November 2018

AEP TEXAS, INC.

LCRA TRANSMISSION SERVICES CORPORATION

Bakersfield to Solstice 345-kV Transmission Line Project
Environmental Assessment and Alternative Route Analysis

Pecos County, Texas

PROJECT NUMBER:
149604

PROJECT CONTACT:
Lisa Barko Meaux
EMAIL:
lisa.barko@powereng.com
PHONE:
281-765-5507

POWER ENGINEERS

(This page left blank intentionally.)

Bakersfield to Solstice 345-kV Transmission Line Project

PREPARED FOR: AEP TEXAS, INC. AND LCRA TRANSMISSION SERVICES CORPORATION

PREPARED BY: POWER ENGINEERS, INC. (HOUSTON, TEXAS)

(This page left blank intentionally.)

TABLE OF CONTENTS

1.0 DESCRIPTION OF THE PROPOSED PROJECT 1-1
1.1 Scope of the Project 1-1
1.2 Purpose and Need 1-2
1.3 Agency Actions 1-6
1.3.1 Public Utility Commission of Texas 1-6
1.3.2 United States Army Corps of Engineers 1-7
1.3.3 United States Fish and Wildlife Service 1-8
1.3.4 Federal Aviation Administration 1-8
1.3.5 United States Department of Defense Sitting Clearing House 1-9
1.3.6 Texas Parks and Wildlife Department 1-10
1.3.7 Texas Commission on Environmental Quality 1-10
1.3.8 Texas Historical Commission 1-10
1.3.9 Texas Department of Transportation 1-11
1.3.10 University Lands 1-11
1.3.11 Texas General Land Office 1-11
1.4 Description of Proposed Design and Construction 1-12
1.4.1 Transmission Line Design Considerations 1-12
1.4.2 Typical Transmission Line Structures and Easements 1-12
1.4.3 Stations 1-13
1.5 Transmission Line Construction Considerations 1-18
1.5.1 Right-of-Way Preparation 1-19
1.5.2 Construction 1-20
1.5.3 Conductor and Shield Wire Installation 1-20
1.5.4 Cleanup 1-21
1.6 Transmission Line Maintenance 1-22
1.7 Station Site Construction Considerations 1-23

2.0 DESCRIPTION OF THE STUDY AREA 2-1
2.1 Routing Study Methodology 2-1
2.1.1 Study Area Boundary Delineation 2-1
2.1.2 Base Map Development 2-2
2.1.3 Evaluation Criteria 2-5
2.1.4 Data Collection and Constraints Mapping 2-6
2.1.5 Reconnaissance Surveys 2-7

2.2 Environmental Integrity 2-7
2.2.1 Physiography and Geology 2-7
2.2.2 Soils 2-10
2.2.2.1 Soil Associations 2-10
2.2.2.2 Prime Farmland Soils 2-11
2.2.2.3 Hydric Soils 2-12
2.2.3 Mineral and Energy Resources 2-12
2.2.4. Water Resources 2-12
2.2.4.1 Surface Water 2-12
2.2.4.2 Ground Water 2-13
2.2.4.3 Floodplains 2-14
2.2.5 Ecological Resources 2-14
2.2.5.1 Vegetation 2-15
2.2.5.2 Terrestrial Wildlife 2-17
2.2.5.3 Aquatic Habitat 2-29
2.2.5.4 Threatened and Endangered Species 2-30
2.3 Community Values 2-40
2.4 Human Development 2-41
2.4.1 Existing Land Use 2-41
2.4.2 Planned Land use 2-42
2.4.3 Agriculture 2-43
2.4.4 Oil and Gas Facilities 2-43
2.4.5 Utility Features/Generation Facilities 2-43
2.4.6 Transportation/Aviation/Communication Facilities 2-44
2.4.7 Parks and Recreation Areas 2-46
2.5 Socioeconomics 2-48
2.5.1 Population Trends 2-48
2.5.2 Employment 2-48
2.5.3 Leading Economic Sectors 2-49
2.6 Aesthetics 2-50
2.7 Cultural Resources 2-51
2.7.1 Cultural Background 2-53
2.7.2 Literature and Records Review 2-60
2.7.3 Previous Investigations 2-71
2.7.4 High Probability Areas 2-76

3.0 ALTERNATIVE ROUTE DEVELOPMENT....3-1
3.1 Opportunities and Constraints Evaluation....3-1
3.1.1 Existing Linear Corridors....3-1
3.2 Alternative Route Selection....3-3
3.2.1 Preliminary Alternative Route Segments....3-3
3.2.2 Public Involvement Program....3-7
3.2.2.1 Correspondence from Agencies and Officials....3-7
3.2.2.2 Open House Meeting....3-10
3.2.2.3 Internet Website....3-12
3.3 Modifications to the Primary Alternative Route Segments....3-13
3.3.1 New Segments....3-13
3.3.2 Segment Modifications....3-13
3.4 Primary Alternative Routes....3-39

4.0 POTENTIAL IMPACTS OF THE PRIMARY ALTERNATIVE ROUTES....4-1
4.1 Natural Resources Impacts....4-1
4.1.1 Impacts on Geological Resources....4-1
4.1.2 Impacts on Soils....4-2
4.1.3 Impacts on Water Resources....4-11
4.1.3.1 Surface Water....4-11
4.1.3.2 Ground Water....4-12
4.1.3.3 Floodplains....4-12
4.1.4 Impacts on Ecosystem Systems....4-12
4.1.4.1 Vegetation....4-12
4.1.4.2 Wildlife....4-14
4.1.4.3 Threatened and Endangered Species....4-16
4.1.4.4 Summary of Natural Resources Impacts....4-18
4.2 Human Resource Impacts....4-19
4.2.1 Socioeconomic Impacts....4-19
4.2.2 Impacts on Community Values....4-19
4.2.3 Impacts on Land Use....4-20
4.2.3.1 Habitable Structures....4-20
4.2.3.2 Utilizing/Paralleling Existing Transmission Line ROW....4-20
4.2.3.3 Paralleling Other Existing Compatible ROW....4-21
4.2.3.4 Paralleling Property Lines....4-22
4.2.3.5 Paralleling Pipelines....4-23

4.2.3.6 Overall Length of Routes 4-23
4.2.4 Impacts on Transportation/Aviation/Communication Facilities 4-24
4.2.5 Impacts on Parks and Recreation 4-26
4.2.6 Impacts on Aesthetics 4-27
4.2.7 Summary of Human Resources Impacts 4-28
4.3 Cultural Resource Impacts 4-28
4.3.1 Direct Impacts 4-29
4.3.2 Mitigation 4-29
4.3.3 Summary of Cultural Resource Impacts 4-30

5.0 LIST OF PREPARERS 5-1

6.0 REFERENCES CITED 6-1

APPENDICES:

A Agency and Other Correspondence

B Public Involvement

C Habitable Structures and Other Land Features in the Vicinity of the Primary Alternative Routes

D Figures 3-14a, b, and c

E Figures 4-1a, b, and c

F LCRA TSC's Oak Wilt Policy

FIGURES:

Figure 1-1 Project Area 1-3
Figure 1-2 Schematic view of the Far West Texas Project taken from a presentation to the ERCOT Board of Directors made on June 12, 2018 1-5
Figure 1-3 Typical Double-Circuit 345-kV Tangent 1-15
Figure 1-4 Typical Double-Circuit 345-kV Angle 1-16
Figure 1-5 Typical Double-Circuit 345-kV Deadend 1-17
Figure 2-1 Study Area Location 2-3
Figure 2-2 Location of the Study Area in Relation to the Physiographic Regions of Texas 2-8
Figure 2-3 Location of the Study Area in Relation to the Vegetational Areas of Texas 2-16
Figure 2-4 Location of the Study Area in Relation to the Biotic Provinces of Texas 2-18
Figure 2-5 Location of the Study Area in Relation to the Cultural Resource Planning Regions of Texas 2-54
Figure 3-1 Preliminary Alternative Route Segments 3-5
Figure 3-2 Addition of Y2; Relabel of Western Portion of O as X2 and Z2 Following the Open House Meeting 3-15
Figure 3-3 Addition of A3; Relabel of Southern Portion of E1 as C3 and the Northern Portion of K1 as D3 Following the Open House Meeting 3-17
Figure 3-4 Realignment of T Following the Open House Meeting 3-19
Figure 3-5 Realignment of A1 Following the Open House Meeting 3-21
Figure 3-6 Realignment of T1 Following the Open House Meeting 3-23
Figure 3-7 Realignment of X1; Reduction of U and Extension of V; Relabel of Western Portion of W1 as B3 Following the Open House Meeting 3-25
Figure 3-8 Realignment of P2; Reduction of Q2 and Extension of M2; Reduction of V2 and Extension of O2 Following the Open House Meeting 3-27
Figure 3-9 Realignment of L; Reduction of F and Extension of M Following the Open House Meeting 3-29
Figure 3-10 Realignment of E Following the Open House Meeting 3-31
Figure 3-11 Realignment of C1 Following the Open House Meeting 3-33
Figure 3-12 Realignment of J1 Following the Open House Meeting 3-35
Figure 3-13 Resulting Primary Alternative Routes Following the Open House Meeting 3-37
Figure 3-14a Primary Alternative Routes (topo base) ..... Appendix D
Figure 3-14b Primary Alternative Routes (topo base) ..... Appendix D
Figure 3-14c Primary Alternative Routes (topo base) ..... Appendix D
Figure 4-1a Habitable Structures and Other Land Use Features in the Vicinity of the Primary Alternative Routes (aerial base) ..... Appendix E

Figure 4-1b Habitable Structures and Other Land Use Features in the Vicinity of the Primary Alternative Routes (aerial base) ..... Appendix E

Figure 4-1c Habitable Structures and Other Land Use Features in the Vicinity of the Primary Alternative Routes (aerial base) ..... Appendix E

TABLES:

Table 2-1 Land Use and Environmental Criteria for Alternative Route Evaluation 2-5

Table 2-2 Mapped Soil Associations within the Study Area 2-10

Table 2-3 Representative Amphibian Species Potentially Occurring within the Study Area 2-19

Table 2-4 Representative Reptilian Species Potentially Occurring within the Study Area 2-19

Table 2-5 Representative Resident Bird Species Potentially Occurring within the Study Area 2-21

Table 2-6 Representative Mammalian Species Potentially Occurring within the Study Area 2-27

Table 2-7 Listed Threatened and Endangered Animal Species within the Study Area 2-32

Table 2-8 Population Trends 2-48

Table 2-9 Civilian Labor Force and Employment 2-49

Table 2-10 Occupations in Pecos County 2-49

Table 2-11 Industries in Pecos County 2-50

Table 2-12 Recorded Cultural Resources within the Study Area 2-60

Table 2-13 Recorded Archeological Sites within the Study Area 2-63

Table 2-14 Cemeteries Recorded within the Study Area 2-70

Table 2-15 Official Texas Historical Markers within the Study Area 2-71

Table 2-16 Previous Cultural Resource Investigations within the Study Area 2-72

Table 3-1 Segment Concerns/Comments 3-13

Table 3-2 Primary Alternative Routes 3-39

Table 4-1 Land Use and Environmental Data for Primary Route Evaluation 4-3

Table 4-2 Land Use and Environmental Data for Primary Route Evaluation (Primary Segments) 4-5

Habitable Structures and Other Land Features in the Vicinity of Primary Alternative Routes (Appendix C)

Table 4-3 Primary Alternative Route 1 ..... C-1

Table 4-4 Primary Alternative Route 2 ..... C-2

Table 4-5 Primary Alternative Route 3 ..... C-3

Table 4-6 Primary Alternative Route 4 ..... C-4

Table 4-7 Primary Alternative Route 5 ..... C-5

Table 4-8 Primary Alternative Route 6 ..... C-6

Table 4-9 Primary Alternative Route 7 ..... C-7

Table 4-10 Primary Alternative Route 8 ..... C-8

Table 4-11 Primary Alternative Route 9 ..... C-9

Table 4-12 Primary Alternative Route 10 ..... C-10
Table 4-13 Primary Alternative Route 11 ..... C-11
Table 4-14 Primary Alternative Route 12 ..... C-12
Table 4-15 Primary Alternative Route 13 ..... C-13
Table 4-16 Primary Alternative Route 14 ..... C-14
Table 4-17 Primary Alternative Route 15 ..... C-15
Table 4-18 Primary Alternative Route 16 ..... C-16
Table 4-19 Primary Alternative Route 17 ..... C-17
Table 4-20 Primary Alternative Route 18 ..... C-18
Table 4-21 Primary Alternative Route 19 ..... C-19
Table 4-22 Primary Alternative Route 20 ..... C-20
Table 4-23 Primary Alternative Route 21 ..... C-21
Table 4-24 Primary Alternative Route 22 ..... C-22
Table 4-25 Primary Alternative Route 23 ..... C-23
Table 4-26 Primary Alternative Route 24 ..... C-24
Table 4-27 Primary Alternative Route 25 ..... C-25
Table 4-28 Airport Facilities 4-25
Table 4-29 Electronic Communication Facilities 4-26
Table 4-30 Parks and Recreation Areas 4-27
Table 4-31 Archeological Sites Recorded within 1,000 feet of the Primary Alternative Routes 4-31
Table 4-32 High Probability Areas Crossed by the Primary Alternative Routes 4-33

ACRONYMS AND ABBREVIATIONS

AEP Texas	American Electric Power Texas, Inc.
AM radio	Amplitude modulation radio
ACSS	aluminum conductor, steel-supported
amsl	above mean sea level
B.P.	Before Present
BEG	Bureau of Economic Geology
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
CCN	Certificate of Convenience and Necessity
CCVT	Capacitance Coupled Voltage Transformer
CFR	Code of Federal Regulations
CLF	civilian labor force
CMP	Coastal Management Program
CR	County Road
CWA	Clean Water Act
DoD	Department of Defense Siting Clearinghouse
EA	Environmental Assessment
EMST	Ecological Mapping Systems of Texas
ERCOT	Electric Reliability Council of Texas
ESA	Endangered Species Act
ESSS	Ecologically Significant Stream Segment
FAA	Federal Aviation Administration
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FM	Farm-to-Market Road
FM radio	Frequency modulation radio
FPPA	Farmland Protection Policy Act
GIS	Geographic Information System
GLO	Texas General Land Office
HPA	high probability areas
HTC	Historic Texas Cemeteries
IH	Interstate Highway
IPaC	USFWS Information for Planning and Conservation
ISD	Independent School District
kcmil	thousand circular mils
kV	kilovolt
LCRA TSC	LCRA Transmission Services Corporation
MBTA	Migratory Bird Treaty Act
ME	Miscellaneous Easement
MVA	Megavolt-amperes
MW	megawatt

NCED	National Conservation Easement Database
NEPA	National Environmental Protection Act
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NHD	National Hydrology Dataset
NOI	Notice of Intent
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWP	Nationwide Permit
NWSRS	National Wild and Scenic Rivers System
OPGW	fiber optic ground wire
OTHM	Official Texas Historical Marker
PEM	palustrine emergent
POWER	POWER Engineers, Inc.
PSS	shrub
PUC	Public Utility Commission of Texas
PURA	Public Utility Regulation Act
RIP	Record-Investigate-Protect
ROW	right-of-way
RRC	Railroad Commission of Texas
RTHL	Recorded Texas Historical Landmarks
SAL	State Antiquities Landmarks
SCS	Soil Conservation Service
SH	State Highway
SHPO	State Historic Preservation Office(r)
SWPPP	Storm Water Pollution Prevention Plan
TAC	Texas Administrative Code
TARL	Texas Archeological Research Laboratory
TASA	Texas Archeological Site Atlas
TCEQ	Texas Commission on Environmental Quality
THC	Texas Historical Commission
THSA	Texas Historical Sites Atlas
TLC	Texas Land Conservancy
TNC	Texas Nature Conservancy
TNRIS	Texas Natural Resource Information System
TPWD	Texas Parks and Wildlife Department
TSS	Texas Speleological Society
TWDB	Texas Water Development Board
TxDOT	Texas Department of Transportation
TXNDD	Texas Natural Diversity Database
TxSDC	Texas State Data Center
UHF	Ultra-High Frequency

US	United States
US Hwy	United States Highway
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VHF	Very High Frequency
VORTAC	VHF Omnidirectional Range/Tactical Aid to Navigation

1.0 DESCRIPTION OF THE PROPOSED PROJECT

1.1 SCOPE OF THE PROJECT

LCRA Transmission Services Corporation (LCRA TSC) and American Electric Power, Texas Inc. (AEP Texas) propose to build a new double-circuit 345-kilovolt (kV) transmission line in Pecos County (the Proposed Project). LCRA TSC will construct, own, operate, and maintain the eastern half of the transmission line connecting to LCRA TSC's Bakersfield Station and AEP Texas will construct, own, operate, and maintain the western half of the transmission line connecting to AEP Texas' Solstice Switch Station. The new transmission line will range from approximately 67.8 to 91.7 miles long, depending on the route ultimately selected by the Public Utility Commission of Texas (PUC or Commission). The Proposed Project also involves construction of interconnection facilities at the existing Bakersfield Station and constructing a 345-kV expansion station adjacent to the existing 138-kV Solstice Switch Station. Figure 1-1 shows the location and extent of the Proposed Project.

The Proposed Project will support the increasing electricity demand in the area of Texas that is generally west of McCamey and Odessa, referred to here as the Far West Texas region. The Electric Reliability Council of Texas (ERCOT), with the involvement of the transmission utilities in the Far West Texas region, conducted studies regarding the electric transmission infrastructure in the region. On June 21, 2017, the ERCOT Board of Directors determined that the Proposed Project was necessary to meet North American Electric Reliability Corporation (NERC) and ERCOT reliability performance standards. On June 12, 2018, the ERCOT Board of Directors endorsed the Proposed Project as critical to the reliability of the ERCOT System pursuant to 16 Texas Administrative Code (TAC) § 25.101(b)(3)(D) and approved ERCOT staff's recommendation to construct the transmission line with two circuits.

LCRA TSC and AEP Texas require PUC approval to amend their respective Certificate of Convenience and Necessity (CCN) to construct, own, operate, and maintain their 50 percent portion of the Proposed Project. The dividing point will be determined following the PUC's approval of the final transmission line route. LCRA TSC will own, operate, and maintain all transmission line facilities, including conductors, wires, structures, hardware, and easements of the eastern half of the transmission line connecting to the Bakersfield Station and AEP Texas will own, operate, and maintain all transmission line facilities, including conductors, wires, structures, hardware, and easements of the western half of the transmission line connecting to the Solstice Switch Station.

1.2 PURPOSE AND NEED

The Proposed Project is necessary to support the increasing electricity demand in the Far West Texas region. The increasing demand is directly related to a significant present and forecasted increase in oil and gas production and processing in the Far West Texas region. The electrical load demand in Far West Texas is expected to grow in excess of 1,000 megawatts (MW) along a portion of the electric system referred to as the Culberson Loop, which spreads into five different counties generally west of Monahans, Texas for approximately 85 miles.

In June 2017, the ERCOT Board of Directors endorsed construction of the Proposed Project as a double-circuit capable 345-kV transmission line with an initial single circuit installed from Bakersfield to Solstice. In June 2018, in response to accelerating and increasing demand growth in the region, the ERCOT Board of Directors endorsed expanding the Proposed Project to include installation of the second circuit at the time of initial construction and determined that the Proposed Project is critical to the reliability of the ERCOT System. The ERCOT Board of Directors' endorsement and critical designation also included construction of an additional double-circuit 345-kV transmission line from Solstice to Sand Lake and the addition of a second 345-kV circuit on existing structures from Odessa to Riverton and Riverton to Sand Lake. A graphic diagram showing the combined projects to meet the need of the load growth in this area endorsed by the ERCOT Board of Directors is provided as Figure 1-2.

Figure 1-1 Project Area Location Map 11 X 17 with a PDF document.

(This page left blank intentionally.)

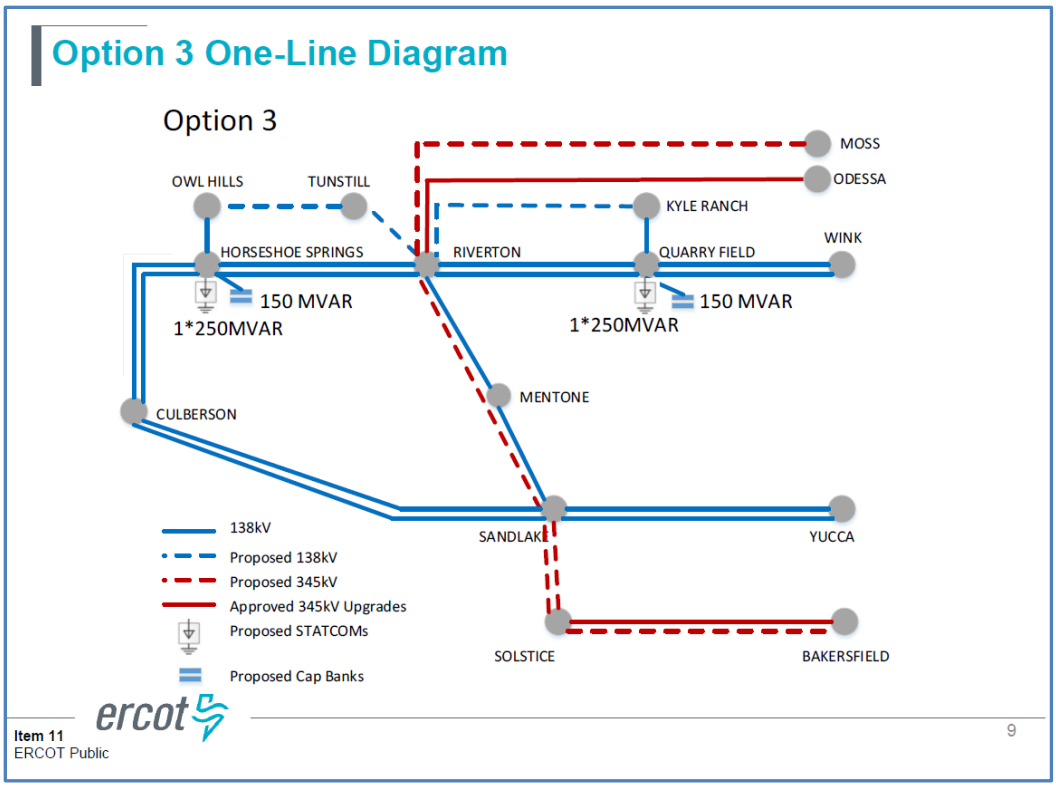


Figure 1-2 Schematic view of the Far West Texas Project taken from a presentation to the ERCOT Board of Directors made on June 12, 2018

1.3 AGENCY ACTIONS

Numerous federal, state, and local regulatory agencies and organizations have developed rules and regulations regarding the routing and potential impacts associated with the construction of the Proposed Project. This section describes the major regulatory agencies and additional issues that are involved in project planning and permitting of transmission lines in Texas. POWER Engineers, Inc. (POWER) solicited comments from various regulatory entities during the development of this document, and records of correspondence and additional discussions with these agencies and organizations are provided in Appendix A.

This environmental assessment (EA) in support of LCRA TSC and AEP Texas' joint application to amend their respective CCN from the PUC is intended to provide information on certain environmental and land use factors identified in § 37.056(c)(4) of the Texas Utilities Code, 16 TAC § 25.101(b)(3)(B), the PUC's CCN application form, and other requirements commonly included in the PUC's preliminary orders for transmission line CCN projects. This EA may also be used in support of any other local, state, or federal permitting requirements, if necessary.

1.3.1 Public Utility Commission of Texas

The PUC regulates the routing of transmission lines in Texas under § 37.056(c)(4)(A)-(D) of the Texas Utilities Code. The PUC regulatory requirements for routing and constructing transmission lines in Texas include:

- 16 TAC § 25.101(b)(3)(B), including the PUC's policy of prudent avoidance;
- 16 TAC § 22.52(a)(4) CCN application requirements;
- PUC preliminary orders for CCN applications; and
- PUC final order approving a project.

Appropriate measures will be taken during engineering design to ensure that any specific provisions of the PUC's final order regarding environmental and right-of-way (ROW) impacts are addressed. If necessary, these measures will be specifically addressed in construction documents, specifications, or other instructions. Following completion of the design, a preconstruction meeting will be held, which will include a review of any regulatory requirements. A physical inspection of the Proposed Project will be performed following project completion to ensure all regulatory requirements were met during construction.

Following issuance of a final order approving the Proposed Project, LCRA TSC and AEP Texas will report the status of the construction of their respective portions of the Proposed Project to the PUC through Monthly Construction Progress Reports. The first report will be filed with the PUC the first month following the approval of the CCN application, and in each subsequent monthly progress report until construction is completed and actual Proposed Project costs have been reported. As required by the PUC, LCRA TSC and AEP Texas will submit location and attribute data for the approved route after it is constructed.

Similarly, as LCRA TSC or AEP Texas identify other obstacles and engineering constraints along their portion of the approved route, they will adjust alignments, adjust structure locations/heights, and/or take other actions consistent with a final order approving the Proposed Project.

1.3.2 United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) is directed by Congress under Section 10 of the Rivers and Harbors Act of 1899 (33 United States Code [U.S.C.] § 403) and Section 404 of the Clean Water Act (CWA) (33 U.S.C. § 1344) to implement these statues. Under Section 10, the USACE regulates all work or structures in or affecting the course, condition, or capacity of navigable Waters of the United States (US). The intent of this law is to protect the navigable capacity of waters important to interstate commerce. Under Section 404, the USACE regulates the discharge of dredged and fill material into all waters of the US, including associated wetlands. The intent of this law is to protect the “waters of the US” and aquatic ecosystems from the indiscriminate discharge of material capable of causing pollution and to restore and maintain their chemical, physical, and biological integrity. USACE approval is required for any route that would cross fee-owned property of the USACE. Other permits may also be required from the USACE for routes that cross waters of the US, including wetlands.

The Proposed Project is located within the jurisdiction of the USACE – Albuquerque District. Review of the National Hydrology Dataset (NHD) and National Wetland Inventory (NWI) maps indicated numerous surface waters of the US and associated areas of potential wetlands within the study area. Upon PUC approval of a route, additional coordination, jurisdictional wetland verifications, and permitting with the USACE – Albuquerque District for a Section 404 Permit might be required. Based on the Proposed Project footprint and construction techniques proposed, the construction of the Proposed Project will likely meet the criteria for the Nationwide Permit (NWP) No. 12 - Utility Line Activities, which apply to activities associated with any cable, line, or wire for the transmission of electrical energy. If the proposed impacts of the Proposed Project exceed the criteria established under General Condition 13 or other

regional conditions listed under the NWP 12, then a Regional General Permit might be required. An Individual Permit is not anticipated for this project.

1.3.3 United States Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) is charged with the responsibility for enforcement of federal wildlife laws and providing comments on proposed construction projects with a federal nexus under the National Environmental Policy Act (NEPA) and within the framework of several federal laws including the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), and Bald and Golden Eagle Protection Act (BGEPA). POWER requested a USFWS Information for Planning and Conservation (IPaC) review and official species list to identify potentially occurring federally protected species and designated critical habitats within the study area (Consultation Code: 02ETAR00-2017-SLI-0747). POWER also reviewed the Texas Natural Diversity Database (TXNDD) records of federal and state listed species occurrences, rare vegetation communities, and/or species of concern. POWER considered these during the route development process.

Upon PUC approval of a route and prior to construction, surveys will be completed as determined necessary to identify any potentially suitable habitat for federally listed species. If suitable habitat is identified, then informal consultation with the USFWS – Austin Ecological Services Field Office might need to occur to determine the need for any required species-specific surveys and/or permitting under Section 7 of the ESA.

1.3.4 Federal Aviation Administration

According to Federal Aviation Administration (FAA) regulations, 14 Code of Federal Regulations (CFR) Part 77.9, the construction of a transmission line requires FAA notification if a transmission tower height will exceed 200 feet or the height of an imaginary surface extending outward and upward at one of the following slopes:

- A 100:1 slope for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport described in paragraph (d) of 14 CFR Part 77.9 having at least one runway longer than 3,200 feet, excluding heliports;
- A 50:1 slope for a horizontal distance of 10,000 feet from the nearest runway of a public or military airport described in paragraph (d) of 14 CFR Part 77.9 where its longest runway is no longer than 3,200 feet in length, excluding heliports; or

- A 25:1 slope for a horizontal distance of 5,000 feet for heliport described in paragraph (d) of 14 CFR Part 77.9.

Paragraph (d) of 14 CFR Part 77.9 includes public-use airports listed in the Airport/Facility Directory (currently the Chart Supplement), public-use or military airports under construction, airports operated by a federal agency or Department of Defense (DoD), or an airport or heliport with at least one FAA approved instrument approach procedure.

Notification is not required for structures that will be shielded by existing structures of a permanent and substantial nature or by natural terrain or topographic features of equal or greater height, and will be located in a congested area of a city, town, or settlement where the shielded structure will not adversely affect safety in air navigation.

The PUC CCN application requires listing private airports within 10,000 feet of any alternative route centerline. Following PUC approval of a route for the proposed transmission line, LCRA TSC and AEP Texas will make a final determination of the need for FAA notification, based on specific structure locations and design. If any of the FAA notification criteria are met for the approved route, a Notice of Proposed Construction or Alteration, FAA Form 7460-1, will be completed and submitted to the FAA Southwest Regional Office in Fort Worth, Texas, at least 30 days prior to construction. The result of this notification, and any subsequent coordination with the FAA, could include changes in line design and/or potential requirements to mark and/or light the structures.

1.3.5 United States Department of Defense Siting Clearing House

The DoD Siting Clearinghouse works with industry to overcome risks to national security while promoting compatible domestic energy development. Energy production facilities and transmission projects involving tall structures, such as electrical transmission towers, may degrade military testing and training operations. The electromagnetic interference from electricity transmission lines can impact critical DoD testing activities. 16 TAC § 22.52 states that upon filing of the application, the DoD shall be notified and an affidavit attesting to the notification shall also be provided with the application. The DoD shall also be provided written notice of the public meeting and if a public meeting is not held, the DoD shall be noticed of the planned filing of the application prior to the completion of the routing study. On January 29, 2018, the DoD was contacted about the Proposed Project to provide notification and to solicit any input from the DoD about the Proposed Project. In addition, on June 22, 2018 and in accordance with 16 TAC § 22.52 (a)(4), public meeting notice was mailed to the DoD Siting Clearinghouse for the public

meeting that was held for the Proposed Project on July 12, 2018. A notice of the filing of the application will be sent to the DoD Siting Clearinghouse when the CCN amendment application is filed with the PUC.

1.3.6 Texas Parks and Wildlife Department

The Texas Parks and Wildlife Department (TPWD) is the state agency with the primary responsibility for protecting the state's fish and wildlife resources in accordance with Texas Parks and Wildlife Code § 12.0011(b). POWER solicited comment from TPWD during the project scoping phase of the Proposed Project, and a copy of this EA will be submitted to TPWD when the CCN amendment application is filed with the PUC. Once the PUC approves a route, additional coordination with TPWD may be necessary to determine the need for any additional surveys, and to avoid or minimize any potential adverse impacts to sensitive habitats, threatened or endangered species, and other state regulated fish and wildlife resources.

1.3.7 Texas Commission on Environmental Quality

The Texas Commission on Environmental Quality (TCEQ) is the state agency with the primary responsibility for protecting the state's water quality. The construction of the Proposed Project will require a Texas Pollution Discharge Elimination System General Construction Permit (TXR150000) as implemented by the TCEQ under the provisions of Section 402 of the CWA and Chapter 26 of the Texas Water Code. More than five acres of land disturbance is anticipated during construction of the Proposed Project for all alternative routes, therefore the construction will be considered a "Large Construction Project" under the TXR150000 General Construction Permit. A Stormwater Pollution Prevention Plan (SWPPP) will be developed and implemented during construction activities, a site notice will be posted, and notification sent to the Municipal Separate Sewer System Operator (if applicable). The submittal of a Notice of Intent (NOI) and Notice of Termination to the TCEQ is also required.

1.3.8 Texas Historical Commission

Cultural resources are protected by federal and state laws if they have some level of significance under the criteria of the National Register of Historic Places (NRHP) (36 CFR Part 60) or under state guidance (TAC, Title 13, Part 2, Chapter 26.7-8). The Texas Historical Commission (THC) was contacted by POWER to identify known cultural resource sites within the study area boundary. POWER also reviewed Texas Archeological Research Laboratory (TARL) records for known locations of cultural resource sites. Once a route is approved by the PUC, additional coordination with the THC and University Lands might determine the need for archeological surveys or additional permitting requirements (e.g., cultural resources investigations on University Lands require the issue of a Texas Antiquities Permit prior to

inception of the work). Even if no additional surveys are required, LCRA TSC and AEP Texas propose to implement an unanticipated discovery procedure during construction activities. If artifacts are discovered during construction, activities will cease near the discovery, and LCRA TSC and AEP Texas will notify the State Historic Preservation Office and University Lands for additional consultation.

1.3.9 Texas Department of Transportation

Where a route for the Proposed Project crosses or requires access from a state-maintained road or highway, LCRA TSC or AEP Texas will obtain a permit from the Texas Department of Transportation (TxDOT) prior to construction if that route is ultimately approved by the PUC. Where a route for the Proposed Project is parallel to TxDOT roads, LCRA TSC and AEP Texas intend to place transmission line structures on adjacent private property and not within the road ROW. LCRA TSC and AEP Texas do not propose to place any structures of the Proposed Project within any TxDOT ROW for reasons including, but not limited to, safety, reliability, and compliance with the Texas Administrative Code, specifically TxDOT's Utility Accommodation Rules.

POWER notified TxDOT of the Proposed Project regarding any roadway projects that might be impacted by a potential route. If the route approved by the PUC crosses TxDOT ROW, it will be constructed in accordance with the rules, regulations, and policies of TxDOT. Best Management Practices (BMPs) will be used as required to minimize erosion and sedimentation resulting from construction. Revegetation will occur as required under the "Revegetation Special Provisions" and contained in TxDOT Form 1023 (Rev. 9-93). Traffic control measures will comply with applicable portions of the Texas Manual of Uniform Traffic Control Devices.

1.3.10 University Lands

University Lands owns a significant amount of property in the central and eastern half of the study area. LCRA TSC and AEP Texas coordinated with University Lands during the development of preliminary route segments to minimize impacts on property owned by University Lands. University Lands' staff had input into these segments and approved all final routing of all the primary route segments located on University Lands property.

1.3.11 Texas General Land Office

The Texas General Land Office (GLO) requires a miscellaneous easement (ME) for ROWs within any state-owned riverbeds or navigable streams or tidally influenced waters. Following PUC approval of a route for the proposed transmission line, LCRA TSC and AEP Texas will determine whether state-owned

riverbeds or navigable streams are crossed by the approved routing and coordinate with the GLO as necessary.

The Texas Land Commissioner administers the Texas Coastal Management Program (CMP) under the GLO, which has the responsibility for implementing the Texas CMP. This program intends to help ensure the environmental and economic well-being of the Texas coast through proper management of coastal natural resource areas. The Texas CMP has federal and state project and permit action review processes to evaluate consistency with the program. The Proposed Project is not located within the Coastal Management Zone and no permitting action will be required under this program.

1.4 DESCRIPTION OF PROPOSED DESIGN AND CONSTRUCTION

1.4.1 Transmission Line Design Considerations

The Proposed Project will be designed, constructed, and operated as a double-circuit 345-kV transmission line with bundled 1926.9 thousand circular mils (kcmil) aluminum conductor, steel-supported (ACSS) "Cumberland" and one fiber optic ground wire (OPGW) on the LCRA TSC half of the Proposed Project and with bundled 1590 ACSS and one OPGW being installed on the AEP Texas half of the Proposed Project. The transmission line will be installed on new steel lattice tower structures within new easements.

The Proposed Project will be rated for operation at 5028 Amperes, yielding a nominal 3,005-Megavolt-amperes (MVA) capacity. The configurations of the conductors and shield wires will provide adequate clearance for operation at 345-kV, considering icing and wind conditions applicable to Pecos County. The Proposed Project will be designed and constructed to meet or exceed the specifications set forth in the current edition of the National Electrical Safety Code (NESC) and will comply with all applicable state and federal statutes and regulations. The results of the Natural/Cultural Resource Assessments will be considered when designing and placing new structures.

1.4.2 Typical Transmission Line Structures and Easements

For all segments of the proposed routing, LCRA TSC and AEP Texas propose to use 345-kV double-circuit capable lattice tower structures for typical tangent, angle, and deadend structures. The geometries of the proposed typical tangent, angle, and deadend structures are shown on Figures 1-3 through 1-5. All structure geometries are illustrative. In some areas, such as transmission line crossings and highway crossings, shorter than typical, taller than typical, or alternative structure types may be utilized. Actual structure types may differ slightly based on newer or different designs available at the time of construction.

The new double-circuit 345-kV transmission facilities will typically be constructed on new ROW within easements approximately 150 feet in width, and using typical spans that range from approximately 900 to 1,500 feet. In some areas, actual spans could be more or less than the typical estimated spans, depending upon terrain and other engineering constraints. Easement widths could also vary to address similar concerns. Access easements and/or temporary construction easements may be needed in some areas.

1.4.3 Stations

The Proposed Project will connect one existing 345-kV station and one 138-kVstation to the existing 345-kV electric transmission grid. One of the connections of the Proposed Project will be to the LCRA TSC Bakersfield Station and the other connection will be to a new 345-kV expansion station adjacent to the 138-kV AEP Texas Solstice Switch Station.

The Bakersfield Station and Solstice Switch Station will both be expanded to accommodate facilities associated with the Proposed Project. No additional land is required at the Bakersfield Station, but there will be additional land required at the Solstice Switch Station to terminate the Proposed Project. The following major electric facilities will be required to connect the Proposed Project to the grid:

<u>Bakersfield Station</u>

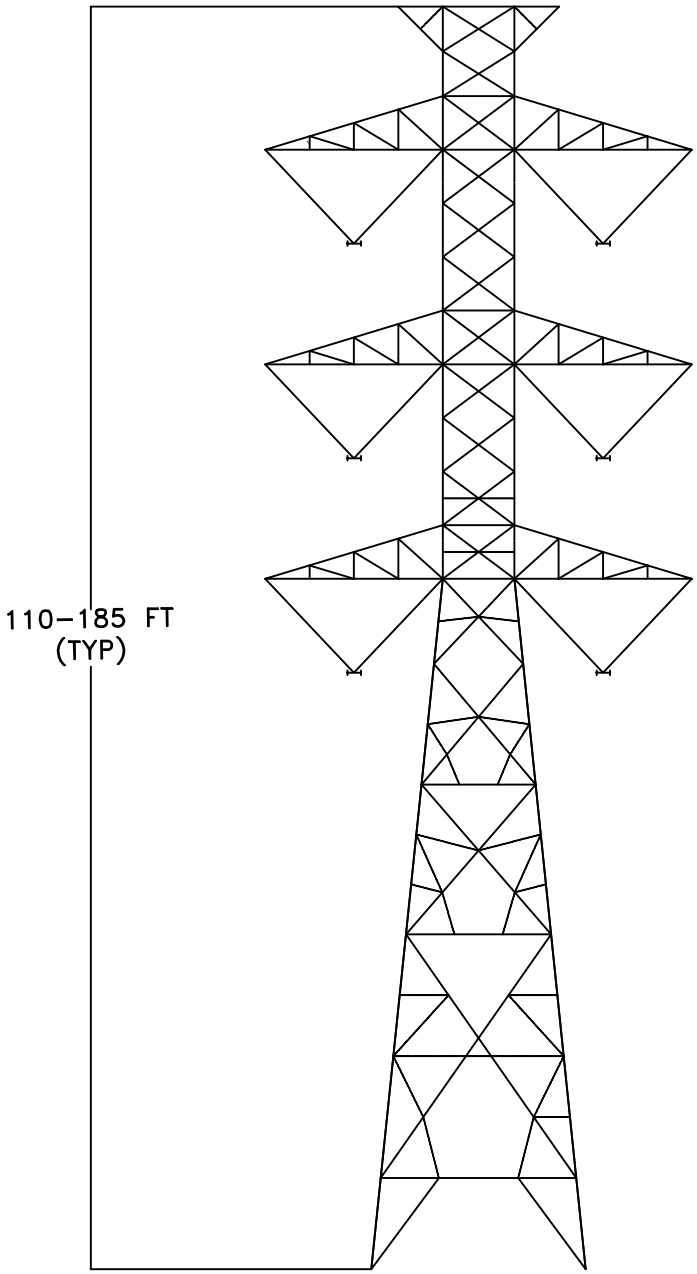
- station A-frame structures
- transmission line circuit breakers
- switches
- transmission line surge arresters
- transmission line capacitance coupled voltage transformer (CCVTs)
- transmission voltage level (345-kV) electric bus
- related line termination facilities

<u>Solstice Switch Station</u>

- two 600 MVA 345/138-kV autotransformers
- reactors
- station A-frame structures
- transmission line circuit breakers
- switches
- transmission line surge arresters

- transmission line CCVTs
- transmission voltage level (345-kV and 138-kV) electric buses
- related line termination facilities

The 345-kV line termination facilities (switches and circuit breakers) will be sized to accommodate the capacity of the new transmission line.



Source: LCRA 2018

Figure 1-3

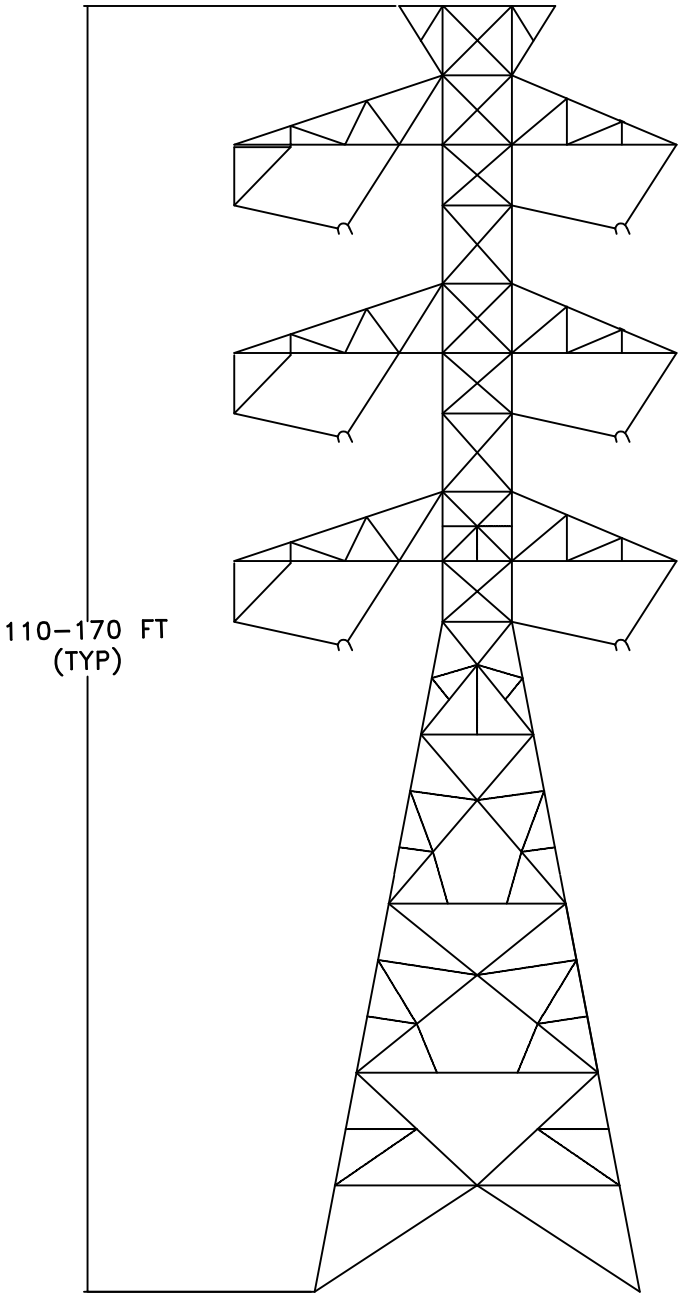
Typical Double-Circuit 345-kV Tangent

Bakersfield to Solstice
345-kV Transmission Line Project

POWER ENGINEERS

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY

LCRA
ENERGY • WATER • COMMUNITY SERVICES



Source: LCRA 2018

Figure 1-4

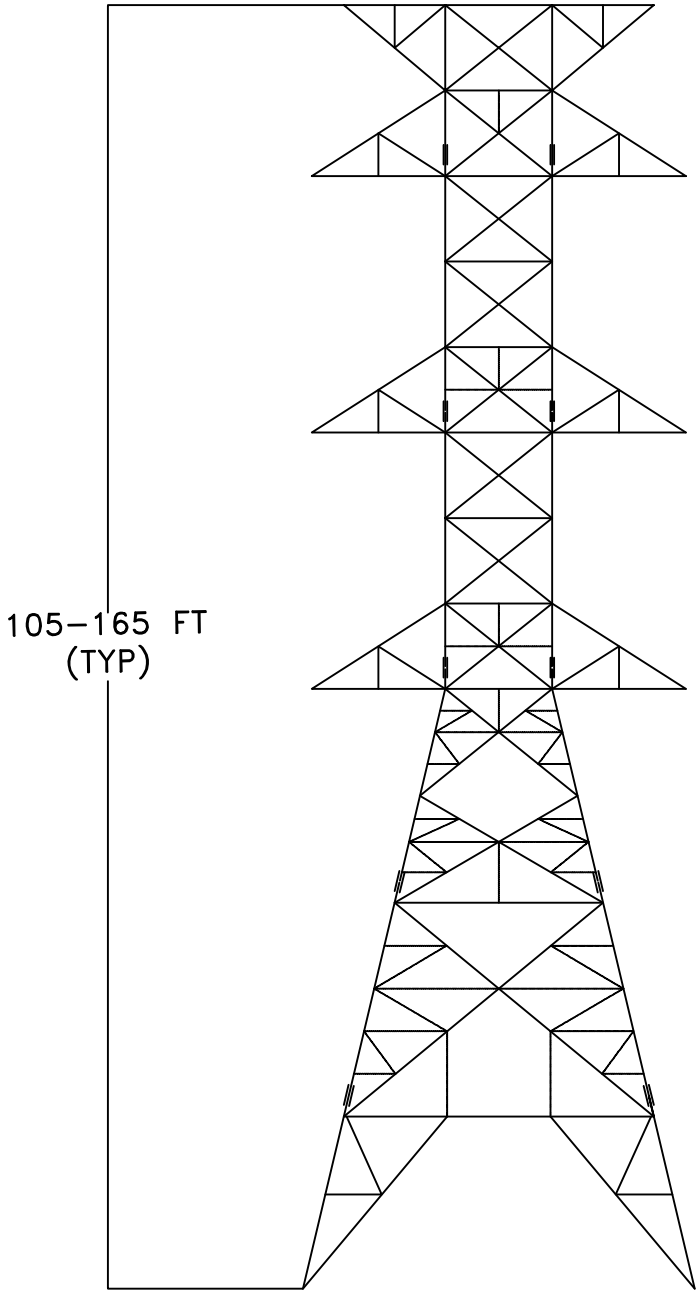
Typical Double-Circuit 345-kV Angle

Bakersfield to Solstice
345-kV Transmission Line Project

POWER ENGINEERS

AMERICAN ELECTRIC POWER

LCRA



Source: LCRA 2018

Figure 1-5

Typical Double-Circuit 345-kV Deadend

Bakersfield to Solstice
345-kV Transmission Line Project

POWER ENGINEERS

AMERICAN ELECTRIC POWER

LCRA

1.5 TRANSMISSION LINE CONSTRUCTION CONSIDERATIONS

Construction of the Proposed Project will require removal of vegetation, excavating for installation of foundations, structure assembly and erection, conductor and shield wire installation, and cleanup when construction is complete.

After alignments and structure locations/heights are set, construction specifications will be prepared and construction will be conducted with attention to the conservation of natural and cultural resources. LCRA TSC and AEP Texas will utilize the following criteria to attain this goal:

1. Efforts will be made to avoid oil spills and other types of pollution, particularly while performing work in the vicinity of streams, ponds, and other water bodies.
2. Water used for construction purposes will not typically be taken from streams or other bodies of water. Should water from streams be necessary, its use will be limited to volumes that will not cause harm to the ecology or aesthetics of the area.
3. Precautions will be taken to prevent the possibility of accidentally starting range fires, in compliance with local fire laws and applicable regulations.
4. Tension stringing of conductors will be employed where possible to reduce the amount of vegetation removal. Helicopters may be considered for use in some areas, potentially including areas where clearing may be difficult or particularly impactful to the environment.
5. When practical, in areas of known endangered or threatened species habitat and in consultation with the USFWS, construction will be performed during seasons of low occurrence or during the non-breeding season (species dependent).
6. The Proposed Project will comply with the TCEQ construction general permit for storm water discharges.
7. If any previously unassessed archeological materials are uncovered during construction, construction will cease in the immediate area of the discovery, and LCRA TSC or AEP Texas will take appropriate actions consistent with those previously described in Section 1.3.
8. ROW preparation will be performed in accordance with the provisions discussed below, in order to diminish soil disturbance during construction.

1.5.1 Right-of-Way Preparation

Trees and brush in the ROW are removed where necessary to ensure safe operation of and access to the line.

Existing and new ROW will be primarily used for access during construction operations. Ingress and egress through private property may be required in limited circumstances to reduce construction impacts. In the event ingress and egress through private property is necessary, existing private roads will be used where practical. In some cases, culverts may be used to cross creeks and tributaries. Where culverts are not used, creek crossings may consist of rock or cobble placed on the stream bottom. The following factors, thoughtfully implemented and applicable to the Proposed Project, will minimize the potential adverse effects of the Proposed Project on the natural environment:

1. Preparation of the ROW for construction of the transmission line facilities will take into account soil stability, the prevention of silt deposition in water courses, and practical measures for the protection of natural vegetation and protection of adjacent resources, such as natural habitat for wildlife.
2. A flail mower may be used instead of bulldozers with dirt blades, where such use will preserve the cover crop of grass, low-growing brush, and similar vegetation.
3. Vegetation will typically be removed in a straight path.
4. Removal of vegetation and grading of construction areas, such as storage areas or setup sites, will be performed in a manner that will minimize erosion and conform to the natural topography.
5. Vegetation removal will be performed in accordance with construction plans, which will be developed in accordance with natural and cultural resource regulations applicable to the area of construction and in a manner that will diminish scarring of the landscape or silting of streams, while ensuring that the transmission line facilities can be constructed, operated, and maintained safely and in accordance with the construction codes referenced above.
6. Vegetation removal will be performed in a manner that diminishes the amount of flora and fauna disturbed during construction of the transmission line, except to the extent necessary to establish appropriate clearance for the transmission line.
7. Vegetation removal and construction activities, including temporary or permanent access roads in the Waters of the US or in the vicinity of streambeds, will be performed in a manner to minimize damage to the natural condition of the area and in accordance with USACE requirements.
8. Vegetation removal will not be performed until a SWPPP has been prepared and a NOI has been submitted to the TCEQ for the Proposed Project.

9. Erosion control devices will be constructed where necessary to prevent soil erosion in the ROW, in accordance with the SWPPP. Erosion control devices will be maintained and inspections conducted until the site is sufficiently re-vegetated, as required by the SWPPP.
10. Roads will be provided with erosion-control measures, which may include side drainage ditches or culverts in accordance with the SWPPP.
11. Roads will be stabilized if constructed on steep slopes. Where feasible, service and access roads will be constructed jointly.
12. In or near areas where ROWs enter dense vegetation and cross major highways or rivers of high scenic value, a screen of natural vegetation may be left in the ROW while still allowing for access to the ROW.

1.5.2 Construction

Survey crews will stake or otherwise mark structure locations. Soil borings and soils testing will provide the parameters for foundation designs for new structures. Construction crews will install foundations for the lattice structures. After foundations have cured sufficiently, crews will set structures. Following structure erection, crews will install the conductor and shield wire suspension assemblies. Conductor suspension assemblies may include porcelain and/or polymer insulators. Structure grounds will be installed using external ground rods. In some areas, avian-perching deterrents will be installed above suspension assemblies.

Although vehicular traffic is a very large part of this operation, construction crews will take care to limit damage to the ROW by minimizing the number of pathways traveled.

1.5.3 Conductor and Shield Wire Installation

Conductor, also referred to as wire and shield wires (for lightning protection), will be installed via a tensioning system. Tensioning systems typically use ropes threaded through stringing blocks or dollies for each conductor and shield wire. Conductor and shield wires will be pulled by the ropes and held tight by a tensioner to keep the wires from coming in contact with the ground and other objects that could damage the wire. In addition, guard structures (temporary wood-pole structures) will be installed where the transmission line crosses overhead electric power lines, overhead telephone lines, roadways, or other areas requiring an additional margin of safety during wire installation. After the wire is tensioned to the required sag, the wire will be taken out of the blocks and placed in the suspension and dead-end clamps for permanent attachment.

1.5.4 Cleanup

The cleanup operation involves stabilizing disturbed areas, removal of debris, and the restoration of items damaged by construction of the Proposed Project. The following criteria will guide the cleanup of construction debris and restoration of the area's natural setting. Further requirements may be imposed by land management agencies.

1. Construction equipment, supplies, and LCRA TSC or AEP Texas (or contractor) property will be dismantled and removed from the ROW when construction is complete.
2. Construction waste, with the possible exception of cleared vegetation, will be removed prior to completion of the Proposed Project.
3. If cleared vegetation is mulched, it may be spread out over the ROW, given to the landowner or a nursery as a product for beneficial use, or picked up and taken to a landfill.
4. Burning is not typically conducted, but may be used as a means of disposal, if no practical alternative exists. Any material to be burned will be piled in a manner and in locations that will cause the least fire risk. Care will be taken to prevent fire or heat damage to trees, shrubs, and structures adjacent to the ROW and station. Burning will conform to local fire and air quality regulations.
5. Soil that has been excavated during construction and not used will be evenly backfilled onto a cleared area, spread to conform to the terrain and the adjacent land, or removed from the site.
6. Replacement of soil adjacent to water crossings for access roads will be at slopes less than the normal angle of repose for the soil type involved.
7. If temporary roads are used, they will be removed and the original slopes restored and re-vegetated as required by the SWPPP.
8. If natural re-vegetation will not provide ground cover in a reasonable length of time, seeding, sprigging or hydro-seeding of restored areas may be used to encourage growth of grasses and other vegetation that is ecologically desirable.
9. Where site factors make it unusually difficult to establish a protective vegetative cover, other restoration procedures may be advisable to prevent erosion, such as the use of gravel, rocks, or concrete.
10. LCRA TSC and AEP Texas will return each affected landowner's property to its original contours and grades unless otherwise agreed to by the landowners' representatives. However, neither LCRA TSC nor AEP Texas will restore a landowner's property to its original contours and grades if doing so will affect the safety or stability of the Proposed Project's structures or the safe operation and maintenance of the line.

1.6 TRANSMISSION LINE MAINTENANCE

Periodic inspection of the ROW, structures, and line will be performed by LCRA TSC or AEP Texas in order to provide for the safe and reliable operation of the transmission line. Preservation of the environmental, natural, and cultural resource conservation factors, designed and built into transmission system siting, require a thoughtful, comprehensive program for maintaining the facilities. The following factors will be incorporated into the maintenance program for this project.

1. Native vegetation, particularly that of value to fish and wildlife, that has been preserved during the construction process and that does not impede access nor have the potential to grow close enough to the transmission line to pose a hazard to the safe operation and maintenance of the transmission line, will be allowed to grow in selected parts of the ROW.
2. Once a cover of vegetation has been established, it will be properly maintained to ensure public safety and a reliable, functioning transmission system.
3. Access roads and service roads, where practical, will be maintained with native grass cover. Where grading is necessary, access and service roads will be graded to the proper slope in order to prevent or diminish soil erosion.
4. If used, United States Environmental Protection Agency (USEPA) approved herbicides will be carefully selected and carefully applied in a manner that will diminish effects on desirable indigenous plant life, and selective application will be used whenever appropriate. To preserve the natural environment, it is essential that herbicides be applied in a manner fully consistent with the protection of the entire environment, particularly the health of humans and wildlife.
5. Maintenance inspection intervals will be established by LCRA TSC and AEP Texas and routine maintenance will be conducted, when possible, while access roads are firm or dry.
6. Aerial and ground maintenance inspection activities of the transmission line facility will include observation of soil erosion problems, fallen timber, and conditions of the vegetation that require attention. As an erosion-control measure, native shrubs, forbs, or grasses may be planted.
7. Transmission line ROW can be used for appropriate types of multiple-use concepts, such as trails suitable for hiking, biking, bird watching, farming, ranching and livestock grazing, wildlife production, and recreational or commercial hunting operations, as long as the activity does not impact public safety or inhibit safe operation and maintenance of the electrical system.

1.7 STATION SITE CONSTRUCTION CONSIDERATIONS

For the Bakersfield Station, construction of the Proposed Project includes expanding the station within the existing station property and the installation of the new facilities. For the Solstice Switch Station, construction of the Proposed Project includes expanding the station and acquiring property for the installation of the new facilities. At each station, the site pad, perimeter fence, and ground grid will be expanded. Electrical equipment, support structures, and foundations will be installed to accommodate the Proposed Project. After all facilities are installed, a final surface layer of gravel will be added in the area of the new facilities and cleanup will occur when construction is complete.

(This page left blank intentionally.)

2.0 DESCRIPTION OF THE STUDY AREA

2.1 Routing Study Methodology

The objective of this EA was to develop alternative routes that provide geographic diversity and comply with § 37.056(c)(4)(A)-(D) of the Texas Utilities Code, 16 TAC § 22.52 (a)(4), and 16 TAC § 25.101(b)(3)(B), including the PUC's policy of prudent avoidance. The study methodology utilized by POWER for this EA included study area delineation based on the project endpoints; identification and characterization of existing land use and environmental constraints; and identification of areas of potential routing opportunity located within the study area. POWER identified potentially affected resources and considered each during the route development process. Input from regulatory agencies, local officials, and the public meeting was also considered during the alternative route development process. Modifications and additions of preliminary alternative segments were made while considering resource sensitivities and public input. Feasible and geographically diverse alternative routes were then selected for analysis and comparison using evaluation criteria to determine potential impacts to existing land use and environmental resources. LCRA TSC and AEP Texas will consider all of the certification criteria in PURA and the PUC Substantive Rules, engineering and construction constraints, grid reliability and security issues, and estimated costs. LCRA TSC and AEP Texas will identify one alternative route that they believe best addresses the requirements of PURA and PUC Substantive Rules and will describe such selection in the CCN application. This alternative route, as well as other alternative routes that provide geographic diversity and sufficient routing options, will all be submitted to the PUC in the CCN application.

2.1.1 Study Area Boundary Delineation

The study area is in the vicinity of Fort Stockton in west Texas within Pecos County. The study area set boundaries for the data collection process and was defined to include feasible geographically diverse alternatives for the location of the transmission lines between the project endpoints. Major physiographic features, jurisdictional boundaries, sensitive land uses, and existing utility corridors helped to define the study area boundaries (see Figure 2-1).

The extent of the project endpoints and the study area are described below and illustrated in Figure 2-1. The study area is oriented in an east to west direction with the existing LCRA TSC Bakersfield Station located in the eastern portion of the study area and the existing AEP Texas Solstice Switch Station located in the western portion of the study area. More specifically, the LCRA TSC Bakersfield Station is located northeast of the City of Fort Stockton, west of Farm to Market Road 1901. The AEP Texas Solstice Switch Station is located west of the City of Fort Stockton, north of Interstate Highway 10.

The eastern boundary of the study area is defined by the existing LCRA TSC Bakersfield Station site. The western boundary of the study area is defined by the existing AEP Texas Solstice Switch Station site. The northern and southern study area boundaries are defined to provide adequate space for the development of a set of geographically diverse routing alternatives east to west and the need to minimize land use conflicts within the study area.

2.1.2 Base Map Development

After delineation of the study area, a project base map, overlain on United States Geological Survey (USGS) 7.5-minute topographic maps and aerial photography, was prepared and used to display resource data for the project area. Resource data categories and factors that were determined appropriate for interpretation and analysis were selected and mapped. The base map provides a broad overview of various resource locations indicating obvious routing constraints and areas of potential routing opportunities.

Data displayed on the base map includes:

- Major land jurisdictions and uses.
- Major roads (including county roads [CRs], farm-to-market roads [FMs], United States Highways [US Hwys], State Highways [SHs], and Interstate Highways [IHs]).
- Existing transmission line and pipeline corridors.
- Airports, private airstrips and communication facilities.
- Parks and wildlife management areas.
- Major political subdivision boundaries.
- Lakes, reservoirs, rivers, and ponds.

Figure 2-1 Study Area PDF format 11X17

FRONT

Figure 2-1 Study Area in PDF format 11X17

BACK

2.1.3 Evaluation Criteria

Land use and environmental evaluation criteria were developed to reflect accepted practices for routing electric transmission lines in the state of Texas (see Table 2-1). Emphasis was placed on acquiring information identified in § 37.056(c)(4)(A)-(D) of the Texas Utilities Code, 16 TAC § 25.101, including the policy of prudent avoidance, and the PUC CCN application form requirements. Evaluation criteria were further refined based on data collection, reconnaissance surveys, and public input. The alternative route development process was conducted with consideration and incorporation of the evaluation criteria.

Evaluation criteria data were reviewed, tabulated, and compared (see Section 4.0) for each resulting primary alternative route and, among other factors, were ultimately used for the delineation of a reasonable number of geographically diverse alternative routes from an environmental and land use perspective.

TABLE 2-1 LAND USE AND ENVIRONMENTAL CRITERIA FOR ALTERNATIVE ROUTE EVALUATION

	LAND USE
1.	Length of primary alternative route (miles)
2.	Number of habitable structures[1] within 500 feet of ROW centerline
3.	Length of ROW using existing transmission line ROW
4.	Length of ROW parallel and adjacent to existing transmission line ROW
5.	Length of ROW parallel and adjacent to existing 345-kV transmission line ROW
6.	Length of ROW parallel and adjacent to existing 138-kV transmission line ROW[2]
7.	Length of ROW parallel and adjacent to existing 69-kV transmission line ROW
8.	Length of ROW parallel and adjacent to other existing ROW (roadways, railways, etc.)
9.	Length of ROW parallel and adjacent to apparent property lines[3]
10.	Sum of evaluation criteria 4, 8, and 9
11.	Percent of evaluation criteria 4, 8, and 9
12.	Length of ROW across parks/recreational areas[4]
13.	Number of additional parks/recreational areas[4] within 1,000 feet of ROW centerline
14.	Length of ROW across University Lands
15.	Length of ROW through cropland
16.	Length of ROW through pasture/rangeland
17.	Length of ROW through land irrigated by traveling systems (rolling or pivot type)
18.	Length of ROW parallel and adjacent to exiting natural gas pipelines (6” diameter or greater)[4]
19.	Number of pipeline crossings[5]
20.	Number of transmission line crossings
21.	Number of IH, US Hwy, and SH crossings
22.	Number of FM road crossings
23.	Number of cemeteries within 1,000 feet of the ROW centerline
24.	Number of FAA registered public/military airports[6] with at least one runway more than 3,200 feet in length located within 20,000 feet of ROW centerline

TABLE 2-1 LAND USE AND ENVIRONMENTAL CRITERIA FOR ALTERNATIVE ROUTE EVALUATION

25.	Number of FAA registered public/military airports[6] having no runway more than 3,200 feet in length located within 10,000 feet of ROW centerline
26.	Number of private airstrips within 10,000 feet of the ROW centerline
27.	Number of heliports within 5,000 feet of the ROW centerline
28.	Number of commercial AM radio transmitters within 10,000 feet of the ROW centerline
29.	Number of FM radio transmitters, microwave towers, and other electronic installations within 2,000 feet of ROW centerline
	AESTHETICS
30.	Estimated length of ROW within foreground visual zone[7] of IH, US Hwys, and SHs
31.	Estimated length of ROW within foreground visual zone[7] of FM roads
32.	Estimated length of ROW within foreground visual zone[7,8] of parks/recreational areas[4]
	ECOLOGY
33.	Length of ROW through upland woodlands/brushland
34.	Length of ROW through bottomland/riparian woodlands
35.	Length of ROW across NWI mapped wetlands
36.	Length of ROW across known habitat of federally listed endangered or threatened species
37.	Length of ROW across open water (lakes, ponds)
38.	Number of stream crossings
39.	Number of river crossings
40.	Length of ROW parallel (within 100 feet) to streams or rivers
41.	Length of ROW across 100-year floodplain
	CULTURAL RESOURCES
42.	Number of recorded cultural resource sites crossed by ROW
43.	Number of additional recorded cultural resource sites within 1,000 feet of ROW centerline
44.	Number of NRHP listed properties crossed by ROW
45.	Number of additional NRHP listed properties within 1,000 feet of ROW centerline
46.	Length of ROW through areas of high archaeological site potential

NOTES:
[1] Single-family and multi-family dwellings, and related structures, mobile homes, apartment buildings, commercial structures, industrial structures, business structures, churches, hospitals, nursing homes, schools, or other structures normally inhabited by humans or intended to be inhabited by humans on a daily or regular basis within 500 feet of the centerline of a transmission project of 230-kV or more.
[2]The data associated with paralleling 138-kV transmission lines includes an existing 69-kV transmission line that is being upgraded for operation at 138-kV prior to the completion of the Proposed Project.
[3]Apparent property boundaries created by existing roads, highways, or railroad ROWs are not "double-counted" in the length of ROW parallel to apparent property boundaries criteria.
[4]Defined as parks and recreational areas owned by a governmental body or an organized group, club, or church within 1,000 feet of the centerline of the project.
[5]Only pipelines six inches and greater in diameter carrying petrochemicals were quantified in the pipeline crossing and paralleling calculations.
[6]As listed in the Chart Supplement South Central U.S. (FAA 2018a formerly known as the Airport/Facility Directory South Central U.S.) and FAA 2018b.
[7]One-half mile, unobstructed. Lengths of ROW within the visual foreground zone of interstates, US and SH criteria are not "double-counted" in the length of ROW within the visual foreground zone of FM roads criteria.
[8]One-half mile, unobstructed. Lengths of ROW within the visual foreground zone of parks/recreational areas may overlap with the total length of ROW within the visual foreground zone of interstates, US Hwy and SH criteria and/or with the total length of ROW within the visual foreground zone of FM roads criteria.

2.1.4 Data Collection and Constraints Mapping

Several methodologies were utilized to collect and review environmental and land use data, including incorporation of readily available Geographic Information System (GIS) coverage with associated metadata; review of maps and published literature; review of files and records from numerous federal,

state, and local regulatory agencies; meetings with stakeholders; and reconnaissance surveys of the study area. Data collected for each resource area were mapped within the study area utilizing GIS layers.

Maps and data layers reviewed include USGS 7.5-minute topographic maps (USGS 2018a), NWI maps, FEMA floodplain data (FEMA 2018), Texas Natural Resources Information System (TNRIS), Railroad Commission of Texas ([RRC] 2018a), TXNDD, and TxDOT county highway maps. Appraisal district parcel boundary data for Pecos County was provided by LCRA TSC and was used to identify apparent property boundaries as potential paralleling opportunity areas. Refined and updated parcel boundary information was also provided by aerial photography (Photo Science 2018) and were used as the background for several of the scaled project maps, including the initial base map, the field maps, the public involvement display boards, and the environmental and land use constraints maps.

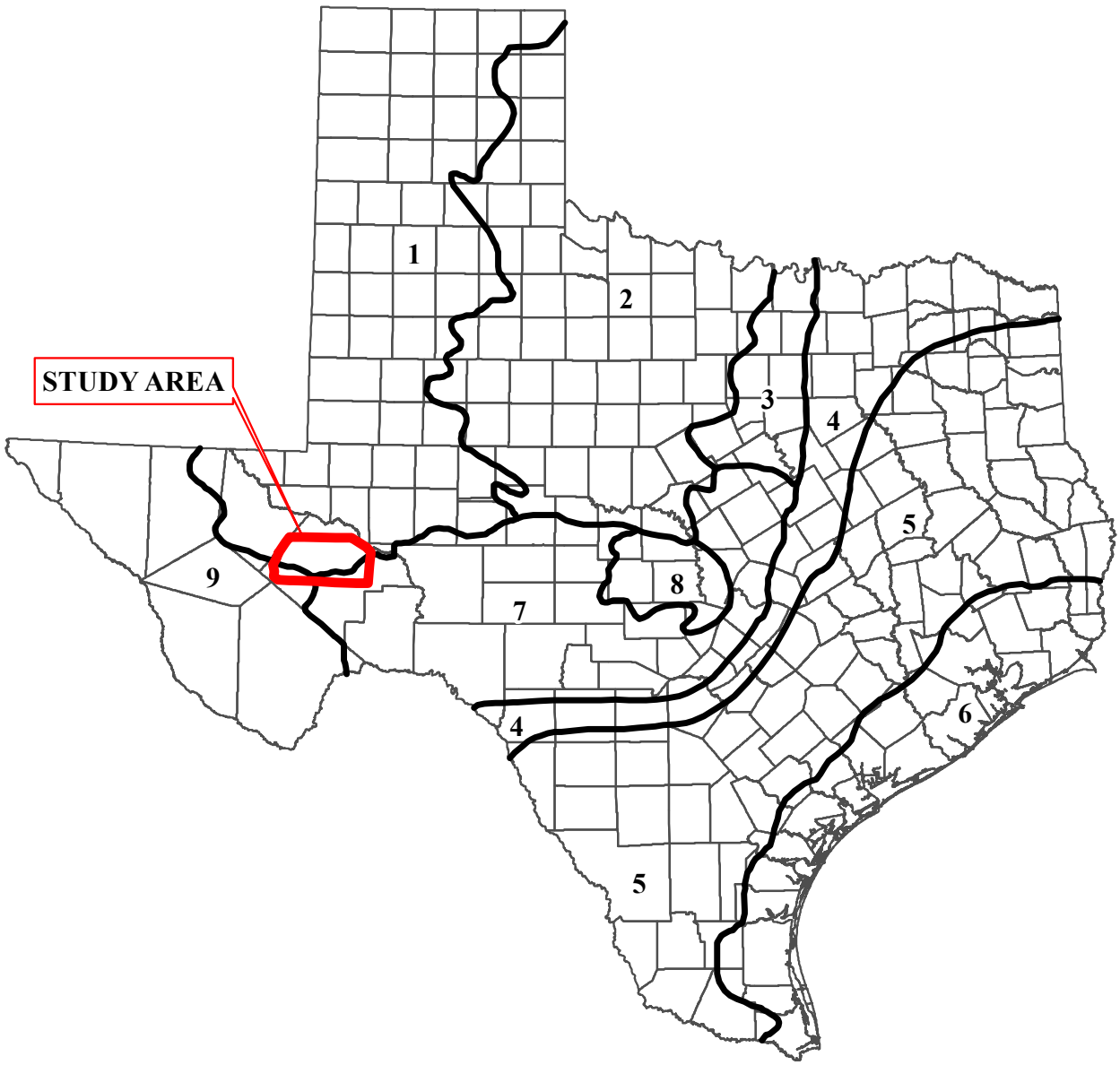
2.1.5 Reconnaissance Surveys

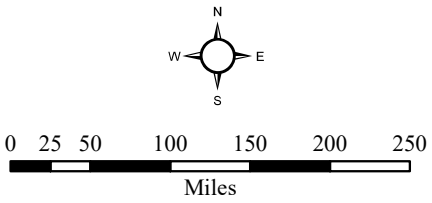
Reconnaissance surveys of the study area were conducted by POWER personnel from publicly accessible areas to confirm the findings of the research and data collection activities, identify changes in land use occurring after the date of available aerial photography, and to identify potential unknown constraints that might not have been previously noted in the data. Reconnaissance surveys of the study area were conducted on March 27 and 28, 2018 and July 12 and 13, 2018.

2.2 Environmental Integrity

2.2.1 Physiography and Geology

As shown in Figure 2-2, the study area is primarily located within the southern portion of the High Plains, the northwest portion of the Edwards Plateau, and the southeast portion of the Basin and Range Physiographic Provinces (Bureau of Economic Geology [BEG] 1996). The southern High Plains region is described as nearly flat with playa lakes and local dune fields with elevations ranging from 2,200 feet to 3,800 feet above mean sea level (amsl). The Edwards Plateau region is described as a flat upper surface with box canyons with elevations ranging from 450 feet to 3,000 feet amsl (BEG 1996). The Basin and Range region is characterized by north and south facing mountains and basins with elevations ranging from 1,700 feet to 8,750 feet amsl. Elevations in the study area range between approximately 2,300 feet amsl near the Pecos River in the northeast portions of the study area to approximately 3,600 feet on the hilltops and mesas in the southern portions of the study area (BEG 1996).





Source: Texas Bureau of Economic Geology, 1996

Legend

Physiographic Region Boundary

1 High Plains
2 North-Central Plains
3 Grand Prairie
4 Blackland Prairies
5 Interior Coastal Plains
6 Gulf Coastal Prairies
7 Edwards Plateau
8 Central Texas Uplift
9 Trans-Pecos Basin and Range

County Boundary

Figure 2-2

LOCATION OF THE STUDY AREA IN RELATION TO THE PHYSIOGRAPHIC REGIONS OF TEXAS

Bakersfield-Solstice 345-kV Transmission Line Project

The BEG (1976 and 1994) geologic atlas maps (Pecos and Fort Stockton Sheets) were reviewed for geologic formations that occur within the study area. Geologic formations occurring within the study area primarily include the Cretaceous-aged Washita and Fredericksburg Groups, and Quaternary-aged deposits.

Cretaceous Aged Formations

Cretaceous-aged Washita and Fredericksburg Groups are often undivided and may also include portions of the Buda and Segovia Formations. The Washita Group is characterized by thick alternative units of clay and limestone up to 200 feet thick. This group may also contain claystone, mudstone, and marine fossils. The Fredericksburg Group is generally comprised of limestone and dolomite with chert in thin layers or nodules and locally gypsiferous marl. This formation may be approximately 60 to 350 feet thick (USGS 2018b).

Quaternary Aged Formations

Quaternary aged rock groups within the study area include alluvium, quaternary deposits, fan deposits, and fluviatile terrace deposits. These deposits are found scattered throughout lower portions of the study area. These groups are more recent and may be located above the floodplain in areas with frequent flooding along the rivers, creeks, streams, and draws. Alluvium and quaternary deposits may contain sand, clay, silt, sand, gravel and organic matter. Fan deposits may also form and include colluvium soils and older Quaternary deposits. Fluviatile terrace deposits may contain sand, silt, clay, gravel, and caliche (USGS 2018b).

Geologically Significant Features

Several potential significant features affecting construction and operation of the transmission line were reviewed within the study area. Potentially hazardous areas reviewed include karst areas with known cave locations, fault lines, historical coal/uranium mining locations and subsurface contamination.

Cave and karst data were collected from a variety of sources including the Texas Speleological Survey ([TSS] 1994 and 2007). The study area lies within the Stockton Plateau and Isolated Edwards Group Outliers Karst Regions (TSS 2007). Amazing Maze Cave is found in the eastern portion of the study area on the Bakersfield Quadrangle (and is managed by the University of Texas). Comanche Springs Cave was identified within the City of Fort Stockton, Texas on the Fort Stockton East Quadrangle. Review of the USGS data and BEG geologic atlas maps indicates no seismic or Quaternary faults are located within

the study area (USGS 2018c). RRC data were reviewed and no historical or current coal/uranium mining activities are/were within the study area (BEG 2018; RRC 2018a and 2018b).

Subsurface contamination (soils or groundwater) from previous commercial activities or dumps/landfills may require additional considerations during routing and/or may create a potential hazard during construction activities. One active landfill was identified within the study area. The City of Fort Stockton landfill was identified approximately 2.0 miles northeast of the City of Fort Stockton (TCEQ 2018a). Review of USEPA Superfund/National Priority List Sites (USEPA 2018a) and TCEQ State Superfund Sites (TCEQ 2018b) did not indicate any federal or state listed sites within the study area.

2.2.2 Soils

2.2.2.1 Soil Associations

The published Natural Resource Conservation Service ([NRCS] 2018) soil survey and soil surveys for Pecos County (Soil Conservation Service [SCS] 1980) were used to identify and characterize the soil associations that encompass the study area. A soil association is a group of soils geographically associated in a characteristic repeating pattern and defined as a single unit (NRCS 2018). Soil associations occurring within the study area are listed in Table 2-2, which summarizes each soil association identified within the study area and indicates if any mapped units of the soil series within the association are considered prime farmlands and/or hydric soils (NRCS 2018).

TABLE 2-2 MAPPED SOIL ASSOCIATIONS WITHIN THE STUDY AREA

MAP UNIT	DESCRIPTION	SOIL UNIT	PERCENT OF ASSOCIATION	LAND FORM	HYDRIC	PRIME FARMLAND
Ector - Sanderson - Rock Outcrop	Very shallow to shallow and deep, gently sloping to steep gravelly soils; and rock outcrop: on limes-tone hills and in valleys	Ector	48%	Hills and Mountains	No	No
		Sanderson	16%			
		Rock Outcrop	16%			
		Other	20%			
Lozier - Rock outcrop	Very shallow to shallow, rolling to steep very gravelly and stony soils; and rock outcrop; on limestone hills	Lozier	71%	Hills and Mountains	No	No
		Rock Outcrop	14%			
		Other	15%			
Reakor - Upton - Delnorte	Deep and very shallow to shallow nearly level to gently undulating very gravelly and loamy soils; on uplands	Reakor	41%	Uplands	No	No
		Upton	30%			
		Delnorte	10%			
		Other	19%			
Reagan - Hodgins -Iraan	Deep nearly level loamy soils; on uplands and floodplains	Reagan	42%	Uplands	No	Prime farmland if irrigated
		Hodgins	20%			
		Iraan	13%			
		Other	25%			

TABLE 2-2 MAPPED SOIL ASSOCIATIONS WITHIN THE STUDY AREA

MAP UNIT	DESCRIPTION	SOIL UNIT	PERCENT OF ASSOCIATION	LAND FORM	HYDRIC	PRIME FARMLAND
Dalby - Reakor	Deep nearly level clayey and loamy soils; on uplands and outwash plains	Dalby	68%	Uplands	No	No
		Reakor	24%			
		Other	8%			
Balmorhea - Reeves	Deep and moderately deep, nearly level loamy soils; on floodplains and uplands	Balmorhea	51%	Floodplains	No	No
		Reeves	27%			
		Other	22%			

Source: SCS 1980; NRCS 2018.

2.2.2.2 Prime Farmland Soils

U.S.C. § 7-4201(c)(1)(A) defines prime farmland soils as those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They have the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. Additional potential prime farmlands are those soils that meet most of the requirements of prime farmland but fail because they lack the installation of water management facilities, or they lack sufficient natural moisture. The United States Department of Agriculture (USDA) would consider these soils as prime farmland if such practices were installed. According to the NRCS Web Soil Survey (NRCS 2018) there are several soil series designated as prime farmland within the study area. The soil associations are listed in Table 2-2.

Typically, the construction of a new transmission line is not considered a conversion of Prime and Important Farmlands because the area within the ROW between the transmission line structures can still be used for agricultural purposes after construction. As a result, no long-term adverse impacts to prime farmland soils are anticipated and without a federal nexus the project would be exempt from the regulations listed under Part 523 - Farmland Protection Policy Act (FPPA) Manual; Subpart B; 523.10,B (8).

The NRCS responded to POWER's solicitation for information in a letter dated February 08, 2018 (Appendix A). The NRCS stated, "The proposed project site may involve areas of Prime Farmland; however, we now consider the installation of transmission lines to be a minimal impact that will have no effect on productive agricultural lands. Due to these reasons, the proposed project is exempt from provisions of FPPA and no further consideration for protection is necessary."

2.2.2.3 Hydric Soils

The National Technical Committee for Hydric Soils defines hydric soils as soils that were formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation (NRCS 2018).

Table 2-2 lists whether there are map unit components that are rated as hydric soils in the study area. Minor soils (Other) within each association were not evaluated for this criterion. According to the NRCS Web Soil Survey Database (NRCS 2018), no major soils within the study area were identified as a hydric soil; however, minor soil components within each soil association may be designated as hydric.

2.2.3 Mineral and Energy Resources

The RRC data, USGS 7.5-minute topographic maps, and aerial photography were reviewed for oil/gas wells, pipelines, wind energy development, and supporting facilities. Multiple oil/gas wells, pipelines, and wind turbines were identified within the study area. Multiple active and historic gravel/caliche quarries/pits were identified within the study area through review of USGS 7.5-minute topographic maps and during field reconnaissance surveys. These features were mapped using GIS and taken into account during the routing process.

2.2.4 Water Resources

2.2.4.1 Surface Water

Water resources evaluated for this study area include lakes, ponds, rivers, streams, and floodplains. Information on water resources within the study area were obtained from a variety of sources including the Texas Water Development Board (TWDB), NHD, USGS (2018c) topographical maps, aerial photographs, and through field reconnaissance.

The study area is located entirely within the Rio Grande River Basin and Lower Pecos River Sub-Basin (USEPA 2018b). The Pecos River (TCEQ Stream Segment: 2311) flows approximately 0.5 mile outside of the northeast corner of the study area. Other named perennial, intermittent, and ephemeral streams within the study area include: Tunas Creek, Comanche Creek, Leon Creek, Courtney Creek, North Fork Independence Creek, Harral Draw, Monument Draw, South Linger Draw, Hole-in-the-Ground Draw, Six-Shooter Draw, Belding Draw, Acebuche Draw, Coyanosa Draw, Hackberry Draw, and Diamond Y Draw. Creeks, draws, and drainages within the study area generally flow in a northeast to east direction, until

their confluence with the Pecos River. Several additional unnamed drainages, ponds, and stock tanks are also within the study area. There are no major reservoirs or rivers within the study area. Review of the TWDB State Water Plan and Regional Water Plan (Region F) did not indicate any proposed reservoir projects within the study area (TWDB 2016 and 2017).

Under 31 TAC § 357.8, TPWD has identified Ecologically Significant Stream Segments (ESSS) based on habitat value, threatened and endangered species, species diversity, and aesthetic value criteria. Review of the TPWD ESSS list identified portions of Diamond Y Springs and Diamond Y Draw (Leon Creek). The basis for this designation includes potential threatened or endangered species/unique communities (TPWD 2018a). Additional information on threatened or endangered species within the study area is discussed in Section 2.6.4.

In accordance with Section 303(d) and 304(a) of the CWA, the TCEQ identifies surface waters for which effluent limitations are not stringent enough to implement water quality standards and for which the associated pollutants are suitable for measurement by maximum daily load. Review of the TCEQ (2014) Texas Integrated Report of Surface Water Quality indicates no surface waters within the study area that meet these water quality standards.

2.2.4.2 Ground Water

The major ground water aquifers mapped within the study area include the Edwards-Trinity and Pecos Valley Aquifers. Minor aquifers identified within the study area include the Captain Reef Complex, Dockum, and Rustler Aquifers. The Edwards-Trinity Aquifer underlies a majority of the study area as well as much of southwestern Texas. Water is contained predominantly within limestone and dolomite of the Edwards Group and sands of the Trinity Group. The average freshwater saturated thickness is approximately 433 feet, with a maximum saturated thickness of over 800 feet. Water quality ranges from fresh to slightly saline, with salinity typically increasing westward within the Trinity Group (TWDB 2011).

The Pecos Valley Aquifer is a major west Texas aquifer occurring north and south of the upper Pecos River Valley. Water is contained predominantly within alluvium and wind-blown deposits, with a thickness of up to 1,500 feet and freshwater saturated thickness averaging 250 feet. A majority of the water harvested from this aquifer is used for agricultural irrigation, but other uses include municipal, industrial, and power generation (TWDB 2011).

Other ground water resources such as public and private water wells and natural springs were identified using TWDB (1975 and 2018) data and USGS topographic maps (USGS 2018c). Several springs and groundwater seeps were identified throughout the study area. These features were mapped using GIS and taken into consideration during the routing process.

2.2.4.3 Floodplains

Federal Emergency Management Agency (FEMA) floodplain mapping data were reviewed for the study area. Based on FEMA Flood Insurance Rate Maps (FIRM), the 100-year floodplain data was not available for the entire study area, but floodplain areas may occur within low lying streams, draws, and associated depressional areas. The 100-year flood (one percent flood or base flood) represents a flood event that has a one percent chance of being equaled or exceeded for any given year (FEMA 2018).

2.2.5 Ecological Resources

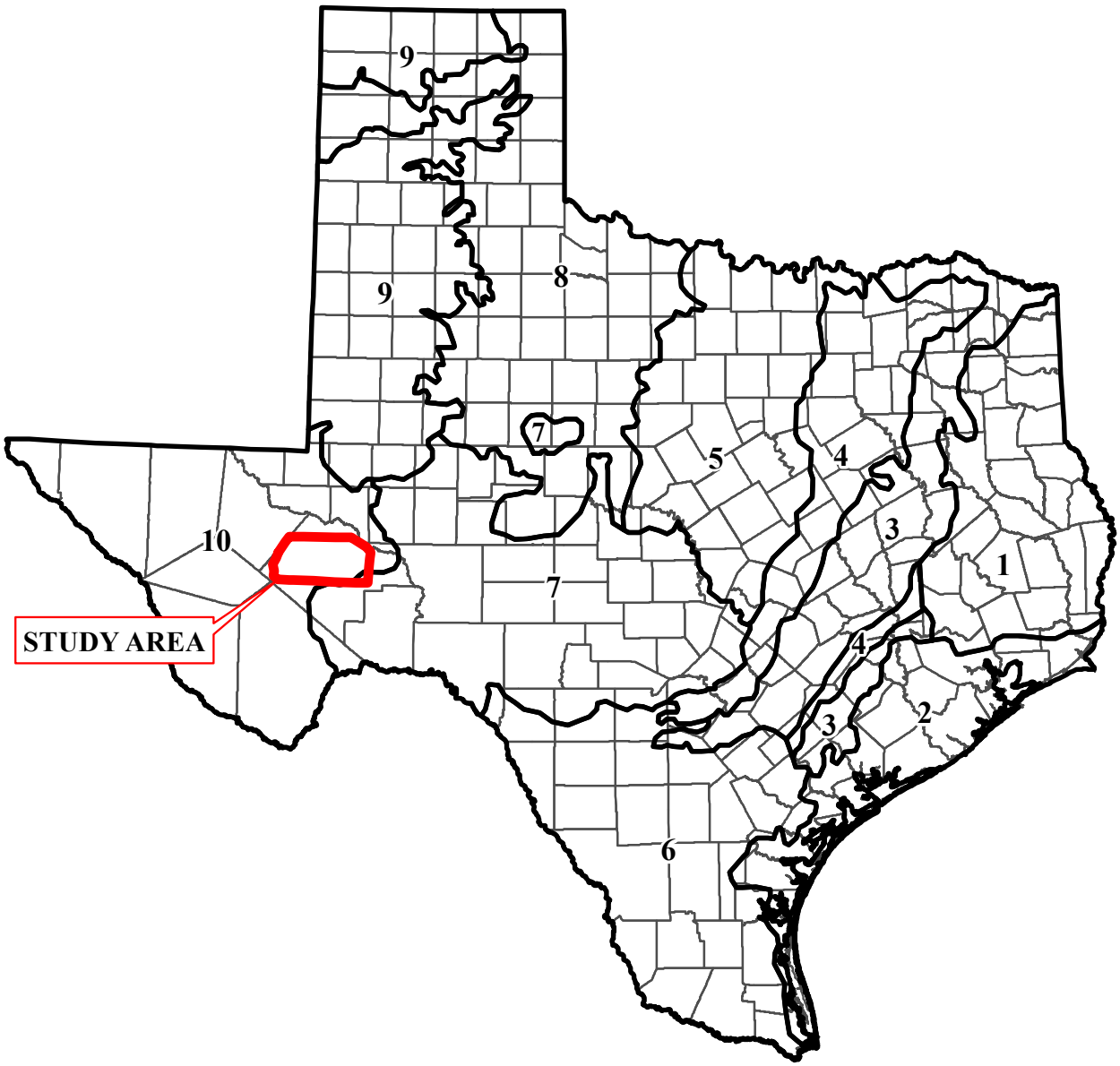
Information on sensitive wildlife and vegetation resources within the study area was obtained from a variety of sources, including correspondence with the USFWS and TPWD. Additional information was obtained from published literature and technical reports. All biological resource data for the study area were mapped using GIS.

For the purpose of this EA, emphasis was placed on obtaining known locations of unique vegetative communities and habitat for special status species that have been previously documented within the study area. Special status species include those listed by the USFWS as threatened, endangered, proposed, or candidate; and those listed by TPWD as threatened, endangered or as a rare species. A GIS file of known occurrences for listed species and/or sensitive vegetative communities was obtained from the TPWD's TXNDD on January 23, 2018. Although the TXNDD (2018) was reviewed, these data do not preclude the potential for a species to exist within the study area. Only a thorough review of existing habitats and/or a species-specific survey could determine the presence or absence of a special status species.

2.2.5.1 Vegetation

As shown in Figure 2-3, the study area is primarily located in the eastern portion of the Trans-Pecos Vegetational Area (Gould 1960). The southeast corner of the study area lies within the Edwards Plateau Vegetational Area (Gould 1960). The study area is also located near the eastern boundary of the Chihuahuan Desert Level III Ecoregion and with the Chihuahuan Basins and Playas and Stockton Plateau Level IV Ecoregions (Griffith et al. 2007). McMahan et al. (1984) describe the typical vegetation types within the study area as Creosote bush (*Larrea tridentata*)-Tarbush (*Flourensia cernua*) Shrub and Mesquite (*Prosopis* sp.)- Juniper (*Juniperus* sp.) Brush. TPWD Ecological Mapping Systems of Texas (EMST) (TPWD 2018b) database indicates the dominant vegetation types within the study area as Mesquite – Creosote bush Shrubland, Creosote bush Shrub, Juniper Shrubland, Hill and Foothill Grassland, Loamy Plains Grassland, Deciduous Semi-arid Shrubland, Semi-arid Grassland, and Mesquite Shrubland. Additional information on EMST ecoregions within the study area can be found in correspondence with TPWD in Appendix A. The paragraphs below provide general descriptions of the historical climax vegetative communities associated with each ecoregion. Species occurrence and density depends on location, hydrology, soil type, and magnitude of previous ground disturbance or land management activities.

The Chihuahuan Desert Ecoregion extends from eastern Arizona to the Edwards Plateau in Texas. Large flats in the bottom of these basins may contain vegetation types in this area which typically include semi-desert grassland and arid shrublands that are internally drained (Griffith et al. 2007). The flat arid floors of these basins (playas) may have saline or alkaline soils, as well as dunes and deposits of windblown sands. Lower positions in these basins may hold salt-tolerant species such as fourwing saltbush (*Atriplex canescens*), pickleweed (*Allenrolfea occidentalis*), and alkali sacaton (*Sporobolus airoides*). Alluvial fans and valleys above these basin flats are dominated by shrub species such as creosote bush and tarbush. Riparian areas are commonly invaded by saltcedars (*Tamarix spp*.) and giant cane (*Arundo donax*). Grazing of sheep and cattle are common in this ecoregion, as well as oil/gas and wind production (Griffith et al. 2007).



N
W E
S

0 25 50 100 150 200 250
Miles

Source: Gould, F.W., Hoffman, G.O., and Rechenthin, C.A. 1960, modified

Legend

Vegetational Areas Boundary
1 Pineywoods
2 Gulf Prairies and Marshes
3 Post Oak Savannah
4 Blackland Prairies
5 Cross Timbers and Prairies
6 South Texas Plains
7 Edwards Plateau
8 Rolling Plains
9 High Plains
10 Trans-Pecos

County Boundary

Figure 2-3

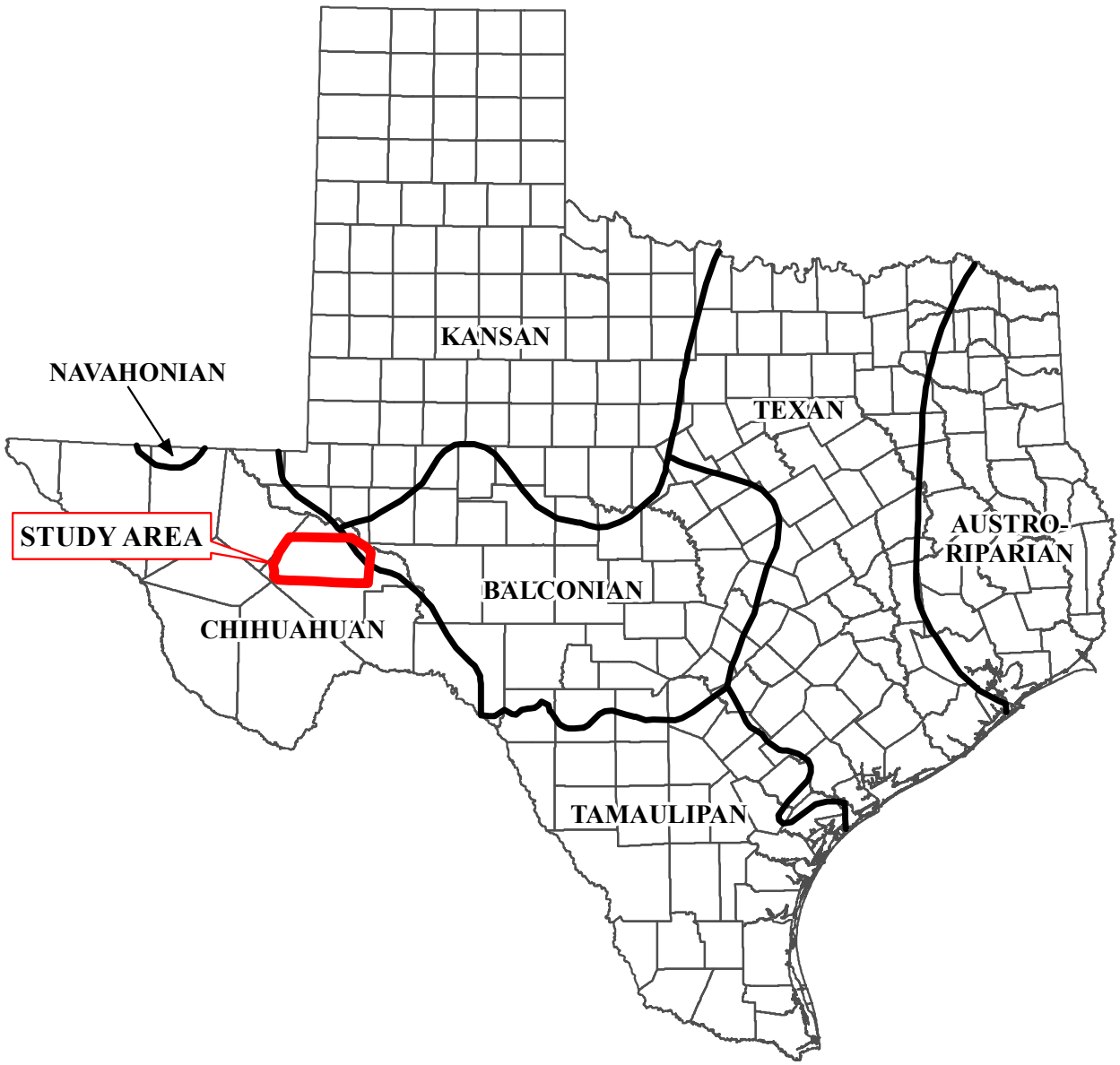
LOCATION OF THE STUDY AREA IN RELATION TO THE VEGETATIONAL AREAS OF TEXAS

Bakersfield-Solstice 345-kV Transmission Line Project

The Stockton Plateau Ecoregion is characterized by its arid elevated broken landscape, with district protruding mesas with limestone substrates. Vegetation in this area is considered transitional between habitats in the Chihuahuan Desert and Edwards Plateau. Historically, fire was an important factor to the Edwards Plateau ecosystem. With the absence of regular fires, woody juniper and mesquite vegetation has encroached on many native grasslands. Common shrub vegetation on mesas and slopes may include honey mesquite *(Prosopis glandulosa*), redberry juniper (*Juniperus pinchotii*), and Ashe juniper (*J. ashei*). On flats and draws vegetation may include grama grasses (*Bouteloua* spp.), yucca (*Yucca* spp.), sotol (*Dasylirion* spp.), lechuguilla (*Agave lechuguilla*), broomweeds (*Amphiachyris* spp.), tasajillo (*Cylindropuntia leptocaulis*), pricklypear (*Opuntia* spp.), and burrograss (*Scleropogon brevifolius*) (Griffith et al. 2007).

2.2.5.2 Terrestrial Wildlife

The study area is predominantly located within the Chihuahuan Biotic Province, with northeast portions of the study area within the Balconian Texan Biotic Province (see Figure 2-4), as described by Blair (1950). At the time of publication, species diversity within the Chihuahuan Biotic Province was noted to include 13 different anurans (frogs and toads), one urodele (salamanders and newts), 38 snake species, 22 lizards, one land turtle, and 83 species of mammals (Blair 1950). Species diversity within the Balconian Biotic Province was noted to include 15 different anurans, seven urodeles, 36 snake species, 16 lizards, two land turtles, and 57 species of mammals (Blair 1950).



N
W E
S

0 25 50 100 150 200 250
Miles

Source: Blair, 1950, modified

Legend

Biotic Province Boundary

County Boundary

Figure 2-4

LOCATION OF THE STUDY AREA IN RELATION TO THE BIOTIC PROVINCES OF TEXAS

Bakersfield-Solstice 345-kV Transmission Line Project

Amphibian species (frogs, toads and salamanders) that may typically occur within the study area are listed in Table 2-3. Frogs and toads may occur in all vegetation types, while salamanders are typically restricted to moist hydric habitats (Tipton et al. 2012).

TABLE 2-3 REPRESENTATIVE AMPHIBIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Acris blanchardi	Blanchard's cricket frog
Ambystoma marortium	Barred tiger salamander
Anaxyrus debilis insidior	Western Chihuahuan green toad
Anaxyrus punctatus	Red-spotted toad
Anaxyrus speciosus	Texas toad
Anaxyrus woodhousii australis	Southwestern Woodhouse's toad
Eleutherodactylus guttilatus	Spotted chirping frog
Eleutherodactylus marnockii	Cliff chirping frog
Gastrophryne olivacea	Western narrow-mouthed toad
Lithobates berlandieri	Rio Grande leopard frog
Scaphiopus couchi	Couch's spadefoot
Spea bombifrons	Plains spadefoot
Spea multiplicata	Mexican spadefoot

Source: Dixon 2013.

Reptiles (turtles, lizards and snakes) that may typically occur in the study area are listed in Table 2-4. These include those species that are more commonly observed near water (i.e., aquatic turtles) and those that are more common in terrestrial habitats (Dixon 2013).

TABLE 2-4 REPRESENTATIVE REPTILIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Turtles	
Apalone spinifera emoryi	Texas spiny softshell
Chelydra serpentina	Snapping turtle
Kinosternon flavescens flavescens	Yellow mud turtle
Terrapene ornata luteola	Desert box turtle
Trachemys scripta elegans	Red-eared slider
Lizards	
Aspidoscelis exsanguis	Chihuahuan spotted whiptail
Aspidoscelis gularis	Common spotted whiptail
Aspidoscelis inornata	Little striped whiptail
Aspidoscelis marmorata	Marbled whiptail
Aspidoscelis scalaris	Plateau spotted whiptail
Aspidoscelis tesselata	Common checkered whiptail
Cophosaurus texanus scitulus	Chihuahuan greater earless lizard
Crotaphytus collaris collaris	Eastern collared lizard
Hemidactylus turcicus	Mediterranean gecko
Holbrookia lacerata approximans	Speckled earless lizard

TABLE 2-4 REPRESENTATIVE REPTILIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Phryosoma cornutum	Texas horned lizard
Phryosoma modestum	Round-tailed horned lizard
Plestiodon multivirgatus	Many-lined skink
Plestiodon obsoletus	Great plains skink
Plestiodon tetragammus brevilineatus	Short-lined skink
Sceloporus cowlesi	Southwest fence lizard
Sceloporus merriami merriami	Merriam's canyon lizard
Sceloporus olivaceus	Texas spiny lizard
Sceloporus poinsettii	Crevice spiny lizard
Scincella lateralis	Little brown skink
Urosaurus ornatus schmidti	Big Bend tree lizard
Uta stansburiana stansburiana	Northern side-blotched lizard
Snakes	
Agkistrodon laticinctus	Broad-banded copperhead
Arizona elegans elegans	Kansas glossy snake
Bogertophis subocularis	Trans-Pecos ratsnake
Coluber taeniatus	Striped whipsnake
Coluber flagellum testaceus	Western coachwhip
Crotalus atrox	Western diamondback rattlesnake
Crotalus lepidus	Rock rattlesnake
Crotalus molossus	Western black-tailed rattlesnake
Crotalus scutulatus	Mohave rattlesnake
Crotalus viridis	Prairie rattlesnake
Diadophis punctatus regalis	Regal ring-necked snake
Gyalopion canum	Chihuahuan hook-nosed snake
Heterodon kennerlyi	Mexican hog-nosed snake
Heterodon nasicus	Plains hog-nosed snake
Hypsiglena jani	Chihuahuan night snake
Lampropeltis alterna	Gray-banded kingsnake
Lampropeltis gentilis	Western milksnake
Lampropeltis splendida	Desert kingsnake
Lampropeltis triangulum gentillis	Central plains milksnake
Micrurus tener	Texas coralsnake
Nerodia erythrogaster	Plain-bellied watersnake
Nerodia rhombifer	Diamond-backed water snake
Opheodrys aestivus	Rough greensnake
Pantherophis bairdi	Baird's ratsnake
Pantherophis emoryi	Great plains ratsnake
Pituophis catenifer sayi	Bullsnake
Rena dissecta	New Mexico threadsnake
Rhinocheilus lecontei	Long-nosed snake
Salvadora grahamiae lineata	Texas patch-nosed snake
Sistrurus tergeminus edwardsii	Desert massasauga
Sonora semiannulata semiannulata	Variable groundsnake
Tantilla cucullata	Trans-pecos black-headed snake
Tantilla hobartsmithi	Smith's black-headed snake

TABLE 2-4 REPRESENTATIVE REPTILIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Tantilla nigriceps	Plains black-headed snake
Thamnophis cyrtopsis cyrtopsis	Western black-necked gartersnake
Thamnophis marcianus	Checkered gartersnake
Thamnophis proximus diabolicus	Arid land ribbonsnake

Source: Dixon 2013.

Numerous avian (bird) species are present within the study area. Bird species occurring within the study area include year-round residents, summer/winter migratory residents, and temporary seasonal migrants. TPWD Trans Pecos Ecoregion bird check (Bryan 2002) list was reviewed for potentially occurring common and abundant species within the study area, as shown in Table 2-5. Additional transient bird species may migrate within or through the study area in the spring and fall and use the area to rest and feed before continuing migration (Lockwood and Freeman 2014). The likelihood for occurrence of each species will depend upon suitable habitat and the season. Migratory birds are protected under the MBTA.

TABLE 2-5 REPRESENTATIVE BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Scientific Name	Common Name	Year-Round Resident	Summer Resident	Winter Resident	Temporary Migrant
ACCIPITRIFORMES: Accipitridae					
Accipiter cooperii	Cooper's hawk	X			X
Accipiter striatus	Sharp-shinned hawk			X	
Buteo albonotatus	Zone-tailed hawk		X		
Buteo jamaicensis	Red-tailed hawk	X			
Buteo regalis	Ferruginous hawk			X	
Buteo swainsoni	Swainson's hawk		X		X
Circus cyaneus	Northern harrier			X	
Parabuteo unicinctus	Harris's hawk	X			
ACCIPITRIFORMES: Cathartidae					
Cathartes aura	Turkey vulture	X	X		
ANSERIFORMES: Anatidae					
Aix sponsa	Wood duck			X	
Anas acuta	Northern pintail			X	
Anas crecca	Green-winged teal			X	
Anas discors	Blue-winged teal				X
Anas platyrhynchos	Mallard	X		X	
Aythya affinis	Lesser scaup			X	
Aythya americana	Redhead			X	
Aythya collaris	Ring-necked duck			X	
Aythya valisineria	Canvasback			X	
Branta canadensis	Canada goose			X	X

TABLE 2-5 REPRESENTATIVE BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Scientific Name	Common Name	Year-Round Resident	Summer Resident	Winter Resident	Temporary Migrant
Bucephala albeola	Bufflehead			X	
Lophodytes cucullatus	Hooded merganser			x	
Mareca americana	American wigeon			X	
Mareca strepera	Gadwall			X	
Oxyura jamaicensis	Ruddy duck			X	
Spatula clypeata	Northern shoveler			X	
Spatula cyanoptera	Cinnamon teal			X	X
APODIFORMES: Trochilidae					
Archilochus alexandri	Black-chinned hummingbird		X		
Selasphorus platycercus	Broad-tailed hummingbird				X
Selasphorus rufus	Rufous hummingbird		X		X
CAPRIMULGIFORMES: Caprimulgidae					
Antrostomus arizonae	Mexican whip-poor-will		X		
Chordeiles acutipennis	Lesser nighthawk		X		X
Chordeiles minor	Common nighthawk		X		X
Phalaenoptilus nuttallii	Common poorwill		X		X
CHARADRIIFORMES: Charadriidae					
Charadrius vociferus	Killdeer	X			
CHARADRIIFORMES: Laridae					
Larus delawarensis	Ring-billed gull			X	X
Sterna forsteri	Forster's tern			X	X
CHARADRIIFORMES: Recurvirostridae					
Himantopus mexicanus	Black-necked stilt		X		X
Recurvirostra americana	American avocet		X		X
CHARADRIIFORMES: Scolopacidae					
Actitis macularius	Spotted sandpiper			X	X
Calidris mauri	Western sandpiper				X
Calidris minutilla	Least sandpiper			X	X
Gallinago delicata	Wilson's snipe				X
Limnodromus scolopaceus	Long-billed dowitcher				X
Phalaropus tricolor	Wilson's phalarope				X
Tringa melanoleuca	Greater yellowlegs			X	X
COLUMBIFORMES: Columbidae					
Columba livia	Rock pigeon	X			
Columbina inca	Inca dove	X			
Columbina passerina	Common ground-dove	X	X		
Streptopelia decaocto	Eurasian collared-dove	X			
Zenaida asiatica	White-winged dove	X			
Zenaida macroura	Mourning dove	X			
CORACIIFORMES: Alcedinidae					
Megaceryle alcyon	Belted kingfisher			X	

TABLE 2-5 REPRESENTATIVE BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Scientific Name	Common Name	Year-Round Resident	Summer Resident	Winter Resident	Temporary Migrant
CUCULIFORMES: Cuculidae					
Geococcyx californianus	Greater roadrunner	X			
FALCONIFORMES: Falconidae					
Falco sparverius	American kestrel			X	X
GALLIFORMES: Odontophoridae					
Callipepla squamata	Scaled quail	X			
Colinus virginianus	Northern bobwhite	X			
GALLIFORMES: Phasianidae					
Meleagris gallopavo	Wild turkey	X			
GRUIFORMES: Rallidae					
Fulica americana	American coot			X	
Porzana carolina	Sora			X	X
Rallus limicola	Virginia rail			X	X
PASSERIFORMES: Aegithalidae					
Psaltriparus minimus	Bushtit	X			
PASSERIFORMES: Alaudidae					
Eremophila alpestris	Horned lark	X			
PASSERIFORMES: Bombycillidae					
Bombycilla cedrorum	Cedar waxwing			X	X
PASSERIFORMES: Calcariidae					
Calcarius ornatus	Chestnut-collared longspur			X	X
PASSERIFORMES: Cardinalidae					
Cardinalis cardinalis	Northern cardinal	X			
Cardinalis sinuatus	Pyrrhuloxia	X			
Passerina caerulea	Blue grosbeak		X		X
Passerina ciris	Painted bunting		X		X
Passerina versicolor	Varied bunting		X		
Pheucticus melanocephalus	Black-headed grosbeak				X
Piranga ludoviciana	Western tanager				X
Piranga rubra	Summer tanager		X		X
PASSERIFORMES: Corvidae					
Aphelocoma woodhousei	Woodhouse's scrub-jay	X			
Corvus corax	Common raven	X			
Corvus cryptoleucus	Chihuahuan raven	X	X		
PASSERIFORMES: Emberizidae					
Aimophila ruficeps	Rufous-crowned sparrow	X			
Amphispiza bilineata	Black-throated sparrow	X			
Calamospiza melanocorys	Lark bunting			X	X
Chondestes grammacus	Lark sparrow		X		X
Junco hyemalis	Dark-eyed junco			X	X
Melospiza lincolnii	Lincoln's sparrow			X	X
Melozone fusca	Canyon towhee	X			

TABLE 2-5 REPRESENTATIVE BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Scientific Name	Common Name	Year-Round Resident	Summer Resident	Winter Resident	Temporary Migrant
Passerculus sandwichensis	Savannah sparrow			X	X
Peucaea cassinii	Cassin's sparrow		X		
Pipilo chlorurus	Green-tailed towhee			X	X
Pipilo maculatus	Spotted towhee			X	X
Pooecetes gramineus	Vesper sparrow			X	X
Spizella breweri	Brewer's sparrow			X	X
Spizella passerina	Chipping sparrow			X	X
Spizella pusilla	Field sparrow			X	X
Zonotrichia leucophrys	White-crowned sparrow			X	X
PASSERIFORMES: Fringillidae					
Haemorhous mexicanus	House finch	X			
Spinus pinus	Pine siskin			X	X
Spinus psaltria	Lesser goldfinch		X		X
PASSERIFORMES: Hirundinidae					
Hirundo rustica	Barn swallow		X		
Petrochelidon fulva	Cave swallow		X		
Petrochelidon pyrrhonota	Cliff swallow		X		
Riparia riparia	Bank swallow				X
Stelgidopteryx serripennis	Northern rough-winged swallow		X		X
Tachycineta bicolor	Tree swallow			X	X
Tachycineta thalassina	Violet-green swallow		X		
PASSERIFORMES: Icteridae					
Agelaius phoeniceus	Red-winged blackbird	X			X
Euphagus cyanocephalus	Brewer's blackbird			X	X
Icterus bullockii	Bullock's oriole		X		
Icterus parisorum	Scott's oriole		X		X
Icterus spurius	Orchard oriole		X		
Molothrus aeneus	Bronzed cowbird		X		
Molothrus ater	Brown-headed cowbird	X	X		
Quiscalus mexicanus	Great-tailed grackle	X			
Sturnella magna	Eastern meadowlark	X		X	
Sturnella neglecta	Western meadowlark	X		X	
Xanthocephalus xanthocephalus	Yellow-headed blackbird				X
PASSERIFORMES: Laniidae					
Lanius ludovicianus	Loggerhead shrike	X			
PASSERIFORMES: Mimidae					
Mimus polyglottos	Northern mockingbird	X			
Toxostoma crissale	Crissal thrasher	X			
Toxostoma curvirostre	Curve-billed thrasher	X			
PASSERIFORMES: Motacillidae					
Anthus rubescens	American pipit			X	X
PASSERIFORMES: Paridae					

TABLE 2-5 REPRESENTATIVE BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Scientific Name	Common Name	Year-Round Resident	Summer Resident	Winter Resident	Temporary Migrant
Baeolophus atricristatus	Black-crested titmouse	X			
PASSERIFORMES: Parulidae					
Cardellina pusilla	Wilson's warbler				X
Geothlypis tolmiei	MacGillivray's warbler				X
Geothlypis trichas	Common yellowthroat		X	X	X
Icteria virens	Yellow-breasted chat		X		X
Oreothlypis celata	Orange-crowned warbler			X	X
Oreothlypis ruficapilla	Nashville warbler				X
Setophaga coronata	Yellow-rumped warbler			X	X
Setophaga petechia	Yellow warbler				X
PASSERIFORMES: Passeridae					
Passer domesticus	House sparrow	X			
PASSERIFORMES: Polioptilidae					
Polioptila caerulea	Blue-gray gnatcatcher		X	X	X
Polioptila melanura	Black-tailed gnatcatcher	X			
PASSERIFORMES: Ptiliogonatidae					
Phainopepla nitens	Phainopepla		X	X	
PASSERIFORMES: Regulidae					
Regulus calendula	Ruby-crowned kinglet			X	X
PASSERIFORMES: Remizidae					
Auriparus flaviceps	Verdin	X			
PASSERIFORMES: Sittidae					
Sitta canadensis	Red-breasted nuthatch			X	
Sitta carolinensis	White-breasted nuthatch			X	
PASSERIFORMES: Sturnidae					
Sturnus vulgaris	European starling	X			
PASSERIFORMES: Troglodytidae					
Campylorhynchus brunneicapillus	Cactus wren	X			
Catherpes mexicanus	Canyon wren	X			
Cistothorus palustris	Marsh wren			X	X
Salpinctes obsoletus	Rock wren	X			
Thryomanes bewickii	Bewick's wren	X			
Troglodytes aedon	House wren			X	X
PASSERIFORMES: Turdidae					
Catharus guttatus	Hermit thrush	X			X
Sialia currucoides	Mountain bluebird			X	X
Sialia mexicana	Western bluebird			X	
Turdus migratorius	American robin			X	X
PASSERIFORMES: Tyrannidae					
Contopus sordidulus	Western wood-pewee				X
Empidonax oberholseri	Dusky flycatcher				X

TABLE 2-5 REPRESENTATIVE BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Scientific Name	Common Name	Year-Round Resident	Summer Resident	Winter Resident	Temporary Migrant
Empidonax traillii	Willow flycatcher				X
Empidonax wrightii	Gray flycatcher		X		
Myiarchus cinerascens	Ash-throated flycatcher		X		
Pyrocephalus rubinus	Vermilion flycatcher	X	X		
Sayornis nigricans	Black phoebe	X			
Sayornis saya	Say's phoebe	X			
Tyrannus forficatus	Scissor-tailed flycatcher		X		
Tyrannus verticalis	Western kingbird		X		
Tyrannus vociferans	Cassin's kingbird		X		
PASSERIFORMES: Vireonidae					
Vireo bellii	Bell's vireo		X		
Vireo plumbeus	Plumbeous vireo				X
Vireo vicinior	Gray vireo		X		
PELECANIFORMES: Ardeidae					
Ardea alba	Great egret		X		
Ardea herodias	Great blue heron	X			
Bubulcus ibis	Cattle egret			X	X
Butorides virescens	Green heron		X		
Nycticorax nycticorax	Black-crowned night-heron		X		
PELECANIFORMES: Threskiornithidae					
Plegadis chihi	White-faced ibis				X
PICIFORMES: Picidae					
Colaptes auratus	Northern flicker			X	
Melanerpes aurifrons	Golden-fronted woodpecker	X			
Picoides scalaris	Ladder-backed woodpecker	X			
Sphyrapicus nuchalis	Red-naped sapsucker			X	
PODICIPEDIFORMES: Podicipedidae					
Aechmophorus clarkii	Clark's grebe			X	
Aechmophorus occidentalis	Western grebe			X	
Podiceps nigricollis	Eared grebe			X	
Podilymbus podiceps	Pied-billed grebe			X	
STRIGIFORMES: Strigidae					
Athene cunicularia	Burrowing owl		X		
Bubo virginianus	Great horned owl	X			
Megascops kennicottii	Western screech-owl	X			
STRIGIFORMES: Tytonidae					
Tyto alba	Barn owl	X			
SULIFORMES: Phalacrocoracidae					
Phalacrocorax auritus	Double-crested cormorant			X	

Source: Bryan 2002; Lockwood and Freeman 2014.

Mammals that may potentially occur in the study area are listed in Table 2-6 (Schmidly and Bradley 2016). The occurrence of each species will be dependent on suitable habitat available with some species, such as bats, migrating through the study area.

TABLE 2-6 REPRESENTATIVE MAMMALIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Ammospermophilus interpres	Texas antelope squirrel
Antilocapra americana	Pronghorn
Antrozous pallidus	Pallid bat
Bassariscus astutus	Ringtail
Canis latrans	Coyote
Cervis canadensis	Elk
Chaetodipus eremicus	Chihuahuan desert pocket mouse
Chaetodipus hispidus	Hispid pocket mouse
Chaetodipus nelsoni	Nelson's pocket mouse
Conepatus leuconotus	Hog-nosed skunk
Cratogeomys castanops	Yellow-faced pocket gopher
Cynomys ludovicianus	Black-tailed prairie dog
Dasypus novemcinctus	Nine-banded armadillo
Didelphis virginiana	Virginia opossum
Dipodomys merriami	Merriam’s kangaroo rat
Dipodomys ordii	Ord’s kangaroo rat
Dipodomys spectabilis	Banner-tailed kangaroo rat
Erethizon dorsatum	Porcupine
Ictidomys parvidens	Rio Grande ground squirrel
Lasionycteris noctivagans	Silver-haired bat
Lasiurus borealis	Eastern red bat
Lasiurus cinereus	Hoary bat
Lepus californicus	Black-tailed jackrabbit
Lynx rufus	Bobcat
Mephitis macroura	Hooded skunk
Mephitis mephitis	Striped skunk
Mus musculus	House mouse
Mustela frenata	Long-tailed weasel
Myotis velifer	Cave myotis bat
Myotis yumanensis	Yuma myotis bat
Neotoma leucodon	White-toothed woodrat
Neotoma micropus	Southern plains woodrat
Notiosorex crawfordi	Crawford's desert shrew
Nyctinomops macrotis	Big free-tailed bat
Odocoileus hemionus	Mule deer
Odocoileus virginianus	White-tailed deer
Onychomys arenicola	Chihuahuan grasshopper mouse
Onychomys leucogaster	Northern grasshopper mouse
Parastrellus hesperus	American parastrelle bat
Perimyotis subflavus	American perimyotis
Perognathus flavus	Silky pocket mouse

TABLE 2-6 REPRESENTATIVE MAMMALIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Perognathus merriami	Merriam's pocket mouse
Peromyscus eremicus	Cactus deermouse
Peromyscus laceianus	Lacey's white-ankled deermouse
Peromyscus leucopus	White-footed mouse
Peromyscus maniculatus	North American deer mouse
Plecotus townsendii	Townsend's big-eared bat
Procyon lotor	Northern raccoon
Puma concolor	Mountain lion
Rattus norvegicus	Norway rat
Rattus rattus	Roof rat
Reithrodontomys fulvescens	Fulvous harvest mouse
Reithrodontomys megalotis	Western harvest mouse
Reithrodontomys montanus	Plains harvest mouse
Sigmodon hispidus	Hispid cotton rat
Spermophilus variegatus	Rock squirrel
Spilogale gracilis	Western spotted skunk
Sus scrofa	Feral pig
Sylvilagus audubonii	Desert cottontail rabbit
Sylvilagus floridanus	Eastern cottontail rabbit
Tadarida brasiliensis	Brazilian free-tailed bat
Taxidea taxus	American badger
Tayassu tajacu	Collared peccary
Thomomys bottae	Botta's pocket gopher
Urocyon cinereoargenteus	Common gray fox
Ursus americanus	American black-bear
Vulpes macrotis	Kit fox
Vulpes vulpes	Red fox
Xerospermophilus spilosoma	Spotted ground squirrel

Source: Schmidly and Bradley 2016.

2.2.5.3 Aquatic Habitat

Mapped wetlands information was incorporated for the study area from the USFWS' NWI database (USFWS 2018a). NWI maps are based on topography and interpretation of infrared satellite data and color aerial photographs and are classified under the Cowardin System (Cowardin et al. 1979). NWI wetlands types identified within the study area include freshwater palustrine emergent (PEM), forested/shrub (PSS), and ponds. PEM wetlands are primarily associated with depressional areas and along the margins of open water areas. PSS wetlands exist typically in depressional or riparian areas near streams, draws, and ponds. Mapped ponds and lakes are typically associated with shallow freshwater stock ponds, retention ponds, and other small impoundments.

Perennial and intermittent streams, as well as ephemeral streams and draws exist in the study area, and may be prone to flash flooding after heavy rain storms. Perennial aquatic environments may support species of smartweeds and docks (*Polygonaceae*), pennyworts (*Hydrocotyle* spp.), widgeon-grass (*Ruppia* spp.), pondweed (*Potamogetonacae*), and duckweeds (*Lemna* spp.). Emergent wetlands may be located along the edges of ponds and streams during wetter periods and may be comprised of such species as rushes (*Juncus* spp.), spikerushes (*Eleocharis* spp.), sedges (*Carex* spp.), and flatsedges (*Cyperus* spp.) (Chadde 2012a and 2012b). Bottomland/riparian areas were mapped by POWER personnel through aerial photography and topographic map interpretation.

The intermittent flowing streams support aquatic species primarily adapted to ephemeral pool habitats. Because they consist of small headwater drainages, persistent flow is unlikely to be sufficient to support any substantial lotic assemblage. Aquatic species in this habitat are typically adapted to rapid dispersal and completion of life cycles in pool habitats having fine-grained substrates. In streams dominated by scoured, sandy-clay bottoms, accumulations of woody debris or leaf pack provide the most important feeding and refuge areas for invertebrates and forage fish. The softer muddy bottoms generally harbor substantial populations of burrowing invertebrates (e.g., larval diptera and oligochaetes) which can be an important food source to higher trophic levels (Hubbs 1957).

The perennial streams and lakes offer relatively stable water levels and the constant pools and flow facilitate stable population growth. Species with flowing water or pooled area habitat requirements will use the perennial streams and those adapted for deeper waters will use the lake/pond environments. With distance downstream, especially in pooled areas, the fish community tends to be heavily dominated by widely distributed sunfish (*Lepomis* spp.), bass (*Micropterus* spp.), and catfish (*Ictalurus* spp.) when sufficient water is present (Hubbs 1957). Several species of turtles, snakes, and amphibians are also

dependent on perennial surface waters for their habitat requirements. Several of these species will infrequently use terrestrial habitats to migrate from between surface waters, but they primarily use impounded and perennial surface waters.

Ponds located in the study area exhibit variability in terms of their age, drainage, use by livestock, past fish stocking, and fertilization history. These aquatic habitats are almost always exposed to full sunlight and do not typically experience the variations in flow as do streams and rivers after heavy rainfall events. Typically, fluctuations in water level are experienced during the summer months because of high evaporation rates and repeated heavy rainfall required to fill the ponds completely. Periods of extended drought in the region may reduce these seasonal water level fluctuations or dry the pond completely. Bottom materials in these ponds are typically universally silt-sized particles, either naturally occurring or added as a liner to prevent leakage.

2.2.5.4 Threatened and Endangered Species

For this routing study, emphasis was placed on obtaining documented occurrences of special status species and/or their potential habitat within the study area. The documented occurrences of species of concern and/or other unique vegetative communities within the study area were also reviewed. Special status species include those listed by the USFWS (2018b) as threatened, endangered, proposed, or candidate; and those species listed by TPWD (2018c) as threatened or endangered or rare. POWER requested a GIS data layer of historical known occurrences for listed species and/or sensitive vegetative communities from the TXNDD (TXNDD 2018). For the purpose of this study, the TXNDD information is not used as a substitute for a presence/absence survey, but as an indication of previous occurrences within suitable habitat for the species.

A USFWS (2018b) IPaC (Consultation Code: 02ETAU00-2018-SLI-1395) official species list was requested and received on August 16, 2018. This USFWS report identifies potentially occurring federal-listed threatened, endangered, and candidate species and habitats within the study area (USFWS 2018b). By definition under the ESA, a threatened species is likely to become endangered within the near foreseeable future throughout all or a significant portion of its range. An endangered species is in danger of extinction throughout all or a significant portion of its range. Candidate species are those that have sufficient information on their biological vulnerability and threat(s) to support listing as threatened or endangered and are likely to be proposed for listing in the near foreseeable future. The ESA also provides for the conservation of designated “Critical Habitat,” which is defined as the areas of land, water, and air space that an endangered species needs for survival. These areas include sites with food and water,

breeding areas, cover or shelter sites, and sufficient habitat to provide for normal population growth and behavior for the species (USFWS 2017). Review of the USFWS data identified six designated Critical Habitats within the study area (USFWS 2018b). Critical Habitat for the diamond tryonia (*Pseudotryonia adamantina*), Gonzales tryonia (*Tryonia circumstriata*), Leon Springs pupfish (*Cyprinodon bovinus*), Pecos sunflower (*Helianthus paradoxus*), Pecos amphipod (*Gammarus pecos*), and Pecos assiminea snail (*Assiminea pecos*). All of these Critical Habitats are located along Leon Creek and Diamond Y Spring within the Diamond Y Spring Macrosite Conservation Easement, north of the City of Fort Stockton, and were mapped using GIS and avoided during the routing process.

Threatened and Endangered Plant Species

The USFWS (2018b) IPaC species list for the study area and TPWD (2018c) county listings were reviewed for special status plant species potentially occurring within the study area. USFWS (2018b) and TPWD (2018c) data identified two federally listed plant species within the study area, the Lloyd's mariposa cactus (*Echinomastus mariposensis*) and Pecos sunflower (*Helianthus paradoxus*).

The Lloyd's mariposa cactus is a federally listed threatened species and may be found on gravelly or rocky limestone grades of arid Chihuahuan shrublands. This species flowers in February or March and fruits one or two months after. It is typically found in the Big Bend region of Brewster and Presidio counties, although USFWS also has the species listed for Pecos County (Poole et al. 2007). This species may occur within the study area if suitable habitat is present.

The Pecos sunflower is a federally listed endangered species that is typically restricted to saline soils of permanently wet desert marshes. This species is only found in Pecos and Reeves counties as well as in five counties in New Mexico and flowers from August to November (Poole et al. 2007; TPWD 2018b). Designated Critical Habitat for this species, if found within the study area, was previously identified along Leon Creek. TXNDD (2018) data identified six occurrences of this species within moist habitats in the study area. This species may occur within the study area where suitable habitat is found.

Threatened and Endangered Animal Species

The USFWS (2018b) IPaC species list identifies eleven animal species (five birds, two fish, one crustacean, and three snails) as federally threatened or endangered for the study area. The TPWD's (2018c) Annotated County Lists of Rare Species identifies 22 federally and/or state-listed, threatened, endangered, candidate, and potentially extirpated animal species (Table 2-7). The TPWD county listing typically includes the same species that USFWS lists; however, it may also reflect additional federally

listed species. Although only federally listed threatened or endangered species are protected under the ESA, state-listed species may receive protection under other federal and/or State laws, such as the MBTA, BGEPA, Chapters 67, 68, and 88 of the TPWD Code, and sections 65.171–65.184 and 69.01–69.14 of Title 31 of the TAC. A brief species description life history and habitat requirements are summarized below for each listed species.

TABLE 2-7 LISTED THREATENED AND ENDANGERED ANIMAL SPECIES WITHIN THE STUDY AREA

LISTED SPECIES		LEGAL STATUS	
Scientific Name	Common Name	USFWS	TPWD[2]
Birds			
Buteo albonotatus	Zone-tailed hawk	-	T
Calidris canutus rufa	Red knot	T[1]	-
Charadrius melodus	Piping plover	T[1]	T
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	T[2]	-
Egretta rufescens	Reddish egret	-	T
Falco femoralis septentrionalis	Northern aplomado falcon	E[1]	E
Falco peregrinus	Peregrine falcon	DL[2]	T
Sternula antillarum athalassos	Interior least tern	E[1]	E
Strix occidentalis lucida	Mexican spotted owl	T[1]	T
Vireo atricapilla	Black-capped vireo	DL[2]	E
Crustaceans			
Gammarus pecos	Pecos amphipod	E[1]	E
Fishes			
Cyprinella proserpina	Proserpine shiner	-	T
Cyprinodon bovinus	Leon Springs pupfish	E[1]	E
Cyprinodon elegans	Comanche Springs pupfish	E[2]	E
Cyprinodon pecosensis	Pecos pupfish	-	T
Gambusia nobilis	Pecos gambusia	E[1]	E
Mammals			
Canis lupus	Gray wolf	EXT, E[2]	E
Mustela nigripes	Black-footed ferret	EXT, E[2]	-
Ursus americanus	Black bear	DL	T
Mollusks/Snails			
Assiminea pecos	Pecos assiminea snail	E[1]	E
Popenaias popeii	Texas hornshell	C[2]	T
Pseudotryonia adamantina	Diamond tryonia	E[1]	E
Tryonia circumstriata	Gonzales tryonia	E[1]	E
Reptiles			
Phrynosoma cornutum	Texas horned lizard	-	T
Tantilla cucullata	Trans-Pecos black-headed snake	-	T

[1] USFWS 2018b.
[2] TPWD 2018c.
E - Federal and/or State-Listed Endangered
T - Federal and/or State-Listed Threatened
DL - Federally Delisted
C - Federal Candidate for Listing
EXT - Extirpated from study area

Federally Listed Species

BIRDS

Interior least tern

The interior least tern (*Sternula antillarum athalassos*) is a subspecies that nests inland along sand and gravel bars within braided streams and rivers. It is also known to nest on man-made structures (inland beaches, wastewater treatment plants, gravel quarries, etc.). USFWS recognizes any nesting least tern that is 50 miles or greater from a coastline as being an interior least tern. Historically in Texas, birds nested along the Canadian, Red, and Rio Grande River systems. This species may still nest along these systems, but is typically restricted to less altered or disturbed areas. TXNDD (2018) did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area due to a lack of suitable riparian nesting habitat, except as a rare non-breeding migrant (Lockwood and Freeman 2014).

Mexican Spotted Owl

The Mexican spotted owl (*Strix occidentalis lucida*) may occur in the Guadalupe and Davis Mountains of far west Texas, nesting on cliffs in Texas that are at higher elevations in deep, cool canyons. Unlike most other species of owls, these owls have dark colored eyes. Their habitat is characterized as mature, old-growth forests of pine (*Pinus* sp.) and fir (*Abies* sp.), on steep slopes and canyons with rocky cliffs. TXNDD (2018) did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area due to a lack of suitable habitat. (Lockwood and Freeman 2014).

Northern aplomado falcon

The northern aplomado falcon (*Falco femoralis septentrionalis*) may be common within its range in Mexico and within South Texas. Historically, the northern aplomado falcon was found in the Trans-Pecos Region east to Midland and also in the south Texas Brushlands. This species was extirpated from Texas in the 1950s and reintroduction of the species to the region has been ongoing since 1989. Current populations exist in coastal prairies and barrier island areas of south Texas (Lockwood and Freeman 2014). In the Trans-Pecos Region, reintroduction efforts have not been as successful, and this species is a rare siting. TXNDD (2018) did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area except as a rare to casual visitor on mid-elevation grasslands (Lockwood and Freeman 2014).

Piping plover

The piping plover (*Charadrius melodus*) is an uncommon-to-locally common winter resident along the Texas coastline and rarely seen inland during migration. They occupy sandy beaches and lakeshores, bayside mudflats, and salt flats. Plovers feed on small marine insects and other small invertebrates. Loss and alteration of nesting and wintering habitat are the primary cause of the decline in plover populations (TPWD 2018c). TXNDD (2018) did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area, except as a rare non-breeding migrant (Lockwood and Freeman 2014).

Red knot

The red knot (*Calidris canutus rufa*) is a migratory bird that nests in the drier arctic tundra areas and overwinters along shorelines along the Gulf of Mexico coastline and into Central and South America (TPWD 2018c; USFWS 2013). TXNDD (2018) did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area, except as a rare non-breeding migrant (Lockwood and Freeman 2014).

Western yellow-billed cuckoo

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a Neotropical migrant which typically breeds along riparian areas in far west Texas. The USFWS separates this western sub-species from its eastern counterpart by the Rocky Mountain Continental Divide for conservation purposes (National Park Service [NPS] 2014). TXNDD (2018) did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area due to a lack of suitable habitat.

CRUSTACEANS

Pecos amphipod

The Pecos amphipod (*Gammarus pecos*) is a small species of aquatic amphipod endemic to two locations in Pecos County, Texas. This species is only known to occur at Diamond Y Spring and Leon Creek, north of the City of Fort Stockton. USFWS Critical Habitat has been designated at these locations (USFWS 2018b; TPWD 2018c). These habitats were mapped using GIS and avoided during the routing process. This species may occur within the study area along Diamond Y Springs and Leon Creek where suitable habitat is found.

FISHES

Comanche Springs pupfish

The Comanche Springs pupfish (*Cyprinodon elegans*) is a small species of fish endemic only in spring-fed waters near the City of Balmorhea, Texas. USFWS Critical Habitat has been designated at these locations (USFWS 2018b; TPWD 2018c). This species is not anticipated to occur within the study area due to a lack of suitable habitat.

Leon Springs pupfish

The Leon Springs pupfish (*Cyprinodon bovinus*) is a small species of fish endemic to natural spring-fed slow-flowing water, marshes, and pools in Pecos County. This species is only known to occur at Diamond Y Spring and Leon Creek, north of the City of Fort Stockton. TXNDD (2018) data identified three occurrences of this species at this location. USFWS Critical Habitat has been designated at these locations (USFWS 2018b; TPWD 2018c). These habitats were mapped using GIS and avoided during the routing process. This species is typically found on the margins of spring-fed marsh pools, away from vegetation. This species may occur within the study area along Diamond Y Springs and Leon Creek where suitable habitat is found.

Pecos gambusia

The Pecos gambusia (*Gambusia nobilis*) is a small species of fish endemic to spring-fed pools and marshes with constant temperature in west Texas and southeast New Mexico. In Texas, this species is found in Jeff Davis and Pecos counties, with the only known locations in aquatic habitats near the City of Balmorhea, Texas and within Leon Creek and Diamond Y Spring outflow north of the City of Fort Stockton. TXNDD (2018) data identified an occurrence of this species at this location. These habitats were mapped using GIS and avoided during the routing process. This species may occur within the study area along Diamond Y Springs and Leon Creek where suitable habitat is found.

MOLLUSKS/SNAILS

Diamond tryonia

The Diamond tryonia (*Tryonia adamantina*) is a small species of aquatic mollusk endemic to Pecos County. This species is only known to occur at Diamond Y Spring and Leon Creek, north of the City of Fort Stockton. TXNDD (2018) data identified an occurrence of this species at this location. USFWS Critical Habitat has been designated at these locations (USFWS 2018b; TPWD 2018c). These habitats were mapped using GIS and avoided during the routing process. This species occurs in mud substrates on the margins of springs and in flowing water of marshes associated with sedges and cattails. This species

may occur within the study area along Diamond Y Springs and Leon Creek where suitable habitat is found.

Gonzales tryonia

The Gonzales tryonia (*Tryonia circumstriata*) is a small species of aquatic mollusk endemic to Pecos County. This species is only known to occur at Diamond Y Spring and Leon Creek, north of the City of Fort Stockton. TXNDD (2018) data identified an occurrence of this species at this location. USFWS Critical Habitat has been designated at these locations (USFWS 2018b; TPWD 2018c). These habitats were mapped using GIS and avoided during the routing process. This species occurs in mud substrates on the margins of springs and in flowing water of marshes associated with sedges and cattails. This species may occur within the study area along Diamond Y Springs and Leon Creek where suitable habitat is found.

Pecos assiminea snail

The Pecos assiminea snail (*Assiminea pecos*) is a small species of semi-aquatic snail endemic to the Pecos River Valley of New Mexico and Texas. This species is now known only to occur at Diamond Y Spring and Leon Creek, north of the City of Fort Stockton. TXNDD (2018) data identified an occurrence of this species at this location. USFWS Critical Habitat has been designated at these locations (USFWS 2018b; TPWD 2018c). These habitats were mapped using GIS and avoided during the routing process. This species is typically found on moist ground or beneath emergent vegetation near slow moving water. This species may occur within the study area along Diamond Y Springs and Leon Creek where suitable habitat is found.

Federal Candidate Species

Texas hornshell

The Texas hornshell (*Popenaias popei*) is a freshwater mussel that inhabits both ends of narrow shallow runs over bedrock, in areas where small-grained materials collect in crevices, along river banks, and at the base of boulders; and is not known from impoundments (Howells et al. 1996). TXNDD (2018) did not identify any occurrences of this species within the study area. This species may occur within the study area if suitable habitat exists.

State Listed Species

BIRDS

Reddish egret

The reddish egret (*Egretta rufescens*) is a wading bird with blue legs, a pink bill, and might occur as white (white phase) or gray with a reddish or rusty colored head and neck (dark phase) (TPWD 2018c). The reddish egret is a permanent resident of the Texas Gulf Coast and inhabits brackish marshes and shallow salt ponds and tidal flats (Alsop 2002). This species may also occur on larger reservoirs within the Tran-Pecos region (Lockwood and Freeman 2014). This species nests on the ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear (TPWD 2018c). TXNDD (2018) data did not identify any occurrences of this species within the study area. This species is not anticipated to occur within the study area due to a lack of suitable habitat.

Zone-tailed hawk

The zone-tailed hawk (*Buteo albonotatus*) inhabits arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains. This species nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions (TPWD 2018c). Zone-tailed hawks are uncommon to locally common summer residents to the central Trans-Pecos and east to the southern Edwards Plateau (Lockwood and Freedman 2014). This species may occur within the study area if suitable habitat is available.

FISHES

Pecos pupfish

The Pecos pupfish (*Cyprinodon pecosensis*) is a small species of fish endemic to the Pecos River Basin, now restricted to upper portions of the basin. This species is typically found in the shallows of clear, vegetated spring waters and sinkhole habitats (TPWD 2018c). TXNDD (2018) data identified two occurrences of this species along the Pecos River, near the northwest corner of the study area. This species may occur within the study area if suitable habitat is available.

Proserpine shiner

The Proserpine shiner (*Cyprinella proserpina*) is a small species of fish endemic to the Rio Grande and Pecos River Basins. This species is typically found in rocky flowing waters and pools of streams and rivers (TPWD 2018c). This species may occur within the study area if suitable habitat is available.

REPTILES

Texas horned lizard

The Texas horned lizard (*Phrynosoma cornutum*) population has decreased due to collection, land use conversions, habitat loss, and increased fire ant populations. The Texas horned lizard inhabits a variety of habitats including open desert, grasslands, and shrubland in arid and semiarid habitats that contain bunch grasses, cacti, and yucca on soils varying from pure sands and sandy loams to coarse gravels, conglomerates, and desert pavements. Their primary prey item is the harvester ant (*Pogonomyrmex* spp.), but they may also consume grasshoppers, beetles, and grubs. The Texas horned lizard thermo-regulates by basking or burrowing into the soil and is active (not hibernating) between early spring to late summer (Henke and Fair 1998). This species may occur within the study area where suitable habitat is available.

Trans-Pecos black-headed snake

The Trans-Pecos black-headed snake (*Tantilla cucullata*) habitat may occur on steep and rocky substrates in mesquite-creosote or pinyon-juniper-oak habitats of west Texas. This species is mostly nocturnal and lays its eggs between June and August. TXNDD (2018) data identified an occurrence of this species in the eastern half of the study area. This species may occur within the study area where suitable habitat is available.

Federally Delisted Species

Peregrine Falcon

The peregrine falcon (*Falco peregrinus*) state listing includes two subspecies: American peregrine falcon (*F. p. anatum*) and arctic peregrine falcon (*F. p. tundrius*). Although only the American subspecies is listed as state threatened, both sub-species are listed together because of their similarity of appearance (TPWD 2018c). Both subspecies are federally delisted because of the recovery of population numbers. The American peregrine falcon inhabits nests in tall cliff eyries and occupies many kinds of habitats during migration, including urban. Stopover habitat during migration may include lake shores and coastlines and the falcon is also a resident breeder in west Texas (USFWS 2006; TPWD 2018c). This species is not anticipated to occur in the study area except as a rare migrant (Lockwood and Freeman 2014).

Black bear

The American black bear (*Ursus americanus*) was listed due to similarities to the sub-species of Louisiana black bear (*U. a. luteolus*). However, as of March 10, 2016, Louisiana black bear was delisted from the Endangered Species List due to recovery of the population. The Louisiana black bear is only known to occur within portions of Louisiana, Mississippi and east Texas and preferred habitat in

bottomland hardwoods and large tracts of inaccessible forested areas (TPWD 2018c). The American black bear historically inhabited various habitats throughout Texas and was once thought to be extirpated from the state. In recent years sightings have increased near the Chisos Mountains in west Texas and the Texas Panhandle from bears dispersing from rugged terrain in Mexico and New Mexico (Schmidly and Bradley 2016). This species may occur within the study area where suitable habitat is found.

Black-capped vireo

The black-capped vireo (*Vireo atricapilla*) nests from northern Tamaulipas through west and central Texas and isolated portions of Oklahoma (Graber 1961; Campbell 2003). Suitable nesting areas typically consist of a patchy network of dense low shrubland cover with branches extending to the ground. Shrub sized broad-leaved vegetation will in general cover 30 to 60 percent or greater of the area and be approximately six feet tall or more (Campbell 2003). Habitat vegetation is typically within early succession stages or located on shallow, poor, or eroded soils which encourage the growth of patchy low shrublands (Graber 1961). The vireo nests from March to July with the young fledging in three to four weeks (Graber 1961; Campbell 2003). It is not uncommon for these vireos to have multiple nesting attempts within one breeding season, building a new nest with each nesting attempt (Graber 1961). Review of TXNDD (2018) data did not identify any occurrences of this species within the study area. This species may occur within the study area as a breeding spring/summer resident (Lockwood and Freeman 2014) if suitable habitat is available.

Extirpated Listed Species

Gray wolf

The gray wolf (*Canis lupus*) was formerly known throughout the western two-thirds of the state inhabiting forests, brushlands, and grasslands. However, the species is now considered extirpated from the state of Texas (Schmidly and Bradley 2016). This species is not anticipated to occur within the study area.

Black-footed ferret

The federally-listed endangered black-footed ferret (*Mustela nigripes*) is associated primarily with prairie dog towns and historically ranged in Texas throughout the northwestern portion of the state including the Panhandle, much of the Trans-Pecos, and a considerable part of the Rolling Plains. However, the black footed ferret is now considered extirpated from Texas with the last records from Dallam County in 1953 and Bailey County in 1963 (Schmidly and Bradley 2016). Therefore, the occurrence of the black-footed ferret within the study area is not anticipated.

Rare Species and Sensitive Vegetation Communities

While not regulated, TPWD (2018c) and TXNDD (2018) data also list rare species and sensitive vegetation communities. TPWD generally recommends consideration for these species and avoidance of the listed vegetation communities when routing linear utility corridors. However, these data do not preclude the potential for each species to exist within the study area. Only a species-specific survey could delineate potential suitable habitat and determine the presence or absence of a special status species. Review of the TXNDD (2018) data identified several species of concern and sensitive vegetation communities within the study area. These habitats were mapped using GIS and taken into account during the routing process. For a discussion of TPWD listed rare species, please refer to the TPWD letter in Appendix A.

2.3 Community Values

The term "community values" is included as a factor for the consideration of transmission line route certification under § 37.056(c)(4)(A) of the Texas Utilities Code. The PUC CCN application requires information concerning the following items that may reveal community values:

- Public meeting or public open house.
- Approvals or permits required from other governmental agencies.
- Brief description of the area traversed.
- Habitable structures within 500 feet of the centerline of the proposed project.
- FAA registered airports, private airstrips, and heliports located in the area.
- Irrigated pasture or croplands utilizing center-pivot or other traveling irrigation systems.

In addition, POWER evaluated the Proposed Project for community values that might not be specifically listed by the PUC in a rule or the application form, but that might be of importance to the community in the area of the project. The term "community values" is not formally defined in the PUC rules. However, in several dockets the PUC Staff and PUC Commissioners have used the following as a working definition: the term "community values" is defined as *a shared appreciation of an area or other natural resource by a national, regional, or local community*. Examples of a community resource would be a park or recreational area, historical or archeological site, or a scenic vista (aesthetics). POWER and LCRA TSC/AEP Texas mailed consultation letters to various local elected and appointed officials and hosted a public open house meeting to identify and collect information regarding community values and community resources.

2.4 Human Development

The study area is comprised of numerous political jurisdictions and land uses. Land use data was collected from a variety of federal, state, and local sources and was organized into the following categories:

- Existing Land Use (Urban/Developed)
- Planned Land Use
- Agricultural
- Oil and Gas Facilities
- Utility Features/Generation Facilities
- Transportation/Aviation/Communication Facilities
- Parks and Recreation Areas

2.4.1 Existing Land Use

Existing land uses were placed into the following categories: urban/developed, agriculture, industrial, and transportation features. The primary sources of land use information were obtained from interpretation of aerial photographs, USGS topographical maps, input from the public and local representatives of the public, and reconnaissance surveys.

Habitable Structures

The PUC definition of a habitable structure was used for this routing study. 16 TAC § 25.101(a)(3) defines a habitable structure as "structures normally inhabited by humans or intended to be inhabited by humans on a daily or regular basis. Habitable structures include, but are not limited to, single-family and multi-family dwellings and related structures, mobile homes, apartment buildings, commercial structures, industrial structures, business structures, churches, hospitals, nursing homes, and schools." Habitable structures were identified using aerial photograph interpretation and reconnaissance surveys from public access roads. Locations of the habitable structures are depicted on Figures 4-1a, b, and c, and the distance from each route centerline is presented in Tables 4-3 through 4-27.

Urban/Developed

The urban/developed classification represents concentrations of surface-disturbing land uses, which include habitable structures and other developed areas characterized with low, medium, and high intensities. The various levels of development include a mix of residential, commercial, and/or industrial land uses.

Developed low, medium, and high intensity areas were identified using aerial photograph interpretation and reconnaissance surveys. These classifications are described below:

- **Developed Low Intensity** areas typically include rural settings with single-family housing units.
- **Developed Medium Intensity** areas typically include single-family housing units that are grouped in residential subdivisions and may include peripheral commercial structures.
- **Developed High Intensity** includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial parks. Areas with the highest concentration of development are typically located within or near the towns and communities in the study area.

Schools

The study area is located within the following three school districts: Buena Vista Independent School District (ISD), Fort Stockton ISD, and Iraan-Sheffield ISD. Fort Stockton ISD has five existing schools located within the study area. Buena Vista and Iraan-Sheffield ISDs have no existing schools located within the study area (TEA 2018).

2.4.2. Planned Land Use

The planned land use component identifies objectives and/or policies regarding land use goals and plans, including conservation easements, managed lands, and proposed developments. Cities and counties typically prepare comprehensive land use plans to provide strategic direction by goals and objectives for the individual city or county. City and county websites were reviewed and correspondence was submitted to local and county officials to identify potential planned land use conflicts. The City of Fort Stockton does not have a comprehensive land use plan, nor do any of the other communities located within the study area.

Conservation Easements

A conservation easement is a restriction property owners voluntarily place on specified uses of their property to protect natural, productive or cultural features. The property owner retains legal title to the property and determines the types of uses to allow or restrict. The property can still be bought, sold and inherited, but the conservation easement is tied to the land and binds all present and future owners to its terms and restrictions. Conservation easement language will vary as to the individual property owner's allowances for additional developments on the land.

A review of non-governmental groups (e.g., National Conservation Easement Database [NCED], The Nature Conservancy [TNC], and Texas Land Conservancy [TLC]) that are land trusts and hold a database for conservation easements within Texas indicated that there are four conservation easements within the study area (NCED 2018; TNC 2018; TLC 2018). All four easements are listed under the name Diamond Y Spring Macrosite Easement and are located north of Fort Stockton. They are privately held by the TNC and are approximately 143 acres, 2,588 acres, 1,411 acres, and 100 acres each (TNC 2018). The land trusts facilitate the conservation easement and ensure compliance with the specified terms and conditions.

2.4.3 Agriculture

Agriculture is a significant segment of the economy throughout Texas, and Pecos County has active agricultural sectors. According to the USDA National Agricultural Statistics Service's 2012 Census of Agriculture, the total market value for agricultural products sold for Pecos County was $47,470,000, an increase of 72 percent over the 2007 market value of $27,545,000. Crop sales accounted for the majority of agricultural sales in Pecos County. The number of farms in Pecos County increased slightly from 287 in 2007 to 291 in 2012 (an increase of one percent) (USDA 2012).

2.4.4 Oil and Gas Facilities

Data was obtained from the RRC (RRC 2018b), which provided a GIS layer for existing oil and gas wells, pipelines, and supporting facilities. Data point categories were reviewed and included the following types: permitted locations, oil, gas, injection/disposal, shut-in, horizontal drain hole, and sidetrack well surface locations. The 2018 RRC dataset along with aerial photograph interpretation and field reconnaissance were used to identify and map existing oil and gas related facilities. Oil and gas wells were identified and are scattered throughout the study area, with greater density in the northern half of the study area.

2.4.5 Utility Features/Generation Facilities

Based on 16 TAC § 25.101(b)(3)(B), paralleling or utilizing existing compatible ROWs and other features are areas that should be considered as areas of opportunity when selecting route alternatives for new transmission lines. Existing compatible ROWs include electrical transmission lines, distribution lines, railroads, and roadways. Other features include property lines or other natural or cultural features. Existing transmission lines, several roadways, parcel lines, and apparent property boundaries were considered as potential paralleling opportunities. Data sources used to identify existing electrical transmission lines include utility company and regional system maps, PLATTS data (2018), aerial imagery, USGS topographical maps, additional available planning documents, and field reconnaissance.

Transmission lines identified include one 345-kV transmission line, nine 138-kV transmission lines, and seven 69-kV transmission lines within the study area. Distribution lines are prevalent throughout the developed portions of the study area; however, these features were not mapped or inventoried.

In addition, several pipelines, with a diameter of 6 inches and above, and water wells were identified and are scattered throughout the study area (Penwell 2018; RRC 2018b; TWDB 2018; University Land Wells 2017).

Generation facilities included four existing wind farms and three existing solar farms identified within the study area boundary.

2.4.6 Transportation/ Aviation/ Communication Facilities

Transportation Facilities

Federal, state, and local roadways were identified using TxDOT county transportation maps, TNRIS data, and field reconnaissance surveys. The roadway transportation system within the study area includes IH10, US Hwy 67, US Hwy 285, US Hwy 385, SH 18, and SH 194, as major roadways. The roadway transportation within the study area also includes the following FM roads: 11, 1053, 1776, 1901, 2023, and 2037. Numerous county and local roads (paved and unpaved) were also identified.

TxDOT's "Project Tracker," which contains detailed information by county for every road/highway project which is or could be scheduled for construction, was reviewed to identify any state roadway projects planned within the study area. The TxDOT Project Tracker indicates that there are eight roadway improvement projects and one roadway widening project located within the study area. The projects include adding milled edge line rumble strips, seal coat, and safety treat fixed objects to the roadways. The roadway widening project is along the southwestern portion of US Hwy 67 but is not scheduled to receive bids until April 2021 (TxDOT 2018a).

The railroads identified within the study area include one South Orient Railroad and one abandoned railroad. Both railroads are located in the central portion of the study area.

Aviation Facilities

POWER reviewed the El Paso and San Antonio Sectional Aeronautical Charts (FAA 2017a and 2017b) and the Chart Supplement for the South Central US (formerly the Airport/Facility Directory) (FAA 2018b) to identify FAA registered facilities within the study area subject to notification requirements

listed in 14 CFR Part 77.9. Facilities subject to notification requirements listed in 14 CFR Part 77.9 include public-use airports listed in the Airport/Facility Directory (currently the Chart Supplement), public-use or military airports under construction, airports operated by a federal agency or DoD, or an airport or heliport with at least one FAA-approved instrument approach procedure.

The Chart Supplement for the South Central US used in conjunction with the El Paso and San Antonio Sectional Aeronautical Charts, contains all public-use airports, seaplane bases and public-use heliports, military facilities, and selected private-use facilities specifically requested by the DoD for which a DoD Instrument Approach Procedure has been published in the US Terminal Procedures Publication.

One public-use FAA registered airport was identified within the study area (FAA 2018b). The Fort Stockton-Pecos County Airport is located within the central portion of the study area and has a runway approximately 4,400 feet long. No public-use heliports or heliports with an instrument approach procedure are listed for the study area in the Chart Supplement for the South Central US (FAA 2018b).

The Fort Stockton very high frequency (VHF) Omnidirectional Range / Tactical Aid to Navigation (VORTAC) ground-based air navigation aid was identified within the study area. This is a radio navigation system that broadcasts a navigational signal and transmits continuously in the VHF and ultra-high frequency (UHF) range (FAA 1986).

In addition, POWER also reviewed the FAA database (FAA 2018a), USGS topographic maps, recent aerial photography, and conducted field reconnaissance from publicly accessible areas to identify private-use airstrips and private-use heliports not subject to notification requirements listed in 14 CFR Part 77.9. There were five private-use airstrips and one private-use heliport identified within the study area. Locations of the airports, airstrips, and heliports can be found on Figures 3-14a, b, c and 4-1a, b, c, and the distances from each route centerline is presented in Tables 4-3 through 4-27.

Communication Towers

Review of the Federal Communication Commission (FCC) database indicated that there is one amplitude modulation radio (AM radio) transmitter located just south of the City of Fort Stockton in the central portion of the study area (FCC 2014).

The FCC also indicated that there are 37 verified frequency modulation radio (FM radio) transmitters/ microwave towers/other electronic installations located within the study area (FCC 2014). These towers

are scattered throughout the study area. Locations of the identified communication towers can be found on Figures 3-14a, b, c and 4-1a, b, c, and the distances from each route centerline is presented in Tables 4-3 through 4-27.

2.4.7 Parks and Recreation Areas

The PUC Standard Application for a CCN requires reporting of parks and recreational areas owned by a governmental body or an organized group, club, or church. Federal and state databases and county/local maps were reviewed to identify any parks and/or recreational areas within the study area. Field reconnaissance surveys were also conducted to identify any additional park or recreational areas.

National/State/County/Local Parks – No national, state, or county parks were identified within the study area (NPS 2018a) (TPWD 2018d).

Local park and recreation areas identified within the study area include:

- Alamo Elementary is located on US Hwy 385 and offers two playscapes and swing sets.
- Apache Elementary is located on West 18th Street and offers basketball courts, tether ball, playscape, and swing sets.
- Desert Pines Golf Course is located on US Hwy 285 and offers an 18-hole course.
- Fort Stockton City Park is located on West 14th Street and offers covered picnic tables, playscape, swing set, merry go round, and space ship climbing structure.
- Fort Stockton High School is located on West 17th Street and offers a football stadium, track, baseball field, and tennis courts.
- Fort Stockton Intermediate School is located on West 2nd Street and offers basketball courts, tennis courts, tack, and swing sets.
- Fort Stockton Middle School is located on West 5th Street and offers a football field, tack, and tennis courts.
- Fort Stockton Recreation Center is located on US Hwy 385 and offers a meeting hall, kitchen, and restrooms.
- Fourteen Mile Park is located on the north side of IH 10 and offers covered picnic tables, restrooms, and parking for large trucks.
- Imperial Highway Park is located on Imperial Hwy/FM 1053 and offers a covered pavilion, basketball court, sand volleyball court, swing set, slide, and playscape.

- James Rooney Memorial Park is located on Parkview Road and offers basketball court, tennis court, walking trail, two playscapes, two covered pavilions, picnic tables, swimming pool, and four baseball fields.
- James Street Park is located on West James Street and offers covered picnic tables and two playground areas.
- Jaycee Park is located on West 3rd Street and offers picnic tables, benches, playscape, and swing set.
- Lannom Park is located on West 7th Street and offers picnic tables, benches, playscape, and swing set.
- Manuel R. Nunez Park is located on South Main Street and offers a gazebo, covered pavilion, rest rooms, benches, and basketball court.
- Pat Taylor Athletic Field is located on South Rio Street and offers four baseball fields.
- Railroad Avenue Park is located on West Railroad Avenue and offers sand volleyball courts, playground, and splash pad.
- Road Side Park is located on the south side of US Hwy 67 and offers covered picnic tables and parking for large trucks.
- TxDOT Pecos County Road Side Park is located on both sides of IH 10 and offers covered picnic tables, restrooms, and parking areas for large trucks.
- Zero Stone Park and Gazebo is located on South Main Street and offers a gazebo, picnic tables, benches, and memorials.

Wildlife Viewing Trails

Review of the TPWD Great Texas Wildlife Trails Far West Texas Trail indicates that there is one driving loop, Permian Basin West Loop, and one wildlife viewing site, Rooney Park and Historic Fort Native Garden, located within the City of Fort Stockton (TPWD 2018e).

Additional recreational activities such as hunting and fishing may occur on private properties throughout the study area, but are not considered to be open to the general public. Locations of the identified parks and recreation areas can be found on Figures 3-14a, b, c and 4-1a, b, c, and the distances from each route centerline is presented in Tables 4-3 through 4-27.

2.5 Socioeconomics

This section presents a summary of economic and demographic characteristics for Pecos County and describes the socioeconomic environment of the study area. Literature sources reviewed include publications of the United States Census Bureau (USCB) and the Texas State Data Center (TxSDC).

2.5.1 Population Trends

Pecos County experienced a population decrease between 2000 and 2010 of eight percent. By comparison, population at the state level increased by nearly 21 percent during the same decade (USCB 2000 and 2010).

According to TxSDC growth projections, Pecos County is projected to experience population growth during the next 30 years. The population increases for the next three decades are projected to be 10 percent, eight percent, and seven percent, respectively. By comparison, the population of Texas is expected to experience population increases of 15 percent, 13 percent, and 12 percent over the same three decades, respectively (TxSDC 2014). Table 2-8 presents the past population trends and projections for Pecos County and for the state of Texas.

TABLE 2-8 POPULATION TRENDS

	PAST		PROJECTED		
STATE/COUNTY	2000	2010	2020	2030	2040
Texas	20,851,820	25,145,561	28,813,280	32,680,231	36,550,578
Pecos County	16,809	15,507	17,051	18,450	19,702

Source: USCB 2000 and 2010; TxSDC 2014.

2.5.2 Employment

The civilian labor force (CLF) in Pecos County increased from 2010 to 2016 with the corresponding population growth by 7.0 percent (445 people). By comparison, the CLF at the state level grew by 11 percent (1,256,676 people) over the same time period (USCB 2010 and 2016).

Between 2010 and 2016, Pecos County experienced a decrease in its unemployment rate from 4.4 percent in 2010 to 4.0 percent in 2016. By comparison, the state of Texas also experienced a small decrease in the unemployment rate over the same time period. The state's unemployment rate decreased from 7.0 percent in 2010 to 6.4 percent in 2016 (USCB 2010 and 2016). Table 2-9 presents the CLF, employment, and unemployment data for Pecos County and the state of Texas for the years 2010 and 2016.

TABLE 2-9 CIVILIAN LABOR FORCE AND EMPLOYMENT

STATE/COUNTY	2010	2016
Texas		
Civilian Labor Force	11,962,847	13,219,523
Employment	11,125,616	12,371,392
Unemployment	837,231	848,131
Unemployment Rate	7.0%	6.4%
Pecos County		
Civilian Labor Force	6,052	6,497
Employment	5,787	6,238
Unemployment	265	259
Unemployment Rate	4.4%	4.0%

Source: USCB 2010 and 2016.

2.5.3 Leading Economic Sectors

The major occupations in Pecos County in 2016 are listed under the category of sales and office occupations, followed by the category of natural resources, construction, and maintenance occupations (USCB 2016). Table 2-10 presents the number of persons employed in each occupation category during 2016 in Pecos County.

TABLE 2-10 OCCUPATIONS IN PECOS COUNTY

OCCUPATION	PECOS COUNTY
Management, business, science, and arts occupations	1,225
Service occupations	1,227
Sales and office occupations	1,401
Natural resources, construction, and maintenance occupations	1,244
Production, transportation, and material moving occupations	1,141

Source: USCB 2016.

In 2010, the industry group employing the most people in Pecos County was educational services, and health care and social assistance, and in 2016 it was agriculture, forestry, fishing and hunting, and mining. The industry group that experienced the most growth from 2000 to 2012 was transportation and warehousing, and utilities, which experienced a 196 percent increase (394 people) (USCB 2016). Table 2-11 presents the number of persons employed in each of the industries in Pecos County for the years 2010 and 2016.

TABLE 2-11 INDUSTRIES IN PECOS COUNTY

INDUSTRY GROUP	PECOS COUNTY	
	2010	2016
Agriculture, forestry, fishing and hunting, and mining	1,076	1,156
Construction	435	606
Manufacturing	78	105
Wholesale trade	52	82
Retail trade	707	833
Transportation and warehousing, and utilities	201	595
Information	68	11
Finance and insurance, and real estate and rental and leasing	206	216
Professional, scientific and management, and administrative and waste management services	195	244
Educational services, and health care and social assistance	1,145	1,086
Arts, entertainment, and recreation, and accommodation and food services	734	479
Other services, except public administration	238	230
Public administration	652	595

Source: USCB 2010 and 2016.

2.6 Aesthetics

§ 37.056(c)(4)(C) of the Texas Utilities Code incorporates aesthetics as a consideration when evaluating proposed electric transmission facilities. There are currently no formal guidelines provided for managing visual resources on private, state, or county owned lands. For the purposes of this study, the term aesthetics is defined by POWER to accommodate the subjective perception of natural beauty in a landscape and measure an area's scenic qualities. The visual analysis was conducted by describing the regional setting and determining a viewer's sensitivity. Related literature, aerial photograph interpretation, and reconnaissance surveys were used to describe the regional setting and to determine the landscape character types for the area.

Consideration of the visual environment includes a determination of aesthetic values (where the major potential effect of a project on the resource is considered visual) and recreational values (where the location of a transmission line could potentially affect the scenic enjoyment of the area) that would help define a viewer's sensitivity. POWER considered the following aesthetic criteria that combine to give an area its aesthetic identity:

- Topographical variation (hills, valleys, etc.).

- Prominence of water in the landscape (rivers, lakes, etc.).
- Vegetation variety (woodland, meadows).
- Diversity of scenic elements.
- Degree of human development or alteration.
- Overall uniqueness of the scenic environment compared with the larger region.

The study area is primarily rural with residential and commercial development concentrated in and around the City of Fort Stockton. The predominant land use within the study area is rangeland and pastureland. The majority of the study area has been impacted by land improvements associated with agriculture, residential/commercial structures, various utility corridors, oil and gas activities, and roadways. Overall, the study area viewscape consists of open rangeland/pastureland.

No known designated views or designated national or state scenic roads or highways were identified within the study area. The study area is located within the 22-county Texas Pecos Trail Region. The trail runs along IH 10 and there are six sites of interest identified within the study area. They include: the Annie Riggs Memorial Museum, Comanche Springs Pool, Historic Fort Stockton, Old Pecos County Jail, Rollins Sibley House, and World's Tallest Roadrunner (THC 2018a).

A review of the NPS website did not indicate any Wild and Scenic Rivers, National Monuments, National Historic Sites, National Historic Landmarks, National Historic Trails, or National Battlefields within the study area (NWSRS 2018; NPS 2018b and 2018c).

Based on these criteria, the study area exhibits a moderate degree of aesthetic quality for the region. The majority of the study area maintains the feel of a rural community. Although some portions of the study area might be visually appealing overall, the aesthetic quality of the study area is not distinguishable from that of other adjacent areas within the region.

2.7 Cultural Resources

§ 37.056(c)(4)(A-D) of the Texas Utilities Code incorporates historical values as a consideration when evaluating proposed electric transmission facilities. The PUC's Standard Application for a CCN further stipulates that known historical sites within 1,000 feet of an alternative route should be listed, mapped, and their distance from the centerline of the alternative route documented in the application filed for consideration. Archeological sites within 1,000 feet of a route should be listed and their distance from the

centerline documented, but they need not be shown on maps for the protection of the site. Sources consulted to identify known sites (national, state, or local commission) should also be listed.

The THC is the state agency responsible for preservation of the state's cultural resources. The THC, working in conjunction with the TARL, maintains records of previously recorded cultural resources as well as records of previous field investigations. Information from the THC's restricted-access Texas Archeological Sites Atlas (TASA) and Texas Historical Sites Atlas (THSA) was acquired, in addition to GIS shapefiles acquired from TARL, to identify and map locations of previously recorded cultural (archeological and historical) resources within the study area. TxDOT's historic bridges database was also reviewed for bridges that are listed or determined eligible for listing on the NRHP. At the national level, NPS websites and data centers were reviewed to identify locations and boundaries for nationally designated historic landmarks, trails and battlefield monuments.

Together, archeological and historical sites are often referred to as cultural resources. Under the NPS standardized definitions, cultural resources include districts, sites, buildings, structures, or objects important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. For this study, cultural resources have been divided into three major categories: archeological resources, historical resources, and cemeteries. These three categories correlate with the organization of cultural resource records maintained by the THC and TARL.

Archeological resources are sites where human activity has measurably altered the earth and left deposits of physical remains (e.g., burned rock middens, stone tools, petroglyphs, house foundations, trails, trash scatters). Most archeological sites in Texas are Native American (prehistoric), Euro/African American, or Hispanic in origin. Much of the study area has not been studied intensively for archeological resources. Therefore, high probability areas (HPAs) for prehistoric and historic archeological resources were determined based on proximity to perennial water sources, certain topographic features, and the presence of structures on historic maps in currently undeveloped areas.

Historical resources include standing buildings or structures (e.g., houses, barns and out buildings), and may also include dams, canals, bridges, transportation routes, silos, etc., and districts that are non-archeological in nature and generally more than 50 years of age.

Cemeteries are locations of intentional human interment and may include large public burial grounds with multiple individuals, small family plots with only a few burials, or individual grave sites. In some

instances, cemeteries may be designated as Historic Texas Cemeteries (HTCs) by the THC or recognized with an Official Texas Historical Marker (OTHM). Cemeteries may also be documented as part of the THC Record-Investigate-Protect (RIP) Program.

2.7.1 Cultural Background

Prehistory

The study area is located in Pecos County, Texas within the Trans-Pecos Resource Planning Region, which is similar in extent to Perttula's (2004) Trans-Pecos archeological region, and shown in Figure 2-5. More specifically, the study area is located within the eastern Trans-Pecos regions, as described by Miller and Kenmotsu (2004). Based primarily on perceived technological changes evident in the archeological record often correlated with broad changes in the physical and cultural environment, the prehistoric occupation of the eastern Trans-Pecos region is most often divided into three broad archeological periods spanning at least the last 12,000 years. These periods include the Paleoindian period, beginning around 12,000 years before present (B.P.); the long-lasting Archaic period, which comprises almost two-thirds of the known prehistoric occupation of west Texas, from about 8,000 B.P. until approximately 1,050 B.P.; and the Late Prehistoric period, which ended with the first Spanish expedition into the region in the late-1500s (approximately 450 B.P.). The following discussion of the culture history of the study area relies heavily on the cultural chronology of the eastern Trans-Pecos Region of West Texas as presented by Miller and Kenmotsu (2004).

N
W E
S

0 25 50 100 150 200 250
Miles

Source: Mercado- Allinger et. al., 1996

Legend

Cultural Resource Planning Region Boundary

County Boundary

Figure 2-5
LOCATION OF THE STUDY AREA IN RELATION TO THE CULTURAL RESOURCE PLANNING REGIONS OF TEXAS

Bakersfield-Solstice 345-kV Transmission Line Project

Paleoindian Period (12,000-8,800 B.P.)

The Paleoindian period is the earliest accepted occupation of peoples in North America. During this period, small, highly mobile bands hunted now-extinct megafauna such as mammoths (*Mammuthus columbi*) and bison (*Bison antiquus*). Despite the popular misconception that these early populations were primarily hunters, evidence from the Gault Site in central Texas suggests that their diet was more generalized (Collins 2002). Archeological evidence indicates that these early hunting and gathering populations subsisted on a well-diversified resource base that included smaller animals, fish, and a variety of reptiles. Paleoindian sites in the region are very rare compared to those from later periods. In the eastern Trans-Pecos region, the early Paleoindian period is subdivided into two complexes, the Clovis Complex and the Folsom Complex, based primarily on diagnostic lanceolate projectile points (Miller and Kenmotsu 2004).

Corresponding with the waning years of the Pleistocene era, the early Paleoindian period was characterized by a comparatively cooler, wetter environment. West Texas was covered in moist woodlands with continuously flowing streams in the mountains, and lakes and marshes throughout the interior basins, and more numerous and more reliable springs and seeps than today (Miller and Kenmotsu 2004; Simmons et al. 1989). The Clovis Complex, attributed to the early Paleoindian Period, is identified by the Clovis spear points, first identified near Clovis, New Mexico (Hofman and Graham 1998). Clovis occupation in the eastern Trans-Pecos region is almost entirely recognized from isolated finds of fluted Clovis points and from private collections. Thus, Clovis adaptations for the eastern Trans-Pecos region are extrapolated from regions where more data exists (Miller and Kenmotsu 2004).

When the Pleistocene epoch came to an end around 10,900 years ago and the mammoth populations had all but disappeared, prehistoric populations began to focus their hunting efforts on the now extinct Bison antiquus, one of the hallmarks of the transition from the early to the late Paleoindian period (Collins 2004). There appears to have been a gradual trend toward warmer and drier conditions, with woodlands slowly replaced by open grassland savannah that supported large herds of bison. Folsom occupation in the eastern Trans-Pecos is known from a site on Chispa Creek in Van Horn County that yielded large numbers of Folsom points, channel flakes, stone tools, and debitage (Miller and Kenmotsu 2004). Folsom components are often mixed with artifacts from the Archaic period in the Trans-Pecos region, making it difficult to separate non-diagnostic artifacts in the mixed assemblages (Miller and Kenmotsu 2004).

The Late Paleoindian Period is recognized by stone tool traditions referred to as the Cody and Plano Complexes, both of which relied heavily on bison (Hofman and Graham 1998). Meserve, Golondrina, and

Angostura projectile points are typical of the Late Paleoindian Period in in the eastern Trans-Pecos region (Turpin 2004). In the eastern Trans-Pecos, Cody and Plano components are found more frequently than the early Paleoindian Complexes, and are identified primarily by Meserve, Golondrina, and Angostura projectile points (Turpin 2004). Although Late Paleoindian components are found in a wide range of topographic zones, most are found near large permanent sources of water, such as the Rio Grande valley and large playas, the last locations with suitable habitats for large animals in an increasingly warmer and dryer Holocene environment (Hofman and Graham 1998; Turpin 2004).

Environmental changes that brought about the extinction of Rancholabrean megafauna and the conversion of woodlands to desert plant communities in west Texas triggered a shift away from Paleoindian adaptations toward a broad-based subsistence orientation termed Archaic (Miller and Kenmotsu 2004; Willey and Phillips 1958).

Archaic Period (8,800-1,250 B.P.)

The Archaic period spans almost 7,000 years, the bulk of the prehistory of the Trans-Pecos region. Probably the most prominent characteristic of the Archaic period is that it epitomizes the foraging lifestyle. In the eastern Trans-Pecos, the period is subdivided into the early, middle, and late Archaic sub-periods based on changes in subsistence and technology in response to broad environmental changes. In general, during the Archaic period, increasing population and increasingly diverse subsistence systems led to an intensification of land use patterns and the exploitation of a broader range of environmental zones (Kenmotsu and Miller 2004).

Little is known of the early Archaic (circa 8,000-6,000 B.P.) in the eastern Trans-Pecos, due to sparse data and no firmly dated substantial early Archaic sites in the region (Kenmotsu and Miller 2004). During this period, the use of stone or caliche as cooking stones appears, and early Archaic materials are found in burned rock features and middens throughout the eastern Trans-Pecos. Groundstone tools appear, coincident with the use of burned rock thermal features, indicating a greater reliance on plant processing (Kenmotsu and Miller 2004). Changes in projectile points during the early Archaic also indicate a change in subsistence. Large lanceolate blades from the Paleoindian period are replaced by smaller stemmed points, such as Uvalde, Martindale, and, later, Pandale and Bulverde points, indicating a focus on smaller game such as deer (Simmons et al. 1989). Increasing regionalization of point types is apparent; point types in the eastern Trans-Pecos are similar to those found in central Texas. Increased regionalization of point types and an in increased reliance on locally accessible stone raw materials

suggest early Archaic groups had a more restricted range of movement than their predecessors (Miller and Kenmotsu 2004).

There is an increase in sites dating to the middle Archaic (circa 5,000-3000 B.P.), suggesting population growth in the Trans-Pecos region during this period. Paleoclimate data shows a continual drying trend that may have caused middle Archaic groups to have a more seasonally intensive land use pattern focused on specific resources (Miller and Kenmotsu 2004). Between 4,000 and 2,500 years B.P., moisture appears to have increased, although middle Archaic subsistence systems still depended on the collection and processing of desert succulents (Simmons et al. 1989). Middle Archaic sites tend to be larger and have more features than early Archaic sites. Although middle Archaic components are found in a variety of settings, suggesting exploitation of new environmental niches, settlement is centered on streams. The most common projectile point forms dating to the middle Archaic have contracting stems with flat, rounded, or pointed bases or expanding stems and concave bases. The contracting stem variations, like Coahuila points, are more prominent in the eastern Trans-Pecos region. Patterns of tool manufacture and maintenance indicate a focus on conservation of tools and repurposing worn or broken tools (Miller and Kenmotsu 2004).

During the late Archaic (circa 3,000-1,500 B.P.), thermal features with burned rock become more numerous and larger (Miller and Kenmotsu 2004). Ring middens become more prominent, some of which have large quantities of lithic artifacts, ash, and charcoal. The sheer number of these features suggests widespread exploitation of desert succulents during the late Archaic. Thoms (2008 and 2009) posited that a marked increase in the use of hot-rock ovens is an expected signature of land-use intensification, which would be expected during a prolonged period of population growth and the onset of mesic conditions following a period of increasing moisture, such as the increase seen during the middle Archaic period. Projectile point technology modifications include shaft to corner and side-notched forms. Adaptations and strategies adopted during the Late Archaic would persist even into historic times in the eastern Trans-Pecos (Miller and Kenmotsu 2004).

Late Prehistoric Period (1,250-300 B.P.)

The Late Prehistoric period in the eastern Trans-Pecos region continued patterns in mobility, subsistence, and settlement that had developed during the Late Archaic, and sites dating to this period yield even larger quantities of materials than those from earlier periods (Miller and Kenmotsu 2004) despite being smaller in general (Simmons et al. 1989). Groups in the eastern Trans-Pecos adopted the bow and arrow and ceramics during this period. A variety of ceramics types have been recorded in the region, indicating

that although the people of the eastern Trans-Pecos interacted with neighboring agricultural groups, they continued traditional lifeways that had developed during the Archaic periods (Miller and Kenmotsu 2004). Within the study area, site 41PC14, also called Squawteat Peak, illustrates the longevity of the foraging lifestyle in the eastern Trans-Pecos. Seven occupation areas and a lithic procurement/quarry area are recorded at the State Antiquities Landmark site. Burned rock middens, multiple hearths, at least 14 tipi or wiki up rings, and bedrock mortar holes are recorded at the site (Turpin 2011; Whelan 2018). Projectile points from the site date from as early as the middle Archaic to the Late Prehistoric periods, and the largest burned rock midden was used as recently as 650 B.P. (Whelan 2018).

Excavations in dry shelters in and near the region have revealed a rich and varied material culture associated with the late Archaic and Late Prehistoric periods. Aside from a suite of stone tools and ceramics, pointed sticks, wooden shaft straighteners, split-yucca fireboards, fire drills, atlatls, throwing sticks, wooden scoops and tongs, pouches and blankets of rabbit fur and sewed skins, basketry, sandals, and vessels made from gourds, are recorded from dry shelters (Simmons et al. 1989). Very little evidence of cultivation has been found in the eastern Trans-Pecos region, unlike the agricultural groups that developed in the western portion of the region. Late Prehistoric groups appear to have continued to rely on desert succulents and hunting for subsistence into the Historic Period.

Historic Period (ca. 500-50 years ago)

Native groups in Texas first encountered Europeans during the mid- to late-1500s when several Spanish entradas passed through the Trans-Pecos region. Efforts to settle the lands by the Spanish were slow due to the barren terrain (Simmons et al. 2004). During the 1600s, Spanish colonization efforts increased with establishment of missions and settlements along the Rio Grande and in the La Junta district (Miller and Kenmotsu 2004). After the Pueblo Revolt of 1684 in New Mexico, approximately 2,000 Spanish refuges and Native Americans loyal to the Spanish were resettled in missions near the El Paso Lower Valley. These missions were abandoned when French forces landed on the Texas Gulf Coast forcing the Spanish to withdraw their forces from the frontier, and it wasn't until 1715 that efforts were made to reestablish the missions. A plan to defend the frontier of the Trans-Pecos region was implemented in 1729 with the construction of presidios to protect settlements from Apache and Comanche bands. Defensive efforts continued through Spanish, Mexican, and American administrations (Simmons et al. 2004).

The first permanent Anglo settlement in the area of Pecos County was the United States Army outpost Fort Stockton, established near Comanche Springs in 1859. The purpose of the army post was to protect

the San Antonio-El Paso Mail stage line. St. Gall, founded by Peter Gallagher, developed nearby into a supply center for the army, mail stages, travelers, and trains (Justice and Leffler 2018).

The fort provided protection for the mail routes, travelers, and freighters until 1861, when it was abandoned by federal troops after news came of Texas' secession from the Union (Wallace 2018; Cutrer 2018). It was re-occupied in that same year by Confederate Captain Charles L. Pyron and a regiment of Texas Mounted Rifles. In 1862, the fort was abandoned by the Confederates, and its ruins were reoccupied again after the Civil War by General Edward Hatch and made the headquarters for the Ninth United States Calvary, a regiment of black troops (Wallace 2018).

Pecos County, originally a part of Bexar Territory, and, later, Presidio County, was established in 1871, and formally organized in 1875 (Justice and Leffler 2018). St. Gall became the county seat, and in 1880 was renamed Fort Stockton. That same year, the army post closed, causing an economic downturn. By 1900, the population of Pecos County was 2,360 and the economy was dominated by sheep and cattle ranching and corn was the dominant crop (Justice and Leffler 2018).

In 1913, the construction of the Kansas, Mexico, and Orient Railway Company of Texas rail across Pecos County stimulated the economy, resulting in population growth and increased land speculation. In an effort to attract land buyers, irrigation projects along the Pecos River were begun. In 1920, there were 207 farms in the area, the majority of which grew cotton and, to a lesser degree, sorghum (Justice and Leffler 2018). In 1927, the Yates oil field, one of the largest in the nation at the time, was discovered.

The economic boom caused by the oil field discovery led to the creation of the towns of Bakersfield, Red Barn, and Iraan to accommodate the influx of people. By 1930, the population reached 7,812, and the number of farms increased to 385 (Justice and Leffler 2018).

During the Great Depression, oil production helped stabilize the county's economy, although farmers were hit hard: the number of tenant farmers decreased from 198 in 1939 to 145 in 1940, and the number of farms decreased to 326 in 1940 (Justice and Leffler 2018). Construction of paved roads began in 1930, and by 1931, US Hwy 290 and SH 82 reached Fort Stockton. In 1956, US Hwy 290 connected Fort Stockton to Big Bend National Park, boosting tourism in the area. Oil and gas production continues to play an important role in the economy (Justice and Leffler 2018).

2.7.2 Literature and Records Review

Historical and archeological data for the study area were reviewed online through the THSA, TASA, and TARL. GIS shapefiles identifying the locations of previously recorded archeological sites were requested from TARL. GIS data from TARL were used to map cultural resource site locations within the study area. Previously recorded cultural resource site data available online from the THSA and TASA were obtained to identify locations of designated historical sites, State Antiquities Landmarks (SALs), cemeteries, HTCs, and OTHMs within the study area, as well as previously conducted cultural resource investigations. The TxDOT historic bridges database was also reviewed for bridges that are listed or determined eligible for listing on the NRHP (TxDOT 2018b). The NPS databases and websites pertaining to NRHP, National Historic Trails, and National Historic Landmark properties were also reviewed to locate and define boundaries for historic properties recorded at the national level (NPS 2018a, 2018b, and 2018c). The results of the review are summarized in Table 2-12.

TABLE 2-12 RECORDED CULTURAL RESOURCES WITHIN THE STUDY AREA

ARCHEOLOGICAL SITES	NRHP-LISTED RESOURCES	NRHP DETERMINED - ELIGIBLE RESOURCE	STATE ANTIQUITIES LANDMARKS	CEMETERIES	OTHM
256	1	34	10	6	20

Source: THC 2018b and 2018c.

Review of the THC and NPS data indicated that one NRHP-listed resource, the Fort Stockton Historical District, is located within the study area. The Fort Stockton army post was one of several army posts established in Texas to defend settlers from Indian attacks and protect the San Antonio-San Diego stage line. Established in 1858, the fort was also the site of an experimental military camel detachment. As discussed earlier, the fort was abandoned by Union forces after Texas seceded from the Union and reoccupied by Confederate forces during the Civil War. After the Civil War the fort was rebuilt, and eventually abandoned in 1886. Four fort buildings, including three structures that functioned as officer quarters and a guard house are in the historical district, as well as the fort cemetery, no longer in use. Two stone foundations remain where the enlisted barracks once stood. The St. Stephens Episcopal Church, Annie Riggs Hotel, a Victorian structure located at the site of the army post hospital, several historic stores, and Comanche Springs are all located in the district (NRHP 1972). Portions of site 41PC71, the archeological component of the Fort Stockton military post, are included in the historic district boundary.

The review of the TASA (THC 2018b), and TARL data indicates that 256 archeological sites have been previously recorded in the study area (see Table 2-13). Of these, 233 are prehistoric in age, nine are

historic, eight contain historic and prehistoric components, the age of two sites is undetermined, and no descriptive data is available for four sites. Seventeen archeological sites have been determined ineligible for listing in the NRHP by the State Preservation Historic Officer (SHPO). Thirty-four sites have been determined by the SHPO to be eligible for listing in the NRHP, nine of which (41PC75, 41PC76, 41PC77, 41PC78, 41PC80, 41PC81, 41PC82, 41PC83, and 41PC84) are designated as SALs. Site 41PC14 has also been designated a SAL but has not been formally assessed for listing on the NRHP.

Of the 34 sites that have been determined eligible for listing on the NRHP, 30 are prehistoric, one is historic, and two have both prehistoric and historic components. Site 41PC79 is a campsite containing a ring midden, hearths, and burned rock dating at least to the late Archaic. Turpin (2009; Turner and Turpin 2012) suggests that sites 41PC79, 41PC442, 41PC443 and several nearby sites and hearths should be considered one site that was concentrated around Escondido Springs. Site 41PC443 is an early through late Archaic campsite with hearths, burned rock mounds, and a ring midden. Lithic tools, gouges, scrapers, projectile points, debitage, and scattered burned rock are recorded from the site (THC 2018b). Site 41PC442 also is a prehistoric campsite with hearths, burned rock middens, stone tools (i.e., gouges and scraper) and debitage.

Many of the prehistoric determined-eligible sites are campsites that contain burned rock features, most of which have been dispersed, to some degree, by erosion. Sites 41PC603 and 41PC604 have concentrations of burned rock that are interpreted as burned rock middens that have been dispersed by erosion. The sites have a small amount of debitage, but lack time-diagnostic artifacts. Three burned rock concentrations that have been dispersed by erosion are also recorded at site 41PC605, along with debitage and two scrapers. Four hearths that have been dispersed by erosion and debitage are reported from site 41PC606 (Turpin 2009). A burned rock concentration, scattered burned rock, hearth and debitage are reported from site 41PC610 (THC 2018b and 2018c). Two deflated burned rock mounds that have been dispersed by runoff, and a dispersed burned rock concentration are reported from site 41PC612, along with naturally occurring chert and one stone tool, a spokeshave (THC 2018b and 2018c). Two hearths are reported from both site 41PC613 and 41PC614, along with debitage. Site 431PC834 has a similar assemblage along with three hearths. Seven hearths, burned rock, scrapers and debitage are reported from site 41PC829. Five hearths are reported from 41PC839, which include burned rock, debitage, scrapers, bifaces, and one historic artifact, a jar.

Bedrock mortars, four concentrations of burned rock, an Abasolo projectile point, debitage, various stone tools and projectile point fragments are reported from 41PC831, which dates, at least in part, to the early

to middle Late Archaic periods. Prehistoric ceramics are reported from two sites in the study area, only one of which, 41PC832, has been determined eligible for listing on the NRHP. Eight burned rock concentrations, a Langtry-like projectile point, groundstone implements, and various stone tools are also reported from the site.

Scattered burned rock and debitage are reported from 41PC615, as well as a variety of projectile points that suggest the site was revisited from the early Archaic to the Late Prehistoric period. Historic-era telephone poles and ceramic insulators are also reported from the site (Turpin 2009). Site 41PC643 has six depressions near what may have been interiors of tipis, with a small scatter of burned rock and debitage, and associated rock shelter. Four large burned rock mounds and three concentrations of burned rock are reported from site 41PC645, as well as a scatter of burned rock, debitage, stone tools, and projectile points. Projectile points from the site suggest it dates, at least in part, to the late Archaic and Late Prehistoric periods (THC 2018b; Turpin 2009). A rock ring measuring between three and four meters in diameter and debitage are reported overlooking a bluff at 41PC409.

Site 41PC611 is a lithic procurement site around a small chert outcrop (Turpin 2009; Turner and Turpin 2012). Materials at the site include tested cobbles, debitage and rough tools, and debitage. A fragment of an aqua glass insulator was also found at the site, possibly associated with a nearby historic-era telegraph line (Turpin 2009).

Sites 41PC607, 41PC608, 41PC644 are rockshelter sites that have been determined eligible for listing on the NRHP. Burned rock is reported from all of the rockshelter sites. Debitage is reported from 41PC607, and a burned rock midden is reported at 41PC408. Midden soil are reported from site 41PC644. A rock ring measuring between three and four meters in diameter overlooking a bluff and debitage are reported from 41PC409.

Site 41PC616 is the Old Spanish Trail, visible as a line of vegetation. This site is a portion of the trail that stretched from San Antonio to El Paso and dates from the Spanish Colonial period to the 1920s (THC 2018b and 2018c).

Sites 41PC75, 41PC76, 41PC77, 41PC78, 41PC80, 41PC81, 41PC82, 41PC83, and 41PC84 have also been designated SALs in addition to being determined eligible for the NRHP (THC 2018b). All of these sites are prehistoric. Sites 41PC75, 41PC76, 41PC77, 41PC78, and 41PC80 are late Archaic to Late Prehistoric period campsites, each with a large ring midden and associated hearths. Sites 41PC81,

41PC82, and 41PC83 each contain an open circle of rocks and debitage, and likely date to the late Archaic and/or Late Prehistoric periods. Bedrock mortars were observed at sites 41PC82 and 41PC83. Site 41PC84 is a small rock shelter site with associated midden. The Squawteat Peak Site (41PC14) includes seven occupation areas and a lithic procurement area. Excavations at the site recorded ring middens, hearths, wiki up rings, mortar holes, and a quarry (THC 2018b; Turpin 2009).

Six cemeteries (Table 2-14) and 20 OTHMS (Table 2-15) are recorded in the study area. None of the cemeteries are designated HTCs. One OTHM is located at The Old Fort Cemetery. The cemetery is located within the Fort Stockton Historic District and was opened in 1859 as a burial ground for soldiers stationed at Fort Stockton. After the fort was closed, the remains of 56 soldiers buried at the cemetery were moved to Fort Sam Houston in San Antonio (THC 2018b). Twelve of the OTHMS are Recorded Texas Historical Landmarks (RTHLs) commemorating notable buildings, including the Annie Riggs Hotel, two churches, a school, a bank, and two stores closely tied to the local history.

A review of the TxDOT list of NRHP-eligible and listed ridges resulted in one NRHP determined-eligible bridge in the study area. The Tunis Creek Bridge was constructed in 1933 by the Lone Star Construction Company of San Antonio. The bridge is on the original alignment of SH 27, previously the Old Spanish Trail spanning the Tunis Creek. The bridge has been determined eligible for the NRHP due to its engineering significance as an example of a standard plan reinforced concrete girder bridge that was designed in the 1930s by the State Highway Department (TxDOT 2018b). The 741-foot-long Tunis Creek Bridge is the longest intact concrete girder bridge of the period (NRHP 2018).

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC1	undetermined	campsite with two hearths, burned rock, debitage, and stone tools and the remains of historic structures and metal artifacts
41PC14	SAL/Eligible	open prehistoric campsite with several “occupation areas”
41PC15	undetermined	campsite with burned rock, debitage, and two projectile points
41PC16	undetermined	campsite with burned rock concentration, possibly a ring midden
41PC17	undetermined	campsite with ring midden, debitage, and burned rock
41PC18	undetermined	campsite with scattered burned rock and debitage
41PC19	undetermined	campsite with hearth, scattered burned rock
41PC20	undetermined	campsite with burned rock midden
41PC31	undetermined	pictograph site
41PC32	undetermined	pictograph site
41PC33	undetermined	pictograph site
41PC60	undetermined	large rockshelter with pictographs

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC69	undetermined	campsite with debitage, possible hearths
41PC71	undetermined	Fort Stockton military post
41PC75	SAL/Eligible	campsite with ring midden and associated hearths
41PC76	SAL/Eligible	campsite with ring midden
41PC77	SAL/Eligible	campsite with ring midden
41PC78	SAL/Eligible	campsite with ring midden
41PC79	Eligible	early to late Archaic campsite with hearths, burned rock middens, debitage, and a historic dump
41PC80	SAL/Eligible	campsite with ring midden, dart point fragments, and debitage
41PC81	SAL/Eligible	campsite with rock circle and stone tools
41PC82	SAL/Eligible	campsite with rock circle and bedrock mortars
41PC83	SAL/Eligible	campsite with rock circle and bedrock mortars
41PC84	SAL/Eligible	rockshelter
41PC384	undetermined	rock shelter with debitage and stone tools
41PC385	undetermined	rock shelter with debitage, and pictographs
41PC386	undetermined	rock shelter with pictographs, petroglyphs, and debitage
41PC387	undetermined	campsite with ring midden, burned rock, and debitage
41PC388	undetermined	cave with burned rock, debitage, cores, and possible mortar holes
41PC393	undetermined	campsite with dispersed hearth and debitage
41PC394	undetermined	lithic scatter with projectile points, a piece of red sandstone, stone tools, and debitage
41PC419	no records	no site form available
41PC434	undetermined	lithic scatter
41PC435	undetermined	debitage (isolated find)
41PC436	undetermined	debitage (isolated find)
41PC437	undetermined	debitage (isolated find)
41PC438	undetermined	debitage (isolated find)
41PC439	undetermined	debitage (isolated find)
41PC440	undetermined	core (isolated find)
41PC441	undetermined	campsite with burned rock and debitage
41PC442	Eligible	campsite with hearths, burned rock middens, stone tools, and debitage
41PC443	Eligible	campsite with hearths, burned rock middens, ring midden, stone tools, and debitage
41PC446	undetermined	no site form available
41PC447	undetermined	no site form available
41PC448	undetermined	no site form available
41PC454	undetermined	midden and hearth
41PC477	undetermined	rockshelter with petroglyphs and burned rock
41PC478	undetermined	late Archaic campsite with hearths, Paisano dart point, debitage, and stone tools
41PC479	undetermined	campsite with burned rock midden
41PC515	Ineligible	lithic scatter
41PC516	Ineligible	lithic scatter
41PC517	undetermined	campsite with burned rock midden and debitage
41PC518	Ineligible	possible Paleoindian lithic scatter with possible Angostura dart point and debitage
41PC519	Ineligible	lithic scatter
41PC520	undetermined	campsite with two small burned rock middens and debitage

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC521	undetermined	campsite with burned rock midden and debitage
41PC522	undetermined	campsite five burned rock middens and debitage
41PC525	undetermined	lithic scatter
41PC526	undetermined	campsite with two middens, hearth, projectile points, and debitage
41PC527	undetermined	middle to late Archaic campsite with two burned rock middens, debitage, Langtry projectile point, and Paisano projectile point
41PC528	undetermined	limestone cairn used by early 20th century air force pilots to mark route between El Paso and San Antonio
41PC529	undetermined	campsite with hearths and debitage
41PC579	undetermined	early and late Archaic campsite with debitage, projectile points, and tools
41PC580	undetermined	lithic scatter
41PC581	undetermined	campsite with hearth, debitage, Zorra and Shumla projectile points, preforms, and stone tools
41PC582	undetermined	early Archaic and late Archaic lithic scatter with Frio and Shumla dart points, and stone tools
41PC583	undetermined	middle Archaic campsite with hearth, debitage, Travis, Langtry and untyped projectile points, and stone tools
41PC584	undetermined	Late Prehistoric campsite with three hearths, stone tools, debitage, and Perdiz projectile point
41PC585	undetermined	early and late Archaic campsite with lithic scatter, Pandale and Nolan projectile points, stone tools, and burned rock
41PC586	undetermined	early through late Archaic lithic scatter with Pandale, Tortugas and Shumla projectile points, bifaces, and debitage
41PC587	undetermined	early Archaic campsite with a large ring midden, Baker and Pandale projectile points, stone tools, and debitage
41PC588	undetermined	late Archaic/Late Prehistoric campsite with a ring midden, Frio projectile points, stone tools, and debitage
41PC589	undetermined	middle Archaic campsite with stone tools, debitage, and hearth and ring midden
41PC590	undetermined	lithic scatter with debitage and stone tools; historic fence line with wire remnants and three large limestone boulders anchoring a fence post.
41PC591	undetermined	campsite with stone tools, projectile points, debitage, and hearth and ring middens
41PC592	undetermined	lithic scatter with debitage and stone tools
41PC593	undetermined	campsite with burned rock ring midden and lithic scatter
41PC594	undetermined	early Archaic and Late Prehistoric and Archaic campsite with burned rock midden, debitage, hearth, Gower projectile point, untyped projectile point, and stone tools
41PC598	undetermined	middle Archaic campsite with burned rock and debitage, stone tools, Pandale projectile point
41PC599	undetermined	campsite with burned rock and debitage
41PC600	undetermined	campsite with burned rock, debitage and historic scatter with glass, cans, horseshoe, and bucket
41PC601	undetermined	Late Prehistoric campsite with debitage, burned rock, and ceramics
41PC602	undetermined	lithic scatter with debitage, bifaces
41PC603	Eligible	campsite with burned rock midden and debitage
41PC604	Eligible	campsite with burned rock concentration and debitage
41PC605	Eligible	campsite with three hearths, debitage and stone tools

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC606	Eligible	campsite with four hearths and debitage
41PC607	Eligible	rockshelter with burned rock
41PC608	Eligible	rockshelter with burned rock and midden
41PC609	Eligible	campsite rock ring with debitage
41PC610	Eligible	campsite with burned rock midden, hearth, and debitage
41PC611	Eligible	lithic procurement area
41PC612	Eligible	campsite with two burned rock middens and a possible spokeshave tool
41PC613	Eligible	campsite with burned and debitage
41PC614	Eligible	campsite with two hearths and debitage
41PC615	Eligible	campsite with hearths, burned rock middens and early telephone line
41PC616	Eligible	Old Spanish Trail
41PC617	undetermined	stage stop, military outpost of Fort Stockton, early ranch
41PC621	undetermined	campsite with three rock rings and debitage
41PC625	undetermined	campsite with hearth and debitage
41PC626	undetermined	campsite with hearth and debitage
41PC627	undetermined	lithic procurement area
41PC629	undetermined	campsite with hearth and debitage
41PC630	undetermined	lithic procurement area
41PC631	undetermined	campsite with ring midden
41PC632	undetermined	historic ranch site with four corrals, four structures, three water reservoirs, and associated fences
41PC634	undetermined	campsite with burned rock middens, bedrock mortars, debitage, and stone tools
41PC643	Eligible	campsite with debitage, stone tools, manos, burned rock, possible tipi rings, and small rockshelter
41PC644	Eligible	small rock shelter with burned rock
41PC645	Eligible	late Archaic to Late Prehistoric campsite with one large burned rock midden, three smaller middens, three hearths, Palmillas projectile points, arrow point fragments, and debitage
41PC656	undetermined	campsite with hearth and debitage
41PC657	undetermined	campsite with hearth and debitage
41PC658	undetermined	campsite with debitage, stone tools and burned rock
41PC659	undetermined	campsite with debitage, stone tools and burned rock
41PC661	undetermined	rock shelter with burned rock
41PC662	undetermined	two rock shelters with petroglyphs, pictograph, and burned rock
41PC663	undetermined	rock shelter with burned rocks and debitage
41PC671	undetermined	donut-shaped stacked rocks/cairns; other rocks arranged to form 2-foot-high letters of the alphabet that appear to spell names - 'pe??', 'tdrrfi', and 'pedro'.
41PC672	undetermined	campsite with two burned rock middens with one dart point and other stone tools
41PC673	undetermined	late Archaic campsite with two burned rock middens, five hearths and a side-notched projectile point
41PC674	undetermined	campsite with hearth, debitage, and stone tools
41PC675	undetermined	campsite with 15 hearths
41PC676	undetermined	rock cairn with burned rock
41PC677	undetermined	rock shelter with stone tools and burned rock

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC678	undetermined	campsite and lithic procurement site with debitage, stone tools, tested cobbles, burned rock, and a hearth
41PC679	undetermined	campsite with hearth
41PC680	undetermined	campsite with burned rock midden, three hearths, and stone tools
41PC681	undetermined	campsite with a hearth
41PC682	undetermined	campsite with three hearths
41PC683	Ineligible	campsite with stone tools, debitage, and burned rock
41PC684	Ineligible	campsite and lithic procurement site with debitage, burned rock, and two hearths
41PC685	Ineligible	campsite with hearth and debitage
41PC686	Ineligible	campsite with hearth, debitage, and stone tools
41PC687	Ineligible	projectile point fragment and historic button back, rifle shells, bottle glass, white ware, brick fragments, cast iron fragments, railroad spikes, nails, and metal
41PC688	undetermined	lithic scatter
41PC689	undetermined	lithic scatter
41PC690	undetermined	lithic scatter
41PC703	undetermined	limestone cairn
41PC704	undetermined	campsite with scattered burned rock and stone tools
41PC705	undetermined	campsite with multiple hearths
41PC706	undetermined	campsite with burned rock midden
41PC707	undetermined	lithic procurement area
41PC708	undetermined	campsite with multiple hearths and lithic scatter
41PC709	undetermined	campsite with burned rock midden
41PC710	undetermined	campsite with two hearths, debitage, and stone tools
41PC711	undetermined	campsite with four hearths
41PC712	undetermined	lithic procurement area
41PC713	undetermined	lithic scatter
41PC714	undetermined	campsite with debitage, stone tools, and scattered burned rock
41PC715	undetermined	lithic scatter
41PC716	undetermined	campsite with burned rock midden and debitage
41PC717	undetermined	campsite with debitage, dart point, and burned rock
41PC718	undetermined	campsite with debitage, stone tools, and burned rock
41PC719	undetermined	campsite with debitage, burned rock, and two historic dumps
41PC720	undetermined	campsite with hearths, debitage, and stone tools
41PC721	undetermined	middle Archaic campsite with hearth, debitage, and Pandale projectile point
41PC722	undetermined	lithic procurement area
41PC723	undetermined	campsite with three hearths and debitage
41PC724	undetermined	campsite with burned rock midden, hearth, debitage, dart point fragment and stone tools
41PC725	undetermined	campsite with debitage and burned rock
41PC726	undetermined	campsite with debitage, stone tools, and burned rock
41PC727	undetermined	campsite with midden debitage and stone tools
41PC728	undetermined	campsite with debitage, stone tools, Frio projectile point, and ground stone tools
41PC729	undetermined	campsite with burned rock midden and burned rock scatter
41PC730	undetermined	campsite with burned rock and debitage
41PC731	undetermined	middle Archaic campsite and lithic procurement area with hearth, Langtry dart point, and

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
		debitage
41PC732	undetermined	campsite with hearth and debitage
41PC733	undetermined	campsite with debitage, stone tools, and burned rock
41PC734	undetermined	campsite with debitage, stone tools, and burned rock
41PC736	undetermined	lithic scatter
41PC737	undetermined	lithic scatter
41PC738	undetermined	lithic scatter
41PC739	undetermined	lithic scatter
41PC740	undetermined	lithic scatter
41PC741	undetermined	lithic scatter
41PC742	undetermined	lithic scatter
41PC743	undetermined	lithic scatter
41PC744	undetermined	lithic scatter
41PC745	undetermined	lithic scatter
41PC746	undetermined	lithic scatter
41PC747	undetermined	lithic scatter
41PC748	undetermined	lithic scatter
41PC749	undetermined	dump site with metal cans, fragments of blue and brown glass, fiesta ware and other ceramics, and a fragment of a bleach bottle
41PC761	Ineligible	campsite with burned rock and stone tool fragment
41PC762	Ineligible	campsite with burned rock scatter and stone tool fragment
41PC763	Ineligible	lithic procurement site
41PC764	undetermined	campsite with three hearths, debitage, and stone tools
41PC765	undetermined	lithic procurement area
41PC766	undetermined	lithic scatter
41PC767	undetermined	lithic scatter
41PC771	undetermined	campsite with burned rock midden, debitage, and stone tools
41PC772	undetermined	lithic procurement area
41PC773	undetermined	campsite with burned rock midden, debitage, and stone tools
41PC774	undetermined	lithic procurement area
41PC775	undetermined	early Archaic campsite with hearth, debitage, stone tools, and Gower projectile point
41PC776	undetermined	campsite with two hearths, dart point fragment, debitage, and stone tools
41PC777	undetermined	campsite with debitage and stone tools
41PC778	undetermined	campsite with two burned rock middens, five hearths, and debitage
41PC779	undetermined	campsite with two burned rock middens, multiple hearths, debitage, and stone tools
41PC780	undetermined	middle Archaic campsite with burned rock midden, three hearths, debitage, stone tools, and a Pandale dart point
41PC781	undetermined	lithic procurement area
41PC782	undetermined	campsite with two hearths
41PC783	undetermined	campsite with two burned rock middens, four hearths, and debitage
41PC784	undetermined	campsite with nine hearths, debitage, and stone tools
41PC785	undetermined	campsite with four hearths, debitage, and stone tools
41PC786	undetermined	campsite with two hearths and a stone tool
41PC787	undetermined	campsite with burned rock midden, debitage, and a stone tool

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC788	undetermined	campsite with two hearths, debitage, and stone tools
41PC789	undetermined	campsite with burned rock midden, debitage, and stone tools
41PC790	undetermined	campsite with hearth, debitage, and dart point fragment
41PC791	undetermined	late Archaic campsite with burned rock midden, Figueroa dart point, dart point fragments, debitage, and stone tools
41PC792	undetermined	campsite with three hearths, debitage, and stone tool
41PC793	undetermined	campsite with hearth, debitage, and stone tools
41PC794	undetermined	campsite with burned rock midden, two hearths, metate, debitage, and stone tools
41PC795	undetermined	campsite with two burned rock middens, burned rock concentrations, debitage, and stone tools
41PC796	undetermined	campsite with burned rock midden hearth, debitage, and a stone tool
41PC797	undetermined	campsite with hearth, debitage, stone tools, and a clam shell scraper
41PC798	undetermined	campsite with three hearths and debitage
41PC799	undetermined	campsite with burned rock midden, two hearths, debitage, and a stone tool
41PC800	undetermined	campsite with two burned rock middens, debitage and stone tools
41PC801	undetermined	campsite with two burned rock middens and multiple hearths, debitage, and stone tools
41PC802	undetermined	lithic scatter
41PC803	undetermined	middle Archaic lithic scatter with Pandale projectile point
41PC804	undetermined	campsite with burned rock midden, multiple hearths, debitage, and stone tools
41PC805	undetermined	campsite with two hearths, a dart point, and stone tools
41PC806	undetermined	campsite with burned rock, debitage, and stone tools
41PC813	undetermined	lithic procurement area at chert outcrop
41PC817	undetermined	windmill, rectangular concrete water tank, trough, and earthen dam and scatter of modern beer glass and sucker rod
41PC818	undetermined	campsite/hearthfield with 33 hearths, burned rock, groundstone, bifaces, projectile points, Ensor projectile point, and debitage
41PC819	undetermined	rock shelter and associated scatter of burned rock and a biface
41PC820	Ineligible	campsite with one hearth, biface, and burned rock
41PC821	undetermined	rock cairn, possible burial
41PC822	undetermined	rock cairn, possible burial
41PC823	Ineligible	campsite with five hearths, burned rock, and debitage
41PC824	undetermined	campsite with burned rock, debitage, projectile point, and bifaces
41PC825	undetermined	railroad grade
41PC827	undetermined	campsite with 16 hearths, three burned rock middens and debitage
41PC828	Ineligible	depression (possible cattle tank) and scatter of cans, glass, semi-porcelain sherds, nails, wire cable, bricks, metal fragments, barrel hoops, and milled lumber
41PC829	Eligible	campsite with seven hearths, scatter of burned rock, debitage, and scrapers
41PC830	undetermined	campsite with one hearths and burned rock
41PC831	Eligible	campsite with four concentrations of burned rock, a cluster of bedfdrock mortars, debitage, burned rock, cores, bifaces, unifaces, manos, metates, an Abasolo projectile point, and two projectile point fragments
41PC832	Eligible	campsite with eight burned rock concentrations, debitage, cores, bifaces, unifaces, scrapers, hammerstone, Langtry-like projectile point, metate, metate fragments, and brownware ceramics

TABLE 2-13 RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP STATUS	SITE DESCRIPTION
41PC833	Ineligible	campsite with debitage, cores, Hueco projectile point, uniface, and groundstone fragments
41PC834	Eligible	campsite with three hearths, burned rock, and debitage
41PC835	undetermined	campsite with three hearths and burned rock
41PC836	undetermined	campsite with three hearths and burned rock
41PC837	undetermined	campsite with two hearths, burned rock, biface, and debitage
41PC838	undetermined	campsite with seven hearths, scatter of burned rock, debitage, scraper, and biface
41PC839	Eligible	campsite with five hearths, burned rock, debitage, cores, bifaces, scrapers, and one jar (historic isolate)
41PC840	undetermined	campsite with one hearth, burned rock and a core
41PC841	undetermined	campsite with three hearths, debitage, cores, bifaces, uniface, and a Hueco projectile point
41PC842	undetermined	campsite with burned rock, debitage, Palmillas projectile point, core, uniface, and mano
41PC843	undetermined	campsite with two hearths, burned rock, cores, bifaces, unifaces, scraper and debitage
41PC844	undetermined	campsite with one hearth and burned rock
41PC845	Ineligible	lithic scatter with debitage, cores, bifaces, and a uniface
41PC846	undetermined	campsite with one hearth, debitage, bifaces, and Langtry projectile point

Source: THC 2018b.

TABLE 2-14 CEMETERIES RECORDED WITHIN THE STUDY AREA

CEMETERY NUMBER	CEMETERY NAME	COUNTY	COMMENTS
PC-C009	Unknown (North of IH 10)	Pecos	
PC-C004	Girvin	Pecos	
PC-C005	Old Fort	Pecos	Official Texas Historical Marker
PC-C007	St. Joseph's Catholic	Pecos	
PC-C008	East Hill	Pecos	
PC-C014	McKenzie	Pecos	

Source: THC 2018b and 2018c.

TABLE 2-15 OFFICIAL TEXAS HISTORICAL MARKERS WITHIN THE STUDY AREA

NAME	COUNTY	DESIGNATION
Annie Riggs Hotel	Pecos	RTHL
Courthouse, Jail and Zero Stone	Pecos	RTHL
First Telephone Exchange	Pecos	
Fort Stockton Guard House	Pecos	RTHL
Fort Stockton Officers' Quarters	Pecos	RTHL
Grey Mule Saloon	Pecos	RTHL
Koehler's Saloon and Store	Pecos	RTHL
Oil and Gas Industry in Pecos County	Pecos	
Old Fort Cemetery	Pecos	
Oldest House	Pecos	RTHL
Pecos County	Pecos	
Rude, Mr. and Mrs. Isaac J.	Pecos	
Saint Stephen's Episcopal Church	Pecos	RTHL
Site of Comanche Springs	Pecos	
Fort Stockton	Pecos	
St. Joseph's Catholic Church	Pecos	RTHL
Telegraph Office and School	Pecos	RTHL
Young's Store	Pecos	RTHL
First National Bank Building	Pecos	RTHL
Fort Stockton, C.S.A.	Pecos	

Source: THC 2018b.

The majority of the prehistoric archeological sites that have been recorded in the study area appear to be campsites with burned rock middens, and/or hearths in close proximity to springs, streams and river channels (Comanche Springs, Tunas Creek, Fourmile Draw); uplands adjacent to these channels; mesa edges and bluff lines overlooking the major draws; and rockshelters. For the few prehistoric sites in the study area that have produced diagnostic artifacts, most date to the Archaic period, perhaps not unexpected given the preponderance of sites with burned rock middens, which appear in this region beginning in the early Archaic Period and continue to be used into the Late Prehistoric period.

2.7.3 Previous Investigations

According to the TASA (THC 2018b), there have been at least 48 previously conducted cultural resource investigations within the study area boundaries (see Table 2-16). Most of these have been undertaken to fulfill Antiquities Code of Texas requirements on state-owned University Lands in the eastern part of the study area.

TABLE 2-16 PREVIOUS CULTURAL RESOURCE INVESTIGATIONS WITHIN THE STUDY AREA

INVESTIGATING AGENCY NAME	SURVEY/PROJECT NAME	SITE(S) RECORDED/VISITED
Southern Archaeological Consultants	A Cultural Resources Assessment and Archaeological Survey of a Proposed CO2 Pipeline on Public School Lands in Pecos and Terrell Counties, Texas (Keller 1998)	41PC479
Texas Department of Highways and Public Transportation 1971	Information not available on TASA	41PC18- 41PC20
Texas Department of Highways and Public Transportation, 1971	Information not available on TASA	
Texas Department of Highways and Public Transportation	An Archaeological Survey on Interstate Highway 10 — Crockett, Kimble, Pecos, Sutton Counties (Crawford 1973)	
Texas Department of Transportation	US 290: 1.0 Mi. East of Ft. Stockton, East 0.6 Mile (Lewis 1975)	41PC17
Texas Department of Transportation	Cultural Resources Assessment - IPE 17 - FM 1776: FM1450 South (TxDOT 1975)	
University of Texas of the Permian Basin, 1979	UT System Block 19, 160 acres	
University of Texas Land System	Report on Archeological Survey of Parts of Sections 8, 9, 12, and 13 of Block 19, University Lands, Pecos County, Texas (Barkes 1980)	41PC394
Information not available on TASA, 1979	Information not available on TASA	
Center for Archeological Research	Archaeological Investigations at Angus Flats, Pecos County, Texas (Gibson 1980)	41PC393
Heartfield, Price and Greene, Inc.	An Archeological Survey for Rio Grande Electric Cooperative, Inc. in Southern and Western Texas — Dimmit, Hudspeth, Kinney, Pecos, Terrell Counties (Gibson and Uecker 1981)	41PC393
Rural Electrification Agency, 1981	Information not available on TASA	
State Department of Highway and Public Transportation	Investigations at the Squawteat Peak Site, Pecos County, Texas (Young 1981)	41PC14
Mid-America Petroleum, 1985	41PC14 and Environs: well pads, access roads, pipelines	41PC14
Heartfield Price and Green	Cultural Resources Investigations	41PC434-41PC441

TABLE 2-16 PREVIOUS CULTURAL RESOURCE INVESTIGATIONS WITHIN THE STUDY AREA

INVESTIGATING AGENCY NAME	SURVEY/PROJECT NAME	SITE(S) RECORDED/VISITED
	of the Proposed Superior-University 19-1-1 Lateral Gas Pipeline Routes through U. T. Lands (Escondido Vineyard), Pecos County, Texas (Madden 1983)	
State Department of Highways and Public Transportation	Spur 194: From Junction US 385 to 1.2 Miles SW (SDHPT 1987)	
Archeological Resource Evaluation Associates	Archaeological Investigation of a Proposed Prison Site near Belding, Texas (Kegley 1993)	
Public Utility Commission, 2000	Information not available on TASA	
PBS&J, 2000	Woodward Mountain	41PC515-41PC522
Hicks and Company, 2000	Pecos County Survey	41PC523, 41PC524
SWCA Environmental Consultants, Inc., 2000	Capitol Hill Wind Ranch	41PC525-41PC528
SWCA Environmental Consultants, Inc., 2000	Cultural Resources Survey for Sherbino Mesa Project	41PC579-41PC594
Center for Big Bend Studies	An Archeological Survey of the Proposed 102-Mile Six Shooter to Midland Airport Fiber Optic Cable Route, Pecos, Crockett, Upton, and Midland Counties, Texas (Young 2003)	41PC14, 41PC15
Turpin and Sons, Inc.	Cultural Resources Evaluation of Big Bend Telephone Company Fiber Optic Lines, Pecos County (Turpin 2005)	41PC393
Turpin and Sons, Inc.	Archeological Survey of Energy Transfer Corporation's Pinon Lateral, University Lands, Pecos County, Texas — Pecos County (Turpin 2007)	41PC598-41PC601
AR Consultants, Inc., 2007	Sherbino Mesa Wind Farm	41PC602
ERM Inc., 2009	Sherbino Mesa 2 Wind Farm	41PC625, 41PC630-41PC632
Turpin and Sons, Inc.	Archeological Investigations on University Lands, Blocks 18, 19, and 21, Pecos County, Texas (Turpin 2009)	41PC79, 41PC442, 41PC443, 41PC603-41PC616, 41PC643-41PC645, 41PC656-41PC663, 41PC671
Blackshare Environmental, 2010	Comanche Overhead Transmission Line	41PC688-41PC690

TABLE 2-16 PREVIOUS CULTURAL RESOURCE INVESTIGATIONS WITHIN THE STUDY AREA

INVESTIGATING AGENCY NAME	SURVEY/PROJECT NAME	SITE(S) RECORDED/VISITED
Turpin and Sons, Inc.	An Archeological Survey of the Proposed Sandridge Tombstone 345-kV Transmission Line, University Lands, Pecos County, Texas (Turpin 2010)	41PC672-41PC687
Turpin and Sons, Inc.	Cultural Resource Assessment of 3.4 miles of BP Wind Energy North America Inc.'s Sherbino Mesa Transmission Line Corridor on University Lands, Pecos County (Turpin 2011)	41PC479, 41PC703-41PC709, 41PC704-41PC 709
Turpin and Sons, Inc.	Cultural Resource Assessment, BP Wind Energy North America Inc.'s Sherbino Mesa Transmission Network, Pecos County, Texas (Turpin 2011)	41PC710-41PC712, 41PC715, 41PC17-41PC732, 41PC736-41PC745, 41PC746, 41PC749
LCRA	LCRA Annual Report of Cultural Resource Investigations for 2011 (Prikryl, Malof, and Hixson 2012)	41PC761, 41PC762
Turpin and Sons, Inc.	Cultural Resource Reconnaissance, University Lands VF Petroleum Seismic Project Pecos County, Texas (Turner and Turpin 2012)	41PC79, 41PC442, 41PC611, 41PC615, 41PC617, 41PC763-41PC767, 41PC783-41PC787
TRC Environmental Corporation	The City of Fort Stockton, Utility Installation, Pecos County, Texas: An Intensive Cultural Resource Survey, Pecos County, Texas (Quigg and Matchen 2014)	
Turpin and Sons, Inc.	An Archeological Reconnaissance of Dawson Geophysical Pecos Phase I Seismic Project Pecos County, Texas (Burgess and Moody 2014)	41PC384-41PC387, 41PC771-806, 41PC601, 41PC621, 41PC672, 41PC673-41PC675, 41PC678, 41PC683, 41PC684
Turpin and Sons, Inc., 2016	Trans Pecos (TPP)	41PC813
Information not available on TASA	Information not available on TASA	
Information not available on TASA	Information not available on TASA	
Information not available on TASA	Information not available on TASA	
Turpin and Sons, Inc.	Negative Findings Report. Cultural Resource Survey. Ft. Stockton Municipal Solid Waste Facility Pecos County, Texas (Turner and Turpin 2016)	

TABLE 2-16 PREVIOUS CULTURAL RESOURCE INVESTIGATIONS WITHIN THE STUDY AREA

INVESTIGATING AGENCY NAME	SURVEY/PROJECT NAME	SITE(S) RECORDED/VISITED
AECOM	Cultural Resources Survey for the Midway Solar Site Project, Pecos County, Texas (Ahr et al. 2017)	41PC761, 41PC762
AmaTerra Environmental, Inc	Archeological Resource Survey at a Proposed Deep Borehole Site, Pecos County, Texas (Butler and Seikel 2017)	41PC817-41PC820, 41PC823
Turpin and Sons, Inc.	Negative Findings Report, Cultural Resource Survey Ft. Stockton Fed-Ex Ground Property, Pecos County, Texas (Turpin 2017)	
Phase One Archaeological Services	Phase One Cultural Resource/Archaeological Investigation Results, Northern Natural Gas, Bakersfield Compressor Station Project, Pecos County, Texas (Hodgson 2017)	41PC821, 41PC822
Turpin and Sons, Inc.	Negative Findings Report Cultural Resource Survey, Woodward Wind Conduit Realignment Pecos County, Texas (Turner 2018)	41PC529
Lone Mountain Archaeological Services, Inc.	Cultural Resource Survey for the Proposed Sanderson 3D Seismic Project, Pecos County, Texas (Boggess and McCormack 2018)	41PC82841PC846
POWER Engineers	Intensive Archeological Survey of Portions of the Proposed AEP Barilla Junction to Permian Basin Transmission Line Rebuild Project Located on City of Fort Stockton Property in Pecos County, Texas (Schubert and Duke 2018)	41PC448

Source: THC 2018b.

2.7.4 High Probability Areas

Review of the previously recorded cultural resource sites data indicates that the study area has not been entirely examined during previous archeological and historical investigations. Consequently, the records review results do not include all possible cultural resources sites within the study area. To further assess and avoid potential impacts to cultural resources, HPAs for prehistoric archeological sites were defined during the route analysis process. HPAs were designated based on a review of the site and survey data within the study area, as well as soils and geologic data, and topographic variables. Within the study area, the prehistoric HPAs typically occur near and along streams, at the heads of major draws, in rock shelters near springs and at outcroppings of chert gravels suited to stone tool manufacture. Terraces and topographic high points that would provide flats for camping and expansive landscape views as well as access to fresh water sources are also considered to have a high probability for containing prehistoric archeological sites.

Historic age resources are likely to be found near water sources. However, they will also be located in proximity to primary and secondary transportation routes (e.g., trails, roads, and railroads) which provided access to the sites. Buildings and cemeteries are also more likely to be located within or near historic communities.

3.0 ALTERNATIVE ROUTE DEVELOPMENT

After defining the study area, the results of data collection and reconnaissance surveys were used to develop an environmental and land use composite constraints map to identify areas of opportunity and constraints for facilitating the development of geographically diverse preliminary alternative route segments to connect the project endpoints. The following sections describe the alternative route development process. The evaluation and comparison between the primary alternative routes is presented in Section 4.0.

3.1 OPPORTUNITIES AND CONSTRAINTS EVALUATION

3.1.1 Existing Linear Corridors

The PUC's Substantive Rules (16 TAC § 25.101(b)(3)(B)(i-iii)) require utilities to consider paralleling or utilizing existing compatible linear features when identifying route alternatives for new transmission lines. In general, locating a transmission line adjacent to existing linear corridors typically minimizes environmental impacts due to existing adjacent disturbances, improved access, and decreased habitat fragmentation. POWER identified multiple linear routing features within the study area, including: existing electrical transmission lines, roadways, active and abandoned railroads, fence lines, and apparent property boundaries. Although large petrochemical pipeline crossings and distances paralleling large petrochemical pipelines were identified, these were not considered positive routing features. Instead, POWER generally sought to minimize paralleling of large petrochemical pipelines and to cross such pipelines perpendicularly where possible and reasonable.

Transmission Line ROWs

POWER, LCRA TSC, and AEP Texas evaluated paralleling adjacent to existing transmission lines identified within the study area, which included one 345-kV transmission line, nine 138-kV transmission lines, and seven 69-kV transmission lines. During the route identification process, AEP Texas informed POWER that several of the existing 69-kV transmission lines have been rebuilt as 138-kV capable or are in the process of being rebuilt 138-kV capable. Opportunities for paralleling adjacent to some of the existing transmission lines were identified. In some instances, constraints located adjacent to the existing transmission lines, their location, or the orientation of these lines precluded paralleling adjacent to them.

Distribution Lines

POWER did not identify existing distribution lines within the study area that were considered viable for potential overbuild or paralleling opportunities for any significant distance of the Proposed Project.

Where potential overbuild opportunities exist for distribution facilities, co-location will be further evaluated during the detail design and construction stage of the Proposed Project in coordination with the owners and operators of the distribution facilities and will consider outage impact during reconstruction, cost allocation, and appropriate operation and maintenance agreements.

Roadway ROWs

POWER evaluated paralleling adjacent to multiple roadways within the study area, including one IH, three US Hwys, two SH, and six FM roads (a complete list of roadways is provided in Section 2.4.6). POWER also evaluated paralleling the numerous county and local roads (paved and unpaved) within the study area. Habitable structures, pipelines, oil or gas wells, and other constraints located near roadways precluded paralleling in some areas.

Railroad ROWs

POWER considered paralleling adjacent to both an active and abandoned railroad that were identified within the study area. The active railway primarily parallels SH 194 and existing transmission lines in the area and is located in the central portion of the study area running northeast to southwest. The abandoned railway is located in the northern portion of the study running northwest to southeast.

Pipeline ROWs

LCRA TSC and AEP Texas do not consider large pipelines carrying hydrocarbons to be a compatible routing feature for this project and paralleling such pipelines was avoided as much as possible. In addition, effort was made to cross the large petrochemical pipelines perpendicularly. Pipelines carrying hydrocarbons with a known diameter of six inches and greater are shown on Figures 3-14a, b, c and 4-1a, b, c.

Fence Lines

POWER identified paralleling opportunities within the study area along fence lines. Fence lines were identified from public roadways and utilizing aerial photography (Photo Science 2018) and were often found along apparent property boundaries.

Apparent Property Boundaries

LCRA TSC provided POWER with apparent property boundary information utilizing county appraisal district property information for Pecos County. Apparent property boundaries within the study area provided several paralleling opportunities between the project endpoints where no other existing linear features were present.

3.2 ALTERNATIVE ROUTE SELECTION

The objective of this EA study was to develop alternative routes that provide geographic diversity and comply with the routing criteria in § 37.056(c)(4) of the Texas Utilities Code, 16 TAC § 25.101(b)(3)(B), the PUC's CCN application form, and other requirements commonly included in the PUC's preliminary orders for transmission line CCN projects. The comments received from regulatory agencies, local officials, public meeting, and other interested stakeholders were also considered during the alternative route development process. Modifications and additions of preliminary alternative route segments were made while considering existing resources and public input. Feasible and geographically diverse alternative routes were selected for analysis and were compared using 46 evaluation criteria (see Table 2-1) to determine potential impacts to land use and environmental resources.

POWER utilized a comprehensive routing and evaluation methodology to develop and evaluate alternative transmission line routing segments. The POWER team identified feasible and geographically diverse locations for preliminary alternative route segments to connect the project endpoints that were then reviewed and further refined by LCRA TSC and AEP Texas for constructability. The preliminary alternative route segments were presented at a public open house meeting on July 12, 2018. Modifications to the proposed preliminary alternative route segments were completed after input was considered from the public open house meeting, additional agency input, meetings with stakeholders, refined data collection, field reconnaissance, and identified potential engineering constraints. The resulting alternative routing segments were combined to form numerous forward progressing alternative routes while also providing geographic diversity. An evaluation and comparative potential impact assessment for each alternative route was completed as provided in Section 4.0

The following sections provide a detailed description of the methodologies and assumptions used to complete the alternative route development process.

3.2.1 Preliminary Alternative Route Segments

Preliminary alternative route segments were identified by POWER using the composite constraints map. Preliminary alternative route segments were developed based upon maximizing the use of opportunity areas while avoiding areas of conflicting land uses or greater impact. Existing and newly flown aerial photography were used in conjunction with the composite constraints superimposed to identify locations for preliminary alternative route segments. POWER utilized the following to identify the preliminary alternative route segments:

- Input received from correspondence with local officials, regulatory agencies, and others.

- Input received from LCRA TSC and AEP Texas regarding existing and future transmission lines and electric generation projects within the study area and reliability concerns with paralleling certain existing transmission lines.
- Results from reconnaissance surveys of the study area.
- Review of aerial photography.
- Environmental and land use constraints data.
- Apparent property boundaries and fence lines.
- Existing compatible linear opportunity areas.
- Locations of existing housing, commercial, and oil and gas developments.

The preliminary alternative route segments were developed in accordance with § 37.056(c)(4) of the Texas Utilities Code 16 TAC § 25.101(b)(3)(B), the PUC's CCN application form, and other requirements commonly included in the PUC's preliminary orders for transmission line CCN projects. It was POWER's intent to develop an adequate number of environmentally acceptable and geographically diverse preliminary alternative route segments while considering such factors as community values, parks and recreation areas, historical and aesthetic values, environmental integrity, route length using or parallel to existing compatible corridors or parallel to apparent property boundaries, and prudent avoidance. POWER, LCRA TSC, and AEP Texas developed 75 preliminary alternative route segments that were presented at the public open house meeting (see Figure 3-1 and Appendix B).

Figure 3-1 Preliminary Alternative Route Segments

11X17 FRONT

Figure 3-1 Preliminary Alternative Route Segments

11X17 BACK

3.2.2 Public Involvement Program

The purpose of the open house meeting, which was held on July 12, 2018, was to solicit input from residents, landowners, public officials, and other interested parties concerning the Proposed Project and the preliminary alternative route segments, and to:

- promote a better understanding of the Proposed Project including the purpose, need, potential benefits and impacts, and the PUC certification process;
- inform the public about the routing procedure, schedule, and route approval process; and
- gather the values and concerns of the public and community leaders.

3.2.2.1 Comments from Agencies and Officials

The following local, state, and federal agencies and officials were contacted by letter in January 2018 by POWER, LCRA TSC, and AEP Texas to solicit comments, concerns, and information regarding potential impacts, permits, or approvals for construction of the Proposed Project. Maps of the study area were included with each letter. Sample copies of the letters sent and all of the responses received as of the date of this report are included in Appendix A.

Contacts Made by POWER:

- United States Army Corps of Engineers (USACE) – Albuquerque District
- United States Department of Defense Siting Clearinghouse (DoD)
- United States Environmental Protection Agency (USEPA)
- United States Fish and Wildlife Service (USFWS)
- Federal Aviation Administration (FAA)
- Federal Emergency Management Agency (FEMA)
- National Park Service (NPS)
- Natural Resource Conservation Service (NRCS)
- Railroad Commission of Texas (RRC)
- Texas Commission on Environmental Quality (TCEQ) – Midland Region
- Texas Department of Transportation (TxDOT) – Aviation Division
- TxDOT – District Engineer - Odessa
- TxDOT – Environmental Affairs Division
- TxDOT – Planning and Programming
- Texas General Land Office (GLO)
- Texas Historical Commission (THC)
- Texas Parks and Wildlife Department (TPWD)

- Texas Water Development Board (TWDB)
- Permian Basin Regional Planning Commission
- Pecos County Historical Commission

Contacts Made by LCRA TSC and AEP Texas:

- AEP Wind Farm Operations
- Barrilla Solar
- BHE Renewables, LLC
- Buckthorn Westex, LLC
- Duke Energy Renewables Solar, LLC
- East Pecos Solar, LLC
- Midway Solar, LLC
- NextEra Energy, Inc.
- Recurrent Energy Development Holdings, LLC
- Sherbino I Wind Farm, LLC
- City of Fort Stockton Utilities
- Oncor Electric Delivery Company
- Rio Grande Electric Cooperative
- South Texas Electric Cooperative
- Southwest Texas Electric Cooperative
- Texas New Mexico Power Company
- Applicable United States Senators
- Applicable United States Congressmen
- Applicable Texas Senators
- Applicable Texas House Members
- Pecos County Officials
- City of Fort Stockton
- Buena Vista Independent School District (ISD)
- Fort Stockton ISD
- Iraan-Sheffield ISD
- Pecos County Chamber of Commerce
- Texas Office of Public Utility Counsel

All comments received were evaluated, considered, and factored into the overall evaluation of the preliminary alternative route segments and development of the alternative routes. Additionally, the information received from the agencies will be taken into consideration by LCRA TSC and AEP Texas before and during construction of the project. The following is a summary of the comments provided by federal, state, and local officials that responded as of this writing and the response to those comments where appropriate.

- The DoD Siting Clearinghouse responded with a letter dated May 23, 2018, stating that after an informal review the proposed transmission line project will have minimal impact on military operations conducted in the area. However, this informal review does not constitute an action under 49 U.S.C. § 44718 and the DoD is not bound by the conclusion arrived at under this informal review.
- The FAA responded with a letter dated February 14, 2018, stating that LCRA TSC and AEP Texas will need to determine if formal notice is required to the FAA under 14 CFR Part 77. LCRA TSC and AEP Texas will coordinate with the FAA as necessary once a route is approved for construction.
- The FEMA responded with a letter dated March 6, 2018, stating that they had no comments to offer.
- The GLO responded with a letter dated February 2, 2018 stating that the GLO does not appear to have any environmental or land use constraints associated with the project. The GLO also requested contact when a final route has been determined in order to determine if the project crosses any Permanent School Fund land or streambeds that would require an easement.
- The NRCS responded with a letter dated February 8, 2018, stating that although they did identify areas of prime farmland within the study area, they now consider the installation of transmission lines to be a minimal impact that will have no effect on productive agricultural lands. The Proposed Project is exempt from provisions of FPPA and no further consideration for protection is necessary. The NRCS also attached a Custom Soil Resource Report and cited several concerns to be considered, including depth of restrictive layer, slope gradient, and erosion potential. They encouraged the use of acceptable erosion control methods during the construction of the project.
- The USFWS responded with an email dated February 12, 2018, stating that species of concern could be identified by downloading information from the IPaC System. USFWS also recommended remaining in or as close to existing ROW to avoid any new potential habitat degradation. IPaC was downloaded August 16, 2018, and provided a list of threatened and endangered species that may occur within the project area and/or may be affected by the project.

- The TCEQ responded with an email dated February 5, 2018, stating that TCEQ Region 7 does not conduct Environmental Assessments for this type of project.
- The THC responded with a letter dated February 12, 2018, stating that the Proposed Project would cross an area containing several previously recorded archeological sites. They also stated that much of the study area has never been surveyed and recommended that the final proposed route be surveyed by a professional archeologist. If the survey is being performed on public land or within a public easement, an Antiquities Permit must be obtained before any investigations are undertaken.
- A TXNDD data request by POWER was fulfilled by TPWD on January 23, 2018, providing shapefiles and a list of species that could be impacted by Proposed Project activities if suitable habitat is present.
- The TPWD responded with an email dated February 7, 2018, requesting shapefiles and substation locations for the project. The TPWD responded with a letter dated March 9, 2018, providing a list of regulations pertaining to the project and numerous recommendations for the project to comply with these regulations.
- TxDOT's Planning and Development Division responded with a letter dated February 1, 2018, stating that TxDOT ROW contains ecologically sensitive areas on US Hwy 67 and SH 18, and that those areas should be avoided. Additionally, utility installation requests are required for accommodation of utility facilities on state highway ROW, and a request must be submitted through the TxDOT Utility Installation Review System. TxDOT also provided information pertaining to permits required for access connections to the state highway system, if necessary, along the selected route.
- The Permian Basin Regional Planning Commission responded with a letter dated February 22, 2018, stating they offer no comment regarding land use or other environmental concerns. They support the importance of contacting County Judge Joe Shuster and Mayor Chris Alexander in Fort Stockton, Texas.

3.2.2.2 Open House Meeting

The open house meeting on July 12, 2018, was held at the Pecos County Civic Center in Fort Stockton, Texas from 5:30 p.m. to 8:00 p.m. LCRA TSC and AEP Texas mailed a total of 1,440 written notices of the meeting to owners of property within 500 feet of each preliminary alternative route segment centerline (see Appendix B). Additional notice letters were sent to elected officials and other interested parties, including the DoD. In addition, a public notice was published on July 5, and 12, 2018 in the *Fort Stockton Pioneer*, a newspaper with general circulation within Pecos County. The public notices announced the

location, time, and purpose of the meeting. A copy of the published newspaper notice is located in Appendix B.

At the meeting, personnel from LCRA TSC, AEP Texas, and POWER staffed information stations with each station devoted to a particular aspect of the project. These stations included maps, illustrations, photographs, and text explaining a particular topic. A GIS station was available to show the extent of the project, the proposed preliminary alternative route segments, property ownership parcel boundaries, and recent aerial photography of the project area. The GIS station was available to answer detailed landowner property questions such as the distance from the proposed alternative route segment centerline to habitable structures. Interested attendees were encouraged to visit each station in order so that the entire process could be explained in the logical sequence of project development, although attendees were free to circulate throughout the room in any manner they preferred. The information station format is typically advantageous because it allows attendees to process information in a more relaxed manner and also allows them to focus on their particular area of interest and ask specific questions. Furthermore, the one-to-one discussions with POWER, LCRA TSC, or AEP Texas personnel typically encourage more interaction from those attendees who might be hesitant to participate in a more formal speaker-audience format.

Upon entering, visitors were asked to sign in and were handed an information packet including a questionnaire. The questionnaire solicited input on the Proposed Project and also included an evaluation of the information presented at the meeting. Also included in the information packet were answers to frequently asked questions and a map indicating the location of the preliminary alternative route segments. Copies of the questionnaire and information packet are located in Appendix B.

After the open house meeting, POWER reviewed and evaluated each questionnaire that was submitted at the meeting or that was sent in after the meeting. Of the 49 people that signed in at the open house meeting, a total of 16 submitted questionnaires at the meeting. Seven additional questionnaires were received from individuals after the meeting, some of whom did not attend the open house meeting. A total of 23 questionnaires were received by LCRA TSC and AEP Texas.

A review of the questionnaires indicated that the majority of the respondents agreed that the need for the project had been adequately explained (96%), and that the exhibits and information presented was helpful to them in understanding the project (83%). Nine (39%) of the questionnaires received indicated that the features on the Land Use and Environmental Constraints Map were accurately plotted. Fifteen

respondents (65%) indicated that they were not aware of any missing features on the Land Use and Environmental Constraints Map.

Respondents were asked if they had a concern with any particular preliminary alternative route segment as they were presented at the open house meeting (Appendix B and Figure 3-1). They were also asked to describe their concerns. Segments O, P, and Q received the most written negative concerns (two each), followed by Segments D1, P1, Q1, and T1 with one each. Segments F and X received the most written positive comments (three each), followed by Segments M, R, W, Y, and L1 with two each. Table 3-1 summarizes the segments that received the most responses to this question, both negative and positive.

TABLE 3-1 SEGMENT CONCERNS/COMMENTS

SEGMENTS	O, P, Q	D1, P1, Q1, T1	F, X	M, R, W, Y, L1
Negative Concerns	2	1	0	0
Positive Comments	0	0	3	2

The questionnaire also solicited comments concerning typical transmission line routing factors, such as land use, paralleling existing corridors, and community values/resources. The questionnaire asked the respondents to rank the factors from one (most important) to 10 (least important) from a list of features that included: reliable electric service; parallel existing transmission line ROW; parallel other existing compatible ROW; parallel property lines; maximize the distance from residences; historic sites; parks and recreational areas; minimize visibility of the lines; and minimize environmental impacts or other concerns. The factors with most importance regarding routing the proposed transmission line project include maintaining reliable service (30%), maximizing the distance from residences (22%), and paralleling other existing utility ROW (9%).

3.2.2.3 Internet Website

To better communicate with the public and provide up-to-date project information, LCRA TSC created a section on LCRA's main website that included project-specific information regarding the Proposed Project (http://www.lcra.org/baksol). Project information available on the website included:

- Project Questionnaire
- Open house invitations/newspaper ad
- Frequently Asked Questions
- Exhibits from the open house meeting
- Aerial photography and topographic maps depicting the study area and alternative routes

- Property ownership maps
- Interactive mapping tool that allows individuals to zoom in on the preliminary segments

3.3 Modifications to the Preliminary Alternative Route Segments

Information received by POWER, LCRA TSC, and AEP Texas from the public, officials, and agencies resulted in modifications to some of the preliminary alternative route segments as well as the identification of new route segments as described in detail below. The preliminary alternative route segments are presented in Figure 3-1. The primary alternative route segments resulting from the segment revisions described below are shown in Figure 3-13.

3.3.1 New Segments

Based on public comment, Segment Y2 was added near FM 1053 as an option to go around the mesa in that area. As a result of adding Segment Y2, two nodes were added near the end of Segment O, which resulted in relabeling the far western portion of the segment as Segments X2 and Z2 (Figure 3-2).

Segment A3 was added south of IH 10 as an option that would connect the eastern and western segment networks. As a result of adding Segment A3, a node was added near the middle of Segment E1, relabeling the southern portion of the segment as Segment C3. A node was also added near the top of Segment K1, relabeling the northern portion of the segment as Segment D3. The northern portion of K1 was modified to provide a perpendicular crossing of a natural gas pipeline (Figure 3-3).

3.3.2 Segment Modifications

The central portion of Segment T was modified by shifting it to the east due to oil and gas development. (Figure 3-4).

The central portion of Segment A1 was shifted to the southeast to keep the segment on one property (University Lands) (Figure 3-5).

The central portion of Segment T1 was modified by slightly shifting it to the north to provide a greater distance from the creek bed (Figure 3-6).

Based on public input, Segment X1 was modified by shifting it to the eastern property boundary. As a result of shifting Segment X1, a node was shifted to the middle of Segment U, which decreased the length

of Segment U and increased the length of Segment V. A node was also added near the end of Segment W1, relabeling the western portion of the segment as Segment B3 (Figure 3-7).

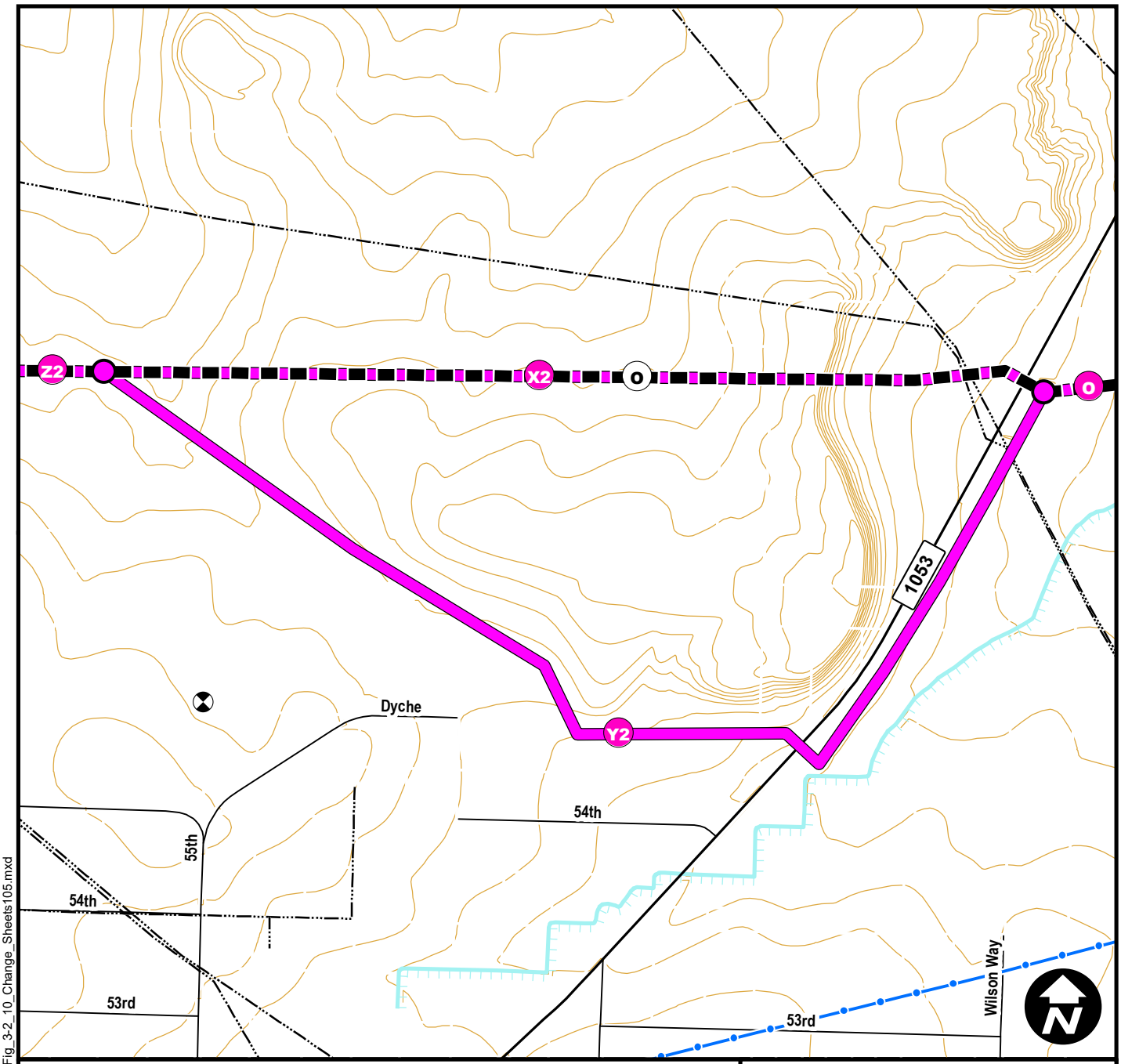
Segment P2 was modified by shifting it to the west to better parallel a roadway (Tinker Rd.). As a result of shifting Segment P2, a node was shifted to the middle of Segment Q2, which decreased the length of Segment Q2 and increased the length of Segment M2. A node was also shifted to the middle of Segment V2, which decreased the length of Segment V2 and increased the length of Segment O2 (Figure 3-8).

The northern portion of Segment L was modified by shifting it to the east to better parallel a roadway (FM 1053). As a result of shifting Segment L, the node was shifted slightly, which decreased the length of Segment F and increased the length of Segment M (Figure 3-9).

The central portion of Segment E was modified by shifting it to the west to avoid the new AEP Texas Lynx Switch Station and the northern portion was modified to provide a perpendicular crossing of FM 11 (Figure 3-10).

Based on input from University Lands, the central portion of Segment C1 was modified by shifting it to the northwest to avoid the Amazing Maze Cave (Figure 3-11).

Based on input from University Lands, the northern portion of Segment J1 was modified by shifting it to the east to better parallel a property line (Figure 3-12).



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- Communication Tower
- Canal or Ditch
- 138-kV Transmission Line
- 101 Farm-to-Market Road
- Local / County Road
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)
- 10 ft Contour Line

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-2

Addition of Y2; Relabel of Western Portion of O as X2 and Z2 Following the Open House Meeting

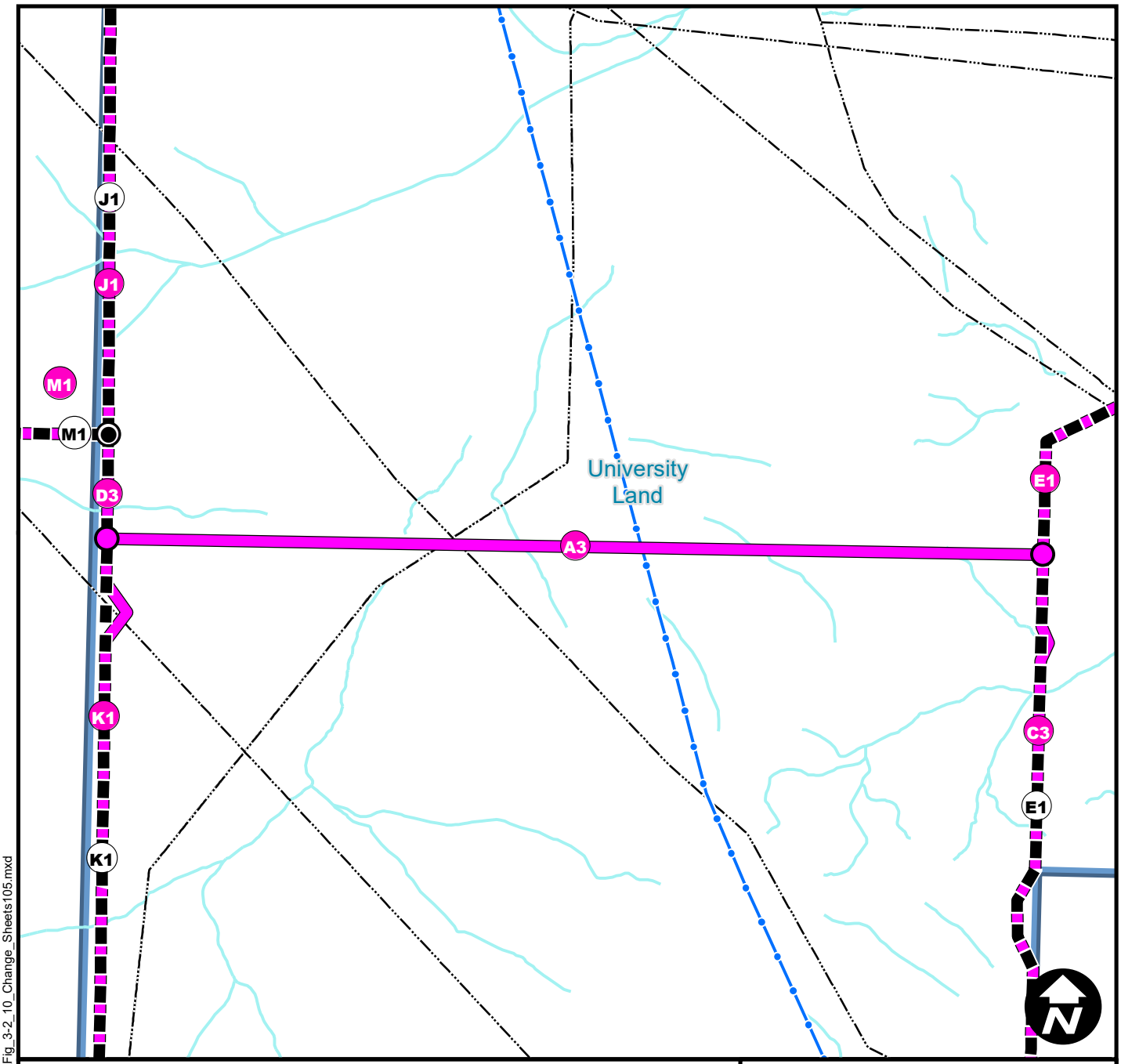
[redacted]

0 2,000 4,000
Feet

10/3/2018

10/3/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- River or Stream
- University Land
- 138-kV Transmission Line
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-3

Addition of A3; Relabel of Southern Portion of E1 as C3 and the Northern Portion of K1 as D3 Following the Open House Meeting

[redacted]

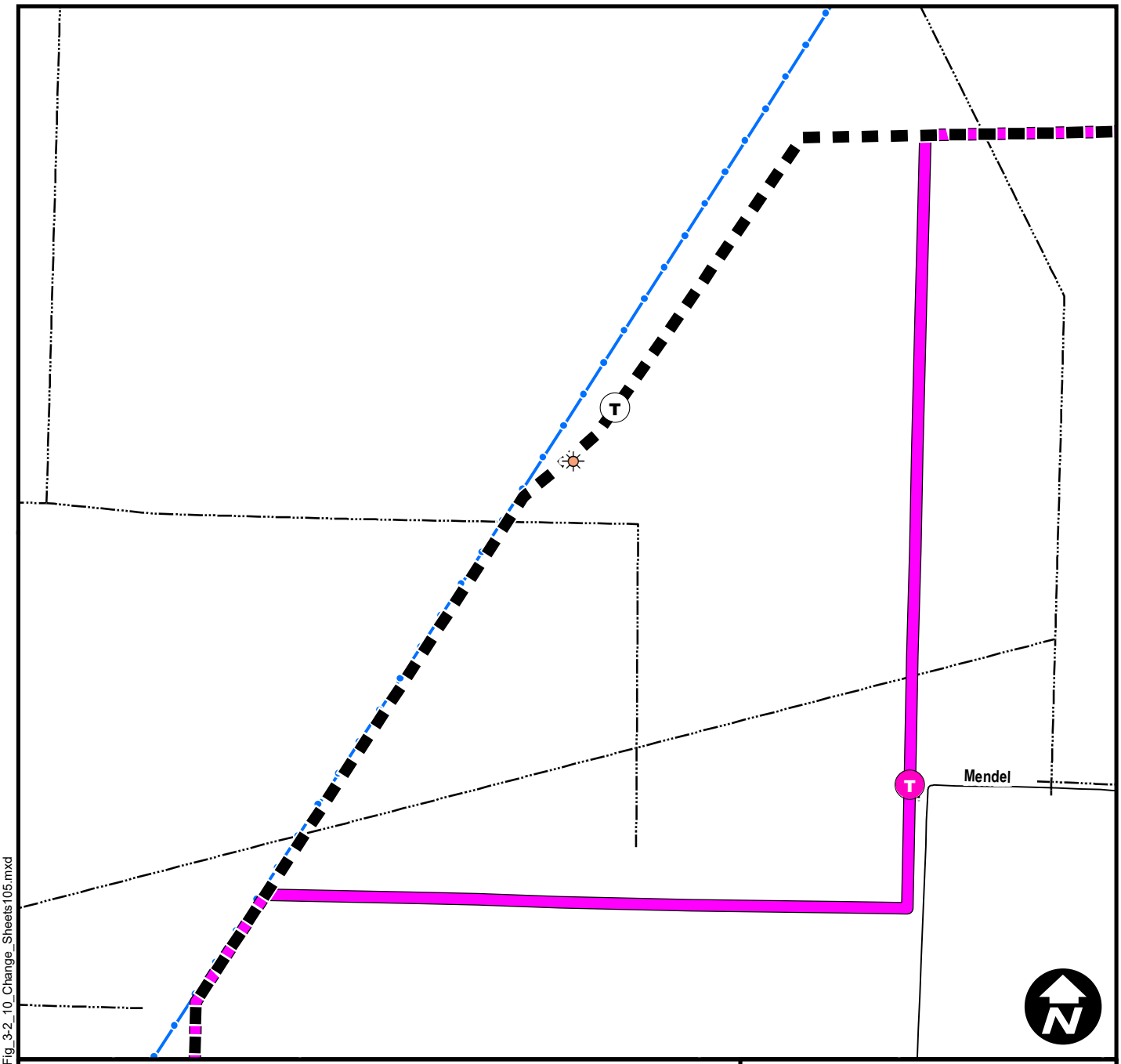
0 5,000 10,000

Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- 138-kV Transmission Line
- Local / County Road
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)
- New Oil & Gas Development

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-4

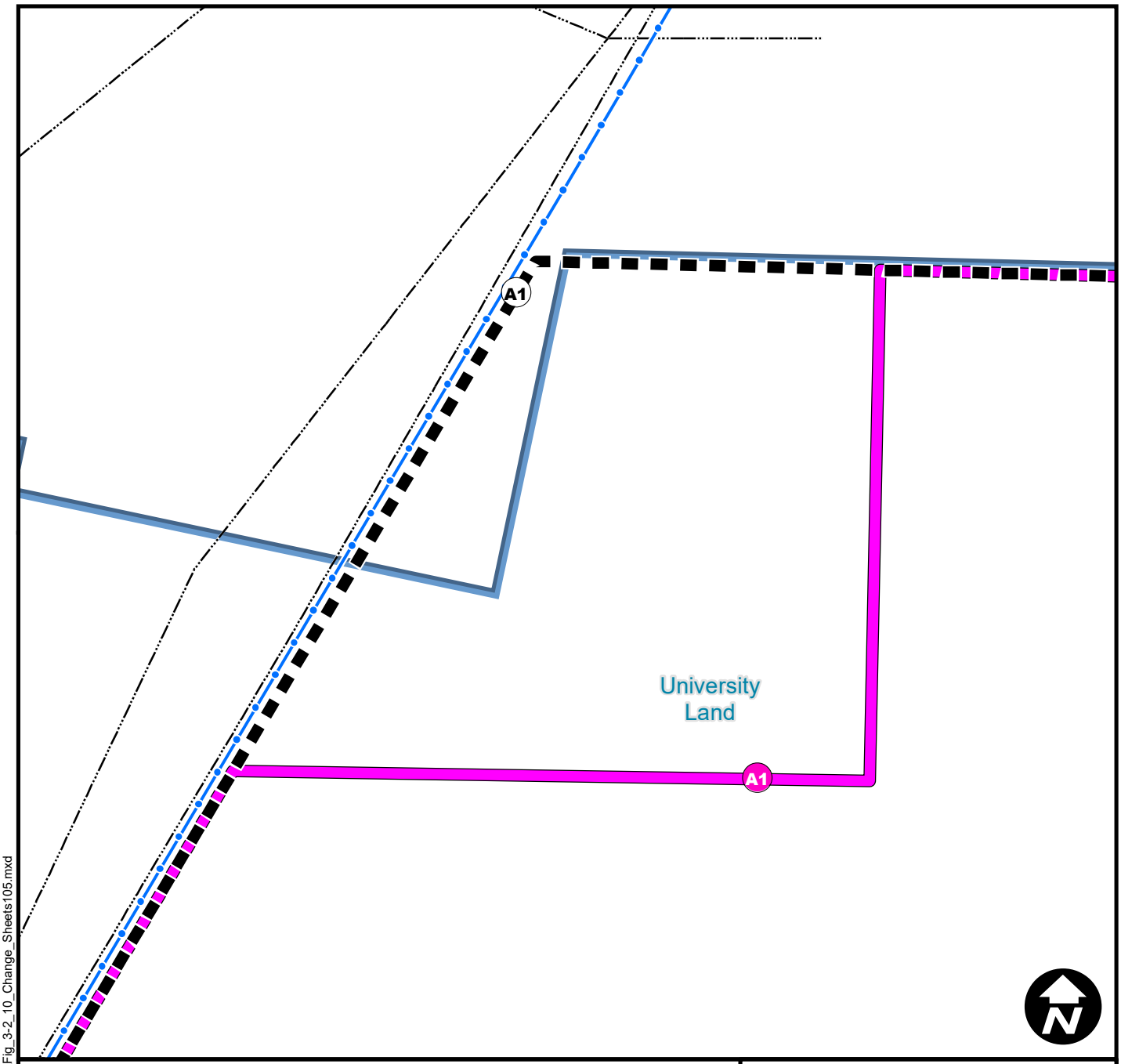
Realignment of T Following the Open House Meeting

0 4,000 8,000
Feet

10/3/2018

10/3/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- University Land
- 138-kV Transmission Line
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-5

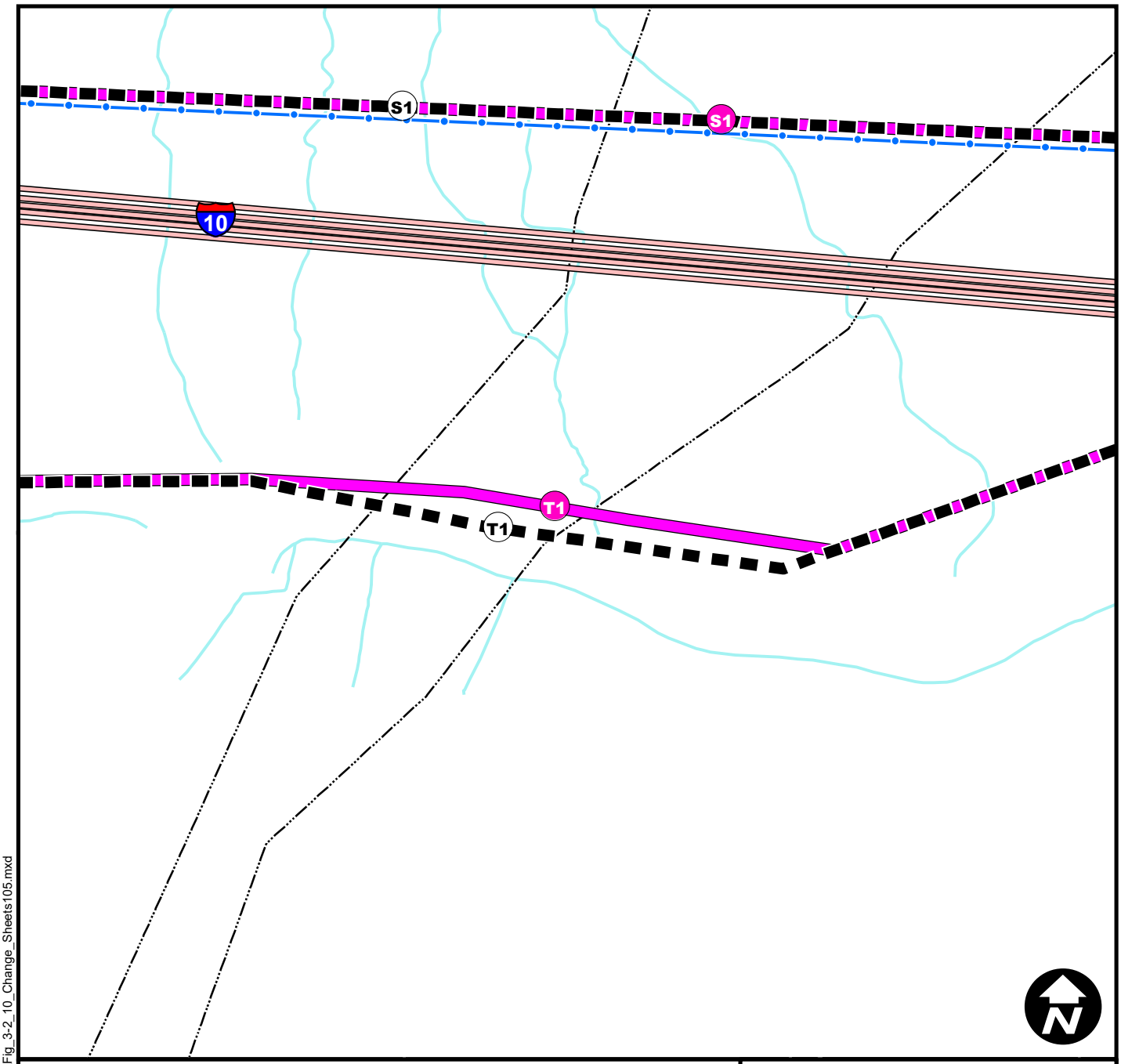
Realignment of A1 Following the Open House Meeting

0 1,500 3,000
Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- River or Stream
- 138-kV Transmission Line
- Interstate Highway
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-6

Realignment of T1 Following the Open House Meeting

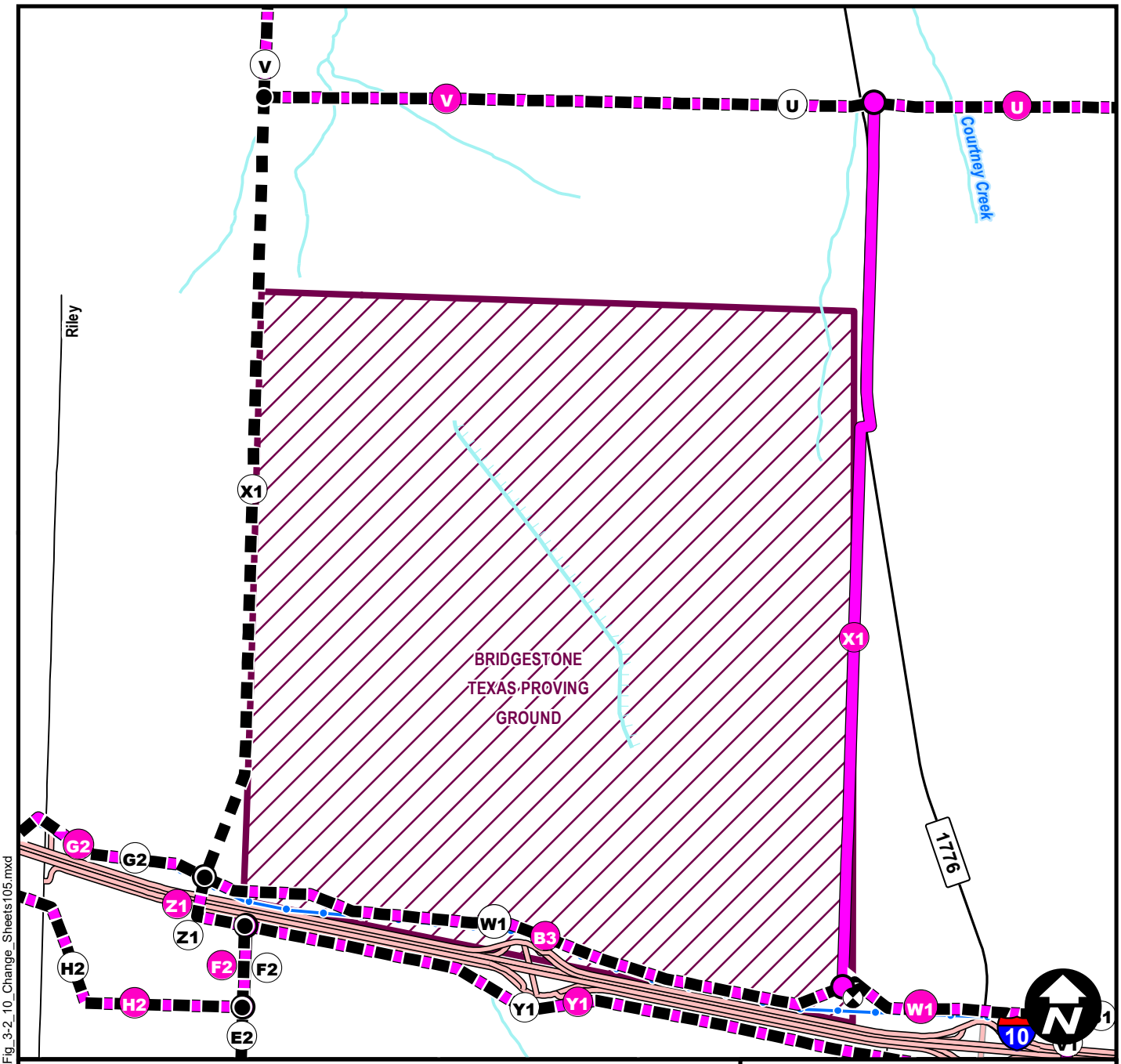
[redacted]

0 1,500 3,000
Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- Communication Tower
- River or Stream
- Canal or Ditch
- Bridgestone Texas Proving Grounds
- 138-kV Transmission Line
- Interstate Highway
- US Highway
- Farm-to-Market Road
- Local / County Road

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-7

Realignment of X1; Reduction of U and Extension of V; Relabel of Western Portion of W1 as B3 Following the Open House Meeting

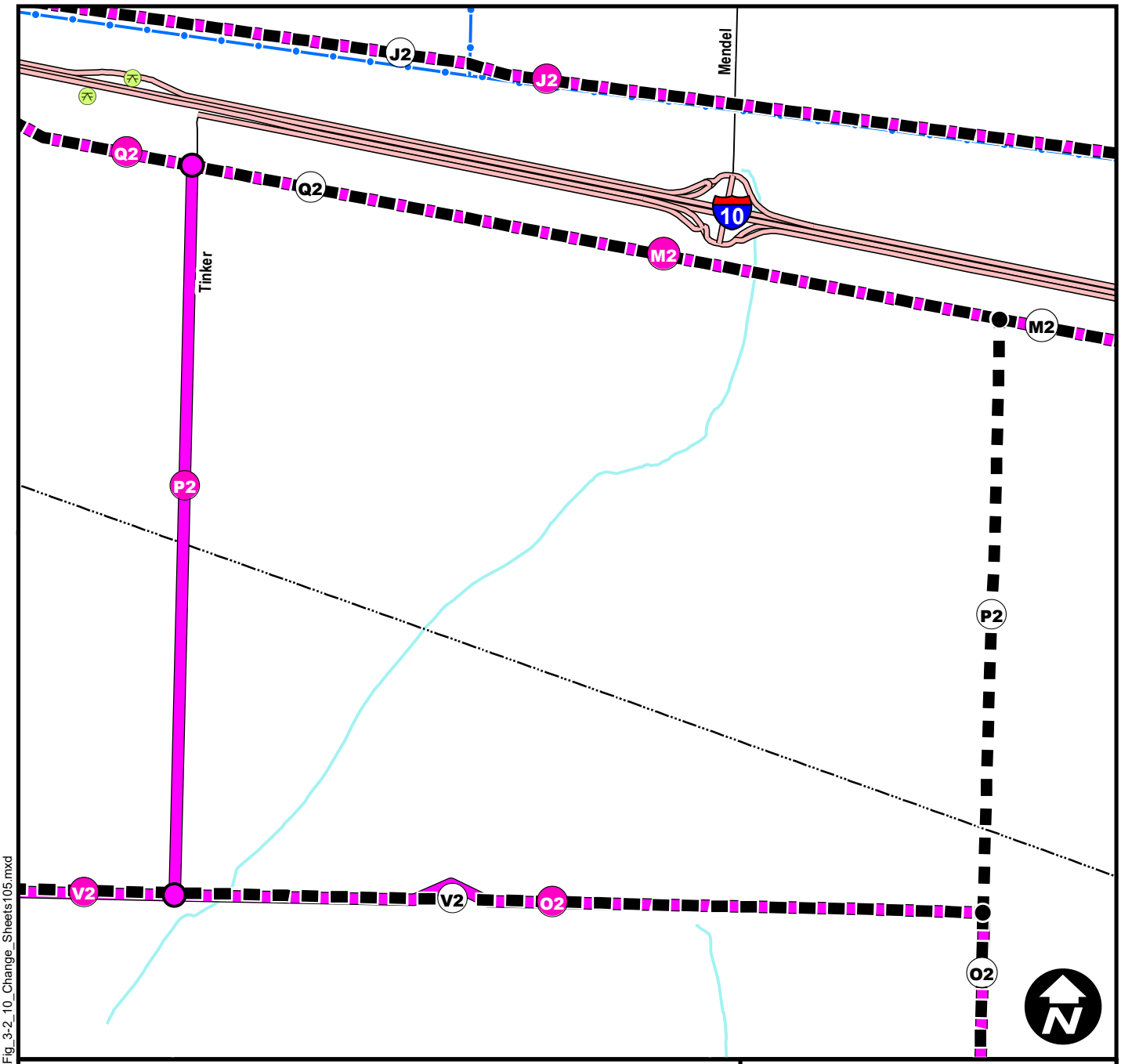
[redacted]

0 4,000 8,000
Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- Park or Recreation Area
- River or Stream
- 138-kV Transmission Line
- Interstate Highway
- Local / County Road
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-8

Realignment of P2; Reduction of Q2 and Extension of M2; Reduction of V2 and Extension of O2 Following the Open House Meeting

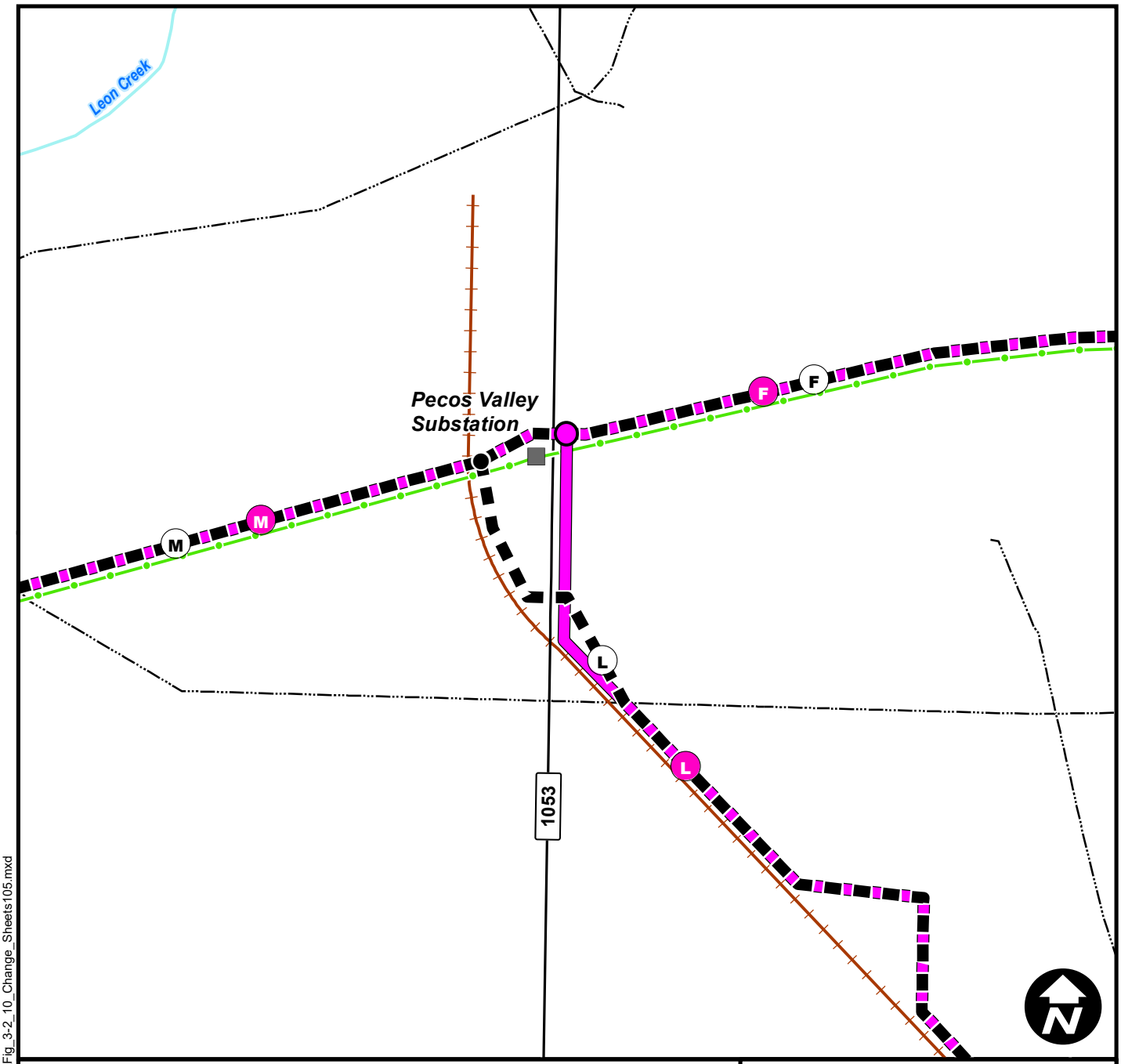
[redacted]

0 3,000 6,000
Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- Existing Substation
- River or Stream
- 69-kV Transmission Line
- 101 Farm-to-Market Road
- Railroad: Abandoned
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-9

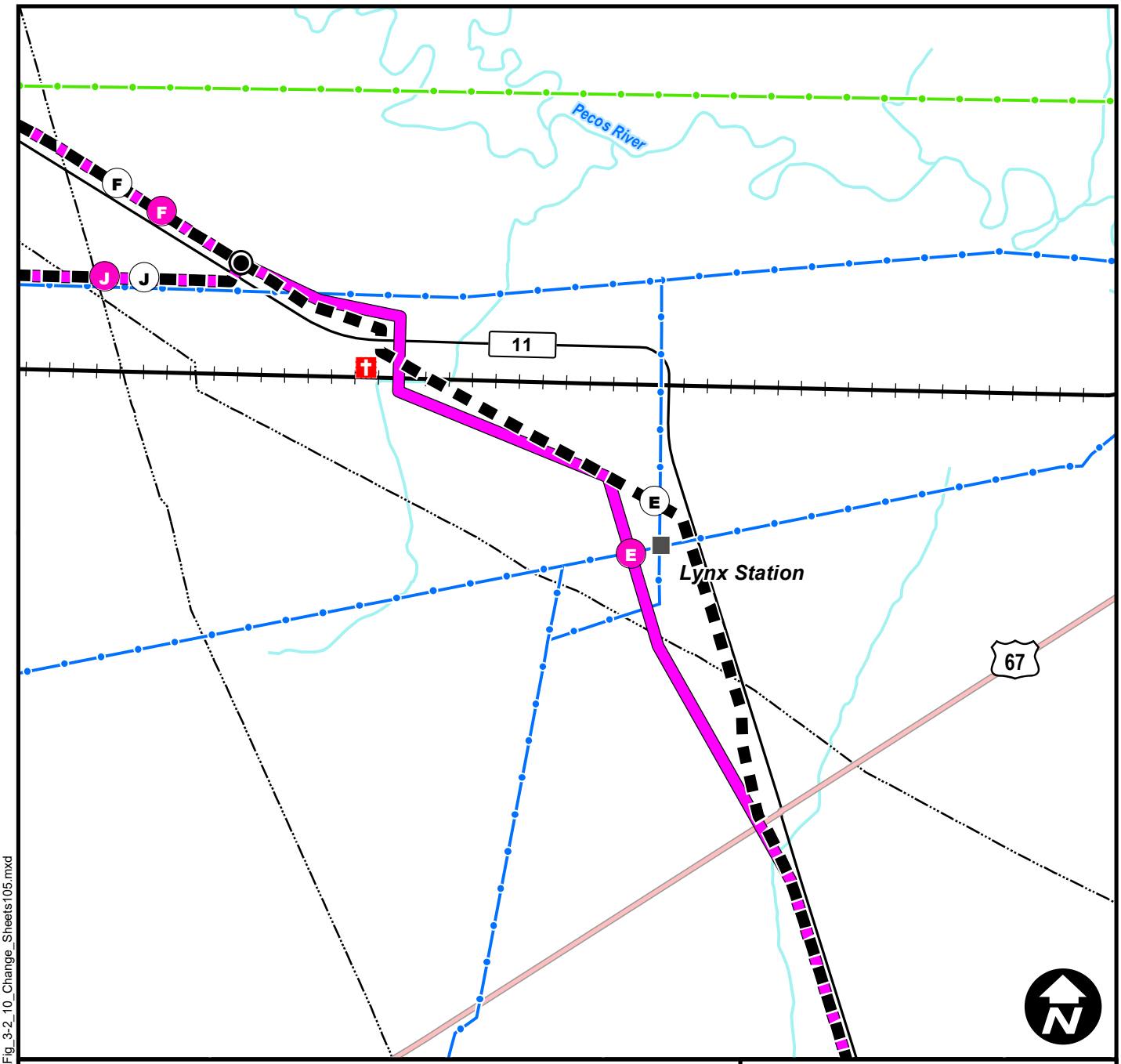
Realignment of L; Reduction of F and Extension of M Following the Open House Meeting

0 1,500 3,000
Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- Cemetery
- Lynx Station
- River or Stream
- 138-kV Transmission Line
- 69-kV Transmission Line
- US Highway
- Farm-to-Market Road
- Railroad
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-10

Realignment of E Following the Open House Meeting

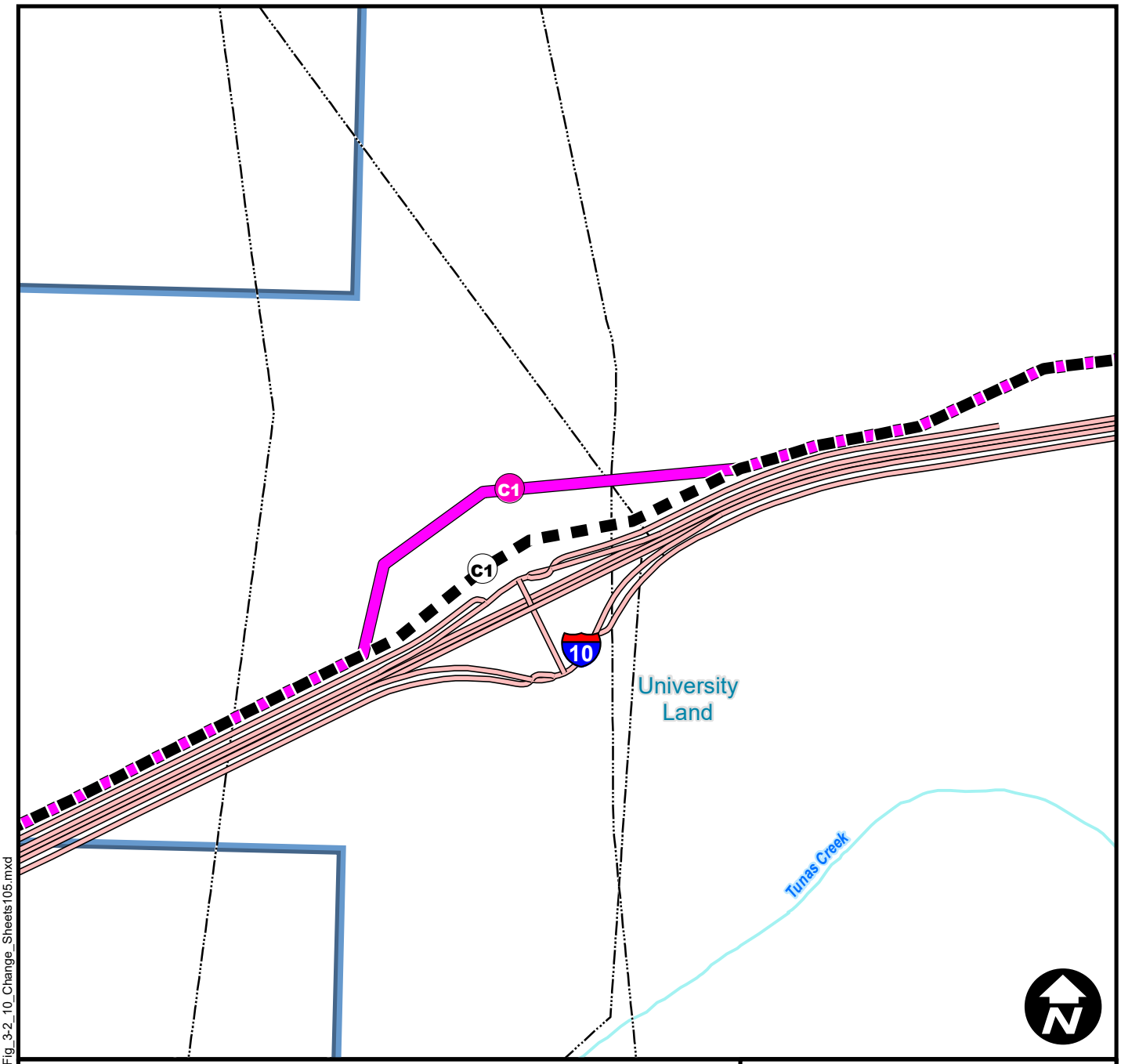
[redacted]

0 2,000 4,000
Feet

9/21/2018

9/21/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\Apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- River or Stream
- University Land
- Interstate Highway
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-11

Realignment of C1 Following the Open House Meeting

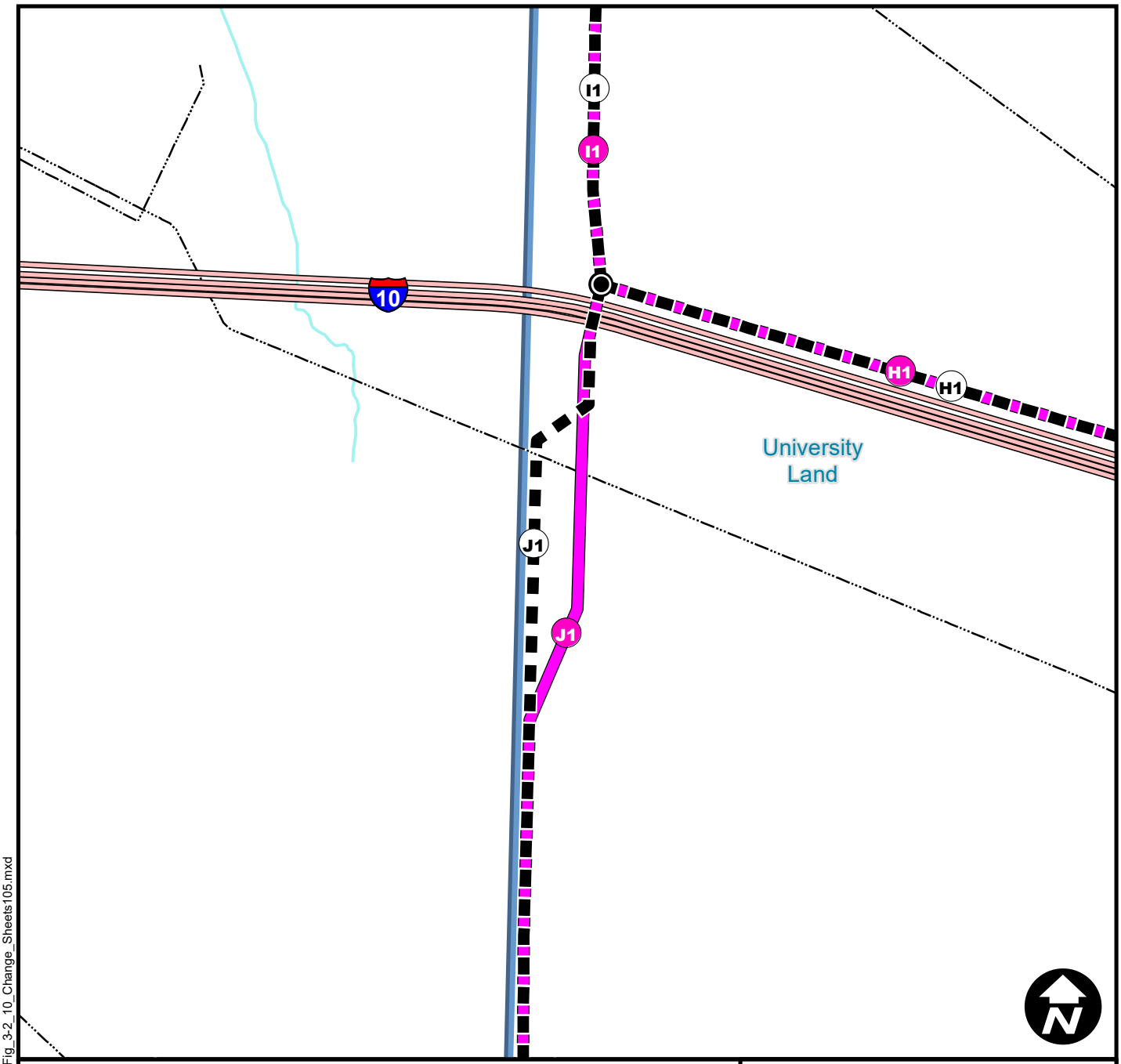
[redacted]

0 1,500 3,000
Feet

10/3/2018

10/3/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)



Legend

- Revised or New Alternative Route Segment
- Unchanged Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Removed Portion of Preliminary Alternative Route Segment Shown at Open House Meeting
- Revised or New Alternative Route Segment Node
- Unchanged Alternative Route Segment Node Shown at Open House Meeting
- Preliminary Alternative Route Segment Node Shown at Open House Meeting
- Resulting Alternative Route Segment Label
- Preliminary Alternative Route Segment Label Shown at Open House Meeting
- Parcel Group
- River or Stream
- University Land
- Interstate Highway
- Pipeline (Greater than or equal to 6 in. diameter or unknown size)

Bakersfield to Solstice 345-kV Transmission Line Project

Figure 3-12

Realignment of J1 Following the Open House Meeting

[redacted]

0 1,500 3,000
Feet

10/3/2018

10/3/2018 H:\Projects\149604_Bakersfield_Solstice_LCRA_AEP\GIS\apps\EA\Fig_3-2_10_Change_Sheets105.mxd

(This page left blank intentionally.)

Insert 11x17 Figure 3-13 Resulting Primary Alternative Routes Following the Open House Meeting

FRONT Page 1

Insert 11x17 Figure 3-13 Resulting Primary Alternative Routes Following the Open House Meeting

BACK Page 1

3.4 Primary Alternative Routes

It was the intent of POWER, LCRA TSC, and AEP Texas to identify alternative routing segments that, when combined, would form an adequate number of reasonable and geographically diverse primary alternative routes that reflect all of the previously discussed routing considerations.

Following the modifications to the 75 preliminary alternative route segments and identification of the new alternative route segments, 82 primary alternative route segments resulted. Numerous possible alternative routes using these 82 primary alternative route segments exist. POWER, LCRA TSC, and AEP Texas identified a total of 25 primary alternative routes for comparison that utilize all of the alternative route segments at least once and also provide geographic diversity. Many additional reasonable forward-progressing alternate routes may be formed by connecting the segments in various combinations. Table 3-2 details the route segment composition and overall length of the 25 primary alternative routes. See Figures 3-14a, b, and c in Appendix D for more detail on the location of the resulting routes. Potential impacts for each of the 46 evaluation criteria (see Table 2-1) were tabulated for each of the primary alternative routes (see Section 4.0).

TABLE 3-2 PRIMARY ALTERNATIVE ROUTES

PRIMARY ALTERNATIVE ROUTES	SEGMENT COMBINATION	TOTAL LENGTH IN MILES
1	A-B-E-F-M-R-W-X-Y	70.7
2	A-C-G-I-K-O-X2-Z2-P-Q-W-X-Y	67.8
3	A-C-G-I-K-O-X2-Z2-R1-S1-W1-B3-G2-J2	69.4
4	A-C-G-I-K-L-M-R-W-X-Y	71.1
5	A-B-E-J-K-O-X2-Z2-P-Q-W-X-Y	71.7
6	A-C-D-E-J-K-O-Y2-Z2-P-U-V-X-Y	74.2
7	A-B-E-J-K-O-Y2-Z2-P-U-X1-B3-G2-J2	75.7
8	A-B-E-F-M-N-T-Y	77.2
9	A-C-D-E-F-M-R-S-T-Y	78.9
10	Z-B1-C1-F1-H1-J1-M1-P1-Q1-S1-W1-B3-G2-J2	78.7
11	A-C-G-I-K-O-X2-Z2-P-Q-S-T-Y	75.6
12	A-B-H-G1-H1-J1-M1-P1-Q1-S1-W1-B3-G2-J2	80.3
13	Z-A1-C1-F1-H1-J1-M1-P1-T1-C2-D2-E2-F2-Z1-G2-J2	81.0
14	A-C-G-G1-H1-J1-M1-P1-T1-C2-D2-K2-L2-I2-J2	81.1
15	Z-B1-C1-F1-H1-J1-M1-P1-T1-C2-D2-K2-N2-O2-P2-Q2-R2	82.5
16	Z-A1-C1-F1-H1-J1-M1-P1-T1-C2-D2-K2-N2-O2-V2-W2-R2	84.1
17	Z-A1-C1-F1-H1-I1-O-X2-Z2-P-U-V-X-Y	81.4
18	Z-B1-D1-L1-N1-O1-P1-Q1-S1-V1-Y1-F2-H2-M2-Q2-R2	88.3
19	Z-A1-C1-F1-H1-J1-M1-P1-Q1-S1-V1-U1-C2-B2-S2-U2-W2-R2	89.3
20	Z-B1-C1-E1-C3-L1-N1-A2-S2-T2-O2-P2-Q2-R2	89.9
21	Z-A1-C1-E1-A3-K1-N1-A2-S2-U2-W2-R2	91.8
22	Z-A1-C1-E1-A3-D3-M1-P1-Q1-S1-W1-B3-G2-J2	77.0
23	A-B-E-J-K-O-X2-Z2-R1-S1-W1-B3-G2-J2	73.4
24	A-C-D-E-F-M-R-W-X-Y	71.1
25	Z-A1-C1-E1-A3-D3-M1-P1-T1-C2-D2-K2-N2-O2-V2-W2-R2	82.4

(This page left blank intentionally.)

4.0 ENVIRONMENTAL IMPACT OF THE PRIMARY ALTERNATIVE ROUTES

The evaluation and comparison of potential impacts for each primary alternative route (route or Route) is based upon the consideration of the requirements of § 37.056(c)(4) of the Texas Utilities Code, 16 TAC § 25.101(b)(3)(B), the PUC's CCN application form, and other requirements commonly included in the PUC's preliminary orders for transmission line CCN projects, as well as public comments from and following the open house meeting, field reconnaissance, and the information and responses received from local officials and state/federal regulatory agencies. Measurements for the majority of the environmental criteria were obtained from aerial photography flown in February 2018 and from available digital resource layers using GIS.

POWER professionals with expertise in different environmental disciplines (geology/soils, hydrology, terrestrial ecology, wetland ecology, land use/aesthetics, socioeconomics, cultural resources [archeological and historical]) and GIS evaluated the routes based upon environmental conditions present along each route (augmented by aerial photo interpretation and field reconnaissance) and the general routing criteria developed by LCRA TSC, AEP Texas, and POWER. Each POWER expert analyzed the routes and the environmental and land use data presented in Table 4-1 (Primary Alternative Route Data) and Table 4-2 (Primary Segment Data) for their technical discipline. A summary of potential impacts to environmental, community, and land use resources is provided in the following sections.

4.1 Natural Resources Impacts

4.1.1 Impacts on Geological Resources

Construction of the proposed transmission line is not anticipated to have any significant adverse effects on the physiographic or geologic features/resources of the area. Erection of the transmission structures will require excavation and minor disturbance of small quantities of near-surface materials, but should have no measurable impacts on the geologic resources or features along any of the primary alternative routes. Known cave and karst feature information was collected and mapped using GIS. Additional information on these known caves/karst features is provided in Section 2.2.1. These features were taken into consideration and avoided where known during the routing process.

Although karst features and formations may occur within this geologic region, no geologic hazards are anticipated to be created.

4.1.2 Impacts on Soils

Activities associated with the construction, operation, and maintenance of electrical transmission lines typically do not adversely impact soils when appropriate mitigative measures are implemented during the construction phase. Potential impacts to soils include erosion, compaction, and conversion of prime farmland soils.

The highest risk for soil erosion and compaction is primarily associated with the construction phase of a project. Prior to construction, LCRA TSC and AEP Texas will develop a SWPPP to minimize potential impacts associated with soil erosion and off ROW sedimentation. Implementation of this plan will incorporate BMPs, including erosion control devices to minimize soil erosion on the ROW during significant rainfall events. The SWPPP will also establish the criteria for revegetation to ensure adequate soil stabilization during the construction and post construction phases. The native herbaceous layer of vegetation will be maintained, to the extent practical, during construction and the most denuded areas with a low erosion potential will be allowed to revegetate naturally with native herbaceous species. Areas with a higher erosion potential, including steep slopes and areas with shallow topsoil, may require seeding and/or matting to stabilize disturbed areas and minimize soil erosion potential during the post construction phase. The ROW will be inspected during and after construction to ensure that potential high erosion areas are identified and appropriate BMPs are implemented and maintained.

The study area supports areas of cropland and pastureland, and some of the soil within the study area isdesignated by the USDA as “Prime Farmlands.” As discussed in Section 2.0, the NRCS does not typically consider the construction of a transmission line to be a significant conversion of these soils. Agricultural activities are typically still practiced around the base of the structures after construction is completed. No significant conversions of prime farmland or state important soils are anticipated related to project activities for any of the primary alternative routes.

Insert Table 4-1 Primary Alternative Route Data 11x17 Front Page 1

Insert Table 4-1 Primary Alternative Route Data 11x17 Back Page 1

Insert Table 4-2 Segment Data 11x17 Front Page 1

Insert Table 4-2 Segment Data 11x17 Back Page 1

Insert Table 4-2 Segment Data 11x17 Front Page 2

Insert Table 4-2 Segment Data 11x17 Back Page 2

Insert Table 4-2 Segment Data 11x17 Front Page 3

Insert Table 4-2 Segment Data 11x17 Back Page 3

4.1.3 Impacts on Water Resources

Throughout the routing process, consideration was given toward minimizing potential impacts to surface waters and associated NWI mapped wetlands. For example, POWER attempted to minimize the length of ROW parallel to streams. TPWD recommended crossing streams at right angles at their narrowest sections to avoid potential impacts. Crossings of these areas were minimized by maintaining a perpendicular angle at each crossing where practical. Additional TPWD guidelines reviewed for construction and clearing within riparian areas are provided in Appendix A.

4.1.3.1 Surface Water

Surface waters within the study area typically include ephemeral, intermittent or perennial streams, drainages, draws, and ponds. If surface waters are crossed, the proposed transmission line will span all surface water crossings, with the structure foundations located outside of the ordinary high water lines. No construction activities are proposed for the project that will significantly impede the flow of water within these watersheds. Vegetation removal at these surface water crossings will be performed in a manner to diminish damage to the natural condition of the area and in accordance with USACE requirements. Erosion control devices will be implemented in accordance with a SWPPP to reduce the potential for sedimentation outside of the ROW. The proper inspection and maintenance of these erosion control devices will minimize the potential for erosion of exposed soils on the ROW and deposition of sediments into surface waters.

All of the primary alternative routes cross streams or creeks. These streams were identified from the NHD database. However, the actual hydrology of some of these streams may have been altered or affected by construction of drainage ditches/canals, levees, impoundments, residential areas, etc. The number of stream crossings range from 13 for Route 7, to 36 crossings for Route 18. No rivers are crossed by any of the primary alternative routes and none of the primary alternative routes were identified to have any length of ROW across open water (lakes, ponds). Sixteen of the primary alternative routes have some length of ROW parallel (within 100 feet) to streams. The length of ROW parallel (within 100 feet) to streams ranges from 0.0 (zero) mile for Routes 2, 4, 5, 6, 7, 11, 12, 14, and 22, to approximately 0.9 mile for Routes 3 and 23.

As discussed in Section 2.2.5.3, NWI maps are based on topography and interpretation of infrared satellite data and color aerial photographs. As such, NWI data is useful for planning and comparative analysis purposes, but should not be relied upon for determining USACE jurisdiction. NWI wetland types identified within the study area include palustrine emergent, forested/shrub, and ponds, and are typically

associated with streams, draws, drainages, and depressional areas. ROW for 20 of the primary alternative routes does not cross any length of mapped NWI wetlands. Routes 13, 14, 15, 16 and 25 cross approximately 0.02 mile of mapped NWI wetlands.

4.1.3.2 Ground Water

The construction, operation, and maintenance of the Proposed Project is not anticipated to adversely affect groundwater resources within the study area, though potential fuel and/or chemical spills during the construction process could potentially impact both surface water and groundwater resources. Thus, standard operating procedures and spill response specifications relating to petroleum product storage, refueling, and maintenance activities of equipment are provided as a component of an applicable SWPPP to avoid and minimize potential contamination to water resources. LCRA TSC and AEP Texas will take all necessary and available precautions to avoid and minimize the occurrence of such spills, and any remedial and disposal activities associated with any accidental spills will be in accordance with state and federal regulations.

4.1.3.3 Floodplains

Based on FEMA FIRMs, 100-year floodplain data was not available for the entire study area, but floodplain areas may occur within low lying streams, draws, and associated depressional areas. Structures may be located within these floodplains; however, engineering considerations and proper structure placement should alleviate the potential for adverse impacts of floodwater flow by minimizing impedance. Construction of the Proposed Project will not have any significant impacts on the overall function of a floodplain, nor adversely affect adjacent or downstream properties. If structures are to be located within a floodplain, LCRA TSC or AEP Texas, as applicable will coordinate with the appropriate county floodplain administrators.

4.1.4 Impacts on Ecosystems

4.1.4.1 Vegetation

Potential impacts to native vegetation will result from clearing the new ROW of woody vegetation and/or clearing herbaceous vegetation. These activities facilitate access for transmission structure construction, line stringing, and maintenance activities. Vegetation removal will be performed in accordance with natural and cultural resource regulations and in a manner that will diminish marring and scarring of the landscape while ensuring that the line can be constructed, operated, and maintained safely and in accordance with state and federal regulations governing utility construction. Prior to construction, removal of woody vegetation within new ROW may be required within areas considered to be upland

forested, bottomland/riparian, and woody wetland areas. Mowing and/or shredding of herbaceous vegetation may be required within pasture/rangeland. Future ROW maintenance activities may include periodic mowing and/or herbicide applications to maintain the herbaceous vegetation layer within the ROW.

Clearing trees and shrubs from woodland areas would generate an additional degree of habitat fragmentation. The degree of new habitat fragmentation is typically reduced when a route uses an existing transmission line ROW or parallels an existing linear feature such as a transmission line, roadway, or fence line/property line. During the route development process, consideration was given to minimizing impacts to riparian areas and to maximizing the length of the routes paralleling existing transmission line ROW and other linear corridors to reduce fragmentation of habitat.

Impacts to vegetation would be limited to what is associated with the construction, operation, and maintenance of the Proposed Project. ROW clearing activities will be completed with minimal vegetation impacts and the existing groundcover will be maintained when practical. The most common land use types within the study area are pasture/rangeland. While the TPWD (see Appendix A) recommends implementing practices to prevent establishment of invasive plant species and sustain native species, the native vegetation within these areas has likely been previously modified. LCRA TSC's and AEP Texas' vegetation management activities are described in Section 1.0 of this document.

All of the primary alternative routes parallel existing linear corridors for some portion of their lengths (including property boundaries) that minimize potential impacts to the vegetation and minimize habitat fragmentation (see Table 4-1).

The study area is primarily comprised of upland brushland vegetation and pasture/rangeland. Bottomland/ riparian woodlands are typically limited to narrow corridors near streams and draws. Some irrigated croplands exist, scattered within the study area. Temporary impacts to row crop species will be the greatest during the growing season and these can be minimized with the seasonal timing of construction activities. Permanent impacts (loss of production areas) will be limited to the footprint of the transmission structures since these areas are inaccessible with large farming or cultivating equipment. Commercially important vegetation species within the study area are primarily agriculturally oriented, including pecan orchards, hay, and row crops. Hay production from improved and unimproved pastures exists in portions of the study area, primarily in support of cattle production. Minimal impacts to hay-production may occur during the construction phase of the project. Primary alternative route lengths within cropland areas range

from approximately 0.0 (zero) mile for Routes 3, 6, 7, 10, 11, 12, 17, 19, 20, 21, 22, and 23, to approximately 1.6 miles for Routes 1 and 24. Primary alternative route lengths proposed within pasture/rangeland areas varies from approximately 66.3 miles for Route 2, to approximately 84.7 miles for Route 18. None of the ROW for any primary alternative route crosses areas traversed by mobile irrigation systems.

Upland woodland/brushland vegetation will also be impacted where clearing is required for the ROW. The length of ROW across upland woodland/brushland vegetation ranges from approximately 5.1 miles for Route 3, to approximately 20.1 miles for Route 8. The length of ROW across bottomland/riparian woodlands ranges from approximately 0.00 (zero) mile for Routes 13 and 14, to approximately 0.85 mile for Route 21.

A summary of the TPWD recommendations (see Appendix A) includes maximizing the use of existing electrical transmission facilities, and where new ROW construction is required, maximizing paralleling existing linear corridors to minimize potential impacts to undisturbed native habitats. Recommendations also included minimizing the clearing of sensitive/native vegetation and avoidance of conservation easements. These recommendations were considered and implemented where practical during the routing process.

4.1.4.2 Wildlife

The primary impact of construction activities for the Proposed Project on terrestrial wildlife species will be associated with temporary disturbances associated with construction activities and with removal of vegetation (habitat modification/fragmentation). Increased noise and equipment movement during construction may temporarily displace mobile wildlife species from the immediate workspace area. These impacts will be short-term and normal wildlife movements are expected to resume after construction is completed. Potential long-term impacts include those resulting from habitat modifications and fragmentation. Most of the vegetation types encountered along the primary alternative routes are associated with upland woodland/brushland, bottomland/riparian woodland/brushland, or pasture/rangeland. Generally, native habitats in the study area have previously been modified to a high degree due to overgrazing development, or to support various land uses. Remnant habitats often serve as shelter and/or movement corridors for many species. By paralleling existing linear corridors such as transmission lines, roadways, or fence lines, the degree of impact to wildlife and habitat fragmentation is reduced.

Construction activities may also impact small, immobile, or fossorial (living underground) animal species through accidental impacts or the alteration of local habitats. Impacts to these species may occur due to equipment or vehicular movement on the ROW by direct impact or due to the compaction of the soil if the species is fossorial. Potential impacts of this type are not typically considered significant and are not likely to have an adverse effect on any species population dynamics within the study area.

If ROW clearing occurs during the nesting season, potential impacts could occur within the ROW area related to potential take of migratory bird eggs and/or nestlings. Increases in noise and activity levels during construction could also potentially disturb breeding or other activities of species nesting in areas immediately adjacent to the ROW. The TPWD recommends using practices to avoid harassment and harm to migratory birds during vegetation removal and that ground-disturbing activities be done outside the nesting season (see Appendix A).

Structure design and other mitigation measures can be implemented to minimize the risk for electrocution and/or collisions of birds with overhead powerline facilities. The danger of electrocution to birds as a result of the Proposed Project will be insignificant since the distance between conductors, from conductor to structure, and from conductor to ground wire for the proposed 345-kV transmission line is greater than the wingspan of any bird in the area. The structures and wires of the line could be a collision hazard to birds in flight. Normally, migratory birds fly at altitudes exceeding the tower structure heights proposed for the project and would be at risk only during periods of migratory fallout (inclement weather and/or high opposing direction winds forcing them to lower altitudes).

The most likely potential permanent impact to wildlife will result from the clearing of upland and bottomland (including wetlands) woodland/brushland habitats. Since a large percentage of the native vegetation in the study area has previously been converted to pastureland/rangeland and cropland uses, the remnant woodland vegetation often serves as a habitat and/or a movement corridor for many species. By utilizing existing ROWs and/or paralleling existing linear features to the greatest reasonable extent, the potential impacts to wildlife and habitat fragmentation are minimized.

Potential impacts to aquatic systems will include effects of erosion, siltation, and sedimentation. Vegetation clearing of the ROW may result in increased suspended solids entering surface waters traversed by the transmission line. Increases in suspended solids may adversely affect aquatic organisms that require relatively clear water for foraging and/or reproduction. Implementation of an SWPPP and installation of erosion control devices would minimize these potential impacts. Physical aquatic habitat

loss or alteration could result wherever riparian vegetation is removed and at temporary crossings for access roads. Increased levels of siltation or sedimentation may also potentially impact downstream areas primarily affecting filter feeding benthic and other aquatic invertebrates. No significant adverse impacts are anticipated to any aquatic habitats crossed or adjacent to the ROW for any of the primary alternative routes. The procedures of LCRA TSC and AEP Texas' to minimize sediment runoff are presented in Section 1.0 of this document.

Construction of the proposed transmission line is not expected to have significant impacts on commercially or recreationally important wildlife species occurring within the study area. Wildlife may temporarily be displaced from areas of activity during the construction phase but should return to normal movement patterns during the operation phase.

4.1.4.3 Threatened and Endangered Species

To determine potential impacts to threatened or endangered species, POWER reviewed several sources of information. Known element occurrence data for the study area was obtained from the TXNDD and comments were received from TPWD (Appendix A). TPWD current county listings for federal- and state-listed threatened and endangered species, USFWS IPaC review, and USFWS designated Critical Habitat locations were included in the review. POWER also utilized several published sources to review life histories and habitat requirements of listed species, as previously discussed in Section 2.2.5.

USFWS (2018b) and TPWD (2018c) data identified two federally listed plant species within the study area: Lloyd's Mariposa cactus and Pecos sunflower. Designated Critical Habitat for these species was previously identified along Leon Creek. None of the alternative routes cross designated Critical Habitat for any federally listed plant species. TXNDD (2018) data identified six occurrences of the Pecos sunflower within the study area and all routes, except Routes 20 and 21, cross at least one element of occurrence polygon for the Pecos sunflower; but, because these are large buffered polygons (the largest of these is approximately 10 miles across) and do not give an accurate estimate of potential habitat, the route lengths across these polygons were not included in the evaluation criteria in Table 4-2. Each of these plant species may occur within the study area where suitable habitat is present. Federally listed plants are not typically protected under the ESA unless on federal lands or if the project has a federal nexus. After the PUC approves a route, field surveys may be performed, if necessary, to identify potential suitable habitat for listed plant species and determine the need for any additional species-specific surveys. With the development of an avoidance and impact minimization plan, the potential for any of the primary alternative routes to adversely affect federally-listed plant species is not anticipated to be significant.

USFWS designated Critical Habitat was identified within the study area for the Diamond tryonia, Gonzales tryonia, Leon Springs pupfish, Pecos amphipod, and Pecos assiminea snail. None the alternative routes cross designated Critical Habitat for any federally listed species (USFWS 2018b). All designated Critical Habitat occurs along Leon Creek and Diamond Y Spring, north of the City of Fort Stockton. All of these are aquatic or semi-aquatic species that occur in these rare perennial spring fed ecosystems. Additional state and federal listed aquatic species include the Texas hornshell, Pecos pupfish, and Proserpine shiner. Erosion control devices would be implemented in accordance with an SWPPP to reduce the potential for sedimentation outside of the ROW. Proper inspection and maintenance of these erosion control devices will minimize the potential for erosion of exposed soils on the ROW and deposition of sediments into surface waters and would minimize impacts to aquatic ecosystems and aquatic species. With the development of an avoidance and impact minimization plan, the potential for any of the primary alternative routes to adversely affect listed aquatic species is not anticipated to be significant.

Review of the TXNDD (2018) data indicates Routes 2, 5, 6, 7, 11, and 17 cross approximately 0.01 mile of potential habitat for the Leon Springs pupfish (federally endangered species). Routes 1, 4, 8, 9, and 24 also cross a TXNDD (2018) occurrence polygon for the Leon Springs pupfish, but because it was a large buffered polygon and did not give an accurate estimate of potential habitat, the route length across this polygon was not included in the evaluation criteria in Table 4-1. If any potential habitat for federally listed threatened or endangered species is identified during a field survey of the PUC approved route, either LCRA TSC or AEP Texas (depending on the location) will further coordinate with the USFWS and TPWD to determine avoidance or mitigation strategies.

State and federally listed avian migrant species potentially occurring within the study area include the northern aplomado falcon, peregrine falcon, interior least tern, piping plover, and red knot. These species are not anticipated to occur within the study area, except as rare non-breeding migrants. The seasonal habitats for these avian species may be spanned or avoided entirely; thus, the Proposed Project is not anticipated to have any adverse impacts to these species.

State and federally listed species such as the western yellow-billed cuckoo, Mexican spotted owl, reddish egret, Comanche Springs pupfish, gray wolf, and black-footed ferret are not anticipated to occur within the study area due to a lack of suitable habitat, extirpation, or the study area is not within the current known range of the species.

Additional state listed species such as the zone-tailed hawk, black-capped vireo, black bear, Texas horned lizard, and Trans-Pecos black-headed snake may occur within the study area where or if suitable habitat is available. The Texas horned lizard and Trans-Pecos black-headed snake may be subject to minor temporary disturbance during construction activities if the species is present. If this species is observed during construction activities, it will be allowed to leave the ROW on its own accord or be relocated by a TPWD-permitted individual. The construction of a transmission line does not include activities associated with collecting, hooking, hunting, netting, shooting, or snaring by any means or device and does not include an attempt to conduct such activities. Therefore, "take" of state-listed species as defined in Section 1.01(5) of the Texas Parks and Wildlife Code, is not anticipated as a result of the Proposed Project.

4.1.4.4 Summary of Natural Resources Impacts

Biological criteria primarily considered for the Proposed Project included the length of ROW through upland woodland/brushlands, riparian/bottomland woodland, potential wetlands, and known and potential habitat of federally-listed endangered or threatened species. Length of ROW parallel to streams or rivers, length of ROW across 100-year floodplains, and number of stream crossings was also evaluated and measured. Other ecological evaluation criteria were considered, but their quantitative differences were insignificant or had a zero value. The overall length of each route and length of each route utilizing existing transmission line ROW or paralleling other compatible ROW as a means to minimize fragmentation and clearing, were also considered. No significant impacts to biological resources are anticipated for any of the primary alternative routes.

- Route 3 has the shortest length of ROW through upland woodland/brushland, at approximately 5.1 miles.
- Routes 13 and 14 have the shortest length of ROW through bottomland/riparian woodlands, at approximately 0.0 (zero) mile each.
- Routes 3, 6, 7, 10, 11, 12, 17, 19, 20, 21, 22, and 23 have the shortest length of ROW across croplands, at 0.0 (zero) mile each.
- Route 2 has the shortest length of ROW across pasture/rangeland, at approximately 66.3 miles.
- Routes 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18, 19, 20, 21, 22, 23, and 24 have the shortest length of ROW through NWI mapped wetlands, at approximately 0.0 (zero) mile each.
- Routes 1, 3, 4, 8, 9, 10, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, and 25 have the least area of ROW across known habitat of federally listed endangered or threatened species; at approximately 0.0 (zero) mile each.

- No routes have any length of ROW across open water.
- Route 7 has the least number of stream crossings with 13 crossings.
- No routes cross any rivers.
- Routes 2, 4, 5, 6, 7, 11, 12, 14, and 22 have the least length of ROW parallel to streams or rivers, at approximately 0.2 mile.

4.2 Human Resource Impacts

4.2.1 Socioeconomic Impacts

LCRA TSC and AEP Texas use their own employees or contractors during the clearing and construction phase of transmission line projects. However, a portion of the project costs will find their way into the local economy through purchases such as fuel, food, lodging, and possibly building materials. ROW easement payments will be made to individuals whose private property is crossed by the transmission line based on the appraised land value. LCRA TSC and AEP Texas are also required to pay state and local sales tax on purchases and are subject to paying local property tax on land or improvements. None of the land associated with ROW acquired for the transmission line will be taken off the tax rolls. The cost of permitting, designing, and constructing the line will be paid for through revenue generated by rates for electrical transmission service. The rates for LCRA TSC's and AEP Texas' electric transmission service are regulated by the PUC.

Potential long-term economic benefits to the community resulting from construction of the Proposed Project are based on the requirement that electric utilities provide an adequate and reliable level of power throughout their service areas. Economic growth and development rely heavily on adequate public utilities, including a reliable electrical power supply. Without this basic infrastructure, a community's potential for economic growth is constrained.

4.2.2 Impacts on Community Values

The term "community values" is included as a factor for the consideration of transmission line certification under Section 37.056(c)(4) of the Texas Utilities Code. Impacts on community values can be classified into two types: 1) direct effects, or those effects which would occur if the location and construction of a transmission line results in the removal of, or loss of public access to, a valued resource; and 2) indirect effects, or those effects which would result from a loss in the enjoyment or use of a resource due to the characteristics (primarily aesthetic) of the proposed line, structures, or ROW. Impacts on community values, whether direct or indirect, can be more accurately gauged as they affect

recreational areas or resources and the visual environment of an area (aesthetics). Impacts in these areas are discussed in detail in Sections 4.2.5 and 4.2.6 of this report.

4.2.3 Impacts on Land Use

The magnitude of potential land use impacts resulting from the construction of a transmission line are determined by the amount of land burdened by the actual ROW and by the compatibility of the transmission line ROW with adjacent land uses. During construction, temporary impacts to land uses within the ROW could occur due to the movement of workers, equipment, and materials through the area. Construction noise and dust, as well as temporary disruptions of traffic flow, may also temporarily affect residents and businesses in the area immediately adjacent to the ROW. Coordination between LCRA TSC and AEP Texas, their contractors, and landowners regarding ROW access and construction scheduling should minimize these disruptions. The primary criteria considered to compare potential land use impacts for this project include proximity to habitable structures, length utilizing or parallel to existing ROW, length parallel to apparent property lines, and overall route length. An analysis of the existing land use within and adjacent to the proposed ROW is required to evaluate the potential impacts.

4.2.3.1 Habitable Structures

One of the most important measures of potential land use impacts is the number of habitable structures located in the vicinity of each route. Habitable structure information for each primary alternative route is shown in Tables 4-3 through 4-27 (see Appendix C). POWER determined the number and distance to habitable structures within 500 feet of the centerline of each route through evaluation during field reconnaissance and from measurements obtained using GIS and aerial photographs.

Some of the primary alternative routes have habitable structures located within 500 feet of their centerlines. Routes 10, 12, 13, 18, 19, 20, 21, and 22 have no habitable structures located within 500 feet of their centerlines. Route 23 has the most habitable structures located within 500 feet of its centerline, at 14. The number of habitable structures located within 500 feet of each primary alternative route centerline is presented in Table 4-1. All known habitable structure locations within 500 feet are shown on Figure 4-1 (see Appendix E).

4.2.3.2 Utilizing/Paralleling Existing Transmission Line ROW

The least impact to land use generally results from locating new lines within or parallel to an existing transmission line ROW. 16 TAC § 25.101(b)(3)(B) states that (among others) the following factors shall be considered in the selection of the alternative routes:

- whether the routes utilize existing compatible ROW, including the use of vacant positions on existing multiple-circuit transmission lines;
- whether the routes parallel existing compatible ROW; and
- whether the routes parallel property lines or other natural or cultural features.

Utilizing Existing Transmission Line ROWs

None of the primary alternative routes utilize existing transmission line ROW. The existing 138-kV and 69-kV transmission lines do not have ROW sufficient for the Proposed Project (150 feet). Vacant positions on existing multiple-circuit transmission lines are not available within the study area.

Paralleling Existing Transmission Line ROWs

POWER identified several existing transmission line corridors within the study area that the Proposed Project could potentially parallel in a reliable manner. The total alternative route lengths parallel to existing transmission line ROW range from approximately 0.0 (zero) mile each for Routes 15 and 20, to approximately 54.4 miles for Route 23. The lengths parallel and adjacent to existing transmission line ROW for each of the primary alternative routes are presented in Table 4-1. In addition, Table 4-1 identifies lengths parallel and adjacent to existing 69-kV, 138-kV and 345-kV transmission lines. The data associated with paralleling138-kV transmission lines includes an existing 69-kV transmission line that is being upgraded for operation at 138-kV prior to the completion of the Proposed Project.

4.2.3.3 Paralleling Other Existing Compatible ROW

Paralleling other existing compatible ROW (such as roadways, railways, etc.) is also generally considered to be a favorable routing criterion, one that usually results in fewer impacts compared to establishing new ROW. POWER identified existing compatible ROWs as potential paralleling opportunities in accordance with the provisions of 16 TAC § 25.101(b)(3)(B). However, POWER deviated from paralleling some compatible ROWs to avoid known constraints (e.g., existing habitable structures, oil and gas facilities, water wells, caves, waterways, etc.).

All of the primary alternative routes parallel other existing ROW to the extent feasible. The routes with lengths paralleling other existing ROW range from approximately 1.7 miles for Route 23, to approximately 27.8 miles for Route 15. The lengths parallel and adjacent to other existing ROW for each of the primary alternative routes are presented in Table 4-1.

Roadway ROWs

Most highways and other roads are coincident with property lines. Thus, in many cases, when routes parallel roads, they are also parallel and adjacent to property lines. POWER evaluated paralleling IH 10, US Hwy 67, US Hwy 285, US Hwy 385, SH 18, FM 11, FM 1053, FM 1776, FM 2023, FM 2037, and numerous other local roads. Roadways are oriented in a north to south as well as east to west direction and presented acceptable paralleling opportunities where practicable and feasible.

Railroad ROWs

One Atchison Topeka and Santa Fe Railroad and one abandoned railroad were identified within the central portion of the study area. The abandoned railroad parallels a portion of Texas Gulf Plant Road and presented an acceptable paralleling opportunity.

4.2.3.4 Paralleling Property Lines

Paralleling property lines is a favorable routing criterion set out in 16 TAC § 25.101(b)(3)(B). Paralleling property lines or fence lines may minimize the potential for disruption to agricultural activities and may create less of a constraint for future development of a tract of land. LCRA TSC and AEP Texas provided POWER with updated parcel line data that was obtained from the Pecos County Appraisal District in January 2018. There can be differences between property lines and parcel lines depending on how the information is organized at the county appraisal district.

In February 2018, LCRA TSC grouped the updated appraisal district parcel data where possible in an effort to identify potential aggregated ownership. Where there are contiguous parcels in apparent common ownership, only paralleling of the outside boundary of the parcels was tabulated. Paralleling interior parcel lines within a group of two or more contiguous parcels was not tabulated as parallel to apparent property lines. Each route was developed to parallel property lines where feasible, while also considering other important factors such as engineering constraints and costs.

The length of primary alternative routes that parallel apparent property lines range from approximately 2.0 miles for Route 23, to approximately 43.7 miles for Routes 20 and 21. The lengths parallel and adjacent to apparent property boundaries for each of the primary alternative routes are presented in Table 4-1.

4.2.3.5 Pipelines

Pipelines are not considered compatible ROW and were avoided to the extent possible. POWER reviewed aerial photography, the RRC website, and obtained Penwell data from LCRA TSC to identify pipeline ROWs located within the study area. Verification was conducted during field reconnaissance where possible.

The length of primary alternative routes that are adjacent and parallel to petrochemical pipelines six inches in diameter or greater range from approximately 0.0 (zero) mile each for Routes 2, 3, 5, 6, 7, and 23, to approximately 4.5 miles for Route 21. The lengths parallel and adjacent to large petrochemical pipelines for each of the primary alternative routes are presented in Table 4-1.

4.2.3.6 Overall Length of Routes

The overall length of a route can be an indicator of the relative level of potential land use and environmental impacts. Potential impacts to land use are typically minimized with routes that have shorter lengths, as less land surface area is required for the ROW. The total lengths of the routes range from 67.8 miles for Route 2, to 91.8 miles for Route 21. The differences in route lengths reflect the direct or indirect pathway of each route between the project endpoints. The length of the routes may also reflect the effort to parallel existing transmission lines, other existing linear features like highways, apparent property boundaries, and the geographic diversity of the primary alternative routes. The approximate lengths for each of the primary alternative routes are presented in Table 4-1.

Typically, a more representative account for the consideration of whether new transmission line routes are parallel and adjacent to existing compatible ROWs, apparent property lines, or other natural or cultural features is demonstrated with the percentage of each total route length parallel to any of these features. These percentages can be calculated for each primary alternative route by adding up the total length parallel and adjacent to existing transmission line ROW, other existing compatible ROW, and apparent property lines and then dividing the result by the total length of the primary alternative route. All of the primary alternative routes parallel existing linear features for some portion of their lengths. The percentage of the primary alternative routes paralleling existing linear features ranges from a high of 86 percent for Route 24, to a low of 57 percent for Route 18. The percent parallel to existing linear features for each of the primary alternative routes are presented in Table 4-1.

4.2.4 Impacts on Transportation/Aviation

Transportation

Potential impacts to transportation may include temporary disruption of traffic and conflicts with proposed roadway and utility improvements. Traffic disruptions would include those associated with the movement of construction equipment and materials to and from the ROW and increased traffic flow and periodic congestion during the construction phase of the Proposed Project. These impacts are typically considered minor, temporary, and short-term.

All the primary alternative routes cross one or more IHs, US Hwys, SHs, or FM roads. The number of IH, US, or SH road crossings range from three each for 13 of the primary alternative routes, to eight for Route 19. The number of FM road crossings range from one for Route 19, to five each for eight of the primary alternative routes. The number of IHs, US Hwys, SHs, and FM road crossings for each of the primary alternative routes are presented in Table 4-1.

Aviation

According to FAA regulations (Title 14 CFR Part 77), the construction of a transmission line requires FAA notification if structure heights exceed the height of an imaginary surface extending outward and upward at a slope of 100:1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of an FAA registered public or military airport having at least one runway longer than 3,200 feet. The FAA also requires notification if the tower structure height exceeds a 50:1 slope for a horizontal distance of 10,000 feet from the nearest runway of an FAA registered public or military airport where no runway is longer than 3,200 feet in length and if the tower structure height exceeds a 25:1 slope for a horizontal distance of 5,000 feet for FAA registered heliports.

The review of federal and state aviation/airport maps and databases, aerial photo interpretation, TxDOT Division of Aviation information, and field reconnaissance were used to identify airports and airstrips located within the study area and within 20,000 feet of the primary alternative routes. There is one FAA registered public airport with a runway longer than 3,200 feet identified within 20,000 feet of seven of the primary alternative routes, Fort Stockton-Pecos County Airport. There are no FAA registered public or military airports with runways shorter than 3,200 feet identified within 10,000 feet of the routes. No FAA registered public heliports were identified within 5,000 feet of the primary alternative routes.

The number of private airports identified within 10,000 feet of the primary alternative routes range from 0 (zero) each for 12 of the primary alternative routes, to two each for Routes 2 and 11. The number of private airports for each of the primary alternative routes is presented in Table 4-1.

The distance for each airport from the nearest route segment was measured using GIS and aerial photograph interpretation (see Table 4-28). All known airport locations are shown on Figures 3-14a, b, c and 4-1 (see Appendix E).

TABLE 4-28 AIRPORT FACILITIES

FIGURE 4-1 MAP ID	AIRSTRIP	NEAREST ROUTE SEGMENT	PRIMARY ALTERNATIVE ROUTES	DISTANCE FROM NEAREST ROUTE SEGMENT (FT)*	RUNWAY LENGTH (FT)[1]	EXCEEDS THE SLOPE[1,2]
100	Fort Stockton-Pecos County Airport (FAA Public)	R1	3, 10, 12, 18, 19, 22, 23	7,412	4,400	Yes
101	Private Airstrip 1 (Private)	H	2, 3, 4, 11, 12, 14	2,077	NA	NA
102	Private Airstrip 2 (Private)	N1	18, 20, 21	1,229	NA	NA
103	Private Airstrip 3 (Private)	Q	2, 5, 6, 7, 11, 17	1,119	NA	NA

*Source: [1]FAA 2018a, *POWER Aerial Photo, and USGS Interpretation.
[2]POWER used aerial photo and USGS interpretation considering elevation information obtained from USGS. topographic maps and a typical transmission structure height of 185 feet.

In addition to the previously discussed airport facilities and runways and as presented earlier in Section 2.4.6, an FAA regulated VORTAC facility was identified within the study area. After review of the potential impacts to the VORTAC facility, POWER, LCRA TSC, and AEP Texas considered structure location and ground elevation to avoid potential impacts to operation of the VORTAC facility. No adverse impacts are anticipated to the VORTAC from any of the primary alternative routes. Once a route is approved by the Commission, LCRA TSC and AEP Texas will coordinate with the FAA if required for the approved route.

Communication

No known AM radio transmitters were identified within the study area or within 10,000 feet of the primary alternative routes. The number of FM radio transmitters, microwave towers, and other electronic communications towers located within 2,000 feet of any of the primary alternative routes range from 0 (zero) each for Routes 6, 21, and 25, to three for Routes 1, 5, 7, 10, 12, and 23. The number of FM radio transmitters, microwave towers, and other electronic communications towers for each of the primary alternative routes is presented in Table 4-1.

The distance of each communication tower from the nearest route segment was measured using GIS and aerial photograph interpretation (see Table 4-29). None of the routes are anticipated to have a significant impact on communication operations in the area. All known electronic communication facility locations are shown on Figures 3-14a, b, c and 4-1 (see Appendix E).

TABLE 4-29 ELECTRONIC COMMUNICATION FACILITIES

FIGURE 4-1 MAP ID	TOWER TYPE	NEAREST ROUTE SEGMENT	PRIMARY ALTERNATIVE ROUTES	DISTANCE FROM NEAREST ROUTE SEGMENT (FT)*
301	Unidentified Communication Tower	B	1, 5, 7, 8, 12, 23	257
302	SBA Structures, LLC (ARS 1246767)	F1	10, 13, 15, 16, 17, 19	1,253
303	Unidentified Communication Tower	R	1, 4, 9, 24	692
304	Unidentified Communication Tower	Q	2, 5, 11	1,141
305	WWC Texas RAS LLC (ASR 1291434)	W	1, 2, 4, 5, 24	1,125
306	WWC Texas RSA LLC (ASR 1243193)	W1	3, 7, 10, 12, 18, 22, 23	368
307	SBA Structures, LLC (ARS 1246765)	J2	3, 7, 10, 12, 13, 14, 15, 18, 20, 22, 23	642

*Source: POWER Aerial Photo, USGS Interpretation, and FCC 2018.

4.2.5 Impacts on Parks and Recreation

Potential impacts to recreation include the disruption or preemption of recreational activities. As previously mentioned, the study area contains recreation areas that consist of several local and neighborhood parks, school playgrounds, and hunting or fishing areas.

None of the primary alternative routes cross parks or recreational areas. The number of additional parks or recreational areas within 1,000 feet of the primary alternative routes ranges from 0 (zero) each for 11 of the alternative routes, to three each for Routes 10, 12, 13, 14, and 15. The number of additional parks or recreational areas within 1,000 feet for each of the primary alternative routes is presented in Table 4-1.

The distance of each park or recreation area from the nearest route segment was measured using GIS and aerial photography interpretation (see Table 4-30). No significant impacts to the use of the parks and recreation facilities located within the study area are anticipated from any of the alternative routes. Also, no adverse impacts are anticipated for any fishing or hunting areas from any of the primary alternative routes. All park or recreational area locations are shown on Figures 3-14a, b, c and 4-1 (see Appendix E).

TABLE 4-30 PARKS AND RECREATION AREAS

FIGURE 4-1 MAP ID	PARKS AND RECREATION AREAS (WITH OWNERSHIP)	NEAREST ROUTE SEGMENT	PRIMARY ALTERNATIVE ROUTES	DISTANCE FROM NEAREST ROUTE SEGMENT (FEET)*
200	Roadside Park (University of Texas)	G1	12, 14	196
201	Interstate 10 Picnic Area (Federal)	F1	10, 13, 15, 16, 17, 19	330
202	Fourteen Mile Park (State of Texas)	H1	10, 12, 13, 14, 15, 16, 17, 19	317
203	Interstate 10 Rest Area-West Bound (Federal)	J2	3, 7, 10, 12, 13, 14, 22, 23	629
204	Interstate 10 Rest Area-East Bound (Federal)	Q2	15, 18, 20	276

*Source: POWER Aerial Photo and USGS interpretation.

4.2.6 Impacts on Aesthetics

Aesthetic impacts or impacts to visual resources exist when the ROW, lines, or structures of a transmission line create an intrusion into, or substantially alter, the character of the existing view. The significance of the impact is directly related to the quality of the view in natural scenic areas, the importance of the existing setting in the use or enjoyment of an area, and in valued community resources in recreational areas.

Potential visibility impacts were evaluated by tabulating the linear feet of each route that would potentially create a new or additional impact to potential sensitive views. The lengths of each route within the foreground visual zone of IHs, US Hwys, SHs, FM roads, and parks or recreational areas (within one-half mile with unobstructed views) were tabulated.

Construction of the proposed 345-kV transmission line could have both temporary and permanent aesthetic effects. Temporary impacts would include views of the actual assembly and erection of the transmission structures. Where wooded areas are cleared, the brush and wood debris could have an additional negative temporary impact on the local visual environment. Permanent impacts from the project would involve the views of the structures and lines. New visual impacts would be minimized by constructing the new transmission line parallel to existing transmission lines.

Route 10 has the longest length within the foreground visual zone of IHs, US Hwys, and SHs, approximately 47.6 miles, while Routes 1, 6, and 24 have the shortest length, approximately 4.0 miles each. The greatest length within the foreground visual zone of FM roads is associated with Route 6,

approximately 12.9 miles, while Route 12 has the shortest length, approximately 1.3 miles. Routes 10, 13 and 15 have the longest length within the foreground visual zone of parks or recreational areas, approximately 4.3 miles each, while 11 of the alternative routes have the shortest length, approximately 0.0 (zero) mile each. The lengths of each of the primary alternative routes within the foreground visual zone of IHs, US Hwys, SHs, FM roads, and parks or recreational areas are presented in Table 4-1.

4.2.7 Summary of Human Resource Impacts

Land use criteria that were primarily considered for the Proposed Project were the number of habitable structures located within 500 feet of each primary alternative route centerline, the overall length of the primary alternative route, and the percentage of the route that parallels existing compatible ROWs (roadways, railways, etc.).

- Routes 10, 12, 13, 18, 19, 20, 21, and 22 have the fewest number of habitable structures located within 500 feet of their centerlines, with 0 (zero) each; Routes 4, 14, 15, 16, and 25 have the second fewest number of habitable structures, with two each, and Routes 1, 2, 8, 9, 11, and 24 have five habitable structures each located within 500 feet of their centerlines. Route 23 has the highest number of habitable structures within 500 feet at 14.
- Route 2 has the shortest overall length, approximately 67.8 miles, Route 3 is slightly longer at approximately 69.4 miles, and Route 1 is approximately 70.7 miles. The longest route is Route 21 at approximately 91.8 miles.
- Route 24 has the highest percent route length that is parallel and adjacent to existing transmission line ROW, parallel and adjacent to other existing compatible ROW (roadways, etc.), and parallel and adjacent to apparent property lines, with approximately 86 percent. Route 1 parallels existing compatible ROW for approximately 84 percent of its length and Route 9 parallels existing compatible ROW for approximately 82 percent of its length. Route 18 has the least percent route length that is parallel to existing compatible ROW at approximately 57 percent.

4.3 Cultural Resources Impacts

The methodology for identifying, evaluating, and mitigating impacts to cultural resources has been established for federal projects and/or permitting actions, primarily through the National Historic Preservation Act. Texas regulations use similar methods when considering cultural resources affected by non-federal undertakings. This process requires identifying significant (i.e., National or State Register-listed or eligible) cultural resources potentially affected by an action, determining the potential impacts of that action, and implementing measures to avoid, minimize, or mitigate those impacts.

4.3.1 Direct Impacts

Construction activities associated with any proposed project can adversely impact cultural resources when they alter the integrity of the characteristics that contribute to a property's significance as defined by the standards of the NRHP or Texas registries. These characteristics may include location, design, setting, materials, workmanship, feeling, and association. Activities associated with the construction, operation, and maintenance of transmission lines could directly or indirectly impact significant cultural resources. For example, earth moving activities during construction typically have the highest potential to directly impact cultural resources by either destruction of all or part of a property or alteration of the setting. Direct visual impacts may occur when transmission structures are built near significant cultural resources such as intact segments of historical trails and historical buildings that derive at least part of their significance from an unaltered historical setting.

4.3.2 Mitigation

The preferred form of mitigation for direct and indirect impacts to cultural resources is avoidance during the detailed design phase, which occurs after a route has been approved by the PUC. Additional mitigation measures for direct impacts may include implementing a program for data recovery excavations if an archeological site cannot be avoided. Reductions in visual impacts to significant buildings and landscapes may also be accomplished by using berms or vegetation screens. Because a cultural resource survey has not been conducted for any of the routes, cultural resources may exist within the transmission ROW that have not been identified or evaluated, and the potential of impacting undiscovered resources exists.

Because the routes have not been systematically surveyed for cultural resources, HPAs for prehistoric cultural resources were identified along the routes. Based on a review of the Fort Stockton Sheet in the BEG Geologic Atlas of Texas (BEG 1994), topographic quadrangles depicting the study area, soil survey data, and the results of archeological projects within the study area, HPAs for prehistoric resources include secondary terraces along major rivers and streams, intact Holocene-era sediments, broad floodplains, areas that may harbor chert lithic resources, and on the edge of terraces above floodplains.

HPAs for prehistoric and historic resources were mapped using GIS, and the length of each route and segment across these areas was tabulated (Tables 4-1 and 4-2).

4.3.3 Summary of Cultural Resource Impacts

The distance from the centerline for each recorded archeological site, NRHP property, and cemetery located within 1,000 feet of the nearest route was measured using GIS and aerial photography interpretation. Thirty-seven recorded archeological sites and one cemetery are located within 1,000 feet of the primary alternative route centerlines (Table 4-31). Ten of these sites are crossed by the primary alternative route ROWs. The cultural resources recorded within 1,000 feet of the primary alternative routes are discussed below.

The Girvin Cemetery is located within 1,000 feet of eight of the alternative route centerlines. The cemetery has not been designated a Historic Texas Cemetery and contains 44 graves, dating to as early as 1917 (Find a Grave 2018; Cemeteries of Texas 2018). The Girvin Cemetery is 126 feet from the centerlines of Routes 1, 5, 6, 7, 8, 9, 23, and 24. No impacts to the cemetery are expected, and it is anticipated that any potential impacts will be mitigated through routing and/or engineering design and construction measures.

The 37 recorded archeological sites located within 1,000 feet of the primary alternative route centerlines are briefly described in Table 2-16 and listed in Table 4-31 along with their distances from the route centerlines. Thirty-two of the sites are recorded as prehistoric sites, three are recorded as historic sites, and two of the sites have both prehistoric and historic components. Prehistoric sites 41PC442, 41PC443, and 41PC831 have been determined eligible for listing on the NRHP. Sites 41PC442 and 41PC443 are crossed by Route 18, and 41PC831 is 802 feet from Route 17. Historic site 41PC616, part of the Old Spanish Trail, has been determined eligible for listing on the NRHP. The trail is crossed by Routes 10, 15, 18, 20, 21, 22, and 25, and is 322 feet from Routes 13, 16, 17, and 19. Both sites with historic and prehistoric components have been determined eligible for the NRHP. Site 41PC79 and 41PC615 are 808 and 706 feet from Routes 10, 15, 18, and 20, respectively.

Five of the archeological sites, have been determined ineligible for listing on the NRHP. Four of the sites, 41PC686, 41PC761, 41PC762, and 41PC763 are prehistoric sites; and site 41PC828 is a historic site. Site 41PC686 is crossed by Route 17. Site 41PC761 is 404 feet from the centerlines of Routes 1, 5, 7, 8, 12, and 23; 805 feet from the centerlines of Routes 2, 3, 4, 6, 9, 11, 14, 24; and 809 feet from the centerlines of 10, 13, 15, 16, 17, 18, 19, 20, 21, 22, and 25. Site 41PC762 is 72 feet from the centerlines of Routes 10, 13, 15, 16, 17, 18, 19, 20 21, 22, and 25; and 208 feet from the centerlines of Routes 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 23, and 24. Site 41PC763 is crossed by Routes 13, 16, 17, 19, 21, 22, and 25. Site 41PC828 is 78 feet from Route 17.

The remaining sites have not been formally assessed for listing on the NRHP. Of these, five sites (41PC69, 41PC765, 41PC772, 41PC824, and 41PC825) are crossed by one or more routes. Site 41PC69 is crossed by Routes 3, 10, 12, 22, and 23. Site 41PC765 is crossed by Routes 13, 16, 17, 19, 21, 22, and 25. Site 41PC772 is crossed by Route 20. Site 41PC824 is crossed by Routes 1, 4, 9, and 24. Site 41PC825 is crossed by Routes 1, 4, 8, 9, and 24.

TABLE 4-31 ARCHEOLOGICAL SITES RECORDED WITHIN 1,000 FEET OF THE PRIMARY ALTERNATIVE ROUTES

SITE TRINOMIAL	DISTANCE IN FEET FROM CENTERLINE	PRIMARY ALTERNATIVE ROUTE(S)
41PC15	553	10, 15, 18, 20
41PC16	292	10, 15, 18, 20
41PC17	716	10, 15, 18, 20
41PC18	769	10, 13, 15, 16, 17, 19
41PC19	655	10, 13, 15, 16, 17, 19
41PC20	571	10, 13, 15, 16, 17, 19
41PC69	0	3, 10, 12, 22, 23
41PC79	808	10, 15, 18, 20
41PC442	0	18
41PC443	0	18
41PC601	571	21, 22, 25
41PC615	706	10, 15, 18, 20
41PC616	0	10, 15, 18, 20, 21, 22, 25
	322	13, 16, 17, 19,
41PC674	819	18, 20
41PC686	24	17
41PC740	356	18
41PC741	496	18
41PC761	404	1, 5, 7, 8, 12, 23
	805	2, 3, 4, 6, 9, 11, 14, 24
	809	10, 13, 15, 16, 17, 18, 19, 20, 21, 22, 25
41PC762	72	10, 13, 15, 16, 17, 18, 19, 20 21, 22, 25
	208	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 23, 24
41PC763	0	13, 16, 17, 19, 21, 22, 25
41PC765	0	13, 16, 17, 19, 21, 22, 25

TABLE 4-31 ARCHEOLOGICAL SITES RECORDED WITHIN 1,000 FEET OF THE PRIMARY ALTERNATIVE ROUTES

SITE TRINOMIAL	DISTANCE IN FEET FROM CENTERLINE	PRIMARY ALTERNATIVE ROUTE(S)
41PC766	300	13, 16, 17, 19, 21, 22, 25
41PC772	0	20
41PC777	745	20
41PC784	412	18, 20
41PC787	709	20
41PC796	949	20
41PC818	977	12, 14
41PC824	62	1, 4, 9, 24
41PC825	67	1, 4, 8, 9, 24
41PC828	78	17
41PC830	243	17
41PC831	802	17
41PC835	514	10, 12, 13, 14, 15, 16, 19
41PC837	649	10, 12, 13, 14, 15, 16, 19
41PC838	783	10, 12, 13, 14, 15, 16, 19
41PC842	274	21

Bold entries are crossed by a 150-foot ROW centered on the primary alternative route centerline.

As mentioned previously, the majority of the primary segments have not been surveyed for cultural resources and the potential for undiscovered cultural resources exists. All of the primary alternative routes cross through areas with high probability for archeological sites (prehistoric and historic). Prehistoric HPAs include secondary terraces along major rivers and streams, intact Holocene-era sediments, broad floodplains, areas that may contain chert lithic resources, the edge of terraces above floodplains, and areas near recorded archeological sites. Based on the estimated amount of HPA crossed by each primary alternative route, Routes 8, 6, 24, and 1 cross the least amount of HPA, with 14.7, 15.0, 15.3, and 16.1 miles of HPA crossed by each route, respectively. Routes 21, 22, 25, 18, and 20 cross the greatest amount of HPA, with 27.0, 27.2, 27.5, 31.3, and 31.5 miles of HPA crossed by each route, respectively. Table 4-32 lists the routes and the total length and percentage of their lengths across HPAs.

TABLE 4-32 HIGH PROBABILITY AREAS CROSSED BY THE PRIMARY ALTERNATIVE ROUTES

ROUTE	LENGTH OF HPA CROSSED BY CENTERLINE (MILES)	PERCENT OF LENGTH CROSSING HPA
1	16.1	22.8
2	16.2	23.9
3	18.7	26.9
4	16.6	23.3
5	16.8	23.4
6	15.0	20.2
7	18.7	24.8
8	14.7	19.1
9	16.2	20.6
10	25.3	32.2
11	17.1	22.6
12	24.2	30.2
13	24.3	30.0
14	24.0	29.6
15	25.3	30.7
16	23.3	27.8
17	21.4	26.2
18	31.3	35.4
19	24.1	26.9
20	31.5	35.0
21	27.0	29.4
22	27.2	35.4
23	19.3	26.3
24	15.3	21.5
25	27.5	33.4

(This page left blank intentionally.)

5.0 LIST OF PREPARERS

This EA and Alternative Route Analysis was prepared for LCRA TSC and AEP Texas by POWER. LCRA TSC and AEP Texas provided information in Sections 1.0 and 4.0. A list of the POWER employees with primary responsibilities for the preparation of this document is presented below.

RESPONSIBILITY	NAME	TITLE
Project Director	Rob R. Reid	Sr. Project Manager II/Vice President
Project Manager	Lisa Barko Meaux	Project Manager III
Hydrology	David Morgan Sairah Teta	Biologist III Biologist I
Ecology	David Morgan Sairah Teta	Biologist III Biologist I
Land Use	Denise Williams Emily Innes	Environmental Planner II Environmental Planner I
Aesthetics	Denise Williams	Environmental Planner II
Public Involvement	Denise Williams Lisa Barko Meaux Emily Innes	Environmental Planner II Project Manager III Environmental Planner I
Cultural Resources	Darren Schubert Emily Duke	Cultural Resource Specialist II Field Representative II
Maps/Figures/Graphics	Austin Streetman Kristen Severud	GIS Analyst III GIS Analyst II

(This page left blank intentionally.)

6.0 REFERENCES CITED

Ahr, Steven W., Andrew Parkyn, and Tanya McDougall. 2017. *Cultural Resources Survey for the Midway Solar Site Project, Pecos County, Texas*. AECOM, Dallas.

Alsop, Fred J. 2002. Birds of Texas. DK Publishing, Inc. New York, New York. 575pp.

Barkes, Eunice. 1980. *Report on Archeological Survey of Parts of Sections 8, 9, 12, and 13 of Block 19, University Lands, Pecos County, Texas*. University of Texas of the Permian Basin

Blair, W.F. 1950. The Biotic Provinces of Texas. *Texas Journal of Science* 2:93-117.

Boggess, Douglas and Beth McCormack. 2018. *Cultural Resource Survey for the Proposed Sanderson 3D Seismic Project, Pecos County, Texas*. Lone Mountain Archaeological Services, Inc. Albuquerque, New Mexico.

Bryan, K.B. 2002. Birds of the Trans-Pecos, A Field Checklist. Texas Parks and Wildlife Department, Austin Texas.

Bureau of Economic Geology (BEG). 1976. Geologic atlas of Texas, Pecos Sheet. Bureau of Economic Geology, University of Texas at Austin. Austin, Texas.

_____. 1994. Geologic atlas of Texas, Fort Stockton Sheet. Bureau of Economic Geology, University of Texas at Austin. Austin, Texas.

_____. 1996. Physiographic Map of Texas. Bureau of Economic Geology, University of Texas at Austin. Austin, Texas.

_____. 2018. Texas Mineral Resources Map. Available on the internet: http://igor.beg.utexas.edu/txmineralresources/ (accessed August 2018).

Burgess, Terry and Angel S. Moody. 2014. *An Archeological Reconnaissance Of Dawson Geophysical Pecos Phase I Seismic Project Pecos County, Texas. TAS, Inc. Submitted to Dawson Geophysical and University Lands, Texas.* Antiquities Permit No. 7032. Copies available from the Texas Historical Commission.

Butler, Joel and Katherine Seikel. 2017. *Archeological Resource Survey at a Proposed Deep Borehole Site, Pecos County, Texas*. AmaTerra Environmental, Inc. Ft Stockton, Texas.

Campbell, Linda. 2003. *The Endangered and Threatened Animals of Texas*. Texas Parks and Wildlife Department. 129 pp.

Cemeteries of Texas. 2018. Girvin Cemetery. Available online (http://www.cemeteries-of-tx.com/Wtx/Pecos/Cemetery/Girvin.html) accessed September 21, 2018).

Chadde, S.W. 2012a. Wetland Plants of Texas, Volume One Monocots. A Bogman Guide. 360pp.

_____. 2012b. Wetland Plants of Texas, Volume Two Dicots. A Bogman Guide. 506pp.

Collins, Michael B. 2002. The Gault Site, Texas and Clovis Research. *Athena Review* 3(2):24-36.

_____. 2004. Archaeology in Central Texas. In *The Prehistory of Texas*. Ed. Timothy Perttula. College Station: Texas A & M University Press.

Cowardin, L.M, V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Crawford, Daymond D. 1973. *An Archaeological Survey on Interstate Highway 10 — Crockett, Kimble, Pecos, Sutton Counties*. SDHPT. Austin, Texas.

Cutrer, Thomas W. 2018. "LEE, ARTHUR TRACY," *Handbook of Texas Online*. Available on the internet: https://tshaonline.org/handbook/online/articles/fle53 (accessed April 2018). Published by the Texas State Historical Association.

Dixon, J.R. 2013. Amphibians and reptiles of Texas, 3rd ed. Texas A&M University Press, College Station, Texas. 447pp.

Federal Aviation Administration (FAA). 1986. VOR, VOR/DME, and VORTAC Siting Criteria. FAA Oder 6820.10. 329pp.

_____. 2017a. National Aeronautical Charting Office. San Antonio Sectional Aeronautical Chart, 100th Edition, Effective November 9, 2017.

_____. 2017b. National Aeronautical Charting Office. El Paso Sectional Aeronautical Chart, 99th Edition, Effective July 20, 2017.

_____. 2018a. Airport Data and Contact Information. Available on the internet: http://www.faa.gov/airports/airport_safety/airportdata_5010/ (accessed January 2018).

_____. 2018b. Chart Supplement South Central U.S. (Formerly known as the Airport/Facility Directory South Central U.S.). Available on the internet: http://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dafd/ (accessed January 2018).

Federal Communication Commission (FCC). 2014. Geographic Information Systems – Licensing Database Extracts. Available on the internet: http://wireless.fcc.gov/geographic/index.htm?job=licensing_database_extracts (accessed July 2014).

Federal Emergency Management Agency (FEMA). 2018. FEMA NHHL v2.4.kml. National Flood Hazard Layer Web Map Service (WMS) in Google Earth. FEMA, Washington D.C. Available Online: https://hazards.fema.gov/femaportal/wps/portal/NFHLWMSkmzdownload (accessed August 2018).

Find a Grave. 2018. "Girvin Cemetery Memorials." Available online at https://www.findagrave.com/cemetery/3811/memorial-search?page=1#sr-39074083 (accessed September 21, 2018).

Gibson, Eric C. 1980. *Archaeological Investigations at Angus Flats, Pecos County, Texas.* University of Texas-San Antonio. San Antonio, Texas.

Gibson, E.C. and H. Uecker. 1981. *An Archeological Survey for Rio Grande Electric Cooperative, Inc. in Southern and Western Texas — Dimmit, Hudspeth, Kinney, Pecos, Terrell Counties*. Center for Archeological Research/University of Texas At San Antonio. San Antonio, Texas.

Gould, F.W., G.O. Hoffman, and C.A. Rechenthin. 1960. Vegetational areas of Texas. Texas Agricultural Extension Service. L-492.

Graber, J.W. 1961. Distribution, Habitat Requirements, and Life History of the Black-Capped Vireo (*Vireo atricapilla*). Ecological Society of America. Ecological Monographs 31:4 pp.313-336.

Griffith, G., S. Bryce, J. Omernik, and A. Rogers. 2007. Ecoregions of Texas. Project Report to Texas Commission on Environmental Quality. Austin, Texas. 125 pp.

Henke S.E. and W.S. Fair. 1998. Management of Texas Horned Lizards. Wildlife Management Bulletin of the Caesar Kleberg Wildlife Research Institute. Texas A&M University-Kingsville. No.2.

Hodgson, John. 2017. *Phase One Cultural Resource/Archaeological Investigation Results, Northern*

Natural Gas, Bakersfield Compressor Station Project, Pecos County, Texas. Phase One Archaeological Services, Inc. Madison, Wisconsin.

Hofman, Jack L. and Russell W. Graham. 1998. The Paleo-Indian Cultures of the Great Plains. In *Archaeology of the Great Plains*, edited by W. Raymond Wood. pp 87-139. University Press of Kansas: Lawrence, Kansas.

Howells, R.G., R.W. Neck and H. Murray. 1996. Freshwater Mussels of Texas. University of Texas. Austin, Texas. 224pp.

Hubbs, C. 1957. Distributional patters of Texas freshwater fishes. Southwest Naturalist 2:89-104.

Justice, Glenn and John Leffler. 2018. "PECOS COUNTY," *Handbook of Texas Online*. Available on the internet: https://tshaonline.org/handbook/online/articles/hcp05 (accessed March 19, 2018). Published by the Texas State Historical Association.

Kegley, George B. 1993. *Archaeological Investigation of a Proposed Prison Site near Belding, Texas*. Archeological Resource Evaluation Associates.

Keller, John E. 1998. *A Cultural resources Assessment and Archaeological Survey of a Proposed CO2 Pipeline on Public School Lands in Pecos and Terrell Counties, Texas — Pecos, Terrell Counties.* Horizon Environmental Services, Inc. Submitted to Eagleton Engineering. Texas Antiquities permit No. 1960. Copies available at Horizon Environmental Services and Southern Archaeological Consultants.

Lewis, R. L. 1975. *US 290: 1.0 Mi. East of Ft. Stockton, East 0.6 Mile*. SDHPT. Austin, Texas.

Lockwood, M.W. and B. Freeman. 2014. The TOS handbook of Texas birds, Second edition, Revised. Texas A&M University Press. College Station, Texas. 403pp.

Madden, Michael R. 1983. Cultural Resources Investigations of the Proposed Superior-University 19-1-1

Lateral Gas Pipeline Routes through U. T. Lands (Escondido Vineyard), Pecos County, Texas. Heartfield, Price and Greene, Inc. Monroe, LA.

McMahan, C.A., R.G. Frye, and L. Brown. 1984. The Vegetation Types of Texas. Texas Parks and Wildlife Department. Austin, Texas.

Miller, Myles R. and Nancy A. Kenmotsu. 2004. Prehistory of the Jornada Mogollon and Eastern Trans Pecos Regions of West Texas. In *The Prehistory of Texas*. Ed. Timothy Perttula. College Station: Texas A & M University Press.

National Conservation Easement Database (NCED). 2018. NCED Easements. Available on the internet: http://nced.conservationregistry.org/browse/map (accessed January 2018).

National Parks Service (NPS). 2014. Western Yellow-billed Cuckoo. Available online: https://www.nps.gov/articles/western-yellow-billed-cuckoo.htm (accessed August 2018).

_____. 2018a. Texas. Available on the internet: http://www.nps.gov/state/tx/index.htm?program=all (accessed January 2018).

_____. 2018b. National Trail System. Available on the internet: http://www.nps.gov/nts/nts_faq.html (accessed January 2018).

_____. 2018c. National Park Service - National Historic Landmark Survey. Available on the internet: http://www.nps.gov/nhl/find/statelists/tx.htm (accessed January 2018).

National Register of Historic Places Registration (NRHP). 1972. Fort Stockton District, Pecos County, Texas. National Register # 73001971.

_____ . 2018. Historic Road Infrastructure of Texas, 1866-1965 MPS. Available on the internet at: http://www.thc.texas.gov/public/upload/preserve/survey/highway/TX_Statewide_Road%20Infrastructure%20MPS.pdf (accessed April 2018).

National Wild and Scenic Rivers System (NWSRS). 2018. National Wild and Scenic Rivers System Wild and Scenic Rivers by State. Available on the internet: http://www.rivers.gov/texas.php (accessed January 2018).

Natural Resources Conservation Service (NRCS). 2018. NRCS Soil Web Survey. Available on the internet: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (accessed August 2018).

Penwell Pipeline Data (Penwell). 2018. Texas. May.

Perttula, Timothy K. 2004. An Introduction to Texas Prehistoric Archeology. In *The Prehistory Of Texas*, Perttula, T.K, ed. Texas University A&M Press, College Station.

Photo Science. 2018. Aerial Base Map (flown February 2018).

PLATTS. 2018. McGraw Hill Financial, Inc., 2 Penn Plaza, New York, New York. (accessed January 2018)

Poole, Jackie M., William R. Carr, Dana M. Price and Jason R. Singhurst. 2007. Rare Plants of Texas. Texas A&M University Press, College Station, Texas 640 pp.

Prikryl, Daniel J., Andrew F. Malof, and Charles A. Hixson. 2012. *LCRA Annual Report of Cultural Resource Investigations for 2011*. Annual Report No. 21. Lower Colorado River Authority Real Estate Services.

Quigg, J. Michael and Paul M. Matchen 2014. *The City of Fort Stockton, Utility Installation, Pecos County, Texas: An Intensive Cultural Resource Survey*. TRC Environmental Corporation. Submitted to the City of Fort Stockton, Texas Antiquities Permit No. 6799. Copies available at the Texas Historical Commission.

Railroad Commission of Texas (RRC). 2018a. Texas Uranium Exploration Program. Available on the internet: http://www.rrc.state.tx.us/mining-exploration/programs/uranium-exploration-program/ (accessed August 2018).

_____. 2018b. Public GIS Viewer. Available on the internet: http://www.rrc.state.tx.us/about-us/resource-center/research/gis-viewers/ (accessed August 2018).

Schubert, Darren and Emily Duke. 2018. *Intensive Archeological Survey of Portions of the Proposed AEP Barilla Junction to Permian Basin Transmission Line Rebuild Project Located on City of Fort Stockton Property in Pecos County, Texas*. POWER Engineers, Inc. Houston, Texas.

Schmidly, D. J. and R.D. Bradley. 2016. The Mammals of Texas, seventh edition. University of Texas Press, Austin, Texas. 694pp.

Simmons, Alan H., Ann Lucy Wiener Stodder, Douglas D. Dykeman, and Patricia A. Hicks. 1989. *Human Adaptions and Cultural Changes in the Greater Southwest: An Overview of Archaeological Resources in the Basin Range Province*. Prepared by the Desert Research Institute, Quaternary Sciences Center, University of Nevada, Reno, and the Bureau of Anthropological Research, University of Colorado, Boulder, with the Arkansas Archeological Survey, Fayetteville. Submitted to the U.S. Army Corps of Engineers, Southwestern, Division, Study Unit 4 of the Southwestern Division Archeological Overview. Contract No. DACW63-84-C-0149.

Soil Conservation Service (SCS). 1980. Soil Survey for Pecos County, Texas. In cooperation with Texas Agricultural Experiment Station. 85pp.

State Department of Highways and Public Transportation (SDHPT). 1987. *Spur 194: From Junction US 385 to 1.2 Miles SW*. SDHPT. Austin, Texas.

Texas Commission on Environmental Quality (TCEQ). 2014. Texas Integrated Report of Surface Water Quality – Texas 303(d) List (Category 5). Available on the internet: https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/14txir/2014_303d.pdf (accessed August 2018).

_____. 2018a. *Data on Municipal Solid Waste Facilities in Texas*. Available on the internet: https://www.tceq.texas.gov/permitting/waste_permits/msw_permits/msw-data (accessed August 2018).

_____. 2018b. *Index to Superfund Sites by County*. Available on the internet: http://www.tceq.texas.gov/remediation/superfund/sites/county (accessed August 2018).

Texas Department of Transportation (TxDOT). 2018a. Project Tracker. Available on the internet: http://www.txdot.gov/project_information/project_tracker.htm (accessed January 2018).

_____. 2018b. NRHP Listed and Eligible Bridges. Available on the internet: https://txdot.maps.arcgis.com/apps/webappviewer/index.html?id=cc9cf3452a324d0bb961a0c8b4edd898 (accessed April 2018).

_____. 1975. *Cultural Resources Assessment - IPE 17 - FM 1776: FM1450 South*. Austin, Texas.

Texas Education Agency (TEA). 2018. School District Locator. Available on the internet: https://tea.texas.gov/Texas_Schools/General_Information/School_District_Locator/School_District_Locator/ (accessed January 2018).

Texas Historical Commission (THC). 2018a. Texas Historical Commission. Texas Heritage Trails Program – Texas Pecos Trail Region. Available on the internet: http://texaspecostrail.com/ (accessed January 2018).

_____ . 2018b. Texas Historical Commission. Texas Archeological Sites Atlas (TASA). Restricted access. Available on the internet: http://nueces.thc.state.tx.us/ (accessed January 2018).

_____ . 2018c. Texas Historical Commission. Texas Historic Sites Atlas. Available on the internet: http://atlas.thc.state.tx.us/ (accessed January 2018).

Texas Land Conservancy (TLC). 2018. Lands. Available on the internet: http://texaslandconservancy.org/lands (accessed January 2018).

Texas Natural Diversity Data Base (TXNDD). 2018. Texas Natural Diversity Database, Texas Parks and Wildlife Department. Texas Biological and Conservation Data System. Austin, Texas. (Report Received: January 23, 2018).

Texas Parks and Wildlife Department (TPWD). 2018a. Ecologically Significant Stream Segments – Region G. Available on the internet: http://tpwd.texas.gov/landwater/water/conservation/water_resources/water_quantity/sigsegs/ (accessed August 2018).

_____. 2018b. Texas Ecosystem Analytical Mapper. Available on the internet: https://tpwd.texas.gov/landwater/land/programs/landscape-ecology/team/ (accessed August 2018).

_____. 2018c. Rare, Threatened and Endangered Species of Texas – Query by County. Available on the internet: http://tpwd.texas.gov/gis/rtest/ (accessed August 2018).

_____. 2018d. Texas Parks and Wildlife - Find a Park. Available on the internet: http://www.tpwd.state.tx.us/spdest/findadest/ (accessed January 2018).

_____. 2018e. Great Texas Wildlife Trails. Far West Texas Trail. Permian Basin West Loop. Available on the internet: https://tpwd.texas.gov/huntwild/wildlife/wildlife-trails/fwtx/permian-basin-west-loop (accessed January 2018).

Texas Speleological Society (TSS). 1994. The Caves and Karst of Texas. National Speleological Society, Inc. Huntsville, Alabama 342 pp.

_____. 2007. Karst Regions of Texas. Texas Speleological Society. Available online: http://www.texasspeleologicalsurvey.org/karst_caving/images/TKR2.jpg (accessed August 2018).

Texas State Data Center (TxSDC). 2014. Texas Population Projections Program. 2014 Population Projections Data Downloads. Available on the internet: http://txsdc.utsa.edu/Data/TPEPP/Projections/Index.aspx (accessed January 2018).

Texas Water Development Board (TWDB). 1975. Major and Historical Springs of Texas. Texas Water Development Board, Report 189. Austin, Texas. Available on the internet: https://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R189/R189.pdf (accessed August 2018).

_____. 2011. Aquifers of Texas Report 380. Texas Water Development Board. Austin, TX.

_____. 2016. Approved Regional Water Plans (Region F). Available on the internet: https://www.twdb.texas.gov/waterplanning/rwp/plans/2016/index.asp(accessed August 2018).

_____. 2017. Water for Texas. Austin, Texas. Available on the internet: https://2017.texasstatewaterplan.org/statewide (accessed August 2018).

_____. 2018. Groundwater Data Viewer. Water Data Interactive. Available on the internet: https://www2.twdb.texas.gov/apps/waterdatainteractive/groundwaterdataviewer (accessed August 2018).

The Nature Conservancy (TNC). 2018. Texas. Places We Protect. Available on the internet: http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/texas/placesweprotect/index.htm (accessed January 2018).

Thoms, V.A. 2008. “Ancient Savannah Roots of the Carbohydrate revolution in South-Central North America,” Plains Anthropologist Vol. 53 No. 205.

_____. 2009. "Rock of ages: propagation of hot-rock cookery in western North America," Journal of Archaeological Science Vol. 36:573-591.

Tipton, B.L., T.L. Hibbits, T.D. Hibbits, T.J. Hibbits, and T.J. Laduc. 2012. Texas Amphibians – A Field Guide. University of Texas Press, Austin, Texas. 309pp.

Turner, Billy D. 2018. *Negative Findings Report Cultural Resource Survey, Woodward Wind Conduit Realignment Pecos County, Texas*. Turpin and Sons, Inc. Canyon Lake, Texas.

Turner, Billy D. Turner and Solveig A. Turpin. 2016. *Negative Findings Report. Cultural Resource Survey. Ft. Stockton Municipal Solid Waste Facility Pecos County, Texas*. Turpin and Sons, Inc. Canyon Lake, Texas.

_____. 2012. *Cultural Resource Reconnaissance University Lands VF Petroleum Seismic Project Pecos County, Texas*. TAS Inc. Submitted to Exploration Geophysics, Inc., Texas Antiquities Permit No. 6142. Copies available at the Texas Historical Commission.

Turpin, Jeff. 2017. Negative Findings Report, Cultural Resource Survey Ft. Stockton Fed-Ex Ground Property, Pecos County, Texas (Complimentary Copy). Turpin and Sons, Inc. Canyon Lake, Texas.

_____. 2005. *Cultural Resources Evaluation of Big Bend Telephone Company Fiber Optic Lines, Pecos County*. Turpin and Sons, Inc. Canyon Lake, Texas.

Turpin, Solveig A. 2011. *Cultural Resource Assessment 3.4 Miles of BP Sherbino Mesa Transmission Line Corridor on University Lands Pecos County, Texas*. TAS Inc. Submitted to the Texas Historical Commission, Antiquities Permit 5836. Copies Available at the Texas Historical Commission.

_____ . 2010. *An Archeological Survey of the Proposed Sandridge Tombstone 345-kV Transmission Line, University Lands, Pecos County, Texas.* Submitted to the Texas Historical Commission, Texas. Copies available at the Texas Historical Commission.

_____ . 2009. *Archeological Investigations on University Lands, Pecos County Blocks 18, 19 and 21*. Borderlands Archeological Research Unit University of Texas at Austin. Submitted to the Texas Historical Commission, Texas Antiquities Permit No. 4671. Copies available at the Texas Historical Commission.

_____. 2007. *Archeological Survey of Energy Transfer Corporation's Pinon Lateral, University Lands, Pecos County, Texas — Pecos County*. Turpin and Sons, Inc. Canyon Lake, Texas.

_____ . 2005. *Cultural Resources Evaluation of Big Bend Telephone Company Fiber Optic Lines Pecos County, Texas*. TAS, Inc. Submitted to the Texas Historical Commission, Texas Antiquities Permit No. 3917. Copies available at the Texas Historical Commission.

_____ . 2004 *The Lower Pecos River Region of Texas and Northern Mexico*. In The Prehistory of Texas, edited by Timothy K. Perttula, Texas A&M University Press.

United States Census Bureau (USCB). 2000. Census 2000 Gateway. State and County Quick Facts. Available on the internet: http://www.census.gov/main/www/cen2000.html (accessed January 2018).

_____. 2010. Census 2010. Available on the internet: http://www.census.gov/2010census/ (accessed January 2018).

_____. 2016. American Fact Finder. Available on the internet: http://factfinder2.census.gov/main.html (accessed January 2018).

United States Department of Agriculture (USDA). 2012. 2012 Census of Agriculture – Texas – State and County Profiles. Available on the internet: https://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Texas/ (accessed January 2018).

United States Environmental Protection Agency (USEPA). 2018a. Superfund Sites Where You Live. Available on the internet: http://www.epa.gov/superfund/sites/ (accessed August 2018).

_____. 2018b. My Waters Mapper. Available online: https://watersgeo.epa.gov/mwm/ (accessed August 2018).

United States Fish and Wildlife Service (USFWS). 2006. Peregrine Falcon (*Falco peregrinus*) Factsheet. Available on the internet: https://www.fws.gov/endangered/esa-library/pdf/Peregrinefactsheet.pdf (accessed August 2018).

_____. 2013. Rufa Red Knot Ecology and Abundance – Supplement To: Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*) [Docket No. FWS–R5–ES–2013–0097; RIN 1018–AY17]. Available online: http://www.fws.gov/northeast/redknot/pdf/20130923_REKN_PL_Supplement02_Ecology%20Abundance_Final.pdf (accessed August 2018).

_____.2017. Ecological Services. Glossary. Available on the internet: https://www.fws.gov/ecological-services/about/glossary.html (accessed August 2018).

_____. 2018a. National Wetland Inventory (NWI) Mapper. Available on the internet: http://www.fws.gov/wetlands/Data/Mapper.html (accessed August 2018).

_____. 2018b. Information for Planning and Consultation (IPaC). (Consultation Code: 02ETAU00-2018-SLI-1395). Report requested and received on August 16, 2018.

United States Geological Survey (USGS). 2018a. 7.5-minute quadrangle maps. The quadrangle maps were accessed through The National Map Download Client. Available for download on the internet: https://viewer.nationalmap.gov/basic/ (accessed July 2018).

_____. 2018b. Mineral Resources On-line Spatial Data. Geologic units in Texas. Available on the internet: http://mrdata.usgs.gov/geology/state/fips-unit.php?state=TX (accessed August 2018).

_____. 2018c. Brief report for Gulf – Margin Normal Faults, Texas. Available on the internet: http://earthquake.usgs.gov/hazards/qfaults/ (accessed August 2018).

University Land Wells 2017. Available on the internet: http://www.utlands.utsystem.edu/Resources/GIS (accessed December 2017).

Wallace, Ernest. 2018. "FORT STOCKTON," *Handbook of Texas Online*. Available on the internet: https://tshaonline.org/handbook/online/articles/qbf46 (accessed March 19, 2018). Published by the Texas State Historical Association.

Whelan, Carly. 2018. "Squawteat Peak," *Texas Beyond History*. Available online at: https://www.texasbeyondhistory.net/trans-p/images/ap8.html (accessed April 2018). Published by The University of Texas Austin.

Willey, Gordon R. and Phillip Phillips. 1958. *Method and Theory in American Archaeology*. Chicago: University of Chicago Press.

Young, Brandon S. 2003. *Cultural Resources Evaluation of Big Bend Telephone Company Fiber Optic Lines, Pecos County*. Reports in Contract Archeology No.8. Center for Big Bend Studies/ Sul Ross State University.

Young, Wayne C. 1981. *Investigations at the Squawteat Peak Site, Pecos County, Texas*. Publications in Archaeology No.20. Austin: SDHPT.