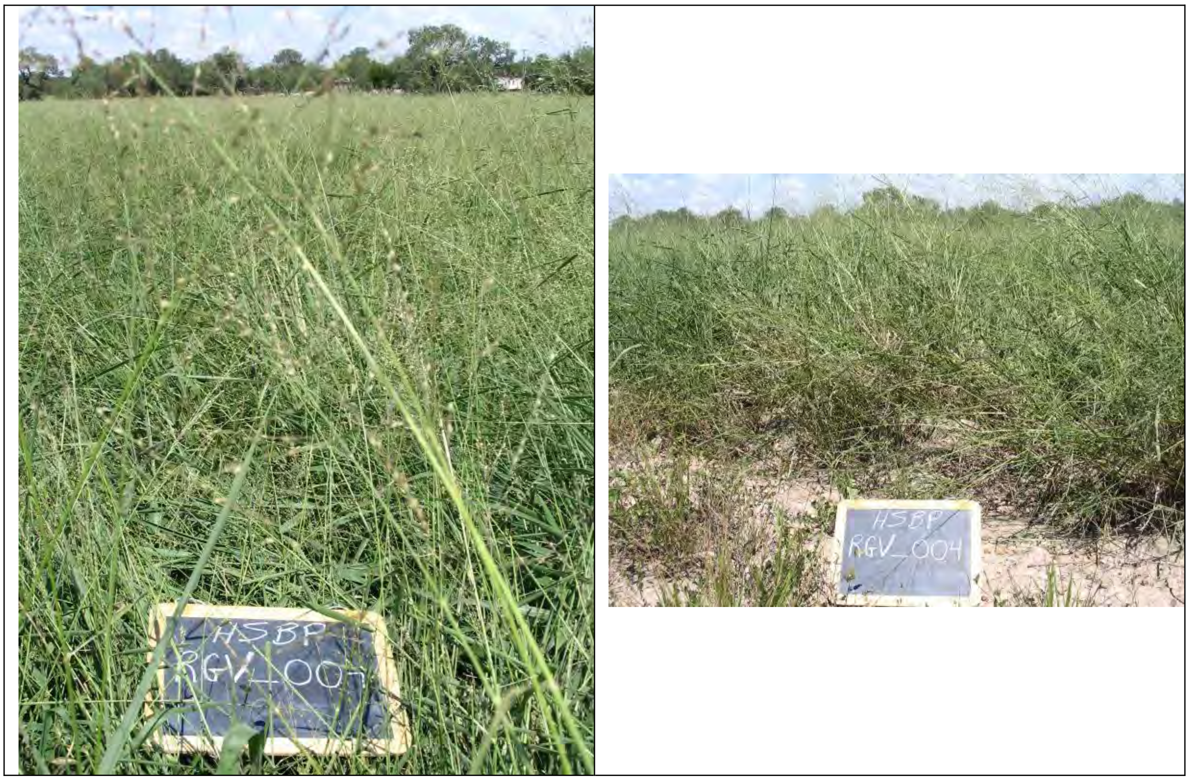

Figure 5-17. Representative Photograph of Alkali Sacaton Habitat

Narrowleaf Cattail

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-meter deep persists (see **Figure 5-18**). Where established, as in proposed Section O-8, narrowleaf cattail stands are monotypic, range from 2-4 meters tall, form bands approximately 10 meters wide, and provide from 60–90 percent cover.

Figure 5-18. Representative Photograph of Broadleaf Cattail Habitat

Smartweed Herbaceous Vegetation

Smartweed is rare within the proposed corridor and dominates the bottom of one canal or large irrigation ditch within Section O-14 (see **Figure 5-19**). The stand is narrow and linear, up to 5 meters wide and smartweed forbs provide approximately 20 percent cover. The canal bottom is saturated with occasional pools of standing water. Adjacent banks support 1–3 meters tall Johnsongrass and switchgrass, primarily. In some locations along the canal or irrigation ditch, an overstory canopy of black willow provides up to 60 percent cover, which is described more fully under the black willow discussion.

Figure 5-19. Representative Photograph of Smartweed Habitat

Duckweed Herbaceous Vegetation

One small pond in Section O-9 supported approximately 90 percent cover by the floating aquatic plant species duckweed (see **Figure 5-20**). This pond also supported a band of narrowleaf cattail on saturated soil around its margin in addition to black willow tall shrubs.

Figure 5-20. Representative Photograph of Duckweed Habitat

5.1.9 Non-Native Woodland, Shrubland and Herbaceous Vegetation Alliances and Associations

Athel Tamarisk Woodland

A small stand 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 5-21**). These trees are approximately 20 meters 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 proposed sections. This vegetation type occurs within the Tamaulipan Floodplain ecological system of NatureServe (2007).

Figure 5-21. Representative Photograph of Athel Tamarisk Stand

Chinaberry Woodland

One stand of Chinaberry, a non-native ornamental tall shrub or small tree, was documented in Section O-16 (see **Figure 5-22**). In this stand, Chinaberry canopy trees ranged from 6–8 meters tall and provided approximately 60 percent cover along with low cover by the canopy trees honey mesquite (5 percent cover), huisache (5 percent), and retama (15 percent). Buffelgrass and switchgrass provide moderate to high herbaceous cover for this stand, 50 percent and 5 percent cover respectively.

Figure 5-22. Representative Photograph of Chinaberry Habitat

Castor Bean / Buffelgrass Shrubland

One abandoned homestead in Section O-9 supported a tall shrubland, up to 5 meters tall, of castor bean, honey mesquite, and mule's fat, which together provide 22 percent cover (see **Figure 5-23**). The commonly–occurring, nonnative buffelgrass contributed 20 percent cover within this stand.

Figure 5-23. Representative Photograph of Castor Bean / Buffelgrass Habitat

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 5-24**). Buffelgrass ranges from 0.5–1.5 meters tall and provides from 25–100 percent 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, buffelgrass dominates the understory often providing 90–100 percent cover. In some herbaceous stands within the project region, bufflegrass shares dominance with switchgrass, Johnsongrass, and windmill grass forming mixed stands or a type of ecotone. This vegetation type occurs within all the Tamaulipan ecological systems described by NatureServe for this region (2007).

Figure 5-24. Representative Photographs of Buffelgrass Habitat

Switchgrass Herbaceous Vegetation

Switchgrass is common throughout the project corridor on sites that are more mesic (see **Figure 5-25**). Switchgrass is a native bunchgrass likely introduced to the project region for livestock forage and erosion control. Switchgrass ranges from 1–2 meters tall and provides from 40–95 percent 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 NWRs) or have otherwise become established, switchgrass can dominate the understory providing 25–75 percent cover. In some herbaceous stands within the project region, switchgrass shares 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 5-25. Representative Photographs of Switchgrass Habitat

Silver Bluestem – Buffelgrass Herbaceous Vegetation

A large patch of silver bluestem and bufflegrass was sampled on the level embankment within Section O-5 (see **Figure 5-26**). Silver bluestem provided 50 percent cover and buffelgrass provided 15 percent cover. A few shrubs of *Acacia* sp. provide low cover, up to 4 percent.

Figure 5-26. Representative Photograph 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 proposed sections and a few larger stands were observed, possibly as remnant stands from past farming efforts. Nearly monotypic stands occur in Sections O-11, O-13, and O-14 with Johnsongrass, up to 2 meters tall, providing 80–90 percent cover (see **Figure 5-27**). In one stand, switchgrass provides up to 5 meters cover and a few castor bean shrubs provide approximately 2 meters cover. These large stands are irrigated during the growing season or receive sufficient runoff following precipitation events to survive.

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 5-28**). Typical stands of this nonnative rhizomatous grass were sampled along proposed Sections O-8 and O-15 where Bermuda grass ranged in cover from 15–45 percent. Along O-15, heavy and apparently continual grazing by cattle drives the dominance of Bermuda grass. Associated herbaceous species that individually provide 10 percent cover or less include buffelgrass, switchgrass, windmill grass, sandbur, and morning-glory. In one stand the tall shrub huisache provided 5 percent cover.

Figure 5-27. Representative Photograph of Johnsongrass Habitat

Figure 5-28. 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, and O-20 (see **Figure 5-29**). 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 is dense and typically provides 90-95 percent cover. Associated tall shrubs, from 2-5 meters tall, include mule's fat, huisache, and retama that together provide from 1-25 percent cover in windmill grass stands and result in a shrub herbaceous classification.

Figure 5-29. Representative Photographs of Windmill Grass Herbaceous Vegetation

Mediterranean Lovegrass – Rough Pigweed Semi-Natural Herbaceous Vegetation

A fallow agricultural field in Section O-2 supported a large stand of Mediterranean lovegrass and the tall, coarse forb, rough pigweed (see **Figure 5-30**). The nonnative grasses Mediterranean lovegrass and Bermuda grass provided approximately 45 percent and 8 percent cover, respectively, and the forbs rough pigweed and annual sunflower provided approximately 15 percent and 2 percent cover, respectively. This vegetation type would be removed by plowing or tilling if the field is prepared for planting at a future date.

Figure 5-30. Representative Photograph of Lovegrass – Rough Pigweed Habitat

Quelite Cenizo – Buffelgrass Semi-Natural Herbaceous Vegetation

One large patch of quelite cenizo forbs has become established within a buffelgrass matrix on the embankment between the levee road and the adjacent paved highway of Section O-4 near Penitas. Quelite cenizo, providing up to 65 percent cover, dominates a short reach of this section and extends from the levee road to the pavement edge (see **Figure 5-31**). This stand occupies approximately 1 acre, supports the nonnative grasses buffelgrass (10 percent cover) and Johnsongrass (2 percent cover), and includes a few shrubs of honey mesquite that provide sparse cover, up to 5 percent.

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

5.2 Plant Species Identified

A complete plant list of all species identified during the field surveys, including its wetland status and the fence section in which it was identified is provided in **Table 5-1**.

Table 5-1. Complete Plant List of all Species Identified

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Abutilon abutiloides / Berlandier Abutilon	---		X																				1
Abutilon fruticosum / Pelotazo	---										X		X	X									3
Abutilon trisulcatum / Amantillo	---	X			X		X	X	X	X	X	X	X	X	X	X	X	X					14
Acacia farnesiana / Huisache	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	19
Acacia rigidula / Chaparro Prieto	---	X		X	X																		3
Acacia schaffneri / Huisachillo, Twisted Acacia	---					X																	1
Acacia wrightii / Catclaw	---	X	X																				2
Acalypha monostachya / Round Copperleaf			X																				1
Acleisanthes obtusa / Berlandier Trumpets		X																					1
Agave americana / Century Plant	---	X																					1
Allionia incarnata / Trailing Allionia	---	X																					1
Aloysia gratissima / Whitebrush	---	X	X																				2
Aloysia macrostachya / Sweet Stem	---	X																					1
Amaranthus sp. / Amaranth	---						X	X	X	X	X			X									6

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Amaranthus palmeri / Palmer Pigweed	FACU	X	X																				2
Amaranthus retroflexus / Rough Pigweed	FACU-		X																				1
Ambrosia sp. / Ragweed	---					X																	1
Ambrosia psilostachya / Western Ragweed	FACU-	X	X																				2
Ampelopsis arborea / Peppervine	FAC								X	X	X	X		X	X		X						7
Anisocactus sheeri / Fish-hook Cactus	---	X																					1
Anredera vesicaria / Maderia Vine	---	X																					1
Antigonon leptopus / Queen's Wreath	---																						
Aristida adscencionis / Sixweeks Threeawn	---	X																					1
Arundo donax / Giant Reed, Carrizo	FAC+			X						X	X		X	X	X			X			X	X	9
Aster spinosus (Leucosyris spinosa) / Mexican Devil-weed	FACW-					X		X						X	X	X							5
Aster subulatus / Prairie Aster	OBL		X																				1
Atriplex matamorensis / Quelite Cenizo, Matamoros Saltbush	---				X																		1
Baccharis neglecta / Jara Dulce, Roosevelt Weed	FAC		X	X						X	X	X		X									6
Baccharis salicifolia / Jara, Mule's Fat	FACW			X						X	X	X		X									5

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Baccharis texana / Baccharis	---																		X			X	**2**
Bahia absinthifolia / Hairy Seed Bahia	---	X																					**1**
Bastardia viscosa / Mexican Bastardia	---	X	X																			X	**3**
Billieturnera helleri / Copper Sida	---	X																					**1**
Boerhaavia sp. / Boerhaavia	---	X																					**1**
Bothriochloa laguroides / Silver Bluestem	---					X																	**1**
Calyptocarpus vialis / Straggler Daisy	FAC	X																					**1**
Capsicum annuum / Chilipiquin	---	X	X																				**2**
Cardiospermum dissectum / Balloon Vine	---	X	X																				**2**
Castela erecta / Amargosa, Goatbush	---			X																			**1**
Castela texana / Amargosa	---	X																					**1**
Celosia nitida / Albahaca	---	X																					**1**
Celtis laevigata / Palo blanco, Texas Sugarberry	FAC	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X	**18**
Celtis laevigata var. *reticulata* / Palo Blanco, Netleaf Hackberry	UPL				X	X	X						X	X	X		X	X					**8**
Celtis pallida / Granjeno, Spiny Hackberry	---	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	**19**

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Cenchrus ciliaris / Buffelgrass	---	X																				X	2
Cenchrus insertus / Sandbur	---	X											X	X	X	X		X					6
Cenchrus spinifex / Common Sandbur	---		X																				1
Cercidium texanum / Paloverde	---	X																					1
Cestrum sp. / Jessamine	---	X																					1
Cevallia sinuata / Stinging Stickleaf	---	X																					1
Chamaesyce sp. / Mat Spurge	---					X			X			X			X	X							5
Chenopodium berlandieri / Goosefoot	---	X	X																				2
Chloris cucullata / Hooded Windmill grass	---		X																				1
Chloris sp. / Windmill Grass	---														X		X						2
Chromoleana odorata / Crucita	---	X																					1
Cissus incisa (Cissus trifoliata) / Hierba del Buey, Ivy Treebine, Possum Grape	FACU-	X	X			X		X	X		X	X		X	X		X	X	X			X	13
Citharexylum berlandieri / Berlandier's Fiddlewood	---																				X		1
Citharexylum brachyantherum / Mission Fiddlewood	---	X																					1

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Clematis drummondii / Barbas de Chivato, Old Man's Beard	---	X	X	X	X	X	X		X		X	X		X	X	X		X	X				14
Cocculus diversifolius / Snail Vine	---	X																	X			X	3
Colubrina texensis / Hog Plum	---	X																					1
Commelina erecta / Day Flower	---	X	X																			X	3
Condalia hookeri / Brasil, Bluewood Condalia	---	X	X	X	X		X		X		X												7
Convolvulus equitans / Texas Bindweed	---		X							X	X										X		4
Conyza canadensis / Horse Weed	UPL		X																				1
Cordia boisseri / Anacahuita, Mexican Olive	---	X		X	X																		3
Coryphantha macromeris / Dumpling Cactus	---	X																					1
Coryphantha robertii / Runyon's Escobaria	---	X																					1
Croton incanus / Vara Blanca	---	X																					1
Croton leucophyllus / Two-color Croton	---		X																				1
Croton lindheimerianus / Three-seed Croton	---	X																					1
Croton sp. / Croton	---	X		X	X				X														4
Cynanchum barbigerum / Milkweed Vine	---	X	X																				2

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Cynodon dactylon / Pato de Gallo, Bermuda Grass	FACU+			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					15
Cyperus tenuis / Flat Sedge	---								X														1
Dactyloctenium aegyptium / Durban Crowfootgrass	---	X																					1
Dalea pogonathera / Bearded Dalea	---	X																					1
Datura inoxia / Indian Apple	---	X																					1
Desmanthus obtusus / Bluntpod Bundleflower	---	X																					1
Diospyros texana / Texas Persimmon	---	X																					1
Ditaxis humilis / Low Wild Mercury	---	X																					1
Dyssodia tenuiloba / Tiny Tim Dogweed	---	X																					1
Echinocactus texensis / Manca Caballo, Horse Crippler	---			X																			1
Echinocereus berlandieri / Berlandier's Alicoche	---			X																			1
Echinocereus enneacanthus / Pitaya, Strawberry Cactus	---	X		X																			2
Echinocereus rechinbachii / Rainbow Cactus	---	X																					1
Ehretia anacua / Anacua	---	X	X	X	X	X			X	X		X	X		X		X	X	X			X	14
Ephedra antisyphilitica / Clapweed	---	X																					1

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Eragrostis barrelieri / Mediterranean Lovegrass	---		X									X		X	X	X	X						6
Erioneuron pilosum / Hairy tridens	---	X																					1
Eupatorium odoratum (Chromoleana odorata) / Crucita, Christmas Bush	---								X		X	X		X									4
Euphorbia albomarginata / Whitemargin Euphorbia	---	X																					1
Euphorbia laredana / Laredo Euphorbia	---	X																					1
Euphorbia serpens / Hierba de la Golondrina	---		X																				1
Evolvulus alsinoides / Ojo de Vibora	---	X																					1
Eysenhardtia texana / Vara Dulce, Texas Kidneywood	---	X		X																			2
Ferocactus setispinus / Rio Grande Valley Barrel Cactus	---	X																					1
Florestina tripteris / Sticky Palafoxia	---	X	X																				2
Forestiera angustifolia / Elbow Bush	---	X																					1
Fraxinus berlandieriana / Mexican Ash	FAC	X	X		X																		3
Guajacum angustifolium / Guayacan, Soap-bush, Ironwood	---	X	X	X																			3
Gaura sp. / Gaura	---														X								1

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Gaura parviflora / Lizard Tail	NI																		X				1
Gutierrezia texana var. *glutinosa* / Broomweed	---	X																					1
Havardia pallens / Tenaza	---																				X	X	2
Heimia salicifolia / Hachinal	FACW+	X	X																				2
Helianthus annuus / Annual Sunflower	FAC	X	X		X		X	X			X				X			X			X		9
Heliotropium angiospermum / Heliotrope	UPL	X	X						X		X				X			X	X			X	8
Heliotropium confertifolium / Crowded Heliotrope	---	X																					1
Herrissantia crispa / Netveined Herissantia	---	X																					1
Heterotheca subaxillaris / Camphor Weed	---	X	X																				2
Hibiscus maritanus / Tulipan del Monte	---	X																					1
Ibervillea lindheimerii / Globe Berry	---			X							X												2
Ipomoea amnicola / Morning Glory	FACW-	X	X																				2
Ipomoea carnea / Tree Morning Glory	---																			X	X		2
Ipomoea rupicola / Cliff Morning Glory	---		X																				1
Ipomoea sinuata (Merremia sinuata) / Alamo Vine	---					X			X		X	X		X	X	X	X	X			X		10

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Ipomoea trichocarpa / Sharppod Morning Glory	FAC														X								1
Isocoma coronopifolia / Common Goldenweed	---	X																					1
Jatropha dioica / Leather Stem	---	X																					1
Jefea brevifolia / Shorthorn Zexmenia	---	X																					1
Justicia pilosella / Hairy Tubetongue	---	X																					1
Kallstroemia californica / Texas Tack	---	X																					1
Karwinskia humboldtiana / Coyotillo	---	X	X	X					X														4
Koeberlinia spinosa / Junco, Allthorn	---			X																			1
Krameria ramosissima / Calderona	---	X																					1
Lantana achyranthifolia / Desert Lantana	---		X																				1
Lantana camara / Lantana	FACU											X		X	X								3
Lantana urticoides / Texas Lantana	---	X	X																X				3
Leucaena leucocephala / Poponac	FACU	X																					1
Leucaena pulverulenta / Tepeguaje, Lead Tree	---		X	X	X	X	X	X		X		X		X	X			X	X				12
Leucophyllum frutescens / Cenizo, Purple Sage	---	X	X	X																			3
Leucosyris spinosa / Spiny Aster	FACW-		X																		X		2

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Lippia alba / Brushy Lippia	FAC*																		X				**1**
Lippia graveolens / Mexican Oregano	---	X																					**1**
Lycium berlandieri / Wolfberry	---	X																					**1**
Malvastrum americanum / Malva Loca	---							X															**1**
Malvastrum coromandelianum / Three-lobed False Mallow	---	X	X					X		X	X	X	X	X	X	X	X	X					**12**
Malvaviscus arboreus var. *drummondii* / Turk's Cap	---											X		X									**2**
Mammillaria heyderi / Bizniga de Chilitos, Nipple Cactus, Little Chilis	---	X		X	X																		**3**
Manfreda sileri / Manfreda	---			X																			**1**
Marsilea macropoda / Water-clover	OBL																	X					**1**
Maurandya antirrhiniflora / Snapdragon Vine	---		X																				**1**
Melampodium cinereum / Blackfoot Daisy	---	X																					**1**
Melia azedarach / Paraiso, Chinaberry-tree	---	X					X		X	X	X	X	X	X	X		X						**10**
Melochia pyramidata / Pyramid Flower	FAC-		X																				**1**
Mentzelia lindheimeri / Linheimer Mentzelia	---	X																					**1**
Mikania scandens / Climbing Hempweed	FACW+								X														**1**

Scientific Name / Common Name	**Wetland Indictor 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 # of fence sections in which species occurs**
Mimosa malacophylla / Raspilla	---	X																					**1**
Mimosa pigra var. *berlandieri* / Zarza	FAC														X								**1**
Mimosa stringillosa / Powderpuff	---															X							**1**
Mimosa texana / Texas Mimosa	---	X																				X	**2**
Mirabilis jalapa / Four-o'clock	---	X	X																				**2**
Morus alba / Mulberry	FACU*	X	X																		X		**3**
Nicotiana glauca / Tree Tobacco	FAC	X																					**1**
Nyctaginia capitata / Nyctaginia	---	X																					**1**
Opuntia engelmannii / Nopal, Texas Prickly Pear	---	X	X	X	X	X	X	X	X	X	X	X		X		X							**13**
Opuntia leptocaulis / Tasajillo, Christmas Cactus	---	X	X	X	X																		**4**
Opuntia schottii / Clavellina, Dog Cholla	---	X		X	X																		**3**
Oxalis dichondrifolia / Agrito	---	X																					**1**
Oxalis drummondii / Wood Sorrel	---														X	X							**2**
Palafoxia texana / Texas Palafoxia	---	X	X																				**2**
Palafoxia texana var. *ambigua* / Palafoxia	---		X			X												X					**3**

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Panicum virginatum / Switchgrass	---			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					15
Parkinsonia aculeata / Retama	FACW-	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X			X		16
Parkinsonia texana / Paloverde, Texas Paloverde	---			X	X																		2
Parthenium confertum / False Ragweed	---	X	X					X	X	X	X	X	X	X	X	X	X	X	X		X		15
Passiflora foetida / Passion Flower	NI	X	X																				2
Pennisetum ciliare (Cenchrus ciliaris) / Buffelgrass	---	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					16
Phaulothamnus spinesecens / Snake Eyes	---	X	X																				2
Phoradendron tomentosum / Mistletoe	---	X	X	X																			3
Phragmites australis / Common Reed	FACW																						0
Phyla nodiflora / Frog Fruit	FACW															X							1
Phyllanthus polygonoides / Knotweed	---	X																					1
Physalis cinerascens / Ground Cherry	---	X	X								X			X	X			X				X	7
Pithecellobium ebano (Chloroleucon ebano, Ebanopsis ebano) / Ebano, Texas Ebony	---	X	X	X	X		X	X	X				X		X		X		X		X	X	13
Polanisia dodecandra ssp. *riograndensis* / Clammyweed	FACU	X	X																				2

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Polygala glandulosa / Glandular Milkwort	---	X																					1
Polygonum pensylvanicum / Smartweed	FACW-								X					X	X								3
Populus deltoides / Eastern Cottonwood	FAC													X									1
Portulaca pilosa / Chisme	---	X																					1
Prosopis glandulosa / Mesquite, Honey Mesquite	---	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X			X	17
Prosopis reptans / Tornillo, Screw-bean Mesquite	FAC+	X																					1
Ratibida columnaris / Mexican Hat	---																					X	1
Rhynchosia minima / Least Snoutbean	---											X						X					2
Ricinus communis / Castor Bean	FACU	X	X	X				X	X	X		X		X	X	X	X				X		12
Rivina humilis / Coralito, Pigeonberry	---	X							X														2
Rubus trivialis / Dewberry	FAC											X											1
Ruellia runyonii / Wild Petunia	---														X								1
Ruellia spp. / Ruellia	---	X																					1
Sabal sp. / Palmetto	---										X												1
Sabal mexicana / Mexican Palmetto, Sabal Palm	---																					X	1
Salix nigra / Sauz, Black Willow	FACW+	X		X					X					X	X			X	X			X	8
Salsola australis / Russian-thistle	FACU	X	X				X	X	X	X	X												7

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Sanvitalia ocymoides / Sanvitalia	---														X		X						2
Sarcostema cynanchoides / Climbing Milkweed	---	X	X																X				3
Schaefferia cunefolia / Desert Yaupon	---	X																					1
Schinus terebinthinus / Brazilian Pepper	---																			X			1
Senna bauhinoides / Two-leaved Senna	---	X																					1
Serjania brachycarpa / Serjania	---	X																					1
Setaria ramisetum / Bristlegrass	---		X																				1
Setaria scheelei / Southwest Bristlegrass	---		X																				11
Setaria texana / Texas Bristlegrass	---		X																				1
Sida abutifolia / Spreading Sida	---		X																				1
Sida spinosa / Prickly Sida	UPL				X	X	X	X	X	X	X	X	X	X	X		X						12
Sideroxylon celastrinum / Coma	---	X		X	X		X		X														5
Solanum elaeagnifolium / Trompillo, Silverleaf Nightshade	---	X		X				X	X	X	X	X	X	X	X	X	X	X				X	14
Solanum rostratum / Mala Mujer	---	X																					1
Solidago canadensis / Tall Goldenrod	FACU+																				X		1

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Sorghum halepense / Johnsongrass	FACU			X				X	X	X	X	X	X	X	X	X	X	X					12
Sporobolus airoides / Alkali Sacaton	FAC				X																		1
Sporobolus pyramidatus / Whorled Dropseed	FAC				X	X																	2
Suaeda sp. / Suaeda	FACW				X			X															2
Talinum angustissimum / Flame Flower	---	X																					1
Tamarix aphylla / Athel Tamarisk, Saltcedar	FACW		X							X													2
Teucrium cubense / Germander	FAC+		X																				1
Tetraclea coulteri / Stink Weed	---	X																					1
Thamnosma texana / Dutchman's Breetches	---	X																					1
Theolocactus bicolor / Glory of Texas	---	X																					1
Thelocactus setispinus / Fishhook Cactus	---	X			X																		2
Thymophylla sp. / Dogweed	---					X																	1
Tidestromia lanuginosa / Espanta Vaqueros	---	X	X																				2
Tiquilia canescens / Oreja de Perro	---	X																					1
Tribulus terrestris / Goathead	---		X																				1
Trichloris pluriflora / False Rhodegrass	---		X																				1

Scientific Name / Common Name	Wetland Indictor 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 # of fence sections in which species occurs
Tridens muticus / Slim Tridens	---	X																					1
Turnera diffusa / Damiana	---	X																					1
Typha domingensis / Tule, Narrow-leaf Cattail	OBL								X					X					X			X	4
Verbena canescens / Vervain	---																						
Verbena halei / Slender Verbain	---		X																				1
Verbesina encelioides / Cowpen Daisy	FAC		X							X	X						X	X					5
Verbesina microptera / Capitana, Frostweed	---														X						X	X	3
Viguiera stenoloba var. *chihuahuensis* / Skeleton-leaf Goldeneye	---			X																			1
Waltheria indica / Hierba del Soldado	---		X					X	X	X	X	X	X	X	X	X	X	X	X				13
Wilcoxia poselgeri / Rat-tail Cactus	---	X																					1
Yucca treculeana / Palma Pita, Spanish Dagger	---	X													X								2
Zanthoxylum fagara / Colima	---	X	X				X		X		X	X	X						X				8
Ziziphus obtusifolia / Clepe, Lotebush	---	X	X	X	X				X														5
Total # of FACW- to OBL species per section		4	6	3	2	2	1	3	4	3	2	1	1	5	4	2	1	1	2	0	2	2	
Total # of species per fence section		143	79	43	34	24	22	25	40	29	37	33	23	40	45	23	27	30	21	2	15	23	

5.3 Proposed Fence Section Characteristics and Description of Habitat Quality

A general description of the habitat quality and the characteristics of each section are provided below.

SECTION O-1

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 covers approximately 3.75 miles in the area of the Roma, Texas POE. 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 is not proposed within deep arroyos therefore they were not rigorously sampled. On inspection they support a mixture of tree and shrub species that consists of honey locust, huisache, and granjeno in the tree and tall shrub 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 biotic community and adjacent to the Barretal.

Ashy dogweed was searched for in Section O-1, but was not found. Ashy dogwood 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. In Starr County it is often associated with outcrops of fossil oyster shells. Fossil oyster shells outcropped with the sandstone bluffs and in the eroded arroyos of Section O-1 in Roma. Johnston's Frankenia was searched for in the proposed ROW but not found.

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 searched for in a gravel-covered outcrop. *Billieturnera helleri,* an indicator of saline soils was found growing with a number of species of cacti. Absent was saladillo. Star cactus was not found in the proposed ROW. Zapata bladderpod was not found in the sandstone outcrops in Section O-1.

Walker's manioc occurs in Starr County in association with caliche in blackbrush-cenizo and barretal (*Helietta parvifolia*) associations. Caliche outcrops were not observed in the proposed ROW visited.

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 covers approximately 8.74 miles near the Rio Grande City, Texas POE. Several arroyos or deep drainages that are intermittently flooded occur within the Section O-2. Construction is not proposed within deep arroyos therefore they were not rigorously sampled. On inspection they support a mixture of tree and shrub species that consists of honey locust, huisache, and granjeno in the tree and tall shrub 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 dogwood occurs in shallow to deep sand with a dominance of native grasses A sandy area supports a woodland of mesquite-prickly pear cactus in this Section, probably a secondary succession from abandoned crop and pastureland. Ashy dogwood was not observed in the proposed ROW. No rare species were observed in this section, and the habitat for the potential occurrence of other rare species was not found.

SECTION O-3

County: Hildago
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 consisted of two U. S. Fish and Wildlife Service (USFWS) Los Ebanos tracts, an International Boundary and Water Commission (IBWC) easement, some residential areas surrounded by mesquite-buffelgrass pastures, and a very small (<1 acre) brush tract owned by the Mennonite Brothers Church. According to USFWS staff, both USFWS tracts were previously agricultural fields that had been re-vegetated around 2002-2003. The re-vegetation efforts were, for the most part, not successful, and the tracts consisted of mostly disturbance colonizers such as Roosevelt weed, seep willow, lead tree, and mesquite, with an herbaceous layer dominated by switchgrass and buffelgrass. The IBWC tract was also previously disturbed and contained the same species composition. The Mennonite Brothers Church tract obviously had goats in and out of there for years, but there was an interesting assemblage of brush such as goat-bush, blackbrush, bluewood condalia, coyotillo, allthorn, guayacan, and lotebush, along with seven species of cacti and an abundance of *Manfreda*. This brush tract was not the best quality brush and no rare or listed plants were observed. This Section occurs within the Upper Valley Flood Forest and Upland Thornscrub biotic communities.

SECTION O-4

County: Hildago
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
If So, Habitat Quality: NA

Section Habitat Description: This Section occurs within the Upper Valley Flood Forest and Upland Thornscrub biotic communities, as well as within the Mid-Valley Riparian Woodland biotic community. This section consisted of a very small (~an acre or less) portion of the Texas Parks and Wildlife Department's (TPWD) Penitas tracts, many agricultural fields (some plowed and empty, some with sugar cane), other disturbed tracts in various stages of re-growth, and residential areas. The TPWD tract had a woody fenceline consisting mostly of mesquite, with an abundant number of cacti (fishhook, dog cholla, nipple cactus, tasajillo, and prickly pear) that had colonized below at the base of the tree line. Just beyond the fenceline into the TPWD property was a cleared pipeline right-of-way. All remaining areas of the section were either agricultural fields or disturbed sites that did not contain anything biologically significant with respect to rare plants.

SECTION O-5

County: Hildago
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 USFWS Granjeno tract)
If So, Habitat Quality: Low

Section Habitat Description: This Section is located primarily within the Mid-Valley Riparian Woodland biotic community. This section contained the edge of the USFWS Granjeno tract. Although we did not have permission to access across the property fenceline, the woody species along the boundary consisted of mesquite, hackberry, sugarberry, anaqua, huisache, and lead tree, with Bermuda grass and switchgrass as the dominant herbaceous cover. The remainder of Section 5 consisted of residential areas, some agricultural fields, and some small disturbed tracts. There was no rare plant potential habitat identified.

SECTION O-6

County: Hildago
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
If So, Habitat Quality: NA

Section Habitat Description: There are no tracts owned by the USFWS or TPWD within Section O-6. Within this section there is a tremendous amount of urban, industrial, and residential areas within the project boundary. There was also a small amount of agricultural fields (mostly fallow), and other highly disturbed parcels. There was no rare plant potential habitat identified.

SECTION O-7

County: Hildago
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
If So, Habitat Quality: NA

Section Habitat Description: Although this section borders a USFWS tract, the proposed project is to the north of their property and will not directly impact it. This section is entirely agricultural. Some fields are plowed and empty, some fallow, and others have sugar cane and sunflowers. There is no rare plant habitat within this section.

SECTION O-8

County: Hildago
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
If So, Habitat Quality: NA

Section Habitat Description: This section is composed primarily of agricultural fields (fallow, sugar cane, sunflowers, and empty plowed areas). There is also one disturbed brushy re-growth area, one tiny boundary of a TPWD tract (Las Palomas), and one USFWS tract (La Coma) that the project traverses. The Las Palomas tract boundary is dense with trees and brush consisting of retama, mesquite, spiny hackberry, lime pricklyash, bluewood condalia, sugarberry, hackberry, anaqua, ebony and chinaberry. The understory created by this dense brush is very dark and is mostly bare ground with a few pigeonberries noted. Where the sun can penetrate, switchgrass is dominant. Targeted rare plants were surveyed for within Las Palomas, but none were identified. The USFWS La Coma tract within the project boundary is yet another disturbed property with little to no rare plant potential. The understory is a dense, high stand of buffelgrass and switchgrass with scattered mesquite, huisache, and retama. There is also spiny hackberry, coma, coyotillo, anaqua, lotebush and prickly pear. Targeted rare plants were surveyed for within La Coma, but none were found.

SECTION O-9

County: Hildago
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
If So, Habitat Quality: Medium

Section Habitat Description: Section O-9 has many agricultural fields (fallow, corn, sugar cane, and plowed bare). There is a small section of residential use near the Resacas, and a huge, deep ravine lined with towering sugarberries just to the south.

SECTION O-10

County: Hildago
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
If So, Habitat Quality: Low

Section Habitat Description: Section O-10 is primarily agricultural fields (sugar cane, fallow, and plowed empty) with canals and stands of giant reed throughout. There is one USFWS tract that is traversed by the project along this section. (Tract name possibly called Rosario Banco). This tract is a previously disturbed area undergoing re-growth. On the eastern portion of the tract the buffelgrass and switchgrass are so thick and high within, that it almost difficult to walk through. Scattered trees and shrubs on this tract are mesquite, spiny hackberry, retama, sugarberry, chinaberry, lime pricklyash, and bluewood condalia. At the western side of this tract, the woody vegetation becomes more dense and the understory is mostly bare ground. (Note: A Mexican tree frog was spotted on a sugarberry leaf within this tract.)

SECTION O-11

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

Section Habitat Description: Section O-11 traverses quite a large section of the TPWD Anaqua Wildlife Management Area (WMA). The woody species consist mostly of lead tree, hackberry, sugarberry, huisache, chinaberry, spiny hackberry, anaqua, and lime pricklyash. The understory has many escaped lantanas and turk's cap, along with many tangled vines such as least snoutbean, dewberry, ivy treebine, and peppervine. There was no suitable habitat for listed plants within this WMA. Listed plants were surveyed for, but were not found. The remainder of this section was fallow agricultural fields.

SECTION O-12

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

Section Habitat Description: This section contained a large sugar cane field, a large disturbed brush tract with very little 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, hackberry, sugarberry, ebony, mesquite, huisache and retama.

SECTION O-13

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

Section Habitat Description: This section contains mostly agricultural fields (sorghum and fallow). The southern portion is nearby to a USFWS tract (name unknown), but will not impact that property directly. There was no listed plant habitat within this section.

SECTION O-14

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

Section Habitat Description: This section is paralleled by a canal for the entire extent. No rare plants were observed in this highly disturbed section. No suitable habitat was observed in this section.

SECTION O-15

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

Section Habitat Description: This section consisted of agricultural fields (mostly sugar cane or clear) and residential areas. There was no rare plant habitat within this section.

SECTION O-16

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

Section Habitat Description: This section consisted of mostly agricultural fields and residential neighborhoods. There was one very small woody area, but it was highly disturbed and contained no listed plant habitat.

SECTION O-17

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

Section Habitat Description: Section O-17 was situated next to agricultural fields, along a canal edge, and nearby residential or multi-use property (an area of abandoned vehicles). There was one small brushy tract with low diversity (mostly switchgrass understory with a mesquite, retama, spiny hackberry overstory). Within this tract there was a tiny mesic depression with water-clover along the edge. All areas of this section were disturbed in some way, and there was no listed plant habitat observed.

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: A single stand of tepeguahe woodland from 10-15m tall was documented in Section O-18. Retama has reinvaded non-native grassland habitat to form shrublands and short-stature woodlands in Section O-18.

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: In some places of Section O-19, windmill grass has become the dominant grass forming nearly pure stands on levee banks, however extensive, monotypic stands occupy fields that were historically cultivated.

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: In some places of Section O-20, windmill grass has become the dominant grass forming nearly pure stands on levee banks, however extensive, monotypic stands occupy fields that were historically cultivated.

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: Sabal palms are distributed predominantly in proposed Section O-21 as scattered individuals, small groups or linear clumps, and patches and stands where they persist as seedlings, tall shrubs and as trees up to 20 meters tall. Only a few sabal palm trees were observed in other proposed project sections. The USFWS has established the Boscaje de la Palma tract 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. In addition, two short-stature huisache woodland stands were observed in Section O-21.

5.4 Wetlands and WOUS

Wetland delineations have not yet been conducted. The most current information available to identify wetlands in Route B is the NWI (USFWS 2007). No NWI coverage is currently available for Sections O-1, O-2, O-3, O-5, O-6, O-7, and O-8. Approximately 7.3 acres of wetlands are within the remaining sections of the proposed project corridor of Route B (see **Table 5-2)**.

Table 5-2. NWI Identified Wetlands that Occur within the Proposed Project Corridor

Section	Wetland Type	Acreage
O-4	Freshwater Pond	0.2
O-9	Freshwater Pond	negligible
	Freshwater Emergent Wetland	0.8
O-10	Freshwater Emergent Wetland	0.7
	Lake	0.1
O-11	Freshwater Forested/Shrub Wetland	negligible
O-13	Riverine	0.2
	Freshwater Emergent Wetland	0.3
	Freshwater Emergent Wetland	0.2
	Freshwater Emergent Wetland	0.8
O-15	Freshwater Emergent Wetland	0.8
O-17	Freshwater Emergent Wetland	0.8
O-19	Riverine	0.5
O-20	Freshwater Emergent Wetland	0.9
	Freshwater Forested/Shrub Wetland	negligible
O-21	Freshwater Emergent Wetland	0.8
	Freshwater Pond	0.2

Source: USFWS 2007 – NEED CORRECT CITATION FOR NWI

Note: Wetland acreage is based on NWI data. No NWI coverage is currently available for Sections O-1, O-2, O-3, O-5, O-6, O-7, O-8.

5.5 Wildlife Observed

Table 5-3 below lists wildlife observed during the field surveys. The table can provide a general indication of species richness in each section. Based on the number of species observed, Sections O-1, O-2, and O-14 presented the greatest wildlife diversity in terms of species richness.

Table 5-3. Wildlife Observed During Natural Resources Surveys Conducted October 1 to 7, 2007

		Section Numbers																		
Scientific Name	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
	C								x											
ttatus	C								x											
s	C																	x		
	C																			
rynus dorsalis	Potential Habitat		x																	
udinii	State Threatened Species										x									
erodactylus cystignathoides	C								x	x										
erlandieri	C								x						x					
abialis	Potential Habitat								x											
rifer cyanogenys	C	x						x												
elis laredoensis	C	x	x	x						x		x		x	x			x		
exlineatus viridis	C	x										x		x						
mys gorzugi	C						x													
a cornutum	State Threatened Species		x																	
one spinifera emoryi	C														x					
mericana	C																		x	
	C														x					
s	C	x											x				x	x		x
	C														x					
	C														x					
	C	x	x	x	x	x			x										x	
	C	x		x																
drocygna autumnalis	C														x				x	
exicanus	C														x	x				
anus	C														x					
nocephalus	C		x																x	
us	C									x										
	C	x																		
nus tyrannulus	C				x															
s ater	C										x		x				x			
runneicapillus	C	x																		
	C															x				
leucus	C	x																		
a passerina	C		x	x	x	x	x		x	x	x					x	x	x		x
ii	C	x	x	x	x	x	x		x	x	x		x	x	x		x	x	x	x
way	C	x																		
rocorax auritus	C														x					
gna	C		x																	

Scientific Name	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
is	C								x											
nerpes aurifrons	C	x	x		x	x			x	x	x	x	x		x				x	x
	C									x		x				x			x	
	C	x				x									x	x			x	
atus	C		x	x							x				x		x			
alifornianus	C	x																		
oleuca	C									x										
exicanus	C	x	x	x		x	x	x	x	x	x				x		x		x	x
	C									x					x					
	C	x	x																	
cirostris	C	x	x			x			x	x					x					
us	C			x																
	C								x											
nus	C	x	x	x	x	x							x	x	x	x		x		
us	C	x	x												x		x			
	C	x		x					x						x			x	x	
tipennis	C	x		x																
	C															x				
cianus	C		x																	
ericanus	C															x				
us scolopaceus	C																		x	
ongirostre	C	x	x																	
a	C	x	x	x	x	x	x			x	x			x	x		x	x	x	x
inalis	C	x	x		x	x						x	x	x	x					
	C		x	x					x		x		x						x	
	C				x					x										
glottos	C	x	x		x	x		x	x	x	x	x	x		x	x		x	x	x
diceps	C																		x	
	C												x							
nica	C																		x	
is	C			x					x											
noeniceus	C	x	x						x		x				x	x			x	
	C	x																		x
s forficatus	C	x	x		x		x			x				x	x	x		x		x
	C	x	x	x	x	x	x		x	x										
us rubinus	C									x										
	C																		x	
ccyzus americanus occidentalis	Candidate Species									x										
	C														x	x				
ica	C		x					x												
	C		x																	
ri tajacu	C	x	x		x										x					
eoargenteus	C														x					
	C		x																	

Scientific Name	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
	C	x	x	x																
bonii	C	x																		
danus	C												x							
ontomys fulvescens	C	x													x					
mys compactus	C	x																		
dus	C			x																
philus mexicanus	C		x												x					x
novemcinctus	C		x	x									x							
	C							x												x
	Total # Species Per Section:	26	22	14	12	12	6	5	14	16	10	4	9	5	23	12	8	8	18	9

6. Avoidance and Minimization Measures

A part of the coordination between USBP and USFWS, best management practices are under development for the construction, operation, and maintenance of the proposed tactical infrastructure. The best management practices are designed to avoid and minimize impacts to biotic resources, specifically threatened and endangered resources. These measures will be presented in the Final Report.

7. Permits, Technical Studies and Notifications

In compliance with state and federal regulations, the following should be investigated or conducted to assess the potential that regulatory requirements have been met. It should be noted that additional permits, studies, or notifications may be required which are not listed herein.

Permits			
Permit Type	**Issuing Agency**	**Reason**	**Legislation**
404 Permit	USACE	Wetland and WOUS delineation	Section 404 of the Clean Water Act authorizes the USACE to issue permits regulating the discharge of dredged or fill material into the waters of the United States, including wetlands. General permits are often issued by USACE for categories of activities that are similar in nature and would have only minimal individual or cumulative adverse environmental effects. A general permit can also be issued on a programmatic basis ("programmatic general permit") to avoid duplication of permits for state, local or other Federal agency programs.
401 Water Quality Certification	Texas Commission on Environmental Quality (TCEQ)	Wetland and WOUS delineation	Section 401(a)(1) of the Clean Water Act (CWA) specifies that any applicant for a Federal license or permit to conduct any activity, including but not limited to the construction or operation of facilities that may result in any discharge into navigable waters, shall provide the federal licensing or permitting agency a certification from the State in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the navigable water at the point where the discharge originates or will originate, that any such discharge will comply with the applicable provisions of Sections 301, 302, 303, 306, and 307 of the Clean Water Act (SWRCB 2007).

Permits			
Permit Type	**Issuing Agency**	**Reason**	**Legislation**
Section 7 (ESA) consultation	USFWS	Allow the proposed action to proceed while avoiding impacts to listed species.	Section 7 of the ESA directs all Federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the Service, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to the management of Federal lands as well as other Federal actions that may affect listed species, such as Federal approval of private activities through the issuance of Federal funding, permits, licenses, or other actions.
Migratory Bird Treaty Act (MBTA) coordination (Migratory Bird Depredation Permit)	USFWS	Fence constructed during breeding season.	The MBTA established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird,. . . or any part, nest, or egg of any such bird. The Migraotry Bird Depredation Permit is USFWS Form 3-200-13.
Special Use Permits for access to National Wildlife Refuge areas	USFWS	As requested by LRGNWR managers.	N/A

Permits			
Permit Type	**Issuing Agency**	**Reason**	**Legislation**
Take Permit	State of Texas, Texas Parks and Wildlife Department	Texas Endangered Speceis Act compliance.	Animals: Laws and regulations pertaining to endangered or threatened animal species are contained in Chapters 67 and 68 of the Texas Parks and Wildlife (TPW) Code and Sections 65.171 - 65.176 of Title 31 of the Texas Administrative Code (T.A.C.). Plants: Laws and regulations pertaining to endangered or threatened plant species are contained in Chapter 88 of the TPW Code and Sections 69.01 - 69.9 of the T.A.C.

Notification	
Agency	**Contact Information**
USFWS – Regional	Larisa Ford, PhD, MPA Fish & Wildlife Biologist, Ecological Services United States Fish & Wildlife Service Texas A&M University at Corpus Christi 6300 Ocean Drive, USFWS -Unit 5837 Corpus Christi, TX 78412-5837 361-994-9005 361-994-8262 (fax)
USFWS – Refuge	Bryan Winton Refuge Manager Lower Rio Grande Valley National Wildlife Refuge (956) 784-7521 (956) 874-4304 cell
Texas Department of Parks and Wildlife	No contact available at this time.

Additional Studies	
Agency	**Study**
USACE	Wetland Delineation and Determination

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9. References

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BIOLOGICAL SURVEY
APPENDIX A

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's 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 are found 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 times vary with the location of the brown pelican. In Texas, brown pelican populations nest irregularly usually beginning in late fall and extending through June. The clutch size average 2-3 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 1920-30's 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 1960's and 1970's when the brown pelican would eat menhaden loaded with DDT and Endrin. This 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 turtles are found in tropical waters of the Atlantic, Pacific, and Indian Oceans. Their main nesting grounds are found on Aves Island in Costa Rica and Surinam. They have rarely been observed nesting in Texas including a single female recently observed in Kenedy County, Texas. Juveniles exist in offshore areas from Texas to Massachusetts (NatureServe 2007).

Natural History:

Habitat: Hatchlings restrict themselves 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-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 monthgs 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, 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 Cameroun 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 still roam Central and South America in greater numbers than seen in the United States (USFWS 1990).

Natural History:

Habitat: The habitat of the jaguarundi is similar to the ocelot and is found within the Tamaulipan Biotic Province which includes several variations of sub-tropical thornscrub brush. Potential habitat includes four different areas of the Lower Rio Grande Valley: Mesquite-Granjeno Parks, Mesquite-Blackbrush Brush, Live oak Woods/Parks, and Rio Grande Riparian. Jaguarundi prefer dense thornscrub habitats with greater than 95% canopy cover . 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. This creates islands of habitat where the jaguarundi cannot migrate from area to area leaving them vulnerable.

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 of its life history stages (NMFS and USFWS 1993).

Natural History:

Habitat: Hawksbill habitat use depends on their life stage. Posthatchling hawksbills occupy the pelagic environment, hiding from predators in the weedlines. Juveniles then enter 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 occur earlier and either during the migratory route or off the nesting beach. They nest an average of 4.5 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 with one nesting beach that receives the majority of the nesting females. This beach is located near Rancho Nuevo in southern Tamaulipas, Mexico. The ridley sea turtle has the most restricted nesting distribution of any sea turtle. 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 and associated infauna and other epipelagic species found in 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 1940’s to early 1960’s. 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, there were nesting sites 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 is found 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 Michoacá, 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 is still a threat. Incidental take by fisheries 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 spotted 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 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 takes 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 3000m in the Andes. The falcon also inhabits areas in most of Latin America. The historic range includes areas of Texas, New Mexico, and Arizona. In Texas, they are still observed in south Texas and the Trans-Pacos region (USFWS 1990).

Natural History:

Habitat: In populations found in the United States, northern aplomado falcons inhabited yucca-covered sand ridges in coastal prairies, riparian woodlands in open grasslands, and in desert grasslands with scattered mesquite (*Hilaria belangeri*) and yucca. They do not construct their own stick platform 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 fled at 32-40 days and are dependent on their parents 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 1970's 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 habitat of the ocelot and is found within the Tamaulipan Biotic Province which includes several variations of sub-tropical thornscrub brush. Potential habitat includes four different areas of the Lower Rio Grande Valley: Mesquite-Granjeno Parks, Mesquite-Blackbrush Brush, Live oak Woods/Parks, and Rio Grande Riparian. Ocelot prefer dense thornscrub habitats with greater than 95% canopy cover. Thei r average home range is about 15 km^2 (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 after lactation had ceased 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 other rodents, 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 4 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 inverterbrates 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 *(Charadnus 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 an endemic species 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. Only three populations are known to exist at the moment 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 with a silvery to grayish-green appearance that is 10-30 cm tall. It has simple, opposite leave on the bottom that transition to alternate near the inflorescence. The flowers are dioecious with the staminate flowers on terminal races 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 *(Booteloua 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 an endemic species to southern Texas and northern Mexico whose historical range includes Hidalgo, Starr, Zapata, and possibly Cameron Counties in Texas and the states of Nuevo Leon and Tamaulipas in Mexico. Known populations exist on private land in Starr County, Texas, Tamaulipas, Mexico, and Nuevo Leon, Mexico. Other populations likely exist 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 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. The cactus flowers 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 thorn shrub 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 whose historical range included Cameron and Hidalgo Counties, Texas and the states of Coahuila, Nuevo Leon, and Tamaulipas in Mexico. The status of Mexican populations is unknown at the time. The only confirmed population of the Texas ayenia lies on private property within Hidalgo County.

Natural History:

Morphology: The Texas ayenia is a sub-shrub with pubescent leaves and stems that is between 60 cm and 150 cm. The leaves are alternate, simple leaves. The flowers are axillary with up to 4 per node and their color alternates 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 plant community occurs on well-drained riparian terraces with canopy cover close to 95% Species found in this community includes la coma *(Bumelia celastrina),* brasil *(Condalia hookeri),* granjeno (*Celtis pollicki),* and snake-eyes *(Phaulothamnus spinesceris).*

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: Walker's manioc is an endemic species of the Lower Rio Grande Valley of Texas and northern Mexico. One population exists in Tamaulipas, Mexico and ten populations have been observed in the United States in Starr and Hidalgo counties of Texas.

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 5-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 nati ve brush habitat has been cleared in the United States for agriculture, urban development, and recreation. The U.S. population has been reduced to a single plant 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 whose only known population exists of 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 head 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 these areas 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, only five populations were known in Texas and another population from near Monterrey, Mexico. However, the frankenia has been found on 30 new sites in Starr and Zapata Counties in Texas (NatureServe 2007).

Natural History:

Morphology: Johnston's frankenia is a member of the family 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 a high gypsum content (NatureServe 2007).

Threats: The species is still threatened by brush clearing and oil and gas development, but conservation agreements are being signed by private landowners to protect the plant (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, Red, and Rio Grande River. 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 River and along the Pecos River at the Bitter Lake National Wildlife Refuge, New Mexico (USFWS 1990).

Natural History:

Habitat: Along river systems such as the Rio Grande, least terns nest on sparsely vegetated sand and gravel bars along a wide, unobstructed river channel or salt flats along lake shorelines. Least terns also have been observed to nest on artificial habitats such as sand and gravel pits and dredge islands (USFWS 1990).

Breeding: Least terns reside 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 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 *Carpiodes.* They usually hunt near their nesting sites (USFWS 1990).

Threats: The taming of wild 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 an endemic species to southern Texas and possibly northern Mexico. Four populations are known in Starr County. Two populations are found on the Lower Rio Grande Valley National Wildlife Refuge and two occur on private land. Three populations are known from Zapata County. Two are located on highway rights-of-way between the towns of Zapata and Falcon and another lies near Falcon Lake (USFWS 2004).

Natural History:

Morphology: The Zapata bladdepod 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 terracs above the Rio Grande flood plain. It is associated with highly calcareous sandstones and clays. The bladderpod is a component of an open *Leucophyllum fretescens – 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.

APPENDIX J

Preliminary Cultural Resources Findings

APPENDIX J

PRELIMINARY CULTURAL RESOURCES FINDINGS

1. General Historic Context

1.1 Precontact (Archaeological) Overview

The precontact history of the lower Rio Grande is rich, unique, and important. The river has been a critical conduit for trade and transportation, and a natural border between interests to the north and the south. The area's archaeological record is dominated by open-air sites, burned rock middens, lithic artifact scatters, clay dunes in the Rio Grande delta, and shell middens near the coast. These sites are difficult to identify and date because of heavy erosion, shallow soil horizons, and extensive artifact removal by collectors. The lack of excavation of deeply stratified subsurface sites means that the chronology of the south Texas plains is poorly understood.

The following discussion of the precontact history of the south Texas plains is divided into three general cultural periods. The Paleoindian period represents the first documented human occupation of the region. Evidence of the earliest Paleoindian complexes, Clovis and Folsom, has been found throughout southern Texas, although most of this evidence is from surface collections of the distinctive fluted points that characterize these complexes. Clovis and Folsom hunters appear to have specialized in hunting large animals, including mammoth and bison. Two stratified Paleoindian sites have been excavated in the South Texas region, Berger Bluff (41GD30) in Goliad County, and Buckner Ranch (41BE2) in Bee County.

The Archaic period in southern Texas is divided into the early, middle, and late subperiods based on subtle changes in material cultural and settlement patterns. During this period, hunting and gathering continued as the primary means of subsistence, but populations responded to fluctuations in regional climate by exploiting an increasingly wide range of plant and animal resources and geographic settings for settlement and subsistence Specifically, the Early and Middle Archaic overlap with the Altithermal (ca. 6000–2000 B.C.), a warm and dry climate episode. The Early Archaic is poorly documented in the southern Texas region, especially on the Rio Grande Delta, due to deep sediment deposition. The available evidence suggests that population density was unchanged from the Paleoindian period, and that Early Archaic hunters continued to live in small, highly mobile groups. Middle Archaic sites appear to be more common than Early Archaic sites, and are found in upland, alluvial, and tributary settings and estuary bays. Middle Archaic sites in southern Texas are also distinguished by the occurrence of ground stone artifacts (Hester et al. 1989) and other evidence for expanded plant use, including an increase in the number of burned rock middens. Exploitation of coastal resources also appears to have increased. The increasing breadth of subsistence-related resources is accompanied by an increase in site size and artifact abundance, suggesting an increase in population (Hester et al. 1989). Sites from the later Middle Archaic also contain evidence of trade between the Rio Grande plain and the coastal delta, and elaboration of ritual or ceremonial practices in the form of cemeteries for burial of the dead. Late Archaic sites are relatively common in the project area, suggesting increasing population density (Hester et al. 1989). Along with increasing site density, the period is marked by a continued expansion in the variety of resources exploited for subsistence, with rodents and rabbits becoming more common in the archaeological record and specialized plant resource extraction features, such as hearths, increasing in frequency. Sites also appear to have been used repeatedly, suggesting a more sedentary settlement pattern or an increasingly scheduled subsistence regime. Regional trade of items such as marine shell pendants continues, as does use of cemeteries.

The Late Prehistoric period is well-documented in the region. It is characterized by the appearance of pottery and the bow and arrow, although point typologies have not been formalized (Hester et al. 1989). In much of southern Texas, the Late Prehistoric period has two distinct horizons: the Austin (A.D. 800–1350) and the Toyah (A.D. 1350–1600) (Black 1986). Bone-tempered pottery with incised designs appears by A.D. 1000. The Toyah horizon is the best documented and is associated with the occurrence of Perdiz points, small end scrappers, flake knives, beveled knives, Leon Plain bone-tempered pottery, ceramic figurines and pipes, and shell and bone ornaments and beads. Toyah sites are generally found near streams. Along the coast, the Late Prehistoric period begins around A.D. 1200 with the Rockport complex. In the Rio Grande delta area, the Late Prehistoric begins around A.D. 1200 with the Brownsville complex. This complex is similar to the Austin and Toyah horizons, and is characterized in large part by bone-tempered ceramics virtually identical to inland types and a well-developed shell-working industry (THC 2007b).

1.2 Overview of Postcontact History

In the nearly 500 years since initial Spanish exploration, the area has been claimed and influenced by four nations: Spain, Mexico, Republic of Texas, and the United States. Each has pursued its own interests and left its mark as historic landmarks or in patterns of land use and settlement.

Missions were the focus during the Spanish colonial period (ca. 1519–1822) (USACE 1999). Spanish-speaking peoples established ranches in support of the missions. During the Early Anglo-European period (1822–1845), the missions of northern Mexico and Texas were secularized and became less important. Anglo-Americans and Anglo-Europeans began rapidly settling in Texas, bringing with them their own customs, traditions, and influences. Some were of Irish and Mexican descent, and practiced small-scale farming and ranching. These Empresarios had been granted lands in exchange for settling in the area and becoming Mexican citizens. Large-scale Mexican/Spanish ranching interests continued in the area. Roma became an important port town in this period because of its favored location where river boats met overland routes. In 1836, the Anglo colonists revolted against Mexico and won their independence by defeating Santa Anna at San Jacinto.

During the Texas Republic period (1836–1846), the lower Rio Grande was central to the border tensions between the newly independent Texan republic and the government of Mexico, culminating in the Mexican-American War (1846–1848). On behalf of the Texans, U.S. troops under General Zachary Taylor landed their forces at Port Isabel and established Fort Brown on the Rio Grande across from Matamoros. The presence of these troops provoked the Mexican government to attack, starting the Mexican-American War. Besides military action at Fort Brown, significant battles occurred at Palo Alto and Resaca de la Palma in the lower Rio Grande.

During the American period (1848–present), Anglo-European farmers and ranchers continued to settle the lower Rio Grande area. They continued the large-scale, export cattle ranching started by the Mexicans. To protect the U.S. border, the U.S. Army constructed a line of forts from north-central Texas to the Rio Grande. A second line of forts was established, including Fort Ringgold. As Anglo-American and Anglo-European settlers moved in, towns grew at road and river crossings. Potteries, brick kilns, and local commercial centers were established.

The lower Rio Grande Valley played an important role during the Civil War as local supporters used the river to transport cotton and war materials to support the Confederate effort. Roma and Brownsville, in particular, prospered during the period. The last battle of the Civil War occurred at Fort Brown, ironically a month after the war's official end at Appomattox.

The decades following the Civil War were the years of the large cattle drives north on Chisolm Trail, which began at Brownsville. Railroads, drought, and the use of barbed wire contributed to the eventual breakup of large ranches, open range ranching, and the large cattle drives. The large ranches and open ranges were broken into smaller farms, many owned by immigrants from the Midwestern states. New irrigation systems enabled large-scale agriculture and the lower Rio Grande became noted for its rich croplands, sugar cane production, and citrus groves.

In recognition of the important-contribution of the lower Rio Grande to Texas and American history, the Texas Historical Commission designated the 200-mile area from Laredo to Brownsville along the Rio Grande as the Los Rios del Camino Heritage Trail (THC 2007a; Sanchez 2007, 1997). The binational Los Caminos del Rio Heritage Project was created to support the understanding and appreciation of the history of the area (Sanchez 2007).

The location of the Proposed Action along the lower Rio Grande places it in an area rich in cultural resources. Alternatives 2 and 3 would cross within two historic districts that are designated NHLs: the Roma Historic District and Fort Brown. Each would extend adjacent to or within the bounds of four additional NRHP-listed historic districts: Fort Ringgold Historic District, Louisiana-Rio Grande Canal Company Irrigation System Historic District (including Old Hidalgo Pumphouse), Neale House, and Old Brulay Plantation. It would be in the general vicinity of many other NRHP-listed properties, such as the Rancho Toluca Historic District, La Lomita Historic District, Gems Building, and Stillman House. It is known that additional architectural resources eligible for the NRHP but not formally nominated for listing are also in the vicinity of the Proposed Action. Others that meet the NRHP eligibility criteria but have not been inventoried or evaluated are expected. Historic-era property types in the lower Rio Grande area include historic residential, commercial, and institutional buildings both in settled communities and in rural contexts; military forts; transportation resources (ferry crossing and ferry, suspension bridge); cemeteries; religious complexes; industrial resources (irrigation systems and associated water pumphouses); and farmsteads, plantations, and ranch complexes. These might be found as standing structures or historic archaeological sites. Such sites are known to include shipwrecks, forts, homesteads, and trash scatters. One site is listed on the NRHP (Fort Brown).

2. Specific Historic Property Discussion

In the following discussion, historic districts and individual properties listed in the NRHP that occur near Alternatives 2 and 3 would be described. Previously identified archaeological resources would also be noted. This discussion is based on information contained in the THC Texas Historic Sites Atlas and Texas Archaeological Sites Atlas. Cultural resources surveys of the APEs that would be directly impacted under Alternatives 2 and 3, are underway or about to commence; these surveys are anticipated to identify additional resources. **Table J-1** summarizes the resources discussed in this section.

2.1 Roma Historic District

The Roma Historic District was designated an NHL by the Secretary of the Interior in 1993. The 15-block historic district comprises 35 contributing buildings, including the Nestor Sáenz Store (1884) and Manuel Guerra House and Store (1878–84). The Roma-San Pedro International Bridge (1928) is a contributing property of the historic district. It is anticipated that architectural survey efforts would identify additional buildings that are individually eligible for listing in the NRHP, both within and outside of historic district.

The 19th-century town of Roma was an important shipping point for steamboats along the Rio Grande. The site was first settled in 1760 by Spanish colonists from the colonial settlement, Mier, on the south bank of the Rio Grande. With the

Table J-1. Table of Known Historic Properties That Might Be Affected

Fence Section	Historic Property	NRHP Status
O-1	Roma Historic District	NRHP–listed, NHL
O-2	Fort Ringgold Historic District (including an archaeological component)	NRHP–listed
O-3	Los Ebanos Crossing, Ferry, and Community	Likely NRHP–eligible
O-5	La Lomita Historic District	NRHP–listed
O-6	Louisiana-Rio Grande Canal Company Irrigation System Historic District (including Old Hidalgo Pumphouse)	NRHP–listed
O-10	Toluca Ranch Historic District	NRHP–listed
O-14	Landrum House	Registered Texas Historic Landmark, likely NRHP–eligible
O-19	Brownsville and Fort Brown Historic District (including an archaeological component)	Fort Brown – NRHP–listed, NHL Brownsville has many NRHP–listed and Registered Texas Historic Landmark properties (depends on delineations of APE)
O-19	Neale House	NRHP–listed
O-21	Old Brulay Plantation Historic District	NRHP–listed

development of steamboat river commerce in the middle of the 19th century, Roma prospered as the western port for flatbed ships carrying cotton down the Rio Grande and supplies upriver. It also was a connection point for overland trade into western Texas and the eastern interior of Mexico.

The Roma Historic District represents an outstanding example of the building techniques of the Lower Rio Grande. These techniques, derived from the 18th-century traditions of northern Mexico, are best exemplified by the finely detailed brick commercial and residential buildings designed and constructed by German emigrant mason Heinrich Portscheller. Influenced by the architecture of its sister city of Mier across the river and by the architecture of Guerrero Viejo, Mexico, Roma possesses buildings of river sandstone, caliche limestone, and molded brick. Masons used both *rejoneado* and *sillar* construction techniques in Roma. The International Bridge linking Roma to Mexico is the last suspension bridge on the Rio Grande and a contributing element of the historic district (Weitze 1993).

2.2 Fort Ringgold Historic District

Fort Ringgold was one of four military posts the Federal government organized along the Lower Rio Grande following the Mexican-American War. Its location on the Rio Grande made the post an important supplier of goods and materials to military installations further upriver. Troops stationed at Fort Ringgold helped quell numerous border conflicts that erupted from 1849 to 1917. The troops ultimately helped bring stability, which contributed to economic development on both sides of the Rio Grande. The fort was deactivated by the Army in 1944 and sold to the Rio Grande City school system.

The Fort Ringgold Historic District encompasses much of the U.S. Army installation established in 1848. The Fort Ringgold Historic District was listed in the NRHP in 1993 under Criteria A and C at the state level of significance. The district, which includes approximately 75 acres, has 41 contributing properties. Most of the buildings are at the northern end of the historic district surrounding the parade ground. They are associated with the post-1869 development of the older fort. During the earlier phase (1848–1869), frame buildings were constructed to the south on two hills overlooking the Rio Grande and a steamboat dock. A small settlement grew called Davis Landing or Davis Rancho. The 1848 buildings included a hospital, storehouses, barracks, Commandant's house, stables, mess hall and fort store, and cemetery. When new buildings were constructed to the north in 1869, these earlier structures were given new uses. The Commandant's house (also known as the Lee House or Robert E. Lee House) from the earlier post was used later as the quartermaster's office after construction of the new post. Archaeological site 41SR142 is the archaeological component of the earlier fort, and encompasses an area larger than the historic district (Clark 1975).

2.3 Los Ebanos Crossing, Ferry, and Community of Los Ebanos

The Los Ebanos ferry crossing lies on an ancient river ford site used during the 1740s by the Spanish colonist, Jose de Escandó. Historically, a salt trail led from the ford crossing to La Sal del Rey, an inland salt lake 40 miles northeast that produced the first export from the region. The ford also was used over several centuries, notably by troops of the Mexican-American War, 1846; by Texas Rangers chasing cattle rustlers, 1874; and by smugglers in many eras, especially during the American prohibition years, 1920–33 (THC 2007a). A ferry and inspection station are located at the crossing today. Los Ebanos Ferry, established in 1950, is notable as the only government-licensed, hand-pulled ferry on any boundary of the United States. The ferry has capacity for 3 automobiles and approximately 12 persons. The ferry cable is connected to an estimated 250-year–old Texas ebony tree that is included in the Texas Forest Service's *Famous Trees of Texas* (Texas Forest Service 2007). It is possible that the Los Ebanos Ferry is eligible for listing in the NRHP and that the area including the ferry is a historic landscape. The community of Los Ebanos is an historic town, and has a cemetery where veterans of many wars are buried. It was named for and associated with the unique ebony trees.

2.4 La Lomita Historic District

La Lomita Historic District, listed in the NRHP in 1975, comprises three contributing properties. The earliest remaining property is the stucco and stone mission chapel with a bell tower constructed in 1899. On the small hill is the mission-style St. Peter's Novitiate erected in 1912 that served as a novitiate training center for student priests. Together, the Mission chapel, 122 acres of farm and ranch lands, and novitiate are tangible reminders of the important role of the Catholic Church in the lower Rio Grande Valley. They also document the contribution of the Oblate Fathers in settling this southern tip of Texas (Landon 1975).

2.5 Louisiana-Rio Grande Canal Company Irrigation System Historic District

The Louisiana-Rio Grande Canal Company Irrigation System Historic District was listed in the NRHP in 1995. The 31,200-acre historic district comprises the first-lift and second-lift pumphouses and the associated historic irrigation canal network. The first-lift pumphouse, known as the Old Hidalgo Pumphouse, is significant for its historical associations and engineering and retains original equipment. The historic canal system extends for approximately 500 miles, and includes border-to-border earthen canals, concrete-lined facilities, and canals in pipes on original alignments.

The historic district is significant at the state level under Criterion A with a period of significance from 1904 to 1949. The system contributed to the early 20th century agricultural revolution in the Lower Rio Grande. Private irrigation systems, like the Louisiana-Rio Grande system constructed by the Louisiana-Rio Grande Canal Company, transformed the arid brush land of the Lower Rio Grande Valley into a vast patchwork of 20- to 80-acre irrigated farms within two decades following the 1904 arrival of the first railroad to the isolated area. Once established, the successful production of those farms defined South Texas as one of the nation's three largest winter agricultural regions until a freeze in 1949. Today the irrigation system, except the Old Hidalgo Pumphouse, is owned by the Hidalgo County Irrigation District No. 2 (Moore et al. 1992).

2.6 Toluca Ranch

The Toluca Ranch, listed in the NRHP in 1983 as a historic district, is one of the few intact ranch ensembles in the Rio Grande Valley. Originally the ranch land holdings included 5,900 acres. The four contributing properties constituting Toluca Ranch are the Church of St. Joseph of the Worker, a two-story house, a store, and a schoolhouse. Constructed in 1899 by Florencio Saenz, the Gothic Revival church with a tower served the Saenz family and local community. The two-story Italianate-style house was constructed in 1906 by Saenz. The schoolhouse was built in 1903 and operated for the children of the local community and the Saenz family until 1911. Saenz was a progressive farmer. Four hundred acres of Saenz's croplands were irrigated to grow beans, corn, melons, and sugar cane for ranch consumption. On pasturelands further north of the river he raised horses, sheep, goats, and cattle (Victor 1981).

2.7 Landrum House

The Landrum House has been a Recorded Texas Historic Landmark since 1978. It is not listed in the NRHP, but is likely to be eligible for its historical and architectural significance. The house was constructed in 1902 for Frances and James Landrum (THC 2007a).

2.8 Sabas Cavazos Cemetery

The Sabas Cavazos Cemetery was established in 1878 with the burial of rancher and businessman, Sabas Cavazos. Cavazos was great grandson to Jose Salvador de la Garza, recipient of the Espiritu Santo royal land grant of approximately 250,000 acres encompassing present-day Brownsville (ACHP 2007b). It lies approximately 0.25 miles north of the Section O-17 corridor (THC 2007a).

2.9 Brownsville and Fort Brown Historic District

Brownsville is rich in historic buildings and sites, many of which are listed in the NRHP. Fort Brown, a historic district designated an NHL, was established in April 1846 by Brigadier General Zachary Taylor and became the first U.S. military post in Texas. The fort was important in some of the earliest battles of the Mexican-American War, the Battles of Palo Alto and Resaca de la Palma. The early fort comprised earthworks with six bastions in the form of a six-pointed star with 15-foot thick walls.

During the Civil War, Brownsville became an important Confederate port town. Boats transported cotton bound for Europe and inbound war material for the Confederacy. Union troops fought for control of Fort Brown, which was held by the Confederate army until the end of the war. Troops from Fort Brown engaged in the last battle of Civil War, the Battle of Palmetto Hill, nearly a month after the Confederacy surrendered at Appomattox (NPS 2007).

After the Civil War, the fort was re-occupied by the U.S. Army and expanded. Under the efforts of Lieutenant Wouldiam Gorgas (later U.S. Army Surgeon General), Fort Brown had a major role in the medical research related to the control of yellow fever. Fort Brown also contributed to efforts to control the Mexican bandit trouble of 1913–1917. In 1948, the fort was transferred to the city of Brownsville. Today the former hospital and other historic buildings are part of the University of Texas/Southmost College campus. Archaeological site

41CF96, south of the later fort complex, is the remnants of the earthworks of the original Fort Brown (THC 2007a).

Brownsville has many other NRHP-listed historic buildings and sites. Near Fort Brown is the Neale House (ca. 1850). Although relocated, the Neale House is significant as one of the oldest houses in Brownsville. Within downtown Brownsville are the Gems Building and the Stillman House. Constructed in 1850 and listed in the NRHP in 1979, the Stillman House is one of the earliest Greek Revival-style brick structures in the region (ACHP 2007c). The house was originally built for and occupied by Charles Stillman, who hired a surveyor to lay out the town lots adjacent to Fort Brown before Brownsville was founded. The house was later occupied by Thomas Carson, Brownsville mayor from 1879 to 1892 and judge of the Cameron County Commissioners Court. There also are a number of historic shipwrecks that are reported west of Fort Brown including archaeological site 41CF177, a steamboat shipwreck site (THC 2007b).

2.9 Old Brulay Plantation Historic District

The Old Brulay Plantation, listed in the NRHP in 1975, is composed of the two-story brick house of French emigrant George N. Brulay and nine buildings associated with his sugar cane plantation. The Brulay Plantation was purchased in 1870 by Brulay. In 1872, he built the first commercial sugar mill in the area to produce *piloncillo* (a dark brown sugar) on his 300-acre plantation and began irrigating his fields. In irrigating his plantation, Brulay revolutionized agricultural practices in the lower Rio Grande Valley; in the early 20th century, irrigation districts established elaborate irrigation systems throughout the valley. Brulay’s cultivated fields are north of the structures (Clark 1975). The Brulay Cemetery is north and east of the plantation complex.

2.10 Archaeological Resources

Previously reported prehistoric archaeological resources within a mile of the Proposed Action are primarily open–air campsites and lithic scatters. Temporal and cultural affiliations of the sites are unclear, and few sites are very extensive. The recorders did not evaluate the NRHP eligibility of most of them. Additional prehistoric sites are expected to be found.

In general, historic archaeological sites can be expected to include early Spanish and Mexican colonial remains, forts, shipwrecks, early Republic and American-period sites, homesteads, industrial archaeological sites such as potteries and early irrigation and agricultural sites and features, and historic trash scatters. There might be additional types of historic archaeological sites identified upon further research. Should any sites be found through archaeological surveys, they would be considered for various treatment options such as redesigning the project or data recovery.

3. Cultural Resource Surveys

3.1 Area of Potential Effects

According to 36 CFR 800, the Area of Potential Effects (APE) of a Federal undertaking is defined as the geographical area within which effects on historic properties could occur if such properties hypothetically exist. According to 36 CFR 800, the APE should account for both direct and indirect effects. 36 CFR 800.5(a)(2) specifically cites as adverse effects both visual effects and changes to the setting of a historic property where the setting contributes to the significance of the property.

Under Alternative 2 of the Proposed Action, direct construction impacts would occur within a 60-foot–wide corridor that accounts for grading of vegetation and fence construction. Under Alternative 3, the direct construction APE would directly affect a 130-foot-wide corridor. In addition, there are ancillary areas outside the corridor of both alternatives such as construction staging areas. Thus, for direct construction purposes, the APE considers a 150-foot-wide corridor plus ancillary areas outside that corridor. A second APE for both Alternatives 2 and 3 is being delineated by USBP in consultation with the THC to account for visual impacts, noise, and other potential impacts that extend beyond immediate construction locations. Topography, type and density of vegetation and intervening development, orientation of streets and properties in relation to the Proposed Action, traffic patterns, and surrounding development all are factors to be considered in the definition of this latter APE.

Finally, several Native American tribes with ancestral ties to lands within the Rio Grande Valley Sector have been contacted for input into the cultural resources survey as required under NHPA.

3.2 Identification of Historic Properties

Efforts are underway to identify historic properties potentially affected by the Proposed Action. An archaeological survey is in progress, and an architectural survey would begin in the near future (November 2007). To prepare for these studies, information about previously recorded archaeological, historical, and architectural sites within the 150-foot survey corridor and within a 1-mile radius of the corridor was gathered from the two THC atlases. This information was plotted on project maps, aerial photographs, and topographic maps to identify areas of interest for further identification and evaluation. This data set was considered as a starting point because it has inherent limitations. Much of the survey data from the THC atlases are not recent and might not be complete. Not all of the area of the corridor has had recent archaeological surveys, and the information from past surveys is quite fragmentary. Information about architectural resources from the Texas Historic Sites Atlas is limited to buildings and historic districts listed in the NRHP. It is assumed that additional buildings and resources are eligible for listing in the NRHP but have not been formally listed or previously surveyed and evaluated.

3.3 Archaeological Resources

Pedestrian and subsurface archaeological survey of accessible portions of fence sections began October 19, 2007. Accessibility has been limited by Right of Entry (ROE) agreements for privately owned parcels, issuance of a Special Use Permit for surveys on lands managed by the USFWS, and Texas Antiquities Permit requirements for all non-Federal publicly owned land (e.g., Texas Parks and Wildlife, county land, municipal parks). The USFWS has found that the surveys would not be harmful to the refuge. The finding is in a public comment period through November 15, 2007.

The archaeological survey is being conducted in accordance with the Texas Archaeological Research Council requirements and standards identified in *Archaeological Survey Standards of Texas.* The survey also is being conducted in accordance with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation Projects* (including the *Standards and Guidelines for Identification, Evaluation, and Archaeological Documentation*). The survey is subject to a State Antiquities Permit from the THC, and the THC has been consulted in the development of the survey methodology. Professional archaeologists meeting the *Secretary of the Interior's Professional Qualifications Standards* are conducting the survey (NPS).

Priority for archaeological survey was determined based upon the general proportion of land in a given section for which access is available. At the time this document is being prepared, an archaeological survey has been completed for 20.6 miles of the 68.06 miles of surveyable alignment. This represents all accessible portions of the McAllen Sector (Sections O-3, O-4, and O-6), the Weslaco Sector (Sections O-7, O-8, O-9, and O-10), and portions of the Harlingen Sector (Sections O-11, O-12, O-13, and portions of O-14). Accessible portions of the Rio Grande City Sector (Sections O-1 and O-2), the Brownsville Sector (Sections O-17, O-18, O-19, and O-20), the Fort Brown Sector (Section O-21), and the remaining portions of the Harlingen Sector (Sections O-15 and O-16) are slated for survey beginning mid-November 2007. The status of archaeological survey is presented in more detail in **Table J-2**.

Archaeological survey to date has resulted in the identification of 11 previously unrecorded sites. The majority of these (n=8) are historic in age or have historic components. Five sites are either prehistoric or have prehistoric components. Preliminary results support a recommendation of eligible for listing in the NRHP for 6 sites, not eligible for 4 sites, and eligible for 1 site. These recommendations are preliminary and are subject to change as investigation continues. Sites recommended as NRHP eligible might require further testing before a determination can be made.

Table J-2. Archaeological Survey Status for All Fence Sections, as of November 1, 2007

Fence Section Number	County	Border Patrol Station	Total Mileage	Approximate Mileage Completed	Approximate Percentage Completed
O-1	Starr	Rio Grande City	5.28	0.00	0.0
O-2	Starr	Rio Grande City	7.3	0.00	0.0
O-3	Hidalgo	McAllen	1.85	0.56	30.0
O-4	Hidalgo	McAllen	4.35	3.48	80.0
O-5	Hidalgo	McAllen	1.72	0.00	0.0
O-6	Hidalgo	McAllen	3.85	2.70	70.0
O-7	Hidalgo	Weslaco	2.43	2.43	100.0
O-8	Hidalgo	Weslaco	2.04	1.63	80.0
O-9	Hidalgo	Weslaco	3.01	3.01	100.0
O-10	Hidalgo	Weslaco	2.42	1.45	60.0
O-11	Cameron	Harlingen	2.32	1.51	65.0
O-12	Cameron	Harlingen	0.95	0.81	85.0
O-13	Cameron	Harlingen	1.58	1.50	95.0
O-14	Cameron	Harlingen	3.06	1.53	50.0
O-15	Cameron	Harlingen	1.92	0.00	0.0
O-16	Cameron	Harlingen	2.97	0.00	0.0
O-17	Cameron	Brownsville	1.62	0.00	0.0
O-18	Cameron	Brownsville	3.58	0.00	0.0
O-19	Cameron	Brownsville	1.62	0.00	0.0
O-20	Cameron	Brownsville	0.9	0.00	0.0
O-21	Cameron	Fort Brown	13.29	0.00	0.0
		Total	**68.06**	**20.60**	**30.3**

The THC requires backhoe trenching of deep sediments on lands with high archaeological potential if the lands fall under the State Antiquities Permit.

All recorded archaeological resources would be evaluated for their NRHP eligibility using the National Register Criteria (36 CFR 60.4) and relevant guidance of the NPS such as *National Register Bulletins 15* and *22*. USBP would request the THC's concurrence regarding determination of a resource's NRHP eligibility; a determination of eligibility from the Keeper of the National Register (NPS) would be sought if the THC does not concur with USBP's evaluation.

3.4 Resources of the Built Environment

An architectural survey of buildings and structures that might be affected by the Proposed Action was begun in November 2007. The APE to be surveyed for indirect impacts related to the Proposed Action is being determined in discussion with the THC and would vary depending on the visual field in a given area, relative to the Proposed Action. Types of resources expected to be surveyed and evaluated include residences, commercial and institutional resources, ranches and plantations, levees, irrigation canals and pumphouses, ferry crossing, bridges, and industrial facilities such as water treatment plants as appropriate. Resources that pre-date 1968 would be surveyed and evaluated, consistent with THC requirements. Based on a windshield survey conducted on October 30–November 1, 2007, it is estimated that as many as 325 buildings and other resources predating 1968 mightrequire survey.

Information about past surveys of architectural resources available at the THC is being evaluated for completeness, level of effort, conformance to current standards, and survey results. This information would help to focus survey efforts so that resources are considered to the extent and manner appropriate. The architectural survey would be conducted in accordance with both the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* and the THC's *Historic Resources Survey Form* and survey guidance. Professionals who meet the *Secretary of the Interior's Professional Qualifications Standards* for architectural historian, historian, and other appropriate discipline would conduct the survey (ACHP 2007a, DOI 1983). The THC has been consulted in the delineation of the APEs and the development of the survey methodology.

All surveyed resources would be evaluated for their NRHP eligibility using the National Register Criteria (36 CFR 60.4) and relevant guidance of the NPS such as *National Register Bulletins 15* and *22*. USBP would request THC concurrence regarding determination of a property's NRHP eligibility; a determination of eligibility from the keeper of the National Register (NPS) would be sought if the THC does not concur with USBP's evaluation.

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APPENDIX K

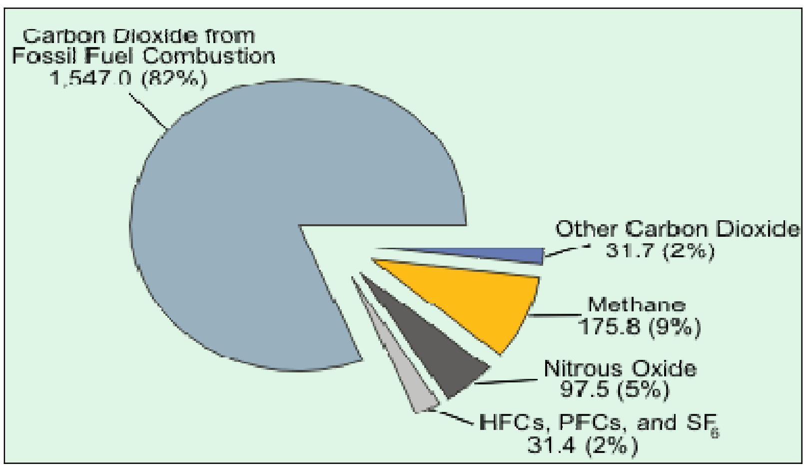
Air Quality Information

Greenhouse Gases

In April 2007, the U.S. Supreme Court declared that carbon dioxide (CO_2) and other greenhouse gases are air pollutants under the Clean Air Act (CAA). The Court declared that the U.S. Environmental Protection Agency (USEPA) has the authority to regulate emissions from new cars and trucks under the landmark environment law.

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases." These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere. Over time, the trapped heat results in the phenomenon of global warming.

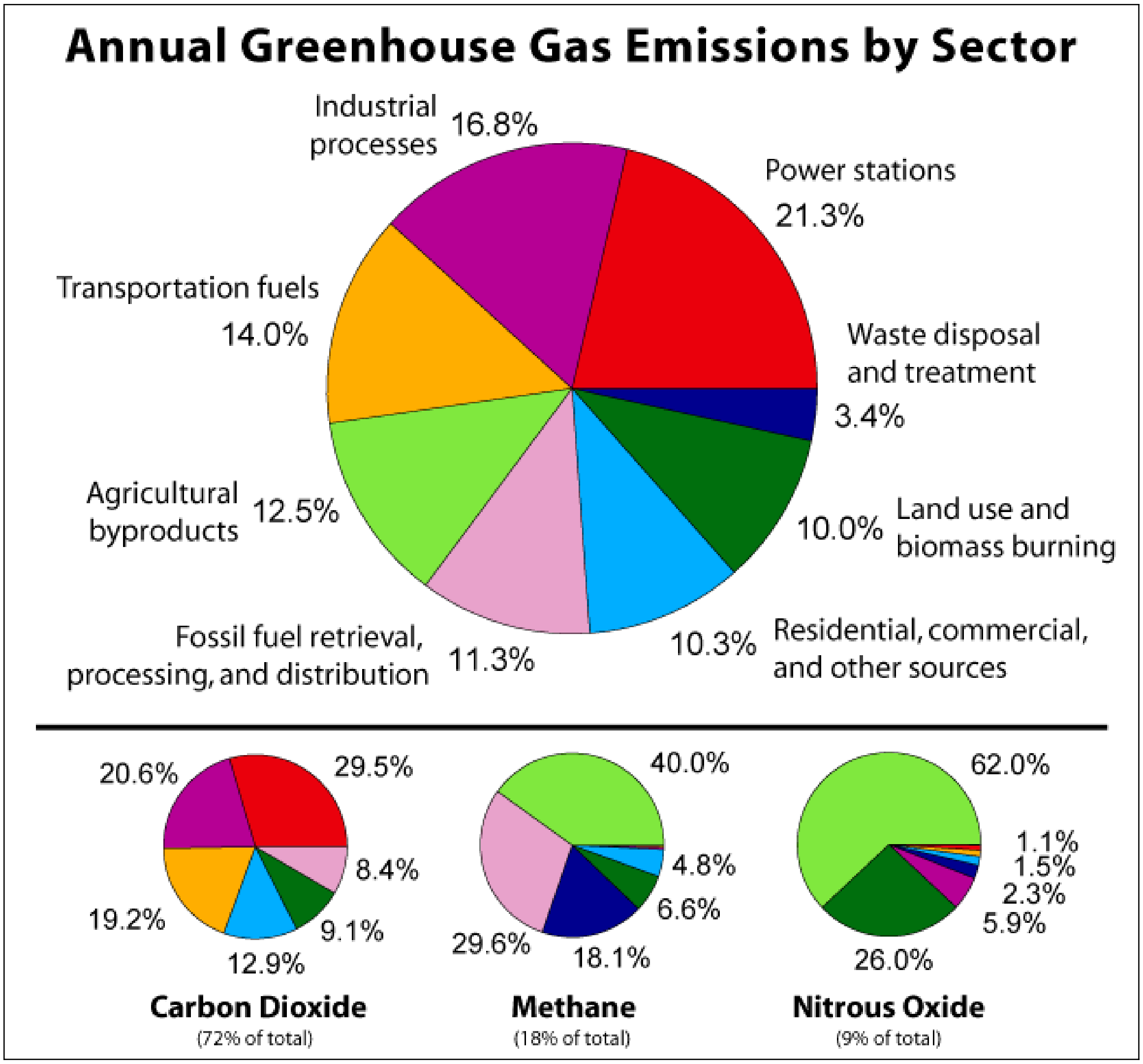
Many gases exhibit these "greenhouse" properties. The sources of the majority of greenhouse gases come mostly from natural sources but are also contributed to by human activity and are shown in **Figure K-1**. It is not possible to state that a specific gas causes a certain percentage of the greenhouse effect because the influences of the various gases are not additive.



Source: Energy Information Administration 2003

Figure K-1. Greenhouse Gas Emissions From Burning of Gas (Million Metric Tons of Carbon Equivalent)

Figure K-2 displays the annual greenhouse gas emissions by sector in the United States. Most government agencies and military installations are just beginning to establish a baseline for their operations and their impact on the greenhouse effect. Since the USEPA has not promulgated an ambient standard or *de minimis* level for CO_2 emissions for Federal actions, there is no standard value to compare an action against in terms of meeting or violating the standard. Hence, we shall attempt to establish the effects on air quality as a result of the amount of CO_2 produced by the Federal action and what could be done to minimize the impact of these emissions.



Source: Rosmarino 2006

Figure K-2. Annual Greenhouse Gas Emissions by Sector

References

Energy Information Administration. 2003. "Greenhouse Gases, Climate Change, and Energy." EIA Brochure. 2003. Available online: <*http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html*> Last updated April 2, 2004. Accessed November 4, 2007.

Tanyalynnette Rosmarino, Director of Field Engineering, Northeast, BigFix, Inc. 2006. "A Self-Funding Enterprise Solution to Reduce Power Consumption and Carbon Emissions." Slide presentation for the NYS Forum's May Executive Committee Meeting Building an Energy Smart IT Environment. 2006. Available online: <*http://www.nysforum.org/documents/html/2007/execcommittee/may/enterprisepowerconsumptionreduction_files/800x600/slide1.html*> Accessed November 4, 2007.

Summary	Summarizes total emissions by calendar year.
Combustion	Estimates emissions from non-road equipment exhaust as well as painting.
Fugitive	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions
Maintenance Emissions	Estimates the total emissions from future maintenance of fencelines and patrol roads from mowers.
Generator Emissions	Estimates the total emissions from emergency generators to power construction equipment.
AQCR Tier Report	Summarizes total emissions for the Brownsville-Laredo Intrastate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

Air Quality Emissions from Alternative 2, Route A

		NO_x (ton)	VOC (ton)	CO (ton)	SO_2 (ton)	PM_{10} (ton)	
CY2008	Construction Combustion	470.443	70.127	549.588	9.409	15.782	
	Construction Fugitive Dust	-	-	-	-	646.336	662.118
	Maintenance Emissions	0.042	0.005	0.021	0.010	0.005	
	Generator Emissions	22.777	1.859	4.907	1.498	1.601	
	TOTAL CY2008	493.263	71.992	554.516	10.917	663.724	

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because the Alternative 2, Route A is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

Brownsville-Laredo Intrastate AQCR

	Point and Area Sources Combined				
Year	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)
2001	44,137	73,577	317,422	2,940	132,788

Source: USEPA-AirData NET Tier Report (http://www.epa.gov/air/data/geosel.html). Site visited on 15 October 2007.

Determination Significance (Significance Threshold = 10%) for Construction Activities

	Point and Area Sources Combined				
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)
Minimum - 2001	44,137	73,577	317,422	2,940	132,788
2008 Emissions	493.263	71.992	554.516	10.917	663.724
Alternative 2, Route A %	**1.118%**	**0.098%**	**0.175%**	**0.371%**	**0.500%**

Construction Combustion Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO and PM_{10} Due to Construction

Includes:

100% of Construct Pedestrian Fence and Patrol Road	22,134,816	ft^2

Assumptions:

Total ground disturbance for pedestrian fence and patrol road would be 69.87 miles long by 60 feet wide (22,134,816 ft^2).
No grading would be required in construction staging areas.
Patrol road would be graded and lined with gravel. No paving would be included in Alternative 2, Route A.
Construction would occur between March and December 2008 for a total of 190 working days.

Total Building Construction Area:	0	ft^2	(none)
Total Demolished Area:	0	ft^2	(none)
Total Paved Area:	0	ft^2	(none)
Total Disturbed Area:	22,134,816	ft^2	
Construction Duration:	1.0	year(s)	
Annual Construction Activity:	190	days/yr	

Emissions Factors Used for Construction Equipment

Reference: Guide to Air Quality Assessment, SMAQMD, 2004

Emissions factors are taken from Table 3-2. Assumptions regarding the type and number of equipment are from Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Bulldozer	1	29.40	3.66	25.09	0.59	1.17
Motor Grader	1	10.22	1.76	14.98	0.20	0.28
Water Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	3	60.51	9.02	70.69	1.21	2.03

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Paver	1	7.93	1.37	11.62	0.16	0.22
Roller	1	5.01	0.86	7.34	0.10	0.14
Total per 10 acres of activity	2	12.94	2.23	18.96	0.26	0.36

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Loader	1	7.86	1.35	11.52	0.16	0.22
Haul Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	2	28.75	4.95	42.14	0.58	0.80

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Stationary						
Generator Set	1	11.83	1.47	10.09	0.24	0.47
Industrial Saw	1	17.02	2.12	14.52	0.34	0.68
Welder	1	4.48	0.56	3.83	0.09	0.18
Mobile (non-road)						
Truck	1	20.89	3.60	30.62	0.84	0.58
Forklift	1	4.57	0.79	6.70	0.18	0.13
Crane	1	8.37	1.44	12.27	0.33	0.23
Total per 10 acres of activity	6	67.16	9.98	78.03	2.02	2.27

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Air Compressor	1	6.83	0.85	5.82	0.14	0.27
Total per 10 acres of activity	1	6.83	0.85	5.82	0.14	0.27

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activitiy, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
b) The SMAQMD 2004 reference lists emissions factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC.
c) The SMAQMD 2004 reference does not provide SO_2 emissions factors. For this worksheet, SO_2 emissions have been estimated based on approximate fuel use rate for diesel equipment and the assumption of 500 ppm sulfur diesel fuel. For the average of the equipment fleet, the resulting SO_2 factor was found to be approximately 0.04 times the NOx emissions factor for the mobile equipment (based upon 2002 USAF IERA "Air Emissions Inventory Guidance") and 0.02 times the NOx emissions factor for all other equipment (based on AP-42, Table 3.4-1)
d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSIONS FACTOR SUMMARY

Source	Equipment Multiplier*	SMAQMD Emissions Factors (lb/day)				
		NO_x	VOC	CO	SO_2**	PM_{10}
Grading Equipment	51	156814.195	23375.707	183196.091	3136.284	5260.830
Paving Equipment	1	0.000	0.000	0.000	0.000	0.000
Demolition Equipment	1	0.000	0.000	0.000	0.000	0.000
Building Construction	1	0.000	0.000	0.000	0.000	0.000
Air Compressor for Architectural Coating	1	0.000	0.000	0.000	0.000	0.000
Architectural Coating**			0.000			

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project
**Emissions factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emissions Factor for Grading Equipment NOx = (Total Grading NOx per 10 ac*((total disturbed area/43560)/10))*(Equipment Multiplier)

BW1 FOIA CBP 001149

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	22,134,816	508.15	6	(from "CY2008 Grading" worksheet)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per the SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}
Grading Equipment	940,885.17	140,254.24	1,099,176.55	18,817.70	31,564.98
Paving	-	-	-	-	-
Demolition	-	-	-	-	-
Building Construction	-	-	-	-	-
Architectural Coatings	-	-	-	-	-
Total Emissions (lbs):	**940,885.17**	**140,254.24**	**1,099,176.55**	**18,817.70**	**31,564.98**

Results: Total Project Annual Emissions Rates

	NO_x	VOC	CO	SO_2	PM_{10}
Total Project Emissions (lbs)	940,885.17	140,254.24	1,099,176.55	18,817.70	31,564.98
Total Project Emissions (tons)	470.44	70.13	549.59	9.41	15.78

CO2 Emissions

It is assumed that 30 vehicles consisting of bulldozer, grader, forklift, cranes, rollers, and light duty trucks would be usefor this project.

It is further assumed that the total approximate average miles per day per vehicle would be 10 miles

It is assumed that the average vehicle will produce 19.5 pounds of CO2 per gallon of gas used. (www.eia.doe.gov/oiaf/1605/coefficients)

30 vehicles x 10 miles/day/vehicle x 190 days working x 1 gal/10 miles x 19.5 lb co2/gal x ton/2000lb = 55 tons CO2

Estimate emissions of CO2 for BLIAQCR region is 995,000 tons per year

BW1 FOIA CBP 001150

Construction Fugitive Dust Emissions for CY 2008

Calculation of PM_{10} Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions

Acres graded per year:	508.15	acres/yr	(From "CY2008 Combustion" worksheet)
Grading days/yr:	5.59	days/yr	(From "CY2008 Grading worksheet)
Exposed days/yr:	90	assumed days/yr graded area is exposed	
Grading Hours/day:	8	hr/day	
Soil piles area fraction:	0.10	(assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5	%	(mean silt content; expected range: 0.56 to 23, AP-42 Table 13.2.2-1)
Soil percent moisture, M:	85	%	(http://www.cpc.noaa.gov/products/soilmst/w.shtml)
Annual rainfall days, p:	70	days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, I:	39.5	%	Ave. of wind speed at Brownsville, TX (ftp://ftp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/)
Fraction of TSP, J:	0.5	per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	8	ft	
Qty construction vehicles:	152.44	vehicles	(From "CY2008 Grading worksheet)
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)
PM_{10} Adjustment Factor k	1.5	lb/VMT	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor a	0.9	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor b	0.45	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
Mean Vehicle Weight W	40	tons	assumed for aggregate trucks

TSP - Total Suspended Particulate
VMT - Vehicle Miles Traveled

BW1 FOIA CBP 001151

Emissions Due to Soil Disturbance Activities

Operation Parameters (Calculated from User Inputs)

Grading duration per acre	0.1	hr/acre	
Bulldozer mileage per acre	1	VMT/acre	(Miles traveled by bulldozer during grading)
Construction VMT per day	762	VMT/day	
Construction VMT per acre	8.4	VMT/acre	(Travel on unpaved surfaces within site)

Equations Used (Corrected for PM_{10})

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})/(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(k(s/12)^{a}(W/3)^{b})]\ [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emissions Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

Calculation of PM_{10} Emissions Factors for Each Operation

Operation	Emissions Factor (mass/ unit)	Operation Parameter	Emissions Factor (lbs/ acre)
Bulldozing	0.04 lbs/hr	0.1 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	2.85 lbs/VMT	8.4 VMT/acre	24.00 lbs/acre

BW1 FOIA CBP 001152

Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

Soil Piles EF = 1.7(s/1.5)[(365 - p)/235](I/15)(J) = (s)(365 - p)(I)(J)/(3110.2941), p. A9-99.

Soil Piles EF = 15.9 lbs/day/acre covered by soil piles

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)
Soil Piles EF = 1.59 lbs/day/acres graded

Graded Surface EF = 26.4 lbs/day/acre (recommended in CEQA Manual, p. A9-93).

Calculation of Annual PM_{10} Emissions

Source	Emissions Factor		Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing	0.00	lbs/acre	508.15	NA	0	0.000
Grading	0.80	lbs/acre	508.15	NA	407	0.203
Vehicle Traffic	24.00	lbs/acre	508.15	NA	12,195	6.098
Erosion of Soil Piles	1.59	lbs/acre/day	508.15	90	72,716	36.358
Erosion of Graded Surface	26.40	lbs/acre/day	508.15	90	1,207,354	603.677
TOTAL					1,292,671	646.34

Soil Disturbance EF: 24.80 lbs/acre
Wind Erosion EF: 27.99 lbs/acre/day

Back calculate to get EF: 455.46 lbs/acre/grading day

BW1 FOIA CBP 001153

Construction (Grading) Schedule for CY 2008

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 508.15 acres/yr (from "CY2008 Combustion" Worksheet)
Qty Equipment: 152.44 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	508.15	63.52
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	508.15	248.43
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	254.07	256.19
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	254.07	105.10
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	508.15	178.22
TOTAL								851.46

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 851.46
Qty Equipment: 152.44
Grading days/yr: 5.59

BW1 FOIA CBP 001154

Maintenance Activities Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO and PM_{10} Due to Maintenance Activities

The pedestrian fenceline and patrol road would require mowing approximately two times per year to maintain vegetation height and allow enhanced visibility and security.

Assumptions:
Approximately 508.15 acres of land would be mowed twice per year.
Two agricultural mowers (40 horsepower) would operate for approximately 14 days.
Each working day would be 8 hours.
Agricultural mowers operate at 43% load capacity (17.2 horsepower).

Emissions Factors Used for Maintenance Equipment

Reference: USAF IERA "Air Emissions Inventory Guidance", July 2001, Table 7-6. Criteria Pollutant Emissions Factors for Nonroad Diesel Engines.

Emissions Factors

Equipment	Rated Power (hp)	Loading Factor (% of Max Power)	Operating Time (hr/yr)	BSFC (lb/hp-hr)	NO_x (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	SO_2 (g/hp-hr)	PM_{10} (g/hp-hr)
Agricultural Mower (Diesel)	40	43	224	0.408	5.0	0.6	2.5	1.19	0.6

BSFC = Brake Specific Fuel Consumption

Results: Total Maintenance Annual Emissions Rates

	NO_x	VOC	CO	SO_2	PM_{10}
Total Maintenance Emissions (lbs)	84.954	10.195	42.477	20.219	10.195
Total Maintenance Emissions (tons)	0.042	0.005	0.021	0.010	0.005

Example:
Total Maintenance Emissions (lbs of NO_x) =
(Rated power output of equipment engine)*(Loading Factor/100)*(Operating Time)*(Number of Equipment)*(Emissions Factor)*(Conversion factor)

Total Maintenance Emissions (lbs of NO_x) = (40 hp)*(43/100)*(224 hr/yr)*(2 Equipment)*(5.0 g/hp-hr)*(0.002205 lb/g) = 84.95 lbs/yr

BW1 FOIA CBP 001155

Emissions from Diesel Powered Generators for Construction Equipment

Alternative 2, Route A would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6	
Maximum Hours of Operation	8	hrs/day
Number of Construction Days	190	

Total Generator Capacity	75	hp
Hourly Rate	0.5262	MMBtu/hr
Annual Use	4,799	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Generator Emissions Factors (Diesel)

NO_x	4.41	lb/MMBtu
VOC	0.36	lb/MMBtu
CO	0.95	lb/MMBtu
SO_x	0.29	lb/MMBtu
PM_{10}	0.31	lb/MMBtu

Emissions (Diesel)

NO_x	10.581	tpy
VOC	0.864	tpy
CO	2.279	tpy
SO_x	0.696	tpy
PM_{10}	0.744	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (4,799*4.41)/2000 = 10.581 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

BW1 FOIA CBP 001156

Emissions from Diesel Powered Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 365 days per year.

Number of Generators	30	
Maximum Hours of Operation	12	hrs/day
Number of Construction Days	365	

Total Generator Capacity	6	hp
Hourly Rate	0.0421	MMBtu/hr
Annual Use	5,531	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Generator Emissions Factors (Diesel)

NO_x	4.41	lb/MMBtu
VOC	0.36	lb/MMBtu
CO	0.95	lb/MMBtu
SO_x	0.29	lb/MMBtu
PM_{10}	0.31	lb/MMBtu

Emissions (Diesel)

NO_x	12.196	tpy
VOC	0.996	tpy
CO	2.627	tpy
SO_x	0.802	tpy
PM_{10}	0.857	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (5,531*4.41)/2000 = 12.196 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

BW1 FOIA CBP 001157

Brownsville-Laredo Intrastate Air Quality Control Region

			Area Source Emissions						Point Source Emissions					
Row # SORT	State	County	CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2	VOC
1	TX	Cameron Co	84,539	10,659	36,197	6,679	849	15,988	386	1,169	149	111	136	516
2	TX	Hidalgo Co	145,505	17,041	61,198	11,285	1,161	27,056	4,064	2,697	319	313	41	773
3	TX	Jim Hogg Co	1,621	110	1,229	291	18.5	763	77.3	293	3.32	3.32	0.08	50
4	TX	Starr Co	17,040	2,251	12,645	2,259	141	4,287	433	1,144	0.47	0.42	30.4	215
5	TX	Webb Co	47,946	5,122	9,943	2,380	376	13,764	755	1,128	36.7	35.6	25.2	124
6	TX	Willacy Co	9,021	1,371	9,238	1,777	121	2,753	144	253	1.61	1.61	0.02	49.6
7	TX	Zapata Co	5,466	396	1,828	477	40.1	7,134	425	503	0.18	0.17	0.21	104
Grand Total			311,138	36,950	132,278	25,148	2,707	71,745	6,284	7,187	510	465	233	1,832

SOURCE:
http://www.epa.gov/air/data/geosel.html
USEPA - AirData NET Tier Report
*Net Air pollution sources (area and point) in tons per year (2001)
Site visited on 15 October 2007.

Brownsville-Laredo Intrastate AQCR (40 CFR 81.135):
In the State of Texas: Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, Zapata County

BW1 FOIA CBP 001158

Summary	Summarizes total emissions by calendar year.
Combustion	Estimates emissions from non-road equipment exhaust as well as painting.
Fugitive	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions
Maintenance Emissions	Estimates the total emissions from future maintenance of fencelines and patrol roads from mowers.
Generator Emissions	Estimates the total emissions from emergency generators to power construction equipment.
AQCR Tier Report	Summarizes total emissions for the Brownsville-Laredo Intrastate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

BW1 FOIA CBP 001159

Air Quality Emissions from Alternative 2, Route B

		NO_x (ton)	VOC (ton)	CO (ton)	SO_2 (ton)	PM_{10} (ton)
CY2008	Construction Combustion	470.241	70.097	549.352	9.405	15.776
	Construction Fugitive Dust	-	-	-	-	645.982
	Maintenance Emissions	0.042	0.005	0.021	0.010	0.005
	Generator Emissions	22.777	1.859	4.907	1.498	1.601
	TOTAL CY2008	493.061	71.961	554.280	10.913	663.364

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because Alternative 2, Route B is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

Brownsville-Laredo Intrastate AQCR

	Point and Area Sources Combined				
Year	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)
2001	44,137	73,577	317,422	2,940	132,788

Source: USEPA-AirData NET Tier Report (http://www.epa.gov/air/data/geosel.html). Site visited on 15 October 2007.

Determination Significance (Significance Threshold = 10%) for Construction Activities

	Point and Area Sources Combined				
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)
Minimum - 2001	44,137	73,577	317,422	2,940	132,788
2008 Emissions	493.061	71.961	554.280	10.913	663.364
Alternative 2, Route B %	**1.117%**	**0.098%**	**0.175%**	**0.371%**	**0.500%**

Construction Combustion Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO and PM_{10} Due to Construction

Includes:

100% of Construct Pedestrian Fence and Patrol Road 22,125,312 ft^2

Assumptions:

Total ground disturbance for pedestrian fence and patrol road would be 69.84 miles long by 60 feet wide (22,125,312 ft^2).
Alternative 2
Patrol road would be graded and lined with gravel. No paving would be included in Alternative 2, Route B.
Construction would occur between March and December 2008 for a total of 190 working days.

Total Building Construction Area:	0 ft^2	(none)
Total Demolished Area:	0 ft^2	(none)
Total Paved Area:	0 ft^2	(none)
Total Disturbed Area:	22,125,312 ft^2	
Construction Duration:	1.0 year(s)	
Annual Construction Activity:	190 days/yr	

BW1 FOIA CBP 001161

Emissions Factors Used for Construction Equipment

Reference: Guide to Air Quality Assessment, SMAQMD, 2004

Emissions factors are taken from Table 3-2. Assumptions regarding the type and number of equipment are from Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Bulldozer	1	29.40	3.66	25.09	0.59	1.17
Motor Grader	1	10.22	1.76	14.98	0.20	0.28
Water Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	3	60.51	9.02	70.69	1.21	2.03

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Paver	1	7.93	1.37	11.62	0.16	0.22
Roller	1	5.01	0.86	7.34	0.10	0.14
Total per 10 acres of activity	2	12.94	2.23	18.96	0.26	0.36

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Loader	1	7.86	1.35	11.52	0.16	0.22
Haul Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	2	28.75	4.95	42.14	0.58	0.80

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Stationary						
Generator Set	1	11.83	1.47	10.09	0.24	0.47
Industrial Saw	1	17.02	2.12	14.52	0.34	0.68
Welder	1	4.48	0.56	3.83	0.09	0.18
Mobile (non-road)						
Truck	1	20.89	3.60	30.62	0.84	0.58
Forklift	1	4.57	0.79	6.70	0.18	0.13
Crane	1	8.37	1.44	12.27	0.33	0.23
Total per 10 acres of activity	6	67.16	9.98	78.03	2.02	2.27

Note: Footnotes for tables are on following page

BW1 FOIA CBP 001162

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Air Compressor	1	6.83	0.85	5.82	0.14	0.27
Total per 10 acres of activity	1	6.83	0.85	5.82	0.14	0.27

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activitiy, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emissions factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC.

c) The SMAQMD 2004 reference does not provide SO_2 emissions factors. For this worksheet, SO_2 emissions have been estimated based on approximate fuel use rate for diesel equipment and the assumption of 500 ppm sulfur diesel fuel. For the average of the equipment fleet, the resulting SO_2 factor was found to be approximately 0.04 times the NOx emissions factor for the mobile equipment (based upon 2002 USAF IERA "Air Emissions Inventory Guidance") and 0.02 times the NOx emissions factor for all other equipment (based on AP-42, Table 3.4-1)

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSIONS FACTOR SUMMARY

Source	Equipment Multiplier*	SMAQMD Emissions Factors (lb/day)				
		NO_x	VOC	CO	SO_2**	PM_{10}
Grading Equipment	51	156746.864	23365.670	183117.432	3134.937	5258.571
Paving Equipment	1	0.000	0.000	0.000	0.000	0.000
Demolition Equipment	1	0.000	0.000	0.000	0.000	0.000
Building Construction	1	0.000	0.000	0.000	0.000	0.000
Air Compressor for Architectural Coating	1	0.000	0.000	0.000	0.000	0.000
Architectural Coating**			0.000			

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project

**Emissions factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emissions Factor for Grading Equipment NOx = (Total Grading NOx per 10 ac*((total disturbed area/43560)/10))*(Equipment Multiplier)

BW1 FOIA CBP 001163

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	22,125,312	507.93	6	(from "CY2008 Grading" worksheet)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per the SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}
Grading Equipment	940,481.19	140,194.02	1,098,704.59	18,809.62	31,551.43
Paving	-	-	-	-	-
Demolition	-	-	-	-	-
Building Construction	-	-	-	-	-
Architectural Coatings	-	-	-	-	-
Total Emissions (lbs):	**940,481.19**	**140,194.02**	**1,098,704.59**	**18,809.62**	**31,551.43**

Results: Total Project Annual Emissions Rates

	NO_x	VOC	CO	SO_2	PM_{10}
Total Project Emissions (lbs)	940,481.19	140,194.02	1,098,704.59	18,809.62	31,551.43
Total Project Emissions (tons)	470.24	70.10	549.35	9.40	15.78

CO2 Emissions

BW1 FOIA CBP 001164

Construction Fugitive Dust Emissions for CY 2008

Calculation of PM_{10} Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions

Acres graded per year:	507.93	acres/yr	(From "CY2008 Combustion" worksheet)
Grading days/yr:	5.56	days/yr	(From "CY2008 Grading worksheet)
Exposed days/yr:	90	assumed days/yr graded area is exposed	
Grading Hours/day:	8	hr/day	
Soil piles area fraction:	0.10	(assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5	%	(mean silt content; expected range: 0.56 to 23, AP-42 Table 13.2.2-1)
Soil percent moisture, M:	85	%	(http://www.cpc.noaa.gov/products/soilmst/w.shtml)
Annual rainfall days, p:	70	days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, I:	39.5	%	Ave. of wind speed at Brownsville, TX (ftp://ftp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/)
Fraction of TSP, J:	0.5	per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	8	ft	
Qty construction vehicles:	152.38	vehicles	(From "CY2008 Grading worksheet)
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)
PM_{10} Adjustment Factor k	1.5	lb/VMT	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor a	0.9	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor b	0.45	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
Mean Vehicle Weight W	40	tons	assumed for aggregate trucks

TSP - Total Suspended Particulate
VMT - Vehicle Miles Traveled

BW1 FOIA CBP 001165

Emissions Due to Soil Disturbance Activities

Operation Parameters (Calculated from User Inputs)

Grading duration per acre	0.1	hr/acre	
Bulldozer mileage per acre	1	VMT/acre	(Miles traveled by bulldozer during grading)
Construction VMT per day	762	VMT/day	
Construction VMT per acre	8.3	VMT/acre	(Travel on unpaved surfaces within site)

Equations Used (Corrected for PM10)

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})/(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(k(s/12)^{a}(W/3)^{b})]\ [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emissions Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

Calculation of PM_{10} Emissions Factors for Each Operation

Operation	Emissions Factor (mass/ unit)	Operation Parameter	Emissions Factor (lbs/ acre)
Bulldozing	0.04 lbs/hr	0.1 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	2.85 lbs/VMT	8.3 VMT/acre	23.70 lbs/acre

BW1 FOIA CBP 001166

Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

Soil Piles EF = 1.7(s/1.5)[(365 - p)/235](I/15)(J) = (s)(365 - p)(I)(J)/(3110.2941), p. A9-99.

Soil Piles EF = 15.9 lbs/day/acre covered by soil piles

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)
Soil Piles EF = 1.59 lbs/day/acres graded

Graded Surface EF = 26.4 lbs/day/acre (recommended in CEQA Manual, p. A9-93).

Calculation of Annual PM_{10} Emissions

Source	Emissions Factor		Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing	0.00	lbs/acre	507.93	NA	0	0.000
Grading	0.80	lbs/acre	507.93	NA	406	0.203
Vehicle Traffic	23.70	lbs/acre	507.93	NA	12,038	6.019
Erosion of Soil Piles	1.59	lbs/acre/day	507.93	90	72,684	36.342
Erosion of Graded Surface	26.40	lbs/acre/day	507.93	90	1,206,835	603.418
TOTAL					1,291,964	645.98

Soil Disturbance EF: 24.50 lbs/acre
Wind Erosion EF: 27.99 lbs/acre/day

Back calculate to get EF: 457.26 lbs/acre/grading day

BW1 FOIA CBP 001167

Construction (Grading) Schedule for CY 2008

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 507.93 acres/yr (from "CY2008 Combustion" Worksheet)
Qty Equipment: 152.38 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	507.93	63.49
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	507.93	248.32
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	253.96	256.08
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	253.96	105.06
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	507.93	178.14
TOTAL								851.09

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 851.09
Qty Equipment: 153.00
Grading days/yr: 5.56

Maintenance Activities Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO and PM_{10} Due to Maintenance Activities

The fenceline and patrol road would require mowing approximately two times per year to maintain vegetation height and allow enhanced visibility and security.

Assumptions:
Approximately 507.93 acres of land would be mowed twice per year.
Two agricultural mowers (40 horsepower) would operate for approximately 14 days.
Each working day would be 8 hours.
Agricultural mowers operate at 43% load capacity (17.2 horsepower).

Emissions Factors Used for Maintenance Equipment

Reference: USAF IERA "Air Emissions Inventory Guidance", July 2001, Table 7-6. Criteria Pollutant Emissions Factors for Nonroad Diesel Engines.

				Emissions Factors					
Equipment	Rated Power (hp)	Loading Factor (% of Max Power)	Operating Time (hr/yr)	BSFC (lb/hp-hr)	NO_x (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	SO_2 (g/hp-hr)	PM_{10} (g/hp-hr)
Agricultural Mower (Diesel)	40	43	224	0.408	5.0	0.6	2.5	1.19	0.6

BSFC = Brake Specific Fuel Consumption

Results: Total Maintenance Annual Emissions Rates

	NO_x	VOC	CO	SO_2	PM_{10}
Total Maintenance Emissions (lbs)	84.954	10.195	42.477	20.219	10.195
Total Maintenance Emissions (tons)	0.042	0.005	0.021	0.010	0.005

Example:
Total Maintenance Emissions (lbs of NO_x) =
(Rated power output of equipment engine)*(Loading Factor/100)*(Operating Time)*(Number of Equipment)*(Emissions Factor)*(Conversion factor)

Total Maintenance Emissions (lbs of NO_x) = (40 hp)*(43/100)*(224 hr/yr)*(2 Equipment)*(5.0 g/hp-hr)*(0.002205 lb/g) = 84.95 lbs/yr

BW1 FOIA CBP 001169

Emissions from Diesel Powered Generators for Construction Equipment

Alternative 2, Route B would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6	
Maximum Hours of Operation	8	hrs/day
Number of Construction Days	190	

Total Generator Capacity	75	hp
Hourly Rate	0.5262	MMBtu/hr
Annual Use	4,799	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Generator Emissions Factors (Diesel)

NO_x	4.41	lb/MMBtu
VOC	0.36	lb/MMBtu
CO	0.95	lb/MMBtu
SO_x	0.29	lb/MMBtu
PM_{10}	0.31	lb/MMBtu

Emissions (Diesel)

NO_x	10.581	tpy
VOC	0.864	tpy
CO	2.279	tpy
SO_x	0.696	tpy
PM_{10}	0.744	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (4,799*4.41)/2000 = 10.581 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

BW1 FOIA CBP 001170

Emissions from Diesel Powered Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 365 days per year.

Number of Generators	30	
Maximum Hours of Operation	12	hrs/day
Number of Construction Days	365	

Total Generator Capacity	6	hp
Hourly Rate	0.0421	MMBtu/hr
Annual Use	5,531	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
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NO_x	4.41	lb/MMBtu
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PM_{10}	0.31	lb/MMBtu

Emissions (Diesel)

NO_x	12.196	tpy
VOC	0.996	tpy
CO	2.627	tpy
SO_x	0.802	tpy
PM_{10}	0.857	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (5,531*4.41)/2000 = 12.196 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Brownsville-Laredo Intrastate Air Quality Control Region

			Area Source Emissions						Point Source Emissions					
Row #	State	County	CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2	VOC
SORT														
1	TX	Cameron Co	84,539	10,659	36,197	6,679	849	15,988	386	1,169	149	111	136	516
2	TX	Hidalgo Co	145,505	17,041	61,198	11,285	1,161	27,056	4,064	2,697	319	313	41	773
3	TX	Jim Hogg Co	1,621	110	1,229	291	18.5	763	77.3	293	3.32	3.32	0.08	50
4	TX	Starr Co	17,040	2,251	12,645	2,259	141	4,287	433	1,144	0.47	0.42	30.4	215
5	TX	Webb Co	47,946	5,122	9,943	2,380	376	13,764	755	1,128	36.7	35.6	25.2	124
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Grand Total			311,138	36,950	132,278	25,148	2,707	71,745	6,284	7,187	510	465	233	1,832

SOURCE:
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USEPA - AirData NET Tier Report
*Net Air pollution sources (area and point) in tons per year (2001)
Site visited on 15 October 2007.

Brownsville-Laredo Intrastate AQCR (40 CFR 81.135):
In the State of Texas: Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, Zapata County

Summary	Summarizes total emissions by calendar year.
Combustion	Estimates emissions from non-road equipment exhaust as well as painting.
Fugitive	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions
Maintenance Emissions	Estimates the total emissions from future maintenance of fencelines and patrol roads from mowers.
Generator Emissions	Estimates the total emissions from emergency generators to power construction equipment.
AQCR Tier Report	Summarizes total emissions for the Brownsville-Laredo Intrastate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

Air Quality Emissions from Alternative 3

		NO_x (ton)	VOC (ton)	CO (ton)	SO_2 (ton)	PM_{10} (ton)
CY2008	Construction Combustion	2,927.478	436.388	3,419.987	58.550	98.212
	Construction Fugitive Dust	-	-	-	-	1,615.145
	Maintenance Emissions	0.127	0.015	0.064	0.030	0.015
	Generator Emissions	22.777	1.859	4.907	1.498	1.601
	TOTAL CY2008	2,950.383	438.263	3,424.958	60.078	1,714.973

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because Alternative 3 is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

Brownsville-Laredo Intrastate AQCR

	Point and Area Sources Combined				
Year	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)
2001	44,137	73,577	317,422	2,940	132,788

Source: USEPA-AirData NET Tier Report (http://www.epa.gov/air/data/geosel.html). Site visited on 15 October 2007.

Determination Significance (Significance Threshold = 10%) for Construction Activities

	Point and Area Sources Combined				
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)
Minimum - 2001	44,137	73,577	317,422	2,940	132,788
2008 Emissions	2,950.383	438.263	3,424.958	60.078	1,714.973
Alternative 3 %	**6.685%**	**0.596%**	**1.079%**	**2.044%**	**1.292%**

BW1 FOIA CBP 001174

Construction Combustion Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO and PM_{10} Due to Construction

Includes:

100% of Construct Pedestrian Fences and Patrol Road	55,313,280	ft^2

Assumptions:

Total ground disturbance for pedestrian fence and patrol road would be 69.84 miles long by 150 feet wide (55,313,280 ft^2).
No grading would be required in construction staging areas.
Patrol road would be graded and lined with gravel. No paving would be included in Alternative 3.
Construction would occur between March and December 2008 for a total of 190 working days.

Total Building Construction Area:	0	ft^2	(none)
Total Demolished Area:	0	ft^2	(none)
Total Paved Area:	0	ft^2	(none)
Total Disturbed Area:	55,313,280	ft^2	
Construction Duration:	1.0	year(s)	
Annual Construction Activity:	190	days/yr	

Emissions Factors Used for Construction Equipment

Reference: Guide to Air Quality Assessment, SMAQMD, 2004

Emissions factors are taken from Table 3-2. Assumptions regarding the type and number of equipment are from Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Bulldozer	1	29.40	3.66	25.09	0.59	1.17
Motor Grader	1	10.22	1.76	14.98	0.20	0.28
Water Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	3	60.51	9.02	70.69	1.21	2.03

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Paver	1	7.93	1.37	11.62	0.16	0.22
Roller	1	5.01	0.86	7.34	0.10	0.14
Total per 10 acres of activity	2	12.94	2.23	18.96	0.26	0.36

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Loader	1	7.86	1.35	11.52	0.16	0.22
Haul Truck	1	20.89	3.60	30.62	0.42	0.58
Total per 10 acres of activity	2	28.75	4.95	42.14	0.58	0.80

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Stationary						
Generator Set	1	11.83	1.47	10.09	0.24	0.47
Industrial Saw	1	17.02	2.12	14.52	0.34	0.68
Welder	1	4.48	0.56	3.83	0.09	0.18
Mobile (non-road)						
Truck	1	20.89	3.60	30.62	0.84	0.58
Forklift	1	4.57	0.79	6.70	0.18	0.13
Crane	1	8.37	1.44	12.27	0.33	0.23
Total per 10 acres of activity	6	67.16	9.98	78.03	2.02	2.27

Note: Footnotes for tables are on following page

BW1 FOIA CBP 001176

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)
Air Compressor	1	6.83	0.85	5.82	0.14	0.27
Total per 10 acres of activity	1	6.83	0.85	5.82	0.14	0.27

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activitiy, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emissions factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC.

c) The SMAQMD 2004 reference does not provide SO_2 emissions factors. For this worksheet, SO_2 emissions have been estimated based on approximate fuel use rate for diesel equipment and the assumption of 500 ppm sulfur diesel fuel. For the average of the equipment fleet, the resulting SO_2 factor was found to be approximately 0.04 times the NOx emissions factor for the mobile equipment (based upon 2002 USAF IERA "Air Emissions Inventory Guidance") and 0.02 times the NOx emissions factor for all other equipment (based on AP-42, Table 3.4-1)

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSIONS FACTOR SUMMARY

Source	Equipment Multiplier*	SMAQMD Emissions Factors (lb/day)				
		NO_x	VOC	CO	SO_2**	PM_{10}
Grading Equipment	127	975826.067	145462.752	1139995.780	19516.521	32737.183
Paving Equipment	1	0.000	0.000	0.000	0.000	0.000
Demolition Equipment	1	0.000	0.000	0.000	0.000	0.000
Building Construction	1	0.000	0.000	0.000	0.000	0.000
Air Compressor for Architectural Coating	1	0.000	0.000	0.000	0.000	0.000
Architectural Coating**			0.000			

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project

**Emissions factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emissions Factor for Grading Equipment NOx = (Total Grading NOx per 10 ac*((total disturbed area/43560)/10))*(Equipment Multiplier)

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Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	55,313,280	1,269.82	6	(from "CY2008 Grading" worksheet)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per the SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}
Grading Equipment	5,854,956.40	872,776.51	6,839,974.68	117,099.13	196,423.10
Paving	-	-	-	-	-
Demolition	-	-	-	-	-
Building Construction	-	-	-	-	-
Architectural Coatings	-	-	-	-	-
Total Emissions (lbs):	**5,854,956.40**	**872,776.51**	**6,839,974.68**	**117,099.13**	**196,423.10**

Results: Total Project Annual Emissions Rates

	NO_x	VOC	CO	SO_2	PM_{10}
Total Project Emissions (lbs)	5,854,956.40	872,776.51	6,839,974.68	117,099.13	196,423.10
Total Project Emissions (tons)	2,927.48	436.39	3,419.99	58.55	98.21

CO2 Emissions

It is assumed that 75 vehicles consisting of bulldozer, grader, forklift, cranes, rollers, and light duty trucks would be usefor this project.

It is further assumed that the total approximate average miles per day per vehicle would be 10 miles

It is assumed that the average vehicle will produce 19.5 pounds of CO2 per gallon of gas used. (www.eia.doe.gov/oiaf/1605/coefficients)

75 vehicles x 10 miles/day/vehicle x 190 days working x 1 gal/10 miles x 19.5 lb co2/gal x ton/2000lb = 137.5 tons CO2

Estimate emissions of CO2 for BLIAQCR region is 995,000 tons per year

BW1 FOIA CBP 001178

Construction Fugitive Dust Emissions for CY 2008

Calculation of PM_{10} Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions

Acres graded per year:	1269.82	acres/yr	(From "CY2008 Combustion" worksheet)
Grading days/yr:	5.59	days/yr	(From "CY2008 Grading worksheet)
Exposed days/yr:	90	assumed days/yr graded area is exposed	
Grading Hours/day:	8	hr/day	
Soil piles area fraction:	0.10	(assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5	%	(mean silt content; expected range: 0.56 to 23, AP-42 Table 13.2.2-1)
Soil percent moisture, M:	85	%	(http://www.cpc.noaa.gov/products/soilmst/w.shtml)
Annual rainfall days, p:	70	days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, I:	39.5	%	Ave. of wind speed at Brownsville, TX (ftp://ftp.wcc.nrcs.usda.gov/downloads/climate/windrose/texas/brownsville/)
Fraction of TSP, J:	0.5	per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	8	ft	
Qty construction vehicles:	380.95	vehicles	(From "CY2008 Grading worksheet)
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)
PM_{10} Adjustment Factor k	1.5	lb/VMT	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor a	0.9	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor b	0.45	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
Mean Vehicle Weight W	40	tons	assumed for aggregate trucks

TSP - Total Suspended Particulate
VMT - Vehicle Miles Traveled

BW1 FOIA CBP 001179

Emissions Due to Soil Disturbance Activities

Operation Parameters (Calculated from User Inputs)

Grading duration per acre	0 hr/acre	
Bulldozer mileage per acre	1 VMT/acre	(Miles traveled by bulldozer during grading)
Construction VMT per day	1905 VMT/day	
Construction VMT per acre	8.4 VMT/acre	(Travel on unpaved surfaces within site)

Equations Used (Corrected for PM10)

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})/(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(k(s/12)^{a}(W/3)^{b})]\ [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emissions Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

Calculation of PM_{10} Emissions Factors for Each Operation

Operation	Emissions Factor (mass/ unit)	Operation Parameter	Emissions Factor (lbs/ acre)
Bulldozing	0.04 lbs/hr	0 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	2.85 lbs/VMT	8.4 VMT/acre	24.00 lbs/acre

BW1 FOIA CBP 001180

BW1 FOIA CBP 001181

Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

Soil Piles EF = 1.7(s/1.5)[(365 - p)/235](I/15)(J) = (s)(365 - p)(I)(J)/(3110.2941), p. A9-99.

Soil Piles EF = 15.9 lbs/day/acre covered by soil piles

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)
Soil Piles EF = 1.59 lbs/day/acres graded

Graded Surface EF = 26.4 lbs/day/acre (recommended in CEQA Manual, p. A9-93).

Calculation of Annual PM_{10} Emissions

Source	Emissions Factor		Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing	0.00	lbs/acre	1269.82	NA	0	0.000
Grading	0.80	lbs/acre	1269.82	NA	1,016	0.508
Vehicle Traffic	24.00	lbs/acre	1269.82	NA	30,476	15.238
Erosion of Soil Piles	1.59	lbs/acre/day	1269.82	90	181,711	90.855
Erosion of Graded Surface	26.40	lbs/acre/day	1269.82	90	3,017,088	1,508.544
TOTAL					3,230,290	1,615.15

Soil Disturbance EF: 24.80 lbs/acre
Wind Erosion EF: 27.99 lbs/acre/day

Back calculate to get EF: 455.46 lbs/acre/grading day

Construction (Grading) Schedule for CY 2008

Estimate of time required to grade a specified area.

Input Parameters

Construction area:	1,269.82	acres/yr (from "CY2008 Combustion" Worksheet)
Qty Equipment:	380.95	(calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1269.82	158.73
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	1269.82	620.80
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	634.91	640.20
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	634.91	262.65
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	1269.82	445.36
TOTAL								2127.73

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	2127.73
Qty Equipment:	380.95
Grading days/yr:	5.59

BW1 FOIA CBP 001182

Maintenance Activities Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO and PM_{10} Due to Maintenance Activities

The fenceline and patrol road would require mowing approximately two times per year to maintain vegetation height and allow enhanced visibility and security.

Assumptions:
Approximately 1,269.82 acres of land would be mowed twice per year.
Six agricultural mowers (40 horsepower) would operate for approximately 14 days.
Each working day would be 8 hours.
Agricultural mowers operate at 43% load capacity (17.2 horsepower).

Emission Factors Used for Maintenance Equipment

Reference: USAF IERA "Air Emissions Inventory Guidance", July 2001, Table 7-6. Criteria Pollutant Emission Factors for Nonroad Diesel Engines.

Emission Factors

Equipment	Rated Power (hp)	Loading Factor (% of Max Power)	Operating Time (hr/yr)	BSFC (lb/hp-hr)	NO_x (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	SO_2 (g/hp-hr)	PM_{10} (g/hp-hr)
Agricultural Mower (Diesel)	40	43	224	0.408	5.0	0.6	2.5	1.19	0.6

BSFC = Brake Specific Fuel Consumption

Results: Total Maintenance Annual Emission Rates

	NO_x	VOC	CO	SO_2	PM_{10}
Total Maintenance Emissions (lbs)	254.863	30.584	127.431	60.657	30.584
Total Maintenance Emissions (tons)	0.127	0.015	0.064	0.030	0.015

Example:
Total Maintenance Emissions (lbs of NO_x) =
(Rated power output of equipment engine)*(Loading Factor/100)*(Operating Time)*(Number of Equipment)*(Emission Factor)*(Conversion factor)

Total Maintenance Emissions (lbs of NO_x) = (40 hp)*(43/100)*(224 hr/yr)*(2 Equipment)*(5.0 g/hp-hr)*(0.002205 lb/g) = 84.95 lbs/yr

BW1 FOIA CBP 001183

Emissions from Diesel Powered Generators for Construction Equipment

Alternative 3 would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6	
Maximum Hours of Operation	8	hrs/day
Number of Construction Days	190	
Total Generator Capacity	75	hp
Hourly Rate	0.5262	MMBtu/hr
Annual Use	4,799	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Generator Emissions Factors (Diesel)

NO_x	4.41	lb/MMBtu
VOC	0.36	lb/MMBtu
CO	0.95	lb/MMBtu
SO_x	0.29	lb/MMBtu
PM_{10}	0.31	lb/MMBtu

Emissions (Diesel)

NO_x	10.581	tpy
VOC	0.864	tpy
CO	2.279	tpy
SO_x	0.696	tpy
PM_{10}	0.744	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (4,799*4.41)/2000 = 10.581 tpy
Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

BW1 FOIA CBP 001184

Emissions from Diesel Powered Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 365 days per year.

Number of Generators	30	
Maximum Hours of Operation	12	hrs/day
Number of Construction Days	365	

Total Generator Capacity	6	hp
Hourly Rate	0.0421	MMBtu/hr
Annual Use	5,531	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Generator Emissions Factors (Diesel)

NO_x	4.41	lb/MMBtu
VOC	0.36	lb/MMBtu
CO	0.95	lb/MMBtu
SO_x	0.29	lb/MMBtu
PM_{10}	0.31	lb/MMBtu

Emissions (Diesel)

NO_x	12.196	tpy
VOC	0.996	tpy
CO	2.627	tpy
SO_x	0.802	tpy
PM_{10}	0.857	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (5,531*4.41)/2000 = 12.196 tpy

Source: Emissions Factors: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Brownsville-Laredo Intrastate Air Quality Control Region

			Area Source Emissions						Point Source Emissions					
Row #	State	County	CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2	VOC
SORT														
1	TX	Cameron Co	84,539	10,659	36,197	6,679	849	15,988	386	1,169	149	111	136	516
2	TX	Hidalgo Co	145,505	17,041	61,198	11,285	1,161	27,056	4,064	2,697	319	313	41	773
3	TX	Jim Hogg Co	1,621	110	1,229	291	18.5	763	77.3	293	3.32	3.32	0.08	50
4	TX	Starr Co	17,040	2,251	12,645	2,259	141	4,287	433	1,144	0.47	0.42	30.4	215
5	TX	Webb Co	47,946	5,122	9,943	2,380	376	13,764	755	1,128	36.7	35.6	25.2	124
6	TX	Willacy Co	9,021	1,371	9,238	1,777	121	2,753	144	253	1.61	1.61	0.02	49.6
7	TX	Zapata Co	5,466	396	1,828	477	40.1	7,134	425	503	0.18	0.17	0.21	104
Grand Total			311,138	36,950	132,278	25,148	2,707	71,745	6,284	7,187	510	465	233	1,832

SOURCE:
http://www.epa.gov/air/data/geosel.html
USEPA - AirData NET Tier Report
*Net Air pollution sources (area and point) in tons per year (2001)
Site visited on 15 October 2007.

Brownsville-Laredo Intrastate AQCR (40 CFR 81.135):
In the State of Texas: Cameron County, Hidalgo County, Jim Hogg County, Starr County, Webb County, Willacy County, Zapata County

BW1 FOIA CBP 001186