September 2018

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC

Bailey to Jones Creek Transmission Line Project
Environmental Assessment and Alternative Route Analysis

Brazoria, Matagorda and Wharton Counties, Texas

PROJECT NUMBER:
147806

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

POWER ENGINEERS

(This page left blank intentionally.)

Bailey to Jones Creek Transmission Line Project

PREPARED FOR: CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC

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

(This page left blank intentionally.)

EXECUTIVE SUMMARY

CenterPoint Energy Houston Electric, LLC ("CenterPoint Energy") proposes to construct a new 345 kilovolt ("kV") double-circuit transmission line located in Brazoria, Matagorda and Wharton Counties, Texas, that would extend for approximately 53.9 to 84.3 miles from CenterPoint Energy's existing Bailey Substation located in eastern Wharton County to the existing Jones Creek Substation located in southeastern Brazoria County. The Bailey Substation is located in Wharton County, approximately one mile east of the intersection of State Highway ("SH") 60 and Bailey Road. The Jones Creek Substation is located in Brazoria County, 0.6 mile north of the intersection of SH 36 and County Road 217. CenterPoint Energy retained POWER Engineers, Inc. ("POWER") to prepare this Environmental Assessment and Alternative Route Analysis to support the Public Utility Commission of Texas ("PUC") application for a Certificate of Convenience and Necessity for the proposed project.

POWER, with input from CenterPoint Energy, identified the study area boundaries utilizing the two initial endpoints, as well as potential paralleling features and constraints. CenterPoint Energy provided the location of its existing 138 kV and 345 kV transmission line corridors. Data collection was conducted to identify the environmental and land use constraints within the study area that were pertinent to the identification of preliminary transmission line segments. Data collection activities included a review of readily available data, coordination with federal and state regulatory agencies and local officials and reconnaissance surveys from public viewpoints. POWER and CenterPoint Energy initially identified 261 geographically diverse preliminary transmission line segments that were presented at three public meetings in February 2018 to solicit public input. Input received from the public meetings, local agencies and reconnaissance surveys in conjunction with consideration of the project objectives, including geographic diversity, resulted in the identification of 30 proposed alternative routes.

The potential environmental and land use impacts for each proposed alternative route were tabulated by POWER for each evaluation criteria. CenterPoint Energy provided the engineering review and estimated construction cost for each proposed alternative route. The proposed transmission line routes were grouped into geographically diverse route families and key evaluation criteria were selected and used to compare potential impacts to rank the proposed alternative routes within each route family. POWER compared 30 proposed alternative routes and determined that Routes 5 and 28 are the proposed alternative routes that best address the requirements of the Public Utility Regulatory Act ("PURA") and the PUC Substantive

Rules. Proposed Alternative Route 5 crosses state owned property and Proposed Alternative Route 28 does not.

CenterPoint Energy provided input and review throughout the routing study process and agreed that Proposed Alternative Routes 5 and 28 are the proposed alternative routes that best addresses the requirements of PURA and the PUC Substantive Rules.

TABLE OF CONTENTS

Appendices:

FIGURES:

TABLES:

ACRONYMS AND ABBREVIATIONS:

ACEP-WRE	Agricultural Conservation Easement Program Wetland Reserve Easement
AM radio	Amplitude Modulation radio
amsl	above mean sea level
ARNI	Aquatic Resources of National Importance
BEG	Bureau of Economic Geology
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
B.P.	Before Present
BRA	Brazos River Authority
CCN	Certificate of Convenience and Necessity
CCS	Compressed Construction Site
CenterPoint Energy	CenterPoint Energy Houston Electric, LLC
CFR	Code of Federal Regulations
CLF	civilian labor force
CMP	Texas Coastal Management Program
CMZ	Costal Management Zone
CNRA	Coastal Natural Resource Areas
CR	County Road
CWA	Clean Water Act
DoD	Department of Defense Siting Clearing House
EA	Environmental Assessment and Alternative Route Analysis
EMF	Electromagnetic Field
ERCOT	Electric Reliability Council of Texas
ESA	Endangered Species Act
ESSS	Ecologically Significant Stream Segment
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FM	Farm-to-Market Road
FM radio	Frequency Modulation radio
FPPA	Farmland Protection Policy Act
GIS	Geographic Information Systems
GLO	Texas General Land Office
HPA	high probability area
HTC	Historic Texas Cemetery
IPaC	Information for Planning and Consultation
ISD	Independent School District
kV	kilovolt
L	lacustrine
MBTA	Migratory Bird Treaty Act
ME	miscellaneous easement
NCED	National Conservation Easement Database

NEPA	National Environmental Protection Act
NESC	National Electrical Safety Code
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NOT	Notice of Termination
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWP	Nationwide Permit
NWR	National Wildlife Refuge
OTHM	Official Texas Historical Marker
PEM	Palustrine emergent
PFO	Palustrine forested
POWER	POWER Engineers, Inc.
Project	Bailey to Jones Creek Transmission Line Project
PSS	Palustrine shrub-shrub
PUB	Palustrine unconsolidated bottom
PUC	Public Utility Commission of Texas
PURA	Public Utility Regulatory Act
RIP	Record, Investigate and Protect program
ROW	right-of-way
RPG	Regional Planning Group
RRC	Railroad Commission of Texas
RTHL	Recorded Texas Historic Landmark
SAL	State Archeological Landmark
SCS	Soil Conservation Service
SH	State Highway
SHPO	State Historic Preservation Office
Staff	PUC Staff
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
TDCJ	Texas Department of Criminal Justice
THC	Texas Historical Commission
THSA	Texas Historical Site Atlas
TLC	Texas Land Conservancy
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TNRIS	Texas Natural Resource Information System
TPDES	Texas Pollution Discharge Elimination 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
US	United States
U.S.C.	United States Code
US Hwy	United States Highway
USACE	United States Army Corps of Engineers
USBOC	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
WMA	Wildlife Management Area

1.0 DESCRIPTION OF THE PROPOSED PROJECT

1.1 SCOPE OF THE PROJECT

CenterPoint Energy Houston Electric, LLC ("CenterPoint Energy") proposes to construct a new 345 kilovolt ("kV") double-circuit transmission line located in Brazoria, Matagorda and Wharton Counties, Texas, also referred to as the Bailey to Jones Creek Transmission Line Project ("Project"). See Figure 1-1 for a map of the Project vicinity. The new transmission line will connect CenterPoint Energy's existing Bailey Substation located in eastern Wharton County to the existing Jones Creek Substation located in southeastern Brazoria County.

CenterPoint Energy retained POWER Engineers, Inc. ("POWER") to prepare this Environmental Assessment and Alternative Route Analysis ("EA") to support the application for a Certificate of Convenience and Necessity ("CCN") for the Project. This EA discusses the environmental and land use constraints identified within the study area, documents routing methodologies and public involvement, and provides an evaluation of alternative routes. This document provides information in compliance with the requirements of Section 37.056(c)(4)(A)-(D) of the Public Utility Regulatory Act ("PURA"), the Public Utility Commission of Texas ("PUC") CCN application form and 16 Texas Administrative Code ("TAC") § 22.52 and § 25.101. The EA may also be used to support any additional local, state, or federal permitting activities that may be required for construction of the Project.

To assist POWER with the evaluation of the Project, CenterPoint Energy provided POWER with the project endpoints, information regarding the need for the Project, CenterPoint Energy's construction practices and right-of-way ("ROW") requirements. CenterPoint Energy also provided information regarding engineering and design requirements, as well as estimated cost information associated with the proposed alternative routes.

1.2 AGENCY ACTIONS

Numerous federal, state and local regulatory agencies have rules and regulations regarding the routing process and potential impact assessment associated with construction of high voltage electrical transmission lines. This section describes the major regulatory agencies and issues that are involved in planning and permitting of transmission lines within the state of Texas. POWER solicited project scoping comments from various regulatory agencies during the development of the EA. Records of correspondence are provided in Appendix A.

1.2.1 Public Utility Commission of Texas

The PUC regulates the routing of transmission lines in Texas under Section 37.056(c)(4)(A)-(D) of PURA. The PUC regulatory rules and guidelines for routing transmission lines include:

- 16 TAC § 25.101(b)(3)(B)
- 16 TAC § 22.52(a)
- Policy of prudent avoidance
- CCN application requirements

This EA has been prepared by POWER in support of CenterPoint Energy's CCN application for this Project to be filed at the PUC for approval.

1.2.2 United States Army Corps of Engineers

The United States Army Corps of Engineers ("USACE") has been directed by Congress to administer 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). 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 of the CWA, the USACE regulates the discharge of dredge and fill material into "waters of the US," including associated wetlands. The purpose of Section 404 is to protect the nation's waters from indiscriminate discharge and to minimize the potential adverse impacts and degradation of the "waters of the US" and aquatic ecosystems.

Although the USACE-Galveston District does not publish a list of designated Section 10 (Navigable) surface waters, the Gulf Intercoastal Waterway, Caney Creek, Live Oak Bayou, Bastrop Bayou, Brazos River, Colorado River and San Bernard River may be considered navigable waters of the US subject to Section 10 of the Rivers and Harbors of 1899. A review of the National Wetland Inventory ("NWI") maps indicated numerous emergent and forested/shrub wetland areas occur throughout the study area.

FIGURE 1-1

PROJECT VICINITY

OVERSIZED MAP

PAGE 1-3

(This page left blank intentionally.)

Upon PUC approval of a route, additional coordination, jurisdictional wetland verifications and permitting with the USACE-Galveston District for a Section 404/10 Permit may be required if the approved route includes utility facilities (i.e., substations, foundations and access roads) to be constructed within potential jurisdictional areas. If the facilities are constructed within jurisdictional areas, the construction of the Project may meet the conditions of Nationwide Permit ("NWP") No. 12 - Utility Line Activities. NWP 12 authorizes activities for the construction, repair and removal of utility lines and associated facilities (i.e., substations, foundations and access roads) in waters of the US provided the general and regional conditions of the permit are met. Within Brazoria County NWP Regional Condition 15c does not authorize discharges into designated Columbia Bottomlands habitats. Spatial data of designated Columbia Bottomlands was obtained from the USACE and these areas where mapped by geographic information systems ("GIS") during the routing process and avoided where practical. Based on a review of the current Project endpoints and NWI mapped wetlands, it is uncertain at the time of this report exactly how many wetlands would be impacted and whether/or what mitigation under a Section 404/10 permit would be required for this Project without conducting site specific survey of waters of the US and wetland delineations.

1.2.3 United States Fish and Wildlife Service

The United States Fish and Wildlife Service ("USFWS") is charged with the responsibility of enforcement of federal wildlife laws and providing comments on proposed construction projects with a federal nexus under the National Environmental Protection 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 reviewed the USFWS listed species for Brazoria, Matagorda and Wharton Counties, and solicited Texas Natural Diversity Database ("TXNDD") element occurrence records from the Texas Parks and Wildlife Department ("TPWD"). No known populations of any species protected under the ESA were identified within the study area. The lack of data does not indicate the absence of any listed species or potential habitats within the study area. Bald eagles (*Haliaeetus leucocephalus)* were observed and may be present in the study area and are protected by the BGEPA and MBTA. A survey of eagle nests performed by CenterPoint Energy in February of 2018 confirmed a number of eagle nests in the study area (further discussed in Section 4.4.4.4). The USFWS recommends that the Project follow the National Bald Eagle Management Guidelines to avoid and minimize harm and disturbance of bald eagles.

Upon PUC approval of a route, coordination with the USFWS Texas Coastal Ecological Services Field Offices may be required to determine the need for any required species-specific surveys or additional permitting under the MBTA or Sections 7 or 10 of the ESA.

1.2.4 Federal Aviation Administration

According to Federal Aviation Administration ("FAA") regulations, Title 14 Code of Federal Regulations ("CFR") Part 77.9, the construction of a transmission line requires FAA notification if a transmission tower structure 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.

- 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, 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 also requires listing private airports within 10,000 feet of any proposed alternative route centerline. Following PUC approval of a route for the proposed transmission line, CenterPoint Energy 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.

1.2.5 Department of Defense Siting Clearing House

The Department of Defense ("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. The 16 Texas 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.

1.2.6 Texas Parks and Wildlife Department

The TPWD is the state agency with the primary responsibility of protecting the state's fish and wildlife resources in accordance with the Texas Parks and Wildlife Code Section 12.0011(b). POWER solicited comments from the TPWD during the scoping phase of the Project, and a copy of this EA will be submitted to TPWD when the CCN 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 fish and wildlife resources.

1.2.7 Texas Coastal Management Program

The Texas Land Commissioner administers the Texas Coastal Management Program ("CMP") under the Texas General Land Office ("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.

Portions of the Project are located within the designated Coastal Management Zone ("CMZ") (GLO 2018). When construction is proposed within CMZ, the GLO must conduct a state or federal consistency

review to determine whether the proposed activity is consistent with the CMP goals and policies. A Coastal Zone Consistency Statement must also be submitted to the USACE along with any Section 404/10 permit application. As a state agency, the PUC is charged with complying with the policies of the CMP when approving CCNs for electric transmission lines located in the CMZ.

1.2.8 Floodplain Management

Flood Insurance Rate Maps, published by the Federal Emergency Management Agency ("FEMA"), were reviewed to determine floodplain boundaries within the study area. The mapped 100-year floodplains are typically associated with the larger creeks and streams or rivers. The 100-year floodplain represents a flood event that has a one percent chance of being equaled or exceeded for any given year (FEMA 2018). Construction of the proposed transmission line is not anticipated to create any significant permanent changes in the existing topographical grades and should not significantly affect the stormwater runoff rates within the study area. Additional coordination with the study area counties' floodplain administrators may be required after PUC route approval to determine if any permits or mitigation are necessary.

1.2.9 Texas Commission on Environmental Quality

The construction of the Project may require a Texas Pollution Discharge Elimination System ("TPDES") General Construction Permit (TXR150000) as implemented by the Texas Commission on Environmental Quality ("TCEQ") under the provisions of Section 402 of the CWA and Chapter 26 of the Texas Water Code. The TCEQ has developed a tiered approach for implementing this permit that is dependent on the acreage of ground disturbance. No permitting is required for land disturbances of less than one acre. If more than one acre but less than five acres are disturbed, then a Stormwater Pollution Prevention Plan ("SWPPP") must be developed prior to and implemented during construction activities, accompanied with posting a site notice and sending notification to the Municipal Separate Storm Sewer System Operator. If more than five acres of land are disturbed, then the submittal of a Notice of Intent ("NOI") and Notice of Termination ("NOT") is also required by the TCEQ. Once a route is approved by the PUC, the proposed disturbed surface area will be calculated and appropriate conditions of the TX150000 permit will be determined.

A Section 401 Water Quality Certificate from the TCEQ may also be required if the Project requires an USACE Individual Permit for proposed impacts to surface waters or wetlands as previously discussed.

TCEQ has the authority to review federally permitted or licensed activities that may result in a discharge of pollutants to the waters of the US within the state of Texas.

1.2.10 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). Chapter 26 of the TAC requires state agencies and political subdivisions of the state to notify the Texas Historical Commission ("THC") of ground-disturbing activity on public land. POWER contacted the THC to identify known cultural resources within the study area boundary. POWER also reviewed Texas Archeological Research Laboratory ("TARL") records for known locations of archeological sites and the THC's online, restricted-access Texas Archeological Sites Atlas ("TASA") and Texas Historical Sites Atlas ("THSA") for the locations of recorded cemeteries, NRHP properties, State Antiquities Landmarks ("SALs") and Official Texas Historical Markers ("OTHMs"). Once a route is approved by the PUC, additional coordination with the THC will occur, if required, to determine the need for cultural resource surveys or additional permitting requirements. Even if no additional surveys are required, CenterPoint Energy will implement an unanticipated discovery procedure during construction activities. If artifacts are discovered during construction, activities will cease in the area of discovery and CenterPoint Energy will notify the State Historic Preservation Office ("SHPO") for additional consultation.

1.2.11 Texas Department of Transportation

The Texas Department of Transportation ("TxDOT") has been notified of the Project. If the route approved by the PUC crosses TxDOT roadways, the Project will be constructed in accordance with the rules, regulations, policies and expansion plans of TxDOT. Best Management Practices ("BMP") will be used, as required, to minimize erosion and sedimentation resulting from the construction. Revegetation will occur within existing TxDOT ROWs as required under the "*Revegetation Special Provisions*" 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.

1.2.12 Texas General Land Office

The Texas GLO requires a miscellaneous easement ("ME") for ROWs within any state-owned riverbeds and navigable streams (non-tidal). A ME will be required if the approved Project ROW crosses areas meeting these criteria. After PUC route approval, additional coordination with the Texas GLO may be required to determine the need for any MEs.

1.3 DESCRIPTION OF PROPOSED DESIGN AND CONSTRUCTION

1.3.1 Structure Design

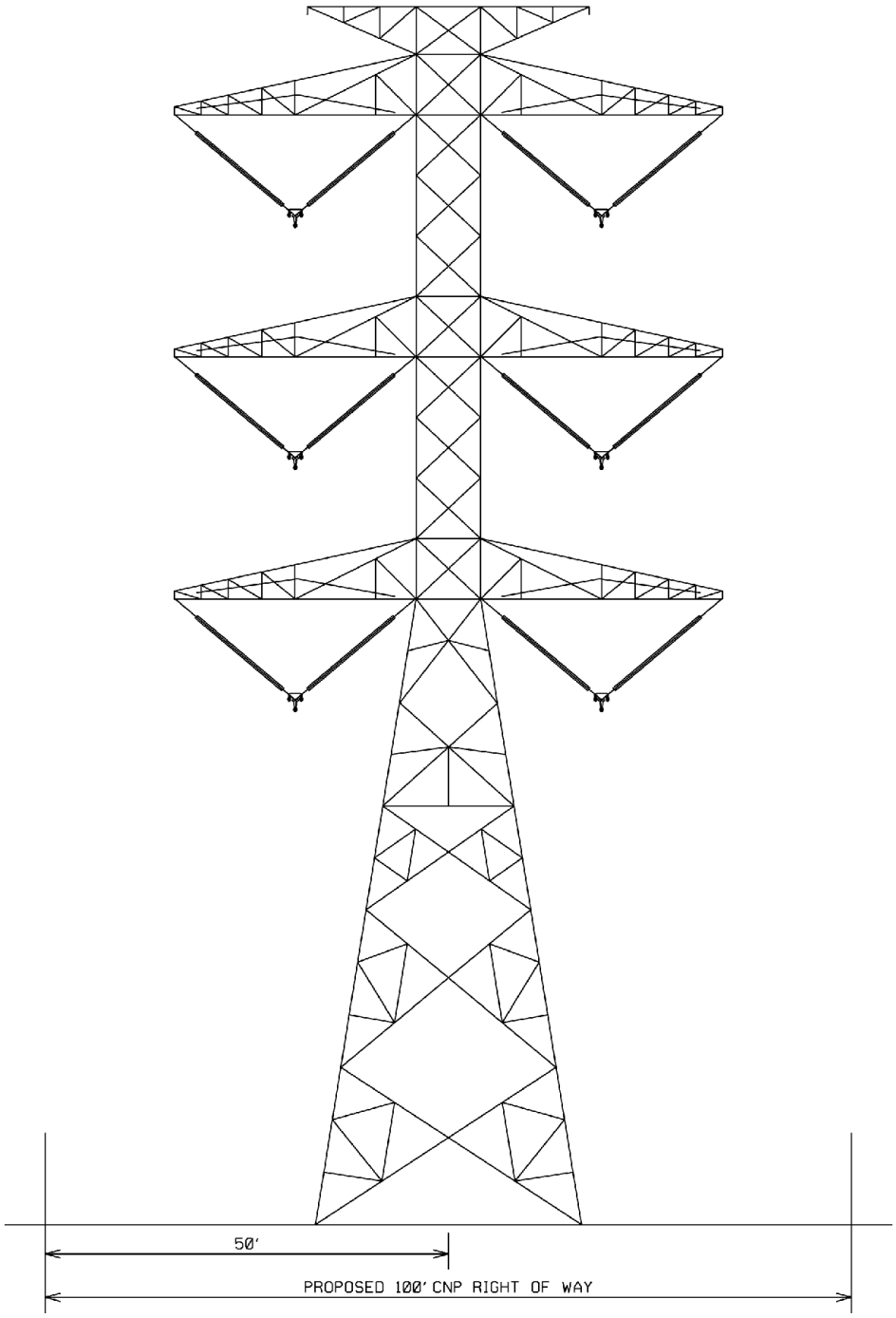
CenterPoint Energy proposes to predominantly use double-circuit steel lattice towers with a vertical phase configuration in a 100-foot-wide ROW for all of the proposed alternative routes. Depending on the terrain and other considerations, such as the length of span between structures and clearance requirements needed to cross rivers, wetland areas, utility crossings and roadway crossings, CenterPoint Energy may require wider ROW widths and alternative structure types (e.g., tubular steel poles and delta lattice steel towers). ROW widths may also vary depending on FAA determination. The exact location or extent of the different structure types and ROW widths cannot be determined until the PUC approves a route, surveys are conducted, and more detailed engineering designs are completed.

Construction of lattice towers will require drilled pier foundations made of steel-reinforced concrete. The span length between lattice tower structures will be approximately 850 feet. Typical lattice tower height with a vertical phase configuration will have a height range of approximately 151 to 171 feet depending on terrain and required National Electrical Safety Code ("NESC") clearances (Figure 1-2). Typical lattice tower height with a delta configuration will have a height range of approximately 136 to 156 feet depending on terrain and required NESC clearances (Figure 1-3).

Construction of tubular steel poles will require drilled shaft foundations made of steel-reinforced concrete. Typical steel poles will have a height range of approximately 150 to 170 feet in height and have a span length of approximately 850 feet (Figure 1-4).

The exact range of different structure heights cannot be determined until a route is approved by the PUC, surveys are conducted, and more detailed engineering designs are completed.

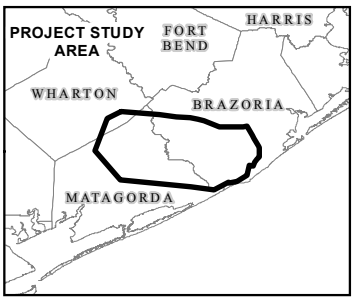
151' to 171' Typical Structure Height



Note:

This drawing was prepared by POWER with information provided by CNP for a specific project, taking into consideration the specific and unique requirements of the project. Reuse of this drawing or any information contained in the drawing for any purpose is prohibited unless written permission from both POWER and POWER's client is granted.

Revised: June 27, 2018
Printed: June 27, 2018



BAILEY TO JONES CREEK PROJECT

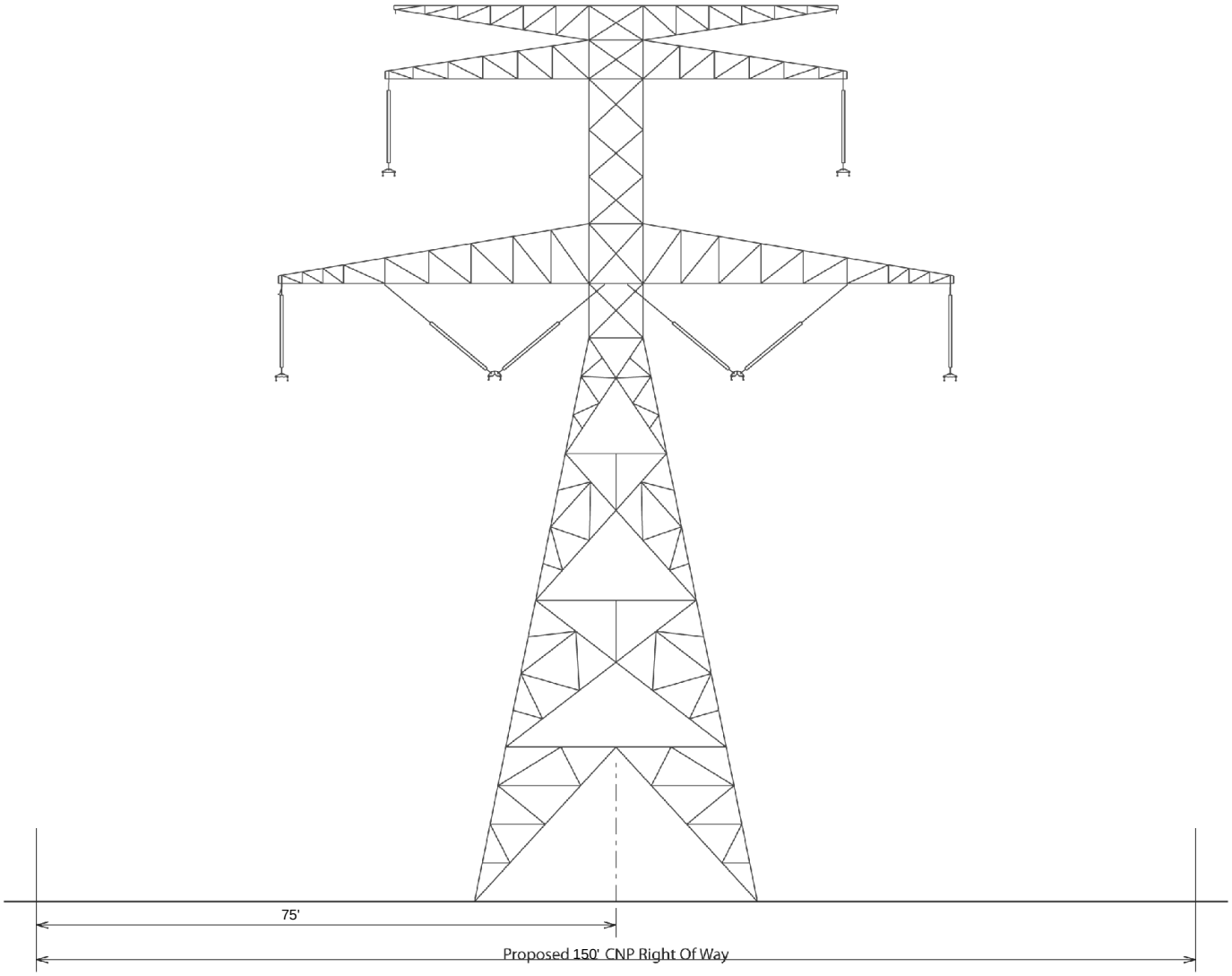
FIGURE 1-2
TYPICAL 345 KV DOUBLE-CIRCUIT STEEL TOWER-VERTICAL WITHIN NEW ROW

POWER ENGINEERS

CenterPoint Energy

(This page left blank intentionally.)

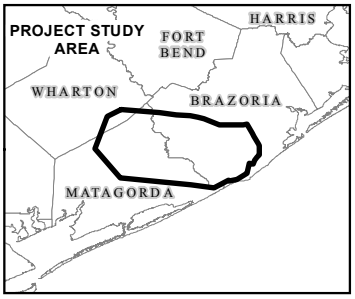
136' to 156' Typical Structure Height



Note:

This drawing was prepared by POWER with information provided by CNP for a specific project, taking into consideration the specific and unique requirements of the project. Reuse of this drawing or any information contained in the drawing for any purpose is prohibited unless written permission from both POWER and POWER's client is granted.

Revised: August 15, 2018
Printed: August 15, 2018



BAILEY TO JONES CREEK PROJECT

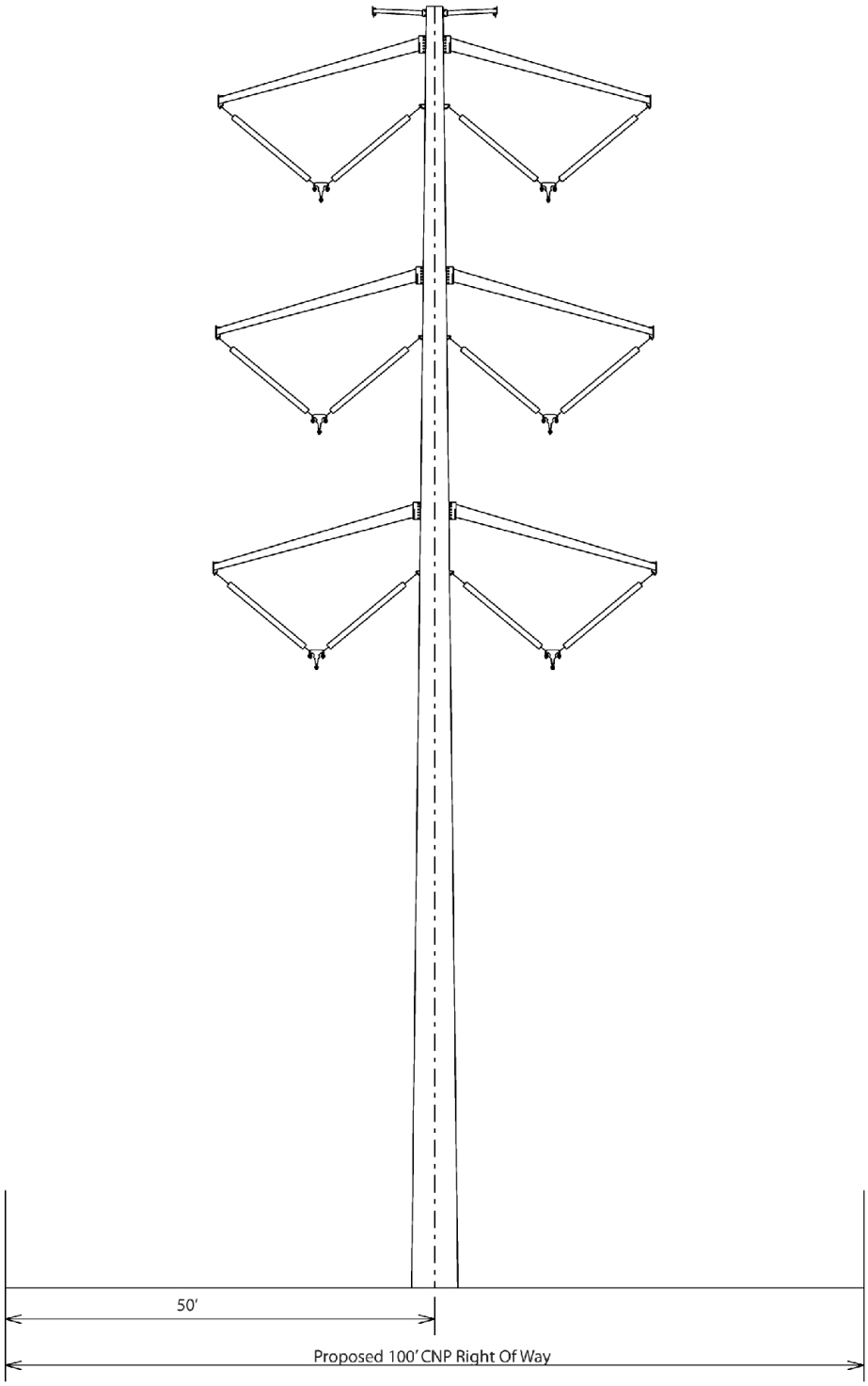
FIGURE 1-3
TYPICAL 345 KV DOUBLE-CIRCUIT STEEL TOWER-DELTA WITHIN NEW ROW

POWER ENGINEERS

CenterPoint Energy

(This page left blank intentionally.)

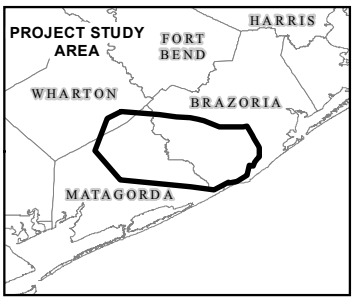
150' to 170' Typical Structure Height



Note:

This drawing was prepared by POWER with information provided by CNP for a specific project, taking into consideration the specific and unique requirements of the project. Reuse of this drawing or any information contained in the drawing for any purpose is prohibited unless written permission from both POWER and POWER's client is granted.

Revised: August 15, 2018
Printed: August 15, 2018



BAILEY TO JONES CREEK PROJECT

FIGURE 1-4
TYPICAL 345 KV DOUBLE-CIRCUIT STEEL POLE-VERTICAL WITHIN NEW ROW

POWER ENGINEERS

CenterPoint Energy

(This page left blank intentionally.)

1.3.2 Surveying

Surveying of the transmission line ROW is required to locate the centerline, the structure locations, obstacles above and below ground, and the edges of both new and existing ROW. Surveying will be conducted after the PUC approves a route.

1.3.3 Clearing

Tree and shrub clearing may be needed in areas where new ROW is acquired. If a SWPPP is required, it will be implemented along the approved route prior to the start of clearing. Mechanized cutters and hand tools will be used to remove impeding vegetation to ground level.

1.3.4 Structure Placement

Specialized wide-track vehicles, tractor trailers and line trucks with trailers will be used to transport construction materials along the ROW to the structure locations. Typically, the concrete foundations will be installed before the steel lattice towers or steel poles are erected to allow the foundations to cure and reach adequate strength.

Steel pole sections will be delivered to the site location shortly before the poles are ready to be set. A large crane would then set the pole sections onto the foundation. The steel lattice towers will be delivered in bundles and set next to the proposed structure location shortly before structure erection. The towers will be assembled on-site and a crane will be used to set the sections onto the previously installed foundations.

1.3.5 Conductor and Static Wire Installation

Once the structures have been erected, the stringing and clipping-in of conductors and static wires will begin. Outages are not anticipated during the conductor and static wire installation. Each road crossing will have either temporary guard structures and/or conductor shields installed for public and laborer protection while stringing in the new conductors. Existing transmission and distribution circuits will have either temporary guard structures and/or conductor shields installed for public and laborer protection while stringing in the new conductors.

1.3.6 Cleanup

Cleanup operations will be performed as construction activities are completed. Cleanup includes removal of debris, unused materials and trash. Any necessary soil stabilization and reestablishing of vegetation

cover will also occur during cleanup, following the procedures dictated in the SWPPP, if required. Pre-construction contours will also be restored following construction.

2.0 DESCRIPTION OF THE STUDY AREA

In November 2017, the Electric Reliability Council of Texas ("ERCOT") staff recommended "Bridge the Gap Upgrades" and construction of a new 345 kV double-circuit transmission line from the Bailey Substation to the Jones Creek Substation, along with other system upgrades, to address both the near-term and long-term reliability needs and to serve the committed and future load in the Freeport area (ERCOT RPG 2017a). This recommendation was subsequently endorsed unanimously by the ERCOT Technical Advisory Committee in November 2017 and also the ERCOT Board of Directors on December 12, 2017 (ERCOT RPG 2017b). Based on ERCOT's recommendation, and with input from CenterPoint Energy, POWER identified the study area boundary, considering the identified endpoints: CenterPoint Energy's existing Bailey and Jones Creek 345 kV Substations. The study area boundary is depicted in Figure 2-1.

The study area was defined to provide an area large enough to develop an adequate set of geographically diverse alternative routes. The northern study area boundary is defined by the location of the Bailey Substation and an existing 138 kV transmission line that extend in an east-west direction. The eastern study area boundary is defined by the location of the Jones Creek Substation and an existing 138 kV and 345 kV transmission line corridor that extend in a north-south direction. The western study area boundary parallels an existing 138 kV transmission line that extends in a northwest-southeast direction and also a portion of Farm-to-Market Road ("FM") 1468. The area to the east of the study area, including the town of Freeport, is defined by intense residential and industrial development. In addition, the areas to the south and west are defined by the waters of the Texas Gulf Coast. The southern study area boundary is defined to provide adequate room for the development of a set of geographically diverse routing alternatives west to east, and the need to minimize potential land use conflicts within the study area.

To describe the environmental setting of the study area, land use and environmental resource data was collected for community values and environmental integrity.

(This page left blank intentionally.)

FIGURE 2-1

STUDY AREA BOUNDARY

OVERSIZED MAP

PAGE 2-3

(This page left blank intentionally.)

2.1 COMMUNITY VALUES

The term "community values" has not been formally defined for regulatory purposes by the PUC but is included as a consideration for transmission line certification under Section 37.056(c)(4)-(A-D) of PURA. In several dockets, the PUC has used the following as a working definition: "the term 'community values' may be interpreted as a shared appreciation of an area or other natural resource by a national, regional or local community." The PUC CCN application requires information related to the following items that may provide indications of community value impacts:

- Public meeting or public open house required by 16 TAC § 22.52.
- Approval or permits required from other governmental agencies.
- Brief description of the area traversed.
- Habitable structures within 500 feet of the centerline for a 345 kV transmission line.
- Amplitude Modulation ("AM") radio, Frequency Modulation ("FM") radio, microwave and other electronic installations in the area.
- FAA-registered airstrips, private airstrips and heliports located in the area.
- Irrigated pasture or croplands utilizing center-pivot or other traveling irrigation systems.

POWER collected this information and also evaluated the study area for community values that may be of importance to a particular community as a whole. Examples of a particular community value would be avoidance of a park or recreational area, historical or archeological site or a scenic vista, which can be related to aesthetics. Community values data were collected for land use, recreational and park areas and historical and aesthetic values. Recreational and park areas and historical and aesthetic values are further discussed in more detail in Sections 2.2 and 2.3. POWER also mailed consultation letters to local officials to obtain insight into community values from appointed and elected officials. In addition, POWER participated in CenterPoint Energy's public open house meetings to collect information regarding community values directly from the public.

2.1.1 Land Use

Land jurisdiction is defined as the control maintained by major landholders or land managers. Jurisdiction does not necessarily represent ownership. Potential conflicts could arise from crossing jurisdictional boundaries that were evaluated in this study. For example, a 345 kV transmission line crossing publicly-held land may cause a conflict with ongoing planning processes or a land management plan. Land jurisdictions were identified and delineated primarily from GIS metadata (Brazoria County Appraisal District 2017 and 2018; Matagorda County Appraisal District 2017 and 2018; NAIP 2014-2018; PLATTS 2017; Wharton County Appraisal District 2017 and 2018).

Existing land data collected included urban and residential areas, agriculture, oil and gas facilities, planned land use, transportation, aviation, utilities and communication towers. The primary sources of land use information were obtained from interpretation of aerial photographs, United States Geological Survey ("USGS") topographical maps and field reconnaissance surveys. In addition, the economic and demographic characteristics within the study area counties were gathered and are further discussed under Socioeconomics in Section 2.1.2.

2.1.1.1 Urban and Residential Areas

The urban and residential 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 institutional, commercial and industrial land uses.

The PUC definition of a habitable structure was used for this routing study. 16 TAC § 25.101(a)(3) defines habitable structures 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, churches, hospitals, nursing homes and schools." Habitable structures were identified using aerial photographs (NAIP 2014-2018) supplemented with readily available websites with aerial imagery, including Google Earth, Bing and reconnaissance surveys from public points of view.

Low, Medium and High Intensity developed areas were identified using aerial photograph interpretation and reconnaissance surveys. These classifications are described below:

- **Low Intensity** areas typically include rural settings with single-family housing units.
- **Medium Intensity** areas typically include single-family housing units that are grouped in residential subdivisions and may include peripheral commercial structures.
- **High Intensity** areas include highly developed areas where people reside or work in high numbers. Examples include apartment complexes and commercial or industrial parks.

The study area is generally located between the City of Oyster Creek in Brazoria County and the Town of Markham in Matagorda County. Existing developments include industrial facilities, residential subdivisions and commercial businesses concentrated along major roadway corridors, including State Highways ("SHs") 35, 36, 60, 227, 288 and 332. Developed medium intensity, single family residences

are clustered within subdivisions. These existing developments are primarily within the eastern portion of the study area.

Schools

The study area is located within the following 10 school districts: Angleton Independent School District ("ISD"), Bay City ISD, Boling ISD, Brazosport ISD, Columbia-Brazoria ISD, El Campo ISD, Tidehaven ISD, Sweeny ISD, Van Vleck ISD and Wharton ISD. There is also one private school within the study area under the Shekinah Rediance Academy called West Columbia Charter School. There was a total of 37 schools identified within the study area (TEA 2017).

2.1.1.2 Planned Land Use

The planned land use component identifies objectives and policies regarding land use goals and plans, including conservation easements, managed lands and proposed developments. Communities typically prepare comprehensive land use plans to provide strategic direction for the individual community. The websites for the study area counties were reviewed and correspondence was submitted to local city and county officials to identify any planned land use conflicts. The City of Lake Jackson has a Comprehensive Master Plan intended to guide future development, redevelopment and community enhancement efforts over the next 20 years (City of Lake Jackson 2016). No other comprehensive land use plans were identified within the study area.

Conservation Easements

A conservation easement is a restriction that 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. The land trusts facilitate the easement and ensure compliance with the specified terms and conditions.

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 databases for conservation easements within Texas indicated eight conservation easements within the study area. Five of the easements are held by the US Natural Resource Conservation Service ("NRCS") under the Wetlands Reserve Program, with one of those under the Agricultural Conservation Easement

Program Wetland Reserve Easement ("ACEP-WRE"). Two of the easements are held under Ducks Unlimited, and one of the easements is held under the TLC (NCED 2017).

2.1.1.3 Agriculture

The agriculture classification represents a combination of irrigated and non-irrigated cultivated row crops, which are primarily corn, cotton, hay and sorghum. Agricultural areas are further divided into pasture and cultivated crops based on aerial photography interpretation and reconnaissance surveys. Pasture areas are typically comprised of grasses, legumes or grass-legume mixtures planted for livestock grazing, or the production of seed or hay crops, typically on a perennial cycle. Cultivated crops are areas used for the production of annual row crops and perennial woody crops, such as orchards and vineyards.

Agriculture has a significant influence on the economy throughout Texas and the study area counties have active agricultural sectors. According to the United States Department of Agriculture's ("USDA") National Agricultural Statistics Service's 2012 Census of Agriculture, the total market value for agricultural products sold within the three study area counties was $621,576,000, an increase of 55 percent over the 2007 market value. All of the three study area counties experienced an increase of total market value of agricultural products from 2007 to 2012. Crop sales accounted for the majority of agricultural sales in all of the study area counties. The number of farms in the study area counties increased from 4,989 in 2007 to 5,500 in 2012 (a 10 percent change) (USDA 2012). Detailed agricultural information for the study area counties is provided in Table 2-1.

TABLE 2-1 AGRICULTURE

COUNTY	TOTAL MARKET VALUE OF AGRICULTURAL PRODUCTS			DISTRIBUTION OF PRODUCTS (2012)		NUMBER OF FARMS		
	2007	2012	Change	Crop Sales	Livestock Sales	2007	2012	Change
Brazoria County	$55,123,000	$118,236,000	114%	61%	39%	2,580	3,091	20%
Matagorda County	$106,756,000	$129,703,000	21%	59%	41%	903	856	-5%
Wharton County	$240,197,000	$373,637,000	56%	72%	28%	1,506	1,553	3%

Source: USDA 2012.

2.1.1.4 Oil and Gas Facilities

Oil and gas well data was obtained from the Railroad Commission of Texas ("RRC") (RRC 2017) and digitized by POWER to create 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 holes and sidetrack well surface locations. Multiple pipelines were identified throughout the study area (RRC 2017).

2.1.1.5 Transportation/Aviation/Utilities

Transportation

Federal, state and local roadways were identified using TxDOT county transportation maps, Texas Natural Resource Information System ("TNRIS") data and field reconnaissance surveys. The roadway transportation system within the study area includes the following major roadways: SHs 35, 36, 60, 227, 288 and 332. The roadway transportation within the study area also includes the following FMs: 521, 522, 523, 524, 1162, 1301, 1459, 1468, 1495, 1728, 2004, 2175, 2431, 2540, 2611, 2668, 2852, 2918 and 3156 (TxDOT 2017a). Numerous county and local roads (paved and unpaved) were also identified.

The TxDOT's "Project Tracker" which contains detailed information by county for every 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 several roadway projects located within the study area. In Brazoria County, there are five roadway maintenance and repair projects, one roadway widening project, one project to add shoulders, one project to repair safety objects and one project to replace a bridge deck within the study area. The roadway widening project is along SH 36 and extends the entire length of the highway through the study area. SH 36 will be widening to a four-lane divided roadway and construction is scheduled to begin in 5 to 10 years. In Matagorda County, there are five roadway maintenance and repair projects, two projects to replace bridges, two projects to repair safety objects and one project to add shoulders within the study area. In Wharton County, there are two projects to replace bridges and one project to repair safety objects within the study area (TxDOT 2017b).

The railroads identified within the study area include the Atchison, Topeka and Santa Fe Railway located along SH 60 in the northwestern portion of the study area. The Southern Pacific Railroad line is located along portions of FM 35 in the western portion of the study area, and the Missouri Pacific Railroad is also in the western portion of the study area heading into Bay City. The Union Pacific Railroad Company has a railroad located in the central portion, through the cities of Sweeny and Brazoria, and eastern portion of the study area, through the cities of Lake Jackson, Clute and Freeport (TxDOT 2017b).

Aviation

POWER reviewed the Houston Sectional Aeronautical Chart (FAA 2017a) and the Chart Supplement for the South Central US (formerly the Airport/Facility Directory) (FAA 2017b) 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 Houston Sectional Aeronautical Chart, 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.

Two public-use FAA registered airports were identified within the study area, Bay City Regional Airport and Texas Gulf Coast Regional Airport (FAA 2017b). 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 2017b).

In addition, POWER also reviewed the FAA database (FAA 2017c), 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 seven private-use airstrips and four private-use heliports identified within the study area.

The Bay City Non-Directional Beacon was identified within the study area. This is a ground-based, low frequency radio transmitter used as an instrument approach for airports and offshore platforms (SAC 2018).

Utilities

Utility features inventoried include existing electrical transmission lines, pipelines, water wells and water tanks. Data sources used to identify existing electrical transmission lines include utility company and regional system maps, PLATTS data (PLATTS 2017), aerial imagery (NAIP 2014-2018), USGS topographic maps, additional available planning documents and field reconnaissance surveys. Transmission lines identified include four 345 kV transmission lines, approximately twelve 138 kV transmission lines and approximately fourteen 69 kV transmission lines. Distribution lines are prevalent throughout the developed portions of the study area; however, these features were not mapped or inventoried because they were not potential overbuilding opportunities for a 345 kV transmission line.

Numerous water wells are also located throughout the study area (Texas Water Development Board ["TWDB"] 2017a).

2.1.1.6 Communication Towers

Review of the Federal Communication Commission ("FCC") database indicated that no AM radio transmitters are located within the study area. The FCC did indicate that there are 231 FM radio transmitters/microwave towers/other electronic installations within the study area (FCC 2017).

2.1.2 Socioeconomics

The following is a description of the socioeconomic patterns related to population and employment in Brazoria, Matagorda and Wharton Counties, Texas. The trend analysis is based upon the most recent United States Census Bureau ("USBOC") information for the years 2000 and 2010 (USBOC 2000 and 2010).

2.1.2.1 Population Trends

Brazoria and Wharton Counties experienced a population increase of 30 percent and 0.2 percent, between 2000 and 2010 respectively, while Matagorda County experienced a population decrease of three percent. By comparison, population at the state level increased by nearly 21 percent from 2000 to 2010 (USBOC 2000 and 2010).

According to TXSDC projections, all three study area counties are projected to experience population growth during the next 30 years. The largest population increase for 2010 to 2020 between the three counties is projected to be in Brazoria County, at 19 percent. The population increase for 2020 to 2030 and 2030 to 2040 in Brazoria County is projected to be at 18 percent and 17 percent, respectively. In Matagorda County the population increase for 2010 to 2020, 2020 to 2030 and 2030 to 2040 are projected to be at seven percent, six percent and four percent, respectively. In Wharton County the population increases for 2010 to 2020, 2020 to 2030 and 2030 to 2040 are projected to be at six percent, six percent and three percent, respectively. By comparison, the population of Texas is expected to experience population increases of 15 percent, 13 percent and 12 percent over the next three decades, respectively (TXSDC 2014). Table 2-2 presents the past population trends and projections for the study area counties and for the state of Texas.

TABLE 2-2 POPULATION TRENDS

STATE / COUNTY	PAST		PROJECTED		
	2000	2010	2020	2030	2040
Texas	20,851,820	25,145,561	28,813,282	32,680,217	36,550,595
Brazoria County	241,767	313,166	372,259	438,727	512,195
Matagorda County	37,957	36,702	39,448	41,823	43,482
Wharton County	41,188	41,280	43,551	45,988	47,559

Sources: USBOC 2000 and 2010; TXSDC 2014.

2.1.2.2 Employment

From 2000 to 2015, the civilian labor force ("CLF") in all three study area counties increased. Brazoria County saw an increase in its CLF from 2000 to 2015 of 45 percent (50,240 people). Matagorda County saw an increase in CLF of three percent (519 people). Wharton County saw an increase in its CLF of seven percent (1,222 people). By comparison, the CLF at the state level grew by 32 percent (3,175,771 people) over the same time period (USBOC 2000 and 2015). Table 2-3 presents the CLF for the study area counties and the state of Texas for the years 2000 and 2015.

Between 2000 and 2015, only one of the study area counties experienced an increase in their unemployment rate. The unemployment rate for Wharton County increased from a low of 6.0 percent in 2000, to a high of 6.6 percent in 2015. Matagorda County experienced a decrease in unemployment from 8.4 percent to 6.4 percent during the same period. Brazoria County's unemployment rate remained the same from 2000 to 2015, at 5.4 percent. By comparison, the state of Texas also experienced a small increase in the unemployment rate over the same period. The state's unemployment rate increased from 6.1 percent in 2000, to 7.0 percent in 2015 (USBOC 2000 and 2015). Table 2-3 presents the employment and unemployment data for the study area counties and the state of Texas for the years 2000 and 2015.

TABLE 2-3 CIVILIAN LABOR FORCE AND EMPLOYMENT

STATE/COUNTY	2000	2015
Texas		
Civilian Labor Force	9,830,559	13,006,330
Employment	9,234,372	12,094,262
Unemployment	596,187	912,068
Unemployment Rate	6.1%	7.0%
Brazoria County		
Civilian Labor Force	112,798	163,038
Employment	106,662	154,290
Unemployment	6,136	8,748
Unemployment Rate	5.4%	5.4%
Matagorda County		
Civilian Labor Force	16,434	16,953
Employment	15,054	15,874
Unemployment	1,380	1,079
Unemployment Rate	8.4%	6.4%
Wharton County		
Civilian Labor Force	18,682	19,904
Employment	17,563	18,584
Unemployment	1,119	1,320
Unemployment Rate	6.0%	6.6%

Source: USBOC 2000 and 2015.

2.1.2.3 Leading Economic Sectors

The major occupations in Brazoria County in 2015 are listed under the category of management, business, science and arts, followed by the category of sales and office. The major occupations in Matagorda County in 2015 are listed under the category of sales and office, followed by the category of management, business, science and arts. The major occupations in Wharton County in 2015 are listed under the category of management, business, science and arts, followed by the category of sales and office (USBOC 2015). Table 2-4 presents the number of persons employed in each occupation category during 2015 in the study area counties.

TABLE 2-4 OCCUPATIONS IN THE COUNTIES WITHIN THE STUDY AREA

OCCUPATION	BRAZORIA COUNTY	MATAGORDA COUNTY	WHARTON COUNTY
Management, business, science and arts	63,303	3,568	5,061
Service	22,017	3,235	3,620
Sales and office	32,302	3,771	3,725
Natural resources, construction and maintenance	16,965	2,740	3,245
Production, transportation and material moving	19,703	2,560	2,933

Source: USBOC 2015.

In 2000 and 2015, the industry groups employing the most people in all three study area counties were educational services, health care and social assistance. Table 2-5 presents the number of persons employed in each of the industries in the study area counties for the years 2000 and 2015.

TABLE 2-5 INDUSTRIES IN THE COUNTIES WITHIN THE STUDY AREA

INDUSTRY GROUP	BRAZORIA COUNTY		MATAGORDA COUNTY		WHARTON COUNTY	
	2000	2015	2000	2015	2000	2015
Agriculture, forestry, fishing and hunting and mining	2,351	3,858	1,223	975	2,025	2,289
Construction	12,264	13,949	1,758	1,590	1,056	1,640
Manufacturing	19,170	22,244	1,673	1,766	2,546	1,709
Wholesale trade	3,644	3,783	411	355	778	726
Retail trade	10,957	14,844	1,661	1,631	1,887	2,268
Transportation and warehousing and utilities	6,004	7,533	1,730	1,716	910	964
Information	1,914	2,230	112	65	229	113
Finance and insurance and real estate and rental and leasing	5,652	7,179	587	534	764	738
Professional, scientific and management and administrative and waste management services	8,658	16,337	827	1,483	858	1,196
Educational services and health care and social assistance	19,341	36,995	2,907	3,259	3,958	4,425
Arts, entertainment and recreation and accommodation and food services	6,111	10,628	775	1,328	923	992
Other services, except public administration	4,963	7,105	644	883	928	982
Public administration	5,633	7,605	746	289	701	542

Source: USBOC 2000 and 2015.

2.2 RECREATIONAL AND PARK AREAS

Recreational, park and preservation areas were identified through state, federal and local agency websites, county documents and reconnaissance surveys. This category primarily includes existing areas that are:

- Dedicated as park land or open space by a governmental body, an organized group, club or church;
- Recognized as nationally or regionally significant preservation or recreation areas; or
- Formally designated unique or undisturbed natural areas.

Federal and state databases searches 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 parks or recreational areas.

2.2.1 National/State/County/Local Parks

No national or state parks were identified within the study area (National Parks Service [“NPS”] 2017a; TPWD 2017a).

Two Brazoria County parks were identified within the study area. Hanson Riverside County Park is located on SH 35 along the San Bernard River, and offers a large covered pavilion, picnic tables, an observation tower, playground, fishing pier, canoe launch, extended trail system, paved parking areas and restrooms. Buffalo Camp County Park is located in the Buffalo Camp subdivision, at the corner of Otter Trail and Deer Trail, and offers a large covered pavilion, picnic area, playground, walking trail and paved parking area (Brazoria County 2017). One Matagorda County park was identified within the study area. Matagorda County Birding Nature Center is located on SH 35 along the Colorado River, and offers bird watching, six botanical gardens, walking trails and golf cart rentals (MCBNC 2017).

The Bay City Country Club, located in Matagorda County along SH 35, offers a nine-hole golf course, pro shop, tennis courts and club restaurant. The Freeport Golf Club, located in Brazoria County along CR 217, offers an 18-hole golf course, pro shop and practice facilities. The Rio Colorado Golf Club, located in Matagorda County along Riverside Road, offers an 18-hole golf course, pro shop and practice facilities. The Wilderness Golf Course, located in Brazoria County along SH 332, offers an 18-hole golf course, pro shop and practice facilities. Additional small city parks and school recreational areas were identified throughout the study area, as shown in Table 2-6.

TABLE 2-6 RECREATIONAL AND PARK AREAS WITHIN THE STUDY AREA

NAME/ASSOCIATION	DESCRIPTION
BAY CITY	
Amistad Park	Baseball field, basketball court, playground, pavilion and restrooms
Bay City Park	Soccer fields and restrooms
Baseball Park 1	Baseball fields
Community Park	Baseball fields, restrooms and tennis courts
Duncan Park	Playground, basketball courts, volleyball, horseshoe pits, pavilion and picnic area
Gusman Park	Memorial and oak trees
Hardeman Park	Football fields, skate park, walking trail and restrooms
Henderson Park	Basketball court
Highland Park	Playground and picnic areas
Hilliard Pool	Pool, concession stand and restrooms
Le Tulle Park	Pavilions, lakes, playgrounds, picnic areas and 18-hole disc golf course
Liberty Park	Gazebo and picnic area
Mary Withers Runnells Park	Volleyball courts, tennis courts and picnic areas
Riverside Park	Playground, walking trails, boat ramp, camp ground, restrooms and covered picnic area
Sports Complex	Softball fields
Valiant Pool	Pool, concession stand and restrooms
BRAZORIA CITY	
American Legion Hall	Pavilions for rent, train caboose, playground and restrooms
Lion's Club Park	Playground and covered picnic area
Wilson City Park	Playground, basketball court and covered picnic area

TABLE 2-6 RECREATIONAL AND PARK AREAS WITHIN THE STUDY AREA

NAME/ASSOCIATION	DESCRIPTION
CLUTE	
Broaddus Park	Playground, basketball court and picnic areas
Clute Municipal Park	Playground, basketball court, pavilions, horse shoe pits, outdoor stage, foot bridges, picnic areas, pool, fitness center and event center
Cobb Field	Soccer fields and concession stand
Hardy Park	Basketball court, swings and picnic area
Stratton Ridge Sportsplex	Softball fields, soccer field and playground
Wilson Park	Playground, basketball court, pavilion and picnic area
FREEPORT	
Arrington Park	Playgrounds, basketball court and picnic area
Freeport Community House	Pavilion for rent
Freeport Community House Boat Ramp	Boat ramp
Freeport Municipal Park	Basketball courts, walking trail and playgrounds
Freeport Municipal Park Boat Ramp	Boat ramp and fishing pier
Freeport Recreation Center	Swimming, basketball, volleyball, badmitton and aerobics
Peppermint Park	Playgrounds, backstop and picnic area
Riverside Ball Park	Baseball Fields
Stephen F. Austin Park	Softball Fields, basketball courts and playground
Veteran's Memorial Park	Memorial pavers and reflection area
LAKE JACKSON	
Bluebonnet Park	Benches and open space
Brazos Oaks Park	Playground, backstop and picnic area
Brazoswood Key Club Park	Playground and picnic area
Captain R.R. Terry Park	Playground
Class "C" Parks	Various open spaces
Cottonwood Park	Open Space
Dow Centennial Bottomlands Park	Bottomland forest
Dunbar Park	Dis Golf Course, kayak/canoe launch, football field, pavilion, picnic areas, playground, restrooms and soccer fields
Firemens Park	Playground, bike rack and picnic area
Garland Park	Tennis courts, playground, bike rack and picnic area
Huisache Park	Playground and basketball court
James F. Crews Park	Walking path and open space
Jasmine Park	Tennis courts, playground, meeting hall, picnic area and restrooms
Junior Service League Park	Playground and picnic area
Lake Jackson Recreation Center	Gymnasium and racquetball courts
Lloyd Morrison Park at Shy Pond	Fishing pier, pond, playground, pavilion, restrooms and picnic areas
MacLean Park	Fitness trail, basketball court, pavilion, playground, sand volleyball courts, soccer fields, tennis court, softball fields, restrooms, stage with lighting and picnic areas
Madge Griffith Park	Baseball field, pee wee fields, softball fields, playground, pool and picnic areas
Pecan Park	Playground and picnic area
Plantation Oaks Park	Playground and picnic area
Shadow Glen Park	Playground
Suggs Park	Baseball fields, concession stand and restrooms
Timbercreek Park	Playground
Wilderness Park	Hiking trail, boat ramp and picnic area
Yaupon Park	Open space and picnic area
RICHWOOD	
Richwood Municipal Park	Playground, baseball field, soccer field, tennis court, pavilion, gazebo, back stops and walking trail
Bobby Ford Park	Playground, walking trail, basketball court and picnic area

TABLE 2-6 RECREATIONAL AND PARK AREAS WITHIN THE STUDY AREA

NAME/ASSOCIATION	DESCRIPTION
SWEENY	
Backyard Park	Playground, sand volleyball court, RV connections, pavilion, restrooms and picnic area
Anderson Park	Playground and gazebo
Martin Luther King Park	Playground, basketball court and picnic area
Compost Park	Open space
WEST COLUMBIA	
First Capital Park	Softball field, pool, volleyball, horseshoes, washers, soccer field, playground, walking trail, pond and fishing pier and pavilion
Loggins Park	Playground and picnic area
Robert R. Dixon Memorial Unity Park	Playground and basketball court

Source: City of Bay City 2017; City of Brazoria 2017; City of Clute 2017; City of Freeport 2017; City of Lake Jackson 2017; City of Richwood 2017; City of Sweeny 2017; City of West Columbia 2017.

The Justin Hurst Wildlife Management Area ("WMA") is located within the study area, west of Freeport near Jones Creek in Brazoria County. The Area has approximately 11,938 aces and offers biking, fishing, hiking, hunting and wildlife viewing (TPWD 2017b). The Nannie M. Stringfellow WMA is also located within the study area, west of Freeport and the San Bernard River. The Area has approximately 3,664 acres and offers special hunts and wildlife viewing (TPWD 2017c).

The San Bernard National Wildlife Refuge ("NWR") is located within the study area, west and northwest of Freeport and the San Bernard River. The Refuge has approximately 54,000 acres and offers wildlife watching, photography, hunting, fishing and environmental education programs (USFWS 2017).

Additional recreational opportunities, including hunting and fishing, may occur on private properties within the study area. However, these are not typically considered to be open to the general public.

2.2.2 Wildlife Viewing Trails

A review of the TPWD Great Texas Wildlife Trails Great Texas Coastal Birding Trail – Upper Texas Coast indicated that a portion of the study area is located within three driving loops. The Brazoria Loop offers seven viewing sites within the study area. These sites include: Varner-Hogg Plantation State Historic Site, Hanson Riverside County Park, Lake Jackson Wilderness Park, Gulf Coast Bird Observatory, Dow Centennial Bottomlands Park, Sea Center Texas and Brazosport Nature Center and Planetarium Nature Trail. The San Bernard Loop offers two viewing sites within the study area. These sites include: San Bernard NWR and the Justin Hurst WMA. The Matagorda/Rio Colorado Loop offers one viewing site within the study area, the Matagorda County Birding and Nature Center (TPWD 2017c).

2.3 HISTORICAL AND AESTHETIC VALUES

Section 37.056(c)(4)(A)-(D) of PURA incorporates historical and aesthetic values as a consideration when evaluating the routing of proposed electric transmission facilities. The THC and TARL maintain records of known cultural resources (archeological, architectural and cemeteries) and of previous field investigations. Information from the THC and TARL databases was reviewed and shapefiles showing the locations of all previously documented archeological resources was requested in order to identify potential cultural resource constraints within the study area. 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, architectural resources and cemeteries.

Archeological Resources are locations where human activity has measurably altered the earth or left deposits of physical remains (e.g., burnt rock middens, stone tools, petroglyphs, house foundations, bottles). Archeological resources can date to either prehistoric times or the historic era.

Architectural Resources include standing buildings (e.g., houses, barns, outbuildings) and intact structures (e.g., dams, canals, bridges, roads, silos).

Cemeteries are places of intentional human interment and may include large public burial grounds with multiple burials, small family plots with only a few burials or individual grave sites. In some instances, cemeteries may be designated as Historic Texas Cemeteries ("HTCs"). HTCs include cemeteries that have been officially added to the THC records and are recognized with a Texas Historical Marker. Other cemeteries may have been documented as part of the THC's Record, Investigate and Protect ("RIP") program and have been assigned a designation number (e.g., C-0249).

2.3.1 Cultural Background

The project area is located within the Southeast Texas archeological region (Patterson 1995; Story et al. 1990; Perttula 2004) within the THCs Eastern Planning Region and Central & Southerm Planning Region (Mercado-Allinger et al. 1996) (Figure 2-2). Very generally, the sequence of recognized archeological manifestations in southeast Texas has been divided into three periods: Paleoindian, Archaic and Late Prehistoric or Ceramic periods. These cultural periods are roughly equivalent to broad patterns of environmental change, described by Aten (1983). These patterns are the Late Glacial (12,000 to 9,000 years before present ["B.P."]), post-Pleistocene adaptations that resulted in a shift in economic orientation and an increasing population (9,000 to 3,000 B.P.) and lastly, essentially modern environmental conditions which developed approximately 3,000 B.P. Ricklis (2004) proposes a prehistoric cultural

sequence for southeast Texas consisting of four occupational periods: Paleoindian (ca. 11,500 to 8,000 B.P., Archaic (ca. 8,000 to 1,500 B.P. [inland], 5,000 to 2,220 B.P. [coastal]) and the Ceramic Period (ca 2,000 to 300 B.P.).

2.3.1.1 Paleoindian Period

The earliest well-established human occupations of North America are referred to as Paleoindian. Isolated Paleoindian chipped stone projectile points, typed as Clovis, have been found on the upper Texas coast in surficial or mixed contexts (Hester 1980; Patterson 1980; Wheat 1953). Story et al. (1990) summarized the distribution and context of Paleoindian remains in southeast Texas and found that, except for well inland of the modern coastline, Paleoindian artifacts on the upper Texas coast are from disturbed or secondary contexts.

Aten (1983:116-117) estimates that during the Paleoindian period, the coastline of the Gulf of Mexico was between 30 and 40 kilometers seaward of its present location. Woodlands covered much of the upper Texas coast and probably extended onto the now submerged continental shelf. Most of the archeological sites dating to this period may lie offshore, be deeply buried in the terraces of major streams, or have been obliterated by Holocene erosion (Abbot 2001; Hester 1980). Because such limited data exist for the Paleoindian period in this area, only certain assumptions can be made regarding Paleoindian cultural development in the region. The presence of large projectile points suggests that hunting large mammals was undoubtedly an important component of the subsistence strategy, although a collection of readily available plant foods probably also contributed to the diet (Collins 2002). Environmental changes that brought about the extinction or dislocation of Rancholabrean megafauna triggered a shift away from Paleoindian adaptations toward a broad-based subsistence orientation termed Archaic (Aten 1983; Willey and Phillips 1958).

0 30 60 120 180 240

Miles

Source: Mercado- Allinger et. al., 1996

Legend

Cultural Resource Planning Region Boundary

County Boundary

BAILEY TO JONES CREEK PROJECT

FIGURE 2-2

LOCATION OF STUDY AREA IN RELATION TO THE CULTURAL RESOURCE PLANNING REGIONS OF TEXAS

POWER ENGINEERS

Date: 6/26/2018

CenterPoint Energy

2.3.1.2 Archaic Period

Probably the most prominent characteristic of the Archaic period is that it epitomizes the foraging lifestyle. The Archaic period on the upper Texas coast is marked by sea-level rise and climatic fluctuation in the middle to late Holocene, from ca. 9,000 to 1,850 B.P. (Aten 1983). Ricklis (2004) frames the Archaic period in southeast Texas in terms of inland and coastal adaptations. Inland, the Archaic period generally extended from 8,000 to 1,500 years ago. Numerous sites dating to this period have been found along primary streams throughout the region and contain stone projectile points that are diverse and reduced in size from the earlier Paleoindian period. These dart points also tend to be made of poorer quality local resources suggesting reduced group mobility and tighter group territories. A lack of faunal and botanical remains at inland archeological sites precludes inferring more than a generalized hunting and gathering subsistence system.

Well-established cemeteries also appear in the archeological record of inland southeast Texas by the middle Archaic (ca. 6,000 to 3,000 B.P.) (Ricklis 2004; Story 1985). Excavation of Site 41AU36 on the lower Brazos River revealed a cemetery in use from the middle Archaic through the early Ceramic period (Hall 1981). By the late Archaic (ca. 3,000 to 1,500 B.P.), cemeteries increased substantially in size and most burials contained a diverse array of grave goods (Ricklis 2004). Story (1985) suggests that the abundance of cemeteries on the western margin of the coastal prairie zone indicates increased territoriality amongst groups in response to an ever-increasing population. Hall (2000) posits that highly productive environments such as river valley bottoms and the floodplains of major streams were home to an aggregate of resources that were predictable, concentrated and fixed on the landscape. Such resources allowed late Archaic groups to operate within smaller, more exclusive territories.

The Archaic period on the upper Texas coast extended from about 5,000 to 2,200 years ago (Ricklis 2004). However, very few intact early Archaic components are known from this region and Aten (1983) and Story (1985) suggest the inland margin of the coastal plain may have been occupied more intensely than the coast as sea levels rose during the early Archaic. The coastline reached its current location between 7,000 and 5,000 B.P. (Aten 1983) and the earliest known shell middens in the area date to this period (Howard et al. 1991). Coastal Archaic sites that have been tested or excavated near the modern shoreline generally consist of shell-bearing sites with lithic tools and debitage, shell and bone tools and the bones of fish, mammals and reptiles (Story 1985).

Beginning around 3,000 years B.P., subsistence systems increasingly focused on coastal zone resources (Aten 1983; Story et al. 1990), following the establishment of relatively stable sea levels and essentially modern, highly productive estuaries (Ricklis 2004). Aten (1979 and 1983) hypothesized the establishment

of seasonal rounds, including regular movements from littoral to inland areas during the late Archaic. Historic native groups have been demonstrated to move in a yearly round from small, dispersed band-sized or less groups during the warm seasons to aggregated villages during the colder months (Aten 1979; Newcomb 1961).

2.3.1.3 Ceramic Period

Pottery first appeared in southeast Texas along the coast around 2,000 years B.P., ushering in the Early Ceramic period. Based on stylistic elements and the progressively earlier dated occurrences as one moves eastward, they arrived in the region via diffusion from Louisiana or the Lower Mississippi River Valley, suggesting an increasing interregional influence from neighboring groups (Aten 1979; Ricklis 2004). There were no apparent major shifts in lifeways during the early years after pottery was introduced. The contents of shell-bearing sites along the upper Texas coast during the Early Ceramic period vary little from the late Archaic shell middens, except for the addition of pottery and a few evolving dart point types, primarily Gary and Kent types (Ricklis 2004). Discrete cemeteries located close to major streams continue to enforce the notion of well-established group territories in response to increasing populations (Aten 1983). Ceramics appeared in inland southeast Texas several centuries later (Aten 1979: 425) and most likely disseminated from the coastal zone where sandy-paste wares had become commonplace (Ricklis 2004).

2.3.1.4 Late Prehistoric Period

Around 1,300 B.P., small, light, straight and expanded stem arrow points began to appear in archaeological assemblages, indicating the introduction of the bow and arrow – a hallmark of the Late Ceramic Period, often referred to as the Late Prehistoric Period, in southeast Texas. Findings at the Mitchell Ridge site on Galveston Island suggest that the Late Ceramic period in the region can be divided into two sub-periods. The initial Late Prehistoric is associated with the introduction of the bow and arrow as evidenced primarily by the presence of Scallorn arrow points. The end of the Late Ceramic period in southeast Texas correlates with changes taking place throughout much of Texas. These changes include the appearance of bison bone in archaeological assemblages around 700 to 800 years B.P. in association with a variety of stone tools. Stone tools associated with the appearance of bison include Perdiz arrow points, thin bifacial knives, expanded base drills and perforators and unifacial end scrapers. The occurrence of bison bone with these tools suggests a significant shift towards reliance on bison and other large game hunting and the processing of meat and hides (Ricklis 2004).

Ceramics in the region continued to evolve during the Late Prehistoric period. Grog and bone tempering were introduced and decorative elements become more elaborate. The change in external design elements

along the upper Texas coast reflects those of various types of the Coles Creek-Plaquemine sequence occurring in coastal Louisiana and the Lower Mississippi River Valley, suggesting a continued interaction with groups from the east (Ricklis 2004).

2.3.1.5 Historic Period

European contact in the region began in the early sixteenth century with the landing of Cabeza de Vaca and his ill-fated party on the Texas coastline in 1528. It is believed that his party crossed Oyster Creek, Old Caney Creek, and the Brazos and San Bernard rivers in their quest for provisions. More long-term contacts resulting from permanent European settlement did not directly impact aboriginal lifeways in southeast Texas until the early eighteenth century (Patterson 1995), although diseases introduced by explorers and early traders had begun to affect Native American populations in Texas by the sixteenth century (Ewers 1974). Skirmishes with colonists resulted in the expulsion of most of the native population by 1850 (Kleiner 2017a).

Anglo-American settlement in the Brazoria and Matagorda County areas began in the early 1820s, with the arrival of 89 families of Austin's Old Three Hundred (Kleiner 2017a and 2017b). The earliest settlements included Velasco (present-day Surfside), Bell's Landing (East Columbia), Columbia and Brazoria (Kleiner 2017a). In 1829, the town of Matagorda was founded at the mouth of the Colorado River as a military post to protect incoming settlers (Kleiner 2017b).

County residents and settlements played important roles in the Texas Revolution, and in May of 1836, Velasco had become the location of the provisional government of the Republic of Texas. Columbia served as the capital of the Republic when sessions of the first Texas Congress met in October 1836, during which Brazoria County and Matagorda County were established as two of the first 23 counties in Texas (Kleiner 2017a and 2017b). The present boundaries of Brazoria County were established with the creation of Fort Bend and Galveston Counties in 1837 and 1838.

As early as the mid-1830s, cotton farms in Brazoria County produced more than 5,000 bales annually and plantation owners in the area became some of the wealthiest in Texas. Cotton and sugar cane plantations in the county relied heavily on slaveholding and by 1860, Brazoria County had 2,027 whites, 5,110 black slaves and six free black residents (Kleiner 2017a). In the study area, the Varner-Hogg and Durazno Plantations are now listed on the NRHP and the Levi Jordan Plantation and the Lake Jackson Plantation are State Antiquities Landmarks (THC 2018b).

Between 1840 and 1856, the city of Matagorda was the second largest port in the state and quickly developed transportation and industry (Kleiner 2017b). The town had a gristmill and a sugar mill. The main agricultural staples in Matagorda County were corn, sugar, cotton and rice; however, cattle and sheep were significant to the economy as well. During the 1850s, cotton production expanded. Plantations were established in the bottomlands on the east side of the Colorado River. Slaves were brought into the area to work these plantations, increasing the number of slaves from 1,208 in 1850 to 2,107 by 1860. The minority white population took steps to keep their control in the area. These measures included a curfew for slaves and free persons of color, and in 1856 served as an excuse to expel the Mexican populations from the county (Kleiner 2017b).

Brazoria and Matagorda Counties voted overwhelming for secession from the United States (Kleiner 2017a and 2017b). During the ensuing Civil War, the Union blockade of the Texas coast severely damaged the economy, blocking cotton from distant markets. Production of cotton did not bounce back from this wartime decline until after 1870. During Reconstruction after the war, the Ku Klux Klan was active in the area (Kleiner 2017a and 2017b). In 1887, white vigilantes from Brazoria, Matagorda and surrounding counties attacked Vann Settlement, a black settlement, in one of the most violent incidents perpetrated by the Ku Klux Klan in the area (Kleiner 2017b).

After the founding of the Matagorda County Rice and Irrigation Company in 1899, the Matagorda County economy became increasingly based on irrigated crops (Kleiner 2017b). The number of acres devoted to rice production reached 60,000 by 1925. The early 1900s also brought about increased influence in national markets and increased immigration after the New York, Texas and Mexican Railways reached Matagorda County. The economy continued to diversify with the discovery of oil and sulfur. Today oil, gas and agriculture continue to be important economic drivers with the major agricultural products being cattle, cotton, rice, sorghum and soybeans (Kleiner 2017b).

The economy of Brazoria County suffered following the Civil War. Principal crops in the county diversified to include corn, grains, sweet and Irish potatoes, fruits, wild grapes, cotton and sugar. Convict labor replaced slave labor, but sugar production never rebounded to previous levels. Cattle have become increasingly important to the local economy since the 1870s (Kleiner 2017a). Oil production began in Brazoria County in the 1900s and sulfur mining began in 1912. Since then, extractive industries have played a major role in the local economy. Manufacturing jobs increased in importance following the establishment of Dow Chemical in 1941 (Kleiner 2017a). The importance of the manufacturing industries today is apparent in and near the study area.

2.3.2 Records Review

Cultural resource 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, 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. 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 record search are summarized in Table 2-7; including the number of previously recorded archeological sites, SALs, cemeteries, HTCs, NRHP-listed properties and OTHMs in the study area.

TABLE 2-7 CULTURAL RESOURCES RECORDED WITHIN THE STUDY AREA

COUNTY	RECORDED ARCHEOLOGICAL SITES	STATE ANTIQUITIES LANDMARKS	NRHP-LISTED PROPERTIES	CEMETERIES	HISTORIC TEXAS CEMETERIES	OTHM
Brazoria	152	10	9	61	8	57
Matagorda	12	1	5	17	0	30
Wharton	1	0	0	0	0	0

Source: THC 2018a and 2018b.

The review of the THSA, TASA (THC 2018a and 2018b) and TARL data indicates that 165 archeological sites have been previously recorded in the study area. Fourteen resources are listed on the NRHP (Table 2-8), including three archeological sites. Eleven State Antiquities Landmarks are designated within the study area, six of which are shipwrecks (including one shipwreck also recorded as an archeological site). Seventy-eight cemeteries are recorded in the study area, eight of which are HTCs and two of which are Recorded Texas Historic Landmarks ("RTHLs"). One cemetery is a designated RTHL and HTC. Eighty-seven OTHMs are recorded in the study area, 18 of which are RTHLs. These cultural resources are discussed in more detail below.

Of the 14 NRHP resources recorded in the study area (Table 2-8), nine are in Brazoria County and five are in Matagorda County. Three of the NRHP resources, the John McCroskey Cabin, the Durazno Plantation and the Varner-Hogg Plantation, have archeological components, recorded as 41BO77,

41BO136 and 41BO133, respectively. The John McCroskey Cabin is an antebellum double log house with associated ruins of a sugar mill and cotton gin. John McCroskey was one of the Old Three Hundred, those settlers that received a grant in Stephen F. Austin's first colony (NRHP 1975). The Durazno Plantation, settled in the 1840s and developed by Stephen F. Austin's nephew, William Joel Bryan, produced sugar, cotton and cattle. Many of the original structures, reminiscent of the antebellum period, were destroyed and what remained was incorporated into later constructions. Original structures include a plantation office and detached kitchen (connected by later constructions), brick cisterns, outbuildings and an unmarked slave cemetery (NRHP 1979a).

TABLE 2-8 NATIONAL REGISTER OF HISTORIC PLACES RESOURCES WITHIN THE STUDY AREA

NRHP REFERENCE NUMBER	PROPERTY NAME	LOCATION	COUNTY	OTHER DESIGNATIONS
91000783	Brazoria Bridge	TX 332	Brazoria	RTHL
10000050	Dow, Alden B. Office and Lake Jackson City Hall	2120 Sixth St., Bay City	Brazoria	
80004081	Durazno Plantation (41BO136)	S of Jones Creek off TX 36, Jones Creek	Brazoria	
91001602	East Columbia Historic District	S. Main St., East Columbia	Brazoria	
4001173	Gazebo for James Richard Marmion	1214 County Road, Sweeney	Brazoria	
75001958	John McCroskey Cabin (41BO77)	Stringfellow Ranch, Cedar Lake	Brazoria	
4001172	Palapa Table for James Richard Marimion	1214 County Road, Sweeny	Brazoria	
76002011	Ammon Underwood House	Main St., East Columbia	Brazoria	RTHL
80004082	Varner-Hogg Plantation (41BO133)	P.O. Box 696	Brazoria	SAL
9000307	Bay City Post Office	2100 Ave. F, Bay City	Matagorda	
6000512	Bay City USO Building	2105 Ave. M, Bay City	Matagorda	
6000927	Hensley-Gusman House	2120 Sixth St., Bay City	Matagorda	
10001223	Judge William Shields Holman House	2504 Ave. K, Bay City	Matagorda	
7000496	South Side Residential Historic District	Bay City	Matagorda	

Source: THC 2017a and 2017b.

The Varner-Hogg Plantation was purchased by Martin Varner in 1824 and used to raise livestock, corn and sugar cane. In 1834, the land was purchased by sugarcane mogul Columbus R. Patton, after which it was known as Patton Place. Slaves built various structures on the property, including the main house, with hand-made brick. After the battle of San Jacinto, Santa Anna was held at the plantation for a short period. The plantation was eventually purchased by Governor James Hogg in hopes of finding oil on the

property (NRHP 1979b). In 1958, it was donated to the state of Texas (Nickles 2010). Prehistoric materials at the site date from the Late Archaic to Ceramic period, including Perdiz and Bulverde projectile points and Goose Creek Plain, Goose Creek Incised and Baytown Plain ceramics. The historic artifacts and structures, including the plantation house and cemetery, date from the 1820s through the mid-1900s (THC 2018b). The site is a SAL and a RTHL (THC 2018b).

Other NRHP properties in the study area are listed for associations with notable individuals and/or their architectural significance. The Ammon Underwood House is representative of Greek revival architecture, built in 1835 to 1836. Ammon Underwood was a Texas revolutionary and legislator. The Brazoria Bridge; Dow, Alden B. Office and Lake Jackson City Hall; East Columbia Historic District; a Gazebo for James Richard Marmion; and a Palapa Table for James Richard Marmion, are also listed NRHP resources in the study area in Brazoria County (THC 2018b). Both the Palapa table and the gazebo are sculptures by Dionicio Rodriguez (NRHP 2004a and 2004b).

NRHP resources in the study area in Matagorda County include the Hensley-Gusman House, a unique example of Queen Anne architectural influences and the Judge William Shields Holman House, a multi-story Queen Anne-style home. The South Side Residential Historic District includes the original Bay City, Texas town plat. The Bay City USO Building and the Bay City Post Office are also NRHP-listed resources in the study area in Matagorda County (THC 2018b).

Of the 165 archeological sites recorded in the study area, 79 are prehistoric in age, 62 are historic and five contain historic and prehistoric components; descriptive information is not available for 19 sites (Table 2-9). Sites 41BO77, 41BO133 and 41BO136 are listed on the NRHP and are discussed above. Sites 41BO140, 41BO165, 41BO172, 41BO229 and 41MG32 have been determined eligible for listing. Eight sites and portions of four sites have been determined ineligible for listing on the NRHP (THC 2018b).

The determined eligible sites include three historic sites, 41BO165, 41BO229 and 41GM32, and two sites with both historic and prehistoric components (41BO140 and 41BO172). Site 41BO165, the Levi Jordan Plantation State Historic Site, dates to the antebellum and Reconstruction periods. Levi Jordan purchased the land for the plantation in 1848 and his slaves built the main house, slave cabins, a brick sugar-house and sugar mill. The plantation produced cotton and sugar cane using slave labor. After the Civil War, many of the freedmen became tenant farmers and continued to work the land. Archeological investigations have been conducted on the main house and the slave quarters. Artifacts associated with domestic activities, including brick, nails, a copper vessel, other metal artifacts and modern debris, have been recovered from the site (Black and Karbula 2015; Karbula et al. 2017; THC 2018b). The majority of

the site is intact, despite impacts from vandals and feral hogs (Black and Karbula 2015; THC 2018b). The Levi Jordan Plantation is a RTHL, SAL and State Historic Site (THC 2018b). Site 41BO229, or the Duff Site, a SAL, is an antebellum plantation with a buried brick cistern and handmade brick fragments reported from the site. Cora (the Caney Creek Wreck), site 41MG32, is a sunken river steam boat (THC 2018b) and is also an SAL.

TABLE 2-9 PREVIOUSLY RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP ELIGIBILITY STATUS	PERIOD	DESCRIPTION
41BO3	Undetermined	Undetermined	No site description
41BO5	Undetermined	Ceramic Period	Shell midden with ceramics
41BO6	Undetermined	Ceramic Period	Shell
41BO7	Undetermined	Historic	Possible historic house
41BO8	Undetermined	Ceramic Period	Shell midden with ceramics and animal bone fragments
41BO9	Undetermined	Ceramic Period	Shell midden
41BO10	Undetermined	Prehistoric	Shell midden
41BO11	Undetermined	Ceramic Period	Shell midden with ceramics and animal bones
41BO12	Undetermined	Ceramic Period	Shell midden with ceramics, animal bone fragments and single burial
41BO13	Undetermined	Ceramic Period	Shell midden with ceramics
41BO14	Undetermined	Ceramic Period	Shell middens with ceramics, debitage, animal bone fragments and a tool fragment
41BO15	Undetermined	Ceramic Period	Shell midden with ceramics, deer and alligator bone
41BO16	Undetermined	Ceramic Period	Shell middens
41BO17	Undetermined	Ceramic Period	Ceramics
41BO18	Undetermined	Ceramic and Historic Period	Shell midden with ceramics, debitage and projectile points, an obsidian projectile point and historic glass
41BO19	Undetermined	Undetermined	No site description
41BO20	Undetermined	Undetermined	No site description
41BO21	Undetermined	Undetermined	No site description
41BO22	Undetermined	Ceramic Period	Campsite with ceramics, animal bone fragments and oyster shells
41BO23	Undetermined	Ceramic Period	Campsite with burned ceramics, animal bone fragments and debitage
41BO24	Undetermined	Undetermined	No site description
41BO30	Undetermined	Ceramic Period	Campsite with shell midden, ceramics and animal bone fragment
41BO31	Undetermined	Ceramic Period	Campsite with animal bone and shells
41BO32	Undetermined	Undetermined	Pumice rock and camel tooth
41BO33	Undetermined	Ceramic Period	Campsite with shell midden
41BO34	Undetermined	Ceramic Period	Campsite with shell midden, ceramics and animal bone fragments
41BO35	Undetermined	Ceramic Period	Extensive shell midden with ceramics, Perdiz and Scallorn projectile points and compound fish hook
41BO36	Undetermined	Undetermined	No site description
41BO37	Undetermined	Undetermined	No site description
41BO50	Undetermined	Ceramic Period	Shell midden with ceramics and deer bones
41BO52	Undetermined	Late Ceramic Period	Campsite with shell midden and ceramics
41BO54	Undetermined	Undetermined	No site description
41BO55	Undetermined	Undetermined	No site description available
41BO56	Undetermined	Undetermined	No site description available

TABLE 2-9 PREVIOUSLY RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP ELIGIBILITY STATUS	PERIOD	DESCRIPTION
41BO57	Undetermined	Undetermined	No site description available
41BO58	Undetermined	Undetermined	No site description available
41BO59	Undetermined	Undetermined	No site description available
41BO60	Undetermined	Undetermined	No site description available
41BO61	Undetermined	Undetermined	No site description available
41BO62	Undetermined	Undetermined	No site description available
41BO63	Undetermined	Undetermined	No site description available
41BO64	Undetermined	Undetermined	No site description available
41BO77	NRHP-listed	Historic Period	McCroskey Log Cabin: Log cabin, cotton gin foundations, brick cistern remains, with sugar mill, cotton gin and cemetery; modern glass, shell and ceramics
41BO79	Eligible; Ineligible	Prehistoric	Campsite with ceramics, lithic flakes, Basal dart fragment, bone awl fragment, animal bone fragments, oyster and rangia shell and charcoal
41BO80	Undetermined	Historic Period	Ellerslie Plantation with structures, foundations and several cisterns
41BO85	Ineligible	Ceramic Period	Shell midden
41BO86	Ineligible	Ceramic Period	Shell midden
41BO87	Undetermined	Ceramic Period	Shell midden
41BO88	Undetermined	Ceramic Period	Shell midden
41BO89	Undetermined	Ceramic Period	Shell midden with animal bone and debitage
41BO90	Undetermined	Ceramic Period	Shell midden with ceramics, animal bone fragments and debitage
41BO91	Undetermined	Ceramic Period	Shell midden
41BO92	Undetermined	Ceramic Period	Shell midden with ceramics
41BO93	Undetermined	Ceramic Period	Shell midden
41BO94	Undetermined	Ceramic Period	Shell midden
41BO95	Undetermined	Ceramic Period	Shell midden with hearths
41BO96	Undetermined	Ceramic Period	Shell midden
41BO97	Undetermined	Ceramic Period	Shell midden
41BO98	Undetermined	Ceramic Period	Shell midden
41BO100	Undetermined	Unknown	Shell midden and charcoal
41BO101	Undetermined	Prehistoric	Shell midden
41BO102	Undetermined	Prehistoric	Shell midden with burned clay and charcoal
41BO103	Undetermined	Ceramic Period	Shell midden with ceramics and animal bone fragments
41BO104	Undetermined	Prehistoric	Shell midden
41BO105	Undetermined	Prehistoric	Shell midden with burned shell and charcoal
41BO106	Undetermined	Prehistoric	Shell midden with burned shell
41BO107	Undetermined	Prehistoric and Historic	Shell midden with glass near the surface of the deposit
41BO108	Undetermined	Prehistoric	Shell midden
41BO109	Undetermined	Ceramic Period and Historic	Foundation remains with historic ceramics and brick fragments and prehistoric ceramics
41BO111	Undetermined	Ceramic Period	Shell midden with, debitage, faunal bones and ceramics
41BO112	Undetermined	Ceramic Period	Shell midden with, ceramics and an oxidized metal pellet
41BO113	Undetermined	Ceramic Period	Shell midden with debitage, animal bones and ceramics
41BO118	Undetermined	Ceramic Period	Shell midden with ceramics and animal bone fragments
41BO119	Undetermined	Ceramic Period	Shell midden with ceramics and charcoal
41BO120	Undetermined	Prehistoric	Shell midden
41BO121	Undetermined	Prehistoric	Shell mound

TABLE 2-9 PREVIOUSLY RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP ELIGIBILITY STATUS	PERIOD	DESCRIPTION
41BO122	Undetermined	Historic Period	Cemetery with multiple grave stones occupied from the 1890s to 1930s
41BO129	Undetermined	Ceramic Period	Shell midden with, debitage, animal bones and ceramics
41BO130	Undetermined	Ceramic Period	Shell midden
41BO131	Undetermined	Ceramic Period	Shell midden
41BO132	Undetermined	Ceramic Period	Shell midden
41BO133	NRHP-listed, SAL	Late Archaic-Ceramic Period and Historic Period	Varner-Hogg Plantation site: structures, burials, refuse pits, glass, historic metal, historic ceramics, perishable fibers, prehistoric ceramics, animal bones and debitage
41BO136	NRHP-listed	Historic Period	Duranzno Plantation: remains of plantation house, slave quarters, sugar mill, slave cemetery, possible Civil War munitions depository and standing kitchen remains
41BO138	Undetermined	Ceramic Period	Shell midden with ceramics, debitage and animal bone fragments
41BO140	Eligible, SAL	Ceramic Period and Historic Period	J.P. Bryan Homestead and shell midden with ceramics, square nails, animal bone fragments, glass, brick foundations including a possible boiler used in ferry operation
41BO141	Undetermined	Historic Period	Historic structure occupied from 1840-1860 with handmade bricks and glass bottle fragments
41BO142	Undetermined	Ceramic Period	Shell midden with ceramics
41BO143	Undetermined	Historic Period	Wharton Family Cemetery associated with a plantation, square nails possibly from a coffin, skull fragments and marble slabs
41BO144	Undetermined	Ceramic Period	Occupation site and shell midden with debitage and tools, two Perdiz points, ceramics, rangia shells, sandstone and animal bone fragments
41BO147	Undetermined	Historic Period	Brick foundation with brick pile and rusted metal scraps
41BO158	Undetermined	Ceramic Period	Shell midden with ceramics and debitage
41BO159	Undetermined	Ceramic Period	Open campsite with clam and terrestrial snail shells and ceramics
41BO160	Undetermined	Ceramic Period	Open campsite with rangia and terrestrial snail shells
41BO164	Undetermined	Historic Period	Mims Plantation and shell midden with house, slave quarters, ferry crossing and cistern
41BO165	Eligible, SAL, THL	Historic Period	Levi Jordan Plantation State Historic Site with a main house, detached kitchen foundation with ceramics, metal, nails, munitions, glass (bottle, jar, chimney lamp, window) and brick fragments (glazed and un-glazed)
41BO169	Undetermined	Ceramic Period	Open campsite with clam and oyster shells
41BO172	Eligible, SAL	Historic Period	Lake Jackson Plantation; pre-civil war plantation with brick structural remains
41BO174	Undetermined	Historic Period	Dance Brothers Gun Factory; Military Arms Manufacturing/Machine Shop and home site with brick foundation, firebox/metal stack and original home
41BO185	Ineligible	Historic Period	Civil War campground and farmstead: cistern, shells, buttons, buckles, metal fragments and bricks and brick fragments
41BO186	Undetermined	Historic Period	House site with silver coin, musket ball, ceramics and a decorated brass hairbrush back
41BO191	Undetermined	Ceramic Period	Shell midden with ceramics and burned and non-burned animal bone fragments

TABLE 2-9 PREVIOUSLY RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP ELIGIBILITY STATUS	PERIOD	DESCRIPTION
41BO192	Undetermined	Prehistoric	Shell concentration
41BO193	Undetermined	Ceramic Period	Shell midden with ceramics and animal bones
41BO196	Undetermined	Historic Period	Engineering structures
41BO201	Undetermined	Ceramic Period and Historic Period	Shell midden with very few prehistoric ceramics and historic to modern dump with structural debris
41BO202	Undetermined, HTC	Historic Period	Pioneer Cemetery: Historic African-American Cemetery with unmarked graves and one grave marker
41BO205	Undetermined	Historic Period	House site with a concrete foundation, well pump housing, wind mill, wooden piers, a metal pipe and a ceramic pipe
41BO211	Undetermined	Ceramic Period	Shell midden
41BO214	Ineligible	Historic Period	Ceramics, glass, metal fragments, modern plastic and animal bones
41BO215	Undetermined	Ceramic Period	Shell midden with burned and unburned shell, charcoal and a possible bone fragment
41BO216	Undetermined	Historic Period	Historic scatter with ceramics, nails, metal and animal bones
41BO219	Ineligible within ROW*	Historic Period	Historic dump associated with a plantation house with transferware ceramics (dark blue, blue, purple), glass, homemade brick, rusted metal and animal bone
41BO220	Ineligible within ROW*	Historic Period	Historic scatter with handmade brick, whiteware and an adjacent historic structure
41BO221	Ineligible within ROW*	Historic Period	Historic trash dump with whiteware, glass, metal and modern trash
41BO222	Undetermined	Historic Period	Bynum Plantation sugar mill with brick walls, foundations, chimne and cisterns
41BO223	Undetermined	Paleo-Indian	Isolated skeletal remains
41BO225	Undetermined	Historic Period	Historic cistern, post holes, pit features, trash scatters with glass, ceramics, metal, bricks and other historic artifacts
41BO226	Undetermined	Historic Period	Confederate gun battery: scatter of hand-made bricks, metal (iron and brass) and glass across three man-made mounds
41BO227	Undetermined	Historic Period	Rock and mortar cattle trough and scatter of historic and modern material
41BO228	Undetermined	Historic Period	Historic farmstead with handmade brick pier foundations, fireplace remnants and chimney fall
41BO229	Eligible; SAL	Historic Period	Duff Site; Pre-Civil War Plantation site with hand-made brick cistern and brick scatter
41BO230	Ineligible	Historic Period	Brick feature: possible chimney, kiln or moonshine still
41BO234	Undetermined	Historic Period	Armstrong cemetery with marked and unmarked graves and a shell concentration
41BO235	Undetermined	Historic Period	Farmstead with buildings, structures, well, cemetery and a scatter of historic and modern trash
41BO236	Undetermined	Historic Period	Farmstead with three standing structures, wells, cistern and trash
41BO237	Undetermined	Historic Period	Farmstead with standing structures, animal pens and historic and modern trash
41BO238	Undetermined	Historic Period	Homestead with burned structural remains and historic trash
41BO241	Undetermined	Ceramic And Historic Period	scatter of brick, glass, metal, historic ceramics and a shell midden with freshwater shell and charcoal

TABLE 2-9 PREVIOUSLY RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP ELIGIBILITY STATUS	PERIOD	DESCRIPTION
41BO243	Undetermined	Historic Period	Scatter with a ceramic tobacco pipe bowl, whiteware, glass (clear and amethyst) round nail and brick
41BO244	Undetermined	Historic/Modern Period	Concrete building rubble
41BO245	Undetermined	Historic/Modern Period	Oil/gas structural remnants with concrete rubble and oyster shells
41BO246	Undetermined	Historic/Modern Period	Scatter with limestone gravels and a butchered animal bone
41BO247	Undetermined	Historic/Modern Period	Oil well (still in use) with modern trash
41BO248	Undetermined	Historic/Modern Period	Trash dump with glass (clear, brown, amethyst), glass bottles and jars of various utility, iron and metal refuse and rubber shoe heel
41BO249	Undetermined	Historic/Modern Period	Homestead with a standing house, collapse shed, chicken coop and trash dump
41BO250	Undetermined	Historic/Modern Period	Trash dump with bottles and jars
41BO251	Undetermined	Modern Period	Outbuilding with brick scatter and modern trash
41BO252	Undetermined	Historic/Modern Period	Structure (possible schoolhouse)
41BO253	Undetermined	Historic Period	Dump with oyster shell and brick fragments
41BO254	Undetermined	Modern Period	Canal and pump house constructed between 1944-1952
41BO255	Undetermined	Historic Period	Plantation and associated outbuildings and features including a pump house, three sheds, a garage, a pig pen, an unidentified outbuilding, ceramics, brick, nails, metal, plastic, glass, animal bone and shell
41BO256	Undetermined, THL	Historic Period	John Sweeny Jr. Cemetery with marked and unmarked graves; associated with Sweeny Jr. Plantation
41BO257	Undetermined	Historic Period	Ranch complex with three standing structures, farm equipment, glass (clear) and mussel shell
41BO258	Undetermined	Ceramic Period	Shell midden with associated debitage
41BO259	Undetermined	Historic Period	Ranch complex with five structures, corrals and a brick cistern
41BO260	Undetermined	Ceramic Period	Shell midden and debitage
41BO262	Undetermined	Modern Period	Domestic site and produce stand
41BO263	Undetermined	Modern Period	Farmstead with four animal shelters/pens, two wells and building materials
41BO265	Undetermined, HTC	Historic Period	Mt. Zion Cemetery; an African-American cemetery with gravestones, a human skull fragment and a square nail
41BO266	Undetermined	Historic	Historic structures and trash with a concrete smoking pit, metal poles, concrete foundation, glass (clear and aqua) and whiteware
41BO267	Undetermined	Ceramic Period	Shell midden with charcoal, ash and debitage
41BO268	Ineligible Within ROW*	Historic Period	Farmstead with an outbuilding, wire nails, faunal bone, concrete, a metal hinge and brick fragments; glass (clear) shards and ceramics
41MG003	Undetermined	Prehistoric	Animal bone fragments and ceramics
41MG031	Undetermined	Historic Period	Brick foundation and remains of sugar cane mill
41MG032	Eligible, SAL	Historic Period	Paddle wheel boat
41MG033	Undetermined	Historic Period	Wooden cabin

TABLE 2-9 PREVIOUSLY RECORDED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

TRINOMIAL	NRHP ELIGIBILITY STATUS	PERIOD	DESCRIPTION
41MG034	Undetermined	Historic Period	19th century plantation site with cemetery, planation house, cotton gin, sugar mill, cotton press and box car telegraph office
41MG041	Undetermined	Ceramic Period	campsite with ceramics clam shell and debitage
41MG053	Undetermined	Ceramic Period	Shell midden with a burned clay ball and fish, rabbit, turtle and deer remains
41MG069	Undetermined	Ceramic Period	Open campsite with ceramics, groundstone, debitage, a Scallon projectile point, marine animal remains, two bone fragments decorated with black paint and charcoal
41MG136	Ineligible	Historic Period	Railroad bed
41MG138	Undetermined	Historic Period	Farmstead with a house and outbuildings
41MG140	Ineligible	Historic/Modern	Farmstead with brick and whiteware scatter
41MG141	Undetermined	Ceramic and Historic Period	Prehistoric campsite with hearth and farmstead with domestic structure; historic glass (clear, milk, amethyst, brown) bottles and window glass, metal (copper, other), ceramics and other historic debris
41WH096	Undetermined	None Undetermined	No site description available

Source: THC 2017b.

Site 41BO140, also known as the J.P. Bryan Homestead is a multicomponent site designated as an SAL. The historic domestic structure is associated with a ferry and commercial landing. A brick foundation, handmade brick fragments, ceramics, iron and steel artifacts associated with structures, window and bottle glass and animal bone fragments are recorded from the site. The prehistoric occupation includes a shell midden. There is evidence of vandalism and burning in recent years and a well on the property has been destroyed from pipeline construction (THC 2018b). Site 41BO172, the Lake Jackson Plantation also contains a shell midden. A projectile point and two ceramic sherds were located under a brick floor of one historic structure at the multi-component site. The historic occupation consists of structures associated with a pre-Civil War sugar and cotton plantation which continued producing sugar with convict labor after the Civil War (THC 2018b).

A total of 78 cemeteries are reported within the study area, eight of which are designated HTCs (see Table 2-10). Pioneer Cemetery (site 41BO202) is a historic African-American cemetery dating from 1888 to 1942. Previous investigations located a buried metal box grave marker and unmarked graves (THC 2018b). Mt. Zion Cemetery (site 41BO265) is also an African-American cemetery with marked and unmarked graves. During previous investigations, a human skull fragment was unearthed at the cemetery (THC 2018b). Sweeny Cemetery (site 41BO256) is a cemetery associated with the Sweeny Jr. Plantation and was used by the slave laborers. There are 67 grave markers, but historical records indicate there are unmarked graves. Phair Cemetery or Hoskin-Phair Cemetery, is also a RTHL and dates from 1853 to the

present. Other HTC-designated cemeteries include the Old Brazoria Cemetery, Old Columbia, Gulf Prairie-Peach Point Cemetery and the Mims Family Cemetery (THC 2015).

TABLE 2-10 CEMETERIES RECORDED WITHIN THE STUDY AREA

THC NUMBER	PROPERTY NAME	COUNTY	DESIGNATION
BO-C002	Pioneer Cemetery (41BO202)	Brazoria	HTC
BO-C003	Hudgins Cemetery	Brazoria	HTC
BO-C012	Zion Temple/Williams Family/Mims-Fannin Plantation	Brazoria	
BO-C014	Old Brazoria Cemetery	Brazoria	HTC
BO-C015	West Columbia Paradise	Brazoria	
BO-C019	Cedar Grove Cemetery-St. Mary's	Brazoria	
BO-C020	Brown Cemetery	Brazoria	
BO-C021	Phair Cemetery	Brazoria	HTC, RTHL
BO-C022	Restwood Memorial Cemetery #1	Brazoria	
BO-C024	Mt. Zion (41BO265)	Brazoria	HTC
BO-C035	Boone Cemetery	Brazoria	
BO-C037	Velasco Cemetery (41BO122)	Brazoria	
BO-C040	Oakland Cemetery/Overcoming Faith	Brazoria	
BO-C042	Jaden	Brazoria	
BO-C048	Aldridge Grave	Brazoria	
BO-C052	Armstrong Cemetery (41BO234)	Brazoria	
BO-C057	Black Family	Brazoria	
BO-C062	Colonial	Brazoria	
BO-C067	Fields Paradise	Brazoria	
BO-C070	Grant Family	Brazoria	
BO-C071	Hagerman Family	Brazoria	
BO-C072	Harris Family Cemetery	Brazoria	
BO-C077	Jerusalem Baptist	Brazoria	
BO-C079	Jordan Family Cemetery	Brazoria	
BO-C084	McGrew	Brazoria	
BO-C085	McNeal-Stone Cemetery	Brazoria	
BO-C087	Nap Neal	Brazoria	
BO-C097	Peaceful Rest Cemetery	Brazoria	
BO-C100	Rainbow Memorial Cemetery	Brazoria	
BO-C101	Robinson Family	Brazoria	
BO-C105	Simpson Family	Brazoria	
BO-C109	Tunstall-NBA Church/Tunstall Family Grave	Brazoria	
BO-C111	White Oak	Brazoria	
BO-C114	Wilson Point Cemetery	Brazoria	
BO-C122	Gulf Coast Cemetery	Brazoria	
BO-C133	Cedar Lawn Haven of Rest	Brazoria	
BO-C136	Brazoria	Brazoria	
BO-C137	Old Columbia	Brazoria	HTC
BO-C139	Wharton-Eagle Island	Brazoria	
BO-C140	Grace Baptist Cemetery	Brazoria	
BO-C142	Gulf Prairie, Peach Point Cemetery, Gulf Prairie-Peach Point Cemetery	Brazoria	HTC
BO-C152	Old Rippe	Brazoria	
BO-C163	St. Paul Baptist	Brazoria	
BO-C165	Mims Family Cemetery	Brazoria	HTC
BO-C172	Chances's Prairie Cemetery 41BO256	Brazoria	

TABLE 2-10 CEMETERIES RECORDED WITHIN THE STUDY AREA

THC NUMBER	PROPERTY NAME	COUNTY	DESIGNATION
BO-C172	Clemens Prison No.2	Brazoria	
BO-C175	Ebenezer-Mills/Mills Family Cemetery	Brazoria	
BO-C178	Fields Family	Brazoria	
BO-C179	Galilee Church	Brazoria	
BO-C180	Glick	Brazoria	
BO-C191	Phillips Family Cemetery	Brazoria	
BO-C193	Roberts	Brazoria	
BO-C194	Roberts (Black)	Brazoria	
BO-C205	Morris	Brazoria	
BO-C207	Neal Family	Brazoria	
BO-C208	Wish	Brazoria	
BO-C211	Gardener Family	Brazoria	
BO-C212	Sweeny African American	Brazoria	
BO-C219	Jones	Brazoria	
BO-C220	Sweeny 41BO256	Brazoria	RTHL
N/A	Cemetery	Brazoria	
MG-C004	Free System Cemetery	Matagorda	
MG-C005	Union Cemetery	Matagorda	
MG-C006	Mathews Cemetery	Matagorda	
MG-C007	Hudgins Cemetery	Matagorda	
MG-C008	Pleasant Green Cemetery	Matagorda	
MG-C009	Williams Cemetery	Matagorda	
MG-C010	Berean Church Cemetery	Matagorda	
MG-C012	unknown (Lake Bowie)	Matagorda	
MG-C013	unknown (Kennedy Sch)	Matagorda	
MG-C015	Unknown	Matagorda	
MG-C016	East End Cemetery	Matagorda	
MG-C017	Bay City Cemetery	Matagorda	
MG-C018	Vine Grove Cemetery	Matagorda	
MG-C019	Andrews Cemetery	Matagorda	
MG-C020	Free System Cemetery	Matagorda	
N/A	St. Mark's Church Cemetery	Matagorda	
N/A	Union Cemetery	Matagorda	

Source: THC 2017a and 2017b.

Of the 87 OTHMs in the study area, 18 are RTHLs (see Table 2-11). Previously mentioned cultural resources that are RTHLs include the Levi Jordan Plantation, the Sweeny Cemetery, the Ammon Underwood House, the Brazoria Bridge and the Hensley-Guzman House. Other notable OTHMs include locations associated with important events in Texas history and individuals and events important to the region's history. The "Columbia – The First Capital of Texas" marker marks the location of the first site of the Capital of Texas (THC 2018a). Nearby, The Dance Gun Shop marker commemorates a shop that produced weaponry for the Confederacy during the Civil War (THC 2018a) and the site of the Old Columbia Hotel, ran by Carry Nation before she moved to Kansas, is commemorated (THC 2018a). The Battle of Jones Creek marker commemorates a skirmish between the Karankawa and a group of men lead by Captain Randal Jones (THC 2018a).

TABLE 2-11 OFFICIAL TEXAS HISTORICAL MARKERS WITHIN THE STUDY AREA

NAME	COUNTY	DESIGNATION
Kilbride-Barkley House	Brazoria	
Adriance, John	Brazoria	
Aldridge-Smith Home	Brazoria	RTHL
Angier, Samuel Tubbs, M.D.	Brazoria	
Austin, John	Brazoria	
Barrett, Don Carlos	Brazoria	
Bell, Thaddus Constantine	Brazoria	
Bell's Landing	Brazoria	
Bethel Presbyterian Church	Brazoria	RTHL
Brazoria Bridge	Brazoria	RTHL
Brazoria Cemetery	Brazoria	
Brazoria Townsite	Brazoria	
The Brazos Canal	Brazoria	
Brown, Major Reuben R.	Brazoria	
Byrom, John S. D.	Brazoria	
Cedar Lake Salt Works	Brazoria	
Columbia Cemetery	Brazoria	
Columbia	Brazoria	
Columbia United Methodist Church	Brazoria	
Dance Gun Shop	Brazoria	
Eagle Island Plantation	Brazoria	
Ellerslie Plantation	Brazoria	
Republic of Texas	Brazoria	
Hazen, Nathaniel C.	Brazoria	
Battle of Jones Creek	Brazoria	
Jordan, Levi, Plantation	Brazoria	RTHL
Long, Jane	Brazoria	
Mosonic Oak	Brazoria	RTHL
McCroskey-Stringfellow House	Brazoria	
McKinstry, George B.	Brazoria	
Carry Nation's Hotel	Brazoria	
Peach Point	Brazoria	RTHL
Phair Cemetery	Brazoria	RTHL
Phillips Family Cemetery	Brazoria	
Rounds, George	Brazoria	
St. John's Lodge No. 5, A.F. & A.M.	Brazoria	
Stringfellow Ranch	Brazoria	
Sweeny, Thomas Jefferson	Brazoria	
Sweeny Cemetery	Brazoria	RTHL
Sweeny Plantation	Brazoria	
Sweeny-Waddy Log Cabin	Brazoria	RTHL
Velasco	Brazoria	
Four Miles Southeast to the Original Town of Velasco	Brazoria	
Velasco Cemetery	Brazoria	
Velasco Lodge No. 757, A.F. & A.M.	Brazoria	
Velasco Methodist Church	Brazoria	
Underwood, Ammon	Brazoria	RTHL
Underwood, Ammon House	Brazoria	RTHL
Weems, M.L., House	Brazoria	
Wharton, William House	Brazoria	
Nash-Wright House	Brazoria	RTHL
Durazno Plantation	Brazoria	

TABLE 2-11 OFFICIAL TEXAS HISTORICAL MARKERS WITHIN THE STUDY AREA

NAME	COUNTY	DESIGNATION
Old Oakland Plantation	Brazoria	
Joseph H. Hawkins	Brazoria	
Tyler-Bryan-Weems House	Brazoria	RTHL
Gulf Prairie Cemetery	Brazoria	
Columbia (First Capital of Texas)	Brazoria	
Bandstand	Matagorda	RTHL
Bay City Library	Matagorda	
Bay City Methodist Church	Matagorda	
Bay City Post Office	Matagorda	
Bethel Baptist Church	Matagorda	
Cedarvale Cemetery	Matagorda	
Moore, D.P. and Louise House	Matagorda	RTHL
Elliot's Ferry	Matagorda	
First Baptist Church of Bay City	Matagorda	
High School, First in Bay City	Matagorda	
First Presbyterian Church of Bay City	Matagorda	
Ingram, Ira, First Speaker of Texas House of Representatives	Matagorda	
Grove Missionary Baptist Church	Matagorda	
Hensley-Guzman House	Matagorda	RTHL
Holman House	Matagorda	RTHL
Matagorda County	Matagorda	
Matagorda, C.S.A.	Matagorda	
Old Bay City Bank	Matagorda	RTHL
Shiloh Missionary Baptist Church	Matagorda	
Caney Post Office	Matagorda	
Early Bay City School	Matagorda	
St. Mark's Episcopal Church	Matagorda	
Daily Tribune and Matagorda County Tribune	Matagorda	
Bell, Josiah Hughes	Matagorda	
First Berrean Missionary Baptist Church	Matagorda	
Site of Hillard High School	Matagorda	
Mount Pilgrim Missionary Baptist Church	Matagorda	
Holy Cross Catholic Church	Matagorda	
Philip H. Parker Post No. 2438, V.F.W.	Matagorda	
Matagorda County	Matagorda	

Source: THC 2017a and 2017b.

Nine shipwrecks are recorded within the study area, six of which are State Antiquities Landmarks, including one that has been determined eligible for the NRHP (see Table 2-12). The Augusta, E.A. Ogden, Hiawatha, Ocean and Cora are riverboat vessels. The Cora, or Caney Creek Wreck, has been mentioned previously and is eligible for the NRHP; the Joe Ed is a freighter; and two of the wrecks are unknown vessels (THC 2018b).

TABLE 2-12 SHIPWRECKS RECORDED WITHIN STUDY AREA

VESSEL NAME	TYPE	LOCATION	DESIGNATION
Augusta	River steamboat	Brazoria	SAL
E.A. Ogden	River steamboat	Brazoria	SAL
Hiawatha	River steamboat	Brazoria	SAL
Joe Ed	Freighter	Brazoria	
Ocean	River steamboat	Brazoria	SAL
Travis	River steamboat	Brazoria	SAL
Unknown	Unknown	Brazoria	
Unknown	Unknown	Brazoria	
Cora (Caney Creek Wreck) 41MG32	River steamboat	Matagorda	SAL

Source: THC 2017b.

A review of the TxDOT historical bridges database indicated that one NRHP-listed bridge and one determined eligible bridge are recorded in the study area The NRHP-listed Bridge is the Brazoria Bridge located on SH 36, spanning the Brazos River Channel. The bridge was constructed in 1939 and was designed by J.D. McKenzie. It significance comes from the bridge's use in connecting SHs 35 and 36 which brought increased commercialization and economic opportunities to Brazoria County. The FM 522 Bridge that crosses the San Bernard River in Brazoria County was determined to be eligible for the NRHP. It was built in 1957 and is an early use of neoprene pads as bearing plates (TxDOT 2018).

Review of the previously recorded cultural resource sites data indicates that the study area has not been examined entirely during previous archeological and historical investigations. Consequently, the records review results do not include all possible cultural resource sites within the study area. To further assess and avoid potential impacts to cultural resources, High probability areas ("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, in addition to soils and geologic data and topographic variables. Native American subsistence was dependent on close proximity to natural features, such as springs and streams, which would provide water and attract game animals. Additionally, backswamps and wetlands afforded access to numerous resources. Areas near these resource-rich areas are considered to have a high potential for prehistoric archeological sites. Terraces and topographic high points near potential sources of water that would provide flats for camping and expansive landscape views affording a hunting or defensive advantage 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. Locations and patterns of distribution for historic-period sites are not readily predictable or

quantifiable and the route analysis process discussed in Section 4.0 considers only recorded sites listed with official state and federal agencies and HPAs developed for prehistoric resources within the study area.

2.3.3 Previous Investigations

According to the TASA (THC 2018b), there have been 207 previously conducted cultural resource investigations within the study area boundaries. Beginning in the 1970s, these surveys were undertaken, for the most part, for the USACE, the United States Environmental Protection Agency ("USEPA") and in advance of oil and gas projects, transportation projects and transmission line projects.

2.3.4 Aesthetic Values

Section 37.056(c)(4)(C) of PURA 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 located within the study area. For the purposes of this study, the term aesthetics is defined by POWER to include the subjective perception of natural beauty in a landscape and measurement of an area's scenic qualities. The visual inventory was conducted by describing the regional setting and determining the viewer sensitivity ratings. 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). POWER considered the following criteria that combine to give an area its aesthetic identity:

- Land form and topography (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 majority of the study area is generally comprised of scattered residential/commercial/industrial development, cropland/rangeland and bottomland hardwoods. The majority of the study area has been impacted by land improvements associated with agriculture, residential structures, industrial facilities,

airstrips, roadways, oil and gas activities and various utility corridors. Overall, the study area viewscape consists of cropland/rangeland and bottomland hardwoods that drain into the rivers and local creeks.

No known outstanding aesthetic resources, designated views, designated scenic roadways or unique visual elements were identified from the literature review or from reconnaissance surveys of the study area. The study area is located within the 28-county Texas Independence Trail Region of the Texas Heritage Trails. The trail runs along SHs 288 and 36 within the study area. The sites of interest include: Varner-Hogg Plantation State Historic Site, Columbia Historical Museum, Gulf Prairie Presbyterian Church and Cemetery, Sea Center Texas, Lake Jackson Historical Museum and Center of Arts and Sciences (THC 2018c).

A review of the NPS website did not identify any Wild and Scenic Rivers, National Parks, National Monuments, National Historic Sites, National Historic Landmarks, National Historic Trails or National Battlefields within the study area (NWSRS 2017; NPS 2018b and 2018c).

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

For this study, the potential visual impacts considered for the Project were limited to line-of-sight views within the immediate foreground (one-half mile, unobstructed) from points located on federal and state highways, FM roads and recreational and park areas.

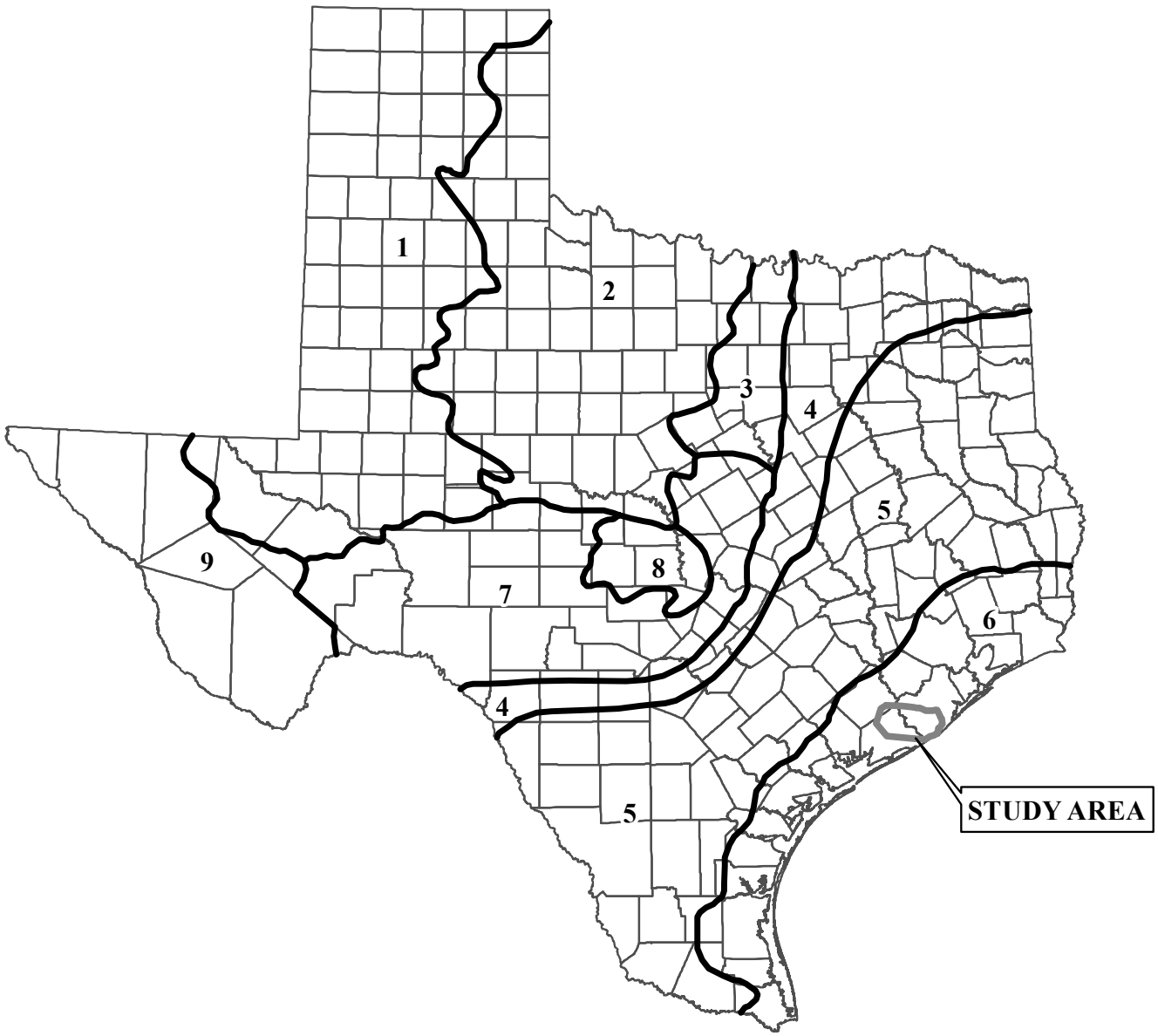
2.4 ENVIRONMENTAL INTEGRITY

Resource inventory data were collected for physiography, geology, soils, surface waters, wetlands and ecological resource areas. These data were mapped within the study area utilizing GIS layers. Additional data collection activities consisted of file and record reviews conducted with the various state and federal regulatory agencies, a review of published literature and review of various maps and aerial photographs. Maps and data layers reviewed include USGS 7.5 minute topographic maps, Google Earth aerial imagery, BEG Geologic Atlas maps, NWI maps, FEMA national flood hazard layer, USEPA Ecoregions of Texas, NRCS soil survey data and TPWD and USFWS endangered species listings

2.4.1 Physiography and Geology

As shown in Figure 2-3, the study area is located within the Coastal Prairies sub-province of the Gulf Coastal Plains Physiographic Region of Texas (BEG 1996). The Coastal Prairies Region extends inland from the Texas Gulf Coast and is characterized by young deltaic sands, silts and clays, creating nearly flat grasslands (BEG 1996). Elevations in the study area range from less than five feet above mean sea level ("amsl") to approximately 75 feet amsl (USGS 2018a).

The study area is underlain by Quaternary-aged alluvium and the Beaumont Formation (BEG 1982 and 1987). Throughout the study area, most creeks and rivers are surrounded by Holocene alluvial deposits and Quaternary fluviatile bench deposits. Alluvium deposits typically consist of unconsolidated clay, silt, sand and gravel. The Beaumont Formation typically consists of clay, silt and sand, and includes point bar, natural levee, stream channel and backswamp deposits. Relict river channels are common features of this formation (BEG 1982 and 1987; USGS 2018b).



0 30 60 120 180 240

Miles

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

BAILEY TO JONES CREEK PROJECT

FIGURE 2-3

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

POWER ENGINEERS

Date: 6/26/2018

CenterPoint Energy

2.4.1.1 Geological Hazards

Geologic hazards potentially affecting the construction and operation of the transmission line were evaluated within the study area. Hazardous areas reviewed included potential karst areas with known cave locations, faults, historical or current coal/uranium mining locations, gravel quarries, landfills and potential subsurface contamination. Available data for the study area was mapped utilizing GIS.

A review of Texas Speleological Society ("TSS") maps did not indicate any karst geology or known caves within the study area (TSS 1994 and 2018). No known quaternary or seismic faults were identified within the study area (BEG 1982 and 1987). However, the study area occurs within the gulf-margin normal faults region in Texas. Faults in this region are characterized as having a slip-rate category of less than 0.2 millimeter per year (USGS 2018c).

According to the RRC (2018) database, no coal mining activities have historically occurred or currently occur within the study area. Aerial imagery and USGS topographic maps identified several sand and gravel quarries scattered throughout the study area (Google 2018; USGS 2018a). Subsidence may occur within the region due to increased groundwater withdrawal primarily within surrounding Harris, Galveston and Fort Bend counties (TWDB 2017b). Subsidence does occur in portions of central and northwest Brazoria County, but no occurrences were identified within the study area (USGS 2004).

The presence of subsurface contamination of soils or groundwater from commercial activities, such as dumps or landfills, can require additional considerations during routing and may create a potential hazard during construction activities. A review of USEPA Superfund/National Priority List Sites (USEPA 2018) and the TCEQ - State Superfund Sites (TCEQ 2018) did not indicate any listed sites within the study area.

2.4.2 Soils

2.4.2.1 Soil Associations

The published NRCS, formerly the Soil Conservation Service, soil surveys for Brazoria, Matagorda and Wharton counties were reviewed to identify and characterize the soils occurring within 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 mapped within the study area are listed in Table 2-13, which also briefly describes each soil association and indicates if any mapped units of the soil series within the association are designated as prime farmlands and/or as hydric soils (NRCS 2018).

TABLE 2-13 SOIL ASSOCIATIONS WITHIN THE STUDY AREA

SOILS ASSOCIATION	DESCRIPTION	SOIL SERIES	PERCENT OF ASSOCIATION	PRIME FARMLAND SOIL	HYDRIC SOIL
Wharton County (SCS 1974; NRCS 2018)					
Edna-Bernard	Poorly drained and somewhat poorly drained soils on uplands that have a surface layer of fine sandy loam and clay loam and lower layers that are dominantly clay	Edna	37	No	No
		Bernard	27	Yes	No
		Other	36	-	-
Lake Charles	somewhat poorly drained soils on uplands that have a surface layer and lower layers of clay	Lake Charles	80	Yes	No
		Other	20	-	-
Miller-Norwood	Moderately well drained and well drained soils on bottomlands that have a surface layer and lower layers of clay and silt loam	Miller	39	No	Yes
		Norwood	23	Yes	No
		Other	38	-	-
Matagorda County (NRCS 2001 and 2018)					
Laewest-Dacosta	Moderately well drained, nearly level to gently sloping, clayey and loamy soils on broad uplands	Laewest	56	Yes	No
		Dacosta	35	Yes	No
		Other	9	-	-
Edna-Texana-Telferner	Moderately well drained and somewhat poorly drained, nearly level to gently sloping, loamy soils	Edna	56	No	No
		Texana	15	Yes	No
		Telferner	11	Yes	No
		Other	18	-	-
Pledger-Asa	Well drained and moderately well drained, nearly level, clayey and loamy soils on broad flood plains	Pledger	69	Yes	No
		Asa	24	Yes	No
		Other	7	-	-
Brazoria-Norwood-Clemville	Well drained and somewhat poorly drained, Nearly level, clayey and loamy soils on nearly level to weakly undulating floodplains along the Colorado River	Brazoria	63	Yes	No
		Norwood	11	Yes	No
		Clemville	9	No	No
		Other	17	-	-
Livia-Palacios-Francitas	Poorly drained, nearly level, loamy and clayey, saline soils on broad, low-lying upland coastal plains and on coastal lowlands	Livia	32	No	No
		Palacios	31	No	No
		Francitas	18	No	No
		Other	19	-	-
Brazoria County (SCS 1981; NRCS 2018)					
Lake Charles	Clayey, somewhat poorly drained, very slowly permeable soils on coastal terraces	Lake Charles	85	Yes	No
		Other	15	-	-
Pledger-Brazoria	Clayey, somewhat poorly drained, very slowly permeable soils on bottom lands	Pledger	70	Yes	No
		Brazoria	25	Yes	No
		Other	5	-	-
Bernard-Edna	Loamy, somewhat poorly drained and poorly drained, very permeable soils on coastal terraces	Bernard	40	Yes	No
		Edna	35	No	No
		Other	25	-	-

TABLE 2-13 SOIL ASSOCIATIONS WITHIN THE STUDY AREA

SOILS ASSOCIATION	DESCRIPTION	SOIL SERIES	PERCENT OF ASSOCIATION	PRIME FARMLAND SOIL	HYDRIC SOIL
Edna-Aris	Loamy, poorly drained and somewhat poorly drained, very permeable soils on coastal terraces	Edna	40	No	No
		Aris	35	No	Yes
		Other	25	-	-
Surfside-Velasco	Clayey, poorly drained and very poorly drained, very permeable soils in marshes	Surfside	60	No	Yes
		Velasco	11	No	Yes
		Other	29	-	-
Harris-Veston	Clayey and loamy, very poorly drained and poorly drained, very slowly permeable and slowly permeable soils in marshes	Harris	50	No	Yes
		Veston	8	No	Yes
		Other	42	-	-
Francitas-Narta	Clayey and loamy, poorly drained and somewhat poorly drained, very slowly permeable soils on coastal terraces	Francitas	40	No	No
		Narta	30	No	Yes
		Other	25	-	-

Source: SCS 1974 and 1981; NRCS 2001 and 2018.

2.4.2.2 Prime Farmland Soils

The Secretary of Agriculture, within 7 U.S.C. § 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 USDA would consider these soils prime farmland if such practices were installed and these soils are designated as Prime Farmland soils in Table 2-8.

This transmission line project is not subject to the requirements of the NEPA or the Farmland Protection Policy Act ("FPPA") because this Project will not be completed by, and will not receive assistance from, any federal agency. The Project is exempt from the FPPA because transmission lines are not a conversion of these farmlands and the site can still be used after construction (as per NRCS letter to POWER on October 19, 2017; Appendix A).

2.4.2.3 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.

Soil map units that are dominantly comprised of hydric soils might have small areas, or inclusions, of non-hydric soils in the higher positions on the landform, and map units dominantly made up of non-hydric soils might have inclusions of hydric soils in the lower positions on the landform (NRCS 2018). The soil units classified as hydric are listed in Table 2-8. Minor soils listed within soil units were not evaluated for this criterion.

2.4.3 Water Resources

Information on water resources within the study area were obtained from a variety of sources including USEPA, the National Hydrography Dataset, TWDB, aerial photography, USGS topographic maps, field reconnaissance surveys and aerial photographs (Google 2018).

2.4.3.1 Surface Waters

From west to east, the study area is located within the Colorado-Lavaca, Colorado, Brazos-Colorado, Brazos and San Jacinto-Brazos river basins (TWDB 2014). Rivers identified within the study area include the Brazos River (TECQ Segment ID: 1201, 1202), Colorado River (TECQ Segment ID: 1401, 1402) and San Bernard River (TECQ Segment ID: 1301, 1302). The Brazos River and San Bernard River generally flow in a southeast direction until their confluence with the Gulf of Mexico (TECQ Segment ID: 2501), approximately one mile south of the study area. The Colorado River generally flows in a south direction until its confluence with Matagorda Bay (TECQ Segment ID: 2451), approximately 15 miles south of the study area.

Named linear surface waters within the study area include: Bastrop Bayou (TECQ Segment ID: 1105), Bell Creek, Big Boggy Creek, Big Slough, Blue Creek, Boggy Bayou, Brushy Bayou, Bucks Bayou, Buffalo Camp Bayou, Caney Creek (TECQ Segment ID: 1304, 1305), Canoe Bayou, Cedar Lake Bayou, Cedar Lake Creek, Cocklebur Slough, Cottonwood Creek, Dance Bayou, Dead Slough, Dry Bayou, Dry Creek, Flag Lake Drainage Canal, Flores Bayou, Gardner Slough, Grassy Slough, Hardeman Slough, Gulf Intercoastal Waterway, Jackson Ditch, Jarvis Creek, Johnsons Timber Slough, Jones Creek, Linnville Bayou (TECQ Segment ID: 1304A), Little Linnville Bayou, Little Slough, Live Oak Bayou (TECQ Segment ID: 2441A), Live Oak Creek, McFadden Bayou, Middle Bayou, Mill Bayou, Mound Creek (TECQ Segment ID: 1302E), Old Brazos River Channel (TECQ Segment ID: 1111), Oyster Creek (TECQ Segment ID: 1109, 1110), Peyton Creek, Quinine Slough, Red Bayou, Salt Bayou, San Bernard

River, Snead Slough, Styles Bayou, Varner Creek, Wadsworth Slough, Water Hole Creek, Wildcat Slough and Wilson Creek. Additional named surface waters within the study area include Brazoria Reservoir, Angleton Fishing and Hunting Club Reservoir, York Reservoir, Club Lake, Lake Jackson, Brock Reservoir, Old Ocean Swamp, Little Lake, Betts Lake, Neal Lake, Jennings Lake, Lake Bowie, Williams Lake, Flag Pond and Bird Pond. Unnamed surface waters within the study area include tributaries, streams, canals, ditches, bayous, marshes, swamps, backwaters, sloughs, lakes, reservoirs and ponds.

Surface waters and their associated wetlands located within the study area may be subject to USACE regulations as "waters of the US" under Section 404 of the CWA. Navigable waters and associated tributaries or backwaters located within the study area may be subject to USACE regulations as "navigable waters of the US" under Section 10 of the Rivers and Harbors Act of 1899. The study area is within the USACE-Galveston District, which determines navigable waters on a case-by-case basis and thus does not publish a list of Section 10 waters; however, the Gulf Intercoastal Waterway, Caney Creek, Live Oak Bayou, Bastrop Bayou, Brazos River, Colorado River and San Bernard River may be Section 10 navigable waters.

2.4.3.2 Special Status Waters

Under 31 T.A.C. 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 (2018a) data indicates six surface waters designated as ESSS stream segments within the study area including: the Colorado River, the Brazos River, San Bernard River, Redfish Bayou, Cedar Lake Creek and Jones Creek.

The Colorado River qualified as an ESSS because of its biological function: extensive freshwater and estuarine wetland habitats display significant overall habitat value, and due to a threatened or unique species being present, which is the blue sucker (*Cycleptus elongatus*). The Brazos River qualified as an ESSS because of riparian conservation areas and threatened or endangered species/unique communities, including unique Live Oak-Water Oak-Pecan bottomlands and the diamondback terrapin. The San Bernard River qualified as an ESSS because of its biological function, riparian conservation area and threatened or endangered species/unique communities, including Live Oak-Water Oak-Pecan bottomlands community and diamondback terrapin. Cedar Lake Creek qualified as an ESSS because of its biological function, location within the San Bernard Wildlife Refuge (a riparian conservation area) and threatened or endangered species/unique communities, including reddish egret, wood stork, brown pelican and white-faced ibis. Its aquatic habitat has a high degree of biodiversity. Redfish Bayou qualified as an ESSS

because it contains a riparian conservation area (Justin Hurst Wildlife Management Area). Jones Creek qualified as an ESSS because it contains a riparian conservation area (Peach Point Wildlife Management Area) and its biological function, including bottomland hardwood habitat displaying significant overall habitat value (TPWD 2018a).

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 meet water quality standards and for which the associated pollutants are suitable for measurement by maximum daily load. The index is divided into two main categories: Category 4 includes impaired waters for which Total Maximum Daily Loads ("TMDL") have already been adopted, or for which other management strategies are underway to improve water quality. Category 5 (303d List) includes impaired waters for which TMDLs or other management strategies are planned.

Review of the TCEQ (2014), Texas Integrated Report of Surface Water Quality (formerly called the 303(d) list) lists impaired water bodies within the study area as: Bastrop Bayou (Tidal), Oyster Creek (Tidal and above Tidal), San Bernard River (Tidal and above Tidal), Caney Creek (Tidal and above Tidal) and Linnville (above Tidal). Bastrop Bayou is listed as impaired due to bacteria. Oyster Creek is listed as impaired for bacteria and depressed dissolved oxygen. The San Bernard River has impairment for bacteria. Caney Creek is listed as impaired for bacteria and depressed dissolved oxygen. Linnville Bayou is listed as impaired due to bacteria (TCEQ 2014).

2.4.3.3 Floodplains

Available floodplain and floodway data were obtained from FEMA. A 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. Detailed FEMA flood hazard boundary maps show the 100-year floodplain includes a large portion of the study area. FEMA mapped floodplains occur primarily on low lying areas near creeks, rivers and bayous (FEMA 2018).

2.4.3.4 Future Surface Water Developments

A review of the 2017 *Texas State Water Plan* did not indicate any evaluated, proposed, or potential new major reservoirs within the study area (TWDB 2017b).

2.4.3.5 Coastal Management Zone

The Texas GLO must develop and implement a comprehensive plan for managing the natural resources along the Texas Gulf of Mexico coastline under the CMP as specified in the Coastal Coordination Act of 1991 (Texas GLO 2018). The PUC must comply with CMP policies when approving CCNs for electric transmission lines that are located within the CMZ under the Coastal Zone Management Act of 1972. The southeast one-third of the study area and a one-mile buffer around the Bernard River lie within the designated CMZ, as defined by the Coastal Management Boundary and Coastal Facilities Designation Line as defined in 31 TAC § 503.1.

POWER reviewed the CMP and also reviewed aerial photography and associated mapping provided by the Texas GLO, FEMA, USFWS and the USGS to identify coastal natural resource areas ("CNRAs") as defined in 31 TAC § 501.3(b). Designated CNRAs include waters of the open Gulf of Mexico, waters under tidal influence, state submerged lands, coastal wetlands, submerged aquatic vegetation, tidal sound and mud flats, oyster reefs, hard substrate reefs, coastal barriers, coastal shore areas, gulf beaches, critical dune areas, special hazard areas (floodplains, etc.), critical erosion areas, coastal historic areas and coastal preserves.

CNRAs potentially occurring within the study area may include Coastal Preserves (San Bernard National Wildlife Refuge, Nannie M. Stringfellow WMA and Justin Hurst WMA); Coastal Shore Areas, Coastal Wetlands (estuarine and freshwater emergent; USFWS 2018a); Special Hazard Areas (FEMA 100-floodplains; FEMA 2018); State Submerged Lands (Portions of Oyster Creek, Brazos River, McNeal Bayou, McNeal Lake, Pelican Lake, Redfish Bayou, San Bernard River, Cedar Lake Creek, Cow Trap Lake and Caney Creek; Texas GLO 2018); and Submerged Aquatic Vegetation, Tidal Sand or Mud Flats and Waters Under Tidal Influence (Portions of Bastrop Bayou, Oyster Creek, Brazos River, San Bernard River, Caney Creek and Live Oak Bayou). Upon PUC approval of a route, on the ground verifications of CNRAs may be required. Refer to Section 4.4.3.3 for further discussion, of potential impacts to CNRAs.

2.4.3.6 Ground Water

The Gulf Coast Aquifer is a major groundwater aquifer that underlies the majority of the study area (TWDB 2011). No minor aquifers were mapped within the study area (TWDB 2011). The Gulf Coast aquifer parallels the Gulf of Mexico coastline from the Louisiana to the Mexican border. It consists of several aquifers, including the Jasper, Evangeline and Chicot aquifers, and is composed of discontinuous sand, silt, clay and gravel beds. The maximum total sand thickness of the Gulf Coast aquifer is approximately 700 feet in the southern portion. Water quality of the Gulf Coast Aquifer is generally good

in the central and northeastern sections, where total dissolved solids are less than 500 milligrams per liter, but declines southward where total dissolved solids range from 1,000 to more than 10,000 milligrams per liter (TWDB 2011).

Review of the TWDB (2018) water well data indicated numerous public and private water wells located throughout the study area. Public water well locations were mapped within the study area. Only one unnamed spring was identified within the study area, located along the San Bernard River west of the city of West Columbia, Texas (Brune 2002; TWDB 2018; and USGS 2018a).

2.4.4 Ecological Resources

2.4.4.1 Ecological Region

The study area is located within the Western Gulf Coastal Plain Level III and within Northern Humid Gulf Coastal Prairies, Floodplains and Low Terraces, and Mid-Coast Barrier Islands and Coastal Marshes IV Ecoregions (USEPA 2018). The Western Gulf Coastal Plain Level III Ecoregion is a flat narrow piece of land paralleling the Gulf Coast and is characterized by its relatively flat topography and grassland natural vegetation. A high percentage of this region has been converted into croplands and in recent years urban and industrial development has greatly expanded (Griffith et al. 2007).

The Northern Humid Gulf Coastal Prairies Level IV Ecoregion are mapped within the western one-third of the study area. This region lies in a band scattered along the northern half of the Texas coast. This region is typically characterized by low flat plains, low rivers and streams with sand, silt and clay substrates. The Northern Humid Gulf Coastal Prairies is a gently sloping coastal plain with generally poorly drained soils. Historically, much of this region was covered in tallgrass prairie and scattered oak mottes. Today, this region has been almost entirely converted into cropland, rangeland or developed for urban or industrial land use. A network of drainage canals, stream channelization and levees also exist in many areas. Commercially important species in the study area include pines, hardwoods, rice and forage crops (Griffith et al. 2007).

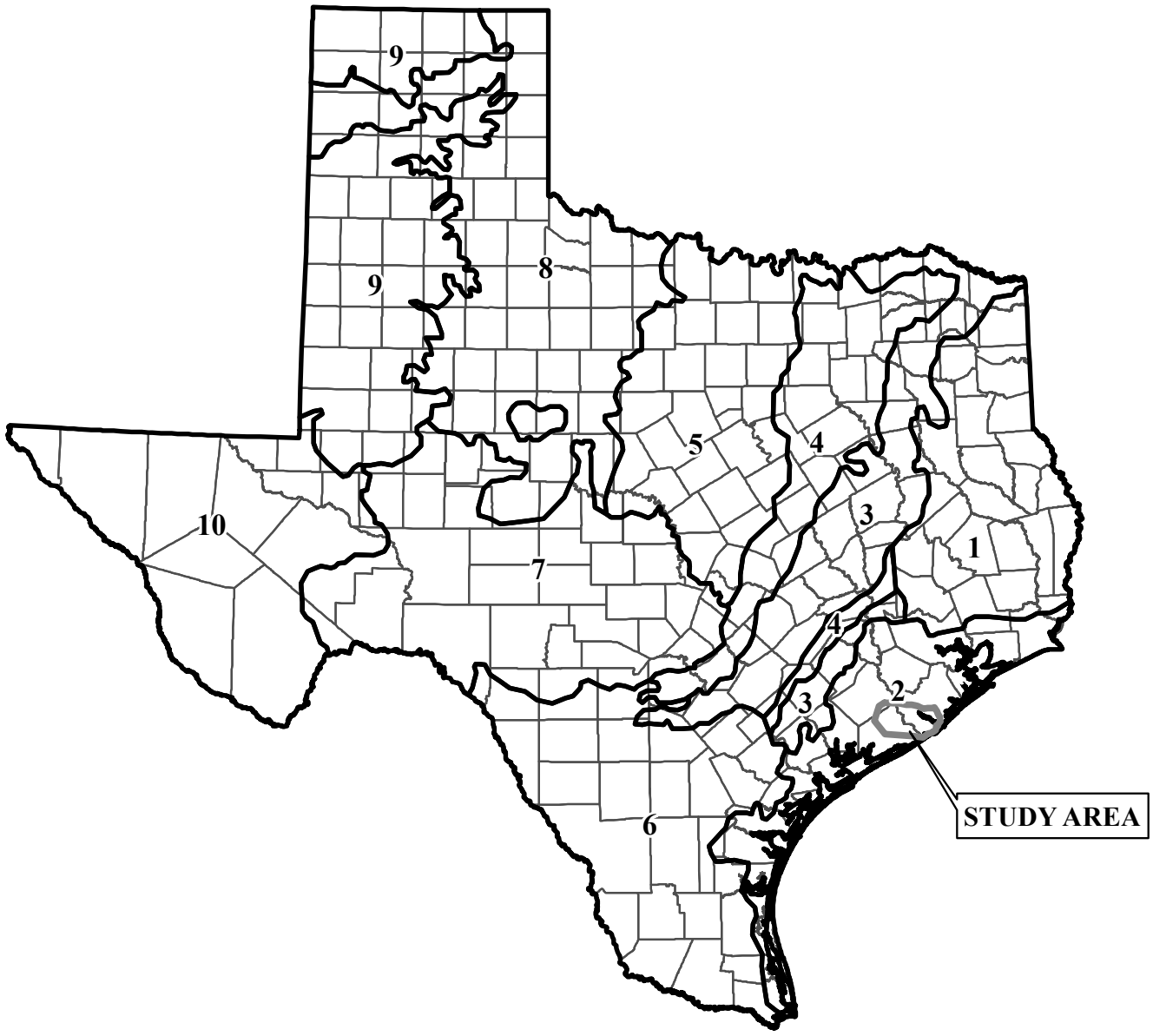
Floodplains and Low Terraces Level IV Ecoregion are mapped within the bulk of the study area, along the Colorado River and from the Live Oak Bayou floodplain in Matagorda County to the Oyster Creek floodplain in Brazoria County. Original vegetation was mostly bottomland forests of pecan, water oak, southern live oak and elm, with some bald cypress on larger streams. The Brazos and Colorado River floodplains are a broad expanse of Holocene alluvial sediments. Large portions of floodplain forest have been removed and converted to cropland and pasture (Griffith et al. 2007).

The Mid-Coast Barrier Islands and Coastal Marshes Level IV Ecoregion are located in a narrow band along the southeast corner of the study area. The region is composed primarily of Holocene deposits with saline, brackish and freshwater marshes; barrier islands with minor washover fans; and tidal flat sands and clays. Smooth cordgrass, marshhay, cordgrass and gulf saltgrass dominate in more saline zones and other vegetation includes primarily grassland composed of seacoast bluestem, sea-oats, common reed, gulfdune paspalum and soilbind morning-glory (Griffith et al. 2007).

2.4.4.2 Vegetation Types

The study area is located within the Gulf Prairies vegetational area of Texas (Gould et al. 1960). Frye et al. (1984) identified four vegetation types within the study area: Crops, Pecan-Elm Forest, Bluestem grassland and Marsh/Barrier Island (Figure 2-4). There are four vegetation sub-types within the Marsh/Barrier Island vegetation type. The freshwater marsh is characterized by maidencane (*Panicum hemitomon*) and alligator weed (*Alternanthera philoxeroides*). A brackish marsh will be characterized by saltmeadow cordgrass (*Spartina patens*) and bulrush (*Scirpus* spp.). As the marsh becomes more saline smooth cordgrass (*Spartina alterniflora*), marsh saltgrass (*Distichlis spicata*) and sea ox-eye (*Borrichia frutescens*) will become the dominate species. Upland vegetation in a marine environment will feature seaoats (*Uniola paniculata)* and seacoast bluestem (*Schizachyrium littorale*).

Mapped vegetation within the Floodplains and Low Terraces Level IV Ecoregion includes bottomland forests of pecan (*Carya illinoinensis*), water oak (*Quercus nigra*), live oak (*Quercus virginiana*) and elm (*Ulmus* spp.), with some bald cypress (*Taxodium distichum*) on larger streams and black hickory (*Carya texana*), post oak (*Quercus stellata*) and winged elm (*Ulmus alata)* (Griffith et al. 2007). Within the study area, mapped vegetation within the Mid-Coast Barrier Islands and Coastal Marshes Level IV Ecoregion includes smooth cordgrass, saltmeadow cordgrass and marsh saltgrass, in more saline zones. Other native grassland vegetation consists of seacoast bluestem, sea-oats, common reed (*Phragmites australis*), gulfdune paspalum (*Paspalum monostachyum*) and beach morning-glory (*Ipomoea pes-caprae*). Some areas may have mottes of sweetbay (*Magnolia virginiana*) and redbay (*Persea borbonia*) (Griffith et al. 2007).



N

0 30 60 120 180 240

Miles

Source: Gould, et. al., 1960.

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

BAILEY TO JONES CREEK PROJECT

FIGURE 2-4

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

POWER ENGINEERS

Date: 6/26/2018

CenterPoint Energy

Vegetation within Northern Humid Gulf Coastal Prairies includes prairie grasslands with little bluestem (*Schizachyrium scoparium*), yellow Indiangrass (*Sorghastrum nutans*), brownseed paspalum (*Paspalum plicatulum*), gulf muhly (*Muhlenbergia capillaris*) and switchgrass (*Panicum virgatum*), with some clusters of southern live oak (*Quercus virginiana*). Riparian forests are dominated by water oak (*Quercus nigra*), pecan (*Carya illinoinensis*), southern live oak, American elm (*Ulmus americana*), cedar elm (*Ulmus crassifolia*) and sugar hackberry (*Celtis laevigata*) (see Table 4-14) (Griffith et al. 2007).

Non-native landcover within the study area includes urban and disturbed land, improved pastureland and cropland. Crops in this region typically include rice, soybeans, grain sorghum, cotton, corn, wheat, pecans and hay (Griffith et al. 2007).

TABLE 2-14 POTENTIAL TREE/SHRUB SPECIES WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
American beautyberry	*Callicarpa Americana*	Mesquite	*Prosopis* spp.
American elm	*Ulmus Americana*	Overcup Oak	*Quercus lyrata*
Ash	*Fraxinus* spp.	Pecan	*Carya illinoensis*
Bald Cypress	*Taxodium distichum*	Post oak	*Quercus stellata*
Black Hickory	*Carya texana*	Rattlebush	*Sesbania drummondii*
Black willow	*Salix nigra*	Redbay	*Persea borbonia*
Blackjack oak	*Quercus marilandica*	Red cedar	*Juniperus virginiana*
Box Elder	*Acer negundo*	Red maple	*Acer rubrum*
Carolina basswood	*Tilia caroliniana*	Red mulberry	*Morus rubra*
Cherry Laurel	*Prunus laurocerasus*	Rusty blackhaw	*Viburnum rufidulum*
Bur Oak	*Quercus macrocarpa*	Salt cedar	*Tamarix spp.*
Cedar elm	*Ulmus crassifolia*	Sea myrtle	*Baccharis halimifolia*
Chinese tallow	*Triadica sebifera*	Sand post oak	*Quercus margaretta*
Chinese privet	*Ligustrum sinense*	Sandjack oak	*Quercus incana*
Chittimwood	*Sideroxylon lanuginosum*	Sassafras	*Sassafras albidum*
Coral-berry	*Symphoricarpos orbiculatus*	Shortleaf pine	*Pinus echinata*
Eastern cottonwood	*Populus deltoids*	Shumard oak	*Quercus shumardii*
Eastern Redbud	*Cercis canadensis*	Southern Live oak	*Quercus virginiana*
Eastern red cedar	*Juniperus virginiana*	Southern red oak	*Quercus falcata*
Escarpment live oak	*Quercus fusiformis*	Sugar hackberry	*Celtis laevigata*
Farkleberry	*Vaccinium arboretum*	Swamp chestnut oak	*Quercus michauxii*
Flowering dogwood	*Cornus florida*	Sweetbay	*Magnolia virginiana*
Green Ash	*Fraxinus pennsylvanica*	Sweetgum	*Liquidambar styraciflua*
Gum	*Nyssa* spp.	Sycamore	*Plantanus americana*
Hawthorn	*Crataegus* spp.	Water oak	*Quercus nigra*

TABLE 2-14 POTENTIAL TREE/SHRUB SPECIES WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Holly	*Ilex* spp.	Water elm	*Planera aquatica*
Huisache	*Acacia farnesiana*	Water hickory	*Carya aquatica*
Lime prickleyash	*Zanthoxylum fagara*	Western soapberry	*Sapindus saponaria L. var. drummondii*
Loblolly pine	*Pinus taeda*	Willow Oak	*Quercus phellos*
		Winged elm	*Ulmus alata*

Source: McMahan et al. 1984; Griffith et al. 2007.

Aquatic and Hydric Habitats

Aquatic habitats within the study area may be associated with surface waters and wetlands. Other aquatic habitats may be associated with the tributaries to these surface waters, including pooled areas of perennial or intermittent drainages. Emergent vegetation in these aquatic habitats is typically limited to the shallow areas along the shorelines or within shallow marshes. Aquatic environments support vegetative species, such as water hyacinth (*Eichhornia crassipes*), arrowhead (*Sagittaria* spp.), coontail (*Ceratophyllum demersum*), cabomba (*Cabomba caroliniana*), pickerelweed (*Pontederia cordata*), pennyworts (*Hydrocotyle* spp.), water lilies (*Nymphaea* spp.), spiderworts (*Tradescantia* spp.), duckweeds (*Lemna* spp.), widgeongrass (*Ruppia maritima*) and glasswort (*Salicornia depressa*) (McMahan et al. 1984).

The hydric habitats in the study area are primarily located within floodplains, riparian and depressional wetland areas associated with creeks, bottomland areas, ponds and lakes. These habitats undergo a seasonal inundation and maintain saturated soils. Typical woody plant species in these riparian areas include Chinese tallow (*Triadica sebifera*), pecan, lime prickly ash (*Zanthoxylum fagara*), water oak, black hickory and winged elm (McMahan et al. 1984; Griffith et al. 2007).

Mapped wetland information was derived from digital copies of the USFWS NWI maps (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). These maps are typically conservative estimates of wetlands, primarily because the hydrology of the area has likely been modified by ground disturbing activities, such as farming, channelized streams, installation of levees and drainages. Review of NWI data indicated numerous wetlands throughout the study area with wetland types including palustrine (freshwater) emergent ("PEM"), palustrine forested ("PFO"), palustrine scrub/shrub ("PSS"), freshwater ponds (palustrine unconsolidated bottom; "PUB") and lakes (lacustrine; "L"). PEM wetlands consist of rooted herbaceous hydrophytes located in pond margins, freshwater marshes or shallow water areas. PFO and PSS wetlands are mapped throughout the study area, primarily within floodplains along creeks. PFO wetlands are wetland areas comprised of hydrophytic trees that

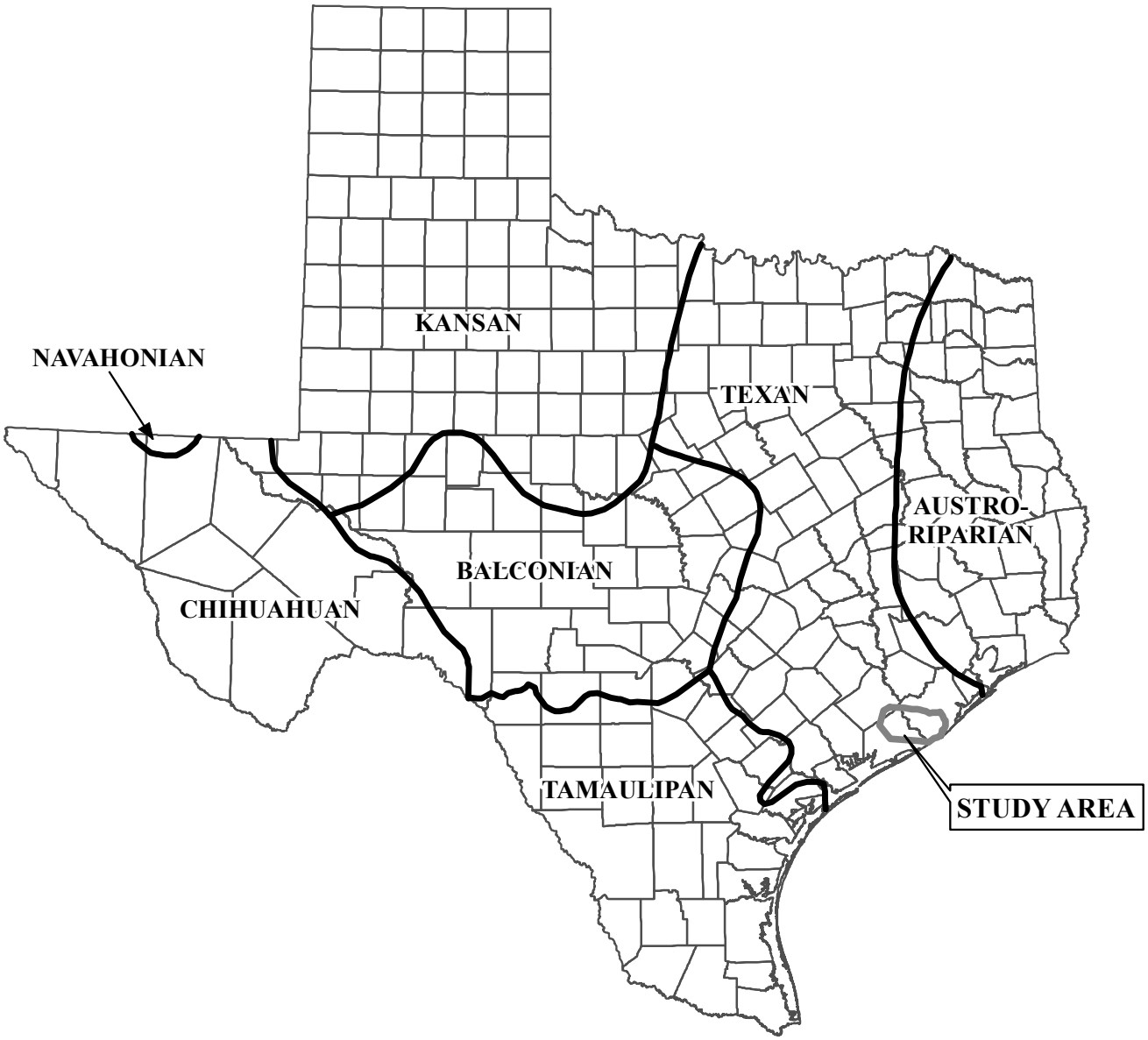
constitute 30 percent or greater of the areal vegetation coverage. PSS wetlands are areas where hydrophytic trees constitute less than 30 percent and the scrub-shrub layer constitutes 30 percent or greater of the areal vegetation cover

Mapped emergent wetlands are particularly numerous in the southeastern corner of the study area, with the largest examples occurring within Justin Hurst WMA. These wetlands are typically comprised of aquatic species, such as cattails (*Typha* spp.), sedges (*Carex* spp.), flatsedges (*Cyperus* spp.), smartweeds (*Polygonum* spp.), bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), water hyacinth, water-pennywort, pickerelweed, arrowhead, white waterlily (*Nymphaea odorata*), cabomba, coontail and duckweed (McMahan et al. 1984). Mapped forested wetlands are throughout the study area with the largest contiguous patches occurring near large rivers and creeks. These wetland areas may contain bald cypress (*Taxodium distichum*) and black willow (*Salix nigra*) in the wettest areas with an understory of swamp privet (*Forestiera acuminata*) and buttonbush (*Cephalanthus occidentalis*). Areas experiencing less frequent inundation may contain green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*) and water hickory (*Carya aquatica*) (McMahan et al. 1984). The dredging or filling of materials within jurisdictional wetlands is regulated by the USACE under Section 404 of the CWA. Additional coordination with the USACE may be required to determine if any permit requirements will be necessary for the construction of the proposed transmission line.

2.4.4.3 Wildlife and Fisheries

Wildlife

The study area is located in the southeastern portion of the Texan Biotic Province (see Figure 2-5) (Blair 1950). The Texan Biotic Province is located adjacent to the Austroriparian Biotic Province to the east and some overlap between these two provinces would be anticipated. At the time of publication, the Texan Biotic Province was known to support 13 anurans, five urodeles, 39 snake species, nine lizards, two land turtles and at least 49 species of mammals (Blair 1950).



0 30 60 120 180 240

Miles

Source: Blair, 1950, modified

Legend

Biotic Province Boundary

County Boundary

BAILEY TO JONES CREEK PROJECT

FIGURE 2-5

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

POWER ENGINEERS

Date: 6/26/2018

CenterPoint Energy

Amphibian species (frogs, toads, salamanders and newts) that potentially occur within the study area counties are listed in Table 2-15. Frogs and toads may occur in all vegetation types and salamanders and newts are typically restricted to moist habitats (Tipton et al. 2012).

TABLE 2-15 AMPHIBIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA COUNTIES

COMMON NAME	SCIENTIFIC NAME
Frogs/Toads	
American bullfrog	*Lithobates catesbeianus*
Cope's gray tree frog	*Hyla chrysoscelis*
Crawfish frog	*Lithobates areolatus*
Eastern narrow-mouth toad	*Gastrophryne carolinensis*
Gray tree frog	*Hyla versicolor*
Great Plains narrow-mouthed toad	*Gastrophryne olivacea*
Green frog	*Lithobates clamitans*
Green tree frog	*Hyla cinerea*
Gulf Coast toad	*Incilius nebulifer*
Hurter's spadefoot toad	*Scaphiopus hurterii*
Northern cricket frog	*Acris crepitans*
Pickerel frog	*Lithobates palustris*
Rio Grande chirping frog	*Eleutherodoctylus cystignathoides*
Southern leopard frog	*Lithobates sphenocephalus*
Spotted chorus frog	*Pseudacris clarkii*
Spring peeper	*Pseudacris crucifer*
Squirrel tree frog	*Hyla squirella*
Strecker's chorus frog	*Pseudacris streckeri*
Upland chorus frog	*Pseudacris feriarum*
Woodhouse's toad	*Anaxyrus woodhousii*
Salamanders/Newts	
Eastern newt	*Notophthalmus viridescens*
Marbled salamander	*Ambystoma opacum*
Small-mouthed salamander	*Ambystoma texanum*
Western lesser siren	*Siren intermedia*

Source: Tipton et al. 2012.

Reptiles (turtles, crocodilians, lizards and snakes) potentially occurring within the study area are listed in Table 2-16. These include those species that are commonly observed near water (i.e., aquatic turtles, alligators and some snakes) and those that are more common in terrestrial habitats (Dixon 2013).

TABLE 2-16 REPTILIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
Turtles	
Chicken turtle	*Deirochelys reticularia miaria*
Diamond-backed terrapin	*Malaclemys terrapin littoralis*
Eastern box turtle	*Terrapene carolina*
Eastern mud turtle	*Kinosternon subrubrum hippocrepis*
Eastern musk turtle	*Sternotherus odoratus*
Eastern snapping turtle	*Chelydra serpentina*
False map turtle	*Graptemys pseudogeographica*
Ornate box turtle	*Terrapene ornata ornata*
Pallid spiny softshell	*Apalone spinifera pallida*
Red-eared pond slider	*Trachemys scripta elegans*
River cooter	*Pseudemys concinna*
Smooth softshell	*Apalone mutica*
Texas cooter	*Pseudemys texana*
Yellow mud turtle	*Kinosternon flavescens*
Crocodilians	
American alligator	*Alligator mississippiensis*
Lizards	
Broad-headed skink	*Eumeces laticeps*
Brown anole	*Anolis sagrei*
Common spotted whiptail	*Cnemidophorus gularis*
Eastern six-lined race runner	*Cnemidophorus sexlineatus*
Five-lined skink	*Eumeces fasciatus*
Green anole	*Anolis carolinensis*
Little brown skink	*Scincella lateralis*
Mediterranean gecko	*Hemidactylus turcicus*
Northern fence lizard	*Sceloporus undulatus hyacinthinus*
Prairie skink	*Eumeces septentrionalis obtusirostris*
Slender glass lizard	*Ophisaurus attenuatus*
Texas horned lizard	*Phrynosoma cornutum*
Texas spiny lizard	*Sceloporus olivaceus*
Snakes	
Blotched water snake	*Nerodia erythrogaster transversa*
Broad-banded water snake	*Nerodia fasciata confluens*
Broad-banded copperhead	*Agkistrodon contortrix laticinctus*
Canebrake rattlesnake	*Crotalus horridus atricaudatus*
Checkered garter snake	*Thamnophis marcianus*
Desert massasauga	*Sistrurus catenatus edwardsi*
Diamond-backed water snake	*Nerodia rhombifer rhombifer*
Dusty hog-nosed snake	*Heterodon nasicus gloydi*
Eastern garter snake	*Thamnophis sirtalis sirtalis*
Eastern hog-nosed snake	*Heterodon platirhinos*
Eastern yellow-bellied racer	*Coluber constrictor flaviventris*
Flat-headed snake	*Tantilla gracilis*

TABLE 2-16 REPTILIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
Glossy crayfish snake	*Regina rigida sinicola*
Graham's crayfish snake	*Regina grahami*
Gulf Coast ribbon snake	*Thamnophis proximus orarius*
Gulf saltmarsh snake	*Nerodia clarkii clarkii*
Louisiana milk snake	*Lampropeltis triangulum amaura*
Marsh brown snake	*Storeria dekayi limnetes*
Mississippi green water snake	*Nerodia cyclopion*
Mississippi ring-necked snake	*Diadophis punctatus stictogenys*
Prairie king snake	*Lampropeltis calligaster calligaster*
Pygmy rattlesnake	*Sistrurus miliarius streckeri*
Rough earth snake	*Virginia striatula*
Rough green snake	*Opheodrys aestivus*
Smooth green snake	*Opheodrys vernalis*
Southern copperhead	*Agkistrodon contortrix contortrix*
Speckled king snake	*Lampropeltis getula holbrooki*
Texas brown snake	*Storeria dekayi texana*
Texas coral snake	*Micrurus tener*
Texas glossy snake	*Arizona elegans arenicola*
Texas rat snake	*Pantherophis obsoleta lindheimeri*
Western coachwhip	*Masticophis flagellum testaceus*
Western cottonmouth	*Agkistrodon piscivorus leucostoma*
Western diamond-backed rattlesnake	*Crotalus atrox*
Western mud snake	*Farancia abacura reinwardti*
Western ribbon snake	*Thamnophis proximus proximus*

Source: Dixon 2013.

Numerous avian species are present within the study area, including year-round residents or migratory species as listed in Table 2-17. Avian migrants may seasonally travel through the study area in the spring and fall, or use the area for nesting in the spring and summer or to overwinter (Lockwood and Freeman 2014). Avian occurrence checklists were reviewed for the USFWS (2013) Brazoria, San Bernard and Big Boggy NWRs. The likelihood for occurrence of each species depends upon suitable habitat and season. All migratory birds have protection under the MBTA.

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
ACCIPITRIFORMES: Accipitridae				
Bald eagle	*Haliaeetus leucocephalus*		X	X
Cooper's hawk	*Accipiter cooperii*	X		X
Northern harrier	*Circus cyaneus*			X
Red-shouldered hawk	*Buteo lineatus*	X		
Red-tailed hawk	*Buteo jamaicensis*	X		
Sharp-shinned hawk	*Accipiter striatus*			X
White-tailed hawk	*Geranoaetus albicaudatus*	X		
White-tailed kite	*Elanus leucurus*	X		
ACCIPITRIFORMES: Cathartidae				
Black vulture	*Coragyps atratus*	X		
Turkey vulture	*Cathartes aura*	X		
ACCIPITRIFORMES: Pandionidae				
Osprey	*Pandion haliaetus*			X
ANSERIFORMES: Anatidae				
American wigeon	*Anas americana*			X
Black-bellied whistling-duck	*Dendrocygna autumnalis*	X		
Blue-winged teal	*Anas discors*			X
Bufflehead	*Bucephala albeola*			X
Canada goose	*Branta canadensis*			X
Canvasback	*Aythya valisineria*			X
Cinnamon teal	*Anas cyanoptera*			X
Fulvous whistling-duck	*Dendrocygna bicolor*		X	
Gadwall	*Anas strepera*			X
Greater white-fronted goose	*Anser albifrons*			X
Green-winged teal	*Anas crecca*			X
Hooded merganser	*Lophodytes cucullatus*			X
Lesser scaup	*Aythya affinis*			X
Mallard	*Anas platyrhynchos*	X		X
Northern pintail	*Anas acuta*			X
Northern shoveler	*Anas clypeata*			X
Red-breasted merganser	*Mergus serrator*			X
Redhead	*Aythya americana*			X
Ring-necked duck	*Aythya collaris*			X
Ruddy duck	*Oxyura jamaicensis*			X
Snow goose	*Chen caerulescens*			X
Wood duck	*Aix sponsa*	X		X
APODIFORMES: Apodidae				
Chimney swift	*Chaetura pelagica*		X	
APODIFORMES: Trochilidae				

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
Ruby-throated hummingbird	*Archilochus colubris*		X	
CAPRIMULGIFORMES: Caprimulgidae				
Chuck-will's-widow	*Antrostomus carolinensis*		X	
Common nighthawk	*Chordeiles minor*		X	
CHARADRIIFORMES: Charadriidae				
Black-bellied plover	*Pluvialis squatarola*			X
Killdeer	*Charadrius vociferus*	X		
Piping plover	*Charadrius melodus*			X
Semipalmated plover	*Charadrius semipalmatus*			X
Snowy plover	*Charadrius nivosus*		X	
Wilson's plover	*Charadrius wilsonia*		X	
CHARADRIIFORMES: Haematopodidae				
American oystercatcher	*Haematopus palliatus*	X		
CHARADRIIFORMES: Laridae				
Black skimmer	*Rynchops niger*	X		
Black tern	*Chlidonias niger*			X
Bonaparte's gull	*Chroicocephalus philadelphia*			X
Common tern	*Sterna hirundo*			X
Forster's tern	*Sterna forsteri*	X		X
Franklin's gull	*Leucophaeus pipixcan*			X
Gull-billed tern	*Gelochelidon nilotica*	X		
Herring gull	*Larus argentatus*			X
Laughing gull	*Leucophaeus atricilla*	X		
Least tern	*Sternula antillarum*		X	
Ring-billed gull	*Larus delawarensis*			X
Royal tern	*Thalasseus maximus*	X		
Sandwich tern	*Thalasseus sandvicensis*	X		
CHARADRIIFORMES: Recurvirostridae				
American avocet	*Recurvirostra americana*	X		X
Black-necked stilt	*Himantopus mexicanus*		X	
CHARADRIIFORMES: Scolopacidae				
Dunlin	*Calidris alpina*			X
Greater yellowlegs	*Tringa melanoleuca*			X
Least sandpiper	*Calidris minutilla*			X
Lesser yellowlegs	*Tringa flavipes*			X
Long-billed curlew	*Numenius americanus*			X
Long-billed dowitcher	*Limnodromus scolopaceus*			X
Marbled godwit	*Limosa fedoa*			X
Pectoral sandpiper	*Calidris melanotos*			X
Ruddy turnstone	*Arenaria interpres*			X

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
Sanderling	*Calidris alba*			X
Semipalmated sandpiper	*Calidris pusilla*			X
Short-billed dowitcher	*Limnodromus griseus*			X
Solitary sandpiper	*Tringa solitaria*			X
Spotted sandpiper	*Actitis macularius*			X
Stilt sandpiper	*Calidris himantopus*			X
Western sandpiper	*Calidris mauri*			X
Whimbrel	*Numenius phaeopus*			X
White-rumped sandpiper	*Calidris fuscicollis*			X
Willet	*Tringa semipalmata*	X		
Wilson's shalarope	*Phalaropus tricolor*			X
Wilson's snipe	*Gallinago delicata*			X
CICONIIFORMES: Ciconiidae				
Wood stork	*Mycteria americana*		X	
COLUMBIFORMES: Columbidae				
Common ground-dove	*Columbina passerina*	X		
Eurasian collared-dove	*Streptopelia decaocto*	X		
Inca dove	*Columbina inca*	X		
Mourning dove	*Zenaida macroura*	X		
Rock pigeon	*Columba livia*	X		
White-winged dove	*Zenaida asiatica*	X		
CORACIIFORMES: Alcedinidae				
Belted kingfisher	*Megaceryle alcyon*			X
CUCULIFORMES: Cuculidae				
Greater roadrunner	*Geococcyx californianus*	X		
Yellow-billed cuckoo	*Coccyzus americanus*		X	
FALCONIFORMES: Falconidae				
American kestrel	*Falco sparverius*			X
Crested caracara	*Caracara cheriway*	X		
FALCONIFORMES: Falconidae				
Merlin	*Falco columbarius*			X
Peregrine falcon	*Falco peregrinus*			X
GALLIFORMES: Odontophoridae				
Northern bobwhite	*Colinus virginianus*	X		
GALLIFORMES: Phasianidae				
Wild turkey	*Meleagris gallopavo*	X		
GAVIIFORMES: Gaviidae				
Common loon	*Gavia immer*			X
GRUIFORMES: Gruidae				
Sandhill crane	*Grus canadensis*			X

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
GRUIFORMES: Rallidae				
American coot	*Fulica americana*	X		X
Clapper rail	*Rallus crepitans*	X		
Common gallinule	*Gallinula galeata*	X	X	
King rail	*Rallus elegans*	X		
Purple gallinule	*Porphyrio martinicus*		X	
Sora	*Porzana carolina*			X
Virginia rail	*Rallus limicola*			X
Yellow rail	*Coturnicops noveboracensis*			X
PASSERIFORMES: Alaudidae				
Horned lark	*Eremophila alpestris*	X		
PASSERIFORMES: Bombycillidae				
Cedar waxwing	*Bombycilla cedrorum*			X
PASSERIFORMES: Cardinalidae				
Blue grosbeak	*Passerina caerulea*		X	
Dickcissel	*Spiza americana*		X	
Indigo bunting	*Passerina cyanea*			X
Northern cardinal	*Cardinalis cardinalis*	X		
Painted bunting	*Passerina ciris*		X	
PASSERIFORMES: Corvidae				
American crow	*Corvus brachyrhynchos*	X		
Blue Jay	*Cyanocitta cristata*	X		
PASSERIFORMES: Emberizidae				
Chipping sparrow	*Spizella passerina*			X
Dark-eyed junco	*Junco hyemalis*			X
Field sparrow	*Spizella pusilla*			X
Le Conte's sparrow	*Ammodramus leconteii*			X
Lincoln's sparrow	*Melospiza lincolnii*			X
Savannah sparrow	*Passerculus sandwichensis*			X
Seaside sparrow	*Ammodramus maritimus*	X		
Song sparrow	*Melospiza melodia*			X
Swamp sparrow	*Melospiza georgiana*			X
Vesper sparrow	*Pooecetes gramineus*			X
White-throated sparrow	*Zonotrichia albicollis*			X
PASSERIFORMES: Fringillidae				
American goldfinch	*Spinus tristis*			X
House finch	*Haemorhous mexicanus*	X		
PASSERIFORMES: Hirundinidae				
Bank swallow	*Riparia riparia*		X	
Barn swallow	*Hirundo rustica*		X	

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
Northern rough-winged swallow	*Stelgidopteryx serripennis*		X	X
Purple martin	*Progne subis*		X	
Tree swallow	*Tachycineta bicolor*			X
PASSERIFORMES: Icteridae				
Boat-tailed grackle	*Quiscalus major*	X		
Bobolink	*Dolichonyx oryzivorus*			X
Brewer's blackbird	*Euphagus cyanocephalus*			X
Brown-headed cowbird	*Molothrus ater*		X	
Common grackle	*Quiscalus quiscula*		X	
Eastern meadowlark	*Sturnella magna*	X		
Great-tailed grackle	*Quiscalus mexicanus*	X		
Orchard oriole	*Icterus spurius*		X	
Red-winged blackbird	*Agelaius phoeniceus*	X		X
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*			X
Loggerhead shrike	*Lanius ludovicianus*	X		
PASSERIFORMES: Mimidae				
Brown thrasher	*Toxostoma rufum*			X
Gray catbird	*Dumetella carolinensis*			X
Northern mockingbird	*Mimus polyglottos*	X		
PASSERIFORMES: Motacillidae				
American pipit	*Anthus rubescens*			X
Sprague's pipit	*Anthus spragueii*			X
PASSERIFORMES: Paridae				
Carolina chickadee	*Poecile carolinensis*	X		
Tufted titmouse	*Baeolophus bicolor*	X		
PASSERIFORMES: Parulidae				
American redstart	*Setophaga ruticilla*			X
Bay-breasted warbler	*Setophaga castanea*			X
Black-and-white warbler	*Mniotilta varia*			X
Blackburnian warbler	*Setophaga fusca*			X
Blackpoll warbler	*Setophaga striata*			X
Black-throated green warbler	*Setophaga virens*			X
Blue-winged warbler	*Vermivora cyanoptera*			X
Canada warbler	*Cardellina canadensis*			X
Chestnut-sided warbler	*Setophaga pensylvanica*			X
Common yellowthroat	*Geothlypis trichas*		X	X
Golden-winged warbler	*Vermivora chrysoptera*			X
Hooded warbler	*Setophaga citrina*			X
Kentucky warbler	*Geothlypis formosa*			X
Louisiana waterthrush	*Parkesia motacilla*			X

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
Magnolia warbler	*Setophaga magnolia*			X
Nashville warbler	*Oreothlypis ruficapilla*			X
Northern parula	*Setophaga americana*		X	
Northern waterthrush	*Parkesia noveboracensis*			X
Orange-crowned warbler	*Oreothlypis celata*			X
Ovenbird	*Seiurus aurocapilla*			X
Palm warbler	*Setophaga palmarum*			X
Prothonotary warbler	*Protonotaria citrea*			X
Tennessee warbler	*Oreothlypis peregrina*			X
Wilson's warbler	*Cardellina pusilla*			X
Worm-eating warbler	*Helmitheros vermivorum*			X
Yellow warbler	*Setophaga petechia*			X
Yellow-breasted chat	*Icteria virens*			X
Yellow-rumped warbler	*Setophaga coronata*			X
Yellow-throated warbler	*Setophaga dominica*			X
PASSERIFORMES: Passeridae				
House sparrow	*Passer domesticus*	X		
PASSERIFORMES: Polioptilidae				
Blue-gray gnatcatcher	*Polioptila caerulea*			X
PASSERIFORMES: Regulidae				
Ruby-crowned kinglet	*Regulus calendula*			X
PASSERIFORMES: Sturnidae				
European starling	*Sturnus vulgaris*	X		
PASSERIFORMES: Troglodytidae				
Carolina wren	*Thryothorus ludovicianus*	X		
House wren	*Troglodytes aedon*			X
Marsh wren	*Cistothorus palustris*			X
Sedge wren	*Cistothorus platensis*			X
PASSERIFORMES: Turdidae				
American robin	*Turdus migratorius*	X		X
Eastern bluebird	*Sialia sialis*		X	
Gray-cheeked thrush	*Catharus minimus*			X
Hermit thrush	*Catharus guttatus*			X
Swainson's thrush	*Catharus ustulatus*			X
Veery	*Catharus fuscescens*			X
Wood thrush	*Hylocichla mustelina*			X
PASSERIFORMES: Tyrannidae				
Eastern kingbird	*Tyrannus tyrannus*		X	
Eastern phoebe	*Sayornis phoebe*			X
Eastern wood-pewee	*Contopus virens*		X	

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
Great crested flycatcher	*Myiarchus crinitus*		X	
Olive-sided flycatcher	*Contopus cooperi*			X
Scissor-tailed flycatcher	*Tyrannus forficatus*		X	
Vermilion flycatcher	*Pyrocephalus rubinus*			X
PASSERIFORMES: Vireonidae				
Philadelphia vireo	*Vireo philadelphicus*			X
Red-eyed vireo	*Vireo olivaceus*			X
Warbling vireo	*Vireo gilvus*			X
White-eyed vireo	*Vireo griseus*	X	X	
PELECANIFORMES: Ardeidae				
American bittern	*Botaurus lentiginosus*	X	X	
Black-crowned night-heron	*Nycticorax nycticorax*	X		
Cattle egret	*Bubulcus ibis*	X	X	
Great blue heron	*Ardea herodias*	X		
Great egret	*Ardea alba*	X		
Green heron	*Butorides virescens*	X	X	
Least bittern	*Ixobrychus exilis*		X	
Little blue heron	*Egretta caerulea*		X	
Reddish egret	*Egretta rufescens*	X		
Snowy egret	*Egretta thula*	X		
Tricolored heron	*Egretta tricolor*		X	
Yellow-crowned night-heron	*Nyctanassa violacea*	X	X	
PELECANIFORMES: Pelecanidae				
American white pelican	*Pelecanus erythrorhynchos*	X		X
Brown pelican	*Pelecanus occidentalis*	X		
PELECANIFORMES: Threskiornithidae				
Roseate spoonbill	*Platalea ajaja*	X		
White ibis	*Eudocimus albus*	X	X	
White-faced ibis	*Plegadis chihi*	X		
PICIFORMES: Picidae				
Downy woodpecker	*Picoides pubescens*	X		
Northern flicker	*Colaptes auratus*			X
Pileated woodpecker	*Dryocopus pileatus*	X		
Red-bellied woodpecker	*Melanerpes carolinus*	X		
Red-headed woodpecker	*Melanerpes erythrocephalus*	X		
Yellow-bellied sapsucker	*Sphyrapicus varius*			X
PODICIPEDIFORMES: Podicipedidae				
Eared grebe	*Podiceps nigricollis*			X
Pied-billed grebe	*Podilymbus podiceps*	X		X
STRIGIFORMES: Strigidae				

TABLE 2-17 BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	*SCIENTIFIC NAME*	RESIDENT	SUMMER	WINTER
Barred owl	*Strix varia*	X		
Great Horned owl	*Bubo virginianus*	X		
STRIGIFORMES: Tytonidae				
Barn owl	*Tyto alba*	X		
SULIFORMES: Anhingidae				
Anhinga	*Anhinga anhinga*	X	X	
SULIFORMES: Fregatidae				
Magnificent frigatebird	*Fregata magnificens*		X	
SULIFORMES: Phalacrocoracidae				
Double-crested cormorant	*Phalacrocorax auritus*			X

Source: USFWS 2013; Lockwood and Freeman 2014.

Mammals potentially occurring in the study area are listed in Table 2-18 (Schmidly and Bradley 2016). The occurrence of each species depends upon the availability of suitable habitat.

TABLE 2-18 MAMMALIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
American badger	*Taxidea taxus*
American beaver	*Castor canadensis*
American mink	*Neovison vison*
Attwater's pocket gopher	*Geomys attwateri*
Baird's pocket gopher	*Geomys breviceps*
Big brown bat	*Eptesicus fuscus*
Big free-tailed bat	*Nyctinomops macrotis*
Black-tailed jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Common raccoon	*Procyon lotor*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Eastern cottontail	*Sylvilagus floridanus*
Eastern flying squirrel	*Glaucomys volans*
Eastern fox squirrel	*Sciurus niger*
Eastern gray squirrel	*Sciurus carolinensis*
Eastern harvest mouse	*Reithrodontomys humulis*
Eastern mole	*Scalopus aquaticus*
Eastern pipistrelle	*Perimyotis subflavus*
Eastern red bat	*Lasiurus borealis*
Eastern spotted skunk	*Spilogale putorius*
Eastern woodrat	*Neotoma floridana*

TABLE 2-18 MAMMALIAN SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
Evening bat	*Nycticeius humeralis*
Feral pig	*Sus scrofa*
Fulvous harvest mouse	*Reithrodontomys fulvescens*
Gray fox	*Urocyon cinereoargenteus*
Hispid cotton rat	*Sigmodon hispidus*
Hispid pocket mouse	*Chaetodipus hispidus*
Hoary bat	*Lasiurus cinereus*
House mouse	*Mus musculus*
Jaguarundi	*Herpailurus yagouaroundi*
Least shrew	*Cryptotis parva*
Long-tailed weasel	*Mustela frenata*
Marsh rice rat	*Oryzomys palustris*
Mountain lion	*Puma concolor*
Muskrat	*Ondatra zibethicus*
Nine-banded armadillo	*Dasypus novemcinctus*
Northern pygmy mouse	*Baiomys taylori*
Northern yellow bat	*Lasiurus intermedius*
Norway rat	*Rattus norvegicus*
Nutria	*Myocastor coypus*
Ocelot	*Leopardus pardalis*
Red fox	*Vulpes vulpes*
Ringtail	*Bassariscus astutus*
River otter	*Lontra canadensis*
Roof rat	*Rattus rattus*
Seminole bat	*Lasiurus seminolus*
Silver-haired bat	*Lasionycteris noctivagans*
Southern flying squirrel	*Glaucomys volans*
Southern short-tailed shrew	*Blarina carolinensis*
Striped skunk	*Mephitis mephitis*
Swamp rabbit	*Sylvilagus aquaticus*
Virginia opossum	*Didelphis virginiana*
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
White-footed mouse	*Peromyscus leucopus*
White-tailed deer	*Odocoileus virginianus*

Source: Schmidly and Bradley 2016.

Fisheries

The divisions of the biotic provinces were separated on the basis of terrestrial vertebrate distributions; however, the distribution of freshwater fish generally corresponds with the terrestrial province boundaries (Hubbs et al. 2008). Areas showing the greatest deviation from this general rule include northeast Texas and the coastal zone.

The small headwater ephemeral streams and intermittent flowing streams support aquatic species primarily adapted to ephemeral pool habitats. These habitat types will support aquatic species that are typically adapted to rapid dispersal and life cycle completion within in-pool habitats typically having fine-grained substrates. In stream reaches 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 aquatic trophic levels.

The perennial streams, large ponds and lakes provide consistent aquatic habitat for all trophic levels with fish the most prominent. The relatively stable water levels of the reservoirs and the constant pools and flow of the streams facilitate stable population growth. Species with flowing water or pooled area habitat requirements will utilize perennial streams and those adapted for deeper waters will utilize the lake and pond environments. Larger populations of fish also attract fish eating bird species. Table 2-19 indicates the fish species potentially occurring within the study area (Thomas et al. 2007).

TABLE 2-19 FISH SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
Alligator gar	*Atractosteus spatula*
American eel	*Anguilla rostrata*
Banded pygmy sunfish	*Elassoma zonatum*
Bantam sunfish	*Lepomis symmetricus*
Bigscale logperch	*Percina macrolepida*
Black bullhead	*Ameiurus melas*
Black crappie	*Pomoxis nigromaculatus*
Blackspotted topminnow	*Fundulus olivaceus*
Blackstripe topminnow	*Fundulus notatus*
Blacktail shiner	*Cyprinella venusta*
Blue catfish	*Ictalurus furcatus*
Bluegill	*Lepomis macrochirus*
Blue sucker	*Cycleptus elongatus*
Blue tilapia	*Oreochromis aurea*
Bluntnose darter	*Etheostoma chlorosomum*
Bowfin	*Amia calva*
Brook silverside	*Labidesthes sicculus*
Bullhead minnow	*Pimephales vigilax*
Channel catfish	*Ictalurus punctatus*
Common carp	*Cyprinus carpio*

TABLE 2-19 FISH SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
Creek chub	*Semotilus atromaculatus*
Creek chubsucker	*Erimyzon oblongus*
Cypress darter	*Etheostoma proeliare*
Dollar sunfish	*Lepomis marginatus*
Dusky darter	*Percina sciera*
Emerald shiner	*Notropis atherinoides*
Fathead minnow	*Pimephales promelas*
Flathead catfish	*Pylodictis olivaris*
Flier	*Centrarchus macropterus*
Freckled madtom	*Noturus nocturnus*
Freshwater drum	*Aplodinotus grunniens*
Ghost shiner	*Notropis buchanani*
Gizzard shad	*Dorosoma cepedianum*
Golden shiner	*Notemigonus crysoleucas*
Golden topminnow	*Fundulus chrysotus*
Goldfish	*Carassius auratus*
Goldstripe darter	*Etheostoma parvipinne*
Grass carp	*Ctenopharyngodon idella*
Green sunfish	*Lepomis cyanellus*
Gulf killifish	*Fundulus grandis*
Inland silverside	*Menidia beryllina*
Lake chubsucker	*Erimyzon sucetta*
Largemouth bass	*Micropterus salmoides*
Longear sunfish	*Lepomis megalotis*
Longnose gar	*Lepisosteus osseus*
Longnose killifish	*Fundulus similis*
Mimic shiner	*Notropis volucellus*
Mississippi silvery minnow	*Hybognathus nuchalis*
Mountain mullet	*Agonostomus monticola*
Orangespotted sunfish	*Lepomis humilis*
Paddlefish	*Polyodon spathula*
Pallid shiner	*Hybopsis amnis*
Pirate perch	*Aphredoderus sayanus*
Pugnose minnow	*Opsopoeodus emiliae*
Rainbow trout	*Oncorhynchus mykiss*
Rainwater killifish	*Lucania parva*
Redbreast sunfish	*Lepomis auritus*
Redear sunfish	*Lepomis microlophus*
Redfin pickerel	*Esox americanus*
Redfin shiner	*Lythrurus umbratilis*
Red shiner	*Cyprinella lutrensis*
Redspotted sunfish	*Lepomis miniatus*
Ribbon shiner	*Lythrurus fumeus*
River carpsucker	*Carpiodes carpio*
Rough silverside	*Membras martinica*
Sailfin molly	*Poecilia latipinna*
Scaly sand darter	*Ammocrypta vivax*
Sharpnose shiner	*Notropis oxyrhyncus*
Sheepshead minnow	*Cyprinodon variegatus*
Shoal chub	*Macrhybopsis hyostoma*
Silver chub	*Macrhybopsis storeriana*
Silverband shiner	*Notropis shumardi*
Slough darter	*Etheostoma gracile*

TABLE 2-19 FISH SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

COMMON NAME	SCIENTIFIC NAME
Smallmouth buffalo	*Ictiobus bubalus*
Spotted bass	*Micropterus punctulatus*
Spotted gar	*Lepisosteus oculatus*
Spotted sucker	*Minytrema melanops*
Starhead topminnow	*Fundulus dispar*
Striped bass	*Morone saxatilis*
Striped mullet	*Mugil cephalus*
Tadpole madtom	*Noturus gyrinus*
Threadfin shad	*Dorosoma petenense*
Yellow bass	*Morone mississippiensis*
Yellow bullhead	*Ameiurus natalis*
Warmouth	*Lepomis gulosus*
Weed Shiner	*Notropis texanus*
Western mosquitofish	*Gambusia affinis*
White bass	*Morone chrysops*
White crappie	*Pomoxis annularis*

Source: Thomas et al. 2007.

Perennial aquatic habitats located within the study area are associated with larger surface waters including the Brazos River, San Bernard River, Colorado River, San Bernard Reservoir, Brazoria Reservoir, Cowtrap Lake, McNeal Lake, Oyster Creek, Caney Creek, Live Oak Creek, Jones Creek, Linnville Bayou, Bastrop Bayou, Snead Slough, Grassy Slough and numerous other small perennial waterbodies. Other aquatic habitats include smaller perennial and intermittent creeks, ponds and marshes. The relatively stable water levels and the constant pools and flow of the streams facilitate stable population levels.

Smaller ponds and lakes located in the study area exhibit variability in terms of their age, drainage, use by cattle, past fish stocking and fertilization history. These aquatic habitats are often exposed to full sunlight and do not typically experience the variations in flow as do streams after heavy rainfall events. Typically, fluctuations in water level are experienced during the summer months due to high evaporation rates and repeated heavy rainfall events are required to fill the ponds completely. Periods of extended drought in the region may reduce the water level or dry the pond completely.

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 between surface waters, but they primarily inhabit perennial surface waters.

2.4.4.4 Threatened and Endangered Species

Data on special status species and unique vegetation resources within the study area was obtained from a variety of sources including correspondence with the USFWS and TPWD, and county lists of special status species (USFWS 2018b; TPWD 2018b). Additional information was obtained from published literature and technical reports. All biological resource inventory data for the study area was mapped utilizing GIS.

For the purpose of this routing study, emphasis was placed on obtaining known locations of unique vegetative communities and critical habitat or known occurrences of 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 species of concern or rare species. A GIS shapefile of known occurrences for listed species and sensitive vegetative communities was obtained from the TXNDD on August 31, 2017. Review of TXNDD data indicates occurrences of several state and federally listed plant and wildlife species within the study area. It should be noted that TXNDD data is not a substitute for presence/absence surveys and absence of occurrence records does not necessarily indicate absence of the species. A TXNDD occurrence record is an indication that a species was observed in the study area at one time and may or may not currently inhabit the area. Species not designated as federally threatened or endangered are not afforded any regulatory protection under the ESA.

A USFWS (2018b) Information for Planning and Consultation ("IPaC") (Consultation Code: 02ETTX00-2018-SLI-1481) Official Species List for the study area was requested and received on May 14, 2018. The Brazoria, Matagorda and Wharton county listings for federal and state listed species were obtained from the TPWD (2018b) County Lists of Rare Species. By federal definition, a threatened species is defined as likely to become endangered within the near 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 threats to support listing as threatened or endangered and are likely to be proposed for listing in the near 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. The primary threat to threatened and endangered species is the destruction or modification of critical habitat areas by uncontrolled land and water development. No critical habitats occur within the study area boundaries; however, designated critical habitat for the piping

plover (*Charadrius melodus*) occurs within two niles of the study area boundary, located at the southeast corner of the study area boundary near the mouth of the Brazos River (USFWS 2018c).

Plant Species

USFWS (2018b) IPaC species list for the study area and TPWD (2018b) county listings were reviewed for special status plant species potentially occurring within the study area. No federal or state listed threatened or endangered plant species were listed within the study area.

Wildlife Species

The USFWS (2018b) IPaC species list for the study area and TPWD (2018b) listings for Brazoria, Matagorda and Wharton counties of threatened, endangered or candidate animal species lists are summarized in Table 2-20. Species not designated as federally threatened or endangered are not afforded any regulatory protection under the ESA; however, additional federal and state laws may provide additional regulatory protection.

TABLE 2-20 THREATENED, ENDANGERED AND CANDIDATE SPECIES LISTED WITHIN THE STUDY AREA COUNTIES

COMMON NAME	SCIENTIFIC NAME	LISTED COUNTIES			LEGAL STATUS	
		Brazoria	Matagorda	Wharton	USFWS[1]	TPWD[2]
Birds						
American peregrine falcon	*Falco peregrinus anatum*	X	X	X	DL	T
Arctic peregrine falcon	*Falco peregrinus tundrius*	X	X	X	DL	-
Attwater's greater prairie chicken	*Tympanuchus cupido attwateri*	-	-	X	E	E
Bald eagle	*Haliaeetus leucocephalus*	X	X	X	DL	T
Brown pelican	*Pelecanus occidentalis*	X	X	-	DL	-
Eskimo curlew	*Numenius borealis*	X	X	-	E, EXT	E, EXT
Interior least tern	*Sterna antillarum athalassos*	-	-	X	E	E
Northern aplomado falcon	*Falco femoralis septentrionalis*	-	X	-	E	E
Reddish egret	*Egretta rufescens*	X	X	-	-	T
Piping plover	*Charadrius melodus*	X	X	-	T	T
Red knot	*Calidris canutus rufa*	X	X	X	T	-
Sooty tern	*Sterna fuscata*	X	X	-	-	T
White-faced ibis	*Plegadis chihi*	X	X	X	-	T
White-tailed hawk	*Buteo albicaudatus*	X	X	X	-	T
Whooping crane	*Grus americana*	X	X	X	E	E
Wood stork	*Mycteria Americana*	X	X	X	-	T

TABLE 2-20 THREATENED, ENDANGERED AND CANDIDATE SPECIES LISTED WITHIN THE STUDY AREA COUNTIES

COMMON NAME	SCIENTIFIC NAME	LISTED COUNTIES			LEGAL STATUS	
		Brazoria	Matagorda	Wharton	USFWS[1]	TPWD[2]
Fish						
Blue sucker	*Cycleptus elongates*	-	X	X	-	T
Sharpnose shiner	*Notropis oxyrhynchus*	X	-	X	E	-
Smalltooth sawfish	*Pristis pectinata*	X	X	-	E	E
Mammals						
Jaguarundi	*Herpailurus yaguaroundi*	X	-	-	E	E
Louisiana black bear	*Ursus americanus luteolus*	X	X	X	DL	T
Ocelot	*Leopardus pardalis*	X	X	-	E	E
Red wolf	*Canis rufus*	X	X	X	E, EXT	EXT
West Indian manatee	*Trichechus manatus*	X	X	-	E	E
Mollusks						
Golden orb	*Quadrula aurea*	-	-	-	C	T
Smooth pimpleback	*Quadrula houstonensis*	X	X	X	C	T
Texas pimpleback	*Quadrula petrina*	-	X	X	C	T
Texas fawnsfoot	*Truncilla macrodon*	X	X	X	C	T
Reptiles						
Alligator snapping turtle	*Macrochelys temminckii*	X	-	-	-	T
Atlantic hawksbill turtle	*Eretmochelys imbricata*	X	X	-	E	E
Green Sea Turtle	*Chelonia mydas*	X	X	-	T	T
Kemp's Ridley sea turtle	*Lepidochelys kempii*	X	X	-	E	E
Leatherback sea turtle	*Dermochelys coriacea*	X	X	-	E	E
Loggerhead sea turtle	*Caretta caretta*	X	X	-	T	T
Texas horned lizard	*Phrynosoma cornutum*	X	X	X	-	T
Texas scarlet snake	*Cemophora coccinea lineri*	-	X	-	-	T
Texas tortoise	*Gopherus berlandieri*	-	X	-	-	T
Timber rattlesnake	*Crotalus horridus*	X	X	X	-	T

[1] USFWS 2018b.
[2] TPWD 2018b.
C - Candidate Species; DL - Delisted Due to Recovery; E - Federal or State Listed Endangered; T - Federal or State Listed Threatened; EXT - Extirpated

The USFWS (2018b) IPaC report for the study area lists 13 species as federally threatened, endangered or candidate species. TPWD county listings include an additional six federal status species not shown on USFWS IPaC species report. The federal status of species listed in TPWD County Lists of Rare Species has been included in Table 2-15 for consistency. The USFWS (2018b) IPaC report and TPWD (2018b) County Lists of Rare Species are shown in Appendix A.

Two listed fish species are federally listed, including the sharpnose shiner (*Notropis oxyrhynchus*) and the smalltooth sawfish (*Pristis pectinata*). Both of these fish species are listed in the TPWD (2018b) county listings, but not listed within the USFWS (2018b) IPaC species lists for the study area. The sharpnose shiner is endemic to the Brazos, Wichita and Colorado River systems. The current known distribution for this species includes the Brazos River system upstream of Possum Kingdom Reservoir. This species is generally found in river runs and pools and is thought to prefer large turbid waters with sand, gravel and clay-mud bottoms. The smalltooth sawfish is endemic to the Brazos River system, although the current known distribution for this species is restricted to Brazos River system upstream of Possum Kingdom Reservoir and may be found in portions of the Colorado River above Lake Buchanan as a result of introductions. This species typically inhabits river channels or medium-to-large prairie streams with sandy substrate and turbid-to-clear warm water (Thomas et al. 2007; TPWD 2018b). TXNDD (2017) data did not document either of these species in or within five miles of the study area and is not anticipated to occur within the study area.

The Attwater's greater prairie chicken (*Tympanuchus cupido attwateri*) is a medium sized grouse that historically inhabited much of the Texas coastal prairie. Prime habitat is described as large tracts of open native tall grass coastal prairie, dominated by bunchgrasses. The grouse feeds in short to midgrass prairie for plants and insects and congregates at leks to conduct breeding courtship activities. Breeding occurs in early February through July (Campbell 2003; TPWD 2018b). The Attwater's greater prairie chicken occurred historically in Wharton County but is now only found in a few isolated populations in Colorado, Galveston and Goliad Counties. This species is not anticipated to occur within the study area (USFWS 2010).

The northern aplomado falcon (*Falco femoralis septentrionalis*) has a grey back, red breast, black "sash" on its belly and striking black markings on its head. The species historically used coastal prairie and marsh habitats that supported small islands of trees and shrubs or that interfaced with woodlands along freshwater drainages and estuaries. The northern aplomado falcon disappeared from the South Texas area in the 1930s and reintroduction of the species to the region has been ongoing since 1985 (Campbell 2003). From Matagorda County southward, this falcon is a rare resident in the Gulf Coast prairies and associated barrier islands (Lockwood and Freeman 2014). This species may occur within the study area if suitable habitat is available.

The federally endangered whooping crane (*Grus americana*) breeds in Canada and winters in marshes along the gulf coast (TPWD 2018b). The study area is located within the 200-mile-wide migratory pathway of the population that nests at Wood Buffalo National Park in Canada and winters at Aransas

National Wildlife Refuge along the Texas coast; however, 90 percent of sightings have occurred west of the study area. The Aransas/Wood Buffalo Flock is the only naturally occurring population of whooping cranes in the wild and contains between 250 and 300 birds (TPWD 2018b; USFWS 2009). Migration stopover sites typically include small sized surface waters with emergent vegetation cover. Several known stopover sites are utilized yearly, but these are located within the Midwest region. Stopover sites may also occur adjacent to agriculture fields where the birds forage. The whooping crane may occur briefly in the study area during the spring or fall migration, if suitable stopover habitats are available (Lockwood and Freeman 2014).

The interior least tern (*Sterna antillarum athalassos*) is the subspecies of least tern that breeds inland along the Missouri, Mississippi, Colorado, Arkansas, Red and Rio Grande River systems along sand and gravel bars within braided streams and rivers. Birds breeding within 50 miles of the Texas coast are not federally or state listed. Within Texas, interior least terns winter along the coast (Campbell 2003; TPWD 2018b). Least terns may occur as nesting migrants within the study area; however, the study area lies within 50 miles of the coastline. The interior least tern sub-species is not anticipated to occur (Lockwood and Freeman 2014).

The piping plover (*Charadrius melodus*) is a small migratory shorebird that nests within the Great Lakes, Northern Great Plains or Atlantic Coast (TPWD 2018b). Primary fall migration to Texas is from July to early September, while spring migration occurs from March to early May. Piping plovers are common to locally uncommon winter residents along the Gulf of Mexico coastline and may occur within the study area as a non-breeding winter migrant if suitable habitat is available (Lockwood and Freeman 2014).

The red knot (*Calidris canutus rufa*) is a migratory bird, which nests in the drier arctic tundra areas and overwinters along shorelines of the Gulf of Mexico and into Central and South America. A spring migratory stopover is located in Delaware Bay where the species gorges on horseshoe crab eggs (TPWD 2018b). This species is a rare to uncommon non-breeding winter migrant along the Texas Coast, especially the upper coast and may occur within the study area as a non-breeding migrant if suitable habitat exists (Lockwood and Freeman 2014).

The five federally-listed reptiles include the hawksbill sea turtle (*Eretmochelys imbricata*), green sea turtle (*Chelonia mydas*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*) and loggerhead sea turtle (*Caretta caretta*). These five species of sea turtle occupy brackish and estuarine areas, coastal bays and the Gulf of Mexico, and nest on coastal beaches

(TPWD 2018b). Sea turtles are not anticipated to occur within the study area, due to a lack of suitable marine habitats (Dixon 2013).

Federally listed mammal species includes the West Indian manatee (*Trichechus manatus*), ocelot (*Felis pardalis*) and jaguarondi (*Herpailurus yaguaroundi*). The West Indian manatee species has not been documented in or within five miles of the study area (TXNDD 2017). The West Indian manatee is a rare aquatic species in Texas and occasionally occurs within rivers, estuaries, canal and bays (Schmidly and Bradley 2016). It is not anticipated that the manatee is present within the study area due to a lack of suitable marine habitat.

The ocelot (*Leopardus pardalis*) is a feline with cream-colored fur and reddish-brown spots outlined in black. The ocelot avoids open areas and prefers dense (75 to 95 percent canopy coverage), thorny, low brush habitats such as chaparral thickets, mesquite-thorn scrub and live oak mottes. Estimated minimum habitat patch size to sustain an ocelot is 65 acres. The ocelot was once distributed throughout South Texas, the southern Edwards Plateau and along the Coastal Plain, but its current range is restricted to the Rio Grande Plains and lower Rio Grande Valley (Campbell 2003). Only two known populations consisting of approximately 50 individuals total are documented within Texas. One population inhabits the LANWR and the other is located on private property within Willacy County (USFWS 2016). Review of TXNDD (2017) did not identify any occurences of this species within the study area. This species is listed in the TPWD (2018b) county listings, but not listed within the USFWS (2018b) IPaC species lists for the study area. This species is not anticipated to occur within the study area due to presumed local extirpation from the area.

The Gulf Coast jaguarundi (*Herpailurus yagouaroundi*) is a feline slightly larger than a domestic cat and has a solid rusty-brown or charcoal gray coat with a long tail. Typical habitat includes a patchwork of bunchgrass pastures with dense thornscrub brush areas nearby. Riparian habitats along rivers or creeks are sometimes used for hunting areas and as movement corridors (Campbell 2003). The main threats to the jaguarundi throughout its range are habitat loss, degradation and fragmentation. Review of TXNDD (2017) identified two EOs within the study area, the last sighting occurring in 1991. This species is listed in the TPWD (2018b) county listings, but not listed within the USFWS (2018b) IPaC species lists for the study area. This species is not anticipated to occur within the study area due to presumed local extirpation from the area.

USFWS Delisted Species

The bald eagle (*Haliaeetus leucocephalus*) was delisted in 2007 by the USFWS because the population had recovered beyond the ESA criteria for listing. The status of the bald eagle population is currently monitored by the USFWS and the species is still afforded federal protection under the MBTA and the BGEPA. Bald eagles are a Texas state threatened species. The bald eagle nests in tall trees adjacent to major surface waters. Bald eagles have been documented nesting near Old Ocean, Texas since 1992, in the vicinity of York Reservoir since 1992, along the Colorado River since 2004 and near the Town of Cedar Lake since 2004 (TXNDD 2017). A survey of eagle nests performed by CenterPoint Energy on February 16, 2018, confirmed a number of eagle nests along the Colorado River and an unrecorded nest along Peyton Creek near its confluence with Live Oak Creek in Matagorda County. Bald eagles may occur within the study area, where suitable habitat is present.

Brown pelicans (*Pelecanus occidentalis*) are common local residents along the coast, foraging in saltwater and estuarine waters and nesting on small offshore islands. They may occasionally be found further inland during the late summer and early fall, particularly on or near larger bodies of water (Lockwood and Freeman 2014). Brown pelicans may occur within the study area, where suitable coastal habitat is present.

The Arctic peregrine falcon (*Falco peregrinus tundrius*) is an uncommon winter resident throughout Texas coastal prairies but are more common along bays, estuaries and coastlines during the winter months (Lockwood and Freeman 2014). The peregrine falcon 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 due to their similarity of appearance (TPWD 2018b). Both subspecies have been delisted from federal listings due to the recovery of population numbers. The American peregrine falcon utilizes many kinds of habitats during migration, particularly areas providing a source of relatively large avian prey, such as ducks, shorebirds or pigeons (Lockwood and Freeman 2014). Falcons may occur within the study area as a non-breeding winter migrant where suitable habitat is present.

The Louisiana black bear was once a common inhabitant of forested regions of eastern Texas, Louisiana and Mississippi. Today, the majority of the remaining population is located in the Atchafalaya and Tensas River basins of Louisiana. In Texas, the bear is an inhabitant of bottomland hardwoods and large tracts of forested areas in east Texas (Campbell 2003). TPWD (2018b) lists this species as a possible transient within these counties; however, TXNDD (2017) data identifies no occurrences of this species in or near

the study area. This species is not anticipated to occur within the study area due to a lack of suitable habitat.

USFWS Candidate Species

Four mollusk species are candidates to be federally-listed: the golden orb (*Quadrula aurea*), smooth pimpleback *(Quadrula houstonensis)*, Texas pimpleback (*Quadrula petrina*) and Texas fawnsfoot *(Truncilla macrodon)*. The golden orb occurs in mud, sand and gravel substrates of rivers and large creeks from the Guadalupe-San Antonio and Nueces-Frio River basins. The smooth pimpleback occurs in the Colorado and Brazos River basins and occupies mixed mud, sand and gravel bottoms in moderate-sized creeks, rivers and reservoirs. The Texas Pimpleback is known to occur in the Colorado and Guadalupe-San Antonio River systems. This mussel occurs in moderate to large creeks and rivers with flowing waters and substrates of sand, mud and gravel. The Texas fawnsfoot occurs in the Colorado and Brazos River basins and resides in sand, gravel or sandy-mud bottoms, in moderately flowing waters (Howells et al. 1996; TPWD 2018b). TXNDD (2017) did not identify any EO of these species within the study area; however, these species may occur within the study area where suitable aquatic habitats occur.

Extirpated Species

The Eskimo curlew (*Numenius borealis*) was historically a spring migrant through Texas and utilized grasslands, pastures, plowed fields and occasionally marshes and mudflats. Today, the Eskimo curlew is thought by many to be extinct, the last confirmed sighting of this bird in Texas was in 1962 (Lockwood and Freeman 2014; TPWD 2018b), therefore it is not anticipated to occur within the study area due to extirpation.

The red wolf (*Canis rufus*) historically occurred throughout the eastern half of the state in forests, brushlands and prairies. The red wolf was known to prey on rabbits, deer, rodents, prairie chickens, crabs and livestock (Schmidly and Bradley 2016). Changes in land-use and over hybridization with the coyote (*Canis latrans*) are thought to have extirpated the red wolf from Texas. TXNDD (2017) did not identify any EO of this species within the study area and it is not anticipated to occur due to extirpation.

TPWD Listed Species

The reddish egret (*Egretta rufescens*) is a wading bird with blue legs and a pink bill and may occur as white (white phase) or gray with a rusty colored head and neck (dark phase). The reddish egret is a permanent resident of the Texas Gulf Coast and inhabits brackish marshes, shallow salt ponds and tidal flats (Alsop 2002). They nest on the ground or in trees and bushes on dry coastal islands in brushy thickets of yucca and prickly pear (TPWD 2018b). This species may occur within the study area as a

breeding resident in coastal areas and a rare post-breeding visitor to inland areas where suitable habitat is available (Lockwood and Freeman 2014).

The Sooty Tern (*Sterna fuscata*) is a scarce to occasional visitor to South Texas brushlands and is primarily found in the Gulf coastal portion of the region (Arvin 2007). Nonbreeding individuals are pelagic and spend most of their lives at sea where they catch jumping fish. Nesting usually occurs from April to July on barrier islands in sparsely vegetated flats above tidal zones. Sooty Terns occur in Texas regularly from March to October. Occasionally hurricanes will carry individuals onto the coast or farther inland (Lockwood and Freeman 2014; TPWD 2018b). This species may occur as a rare visitor within the study area where suitable coastal habitat is available.

The white-faced ibis (*Plegadis chihi*) is a state-threatened species that inhabits freshwater marshes, swamps, ponds, river, sloughs and irrigated rice fields. This species is a colonial nester and forages on insects, newts, leeches, earthworms, snails, crayfish, frogs and fish. This species is a year-round resident along the Gulf Coast of Texas (TPWD 2018b). This species may occur as a resident within coastal areas of the study area where suitable habitat is present (Lockwood and Freeman 2014).

The wood stork (*Mycteria americana*) formerly nested in Texas prior to 1960. This species is now present in Texas only during the late summer and fall as post-breeding dispersers from the Mexican breeding population migrating into Gulf States seeking mudflats and other wetlands. The federally endangered US-breeding distinct population segment does not occur west of Mississippi. Birds in Texas are state threatened but not federally listed. They can be found in prairie ponds, flooded pastures or fields, ditches and other shallow standing water, including saltwater areas. This species usually roosts communally in tall snags, sometimes in association with other wading birds. This species may occur within the study area as a post-breeding visitor where suitable habitat is present (Lockwood and Freeman 2014; TPWD 2018b).

The white-tailed hawk (*Buteo albicaudatus*) inhabits prairies, cordgrass flats and scrub-live oak habitats near the coast. Farther inland, the white-tailed hawk prefers prairies, mesquite and oak savannas and mixed savanna-chaparral habitats (TPWD 2018b). The primary breeding population occurs along the central and southern coasts, south of Matagorda Bay. This species may occur within the study area as a common to uncommon resident in coastal prairies, if suitable habitat is available (Lockwood and Freeman 2014).

The blue sucker (*Cycleptus elongates*) is a large freshwater fish that occurs in limited numbers within major rivers in Texas, usually in channels and flowing pools with a moderate current. The blue sucker is

mostly carnivorous and feeds within bottom sediments. Spawning occurs during spring within smaller tributaries (Thomas et al. 2007). The blue sucker may occur within large river habitats in the study area.

The alligator snapping turtle (*Macrochelys temminckii*) inhabits perennial freshwater ecosystems, such as lakes, canals, bayous, ponds and river bottoms (Dixon 2013). The turtle may also enter brackish waters near the coast. This species is typically most active from March through October and may breed April – October. This species may occur within the study area where suitable habitat is present (TPWD 2018b).

The Texas horned lizard (*Phrynosoma cornutum*) 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 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 between early-spring to late-summer (Henke and Fair 1998; TPWD 2018b). This species may occur within the study area if suitable habitat exists.

The Texas scarlet snake (*Cemophora coccinea lineri*) is a semi-fossorial species that is restricted to areas of loose, sandy soil. In south Texas it has been recorded from live oak dotted sand dunes, coastal shrub scrub and agricultural lands with sandy soils. Scarlet snakes forage at night feeding on small lizards and reptile eggs (Dixon and Werler 2005). This species may occur within the study area if suitable habitat is present.

The Texas tortoise (*Gopherus berlandieri*) has a shell with yellowish-orange, “horned” scutes (plates) and is a long-lived, charismatic species that prefers open brush habitats with a grass understory and avoids areas only having open grass and bare ground. The Texas tortoise is active during March to November, and when inactive, it occupies shallow depressions at the base of a bush or cactus, underground burrows or under objects. The Texas tortoise feeds on fruits of prickly pear and other mostly succulent plants (TPWD 2018b). This species may occur within the study area if suitable habitat is present.

The timber rattlesnake (*Crotalus horridus*) occupies moist lowland forest and hilly woodland areas near surface waters. The species frequently utilizes fallen hollow logs and stumps as habitat and forages primarily on small mammals (Dixon and Werler 2005). TXNDD (2017) did not identify any EO of these species within the study area; however, this species may occur within the study area if suitable habitat is present.

TPWD Species of Concern and Sensitive Vegetation Communities

While not regulated, TPWD also lists species of concern for each county and TXNDD data contains occurrence information for species of concern and sensitive vegetation communities within the study area. TPWD generally recommends consideration for these species and avoidance of listed vegetation communities when routing linear utility corridors. Table 2-21 summarizes the TPWD listed species of concern for Brazoria, Matagorda and Wharton counties. Several species of concern and sensitive vegetation communities occur within the study area and these are described below (TXNDD 2017). Additional information on animal or plant species of concern may be found in the TPWD (2018b) County Lists of Rare Species are shown in Appendix A.

TABLE 2-21 TPWD LISTED SPECIES OF CONCERN WITHIN THE STUDY AREA COUNTIES

COMMON NAME	SCIENTIFIC NAME	RECORDED IN STUDY AREA?[1]	COUNTIES LISTED[2]		
			Brazoria	Matagorda	Wharton
Plants					
Awnless bluestem	*Bothriochloa exaristata*		X	-	X
Coastal gay-feather	*Liatris bracteata*	Yes	X	X	-
Florida pinkroot	*Spigelia texana*	No	X	X	-
Giant sharpstem umbrella-sedge	*Cyperus cephalanthus*	No	X	-	-
Indianola beakrush	*Rhynchospora indianolensis*	No	-	X	-
Panicled indigobush	*Amorpha paniculata*	No	-	X	-
South Texas spikesedge	*Eleocharis austrotexana*	No	X	X	X
Texas meadow-rue	*Thalictrum texanum*		X	-	-
Texas sunflower	*Helianthus praecox praecox*		X	-	-
Texas tauschia	*Tauschia texana*	Yes	X	X	X
Texas windmill grass	*Chloris texensis*	No	X	-	-
Threeflower broomweed	*Thurovia triflora*	Yes	X	X	-
Shinner's sunflower	*Helianthus occidentalis plantagineus*	Yes	-	X	-
Amphibians					
Southern crayfish frog	*Lithobates areolatus areolatus*	Yes	-	-	X
Reptiles					
Texas diamondback terrapin	Malaclemys terrapin littoralis	Yes	X	X	
Fish					
American eel	*Anguilla rostrata*	No	X	X	X
Crustacean					
A crayfish	*Cambarellus texanus*	Yes	-	-	X
Insect					
Gulf coast clubtail	*Gomphus modestus*	Yes	-	X	-
Birds					
Henslow's sparrow	*Ammodramus henslowii*	No	X	X	X
Black rail	*Laterallus jamaicensis*	No	X	X	-
Snowy plover	*Charadrius alexandrinus*	No	X	X	-

TABLE 2-21 TPWD LISTED SPECIES OF CONCERN WITHIN THE STUDY AREA COUNTIES

COMMON NAME	SCIENTIFIC NAME	RECORDED IN STUDY AREA?[1]	COUNTIES LISTED[2]		
			Brazoria	Matagorda	Wharton
Sprague's pipit	*Anthus spragueii*	No	X	X	-
Western snowy plover	*Charadrius alexandrinus nivosus*	No	X	X	-
Western burrowing owl	*Athene cunicularia hypugaea*		-	X	X
Mammals					
Plains spotted skunk	*Spilogale putorius interrupta*	Yes	X	X	X

Sources: [1] TXNDD 2017; [2]TPWD 2018b.

Rare and Sensitive Vegetation Communities

Sensitive vegetation communities documented by TXNDD (2017) within the study area include: Saltgrass-cordgrass series, Sea Oats-bitter panicum, Gammagrass-swithchgrass series, Marshhay cordgrass series, Seacoast blustem-gulfdune paspalum series, Coastal live oak-pecan series, Water oak-pecan series, Alfisol Coastal Prairie, Vertisol Coastal Prairie and Little Bluestem-Brownseed Paspalum Series. The occurrence of sensitive vegetation communities may depend on location, hydrology, soil type and degree of historical ground disturbance and land management practices. A number of patches of these communities have been documented within the study area, totaling between five acres and 18 square miles of the 908 square mile study area.

Additional sensitive vegetation communities within the study area include the Columbia Bottomlands region. This region is a rare mixture of grasslands, hardwood forests and coastal wetlands that include diverse old-growth bottomlands that are important stopover habitats for millions of migratory birds. USACE Nationwide Permit Regional Condition 15c does not authorize discharges into these habitats. Designated Columbia Bottomlands are defined as waters of the US that are dominated by bottomland hardwoods in the Lower Brazos and San Bernard River basins identified in the 1997 Memorandum of Agreement between the USEPA, USFWS, NRCS and TPWD for bottomland hardwoods in Brazoria County. Spatial data of designated Columbia Bottomlands was obtained from the USACE and these areas were mapped by GIS during the routing process.

(This page left blank intentionally.)

3.0 PROPOSED ALTERNATIVE ROUTE IDENTIFICATION

3.1 ROUTING STUDY METHODOLOGY

This section describes the methodologies and assumptions that were used to conduct the environmental assessment and routing study for the Bailey to Jones Creek Transmission Line Project. A base map was developed for the POWER planning team and CenterPoint Energy to delineate the study area boundaries. The POWER planning team was comprised of technical experts within each respective resource field. Initial field reconnaissance was conducted and preliminary evaluation criteria were developed. Based on data pertinent to the study area, the POWER planning team and CenterPoint Energy also established criteria, consistent with PUC standards, for the resource analysis. Data were collected pertaining to land use, recreational and park areas, historical and aesthetic values and environmental integrity. Available GIS coverage with associated metadata was reviewed, and relevant resource data were selected and mapped. Sensitive resource locations were identified on an environmental and land use composite constraints map. Feasible and geographically diverse preliminary transmission line segments were developed, and three public meetings were conducted. Modifications to the preliminary transmission line segments were completed based on the results of the public meetings and additional agency input. Data were tabulated for the resulting proposed transmission line segments, which were then organized into proposed alternative routes. A comparative potential impact assessment of all the proposed alternative routes was completed, culminating in the recommendation of the proposed alternative routes that best address PURA and PUC substantive rules.

The study approach included the following major tasks:

- Base Map Development;
- Study Area Delineation;
- Development of Evaluation Criteria;
- Data Collection and Mapping;
- Reconnaissance Surveys;
- Resource Analysis;
- Opportunities and Constraints Evaluation;
- Preliminary Transmission Line Segment Identification;
- Public Involvement Program;

- Identification of Proposed Transmission Line Segments;
- Selection of Proposed Alternative Routes;
- Impact Assessment of Proposed Alternative Routes; and
- Proposed Alternative Route Selection that best addresses PURA and the PUC's Substantive Rules.

A detailed description of the methodologies used to complete this environmental assessment and routing study follows.

3.1.1 Base Map Development

A base map was prepared at a scale of 1:39,000 (1.0 inch = 3,250 feet). The base map was a two-sheet map covering the area between the study area boundaries and was used to initially display resource data for the study area. Resource data categories and factors that were determined appropriate within the study area were selected and mapped.

Data displayed on the base map include:

- Major land jurisdictions and uses;
- Major roads, including county roads, farm-to-market roads, US highways and State highways;
- Existing transmission line and pipeline corridors;
- Parks and recreational areas;
- Major political subdivision boundaries;
- Lakes, rivers, creeks and ponds;
- Federal Wildlife Management Area;
- USACE designated Columbia Bottomland Hardwoods; and
- USACE mapped NWI wetlands within Columbia Bottomland Hardwoods,

The base map provides a broad overview of various resource locations indicating obvious routing constraints and areas of potential routing opportunities.

3.1.2 Study Area Delineation

The study area boundaries (see Figure 2-1) were defined to include feasible geographically diverse alternatives for the location of the proposed 345 kV transmission line between the Project endpoints. Major physiographic features, jurisdictional boundaries, sensitive resources, land uses and existing roadways and utility corridors helped to define the study area boundaries. The study area boundary (Figure 2-1) was depicted on a study area map that was included with consultation letters, dated September 11, 2017, that were sent to agencies and officials to solicit comments on the Project (see Appendix A).

3.1.3 Evaluation Criteria

Evaluation criteria were developed to reflect accepted practices for routing electric transmission lines in Texas (see Table 3-1). Emphasis was placed on acquiring the types of information identified in Section 37.056(c)(4)(A)-(D) of PURA, the PUC CCN application and 16 TAC § 25.101, including the policy of prudent avoidance. Evaluation criteria were further refined based on data collection, reconnaissance surveys and public input. The routing activities were conducted with consideration and incorporation of the evaluation criteria. Routing activities included data collection, reconnaissance surveys, resource analysis, identification of routing opportunities and constraints and identification of the preliminary transmission line segments. Evaluation criteria data were collected, mapped, tabulated and analyzed (Section 4.0) for each resulting proposed alternative route and ultimately used as a basis for the comparison of the proposed alternative routes as families and the selection of the proposed alternative routes that best meet the requirements under PURA and PUC rules (Section 5.0).

TABLE 3-1 LAND USE AND ENVIRONMENTAL EVALUATION CRITERIA

LAND USE
Length of route (feet)
Length of route (miles)
Number of habitable structures within 500 feet of route centerline
Number of habitable structures in previous criterion also within 500 feet of an existing transmission line
Number of habitable structures potentially to be relocated/removed
Length of route using existing transmission line easement
Length of new ROW required for route
Length of route parallel to existing transmission line ROW
Length of route not utilizing/paralleling existing transmission line ROW
Length of route parallel to existing pipeline ROW
Length of route parallel to existing railroad ROW
Length of route paralleling apparent property lines

TABLE 3-1 LAND USE AND ENVIRONMENTAL EVALUATION CRITERIA

LAND USE
Length of route parallel to other existing ROW (roadway, etc.)
Length of route not parallel to pipeline ROW, railroad ROW, apparent property lines or other existing ROW (roadway, etc.)
Percent of route parallel with apparent features, property lines, pipelines, railroads or an existing ROW
Length of route across parks/recreational areas
Number of additional parks/recreational areas within 1,000 feet of route centerline
Total length of route across Texas Department of Criminal Justice (TDCJ) and TPWD properties
Length of route across TDCJ property
Length of route across TPWD property
Length of route across residential areas
Length of route across commercial/industrial areas
Length of route across agricultural land/cropland
Length of route across pastureland
Length of route across mobile irrigated cropland or pastureland
Number of pipeline crossings
Number of transmission line crossings
Number of US and state highway crossings
Number of FM road crossings
Number of local road crossings
Number of cemeteries within 1,000 feet of the route centerline
Number of heliports within 5,000 feet of route centerline
Number of private airstrips within 10,000 feet of route centerline
Number of FAA-listed airfields within 10,000 feet of route centerline having no runway more than 3,200 feet
Number of FAA-listed airfields within 20,000 feet of route centerline having at least one runway more than 3,200 feet
Number of commercial AM radio transmitters within 10,000 feet of route centerline
Number of FM radio transmitters, microwave relay stations, and other electronic installations, etc., within 2,000 feet of route centerline
Number of water wells within the ROW
Number of oil and gas wells within the ROW
AESTHETICS
Estimated length of route within foreground visual zone of US and state highways
Estimated length of route within foreground visual zone of FM and county roads
Estimated length of route within foreground visual zone of park and recreational areas
ECOLOGY
Length of route across upland woodlands
Length of route across bottomland/riparian woodlands
Length of route across National Wetland Inventory mapped forested or scrub/shrub wetlands
Length of route across National Wetland Inventory mapped emergent wetlands
Total length of route across National Wetland Inventory mapped wetlands
Length of route across USACE designated Columbia Bottomlands

TABLE 3-1 LAND USE AND ENVIRONMENTAL EVALUATION CRITERIA

LAND USE
Length of route across National Wetland Inventory mapped wetlands within USACE designated Columbia Bottomlands
Length of route across Coastal Management Zone
Length of route across known habitat of federal endangered/threatened species of plants or animals
Number of known state rare/unique plant locations within the ROW
Length of route across open water (lakes or ponds)
Number of stream and canal crossings
Length of route parallel to streams within 100 feet of route centerline
Length of route across 100-year floodplains
CULTURAL RESOURCES
Number of recorded historical or archeological sites crossed within ROW
Number of additional recorded historical or archeological sites within 1,000 feet of route centerline
Number of National Register of Historic Places listed or determined-eligible properties within ROW
Number of additional National of Register Historic Places listed or determined-eligible properties within 1,000 feet of route centerline
Length of route across areas of high archeological/historic site potential

3.2 DATA COLLECTION AND CONSTRAINTS MAPPING

Once the initial study area boundary was identified, comprehensive data collection activities began. POWER developed a list of potentially interested regulatory agencies, elected officials and organizations to receive a project scoping letter. The purpose of the letter was to inform the various officials and agencies of the Project and to give them the opportunity to provide information regarding sensitive resources and potential issues within the study area. POWER utilized websites from Brazoria, Matagorda and Wharton counties, in addition to confirmation through telephone calls, to identify local officials. Various federal and state agencies that may have potential concerns or regulatory permitting requirements for the Project were also contacted. Copies of correspondence with the various federal and state regulatory agencies, county and local officials, departments and non-governmental agencies are included in Appendix A.

Federal, state, and local agencies and officials contacted include:

- FEMA
- FAA
- NRCS
- USACE
- DoD Siting Clearinghouse
- USEPA

- USFWS
- RRC
- TCEQ
- TxDOT – Division of Aviation
- TxDOT – District Engineers
- TxDOT – Environmental Affairs Division
- TxDOT – Planning and Programming
- Texas GLO
- THC
- TPWD
- TWDB
- Brazoria County Officials
- Brazoria County Historical Commission
- Brazoria County Engineering Department
- Matagorda County Officials
- Matagorda County Historical Commission
- Wharton County Officials
- Wharton County Historical Commission
- City of Angleton
- City of Bay City
- City of Brazoria
- City of Clute
- City of Freeport
- City of Lake Jackson
- City of Richwood
- City of Sweeny
- Village of Jones Creek
- City of West Columbia
- Angleton ISD
- Bay City ISD
- Boling ISD
- Brazosport ISD
- Columbia-Brazoria ISD

- El Campo ISD
- Sweeny ISD
- Tidehaven ISD
- Van Vleck ISD
- Wharton ISD
- Brazos River Authority
- Friends of the River San Bernard
- Lower Colorado River Authority
- Houston-Galveston Area Council
- Bayou Land Conservancy
- Gulf Coast Birding Observatory
- The Nature Conservancy
- Texas Land Trust Council

Available data were mapped to identify existing conditions and to determine potential conflicts that would result from the proposed 345 kV transmission line. Resource data were collected for land use, historical (cultural and archeological) and aesthetic values, physiographic and geologic features, surface waters, wetlands and biological resource areas. Data were mapped within the study area using GIS layers. Additional data collection consisted of file and record reviews conducted with various state regulatory agencies, a review of published literature and a review of various maps and readily available aerial imagery on the internet (NAIP 2014-2018) and Google Maps. Results from the resource inventory data were described in Section 2.0 and were reflected on the Composite Constraints Map developed at a scale of 1:18,000 (1.0 inch = 1,500 feet).

3.3 RECONNAISSANCE SURVEYS

POWER personnel conducted reconnaissance surveys of the study area to confirm the findings of the research and data collection activities and to identify potential constraints that may not have been previously noted. Reconnaissance surveys confirmed some data point accuracy and identified changes in land use that occurred after the date of the aerial photography. Reconnaissance surveys were limited to visual observations conducted from public roads and existing public ROWs located within the study area.

Reconnaissance surveys were conducted on the following dates:

- September 12, 2017
- November 7, 2017

- April 26, 2018

3.4 RESOURCE ANALYSIS

The composite constraints map was used as a foundation for the resource analysis. Criteria were developed for each resource to establish constraint parameters which facilitated the identification of preliminary transmission line segments. The following definitions were considered:

- **Resource Value**: A measure of rarity, intrinsic worth, singularity or diversity of a resource within a particular area.
- **Protective Status**: A measure of the formal concern as expressed by legal protection or special status designation.
- **Present and Known Future Uses**: A measure of the level of potential conflict with land management and land use policies.
- **Hazards**: A measure of the degree to which construction and operation of the transmission line could be affected by a known resource hazard.

Using this framework, overlays of individual resources were mapped to provide a visual representation of constraint areas, and potential routing opportunity areas were identified. Where feasible, identified constraints were avoided to the extent practicable to minimize potential impacts or conflicts.

3.5 OPPORTUNITIES AND CONSTRAINTS EVALUATION

In order to identify preliminary transmission line segments, information gathered during the data collection task, review of agency comments and management plans, internal review and discussions with the Project team were used to determine routing opportunities and constraints within the study area. Routing opportunities were generally located within open, undeveloped areas, or parallel to existing linear corridors. For example, existing transmission lines, roadways and property boundaries provided routing opportunities.

3.5.1 Existing Linear Corridors

Within the areas of opportunity, POWER identified existing linear corridor features as potential paralleling opportunities in accordance with the PURA Section 37.056(c) and 16 TAC § 25.101(b)(3)(B)(i-iii). Apparent property boundaries, roadways and existing transmission lines were evaluated for potential paralleling opportunities. Data sources used to identify existing linear ROWs include utility company regional system maps, aerial imagery, USGS topographical maps, CAD files

from CenterPoint Energy (Brazoria County Appraisal District 2017 and 2018; Matagorda County Appraisal District 2017 and 2018; Wharton County Appraisal District 2017 and 2018), additional available planning documents and reconnaissance surveys (PLATTS 2017; NAIP 2014-2018).

3.5.2 Apparent Property Boundaries

Apparent property boundaries and fence lines were initially identified using readily available existing aerial photography (NAIP 2014-2018) supplemented by parcel data that was downloaded (Brazoria County Appraisal District 2017 and 2018; Matagorda County Appraisal District 2017 and 2018) and purchased (Wharton County Appraisal District 2017 and 2018). CenterPoint Energy downloaded and purchased parcel information for all counties in the initial study area boundary directly from Brazoria, Matagorda and Wharton county appraisal districts. The December 2017 parcel information was relied on in the beginning phase of the Project to identify potential paralleling opportunities. In June 2018, CenterPoint Energy obtained parcel data layers for a second time directly from Brazoria, Matagorda and Wharton Counties. The 2018 parcel information was relied on to identify apparent property boundaries within the study area.

3.5.3 Roadway ROWs

POWER evaluated paralleling SHs 35, 36, 60, 227, 288 and 332, and numerous other local roads. However, in many instances, existing constraints, developments and habitable structures prohibited paralleling many of the road ROWs due to development that typically occurs along existing road ROWs.

3.5.4 Existing Transmission Line ROWs

POWER identified several existing transmission line corridors in the area, which include four 345 kV transmission lines, approximately twelve 138 kV transmission lines and approximately fourteen 69 kV transmission lines. Numerous opportunities for paralleling these transmission lines were identified. In some instances, constraints are located adjacent to these transmission lines or the location or orientation of these lines precluded paralleling them.

3.5.5 Existing Pipeline ROWs

POWER reviewed aerial photography and RRC data to identify pipeline ROWs within the study area. Pipeline locations were verified, where possible, during field reconnaissance surveys. POWER identified multiple existing pipeline ROWs traversing the study area. The existing pipeline ROWs were considered, but did not always provide suitable paralleling opportunities. The PUC rulemaking Project No. 42740 regarding paralleling of pipelines was also taken into consideration.

3.6 PROPOSED ALTERNATIVE ROUTE IDENTIFICATION

CenterPoint Energy provided the location of the existing Bailey Substation and existing Jones Creek Substation to POWER. Multiple subsequent preliminary transmission line segments were developed to connect the Project endpoints.

3.6.1 Preliminary Transmission Line Segments

Preliminary transmission line segments were identified on an overlay of the composite environmental and land use constraints map. These segments were developed based upon maximizing the use of routing opportunity areas while avoiding areas of high environmental constraints or conflicting land uses. Aerial photography was used as the background of the composite constraints overlay to identify optimal locations for the preliminary transmission line segment centerlines. During the preliminary transmission line segment development process, the location of residential areas, habitable structures, industrial facilities, pipelines, surface water crossings, wetlands, property boundaries, agricultural land and other sensitive resource areas were considered. POWER utilized the following to identify the preliminary transmission line segments:

- Input received from scoping activities with local officials, regulatory agencies and others.
- Results from reconnaissance surveys of the study area.
- Review of aerial photography.
- Findings of the data collection activities.
- Environmental and land use composite constraints maps.
- Apparent property boundaries from the study area counties' appraisal districts.
- Existing compatible opportunity areas.
- Location of existing developments.

The preliminary transmission line segments were identified in accordance with the PURA § 37.056 (c)(4)(A)-(D), 16 TAC § 25.101, including the PUC's policy of prudent avoidance, while also considering the evaluation criteria in Table 3-1. It was POWER's intent to identify preliminary transmission line segments that, when combined, formed an adequate number of reasonable and geographically diverse proposed alternative transmission line routes based on all of the previously mentioned routing considerations.

POWER, with CenterPoint Energy's input, identified 261 preliminary transmission line segments (see Figure 3-1). The preliminary transmission line segments were overlaid on aerial imagery (NAIP 2014-2018) along with land use and environmental constraint data and were presented at the three public meetings (see Section 3.6.2 and Appendix B).

(This page left blank intentionally.)

FIGURE 3-1

PRELIMINARY TRANSMISSION LINE SEGMENTS

OVERSIZED MAP

(This page left blank intentionally.)

3.6.2 Public Involvement Program

After developing the 261 preliminary transmission line routing segments, a public meeting was held for each of the three study area counties. The purpose of the public meetings was to solicit comments, concerns and input from residents, landowners, public officials and other interested parties concerning the Project with reference to the preliminary transmission line segments, the overall transmission line routing process, and to:

- Promote a better understanding of the Project, including the purpose, need, potential benefits and impacts and the PUC CCN application approval process.
- Inform the public about the routing procedure, schedule and decision-making process.
- Allow the decision-making process to adequately identify and consider the values and concerns of the public and community leaders.

3.6.2.1 Public Meetings

CenterPoint Energy hosted three public meetings. The meetings were held within the community to solicit comments, concerns and input from residents, landowners, public officials and other interested parties. The public meetings were held on the following dates, times and locations:

- February 6, 2018 from 5:00 to 8:00 p.m., Lake Jackson Civic Center, 333 Highway 332, Lake Jackson, Texas 77566 (Brazoria County).
- February 8, 2018 from 5:00 to 8:00 p.m., Wharton Civic Center, 1924 North Fulton Street, Wharton, Texas 77488 (Wharton County).
- February 13, 2018 from 5:00 to 8:00 p.m., Bay City Civic Center, 201 Seventh Street, Bay City, Texas 77414 (Matagorda County).

Individual notification letters announcing the three public meetings were directly mailed by CenterPoint Energy to 2,398 landowners whose property is located within 530 feet of each of the preliminary transmission line segments. Instead of 500 feet, 530 feet was used to account for the ±30 feet horizontal accuracy of the aerial photography used. CenterPoint Energy also publicized the three public meetings through a public notice published in four local newspapers.

- The Facts: February 1, 2018
- The Wharton Journal-Spectator: February 3, 2018

- Bay City Tribune: February 4, 2018
- Houston Chronicle: February 4, 2018

The public notice announced the location, time and purpose of the meetings. Copies of the landowner notice and the public notice for the three public meetings are provided in Appendix B.

At the public meetings, personnel from CenterPoint Energy and POWER staffed information stations, with each station devoted to a particular aspect of the Project. The stations included maps (two sets of six display maps (3.5-foot by 4.0-foot display boards at a scale of 1:18,000 (1.0 inch = 1,500 feet)), illustrations, photographs and text explaining each topic. In addition to the information stations, CenterPoint Energy also provided six manned GIS computer stations at each meeting. Landowners were provided the opportunity to view their properties or areas of interest in more detail at the GIS stations. POWER staff recorded their comments in a digital format and upon request provided an annotated 8.5-inch by 11-inch color snapshot of their area of interest for the attendee to take home.

Interested citizens and property owners were encouraged to visit each station so that the entire process could be explained in the logical sequence of project development. Using the information station format is 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, one-to-one discussions with CenterPoint Energy and POWER personnel typically encourage more interaction from those citizens who might be hesitant to participate in a more formal speaker-audience format. The names of the information stations were: Registration and Information; Project Need; ROW/Construction; Electromagnetic Field (“EMF”) Information; Routing and Environmental; GIS Computer Stations; Refreshments; and Questionnaire Drop Off.

A video presentation was also provided during the public open house meetings to further explain the Project need and the process.

CenterPoint Energy established a Project website, http://www.centerpointenergy.com/baileyjonescreek, to provide information to the public. The website content explains the scope of the Project including the need for the Project and the construction and routing options, as well as the PUC’s process to review and approve the Project. The website also provides several Project documents, a Project questionnaire, EMF information, maps and aerial photos and a link to the PUC website.

Upon entering the public meetings, visitors were asked to sign in and were handed an information packet, including a questionnaire and a map (see Appendix B) indicating the location of the preliminary transmission line segments and the existing Bailey and Jones Creek Substation sites. The questionnaire solicited comments on the Project and an evaluation of the information presented at the meetings. The information packet also included a welcome sheet that explained how the meeting was organized, a Frequently Asked Questions sheet about the Project, the PUC Certification Process, a project schedule, the transmission need display, several construction displays, the PUC's landowner brochure, landowner protest form, landowner intervention form and State of Texas Landowner's Bill of Rights. Copies of the information packet documents are located in Appendix B.

Of the 2,398 notification letters sent for the three public meetings, 147 people signed in at the public meetings, which represent six percent of the notified landowners. There was a total of 192 known people in attendance at the public meetings. A total of 77 questionnaires were received along with letters and other forms of input such as pictures. Public comments were also recorded at the six GIS computer stations. POWER reviewed and evaluated each questionnaire and comment.

As a result, the analysis indicated that 75 percent of those individuals that submitted a questionnaire agreed that the need for the Project had been adequately explained. The questionnaire solicited comments pertaining to community values and concerns, such as features that should be avoided, if possible, when routing the transmission line. The questionnaire asked the respondents to rank concerns from **1** (greatest concern) to **11** (least concern), from a list of features that included agricultural land, floodplains or wetlands, recreational or park areas, residential areas or subdivisions, commercial areas, schools, churches, cemeteries, historic sites, wildlife or other concerns. Residential areas or subdivisions (44 percent) and schools (13 percent), were ranked as the greatest areas of concern that should be avoided, if possible, when routing the proposed transmission line.

The questionnaire solicited comments regarding which existing linear features the proposed transmission line should follow within the study area. The questionnaire asked the respondents to rank the features they think are most important to follow from **1** (most important) to **7** (least important) from a list that included roads, pipelines, property lines, electrical lines, railroads, ditches and others. The responses that received a rank of **1** (most important) indicated that property lines (34 percent) and electrical lines (12 percent) are the most important existing linear features that should be followed, if possible.

The questionnaire asked if any other factors or features should be considered in determining the location of the proposed transmission line. The majority of responses indicated that consideration should be given to personal property, health effects, wildlife and the effect the proposed transmission line will have on property values. Of the questionnaires received, 39 percent of respondents indicated they were not aware of any incorrect or missing features on the Environmental and Land Use Constraints Map; 35 percent indicated that features were missing or incorrectly plotted on the map; and 25 percent either did not know or did not indicate any incorrect or missing features on the Environmental and Land Use Constraints Map.

When asked on the questionnaire if respondents had a concern with a particular preliminary transmission line segment, 61 (79 percent) responded with either one or more segments. Eleven respondents (14 percent) indicated Segments FW and GP; eight (10 percent) respondents indicated Segments IM, GJ, and GO. The other segments of particular concern include Segments AJ, EA, FQ, and GB (under four percent each). The total percentage does not add up to 100 percent due to multiple answers given by respondents.

When asked on the questionnaire if respondents preferred a specific type of transmission line structure being proposed for the Project, 33 of the respondents (43 percent) answered yes, 22 (29 percent) indicated that they did not have a preference, and the remaining 22 (29 percent) left the question blank.

Of the 33 responses indicating yes, 20 of the respondents indicated a preference for double-circuit steel poles and six would prefer a structure that would have the least impact.

When asked on the questionnaire which of these following situations applied to them (a preliminary transmission line segment is near my home, business, on my land, none of the above or other), and to specify which segment, the following responses were received (the total percentage does not add up to 100 percent due to multiple answers given by respondents):

- Thirty-nine (51 percent) indicated that a preliminary transmission line segment was near their home;
- Eight (10 percent) indicated that a preliminary transmission line segment was near my business;
- Thirty-five (45 percent) indicated that a preliminary transmission line segment was on their land;
- Two (three percent) none of the above; and
- Two (three percent) other.

The questionnaire asked if the information that was provided and the exhibits displayed at the public meeting met their needs. Forty-nine (64 percent) responded "yes," while nine (12 percent) responded "no." The remaining 19 respondents (25 percent) left this question blank.

The questionnaire asked whether the respondent had visited the Bailey to Jones Creek website to view the information about the Project. Of those that responded, 41 answered "yes," and 25 answered "no." This question was left blank or had miscellaneous comments on the remaining 11 questionnaires.

The questionnaire also requested additional comments. Primary themes include property value, personal property, and health risks. Below are selected written comments, remarks and concerns that were provided in response to this question:

- "People and health effects are my concern."
- "It does not seem to be practical to route a transmission line as far south as this line would be to effect my property. I believe the northern most route is the most direct and logical."
- "Please don't run it near my home. I understand the need but pray the highway is a better route for us both. Thank you."
- "If areas of cropland are chosen for the route. Significant attention should be given to marking the tops of the lines with aerial markers such as large round red balls every 200 ft. or so to aid aerial applicators in seeing these lines early in the morning or late evening."
- "Crossing my property would be destroying wetlands and hardwood habitats. The ROW would require taking out 5 or 6 majestic live oak trees that were full grown when Columbus sailed the ocean blue. You would have to cross an existing transmission line that is approx. 80-100 feet tall where it crosses the river."
- "Why come through a city limit or edge of city limit where EMF is a threat and lines would inhibit future housing or business growth, Texas is a pro-business, get'er done place but we are also becoming better educated and concerned about our family's health."
- "If Segment CB which runs across my land is utilized for this Project, I expect to be compensated at today's full market value for my land and not at Brazoria County appraised value."

3.6.2.2 Comments from Agencies, Officials and Organizations

POWER developed a list of federal, state and local agencies and organizations that would potentially have an interest in the Project. Section 3.1.3 lists agencies, organizations and public officials that were sent scoping letters regarding the Project. Maps of the study area were included with each letter. Copies of the agency scoping letters sent and responses received are located in Appendix A.

Responses received are summarized on the following pages.

- The FAA responded with a letter dated September 15, 2017, stating that if CenterPoint Energy is planning to sponsor any construction or alterations which may affect navigable airspace, a FAA Form 7460-1 must be filed electronically via a website. CenterPoint Energy will coordinate with the FAA as necessary once a route is approved for construction.

- FEMA responded with a letter dated September 20, 2017, requesting that each county's floodplain administrator be contacted as to whether a Floodplain Development Permit is needed.

- The NRCS responded with a letter dated October 19, 2017, stating that although they did identify areas of Prime Farmland within the study area, they consider the installation of above ground transmission lines as minimal activity. Therefore, the study area is considered exempt from the FPPA. The NRCS also stated that the proposed site involves USDA-NRCS floodwater retarding structures or Wetland Reserve Program conservation easements within areas of Brazoria and Matagorda counties. Once a final route is selected, they asked that CenterPoint Energy resubmit a request to ensure that these areas will not interfere with the Project corridor. They also encouraged the use of accepted erosion control methods during the construction of the Project.

- The DoD Siting Clearinghouse responded with an email dated October 5, 2017 requesting additional information regarding the Project, which POWER provided in October 13, 2017. The DoD Siting Clearinghouse responded with a letter dated October 20, 2017 stating their informal review of the transmission line project, as proposed, will have minimal impact on military operations conducted in this area.

- The USFWS responded with a letter dated February 1, 2016 and a received stamp dated September 13, 2017, providing a form letter regarding threatened and endangered species inquiries. They also directed POWER to the online listing for federally listed species.

- The TCEQ responded with a letter dated October 13, 2017 stating Brazoria County is designated non-attainment for the 2008 ozone National Ambient Air Quality Standards and classified as moderate. They requested that a completed draft of the EA be completed and submitted for review before the office can provide further comment. They also recommended the environmental assessment address actions that will be taken to prevent surface and groundwater contamination.

- The THC responded with a letter dated September 27, 2017, stating that the study area contains numerous landforms once occupied by prehistoric and historic Native Americans. They further stated that the study area has a moderate to high probability of containing significant cultural resources and that an investigation is warranted. The THC requested that the routes and proposed stations be plotted on a USGS topographic map and submitted for their review.

- The TPWD responded with an email dated September 26, 2017 requesting more information regarding the Project. The TPWD responded with a letter dated October 5, 2017 and provided a project number (38481) and made numerous recommendations. In summary, some of the TPWD recommendations include using existing facilities whenever possible and using existing ROW and utility corridors to minimize impacts to undisturbed habitats, mitigation for all impacts, and avoiding state land.

- The Wildlife Division of TPWD responded with an email dated September 9, 2017 providing data files for the study area and a list of threatened, endangered and rare species.

- The TxDOT responded to POWER's initial scoping letter with an email dated September 22, 2017 providing TxDOT's current project list within the study area for Matagorda and Wharton Counties, stating the list is periodically updated. On October 2, 2017 TxDOT responded to POWER's inquiry regarding state-owned roadway crossings, stating that where the proposed transmission line crosses state-owned roadways (FMs and SHs) a TxDOT utilities permit would be required. Additionally, TxDOT stated that if construction activities require closure of vehicle lanes or the shoulder, separate traffic control approval from the local TxDOT inspector would be needed.

- In response to a request from POWER to TxDOT for more information regarding projects in Brazoria County, TxDOT responded with an email dated March 21, 2018 recommending that POWER contact Bill Brudnick, in the TxDOT Houston District. Mr. Brudnick is responsible for Brazoria County. POWER contacted Mr. Brudnick and TxDOT then responded with a letter

dated April 13, 2018, providing an updated list of major projects in Brazoria County within the study area. The list included the widening of SH 36 to a four-line divided roadway.

- TxDOT responded to a further inquiry from POWER regarding aerial crossings of state highways and FM roads with an email dated April 23, 2018 stating that there is not a problem with aerial power lines crossing an FM road at angles other than 90 degrees. POWER requested further clarification regarding acceptable crossings of state highways and TxDOT represented in an email dated April 24, 2018, that there is some variance in the 90 degree crossing of aerial lines at state highways and FM roads but also suggested that sketches be provided for TxDOT's Utility Section to review. Upon review of the sketches of preliminary state highway crossings, TxDOT responded with an email dated May 10, 2018 stating that an Exception Policy is required for new crossings greater than 105 degrees or less than 75 degrees to highway centerline.

- The TWDB responded with a letter dated September 20, 2017 stating there are not any active TWDB-funded projects located in the areas of the Project. They recommended contacting local entities, including municipalities, county governments, water supply corporations, etc., to determine if there are specific water/wastewater projects that may conflict with the Project.

- The Wharton County Historical Commission responded with a letter dated October 20, 2017, stating that they did not work with projects and permits but that they had appealed to County Judge Phillip Spenrath for a reply.

- The Brazos River Authority ("BRA") responded with a letter dated September 15, 2017, stating that the BRA operates waste water treatment facility within the study area. Should the Project impact the facility they request to be contacted regarding any approvals, permits or easements that might be required.

- The Bayou Land Conservancy responded with a letter dated September 21, 2017, stating that they hold four conservation easements with the study area. Two of the conservation easements also serve as mitigation banks. They would greatly appreciate the Project not crossing these conservation easements if at all possible. A location map of the conservation easements was included.

- The City of Bay City responded with an email dated January 19, 2018 stating the City is not aware of any constraints within the City of Bay City for an alternative route for the proposed transmission line. They also stated they would want to establish a franchise agreement between

the City and CenterPoint Energy if the transmission line is brought through the City. CenterPoint Energy met with Bay City in June of 2018 to discuss the proposed route segments that impact Bay City and the city agreed a franchise agreement would not be needed.

3.6.3 Modifications to Preliminary Transmission Line Segments

POWER and CenterPoint Energy reviewed and considered all comments received from the public meetings and agencies regarding the preliminary transmission line segments (Figure 3-1). The purpose of the review was to evaluate areas of concern and to consider revisions to the preliminary transmission line segments. The information received by CenterPoint Energy and POWER from the public and agencies resulted in modifications to some of the 261 preliminary transmission line segments.

In response to public comments, several segments were modified or combined, and some segments were added to reduce potential impacts to habitable structures and other constraints to the greatest extent practicable, increase geographic diversity and address other concerns from the comments provided. The Project team made final revisions to the preliminary transmission line segments before identifying the proposed alternative transmission line routes to be evaluated by POWER in this EA. The preliminary transmission line segments are presented in Figure 3-1, following the segment modifications derived from data gathered during the public involvement period; the resulting 164 proposed transmission line segments are reflected in Figure 3-2.

Generally, the changes and additions that were made to the preliminary transmission line segments after the open house meetings were made for the following reasons:

- To further reduce the number of habitable structures directly affected by the centerline of the proposed transmission line segments.
- To improve the paralleling of apparent property lines or other physical features.
- To improve the paralleling of compatible ROW.
- To reduce potential land use impacts to ranching and farming operations.
- To increase the number of geographically diverse routing options.

In addition, CenterPoint Energy initially included multiple options to expand the Bailey Substation which required different segment options to enter the Bailey Substation. CenterPoint Energy ultimately

determined that the transmission line could be brought into the Bailey Substation without expanding the footprint of the substation and therefore it was preferable to not include the different expansion options given the greater costs and impacts to surrounding landowners. The preliminary transmission line segments associated with the expansion options were also removed from further consideration.

FIGURE 3-2
PROPOSED TRANSMISSION LINE SEGMENTS
OVERSIZED MAP

(This page left blank intentionally.)

3.6.4 Proposed Alternative Routes

Of the numerous possible forward progressing route combinations, 30 proposed alternative routes were identified and selected by POWER and CenterPoint Energy. They provide geographically diverse alternatives across the study area to connect CenterPoint Energy's Bailey Substation with the Jones Creek Substation. Each of the 164 proposed transmission line segments is used in at least one of the 30 proposed alternative routes.

The 30 proposed alternative routes and their segment combinations are presented in Table 3-2 below. The proposed alternative routes were also subdivided into geographically diverse groups (or "families") represented by eastern, central, and western characterization based on their location within the study area and segment usage. Figure 3-3 (Sheets 1-6 in map pockets) depicts the location of the proposed transmission line segments that, when combined, form the proposed alternative routes overlain on a USGS topographic map, along with the land use and environmental data and constraints identified and previously discussed. Figure 3-4 (Sheets 1-2 in map pockets) displays the entire study area boundary, mapped constraints and also depicts the location of the proposed transmission line segments.

TABLE 3-2 SEGMENT COMPOSITION OF THE PROPOSED ALTERNATIVE ROUTES

PROPOSED ALTERNATIVE ROUTES	GEOGRAPHIC DESCRIPTION/ FAMILY*	SEGMENT COMBINATION
1	Eastern	B-D-C-L-P-T-V-W-Y-Z-AP-BK-BL-CT-CU-CX-DD-DE-DH-DL-DN-DS-DT-ER1-ER2-EV-EZ-FC-FM-FO-FP
2	Eastern	B-D-F-H-L-P-U-V-X-Y-Z- AP-BK-BM-CS-CT-CU-CW-CY-DB-DD-DF-DI-DK-DV-DW-EF-JE-EO-EP-ET-EU-FB-FF-FN-FP
3	Eastern	B-D-F-H-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CR-CS-CT-CU-CW-CY-DB-DD-DF-DG-DH-DL-DO-DQ-DR-DS-DU-EP-ES-ER1-ER2-EW-FA-FF-FN-FP
4	Eastern	B-D-F-H-L-P- U-V-X-Y-Z-BI-BX-CM-CR-CS-CT-CU-CW-CY-DB-DD-DF-DG-DH-DL-DO-DP-DR-DS-DU-EP-ET-EU-FB-FF-FN-FP
5	Eastern	B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CU-CW-CY-DC-IZ-JA-FP
6	Central	B-D-F-H-L-FQ-FY-GC-GE-HQ-HR-CB-BU-BW-BJ-BK-BL-CT-CU-CW-CY-DB-DD-DF-DG-DH-DM-DV-DX-EF-EM-EQ-EU-EX-EY-EZ-FD-FG-FH-FO-FP
7	Central	B-G-J-K-M-GI-GJ-FW-FY-GD-GE-HQ-HR-CC-CD-CE-IN-IO1-IO2-IX-IZ-JA-FP
8	Central	B-G-J-K-M-GI-GO-GP-FW-FY-GD-GE-HQ-HR-HS-IM-IN-CQ-CR-CS-CT-CV-DA1-DA2-IX-IZ-JA-FP
9	Central	B-G-J-K-N-O-GI-GO-GQ-GR-GT-HO-HQ-HT-IL-IM-IN-IO1-IO2-IX-IZ-DJ-DK-DV-DX-EF-EM-EQ-EU-FB-FF-FN-FP
10	Central	B-G-J-K-N-GF-GH-GL-GO-GQ-GS-GT-HP-IE-IL-IM-IN-CQ-CR-CS-CT-CU-CW-CY-DC-IZ-JA-FP
11	Western	B-E-K-N-GF-GH-GK-GN1-JB-HA2-HD-HU-HW-IC-ID-IE- IL-IM-IN-IO1-IO2-IX-IZ-JA-FP
12	Western	B-E-K-N-GF-GH-GK-GM-GX-GZ-HC-HE-HG-HM-HP-IE- IL-IM-IN-IO1-IO2- IX-IZ-JA-FP
13	Western	B-E-K-N-GF-GH-GK-GN1-GN2-HA1-HA2-HE-HV-IB-IC-HL-HM-HO-HQ-HT-IL-IM-IN-IO1-JC-DA2-IX-IZ-JA-FP

TABLE 3-2 SEGMENT COMPOSITION OF THE PROPOSED ALTERNATIVE ROUTES

PROPOSED ALTERNATIVE ROUTES	GEOGRAPHIC DESCRIPTION/ FAMILY*	SEGMENT COMBINATION
14	Western	B-E-K-N-GF-GH-GK-GM-GX-GZ-HB-HF-HG-HM-HO-HQ-HR-HS-IM- IN-IO1-JC-DA2-IX-IZ-JA-FP
15	Western	B-E-K-N-GF-GG-GX-GZ-HB-HU-HX-IB-IC-ID-IE- IL-IM-IN-IO1-IO2 -IX-IZ-JA-FP
16	Eastern	B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CV-DA1-DA2-IX-IZ-JA-FP
17	Eastern	B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CU-CW-CZ-DA1-DA2-IX-IZ-DJ-DK-DV-DX-EF-JE-EN-EQ-EU-FB-FF-FN-FP
18	Western	B-G-J-K-N-GF-GH-GK-GM-GX-GY-HA1-HA2-HD-HU-HW-IC-ID-IE-IL-IM-IN-IO1-JC-DA2-IX-IZ-JA-FP
19	Western	B-G-J-K-N-GF-GH-GK-GN1-JB-HA2-HE-HG-HL-ID-IE-IL-IM-IN-IO1-JC-DA2-IX-IZ-JA-FP
20	Central	B-E-K-M-GI-GO-GQ-GS-GT-HP-IE-IL-IM-IN-CQ-CR-CS-CT-CU-CW-CY-DB-DD-DF-DI-DK-DV-DX-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP
21	Eastern	B-D-C-L-P-U-V-X-Y-Z-BI-BX-CM-CQ-IO1-IO2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP
22	Eastern	B-D-C-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CQ-IO1-IO2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP
23	Western	B-E-K-N-GF-GH-GK-GN1-JB-HA2-HD-HF-HG-HM-HP-IE-IL-IM-IN-IO1-IO2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP
24	Central	B-E-K-M-GI-GO-GQ-GS-GT-HP-IE-IL-IM-IN-IO1-IO2-IX-IZ-DJ-DK-DV-DX-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP
25	Central	B-G-J-K-M-GI-GJ-FW-FY-GD-GE-HQ-HR-CC-CD-CE-IN-IO1-IO2-IX-IZ DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FE-FM-FO-FP
26	Central	B-D-C-L-FQ-FY-GC-GE-HQ-HR-HS-IM-IN-IO1-IO2-IX-IZ DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FM-FO-FP
27	Eastern	B-D-C-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CQ-IO1-IO2-IX-IZ-DJ-JD-DL-DO-DQ-DR-DS-DT-ER1-ER2-EV-EZ-FC-FM-FO-FP
28	Eastern	B-D-C-L-P-U-V-X-Y-Z-BI-BX-CM-CQ-IO1-IO2-IX-IZ-DJ-DL-DO-DP-DR-DS-DT-ER1-ER2-EV-EZ-FD-FG-FH-FO-FP
29	Eastern	B-D-F-H-L-P-U-V-X-Y-Z- AP-BK-BM-CS-CT-CV-DA1-DA2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ET-EU-FB-FF-FN-FP
30	Eastern	B-D-C-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CQ-IO1-IO2-IX-IZ-DJ-JD-DL-DO-DQ-DR-DS-DT-ES-JF-ER2-EV-EZ-FD-FG-FI-FN-FP

*Geographic Description/Family is defined by use of specific segments: Eastern=Y or Z, Central=HQ or GT, and Western=GK or GX.

These 30 proposed alternative routes are further evaluated, discussed and compared in Section 4.0. Within each resource area, the evaluation criteria for each of the proposed alternative routes were tabulated for comparative purposes.

4.0 IMPACT OF THE PROPOSED ALTERNATIVE ROUTES

Evaluation of the 30 proposed alternative routes identified in Section 3.0 was conducted by utilizing the evaluation criteria listed in Table 3-1 in Section 3.1.3. The tabulated data was used to evaluate the proposed alternative routes and to conduct a quantitative comparative analysis. This analysis, along with consideration of geographic diversity, was the first step in the process POWER and CenterPoint Energy used to identify the set of proposed alternative routes, evaluated in Section 5.0, for inclusion in the PUC CCN Application.

The potential impacts of the proposed alternative routes were compared with respect to community values, recreational and park areas, historic and aesthetic values and environmental integrity. The results of the analysis are provided in Tables 4-1 (segment data) and 4-2 (route data), located in Appendix C. This section provides a summary and discussion of the comparison between the 30 proposed alternative routes.

4.1 COMMUNITY VALUES

Impacts on community resources can be divided into direct and indirect effects. Direct effects are those that would occur if the location and construction of a transmission line results in the removal or loss of public access to a valued resource. Indirect effects are those that would result in a loss in the enjoyment or use of a resource due to the characteristics of the proposed transmission line, poles, tower structures or ROW.

4.1.1 Land Use

The magnitude of potential impacts to land use resulting from the construction of a transmission line is determined by the amount of land or land use type displaced 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 may occur due to the movement of workers, equipment and materials through the area. Construction noise and dust, in addition to temporary disruptions of traffic flow, may also temporarily affect residents and businesses in the area immediately adjacent to the ROW. Coordination between CenterPoint Energy, their contractors and the landowners regarding ROW access and construction scheduling should minimize these disruptions.

The evaluation criteria used to compare potential land use impacts include overall route length, the length of route paralleling existing corridors (including apparent property lines), the proximity of the route to habitable structures, potential impacts to recreational and park areas and the length of route across various

land use types. An analysis of the existing land use adjacent to the proposed ROW was required to evaluate the potential impacts. The following sections address potential impacts to land use associated with the 30 proposed alternative routes.

4.1.2 Proposed Alternative Route Length

The length of a proposed alternative route can be an indicator of the relative magnitude of land use impacts. In general, a shorter route means that less land is crossed, which usually results in the least potential impacts. The total lengths of the proposed alternative routes vary from approximately 53.9 miles for Proposed Alternative Route 2, to approximately 84.3 miles for Proposed Alternative Route 18. The differences in route lengths reflect the direct or indirect pathway of each proposed alternative route between the Project endpoints. The length of the proposed alternative routes may also reflect the effort to parallel existing transmission lines, other existing linear features and apparent property lines and provide geographic diversity. The approximate lengths for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

4.1.3 Compatible ROW

16 TAC § 25.101(b)(3)(B) requires that the PUC consider whether new transmission line routes are within existing compatible ROWs and/or are parallel to existing compatible ROWs, property lines or other natural or cultural features. Criteria were used to evaluate compatible ROW utilization, length of route parallel and adjacent to existing transmission line ROW, length of route parallel to other existing linear ROWs and length of ROW paralleling apparent property lines. It should also be noted that if a segment parallels more than one existing linear corridor, only one linear corridor was tabulated (e.g., the segment parallels both an apparent property line and a roadway, but it was only tabulated as paralleling the roadway). Although pipeline ROW was not generally treated as a routing opportunity, POWER and CenterPoint Energy did consider paralleling pipeline ROW where it paralleled other compatible ROW, or where an area is otherwise undisturbed except for an existing pipeline ROW.

Proposed Transmission Line Segments B, FP and JA are proposed to be built partially within existing CenterPoint Energy ROW and are presented in Table 4-1 (Appendix C). Proposed Alternative Routes 5, 7, 8, 10 through 16, 18 and 19 include Proposed Transmission Line Segments B, FP and JA, and utilize the most existing transmission line ROW with approximately 1.8 miles each. All of the remaining 18 proposed alternative routes utilize less CenterPoint Energy's existing transmission line ROW, with approximately 0.9 mile each. The lengths utilizing CenterPoint Energy's existing transmission line ROW for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

All of the proposed alternative routes run parallel to some length of existing transmission line ROW. The total proposed alternative route lengths parallel to existing transmission line ROW vary from approximately 6.5 miles for Proposed Alternative Route 25, to approximately 18.5 miles each for Proposed Alternative Routes 20 and 24. Thirteen of the proposed alternative routes parallel existing transmission line ROW for over 10 miles. The length parallel to existing transmission line ROW for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

The proposed alternative routes with lengths parallel to existing pipeline ROW ranges from approximately 6.3 miles for Proposed Alternative Route 2, to approximately 24.5 miles for Proposed Alternative Route 18. The lengths parallel to existing pipeline ROW for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

The proposed alternative routes with lengths parallel to existing railroad ROW ranges from approximately zero miles for 24 of the proposed alternative routes, to approximately 1.3 miles each for Proposed Alternative Routes 9, 10, 20 and 24. The remaining two proposed alternative routes parallel existing railroad ROW for approximately 0.3 mile each. The lengths parallel to existing railroad ROW for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

All of the proposed alternative routes parallel apparent property lines to the extent feasible in the absence of other existing linear features. The length of proposed alternative routes that parallel apparent property lines ranges from approximately 17.3 miles for Proposed Alternative Route 2, to approximately 39.1 miles for Proposed Alternative Route 14. Fourteen of the proposed alternative routes parallel apparent property lines for over 30 miles. The lengths paralleling apparent property lines for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

The proposed alternative routes with lengths paralleling other existing linear features, including roadways, range from approximately 8.3 miles for Proposed Alternative Route 16, to approximately 26.6 miles for Proposed Alternative Route 15. Twenty-eight of the proposed alternative routes parallel other existing linear features, including roadways, for 10 or more miles. The lengths paralleling other existing linear features for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

To evaluate whether and to what extent, the proposed alternative routes parallel existing compatible ROWs, apparent property lines, or other natural or cultural features, the percentage of each total route length parallel to these features was estimated. These percentages can be calculated by adding up the total

route length paralleling existing transmission lines, existing railroad, other existing ROW and apparent property lines and then dividing the result by the total length of the route. All of the proposed alternative routes parallel existing linear features for over 70 percent of their lengths, with 18 of the proposed alternative routes paralleling existing linear features for 80 percent or more of their lengths. The percentage of each route that parallels existing linear features ranges from 72 percent for Proposed Alternative Route 16, to 89 percent for Proposed Alternative Route 20. The percentage of each proposed alternative route parallel with existing linear features is presented in Table 4-2 (Appendix C).

4.1.4 Urban and Residential Areas

One of the most important measures of potential land use impacts is the number of habitable structures located in the vicinity of each proposed alternative route. POWER determined the number and distance of habitable structures located within 500 feet of the centerline of each proposed alternative route through the interpretation of aerial photography and during reconnaissance surveys. The horizontal accuracy of the aerial photograph used to identify habitable structures was calculated at ±20 feet. To account for this margin of error and to ensure that all habitable structures were properly identified, POWER identified habitable structures within 520 feet of the centerline of each proposed alternative route.

All of the 30 proposed alternative routes have habitable structures located within 500 feet of their centerlines. Due to the developed nature of the study area and the effort made to parallel existing linear features (e.g., existing transmission line, roadway and pipeline ROWs and apparent property lines), 22 of the 30 proposed alternative routes have 200 or more habitable structures located within 500 feet of their centerlines. Proposed Alternative Route 18 has the least number of habitable structures located within 500 feet of its centerline with 164, with 15 of these already within 500 feet of another existing transmission line. It should be noted that where proposed alternative routes parallel adjacent transmission line ROW, the majority of habitable structures along that section will already be within 500 feet of an existing transmission line. Proposed Alternative Route 20 has the most habitable structures located within 500 feet of its centerline with 447, with 53 of these already within 500 feet of an existing transmission line. The number of habitable structures located within 500 feet of each of the proposed alternative route centerlines are presented in Table 4-2 (Appendix C).

Several of the proposed alternative routes for this Project have habitable structures located within 50 feet of their centerlines. These habitable structures will likely be required to be relocated or removed. Based on aerial photography interpretation and verification during field reconnaissance surveys, there is one habitable structure that would be located in the ROW for Proposed Transmission Line Segments AP, CF,

EZ, FD and IO2 and six habitable structures that would be located in the ROW for Proposed Transmission Line Segment EP. The number of habitable structures that would be located in the ROW ranges from zero for nine of the proposed alternative routes, to 10 for Proposed Alternative Route 22. The number of habitable structures located in the ROW of each of the proposed alternative route centerlines are presented in Table 4-2 (Appendix C).

Tables 5-9 through 5-38 (Appendix D) present detailed information on habitable structures within 520 feet of each of the proposed alternative route centerlines. All known habitable structure locations are shown on Figure 3-3 (Sheets 1-6 in map pockets) and on Figure 5-1 (Sheets 1-6 in map pockets).

4.1.5 Land Use Categories

An analysis of compatibility with adjacent land use types was completed for each proposed alternative route. Land use categories occurring within the study area included residential, commercial and industrial areas, agricultural land or cropland, pastureland and state-owned land.

Proposed alternative routes with the greatest lengths across residential areas typically have a higher number of habitable structures located within 500 feet of their centerlines. The proposed alternative routes with lengths across residential areas range from approximately 5.0 miles for Proposed Alternative Route 5, to approximately 11.9 miles for Proposed Alternative Route 25. The lengths across residential areas for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

Commercial and industrial areas crossed by the proposed alternative routes include the five industrial facilities that were identified within the study area. The proposed alternative routes with lengths across commercial and industrial areas range from approximately 0.8 mile for Proposed Alternative Route 8, to approximately 5.9 miles for Proposed Alternative Route 20. The lengths across commercial and industrial areas for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

All proposed alternative routes cross agricultural land or cropland. However, due to the relatively small area affected (location of the structures), and the short duration of construction activities at any one location, such impacts should be both minor and temporary. The proposed alternative routes with lengths across agricultural land or cropland range from approximately 3.3 miles for Proposed Alternative Route 27, to approximately 17.1 miles for Proposed Alternative Route 15. The lengths across agricultural land or cropland for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

All the proposed alternative routes cross pastureland. However, as CenterPoint Energy is not proposing to fence the ROW or otherwise separate the ROW from adjacent lands, there should not be any long-term or significant displacement of current grazing activities within pasturelands. The proposed alternative routes with lengths across pastureland range from approximately 35.0 miles for Proposed Alternative Route 2, to approximately 55.4 miles for Proposed Alternative Route 6. The lengths across pastureland for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

Proposed Transmission Line Segment GO is proposed to cross agricultural lands with known mobile irrigation systems (rolling or pivot). Proposed Alternative Routes 8, 9, 10, 20 and 24 include Proposed Transmission Line Segment GO, which has the only length across agricultural lands with known mobile irrigation systems (rolling or pivot) with approximately 0.1 mile. All of the remaining 25 proposed alternative routes do not cross any agricultural lands with known mobile irrigation systems. The lengths across agricultural lands with known mobile irrigation systems (rolling or pivot) for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

Twenty-one of the proposed alternative routes cross state-owned land. Proposed Transmission Line Segments CV, CW, CX, CY, CZ, DA1 and DA2 each cross property owned by the TDCJ, and Proposed Transmission Line Segments EM, EN, EQ, ET, EU, FA, FB, FF and JA each cross property owned by the TPWD. The proposed alternative routes with lengths across TDCJ and TPWD properties range from zero miles for nine of the proposed alternative routes, to approximately 7.4 miles for Proposed Alternative Routes 5 and 10. The lengths across TDCJ and TPWD properties for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

4.1.6 Transportation/Aviation/Utilities

4.1.6.1 Transportation

Potential impacts to transportation include temporary disruption of traffic and conflicts with future proposed roadways or utility improvements. Traffic disruptions would include those associated with the movement of equipment and materials to the ROW, slightly increased traffic flow and periodic congestion during the construction phase of the Project. These impacts are typically considered minor, temporary and short-term. CenterPoint Energy would be required to obtain road-crossing permits from TxDOT for any crossing of state-maintained roadways.

The number of US Hwys and SHs crossed by the proposed alternative routes ranges from two highway crossings each for Proposed Alternative Routes 1, 16, 27, 28 and 30, to eight highway crossings each for

Proposed Alternative Routes 2, 6, 9 and 20. The number of FM roads crossed by the proposed alternative routes ranges from five road crossings each for Proposed Alternative Routes 11, 19 and 23, to 18 road crossings each for Proposed Alternative Routes 3, 22, 27 and 30. The number of US Hwys, SHs and FM road crossings for each of the proposed alternative routes are presented in Table 4-2 (Appendix C).

4.1.6.2 Aviation

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

One public FAA registered airport, Bay City Municipal Airport, is located within 20,000 feet of 14 of the proposed alternative routes. Following PUC approval of a route for the proposed transmission line, CenterPoint Energy will make a final determination of the need for FAA notification, based on specific route location and structure design. The result of this notification and any subsequent coordination with the FAA could include changes in the line design and/or potential requirements to mark and/or light the structures.

None of the proposed alternative routes are within 10,000 feet of a runway at a public or military FAA registered airport where no runway is more than 3,200 feet in length.

The number of private airstrips located within 10,000 feet of the proposed alternative routes ranges from one for Proposed Alternative Route 6, to four each on Proposed Alternative Routes 12 and 14. The number of heliports located within 5,000 feet of the proposed alternative routes ranges from zero on 18 of the proposed alternative routes, to three for Proposed Alternative Route 18. Table 4-3 presents detailed airport, airstrip and heliport information for each of the proposed alternative routes.

Tables 5-9 through 5-38 (Appendix D) present detailed information on airports, airstrips and heliports. The number of airports, airstrips and heliports for each of the proposed alternative route centerlines are presented in Table 4-2 (Appendix C). The distance for each airport/airstrip and heliport from the nearest

proposed alternative route was measured using GIS software and aerial photograph interpretation (Table 4-3). All known airport/airstrip and heliport locations are shown on Figure 3-3 (Sheets 1-6 in map pockets) and on Figure 5-1 (Sheets 1-6 in map pockets).

TABLE 4-3 AIRSTRIP RUNWAY LOCATIONS

FIGURE 5-1 MAP ID	AIRSTRIP	PROPOSED ALTERNATIVE ROUTES	DISTANCE FROM NEAREST ROUTING SEGMENT (FEET)	ESTIMATED RUNWAY LENGTH (FEET)[1]	EXCEEDS SLOPE[1, 2]
1500	Bay City Municipal Airport (FAA Public)	6, 7, 8, 9, 10, 12, 13, 14, 19, 20, 23, 24, 25, 26	3,586	5,107	Yes
1501	Private Airstrip 1	1, 2, 3, 4, 5, 6, 16, 17, 21, 22, 26, 27, 28, 29, 30	3,523	NA	NA
1502	Peterson Airport	1, 2, 3, 4, 5, 9, 16, 17, 21, 22, 27, 28, 29, 30	6,357	NA	NA
1503	Private Airstrip 2	7, 8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 23, 24, 25	2,177	NA	NA
1504	Private Airstrip 3	7, 8, 10, 20, 24, 25	61	NA	NA
1505	W.D. Cornelius Ranch Airport (Private)	12, 14, 15	2,821	NA	NA
1506	Fehmel Dusting Service Airport (Private)	11, 12, 13, 14, 18, 19, 23	2,265	NA	NA
1507	Eagle Air Park (Private)	3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	2,759	NA	NA
1508	Station 24 Heliport	12, 14, 15, 18	2,680	40	Yes
1509	Cig 809 Heliport	18	3,453	40	Yes
1510	Matagorda Regional Medical Center Heliport	11, 13, 18, 19, 23	1,369	75	Yes
1511	Sweeny Community Hospital Heliport	3, 22, 27, 30	1,420	40	Yes

[1]FAA 2018; 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 151 feet.

4.1.6.3 Utilities

Pipelines (including those carrying oil and gas) will be identified on engineering drawings and flagged prior to construction. CenterPoint Energy will coordinate with the respective pipeline companies at each crossing for continued safe operation of the pipeline during transmission line construction and operation. The number of pipelines crossed by each proposed alternative route varies from 98 crossings on Proposed Alternative Route 1, to 264 crossings for Proposed Alternative Route 14. The number of pipeline crossings for each of the proposed alternative routes is presented in Table 4-2 (Appendix C).

Several existing electric transmission lines were identified within the study area and each of the proposed alternative routes crosses several existing transmission lines. The number of transmission line crossings ranges from nine for Proposed Alternative Route 6, to 18 crossings each for Proposed Alternative Routes 11 and 23. CenterPoint Energy will coordinate with the appropriate entity to obtain the necessary permits or written agreements as required. The number of transmission line crossings for each of the proposed alternative routes is presented in Table 4-2 (Appendix C).

4.1.7 Communication Towers

None of the proposed alternative routes would have a significant impact on electronic communication facilities or operations in the study area. No commercial AM radio towers were identified within 10,000 feet of any of the route centerlines for the proposed alternative routes. The number of FM radio transmitters, microwave towers and other electronic installations identified within 2,000 feet of the route centerlines range from three for Proposed Alternative Route 15, to 11 for Proposed Alternative Route 3.

Tables 5-9 through 5-38 (Appendix D) present detailed information on electronic communication facilities. The number of AM radio towers located within 10,000 feet and FM radio and other commination facilities located within 2,000 feet of the proposed alternative route centerlines are presented in Table 4-2 (Appendix C). The distance of each communication tower from the nearest proposed alternative route was measured using GIS software and aerial photograph interpretation (see Table 4-4). All known communication tower locations are shown on Figure 3-3 (Sheets 1-6 in map pockets) and on Figure 5-1 (Sheets 1-6 in map pockets).

TABLE 4-4 ELECTRONIC COMMUNICATION FACILITIES

FIGURE 5-1 MAP ID	TOWER TYPE	PROPOSED ALTERNATIVE ROUTES	DISTANCE FROM NEAREST SEGMENT (FEET)*
1400	Other electronic installation	1, 2, 3, 4, 5, 6, 16, 17, 21, 22, 26, 27, 28, 29, 30	258
1401	FM Tower	7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 23, 24, 25	666
1402	Other electronic installation	7, 8, 20, 24, 25	502
1403	Other electronic installation	6, 26	1,921
1404	Other electronic installation	6, 7, 8, 25, 26	1,499
1405	Other electronic installation	9, 10, 20, 24	516
1406	Other electronic installation	9, 10, 20, 24	1,244
1407	Other electronic installation	11, 19, 23	637
1408	Other electronic installation	11, 13, 18, 19, 23	1,033
1409	Other electronic installation	12, 13, 14, 19, 23	180
1410	Other electronic installation	9, 13, 14	1,566
1411	Other electronic installation	9, 10, 11, 12, 13, 15, 18, 19, 20, 23, 24	948

TABLE 4-4 ELECTRONIC COMMUNICATION FACILITIES

FIGURE 5-1 MAP ID	TOWER TYPE	PROPOSED ALTERNATIVE ROUTES	DISTANCE FROM NEAREST SEGMENT (FEET)*
1412	Other electronic installation	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	945
1413	Other electronic installation	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	454
1414	Other electronic installation	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	854
1415	Other electronic installation	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	947
1416	Other electronic installation	3, 22, 27, 30	1,173
1417	Other electronic installation	3, 22, 27, 30	1,786
1418	Other electronic installation	3, 20, 22, 27, 30	1,247
1419	Other electronic installation	1, 2, 29	1,588
1420	Other electronic installation	5, 6, 16, 17	1,112
1421	Other electronic installation	2, 3, 4, 5, 6, 10, 20	412
1422	Other electronic installation	2, 3, 4, 5, 6, 10, 20	503
1423	Other electronic installation	2, 3, 4, 6, 9, 17, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30	1,038
1424	Other electronic installation	5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19	1,521

*POWER aerial photo and USGS interpretation; FCC 2017.

4.1.8 Socioeconomics

Construction and operation of the proposed transmission line will not result in a significant change in the population or employment rate within the study area. Construction workers for the Project will commute to the work site on a daily or weekly basis, instead of permanently relocating to the area. The presence of additional workers would likely result in a temporary increase in local retail sales due to purchases of food, fuel and other merchandise. No additional staff will be necessary for line operations and maintenance.

4.2 RECREATIONAL AND PARK AREAS

Impacts to community resources, whether direct or indirect, can be gauged as they affect community recreational and park areas. Potential impacts to recreation include the disruption or preemption of recreational activities during the construction of the Project. There are several parks and recreational areas identified within the study area.

No significant impacts to the use or enjoyment of the parks and recreation facilities located within the study area are anticipated from the construction of any of the proposed alternative routes. No adverse impacts are anticipated for any of the fishing or hunting areas from the construction of any of the proposed alternative routes.

Proposed Transmission Line Segment HU, which is included on Proposed Alternative Routes 11, 15 and 18, crosses approximately 0.5 mile of Riverside Park. Proposed Transmission Line Segments EM, EN, EQ, ET, EU, FA, FB, FF and JA, which are included on Proposed Alternative Routes 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 29, each cross between approximately 0.01 to 4.5 miles of the Justin Hurst WMA (Tables 4-1 and 4-2). These proposed transmission line segments are paralleling existing linear features (roads and transmission lines) to minimize potential impacts within Riverside Park and the Justin Hurst WMA. The lengths of proposed alternative routes that cross parks or recreational areas range from zero on 11 of the proposed alternative routes, to approximately 5.0 miles for Proposed Alternative Routes 11, 15 and 18.

The number of additional parks or recreation areas located within 1,000 feet of the proposed alternative route centerlines ranges from one for Proposed Alternative Route 9, to six each for Proposed Alternative Routes 22, 27 and 30. Refer to Table 4-2 (Appendix C) for the number of parks or recreation areas crossed and located within 1,000 feet of the proposed alternative routes.

Tables 5-9 through 5-38 (Appendix D) present detailed information on parks and recreation areas. The number of parks and recreation areas for each of the proposed alternative route centerlines are presented in Table 4-2 (Appendix C). The distance of each park or recreation area from the nearest proposed alternative route was measured using GIS software and aerial photography interpretation (see Table 4-5). All known park or recreation area locations are shown on Figure 3-3 (Sheets 1-6 in map pockets) and on Figure 5-1 (Sheets 1-6 in map pockets).

TABLE 4-5 PARKS AND RECREATION AREAS

FIGURE 5-1 MAP ID	PARKS AND RECREATION AREAS	PROPOSED ALTERNATIVE ROUTES	DISTANCE FROM NEAREST SEGMENT (FEET)*
1600-A	San Bernard National Wildlife Refuge	1, 2, 3, 4, 5, 6, 16, 17, 21, 22, 26, 27, 28, 29, 30	286
1600-B	San Bernard National Wildlife Refuge	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	149
1600-C	San Bernard National Wildlife Refuge	6, 7, 8, 14, 25, 26	761
1600-D	San Bernard National Wildlife Refuge	3, 22, 27, 30	49
1600-E	San Bernard National Wildlife Refuge	8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 23, 24, 26	185
1601	Matagorda County Birding Nature Center	13, 18	908
1602	Riverside Park	11, 15, 18	0
1603	Levi Jordan Plantation	3, 7, 20, 22, 25, 27, 30	53
1604	Lion's Club Park	1, 6	553
1605	SFA Elementary School Park	5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19	992
1606	Justin Hurst Wildlife Management Area	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	0
1607	Freeport Municipal Golf Course	1, 6, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30	337

*POWER aerial photo and USGS interpretation.

4.3 HISTORICAL AND AESTHETIC VALUES

Methods for identifying, evaluating and mitigating impacts to cultural resources have been established for federal projects or permitting actions, primarily for purposes of compliance with the National Historic Preservation Act ("NHPA"). Similar methods are often used when considering cultural resources affected by state-regulated actions. In either case, this process generally involves: (1) identifying significant (i.e., national- or state-designated) cultural resources within 1,000 feet of the centerline of each routing alternative; (2) determining the potential impacts of the project on those resources; and (3) implementing, where appropriate, measures to avoid, minimize or mitigate those impacts.

Impacts associated with the construction, operation and maintenance of transmission lines can affect cultural resources either directly or indirectly. Construction activities associated with any proposed project can adversely impact cultural resources if those activities alter the integrity of key characteristics that contribute to a property's significance as defined by the standards of the NRHP or the Antiquities Code of Texas. These characteristics might include location, design, setting, materials, workmanship, feeling or association for architectural and engineering resources, or archeological information potential for archeological resources.

Direct impacts are those effects that physically or visually alter the integrity of key aspects or qualities that define the historical significance of the resource. Typically, direct impacts are caused by the actual construction of the line or through increased vehicular traffic during the construction phase.

Indirect impacts include those effects caused by the Project that are farther removed in distance or that occur later in time but are reasonably foreseeable. These indirect impacts might include introduction of visual or audible elements that are out of character with the resource or its setting. Indirect impacts might also occur as a result of alterations in the pattern of land use, changes in population density, accelerated growth rates or increased pedestrian or vehicular traffic after construction. Historic buildings, structures, landscapes and districts are among the types of resources that might be adversely impacted by the indirect impact of the proposed transmission structures and wires.

Mitigation for direct and indirect impacts to cultural resources may be achieved, where appropriate, by avoidance through project design. Additional mitigation measures for direct impacts may include implementing a program for data recovery excavations if an archeological site cannot be avoided. Indirect impacts on historical properties and landscapes can be lessened through careful design and landscaping

considerations, such as using vegetation screens or berms where practicable. Additionally, relocation might be possible for some historic structures.

Because none of the proposed alternative routes have been surveyed in their entirety for cultural resources, the possibility of impacting undiscovered cultural resources exists along all of the proposed alternative routes. Areas with a high probability for prehistoric archeological sites include floodplains and secondary terraces of perennial stream channels, as well as areas near backswamps, wetlands and oxbow lakes. These highly productive environments provided high-food-density foraging areas to populations in the study area. Thus, all of the proposed alternative routes have been determined to have some HPA along their lengths, due to their proximity to water courses, wetlands, oxbow lakes and previously recorded archeological sites. The approximate lengths of HPAs crossed by each proposed alternative route are presented in Table 4-2 (Appendix C).

4.3.1 Historical Values

4.3.1.1 Archeological Sites

The file review, including data from TARL, THSA and TASA, indicated that there are 17 documented archeological sites within 1,000 feet of the proposed alternative routes (summarized in Table 4-6). Of these, five are prehistoric, 11 are historic and one has historic and prehistoric components. Site 41BO214 and portions of site 41BO221 have been determined ineligible for listing on the NRHP. Site 41BO214 is a scatter of historic and modern rubbish; site 41BO221 is a dumpsite with historic and modern materials. Site 41BO136, the Durazno Plantation, is listed on the NRHP and is discussed below. Site 41BO165, the Levi Jordan Plantation, is a SAL, a State Historic Site and has been determined eligible for listing on the NRHP. Site 41BO165 is also discussed below. The remaining sites have not been formally assessed for listing on the NRHP. None of the archeological sites are crossed by proposed alternative routes. The site and their distances to the proposed alternative routes are shown in Table 4-6.

TABLE 4-6 ARCHEOLOGICAL SITES WITHIN 1,000 FEET OF PROPOSED ALTERNATIVE ROUTES

SITE TRINOMIAL	DESCRIPTION	DISTANCE IN FEET FROM CENTERLINE	PROPOSED ALTERNATIVE ROUTE(S)	COMMENTS
41BO100	Prehistoric shell midden	814	3, 4, 8, 10, 20	NRHP eligibility undetermined
41BO103	Prehistoric shell midden	250	5, 6, 16, 17	NRHP eligibility undetermined
41BO109	Prehistoric ceramics and historic foundation and scatter	155	1, 2, 4, 5, 16, 17, 21, 28, 29	NRHP eligibility undetermined
41BO136	Durazno Plantation	931	5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19	NRHP-listed

TABLE 4-6 ARCHEOLOGICAL SITES WITHIN 1,000 FEET OF PROPOSED ALTERNATIVE ROUTES

SITE TRINOMIAL	DESCRIPTION	DISTANCE IN FEET FROM CENTERLINE	PROPOSED ALTERNATIVE ROUTE(S)	COMMENTS
41BO164	Historic Mims Plantation remains	498	3, 4, 8, 10, 20	NRHP eligibility undetermined
41BO165	Levi Jordan Plantation State Historic Site	85	3, 7, 22, 25, 27, 30	SAL, State Historic Site, eligible for NRHP
		140	20	
41BO191	Prehistoric shell midden	984	7, 9, 11, 12, 15, 21, 22, 23, 24, 25, 26, 27, 28, 30	NRHP eligibility undetermined
41BO214	Scatter of historic and modern artifacts	368	2, 3, 4, 5, 6, 10, 20	Determined Ineligible for NRHP
41BO221	Historic trash dump	198	8, 14, 26	Portions of site determined ineligible for NRHP
41BO227	Historic ranching feature and associated artifacts	848	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 20	NRHP eligibility undetermined
41BO238	Historic homestead remains	589	1, 2 ,3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	NRHP eligibility undetermined
41BO257	Historic ranch complex	264	3, 20, 22, 27, 30	NRHP eligibility undetermined
41BO258	Prehistoric shell midden	321	7, 9, 11,12, 15, 21, 22, 23, 24, 25, 26, 27, 28, 30	NRHP eligibility undetermined
41BO259	Historic ranch complex	923	5, 10	NRHP eligibility undetermined
41BO260	Prehistoric shell midden	428	7, 9, 11, 12, 15, 21, 22, 23, 24, 25, 26, 27, 28, 30	NRHP eligibility undetermined
41BO262	Historic homestead and produce stand	468	3, 4, 20, 21, 22, 27, 28, 30	NRHP eligibility undetermined
41MG138	Historic farmstead	277	14, 23	NRHP eligibility undetermined

Source: THC 2018b.

4.3.1.2 Cemeteries

Based on data from the THSA, TASA and topographic maps, 20 cemeteries are located within 1,000 feet of the proposed alternative routes. None of these cemeteries are crossed by the proposed alternative routes. The Gulf Prairie Peach Point Cemetery (an HTC), is bisected by Peach Point Road and mapped as two cemeteries, one on each side of the road. The nearest alternative routes are over 500 feet from the Gulf Prairie Peach Point cemetery boundaries. The Mims Family Cemetery is also a designated HTC. The Mims Family cemetery is 72 feet from Proposed Alternative Routes 8, 10, 21, 22, 27, 28 and 30; 560 feet from Proposed Alternative Routes 3, 4 and 20; and 969 feet from Proposed Alternative Routes 7, 9, 11, 12, 13, 14, 15, 18, 19, 23, 24, 25 and 26. The cemeteries within 1,000 feet of the proposed alternative routes are shown in Table 4-7. The number of cemeteries within 1,000 feet of each of the proposed alternative routes is presented in Table 4-2 (Appendix C).

TABLE 4-7 CEMETERIES WITHIN 1,000 FEET OF THE PROPOSED ALTERNATIVE ROUTES

CEMETERY NAME	THC CEMETERY NUMBER	NEAREST SEGMENT	DISTANCE IN FEET FROM CENTERLINE	DIRECTION TO THE CEMETERY	PROPOSED ALTERNATIVE ROUTE	COMMENTS
Black Family Cemetery	BO-C057	V	571	SW	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	
Brazoria Cemetery	BO-C136	BL	91	E	1, 6	
Colonial Cemetery	BO-C062	AP	523	N	1, 2, 29	
Galilee Church Cemetery	BO-C179	IX	104	NE	7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	
Gardener Family Cemetery	BO-C211	V	780	N	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	
Grace Baptist Cemetery	BO-C140	IN	284	NE	7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 23, 24, 25, 26	
		CE	299		20	
Gulf Prairie, Peach Point Cemetery 1	BO-C142	DI	590	S	2, 20	HTC
		DG	607		3, 4, 6	
Gulf Prairie, Peach Point Cemetery 2	BO-C142	DF	585	N	2, 3, 4, 6, 20	HTC
Jaden Cemetery	BO-C042	IM	545	NE	8. 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 23, 24, 26	
Mims Community Cemetery	n/a	CM	357	SE	3, 4, 20, 21, 22, 27, 28, 30	
Mims Family Cemetery	BO-C165	CM	560	S	3, 4, 20,	HTC
		CQ	72	W	8, 10, 21, 22, 27, 28, 30,	
		IN	969	N	7, 9, 11, 12, 13, 14, 15, 18, 19, 23, 24, 25, 26	
Morris Cemetery	BO-C205	P	784	NW	1, 2, 3, 4, 5, 16, 17, 21, 22, 27, 28, 29, 30	
Oakland Cemetery	BO-C040	DL	371	S	1, 3, 4, 27, 28, 30,	
Roselawn Memorial Park Cemetery	n/a	GT	165	SW	9, 10, 20, 24	
TDCJ Prison Cemetery	n/a	CY	503	N	2, 3, 4, 5, 6, 10, 20	
Union Church Cemetery	MG-C005	FQ	310	SE	6, 26	
Unknown (Kennedy School) Cemetery	MG-C013	HT	414	SW	9, 13	

TABLE 4-7 CEMETERIES WITHIN 1,000 FEET OF THE PROPOSED ALTERNATIVE ROUTES

CEMETERY NAME	THC CEMETERY NUMBER	NEAREST SEGMENT	DISTANCE IN FEET FROM CENTERLINE	DIRECTION TO THE CEMETERY	PROPOSED ALTERNATIVE ROUTE	COMMENTS
Unknown Cemetery 1	n/a	IN	93	W	7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 23, 24, 25, 26	
Vine Grove Cemetery	MG-C018	IE	236	S	10, 11, 12, 15, 18, 19, 20, 23, 24	
Zion Temple Cemetery/Williams Family/Mims-Fannin Plantation	BO-C012	CM	89	SE	3, 4, 20, 21, 22, 27, 28, 30	

Source: THC 2018a and 2018b; aerial imagery and USGS topographic quadrangles.

4.3.1.3 Architectural Sites

Three NRHP-listed or determined-eligible properties are recorded within 1,000 feet of the proposed alternative routes. The Durazno Plantation, also recorded as archeological site 41BO136, is an NRHP-listed property 931 feet from Proposed Alternative Routes 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18 and 19. No direct effects to the plantation are anticipated due to the distance between proposed ROWs and the Durazno Plantation boundary. Much of the proposed transmission line segment nearest the plantation parallels an existing transmission line, diminishing indirect effects to the property. In addition, tree cover between the plantation and proposed alternative routes is expected to obscure the transmission line from view from most of the Durazno Plantation property.

The Gazebo for Richard Marmion is a sculpture that is listed on the NRHP as part of a multiple-property listing honoring the work of sculptor Dionicio Rodriguez. The gazebo is 660 feet from Proposed Alternative Routes 4, 5, 16, 17, 21 and 28. No direct effects are anticipated to the gazebo. Although the viewshed from the gazebo is not a contributing factor to the gazebo's NRHP eligibility, the gazebo is in a wooded area and it is anticipated that tree cover would diminish any indirect effects to the viewshed.

The Levi Jordan Plantation, also recorded as archeological site 41BO165, is a SAL and State Historic Site that has been determined eligible for listing on the NRHP located 85 feet from Proposed Alternative Routes 3, 7, 22, 25, 27 and 30, and 140 feet from Proposed Alternative Route 20. No direct impacts are anticipated to the property. The plantation house is approximately 335 feet from the proposed alternative route centerlines. The proposed centerlines parallel a tree-lined fence line and SH 521 near the plantation, diminishing effects to the viewsheds of the Levi Jordan Plantation.

4.3.1.4 Summary

None of the proposed alternative routes have been systematically surveyed for cultural resources; therefore, the potential for undiscovered cultural resources exists. HPAs have been designated within the study area and the proposed alternative route lengths crossing these areas vary from 23.3 to 35.2 miles. There is the possibility that unknown prehistoric cultural resources and architectural resources may be located along any of the proposed alternative routes.

Proposed Alternative Routes 27, 7 and 3 have the greatest potential to impact recorded archeological sites. These three Proposed Alternative Routes are near the Levi Jordan Plantation State Historic Site. Proposed Alternative Route 7 is also near the Durazno Plantation. These three routes are among those that cross the most HPA, with 31.5, 30.2 and 32.1 miles, respectively. It is anticipated that any sites discovered during engineering or construction phases of the Project would be avoided by spanning or minor route adjustments. Thus, none of the proposed alternative routes are anticipated to have an adverse physical impact on any known cultural resources. Coordination with the THC may be necessary.

4.3.2 Aesthetic Values

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

Construction of the Project could have both temporary and permanent aesthetic effects. Temporary impacts would include views of the actual assembly and erection of the tower structures or concrete poles. Where wooded areas are cleared, the brush and wood debris could have an additional temporary negative impact on the local visual environment. Permanent impacts from the Project would result from visibility of the lattice tower or steel pole structures, conductors and cleared ROW.

Because no landscapes protected by legislation and no landscapes protected from most forms of development were identified within the study area, potential aesthetic impacts were evaluated by tabulating the linear feet of each proposed alternative route that would potentially create a new or additional impact to potential sensitive views. The length of each proposed alternative route within the foreground visual zone of the following viewpoints or corridors was tabulated:

- US and state highways within one-half mile with unobstructed views.
- FM and county roads within one-half mile with unobstructed views.
- Parks and recreational areas within one-half mile with unobstructed views.

Each of the proposed alternative routes has some portion of the route located within the foreground visual zone of US and state highways. Proposed Alternative Route 20 has the longest length of ROW within the foreground visual zone of US and state highways, with approximately 20.2 miles, followed by Proposed Alternative Route 6 with approximately 14.7 miles. Proposed Alternative Route 16 has the least, with approximately 3.8 miles followed by Proposed Alternative Routes 18 and 19 with approximately 4.4 miles each.

All of the proposed alternative routes have some portion of the routes located within the foreground visual zone of FM roads and county roads. Proposed Alternative Route 20 has the longest length of ROW within the foreground visual zone of FM roads and county roads, with approximately 21.6 miles, followed by Proposed Alternative Route 10 with approximately 17.8 miles. Proposed Alternative Routes 16, 17 and 29 have the least, with approximately 6.1 miles each, followed by Proposed Alternative Route 5 with approximately 6.9 miles.

All of the proposed alternative routes have some portion of their ROW length located within the foreground visual zone of parks and recreational areas. Proposed Alternative Route 22 has the longest length of ROW within the foreground visual zone of parks or recreational areas, with approximately 13.0 miles, followed by Proposed Alternative Route 27 with approximately 12.9 miles. Proposed Alternative Route 20 has the least, with 5.3 miles, followed by Proposed Alternative Route 24 with approximately 6.9 miles.

A summary of the lengths for each of the proposed alternative routes within the foreground visual zone of parks and recreational areas, US and state highways, and FM and county roads is presented in Table 4-2 (Appendix C).

4.4 ENVIRONMENTAL INTEGRITY

4.4.1 Physiography and Geology

Construction of the proposed transmission line is not anticipated to have any significant adverse effects on the physiographic or geologic features and resources of the study area. Erection of the lattice towers or monopole structures will require the excavation or 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 proposed alternative routes. No geologic hazards are anticipated to be encountered or created during construction.

4.4.2 Soils

Activities associated with the construction, operation and maintenance of electrical transmission lines typically do not adversely impact soils when appropriate mitigation measures are implemented during the construction phase as required. 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. In accordance with CenterPoint Energy's vegetation management specifications, ROW clearing of woody vegetation including trees, brush and undergrowth will be conducted within the ROW area prior to the start of construction, if required. Areas with total vegetation removal will have the highest potential for soil erosion and the movement of heavy equipment in the ROW creates the greatest potential for soil compaction. A determination of the need for a SWPPP will be made after approval of the route for the line. Prior to construction, CenterPoint Energy will develop a SWPPP if required, to minimize potential impacts associated with soil erosion, compaction and off-ROW sedimentation. Objectives of the plan would incorporate temporary and permanent BMPs to minimize soil erosion on the ROW during significant rainfall events. The SWPPP would also establish the criteria for re-vegetation and mitigating soil compaction to ensure adequate soil stabilization during the construction and post-construction phases. During construction, the native herbaceous layer of vegetation will be maintained to the extent feasible and most bare areas with a low erosion potential will be allowed to re-vegetate with native herbaceous species. Areas with a high erosion potential, including any steep slopes and areas with shallow topsoil, may require seeding or implementation of permanent BMPs (e.g., soil berms or interceptor slopes) to stabilize disturbed areas and minimize soil erosion potential during the post construction phase.

The proposed alternative routes may cross areas designated as prime farmland soils. In addition to the construction-related impacts described above, the major impact on prime farmland soils would be the physical occupation of small areas by the support structures. These occupied areas would not be available for agricultural production and could become obstacles to farm machinery. However, the USDA-NRCS does not consider the limited area of direct impact associated with these structures to be a significant conversion of these soils and the majority of the ROW would be available for agricultural use once construction of the transmission line is completed.

Potential impacts to soils, primarily erosion and compaction, would be minimized if required with the development and implementation of a SWPPP. Therefore, the magnitude of potential soil impacts is considered equivalent for all of the proposed alternative routes. No significant conversions of prime or state important soils are anticipated related to Project activities for any of the proposed alternative routes.

4.4.3 Water Resources

The minimization of potential impacts to surface waters and associated wetlands was considered throughout the routing process. Major water features in the study area included the Brazos River, Colorado River, San Bernard River, Bastrop Bayou, Boggy Bayou, Caney Creek, Gulf Intercoastal Waterway, Linnville Bayou, Live Oak Bayou, Live Oak Creek, Mound Creek, Old Brazos River Channel and Oyster Creek.

Additional named surface waters within the study area include Brazoria Reservoir, Angleton Fishing and Hunting Club Reservoir, York Reservoir, Club Lake, Lake Jackson, Brock Reservoir, Old Ocean Swamp, Little Lake, Betts Lake, Neal Lake, Jennings Lake, Lake Bowie, Williams Lake, Flag Pond and Bird Pond. Additional unnamed surface waters within the study area include tributaries, streams, canals, ditches, bayous, marshes, swamps, backwaters, sloughs, lakes, reservoirs and ponds. Proposed alternative routes crossing these open water areas were minimized, to the extent feasible, by maintaining a perpendicular angle.

4.4.3.1 Surface Water

All of the proposed alternative routes would cross multiple surface waters within the study area. These surface waters typically include rivers, perennial and ephemeral creeks/streams, ponds, small lakes, marshes, bayous and sloughs.

No surface waters or open water areas crossed by the proposed alternative routes exceed the typical spanning distance for a 345 kV transmission line. CenterPoint Energy proposes to span all surface waters crossed by the proposed alternative routes with the structure foundations located outside of the ordinary high water mark, if practical. No proposed construction activities will significantly impede the flow of water within these watersheds. The shorter understory and herbaceous layers of vegetation will remain, where allowable. BMPs will be implemented in accordance with a SWPPP, if required, to reduce the potential for sedimentation outside of the ROW.

All of the proposed alternative routes cross some amount of open water. The approximate lengths of each proposed alternative route crossing open water areas range from 0.1 mile for Proposed Alternative Routes 1, 2, 6, 7, 8 and 29, to 0.5 mile for Proposed Alternative Route 15. The approximate lengths of open water crossed by each proposed alternative route are presented in Table 4-2 (Appendix C).

All of the proposed alternative routes cross existing rivers, streams, creeks and canals. The number of stream crossings for each proposed alternative route range from 53 crossings for Proposed Alternative Route 2, to 84 crossings for Proposed Alternative Route 15. The number of stream and canal crossings for each of the proposed alternative routes is presented in Table 4-2 (Appendix C).

All of the proposed alternative routes parallel some portion of streams and canals within 100 feet. The lengths of each proposed alternative route parallel to streams range from approximately 3.0 miles for Proposed Alternative Routes 2, 3 and 29, to 8.4 miles for Proposed Alternative Route 15. The approximate lengths of each proposed alternative route parallel to streams and canals within 100 feet are presented in Table 4-2 (Appendix C).

All surface waters and their associated wetlands located within the study area are subject to USACE regulations as "waters of the US" under Section 404 of the CWA. Navigable waters and associated tributaries or backwaters located within the study area may be subject to USACE regulations as "navigable waters of the US" under Section 10 of the Rivers and Harbors Act of 1899. The study area is within the USACE-Galveston District, which determines navigable waters on a case-by-case basis and thus does not publish a list of Section 10 waters; however, the Gulf Intercoastal Waterway, Caney Creek, Live Oak Bayou, Bastrop Bayou, Brazos River, Colorado River and San Bernard River may be Section 10 navigable waters. Of these potentially navigable waters, all proposed alternative routes cross the San Bernard River once. Proposed Alternative Routes 12, 13, 14, 15 and 18 each crosses the Colorado River twice. All Proposed Alternative Routes cross Caney Creek at least once. Proposed Alternative Routes 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 23 and 24 each cross Live Oak Bayou once. Upon PUC approval of a route, additional coordination with the USACE-Galveston District may be required to determine the need for Section 10 Permits.

4.4.3.2 Floodplains

All of the proposed alternative routes cross portions of the mapped 100-year floodplains. Construction of the Project should not have a significant impact on the overall function of the floodplain, nor adversely

affect adjacent or downstream properties. CenterPoint Energy will coordinate with the appropriate local floodplain administrators to determine if there are any permit requirements.

All of the proposed alternative routes cross FEMA mapped 100-year floodplains. The approximate lengths of each proposed alternative route crossing mapped 100-year floodplains range from 7.5 miles for Proposed Alternative Route 20, to 26.8 miles for Proposed Alternative Route 16. The approximate lengths of each proposed alternative route crossing 100-year floodplains are presented in Table 4-2 (Appendix C).

4.4.3.3 Coastal Management Zone

The PUC must comply with CMP policies when approving CCNs for electric transmission lines that are located within the CMZ under the Coastal Zone Management Act of 1972. The southeast one-third of the study area and a one mile buffer around the San Bernard River lie within the designated CMZ. CNRAs potentially occurring within the study area may include Coastal Preserves, (San Bernard National Wildlife Refuge, Nannie M. Stringfellow WMA and Justin Hurst WMA), Coastal Shore Areas, Coastal Wetlands (estuarine and freshwater emergent; [USFWS 2018a]), Special Hazard Areas (FEMA 100-floodplains; [FEMA 2018]), State Submerged Lands (Portions of Oyster Creek, Brazos River, McNeal Bayou, McNeal Lake, Pelican Lake, Redfish Bayou, San Bernard River, Cedar Lake Creek, Cow Trap Lake and Caney Creek [GLO 2018]), Submerged Aquatic Vegetation, Tidal Sand or Mud Flats and Waters Under Tidal Influence (Portions of Bastrop Bayou, Oyster Creek, Brazos River, San Bernard River, Caney Creek and Live Oak Bayou). Upon PUC approval of a route, on the ground verifications of CNRAs may be required.

All 30 proposed alternative routes have some portion of their length within the CMZ. The length of alternative route within the CMZ ranges from approximately 19.3 miles for Proposed Alternative Route 6, to 37.1 miles for Proposed Alternative Routes 23 and 24. The proposed alternative routes are not anticipated to cross any known designated Submerged Aquatic Vegetation, Tidal Sand or Mud Flats. These CNRAs typically occur within the coastal estuarine and marine areas in the southeastern portions of the study area.

All of the 30 proposed alternative routes cross Special Hazard Areas (FEMA 100-floodplains) within the CMZ. No construction activities are anticipated that would impede the flow of water within watersheds or floodplains. Engineering design should alleviate the potential of construction activities to adversely impact flood channels and proper structure placement would minimize any flow impedance during a major flood event. The construction of any of the proposed alternative routes is not likely to significantly

impact the overall function of a floodplain, or adversely affect adjacent or downstream properties. CenterPoint Energy will coordinate with the local floodplain administrators as necessary prior to construction.

All 30 proposed alternative routes likely cross Coastal Wetlands (NWI mapped estuarine and wetlands emergent) within the CMZ. All 30 proposed alternative routes cross Waters Under Tidal Influence within the CMZ. All 30 routes cross the tidal influenced portion of the San Bernard River (TCEQ Stream Segment: 1301) once. Additionally, within the CMZ, Proposed Alternative Routes 9 and 13 each cross the tidal influenced portion Caney Creek (TCEQ Stream Segment: 1304) twice and Proposed Alternative Routes 10, 11, 12, 15, 18, 19, 20, 23 and 24 cross Caney Creek once. All of the 30 proposed alternative routes cross State Submerged Lands and Coastal Shore Areas along the San Bernard River within the CMZ. Each of the 30 proposed alternative routes cross the San Bernard River once. Coastal Shore areas associated with these would each include a 100-foot buffer landward of the OHWM of the State Submerged Land (San Bernard River). CenterPoint Energy proposes to span all surface waters to the extent feasible. Additionally, the implementation of a SWPPP and BMPs will also minimize potential impacts. Therefore, no significant adverse impacts are anticipated to any Coastal Wetlands, State Submerged Lands, Coastal Shore Areas and Waters Under Tidal Influence crossed for any of the Proposed Alternative Routes.

Nineteen of the proposed alternative routes likely cross Coastal Preserve lands. Proposed Alternative Routes 2 through 19 and 29 each cross some portion of the TPWD Justin Hurst WMA. Lengths of proposed alternative routes across the Justin Hurst WMA range from approximately 0.7 mile for Proposed Alternative Route 3, to 4.5 miles for Proposed Alternative Routes 5, 7, 8, 10 through 16, 18 and 19. The proposed alternative routes that cross the Justin Hurst WMA are paralleling existing linear features (existing roads and transmission lines) to minimize habitat fragmentation through these areas. Additionally, CenterPoint Energy proposes to span all surface waters to the extent feasible and the implementation of a SWPPP and BMPs will also minimize potential impacts. Therefore, no significant adverse impacts are anticipated to any Coastal Preserves for any of the proposed alternative routes.

4.4.3.4 Groundwater

The construction, operation and maintenance of the Project are not anticipated to adversely affect groundwater resources within the study area. No measurable decrease of aquifer recharge capacity should occur and groundwater contamination is not anticipated from construction activities. During construction activities, another potential impact for both surface water and groundwater resources is related to

potential fuel and other chemical spills. CenterPoint Energy has standard operating procedures and response specifications relating to petroleum product storage, refueling and maintenance activities of equipment to avoid and minimize potential contamination to groundwater resources.

4.4.4 Ecological Resources

4.4.4.1 Vegetation Types

Potential impacts to native vegetation will result from clearing the ROW of woody vegetation or mowing and clearing herbaceous vegetation. These activities facilitate ROW access for structure construction, conductor installation and future maintenance activities. Removal of woody vegetation within the ROW will be required within upland, riparian and bottomland woodland areas, including wetlands, along fence lines with trees greater in height than 10 feet, within grasslands and open pasture areas. Prior to construction, mowing or shredding of herbaceous vegetation will occur within grassland and pasture areas. Mowing activities will continue periodically within the ROW for maintenance purposes. 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 may generate an additional degree of habitat fragmentation. Habitat fragmentation is reduced when a proposed route parallels or utilizes existing linear features such as electrical transmission lines, roads, railroads, pipelines, etc. During the routing process consideration was given to avoid extensive woodland and riparian areas, and to maximize the length of the routes within or parallel to existing linear corridors.

Impacts to vegetation will be limited to that necessary for the construction, operation and maintenance of the Project. ROW clearing activities will be completed with minimal vegetation impacts and the existing herbaceous layer or groundcover will be maintained to the extent practical.

All of the proposed alternative routes cross areas of upland woodlands. The approximate lengths of each proposed alternative route crossing upland woodlands range from 7.5 miles for Proposed Alternative Route 20, to 16.8 miles for Proposed Alternative Route 26. The approximate lengths of each proposed alternative route crossing upland woodlands are presented in Table 4-2 (Appendix C).

All of the proposed alternative routes cross areas of bottomland and/or riparian woodlands. The approximate lengths of each proposed alternative route crossing bottomland/riparian woodlands range from 1.6 miles for Proposed Alternative Route 2, to 5.2 miles for Proposed Alternative Route 13. The

approximate lengths of each proposed alternative route crossing bottomland/riparian woodlands are presented in Table 4-2 (Appendix C).

4.4.4.2 Wetlands

Wetlands serve as habitat to a number of species and are often used as migration corridors for wildlife. Removal of vegetation within wetlands increases the potential for erosion and sedimentation, which can be detrimental to downstream plant communities and aquatic life. Additional potential impacts to wetlands include the temporary or permanent fill associated with structure construction and temporary impacts associated with access. NWI data indicated numerous wetlands throughout the study area with wetland types including freshwater palustrine emergent, palustrine forested, palustrine scrub/shrub, ponds and lakes. CenterPoint Energy proposes to span any wetland areas where practical and hand clear any trees located within the wetland area to minimize potential impacts. The use of equipment mats during construction within emergent herbaceous wetland areas minimizes potential impacts by limiting the level of soil disturbance.

The temporary and/or permanent placement of fill material within jurisdictional surface waters and associated wetlands requires a permit from the USACE under Section 404 of the CWA. Streams and rivers within the study area subject to regulation under Section 404 of the CWA have been avoided where practical, and the placement of fill material may be avoided through spanning if crossed. Prior to construction, an assessment of the PUC approved route would be completed to determine if there would be any planned impacts to possible jurisdictional areas. Additional coordination may be required with the USACE-Galveston District to determine any Section 404 permitting requirements after the PUC issues a final order.

All of the proposed alternative routes cross areas of NWI mapped wetlands. The approximate lengths of each proposed alternative route across total NWI mapped wetlands ranges from 2.03 miles for Proposed Alternative Route 20, to 6.64 miles for Proposed Alternative Route 16. All of the proposed alternative routes cross areas of NWI mapped forested or scrub/shrub wetlands. The approximate lengths of each proposed alternative route across NWI mapped forested or scrub/shrub wetlands range from 0.25 mile for Proposed Alternative Route 20, to 2.17 miles for Proposed Alternative Route 16. All of the proposed alternative routes cross areas of NWI mapped emergent wetlands. The approximate lengths of each proposed alternative route across NWI mapped emergent wetlands ranges from 1.46 miles for Proposed Alternative Route 6, to 5.10 miles for Proposed Alternative Route 13. The approximate lengths of each proposed alternative route crossing NWI mapped wetlands are presented in Table 4-2.

USACE Nationwide Permit Regional Condition 15c does not authorize discharges into Designated Columbia Bottomlands. Columbia Bottomlands are defined as waters of the US that are dominated by bottomland hardwoods in the Lower Brazos and San Bernard River basins. The USEPA and USFWS may designate Columbia Bottomland wetlands as Aquatic Resources of National Importance ("ARNI") and subsequently the USACE may evaluate the potential loss or conversion of these ARNIs on a case-by-case under an Individual Permit. Spatial data of designated potential Columbia Bottomlands was obtained from the USACE and these areas where mapped by GIS during the routing process. Careful consideration was given to these areas during the development of the preliminary transmission line segments and ultimately the proposed alternative routes because of the potential impact on the Project schedule. Only waters of the US within these designated Columbia Bottomlands areas are subject to Regional Condition 15c. Therefore, CenterPoint Energy and POWER minimized crossing of the Columbia Bottomlands, particularly in areas with NWI mapped wetlands or obvious bodies of water. In areas proposed to cross Columbia Bottomlands, the distance can be spanned in whole or in part. Prior to construction, a field assessment of the PUC approved route would be completed to determine if there would be any planned impacts to possible jurisdictional areas and additional coordination with the USACE-Galveston District may be required to determine the need for an Individual Permit.

Twenty-two of the proposed alternative routes cross designated Columbia Bottomlands. The lengths across designated Columbia Bottomlands for each proposed alternative route range from zero miles for Proposed Alternative Routes 7, 11, 12, 13, 14, 15, 18 and 19, to 1.85 miles for Proposed Alternative Route 3. The lengths across NWI Mapped wetlands within designated Columbia Bottomlands for each proposed alternative route range from zero miles for Proposed Alternative Routes 5 through 19, to 0.18 mile (approximately 950 feet) for Proposed Alternative Route 3. All of these crossings can be easily spanned. Careful consideration was given to these areas during the development of the preliminary transmission line segments. These crossings were evaluated using aerial photography, mapped wetlands and NHD data to minimize potential impacts and habitat fragmentation. The length across designated Columbia Bottomlands for each of the proposed alternative routes is presented in Table 4-2 (Appendix C).

4.4.4.3 Wildlife and Fisheries

Impacts on terrestrial wildlife species will be associated with construction activities and with the removal of vegetation, which is considered habitat modification or fragmentation. This will be a temporary disturbance to local wildlife species. 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 would be expected to resume to previous levels after construction is completed. Potential long-term impacts include impacts resulting from habitat modifications or fragmentation. Native habitats have historically been modified to a high degree to support historical and present land uses within the study area.

Construction activities may also impact small, immobile or fossorial (living underground) animal species through incidental takes or the alteration of local habitats. Incidental takes of 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.

If ROW clearing occurs during the nesting season, potential impacts could occur within the ROW related to the taking of migratory bird eggs 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.

TXNDD (2017) data identified several avian nesting rookeries within the study area. However, none of the proposed alternative routes are within 2.0 miles of these known rookeries. No significant adverse impacts are anticipated to any known nesting rookeries located adjacent to the ROW for any of the proposed alternative routes.

Tower structure design and additional mitigation measures can be implemented to minimize the risk for electrocution of birds or the collisions of birds with transmission facilities. The danger of electrocution to birds should be insignificant, because the distance between conductors, conductor to structure, or conductor to ground wire for the proposed 345 kV transmission line is greater than the wingspan of any bird in the area (i.e., greater than eight feet). The tower structures and wires may be a collision hazard to birds in flight. The study area is located within the Central Migratory Flyway for neo-tropical migratory birds. The risk for bird strikes increases in the fall migration period when low visibility is common due to inclement weather conditions. CenterPoint Energy has an established avian program implemented through the CenterPoint Energy's Environmental Department. CenterPoint Energy's Environmental Department will evaluate avian habitats, populations and activities within the final CCN route, and work with the Transmission Operations Department to identify and implement appropriate avian protection measures, where necessary.

Potential permanent impacts to wildlife may result from the clearing of upland and bottomland, including wetlands and woodland habitats. By utilizing or paralleling existing linear features to the greatest extent reasonable or minimizing the route lengths within wooded areas, the potential impacts to wildlife and habitat fragmentation are reduced.

Potential impacts to aquatic systems may include effects of erosion, siltation and sedimentation. The clearing of vegetation from the ROW could result in a temporary increase of suspended solids entering surface waters. Increases in suspended solids may adversely affect aquatic organisms that require relatively clear water for foraging or reproduction. Physical aquatic habitat loss or alteration may result wherever riparian vegetation is removed or at any temporary crossings required for access. Increased levels of siltation or sedimentation may also potentially impact downstream areas primarily affecting filter feeding benthic and other aquatic invertebrates. CenterPoint Energy will implement BMPs as part of any required SWPPP provisions to prevent off-ROW sedimentation and degradation of any wetland areas. If emergent wetland areas are traversed by equipment, matting can be used to minimize the potential temporary impacts. No significant adverse impacts are anticipated to any aquatic habitats crossed or located adjacent to the ROW for any of the proposed alternative routes.

4.4.4.4 Threatened and Endangered Species

A review of the federally listed species potentially occurring within the study area and their life histories was used to determine if suitable habitat may be present. Data and information on special status species and unique vegetation resources within the study area were obtained from a variety of sources, including correspondence with the USFWS, TPWD and TXNDD (see Appendix A). Current county listings for federal and state listed threatened and endangered species 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 2.4.4.4. The absence of TXNDD data does not preclude the need for additional habitat evaluations for potential suitable habitat or the need for any species specific surveys for any listed species for the PUC approved route. No federally designated critical habitat (USFWS 2018a) occurs within the study area; therefore, none of the 30 proposed alternative routes cross any known habitat or designated critical habitat for federally listed animal species (TXNDD 2017).

Threatened and Endangered Plant Species

Federally-listed plant species are only afforded federal protection from taking (to “remove and reduce to possession” and/or “maliciously damage or destroy”) if they are located on federal lands and/or federal

funding or actions are associated with the Project. Listed plant species are also protected from commercial trade, as well as import or export.

State-listed threatened and endangered plant species are afforded protection under Chapter 88 within Title 5 of the Texas Parks and Wildlife Code. Within this regulation, a "take" means to collect, pick, cut, dig up or remove. This restricts the "take" of a listed species from public lands. It also prohibits the collection for sale, possession for commercial sale, transport for commercial sale or sale of all or part of an endangered, threatened or protected plant from private land unless permitted through the TPWD.

USFWS IPaC species list for the study area and TPWD county listings were reviewed for special status plant species potentially occurring within the study area. No federal or state-listed threatened or endangered plant species were listed within the study area. Therefore, the potential for any of the proposed alternative routes to adversely affect listed plant species is not anticipated to occur.

Threatened and Endangered Animal Species

Construction activities along the ROW may temporarily displace wildlife species. Although not anticipated to occur, if state-listed species are observed during construction, they would be allowed to leave the area or could be relocated out of the construction area by a permitted individual. Overall, impacts of the Project are expected to be minimal and temporary. Displaced organisms would be expected to return after construction or permanently relocated. Spanning surface waters and wetlands, and implementing the SWPPP to the extent practicable, will avoid and minimize significant adverse impacts to aquatic species; such as fish and mollusks.

Of the federally-listed species for the study area counties, the northern aplomado falcon has the potential to occur within the study area, although TXNDD data did not identify any known occurrences of this species within the study area. When the PUC approves a route, CenterPoint Energy will consult with USFWS, if necessary, to determine the need for any additional field surveys or Section 7/10 permits.

Other listed avian migrant species, including the interior least tern, piping plover, red knot and whooping crane, which may occur within the study area, but are not expected to occur except as possible migrants or post-breeding dispersers that pass through the study area and potentially occupy habitats temporarily or seasonally. These seasonal habitats may be spanned or avoided entirely. Therefore, the Project is not anticipated to have any adverse impacts to these species. TXNDD (2017) data identified several avian nesting rookeries within the study area; however, none of the proposed alternative routes are within 2.0

miles of these known rookeries. If any potential suitable habitat for federally-listed threatened or endangered species is identified during a field survey of the PUC approved route, CenterPoint Energy will further coordinate with the USFWS to determine avoidance or mitigation strategies.

Of the state-listed species for the study area counties the peregrine falcon, reddish egret, sooty tern, white-faced ibis, white-tailed hawk, wood stork, blue sucker, Louisiana pigtoe, sandbank pocketbook, golden orb, smooth pimpleback, Texas pimpleback, Texas fawnsfoot, alligator snapping turtle, northern scarlet snake, Texas tortoise and timber rattlesnake may occur within the study area as seasonal migrants or as residents if suitable habitats are present. 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 by this Project. Terrestrial species may be subject to minor temporary disturbance during construction activities and, if observed during construction activities, will be allowed to leave the study area or be relocated by a permitted individual. Avian species may be protected under the BGEPA or MBTA.

Bald eagles may nest and winter within the study area and are usually associated with mature trees near large bodies of water. A survey of eagle nests performed by CenterPoint Energy (February 2018) confirmed a number of eagle nests along the Colorado River and an unrecorded nest along Peyton Creek near its confluence with Live Oak Creek in Matagorda County. The nest along Peyton Creek is located approximately 615 feet from Proposed Alternative Routes 11, 13, 15 and 18. Other identified eagle nests are not within 2,000 feet from any of the proposed alternative routes. If in the course of further biological surveys and/or construction activities, any bald eagle roost or nest trees are identified within the vicinity of the Project, CenterPoint Energy will refer to the National Bald Eagle Management Guidelines to avoid and minimize harm and disturbance of bald eagles as recommended by the USFWS.

5.0 PROPOSED ALTERNATIVE ROUTE SELECTION

5.1 EVALUATION OF PROPOSED ALTERNATIVE ROUTES

CenterPoint Energy and POWER selected 30 forward progressing proposed alternative routes that provide geographic diversity and are feasible from a potential impacts, engineering and cost perspective.

To facilitate the comparison of the 30 proposed alternative routes and selection of a route or routes that best addresses the requirements of PURA and the PUC Substantive Rules, the 30 proposed alternative routes were divided into three geographically diverse route families: Eastern, Central and Western.

Proposed alternative routes within each route family were subjected to a quantitative comparison. The proposed alternative routes were ranked within each family and then compared through a consensus process for recommendation of the proposed alternative route or routes that best addresses the requirements of PURA and the PUC Substantive Rules.

Proposed alternative routes that include Segments Y or Z were grouped into the Eastern Route Family, which includes Proposed Alternative Routes 1 through 5, 16, 17, 21, 22 and 27 through 30. Proposed alternative routes that include Segments Y or Z parallel portions of SH 35, CR 359 and apparent property lines.

Proposed alternative routes that include Segments HQ or GT were grouped into the Central Route Family, which includes Proposed Alternative Routes 6 through 10, 20 and 24 through 26. Proposed alternative routes that include Segments HQ or GT parallel FM 2540, CR 457 and apparent property lines.

Proposed alternative routes that include Segments GK or GX were grouped into the Western Route Family, which includes Proposed Alternative Routes 11 through 15, 18, 19 and 23. Proposed alternative routes that include Segments GK or GX parallel apparent property lines and local roadways.

Based on the results of the data tabulation for the proposed alternative routes completed in Section 4.0, POWER technical experts determined that a few of the evaluation criteria did not capture data that helped facilitate a qualitative or quantitative comparison between the proposed alternative routes. Due to the environmental and land use setting within the study area, the absence of certain features in the study area or within the specified distances often resulted in values of zeros in the data table for all or the majority of the proposed alternative routes. This was the case for the following evaluation criteria:

- Number of FAA-listed airfields within 10,000 feet of route centerline having no runway more than 3,200 feet.
- Number of commercial AM radio transmitters within 10,000 feet of route centerline.
- Length of route across known habitat of federal endangered/threatened species of plants or animals.
- Number of recorded historical or archeological sites crossed within ROW.
- Number of NRHP listed or determined-eligible properties within ROW.

Analysis of other evaluation criteria generated quantitative results but did not provide a qualitative comparison between proposed alternative routes because the difference in performance between the routes in these categories was minimal. Examples of these evaluation criteria include:

- Number of additional parks/recreational areas within 1,000 feet of route centerline.
- Length of route across commercial/industrial areas.
- Number of pipeline crossings.
- Number of transmission line crossings.
- Number of US and SH crossings.
- Number of cemeteries within 1,000 feet of the route centerline.
- Number of private airstrips within 10,000 feet of the centerline.
- Length of route across NWI mapped emergent wetlands.

To facilitate the comparison and ranking of the top five proposed alternative routes within each route family and the selection of a route or routes that best addresses the requirements of PURA and the PUC Substantive Rules, Key Evaluation Criteria (see Table 5-1) were derived from the evaluation criteria results presented in Tables 4-1 and 4-2 (Appendix C). The Key Evaluation Criteria in Table 5-1 were used for the ranking and consensus process.

TABLE 5-1 KEY EVALUATION CRITERIA

CATEGORY	EVALUATION CRITERIA
Land Use	Length of route (miles)
	Number of directly affected habitable structures within 500 feet of route centerline
	Number of directly affected habitable structures also within 500 feet of an existing transmission line
	Number of habitable structures potentially to be relocated/removed
	Length of route using existing transmission line easement
	Length of route parallel to existing transmission line ROW
	Length of route paralleling apparent property lines
	Length of route parallel to other existing ROW (roadway, etc.)
	Percent of route parallel with apparent features, property lines, railroads or an existing ROW
	Length of route across parks/recreational areas
	Total length of route across TDCJ and TPWD properties
	Length of route across TDCJ property
	Length of route across TPWD property
	Length of route across residential areas
Aesthetics	Estimated length of route within foreground visual zone of US and state highways
	Estimated length of route within foreground visual zone of FM and county roads
	Estimated length of route within foreground visual zone of park and recreational areas
Ecology	Length of route across upland woodlands
	Length of route across bottomland/riparian woodlands
	Total length of route across National Wetland Inventory mapped wetlands
	Length of route across USACE designated Columbia Bottomlands
	Length of route across National Wetland Inventory mapped wetlands within USACE designated Columbia Bottomlands
	Length of route across open water (lakes or ponds)
	Number of stream crossings
	Length of route parallel to streams within 100 feet of route centerline
	Length of route across 100-year floodplains
Cultural	Number of additional recorded historical and archeological sites within 1,000 feet of route centerline
	Number of additional National of Register Historic Places listed or determined-eligible properties within 1,000 feet of route centerline
	Length of route across areas of high archaeological/historic site potential
Cost	Estimated Construction Cost

For comparison purposes, CenterPoint Energy provided construction cost estimates for each proposed alternative route, including ROW acquisition. The estimated total costs for the 30 proposed alternative routes are summarized in Table 5-2.

TABLE 5-2 SUMMARY OF COST ESTIMATES

PROPOSED ALTERNATIVE ROUTE	INCLUSIVE SEGMENTS	FAMILY/ LOCATION[1]	TOTAL LENGTH (MILES)	ESTIMATED CONSTRUCTION COST[2]	ESTIMATED ROW COST[2]	TOTAL
1	B-D-C-L-P-T-V-W-Y-Z-AP-BK-BL-CT-CU-CX-DD-DE-DH-DL-DN-DS-DT-ER1-ER2-EV-EZ-FC-FM-FO-FP	Eastern	56.3	$457,910,000	$99,009,000	$556,919,000
2	B-D-F-H-L-P-U-V-X-Y-Z- AP-BK-BM-CS-CT-CU-CW-CY-DB-DD-DF-DI-DK-DV-DW-EF-JE-EO-EP-ET-EU-FB-FF-FN-FP	Eastern	53.9	$450,393,000	$99,437,000	$549,830,000
3	B-D-F-H-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CR-CS-CT-CU-CW-CY-DB-DD-DF-DG-DH-DL-DO-DQ-DR-DS-DU-EP-ES-ER1-ER2-EW-FA-FF-FN-FP	Eastern	57.8	$474,339,000	$105,139,000	$579,478,000
4	B-D-F-H-L-P- U-V-X-Y-Z-BI-BX-CM-CR-CS-CT-CU-CW-CY-DB-DD-DF-DG-DH-DL-DO-DP-DR-DS-DU-EP-ET-EU-FB-FF-FN-FP	Eastern	56.1	$461,694,000	$100,623,000	$562,317,000
5	B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CU-CW-CY-DC-IZ-JA-FP	Eastern	55.2	$392,556,000	$89,164,000	$481,720,000
6	B-D-F-H-L-FQ-FY-GC-GE-HQ-HR-CB-BU-BW-BJ-BK-BL-CT-CU-CW-CY-DB-DD-DF-DG-DH-DM-DV-DX-EF-EM-EQ-EU-EX-EY-EZ-FD-FG-FH-FO-FP	Central	72.9	$523,752,000	$110,646,000	$634,398,000
7	B-G-J-K-M-GI-GJ-FW-FY-GD-GE-HQ-HR-CC-CD-CE-IN-IO1-IO2-IX-IZ-JA-FP	Central	71.3	$506,937,000	$108,533,000	$615,470,000
8	B-G-J-K-M-GI-GO-GP-FW-FY-GD-GE-HQ-HR-HS-IM-IN-CQ-CR-CS-CT-CV-DA1-DA2-IX-IZ-JA-FP	Central	75.0	$528,726,000	$111,706,000	$640,432,000
9	B-G-J-K-N-O-GI-GO-GQ-GR-GT-HO-HQ-HT-IL-IM-IN-IO1-IO2-IX-IZ-DJ-DK-DV-DX-EF-EM-EQ-EU-FB-FF-FN-FP	Central	73.9	$580,097,000	$115,104,000	$695,201,000
10	B-G-J-K-N-GF-GH-GL-GO-GQ-GS-GT-HP-IE-IL-IM-IN-CQ-CR-CS-CT-CU-CW-CY-DC-IZ-JA-FP	Central	73.3	$513,773,000	$107,751,000	$621,524,000
11	B-E-K-N-GF-GH-GK-GN1-JB-HA2-HD-HU-HW-IC-ID-IE- IL-IM-IN-IO1-IO2-IX-IZ-JA-FP	Western	77.6	$535,938,000	$112,735,000	$648,673,000
12	B-E-K-N-GF-GH-GK-GM-GX-GZ-HC-HE-HG-HM-HP-IE- IL-IM-IN-IO1-IO2- IX-IZ-JA-FP	Western	79.8	$550,613,000	$115,606,000	$666,219,000

TABLE 5-2 SUMMARY OF COST ESTIMATES

PROPOSED ALTERNATIVE ROUTE	INCLUSIVE SEGMENTS	FAMILY/ LOCATION[1]	TOTAL LENGTH (MILES)	ESTIMATED CONSTRUCTION COST[2]	ESTIMATED ROW COST[2]	TOTAL
13	B-E-K-N-GF-GH-GK-GN1-GN2-HA1-HA2-HE-HV-IB-IC-HL-HM-HO-HQ-HT-IL-IM-IN-IO1-JC-DA2-IX-IZ-JA-FP	Western	78.4	$552,469,000	$114,624,000	$667,093,000
14	B-E-K-N-GF-GH-GK-GM-GX-GZ-HB-HF-HG-HM-HO-HQ-HR-HS-IM- IN-IO1-JC-DA2-IX-IZ-JA-FP	Western	78.8	$546,644,000	$115,303,000	$661,947,000
15	B-E-K-N-GF-GG-GX-GZ-HB-HU-HX-IB-IC-ID-IE-IL-IM-IN-IO1-IO2 -IX-IZ-JA-FP	Western	84.0	$570,179,000	$119,981,000	$690,160,000
16	B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CV-DA1-DA2-IX-IZ-JA-FP	Eastern	57.4	$420,827,000	$93,500,000	$514,327,000
17	B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CU-CW-CZ-DA1-DA2-IX-IZ-DJ-DK-DV-DX-EF-JE-EN-EQ-EU-FB-FF-FN-FP	Eastern	58.4	$461,560,000	$98,886,000	$560,446,000
18	B-G-J-K-N-GF-GH-GK-GM-GX-GY-HA1-HA2-HD-HU-HW-IC-ID-IE-IL-IM-IN-IO1-JC-DA2-IX-IZ-JA-FP	Western	84.3	$560,848,000	$120,069,000	$680,917,000
19	B-G-J-K-N-GF-GH-GK-GN1-JB-HA2-HE-HG-HL-ID-IE-IL-IM-IN-IO1-JC-DA2-IX-IZ-JA-FP	Western	74.7	$536,475,000	$110,493,000	$646,968,000
20	B-E-K-M-GI-GO-GQ-GS-GT-HP-IE-IL-IM-IN-CQ-CR-CS-CT-CU-CW-CY-DB-DD-DF-DI-DK-DV-DX-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP	Central	68.1	$542,479,000	$114,714,000	$657,193,000
21	B-D-C-L-P-U-V-X-Y-Z-BI-BX-CM-CQ-IO1-IO2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP	Eastern	56.7	$474,690,000	$106,020,000	$580,710,000
22	B-D-C-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CQ-IO1-IO2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP	Eastern	58.5	$488,993,000	$111,044,000	$600,037,000
23	B-E-K-N-GF-GH-GK-GN1-JB-HA2-HD-HF-HG-HM-HP-IE-IL-IM-IN-IO1-IO2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP	Western	74.6	$560,205,000	$118,168,000	$678,373,000
24	B-E-K-M-GI-GO-GQ-GS-GT-HP-IE-IL-IM-IN-IO1-IO2-IX-IZ-DJ-DK-DV-DX-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FG-FI-FN-FP	Central	70.9	$551,429,000	$115,585,000	$667,014,000

TABLE 5-2 SUMMARY OF COST ESTIMATES

PROPOSED ALTERNATIVE ROUTE	INCLUSIVE SEGMENTS	FAMILY/ LOCATION[1]	TOTAL LENGTH (MILES)	ESTIMATED CONSTRUCTION COST[2]	ESTIMATED ROW COST[2]	TOTAL
25	B-G-J-K-M-GI-GJ-FW-FY-GD-GE-HQ-HR-CC-CD-CE-IN-IO1-IO2-IX-IZ DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FE-FM-FO-FP	Central	72.4	$545,104,000	$118,365,000	$663,469,000
26	B-D-C-L-FQ-FY-GC-GE-HQ-HR-HS-IM-IN-IO1-IO2-IX-IZ DJ-DK-DV-DW-EF-JE-EO-EP-ES-ER1-ER2-EV-EZ-FD-FM-FO-FP	Central	72.1	$544,185,000	$116,970,000	$661,155,000
27	B-D-C-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CQ-IO1-IO2-IX-IZ-DJ-JD-DL-DO-DQ-DR-DS-DT-ER1-ER2-EV-EZ-FC-FM-FO-FP	Eastern	60.2	$495,839,000	$108,922,000	$604,761,000
28	B-D-C-L-P-U-V-X-Y-Z-BI-BX-CM-CQ-IO1-IO2-IX-IZ-DJ-DL-DO-DP-DR-DS-DT-ER1-ER2-EV-EZ-FD-FG-FH-FO-FP	Eastern	57.8	$471,733,000	$103,608,000	$575,341,000
29	B-D-F-H-L-P-U-V-X-Y-Z-AP-BK-BM-CS-CT-CV-DA1-DA2-IX-IZ-DJ-DK-DV-DW-EF-JE-EO-EP-ET-EU-FB-FF-FN-FP	Eastern	57.8	$473,626,000	$105,523,000	$579,149,000
30	B-D-C-L-P-U-V-X-Y-AA-BU-BV-CD-CF-CM-CQ-IO1-IO2-IX-IZ-DJ-JD-DL-DO-DQ-DR-DS-DT-ES-JF-ER2-EV-EZ-FD-FG-FI-FN-FP	Eastern	59.5	$483,225,000	$107,574,000	$590,799,000

[1] Family/Location defined by the use of specific segments: Eastern = Y or Z, Central = HQ or GT, Western = GK or GX.

[2] Costs for Proposed Alternative Routes are estimated with predominantly double-circuit lattice towers in a vertical configuration within a 100' wide ROW.

POWER, with CenterPoint Energy's input and review, completed a comparison of the proposed alternative routes within each route family, as discussed below, culminating in the ranking of the routes within each family in the following sections. Proposed alternative route selection was completed in compliance with Section 37.056(c)(4)(A)-(D) of PURA, 16 TAC § 22.52(a)(4), 16 TAC §25.101(b)(3)(B) and the PUC's policy of prudent avoidance.

5.2 COMPARISON OF THE PROPOSED ALTERNATIVE ROUTES

POWER used a consensus process to evaluate and compare the potential land use, cultural resource and ecology impacts of the Eastern, Central and Western proposed alternative routes. POWER technical experts with expertise in different disciplines (land use, cultural resources and ecology), as well as POWER's Project Manager, evaluated all the proposed alternative routes based on the environmental conditions present along each route. This evaluation was based on the key evaluation criteria, comments received from the public and from local, state and federal agencies and field reconnaissance of the study area. Each POWER technical expert independently analyzed the routes and the environmental data presented in Tables 5-3, 5-5 and 5-7 and then independently ranked the routes with respect to potential impacts within their respective discipline. The technical experts then met as a group and discussed their independent results. The technical experts as a whole determined the relationship and relative sensitivity among the major land use, cultural resource and ecological factors. The group then ranked the top five proposed alternative routes based strictly upon the environmental data considered along with the cost estimates provided by CenterPoint Energy for later use in facilitating the selection of the route that best addresses the requirements of PURA and the PUC Substantive Rules.

5.2.1 Eastern Route Family

After considering and comparing the key evaluation criteria for the proposed alternative routes within the Eastern Route Family, it was concluded by POWER, with input from CenterPoint Energy that based on the size of the Project, nature of the study area and public input analysis, all the eastern routes would be retained for further consideration. Proposed Alternative Routes 1 through 5, 16, 17, 21, 22 and 27 through 30 were further evaluated. The data tabulation for the Key Evaluation Criteria for the Eastern Route Family is presented in Table 5-3.

(This page left blank intentionally.)

Insert Table 5-3 11x17 FRONT

Insert Table 5-3 11x17 BACK

Compared to the other route families, the eastern routes are the shortest and least expensive routes. The eastern routes tend to have middle to higher numbers of habitable structures located within 500 feet of their centerlines. Eight of the 13 proposed alternative routes within the Eastern Route Family cross TDCJ and TPWD property. Overall, the eastern routes are anticipated to have the least impact to natural resources even though the eastern routes tend to have the longest lengths across NWI mapped wetlands within USACE designated Columbia Bottomlands because all of these lengths can be easily spanned with the longest crossing, at approximately 0.18 mile (950 feet). The eastern routes are anticipated to have minimal impacts to cultural resources.

5.2.1.1 Land Use

All of the eastern routes are approximately 60.0 miles in length or less. Within the Eastern Route Family, Proposed Alternative Route 2 is the shortest, at approximately 53.9 miles. Proposed Alternative Route 27 is the longest within the Eastern Route Family, at approximately 60.2 miles. Proposed Alternative Route 2 represents the most direct pathway between the Project endpoints within the Eastern Route Family (Table 5-3).

Within the Eastern Route Family, Proposed Alternative Route 16 has the fewest number of habitable structures located within 500 feet of its centerline with 174, followed by Proposed Alternative Route 5 with 181. Of the 174 and 181 habitable structures located within 500 feet of their centerlines, 25 of the habitable structures are already located within 500 feet of an existing transmission line. Proposed Alternative Route 2 has the most habitable structures located within 500 feet of its centerline with 427. Of these habitable structures, 17 are already located within 500 feet of an existing transmission line (Table 5-3).

Ten of the 13 proposed alternative routes in the Eastern Route Family would potentially require removal or relocation of existing habitable structures (single-family residences). Proposed Alternative Routes 5, 16 and 17 have the fewest with zero each and Proposed Alternative Route 22 has the most with 10, followed by Proposed Alternative Route 21 with nine and Proposed Alternative Routes 2, 3 and 29, each with seven (Table 5-3).

All of the eastern routes utilize existing transmission line ROW for some portion of their lengths. Proposed Alternative Routes 5 and 16 have the greatest length utilizing existing transmission line ROW, with approximately 1.8 miles each, while the remaining eastern routes utilize existing transmission line ROW for approximately 0.9 mile each (Table 5-3).

All of the eastern routes parallel existing transmission line ROWs for approximately 6.7 miles or more. Proposed Alternative Routes 5 and 16 have the greatest length parallel to existing transmission line ROWs, with approximately 13.1 miles each, while Proposed Alternative Route 3 has the least, with approximately 6.7 miles (Table 5-3).

Within the Eastern Route Family, Proposed Alternative Route 2 has the least amount parallel to apparent property lines, with approximately 17.3 miles. Proposed Alternative Route 27 has the most distance parallel to apparent property lines, with approximately 26.5 miles (Table 5-3).

All of the eastern routes parallel apparent features, property lines, railroads, or an existing ROW for approximately 72 percent or more of their lengths. Proposed Alternative Route 16 has the least with approximately 72 percent of its total length parallel to apparent features, property lines, railroads or an existing ROW, and Proposed Alternative Route 3 has the most, with approximately 81 percent. Generally, the Eastern Route Family has less percent of parallel than either the Central or Western Route Families (Table 5-3).

Proposed Alternative Routes 1, 2, 3, 4, 5, 16, 17 and 29 in the Eastern Route Family cross property owned by either TDCJ or TPWD, or both. Lengths for these eight routes across TDCJ property range between approximately 1.8 miles on Proposed Alternative Routes 16 and 29, to approximately 4.3 miles on Proposed Alternative Route 1. Lengths for these routes across TPWD property range between zero mile on Proposed Alternative Routes 1, 21, 22, 27, 28 and 30 to approximately 4.5 miles each on Proposed Alternative Routes 5 and 16 (Table 5-3). Routes 21, 22, 27, 28 and 30 do not cross any TDCJ or TPWD owned property.

Within the Eastern Route Family, Proposed Alternative Route 5 crosses the least amount of residential land use areas, with approximately 5.0 miles. Proposed Alternative Route 29 crosses the most amount of residential land use areas, with 9.9 miles (Table 5-3).

5.2.1.2 Historical and Aesthetic Values

Within the Eastern Route Family, Proposed Alternative Routes 1 and 29 have the fewest recorded historical or archeological sites within 1,000 feet of their route centerline, with three each. The number of recorded historical and archeological sites within 1,000 feet of route centerlines ranges from three along Proposed Alternative Routes 1 and 29, to seven along Proposed Alternative Routes 3, 4, 21, 22, 27, 28 and 30. Proposed Alternative Routes 1, 2 and 29 do not have any NRHP-listed or determined-eligible sites within 1,000 feet of their route centerlines. Proposed Alternative Routes 5 and 16 each have two

NRHP-listed or determined-eligible properties within 1,000 feet of their route centerlines. Proposed Alternative Routes 1, 2 and 29 also cross the least amount of archeological HPA. The distance of route across archeological HPAs for the Eastern Route Family ranges from approximately 23.3 miles crossed by Proposed Alternative Route 2, to approximately 32.1 miles crossed by Proposed Alternative Route 3 (Table 5-3).

Aesthetic Values

Within the Eastern Route Family, Proposed Alternative Route 16 has the shortest length within the foreground visual zone of a US or SHs, at approximately 3.8 miles. Proposed Alternative Route 2 has the longest such length, at approximately 14.6 miles, located within this visual zone (Table 5-3).

Proposed Alternative Routes 16, 17 and 29 have the shortest lengths within the Eastern Route Family, at approximately 6.1 miles each, located within the foreground visual zone of FM and county roads. Proposed Alternative Route 3 has the longest such length located within this visual zone, at approximately 16.0 miles (Table 5-3).

Proposed Alternative Route 4 has the shortest length within the Eastern Route Family, at approximately 8.3 miles, located within the foreground visual zone of park and recreational areas. Proposed Alternative Route 22 has the longest such length located within this visual zone, at approximately 13.0 miles (Table 5-3).

5.2.1.3 Ecology

The eastern routes typically have moderate lengths across upland woodlands when compared to the Central and Western Route Families. Within the Eastern Route Family, Proposed Alternative Route 1 has the shortest length across upland woodlands, at approximately 9.8 miles, followed by Proposed Alternative Routes 5, 3 and 4 (approximately 10.8, 10.9 and 11.5 miles, respectively). Proposed Alternative Route 21 has the longest length across upland woodlands, at approximately 14.4 miles (Table 5-3).

The eastern routes typically have some of the shortest lengths across bottomland/riparian woodlands when compared to the Western and Central Route Families. Eight of the eastern routes have less than 3.0 miles of their length across bottomland woodlands or riparian areas. Within the Eastern Route Family, Proposed Alternative Route 2 has the shortest length across bottomland woodlands or riparian areas, at approximately 1.6 miles, followed by Proposed Alternative Routes 1 and 3, at approximately 2.0 miles, each. These are the shortest lengths across bottomland woodlands or riparian areas for all of the proposed

alternative routes within all three route families. Proposed Alternative Route 16 has the longest length across bottomland woodlands or riparian areas, at approximately 4.1 miles (Table 5-3).

Within the Eastern Route Family, Proposed Alternative Route 1 has the shortest lengths across all NWI mapped wetlands, at approximately 2.99 miles. Proposed Alternative Route 16 has the greatest length all NWI mapped wetlands, at approximately 6.64 miles (Table 5-3).

The eastern routes typically have some of the longest lengths across USACE designated Columbia Bottomlands when compared to the Central and Western Route Families. Within the Eastern Route Family, Proposed Alternative Routes 29 and 16 have the shortest lengths across USACE designated Columbia Bottomlands, at approximately 0.36 and 0.45 mile, respectively. Proposed Alternative Route 3 has the greatest length across designated Columbia Bottomlands, at approximately 1.85 miles. Proposed Alternative Routes 5, 16 and 17, have the shortest lengths across NWI mapped wetlands within USACE designated Columbia Bottomlands, at zero mile each. Proposed Alternative Route 3 has the greatest across length NWI mapped wetlands within USACE designated Columbia Bottomlands, at approximately 0.18 mile (approximately 950 feet) (Table 5-3).

Within the Eastern Route Family, Proposed Alternative Routes 1, 2 and 29 have the shortest lengths across open water (lakes or ponds), at approximately 0.1 mile each. This ties with the Central Route Family for the shortest lengths across open water. Proposed Alternative Routes 21 and 28 has the longest length across open water (lakes or ponds), at approximately 0.3 mile each. Proposed Alternative Route 2 crosses the least number of streams or canals, with 53. This is the least number of stream crossings for all of the proposed alternative routes within all three route families. Proposed Alternative Routes 27 and 30 have highest number of stream or canal crossings within the Eastern Route Family, with 70. Proposed Alternative Routes 2, 3 and 29 have the shortest lengths parallel to streams or canals, at approximately 3.0 miles each. These are also the shortest lengths parallel to streams or canals within all three route families. Proposed Alternative Route 1 has highest length parallel to streams or canals within the Eastern Route Family, at approximately 8.1 miles (Table 5-3).

Within the Eastern Route Family, Proposed Alternative Routes 3 and 22 have the shortest length across mapped 100-year floodplains, at approximately 20.4 miles each. Proposed Alternative Route 16 has the longest length across mapped 100-year floodplains, at approximately 26.8 miles (Table 5-3).

5.2.1.4 Estimated Cost

Based on the cost estimates provided by CenterPoint Energy, the eastern routes are the least expensive with estimated total costs ranging between approximately $481.7 million for Proposed Alternative Route 5, to approximately $604.8 million for Proposed Alternative Route 27 (see Table 5-3). Proposed Alternative Routes 16 (approximately $514.3 million) and 2 (approximately $549.8 million) are the next least expensive routes within the Eastern Route Family and also within all three route families.

5.2.1.5 Eastern Route Family Ranking and Consensus

The technical experts agreed that all of the eastern routes are viable and acceptable from an overall land use, cultural resource and ecological perspective. The technical experts each ranked the top five eastern routes from **1st** to **5th** (with **1st** having the least potential impact and **5th** the greatest potential impact) from the perspective of their own technical discipline. The results of this ranking are summarized in Table 5-4.

TABLE 5-4 POWER'S ENVIRONMENTAL RANKING AND CONSENSUS OF THE EASTERN ROUTE FAMILY

RANKING					
Eastern Proposed Alternative Route	Land Use Specialist	Ecology Specialist	Cultural Resources Specialist	Project Manager	Consensus
1		3rd	1st		
2		1st	3rd		
3		4th			
4		5th			
5	2nd	2nd		1st	1st
16	1st			2nd	2nd
17			4th		
21			5th		
22					
27	5th			5th	
28	3rd			3rd	3rd
29			2nd		
30	4th			4th	

Comparing the 13 eastern routes from a land use perspective, Proposed Alternative Route 16 was selected as the eastern route having the least-potential land use impact followed by Proposed Alternative Routes 5, 28, 30 and 27, in order of preference. The ecologist ranked Proposed Alternative Route 2 as the eastern route having the least-potential ecological impact followed by Proposed Alternative Routes 5, 1, 3 and 4 in order of preference. Proposed Alternative Route 1 was identified as the eastern route having the least-potential impact on cultural resources followed by Proposed Alternative Routes 29, 2, 17 and 21 in order of preference. The POWER Project Manager ranked the eastern routes, considering all of the key evaluation criteria and giving consideration to whether the routes crossed state owned lands or not and the cost information. Proposed Alternative Route 5 was selected by the POWER Project Manager as the best-

balanced eastern route considering all the key evaluation criteria reviewed and cost information followed by Proposed Alternative Routes 16, 28, 30 and 27 in order of preference. Proposed Alternative Routes 5 and 16 both cross state-owned lands, TDCJ and TPWD, while Proposed Alternative Routes 27, 28 and 30 do not.

Through a consensus process, Proposed Alternative Routes 5, 16 and 28 in order of preference, were selected by the technical experts as the best-balanced eastern routes considering all the key evaluation criteria reviewed along with the cost estimates provided by CenterPoint Energy.

5.2.2 Central Route Family

After considering and comparing the key evaluation criteria for the proposed alternative routes within the Central Route Family it was concluded by POWER, with input from CenterPoint Energy that based on the size of the Project, nature of the study area and public input analysis, all of the central routes would be retained for further consideration. Proposed Alternative Routes 6 through 10, 20 and 24 through 26 were further evaluated. The data tabulation for the Key Evaluation Criteria for the Central Route Family is presented in Table 5-5.

The nine central routes have higher costs when compared to the Eastern Route Family and moderate costs when compared to the Western Route Family. The central routes tend to have moderate to high numbers of habitable structures located within 500 feet of their centerlines. The central routes have some of the highest percent of route parallel with apparent features, property lines, railroads, or an existing ROW. Six of the nine central routes cross TDCJ and TPWD property. Overall, the central routes tend to have comparable lengths across NWI mapped wetlands within USACE designated Columbia Bottomlands with the longest lengths, at approximately 0.05 mile (264 feet), which can easily be spanned. Overall, the central routes are anticipated to have moderate impacts to natural resources and minimal impacts to cultural resources.

5.2.2.1 Land Use

Only one of the nine central routes is less than 70.0 miles in length. Within the Central Route Family, Proposed Alternative Route 20 is the shortest, at approximately 68.1 miles and Proposed Alternative Route 8 is the longest, at approximately 75.0 miles. Proposed Alternative Route 26 represents the most direct pathway between the Project endpoints within the Central Route Family (Table 5-5).

Insert Table 5-5 11x17 FRONT

Insert Table 5-5 11x17 BACK

Within the Central Route Family, Proposed Alternative Route 8 has the fewest number of habitable structures located within 500 feet of its centerline, with 242. Of the 242 habitable structures, nine of them are already located within 500 feet of an existing transmission line. Proposed Alternative Route 20 has the most habitable structures located within 500 feet of its centerline, with 447. Of these habitable structures, 53 are already located within 500 feet of an existing transmission line (Table 5-5).

Seven of the proposed alternative routes in the Central Route Family would require removal or relocation of existing habitable structures (single-family residences). Proposed Alternative Routes 8 and 10 have the fewest each, with zero, and Proposed Alternative Routes 20, 24 and 25 have the most, with nine each, followed by Proposed Alternative Route 26, with eight (Table 5-5).

All of the nine central routes utilize approximately 0.9 mile or more of existing CenterPoint Energy transmission line ROW. Proposed Alternative Routes 7, 8 and 10 utilize the most, with approximately 1.8 miles each, and Proposed Alternative Routes 6, 9, 20, 24, 25 and 26 have the least, using approximately 0.9 mile each of CenterPoint Energy's existing transmission line ROW (Table 5-5).

Six of the nine proposed alternative routes in the Central Route Family parallel apparent property boundaries for approximately 32.6 miles or more. Proposed Alternative Route 20 has the shortest length parallel to apparent property lines, with approximately 20.8 miles, and Proposed Alternative Route 25 has the longest, with approximately 35.4 miles (Table 5-5).

Within the Central Route Family, the lengths parallel to apparent features, property lines, railroads, or an existing ROW range between approximately 81 percent and 89 percent. Proposed Alternative Routes 7, 8 and 26 have the least, with approximately 81 percent each of their total length parallel to apparent features, property lines, railroads, or an existing ROW and Proposed Alternative Route 20 has the most, with approximately 89 percent (see Table 5-5).

Proposed Alternative Routes 6, 7, 8, 9, 10 and 20 in the Central Route Family cross property owned by either TDCJ or TPWD or both. Lengths for these routes across TDCJ property range between zero miles each for Proposed Alternative Routes 7 and 9, to approximately 2.9 miles each on Proposed Alternative Routes 6, 10 and 20. Lengths for these routes across TPWD property range between approximately zero miles on Proposed Alternative Route 20, to approximately 4.5 miles each on Proposed Alternative Routes 7, 8 and 10 (Table 5-5).

Within the Central Route Family, Proposed Alternative Route 10 crosses the least amount of residential land use areas, with approximately 5.5 miles, and Proposed Alternative Route 25 crosses the most amount of residential land use areas, with approximately 11.9 miles (Table 5-5).

5.2.2.2 Historical and Aesthetic Values

Within the Central Route Family, Proposed Alternative Route 6 has the fewest recorded historical or archeological sites within 1,000 feet of route centerline, with three. Proposed Alternative Route 20 has the most recorded historical or archeological sites within 1,000 feet of route centerline, with six. Proposed Alternative Routes 6, 9, 24 and 26 and do not have any NRHP-listed or determined-eligible sites within 1,000 feet of the route centerlines, whereas Proposed Alternative Routes 8, 10, 20 and 25 each have one, and Proposed Alternative Route 7 has two. The amount of archeological HPAs for the Central Route Family ranges from approximately 26.0 miles crossed by Proposed Alternative Route 24, to approximately 33.0 miles crossed by Proposed Alternative Route 26 (Table 5-5).

Aesthetic Values

Within the Central Route Family, Proposed Alternative Route 7 has the shortest length within the foreground visual zone of a US or SH, at approximately 6.1 miles. Proposed Alternative Route 20 has the longest such length located within this visual zone, at approximately 20.2 miles (Table 5-5).

Proposed Alternative Route 26 has the shortest length in the Central Route Family, at approximately 10.8 miles, within the foreground visual zone of FM and county roads. Proposed Alternative Route 20 has the longest such length located within this visual zone, at approximately 21.6 miles (Table 5-5).

Proposed Alternative Route 20 has the shortest length in the Central Route Family, at approximately 5.3 miles, within the foreground visual zone of park and recreational areas. Proposed Alternative Route 26 has the longest such length located within this visual zone, at approximately 12.6 miles (Table 5-5).

5.2.2.3 Ecology

The central routes have the shortest and longest lengths across upland woodlands when compared to the Eastern and Western Route Families. Within the Central Route Family, Proposed Alternative Route 20 has the shortest length across upland woodlands, at approximately 7.5 miles, followed by Proposed Alternative Routes 10 and 24, at approximately 9.5 and 10.4 miles, respectively. Proposed Alternative Route 26 has the longest length across upland woodlands, at approximately 16.8 miles (Table 5-5).

The central routes typically have moderate lengths across bottomland/riparian woodlands areas when compared to the Eastern and Western Route Families. Within the Central Route Family, only two of the central routes have less than 3.0 miles of their length across bottomland woodlands or riparian areas. Proposed Alternative Route 20 has the shortest length across bottomland woodlands or riparian areas, at approximately 2.0 miles, followed by Proposed Alternative Route 6, at approximately 2.6 miles. Within the Central Route Family, Proposed Alternative Routes 9 and 24 have the longest length across bottomland woodlands or riparian areas, at approximately 3.7 miles each (Table 5-5).

Proposed Alternative Routes 20 and 6 have the shortest lengths across all NWI mapped wetlands at approximately 2.0 and 2.7 miles, respectively. Proposed Alternative Route 8 has the greatest length of all NWI mapped wetlands, at approximately 5.7 miles (see Table 5-5). The central routes typically have moderate lengths across USACE designated Columbia Bottomlands when compared to the Eastern and Western Route Families. Within the Central Route Family, Proposed Alternative Route 7 has the shortest lengths across USACE designated Columbia Bottomlands, at approximately zero miles. Proposed Alternative Route 20 has the greatest length across designated Columbia Bottomlands, at approximately 1.0 miles. Within the Central Route Family, Proposed Alternative Routes 6, 7, 8, 9 and 10 have the shortest lengths across NWI mapped wetlands within USACE designated Columbia Bottomlands, at approximately zero miles each. The remaining Proposed Alternative Routes, 20, 24, 25 and 26, each have the same and longest lengths across NWI mapped wetlands within USACE designated Columbia Bottomlands, at approximately 0.1 mile (approximately 264 feet) (Table 5-5).

Within the Central Route Family, Proposed Alternative Routes 6, 7 and 8 have the shortest lengths across open water (lakes or ponds), at approximately 0.1 mile each. This ties with the Eastern Route Family for shortest lengths across open waters. Proposed Alternative Routes 20 and 24 have the longest lengths across open water (lakes or ponds), at approximately 0.4 mile each. Proposed Alternative Route 26 crosses the least number of streams or canals, with 62. Proposed Alternative Route 10 has highest number of stream or canal crossings within the Central Route Family, with 74. Proposed Alternative Routes 7 and 25 have the shortest lengths parallel to streams or canals, at approximately 3.8 miles, each. Proposed Alternative Route 10 has highest length parallel to streams or canals within the Central Route Family, at approximately 7.3 miles (Table 5-5).

Within the Central Route Family, Proposed Alternative Route 20 has the shortest length across mapped 100-year floodplains, at approximately 7.5 miles. Proposed Alternative Route 8 has the longest length across mapped 100-year floodplains, at approximately 22.9 miles (Table 5-5).

5.2.2.4 Estimated Cost

Based on the cost estimates provided by CenterPoint Energy, the central routes are overall the second least expensive routes. Proposed Alternative Routes 20, 26, 25, 24 and 9 are the five most expensive of the Central Route Family (in order of least expensive to most expense) and are comparable to the total costs of the proposed alternative routes in the Western Route Family. The preliminary total cost estimates for all of the central routes range between approximately $615.5 million for Proposed Alternative Route 7, to approximately $695.2 million for Proposed Alternative Route 9 (see Table 5-2). Proposed Alternative Routes 10 (approximately $621.5 million), 6 (approximately $634.4 million) and 8 (approximately $640.4 million) are the next three least expensive routes within the Central Route Family (Table 5-2).

5.2.2.5 Central Route Family Ranking and Consensus

The technical experts agreed that all of the central routes are viable and acceptable from an overall land use, cultural resource and ecological perspective. The technical experts each ranked the top five central routes from **1st** to **5th** (with **1st** having the least potential impact and **5th** the greatest potential impact) from the perspective of their own technical discipline. The results of this ranking are summarized in Table 5-6.

TABLE 5-6 POWER'S ENVIRONMENTAL RANKING AND CONSENSUS OF THE CENTRAL ROUTE FAMILY

RANKING					
Central Proposed Alternative Route	Land Use Specialist	Ecology Specialist	Cultural Resources Specialist	Project Manager	Consensus
6		4th	3rd		
7	1st			1st	1st
8	3rd			2nd	
9		5th	2nd		
10	2nd	3rd	5th	3rd	2nd
20		1st			
24	4th	2nd	1st		3rd
25	5th			4th	
26			4th	5th	

Comparing the nine central routes from a land use perspective, Proposed Alternative Route 7 was selected as the central route having the least-potential land use impact followed by Proposed Alternative Routes 10, 8, 24 and 25, in order of preference. The ecologist ranked Proposed Alternative Route 20 as the central route having the least-potential ecological impact followed by Proposed Alternative Routes 24, 10, 6 and 9, in order of preference. Proposed Alternative Route 24 was identified as the central route having the least-potential impact on cultural resources followed by Proposed Alternative Routes 9, 6, 26 and 10, in order of preference. The POWER Project Manager ranked the central routes, considering all of the key evaluation criteria and giving consideration to whether the routes crossed state owned lands or not and the

cost information. Proposed Alternative Route 7 was selected by the POWER Project Manager as the best-balanced central route considering all the evaluation criteria reviewed and cost information followed by Proposed Alternative Routes 8, 10, 25 and 26, in order of preference. Proposed Alternative Routes 6, 7, 8, 9, 10 and 20 cross state-owned lands, TDCJ and TPWD, while Proposed Alternative Routes 24, 25 and 26 do not.

Through a consensus process, Proposed Alternative Routes 7, 10 and 24, in order of preference were selected by the technical experts as the best-balanced central routes considering all the key evaluation criteria reviewed along with the cost estimates provided by CenterPoint Energy.

5.2.3 Western Route Family

After considering and comparing the key evaluation criteria for the proposed alternative routes within the Western Route Family, it was concluded by POWER with input from CenterPoint Energy that based on the size of the Project, nature of the study area and public input analysis, all of the western routes would be retained for further consideration. Proposed Alternative Routes 11 through 15, 18, 19 and 23 were further evaluated. The data tabulation for the Key Evaluation Criteria for the Western Route Family is presented in Table 5-7.

Compared to the other route families, the eight proposed alternative routes in the Western Route Family are the longest and most expensive routes. The western routes tend to have the least number of habitable structures located within 500 feet of their centerlines, with the exception of Proposed Alternative Route 23. Similar to the Eastern and Central Route Families, few of these habitable structures are already located within 500 feet of an existing transmission line. The western routes have moderate to high percent of route length parallel with apparent features, property lines, railroads, or an existing ROW. Despite their overall longer route lengths when compared to the other two route families, they have moderate lengths parallel to existing transmission line ROW. Seven of the eight western routes cross TDCJ or TPWD property, or both. Only one of the western routes has a portion of its length across NWI mapped wetlands within USACE designated Columbia Bottomlands, at approximately 0.1 mile (approximately 264 feet), which can easily be spanned. Overall, the western routes are anticipated to have moderate impacts to natural resources and minimal impacts to cultural resources.

(This page left blank intentionally.)

Insert Table 5-7 11x17 FRONT

Insert Table 5-7 11x17 BACK

5.2.3.1 Land Use

All of the western routes are 74.6 miles in length or more. Within the Western Route Family, Proposed Alternative Route 23 is the shortest, at approximately 74.6 miles, and Proposed Alternative Route 18 is the longest, at approximately 84.3 miles. Proposed Alternative Route 19 represents the most direct pathway between the Project endpoints within the Western Route Family (Table 5-7).

Within the Western Route Family, Proposed Alternative Route 18 has the fewest number of habitable structures located within 500 feet of its centerline, with 164. Of the 164 habitable structures, 15 of them are located within 500 feet of an existing transmission line. Proposed Alternative Route 23 has the most habitable structures located within 500 feet of its centerline, with 331. Of these habitable structures, 35 are located within 500 feet of an existing transmission line (Table 5-7).

Four of the western routes would potentially require removal or relocation of existing habitable structures (single-family residences). Proposed Alternative Routes 13, 14, 18 and 19 have the fewest, with zero each. Proposed Alternative Routes 11, 12 and 15 each have one; and Proposed Alternative Route 23 has the most, with nine (Table 5-7).

All of the western routes utilize existing CenterPoint Energy transmission line ROW. Proposed Alternative Route 23 utilizes approximately 0.9 mile of CenterPoint Energy's existing transmission line ROW. Proposed Alternative Routes 11, 12, 13, 15, 18 and 19 each utilize approximately 1.8 miles (Table 5-7).

All eight western routes parallel other existing ROWs (roadway, etc.) for over approximately 19.4 miles. Proposed Alternative Route 15 has the greatest length parallel to other existing ROWs (roadway, etc.), with approximately 26.6 miles. Proposed Alternative Route 14 has the least, with approximately 19.4 miles (Table 5-7).

Within the Western Route Family, Proposed Alternative Route 11 has the least amount parallel to apparent property lines, with approximately 32.0 miles. Proposed Alternative Route 14 has the most distance parallel to apparent property lines, with approximately 39.1 miles (Table 5-7).

Within the Western Route Family, the lengths parallel to apparent features, property lines, railroads, or an existing ROW range between approximately 83 percent and 88 percent. Proposed Alternative Route 12 has the least, with approximately 83 percent of its total length parallel to apparent features, property lines, railroads, or an existing ROW. Proposed Alternative Route 11 has the most, with approximately 88

percent. The lengths parallel to apparent features, property lines, railroads, or an existing ROW in the Western Route Family are comparable to the Central Route Family, but more than the Eastern Route Family (Table 5-7).

Proposed Alternative Route 23 in the Western Route Family does not have any portion of its length across TDCJ or TPWD property, while Proposed Alternative Routes 11 through 15, 18 and 19 all cross property owned by either TDCJ or TPWD or both. Lengths for these seven routes across TDCJ property range from zero miles each for Proposed Alternative Routes 11, 12 and 15, to approximately 1.2 miles each on Proposed Alternative Routes 13, 14, 18 and 19. Lengths for these seven western routes across TPWD property are all the same, at approximately 4.5 miles (Table 5-7).

Within the Western Route Family, Proposed Alternative Route 15 crosses the least amount of residential land use areas, with approximately 5.6 miles. Proposed Alternative Route 13 crosses the most amount of residential land use areas, with approximately 8.0 miles (Table 5-7).

5.2.3.2 Historical and Aesthetic Values

Within the Western Route Family, Proposed Alternative Routes 13, 18 and 19 have the fewest recorded historical or archeological sites within 1,000 feet of route centerlines, with one. Proposed Alternative Route 23 has the most recorded historical or archeological sites within 1,000 feet of route centerline, with five. Proposed Alternative Route 23 does not have any NRHP-listed or determined-eligible sites within 1,000 feet of the route centerlines, whereas the remaining routes each have one. The amount of archeological HPAs for the Western Route Family ranges from approximately 29.0 miles crossed by Proposed Alternative Route 19, to approximately 35.2 miles crossed by Proposed Alternative Route 13 (Table 5-7).

Aesthetic Values

Within the Western Route Family, Proposed Alternative Routes 18 and 19 have the shortest length within the foreground visual zone of a US or SH, at approximately 4.4 miles. Proposed Alternative Route 23 has the longest such length located within this zone, at approximately 10.1 miles (Table 5-7).

Proposed Alternative Route 19 has the shortest length within the Western Route Family, at approximately 7.6 miles, within the foreground visual zone of FM and county roads. Proposed Alternative Route 12 has the longest such length within this visual zone, at approximately 10.9 miles (Table 5-7).

Proposed Alternative Routes 12 and 19 have the shortest lengths within the Western Route Family, at approximately 8.4 miles each, within the foreground visual zone of park and recreational areas. Proposed Alternative Route 15 has the longest such length located within this visual zone, at approximately 11.7 miles (Table 5-7).

5.2.3.3 Ecology

The western routes typically have moderate lengths across upland woodlands when compared to the Eastern and Western Route Families. Within the Western Route Family, Proposed Alternative Route 12 has the shortest length across upland woodlands, at approximately 11.7 miles. Proposed Alternative Route 14 has the longest length across upland woodlands, at approximately 15.3 miles (Table 5-7).

The western routes typically have longer lengths across bottomland/riparian woodlands areas when compared to the Eastern and Central Route Families. None of the western routes have less than 4.6 miles of their length across bottomland woodlands or riparian areas. Within the Western Route Family, Proposed Alternative Route 18 has the shortest length across bottomland woodlands or riparian areas, at approximately 4.6 miles. Proposed Alternative Route 13 has the longest length across bottomland woodlands or riparian areas, at approximately 5.2 miles (Table 5-7).

Proposed Alternative Route 23 has the shortest lengths across all NWI mapped wetlands, at approximately 3.1 miles. Proposed Alternative Route 15 has the greatest lengths across all NWI mapped wetlands, at approximately 6.4 miles (Table 5-7). The western routes typically have the shortest lengths across USACE designated Columbia Bottomlands when compared to the Eastern and Central Route Families. Within the Western Route Family, Proposed Alternative Routes 11, 12, 13, 14, 15, 18 and 19 have no portion of their lengths across USACE designated Columbia Bottomlands (zero miles). Proposed Alternative Route 23 has the greatest length across designated Columbia Bottomlands, at approximately 0.6 mile. Within the Western Route Family, Proposed Alternative Routes 11, 12, 13, 14, 15, 18 and 19 have no portion of their lengths across NWI mapped wetlands within USACE designated Columbia Bottomlands (zero miles). Proposed Alternative Route 23 has the greatest length across NWI mapped wetlands within USACE designated Columbia Bottomlands, at approximately 0.1 mile (approximately 264 feet) (Table 5-7).

The western routes typically have longer lengths across open water (lakes or ponds) when compared to the Eastern and Central Route Families. Proposed Alternative Routes 11, 19 and 23 have the shortest lengths across open water (lakes or ponds), at approximately 0.3 mile each. Within the Western Route Family, Proposed Alternative Route 15 has the longest length across open water, at approximately 0.5

mile. Proposed Alternative Routes 19 and 23 cross the least number of streams or canals, with 66 each. Proposed Alternative Route 15 has highest number of stream or canal crossings within the Western Route Family, with 84. Proposed Alternative Route 13 has the shortest length parallel to streams or canals, at approximately 4.3 miles. Proposed Alternative Route 15 has highest length parallel to streams or canals within the Western Route Family, at approximately 8.4 miles (Table 5-7).

Within the Western Route Family, Proposed Alternative Route 23 has the shortest length across mapped 100-year floodplains, at approximately 17.0 miles. Proposed Alternative Route 13 has the longest length across mapped 100-year floodplains, at approximately 25.3 miles (Table 5-7).

5.2.3.4 Estimated Cost

Based on the cost estimates provided by CenterPoint Energy, the proposed alternative routes in the Western Route Family are overall the most expensive routes, with the exception of Proposed Alternative Route 9 in the Central Route Family, at $695.2 million. The estimated total costs for the western routes range between approximately $647.0 million for Proposed Alternative Route 19, to approximately $690.2 million for Proposed Alternative Route 15 (Table 5-2).

5.2.3.5 Western Route Family Ranking and Consensus

The technical experts agreed that all of the western routes are viable and acceptable from an overall land use, cultural resource and ecological perspective. The technical experts each ranked the top five western routes from **1st** to **5th** (with **1st** having the least potential impact and **5th** the greatest potential impact) from the perspective of their own technical discipline. The results of this ranking are summarized in Table 5-8.

TABLE 5-8 POWER'S ENVIRONMENTAL RANKING AND CONSENSUS OF THE WESTERN ROUTE FAMILY

RANKING					
Western Proposed Alternative Route	Land Use Specialist	Ecology Specialist	Cultural Resources Specialist	Project Manager	Consensus
11	2nd	3rd		2nd	2nd
12	4th	4th		4th	
13	5th				
14	3rd	5th	3rd	3rd	3rd
15			5th		
18			4th		
19	1st	2nd	2nd	1st	1st
23		1st	1st	5th	

Comparing the eight western routes from a land use perspective, Proposed Alternative Route 19 was selected as the western route having the least potential land use impact followed by Proposed Alternative Routes 11, 14, 12 and 13, in order of preference. The ecologist ranked Proposed Alternative Route 23 as

the western route having the least potential ecological impact, followed by Proposed Alternative Routes 19, 11, 12 and 14, in order of preference. Proposed Alternative Route 23 was identified as the western route having the least potential impact on cultural resources, followed by Proposed Alternative Routes 19, 14, 18 and 15, in order of preference. The POWER Project Manager ranked the western route, considering all of the key evaluation criteria and giving consideration to whether the routes crossed state owned lands or not and the cost information. Proposed Alternative Route 19 was selected by the POWER Project Manager as the best-balanced eastern route considering all the key evaluation criteria reviewed and the cost information, followed by Proposed Alternative Routes 11, 14, 12 and 23, in order of preference. Proposed Alternative Routes 11 through 15, 18 and 19 all cross state-owned lands, TDCJ or TPWD or both, while Proposed Alternative Route 23 does not.

Through a consensus process, Proposed Alternative Routes 19, 11 and 14 were selected by the technical experts as the best-balanced western routes considering all the key evaluation criteria reviewed along with the cost estimates provided by CenterPoint Energy.

5.3 SELECTION OF THE ROUTE WHICH BEST ADDRESSES THE REQUIREMENTS OF PURA AND PUC SUBSTANTIVE RULES

POWER ranked the top three proposed alternative routes (i.e., the ones having the least potential impact) from each route family. POWER identified the top three Eastern Routes 5, 16 and 28, in order of preference, Central Routes 7, 10 and 24 in order of preference, and Western Routes 19, 11 and 14, in order of preference. POWER, in conjunction with CenterPoint Energy, considered this analysis in the determination of the route that best addresses the requirements of PURA and the PUC Substantive Rules. From these top ranked routes, POWER identified Eastern Route 5 as the route that best addresses the requirements of PURA and the PUC Substantive Rules. However, Proposed Alternative Route 5 crosses approximately 2.9 miles of TDCJ property and approximately 4.5 miles of TPWD property (state owned land). Electric utilities do not have the authority to exercise eminent domain to acquire rights to state owned land. Therefore, POWER looked to identify an additional route that performed well under the evaluation criteria, but that did not cross state owned land. POWER identified Proposed Alternative Route 28 as the second ranked route that best addresses the requirements of PURA and the PUC Substantive Rules, because although it did not perform as well as Proposed Alternative Route 5 did under most of the other designated criteria (including number of habitable structures affected, number of habitable structures that may have to be removed and estimated cost), Proposed Alternative Route 28 does not cross any TDCJ or TPWD property. A discussion on the rationale for the recommendation of a proposed alternative route by consensus that best addresses the requirements of PURA and the PUC Substantive Rules is provided. Tables 5-3, 5-5 and 5-7 summarize the data tabulated for the key

evaluation criteria and include cost estimates for each of the 30 proposed alternative routes. Tables 5-9 through 5-38 in Appendix D present detailed information about habitable structures and other land use features (CCN inventory items) near the 30 proposed alternative routes. The items on Tables 5-9 through 5-38 and the proposed alternative routes are depicted on Figure 5-1 (Sheets 1-6 in the Map Pockets). The 30 proposed alternative routes provide geographic diversity within the Project study area and comply with Section 37.056(c)(4)(A)-(D) of PURA, 16 TAC § 22.52(a)(4), 16 TAC § 25.101(b)(3)(B) and the PUC's Policy of Prudent Avoidance.

Proposed Alternative Route 5 (Segments: B-D-C-L-P-U-V-X-Y-Z-BI-BJ-BK-BM-CS-CT-CU-CW-CY-DC-IZ-JA-FP) is recommended as the route that best addresses the requirements of PURA and the PUC's Substantive Rules. Proposed Alternative Route 5 is the second shortest routes, at 55.2 miles, and has one of the fewer numbers of habitable structures within 500 feet of the route centerline of all the proposed alternative routes, with 181. Proposed Alternative Route 5 does not require any habitable structures be relocated or removed. Proposed Alternative Route 5 crosses state owned land, including approximately 2.9 miles across TDCJ's Clemmons Unit along Segments CW and CY that parallel the south side of SH 36, and approximately 4.5 miles across TPWD's Justin Hurst WMA on Segment JA that parallels an existing transmission line for approximately 3.7 miles of this length. These state entities would both have to agree to grant CenterPoint Energy an easement for Alternative Route 5. Proposed Alternative Route 5 is parallel with existing features for 75 percent of its length. This route crosses 10.8 miles of upland woodlands, crosses almost three miles (2.8 miles) of bottomland/riparian woodlands and has a comparable number of stream crossings (63). Proposed Alternative Route 5 has one of the longer total lengths across NWI-mapped wetlands (5.8 miles). However, these potential impacts may be minimized by spanning wetland areas. Proposed Alternative Route 5 crosses approximately 0.75 mile of USACE designated Columbia Bottomlands, but does not cross any NWI mapped wetlands within USACE designated Columbia Bottomlands. The avoidance and minimization of potential impacts to community values and environmental integrity are maximized with this route. Based on the refined cost estimates provided by CenterPoint Energy, Proposed Alternative Route 5 is the least expensive route within all three route families with an estimated total cost of approximately $481.7 million (Table 5-3).

Proposed Alternative Route 28 (Segments: B-D-C-L-P-U-V-X-Y-Z-BI-BX-CM-CQ-IO1-IO2-IX-IZ-DJ-DL-DO-DP-DR-DS-DT-ER1-ER2-EV-EZ-FD-FG-FH-FO-FP) is recommended as the second route that best addresses the requirements of PURA and the PUC's Substantive Rules, because it does not cross any state owned property (TDCJ or TPWD). Proposed Alternative Route 28 is one of the shorter routes, at 57.8 miles, and has a moderate number of habitable structures within 500 feet of the route centerline, with 275. Proposed Alternative Route 28 has three habitable structures along the centerline

that would potentially require relocation or removal. Proposed Alternative Route 28 is parallel with existing features for 73 percent of its length. This route crosses 13.4 miles of upland woodlands, crosses 3.1 miles of bottomland/riparian woodlands and has a comparable number of stream crossings (62). Proposed Alternative Route 28 has a total length across NWI-mapped wetlands of 3.9 miles. However, these potential impacts may be minimized by spanning wetland areas. Proposed Alternative Route 28 crosses approximately 1.75 miles of USACE designated Columbia Bottomlands, and crosses approximately 0.1 mile of NWI mapped wetlands within USACE designated Columbia Bottomlands. The avoidance and minimization of potential impacts to community values and environmental integrity are maximized with this route. Based on the refined cost estimates provided by CenterPoint Energy, Proposed Alternative Route 28 is the seventh least expensive route within all three route families with an estimated construction cost of approximately $575.3 million (see Table 5-3).

(This page left blank intentionally.)

6.0 LIST OF PREPARERS

This EA was prepared for CenterPoint Energy by POWER. 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	Vice President
Project Manager	Lisa Barko Meaux	Project Manager III
Hydrology	Steve Hicks David Morgan	Senior Biologist II Biologist II
Ecology	Steve Hicks David Morgan Ryan Bayer Lance Gillaspie Stephen Ross	Senior Biologist II Biologist II Project Manager III Biologist II Biologist II
Land Use	Denise Williams Emily Innes	Environmental Planner II Environmental Specialist I
Public Involvement	Lisa Barko Meaux Denise Williams	Project Manager III Environmental Planner II
Aesthetics	Denise Williams	Environmental Planner II
Cultural Resources	Darren Schubert Emily Duke	Cultural Resource Specialist II Field Representative II
Maps/Figures/Graphics	Scott Childress Austin Streetman Kirsten Severud	GIS Analyst II GIS Analyst III GIS Analyst II

(This page left blank intentionally.)

7.0 REFERENCES CITED

Abbot, James T. 2001. *Houston Area Geoarcheology: A Framework for Archeological Investigation, Interpretation, and Cultural Resource Management in the Houston Highway Management District.* Archeological Studies Program Report 27. Austin: Environmental Affairs Division, Texas Department of Transportation.

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

Arvin, J.C. 2007. Birds of the South Texas Brushlands – A Field Checklist. Texas Park and Wildlife Department. Austin, Texas. 20pp.

Aten, Lawrence E. 1979. Indians of the Upper Texas Coast: Ethnohistoric and Archaeological Frameworks. Ph.D. dissertation, Department of Anthropology, University of Texas at Austin.

_____. 1983. Indians of the Upper Texas Coast. New York: Academic Press.

Black, Deidra Aery and James Karbula. 2015. *Archaeological and Metal Detection Investigations of a 4-acre Proposed Development at the Levi Jordan Plantation State Historic Site (41BO165), Brazoria, Texas*. William Self Associates, Inc. Submitted to the Texas Historical Commission, Texas Antiquities Permit No. 7083. Copies available from the Texas Historical Commission.

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

Brazoria County. 2017. Departments. Parks Department. Available on the internet: http://brazoriacountytx.gov/departments/parks-department (accessed August 2017).

Brune, Gunnar. 2002. Springs of Texas, Volume I. Texas A&M University Press. College Station, Texas. 566.

Bureau of Economic Geology (BEG). 1982. Geologic atlas of Texas, Houston sheet. Available on the Internet: https://www.twdb.texas.gov/groundwater/aquifer/GAT/ (accessed May 2018).

_____. 1987. Geologic Atlas of Texas, Beeville-Bay City sheet. Available on the Internet: https://www.twdb.texas.gov/groundwater/aquifer/GAT/ (accessed May 2018).

_____. 1996. Physiographic Map of Texas. University of Texas. Austin, Texas. Campbell, L. 2003. *The Endangered and Threatened Animals of Texas.* Texas Parks and Wildlife Department. Austin, Texas. 129 pp.

Campbell, Linda. 2003. The Endangered and Threatened Animals of Texas. Texas Parks and Wildlife Department. 129 pp. Available on the Internet: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_0013.pdf.

City of Bay City. 2017. Departments. Parks. Available on the internet: http://www.cityofbaycity.org/departments/parks-recreation/parks (accessed August 2017).

City of Brazoria. 2017. Government. Departments. Public Works. Parks and Recreation. Available on the internet: http://www.cityofbrazoria.org/163/Parks-and-Recreation (accessed August 2017).

City of Clute. 2017. Departments. Parks and Recreation. City Parks. Available on the internet: http://www.ci.clute.tx.us/pages/parks.php (accessed August 2017).

City of Freeport. 2017. Government. City Departments. Parks and Recreation. Parks Department. Parks in Freeport. Available on the internet: http://www.freeport.tx.us/default.aspx?name=parks (accessed August 2017).

City of Lake Jackson. 2016. City Government. Comprehensive Master Plan. Available on the internet: http://www.lakejackson-tx.gov/DocumentCenter/View/2502 (Adopted June 6, 2016) (accessed August 2017).

_____. 2017. City Government. City Departments. Parks and Recreation. Available on the internet: (accessed August 2017).

City of Richwood. 2017. Departments. Public Works. Parks and Recreation. Available on the internet: http://richwoodtx.gov/site/departments/public-works/parks-recreation/ (accessed August 2017).

City of Sweeny. 2017. Government. Parks and Recreation. Available on the internet: http://www.ci.sweeny.tx.us/parks.htm (accessed August 2017).

City of West Columbia. 2017. Departments. Parks and Recreation. Available on the internet: http://westcolumbiatx.org/index.aspx?nid=253 (accessed August 2017).

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

Cowardin, L. M., V. Carter, F. C. Golet and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. US Department of the Interior, Fish and Wildlife Service, Washington, D.C. 131 pp.

Dixon, J.R. 2013. Amphibians and Reptiles of Texas: with keys, taxonomic synopses, bibliography and distribution maps. W.L. Moody Jr. Natural History Series. Texas A&M University Press, College Station Texas. 447 pp.

Dixon J.R. and J.E. Werler. 2005. Texas Snakes – A Field Guide. University of Texas Press. Austin, Texas. 364 pp.

Electric Reliability Council of Texas Regional Planning Group (ERCOT-RPG). 2017a. http://www.ercot.com/content/wcm/key_documents_lists/108892/CNP_Freeport_Master_ RPG_11_04_2017_.pdf (accessed June 20, 2018).

_____. 2017b. http://www.ercot.com/content/wcm/key_documents_lists/104002/8_Freeport_Master_Plan _Project_Regional_Planning_Group__RPG__Project.pdf (December 12, 2017) (accessed June 20, 2018).

Ewers, John C. 1974. The Influence of Epidemics on the Indian Populations and Cultures of Texas. *Plains Anthropologist* 8:104-115. FAA. 2008. Federal Aviation Administration (14 CFR Part 77.13. pp 486-487).

Federal Aviation Administration (FAA). 2017a. National Aeronautical Charting Office. Houston Sectional Aeronautical Chart, 99th Edition, Effective March 2, 2017.

_____. 2017b. 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 August 2017).

_____. 2017c. Airport Data and Contact Information. Available on the internet: http://www.faa.gov/airports/airport_safety/airportdata_5010/ (accessed August 2017).

Federal Communication Commission (FCC). 2017. Geographic Information Systems – Licensing Database Extracts. Available on the internet: http://wireless.fcc.gov/geographic/index.htm?job=licensing_database_extracts (accessed August 2017).

Federal Emergency Management Agency (FEMA). 2018. National Flood Hazard Layer. Available on the Internet: https://hazards.fema.gov/femaportal/wps/portal/ NFHLWMSkmzdownload (accessed April 2018).

Frye, R.G., L. Brown and C.A. McMahan. 1984. Vegetational Areas of Texas Map. Texas Parks and Wildlife Department. Austin, Texas. Available on the Internet: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_mp_e0100_1070n_34.pdf (accessed April 2018).

Google. 2018. Google Earth: Aerial Maps. Google Earth version 7.1.2.2041. Google Inc.

Gould, F.W., G.O. Hoffman and C.A. Rechenthin. 1960. *Vegetational Areas of Texas*. Texas A&M University, Texas Agriculture Experiment Station Leaflet. 492pp. Available on the internet: https://tpwd.texas.gov/publications/pwdpubs/media/pwd_mp_e0100_1070ac_34.pdf (accessed April 2018).

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.

Hall, Grant D. 1981. Allens Creek: a study in the cultural prehistory of the Lower Brazos River Valley, Texas. Technical Report 61, Texas Archeological Survey. The University of Texas at Austin. Austin, Texas

_____. 2000. Pecan Food Potential in Prehistoric North America. *Economic Botany* 54: 103-112.

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.

Hester, Thomas R. 1980. *A Survey of Paleo-Indian Archaeological Remains along the Texas Coast. In* Papers on the Archeology of the Texas Coast. Special Report No. 11. Lynn Highley and Thomas R. Hester, eds. Pp1-12. San Antonio: The University of Texas at San Antonio, Center for Archaeological Research.

Howard, Margaret A., Gail L. Bailey, C. Britt Bousman, Karen M. Gardner and Ross C. Fields. 1991. *National Register Testing at the Spanish Moss Site (41GV10) and 41GV53, Galveston County, Texas.* Reports of Investigations Number 77. Austin: Prewitt and Associates, Inc.

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

Hubbs, C., R.J. Edwards and G.P. Garrett. 2008. An annotated checklist of the freshwater fishes of Texas, with keys to identification of species. Texas Academy of Science. Available on the Internet: http://repositories.lib.utexas.edu/bitstream/handle/2152/6290/Hubbs_et_al_2008_checklist.pdf?sequence=2 (accessed April 2018).

Karbula, James W., Zachariah Jamieson and Nicole Inskeep. 2017. *Archaeological Testing of a Historic Anomaly and GPR survey of the Levi Jordan Plantation State Historic Site (41BO165), Brazoria, Texas*. William Self Association, Inc. Submitted to the Texas Historical Commission, Texas Antiquities No. 7264.

Kleiner, Diana J. 2017a. "BRAZORIA COUNTY," *Handbook of Texas Online.* Available online at: https://tshaonline.org/handbook/online/articles/hcb12 (accessed April 2018). Published by the Texas State Historical Association.

_____. 2017b. "MATAGORDA, TX," *Handbook of Texas Online*. Available online at: https://tshaonline.org/handbook/online/articles/hlm35 (accessed April 2018). Published by the Texas State Historical Association.

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.

Matagorda County Birding Nature Center (MCBNC). 2017. Available on the internet: http://mcbnc.org/ (accessed August 2017).

McMahan, G.A., R.G. Frye and K.L. Brown. 1984. *The Vegetation Types of Texas - Including Cropland.* Texas Parks and Wildlife Department. Austin, Texas. Available on the Internet: http://www.tpwd.state.tx.us/publications/pwdpubs/media/ pwd_bn_w7000_0120.pdf (accessed April 2018).

National Agricultural Imagery Program (NAIP). 2014-2018. Brazoria, Matagorda and Wharton Counties, Texas. Available on the internet: http://gis.apfo.usda.gov/arcgis/services (accessed August 2017).

National Conservation Easement Database (NCED). 2017. NCED Easements. Available on the internet: http://nced.conservationregistry.org/browse/map (accessed August 2017).

National Park Service (NPS). 2017a. National Parks. Texas. Available on the Internet: http://www.nps.gov/state/tx/index.htm?program=all (accessed August 2017).

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

_____. 2018b. National Historic Landmarks Program – Lists of National Historic Landmarks - Texas. Available on the internet: https://www.nps.gov/nhl/find/statelists/tx.htm (accessed April 2018).

_____. 2018c. National Trail System. Available on the internet: https://www.nps.gov/subjects/nationaltrailssystem/maps.htm (accessed April 2018).

National Register of Historic Places (NRHP). 1975. John McCroskey Cabin, Brazoria County, Texas. National Register #75001958.

_____. 1979a. Durazno Plantation, Brazoria County, Texas. National Register # 80004081.

_____. 1979b. Varner-Hogg Plantation, Brazoria County, Texas. National Register # 80004082.

_____. 2004a. Palapa Table for James Richard Marmion, Brazoria County, Texas. National Register # 04001172.

_____. 2004b. Gazebo for James Richard Marmion, Brazoria County, Texas. National Register # 04001173.

Natural Resource Conservation Service (NRCS). 2001. Soil survey of Matagorda County, Texas. In cooperation with Texas Agriculture Experiment Station. Available on the Internet: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/texas/TX321/0/Matagorda.pdf (accessed April 2018).

_____. 2018. Soil Web Survey. Available on the internet: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (accessed April 2018).

National Wild and Scenic Rivers System (NWSRS). 2017. National Wild and Scenic Rivers System Wild and Scenic Rivers by State. Available on the Internet: http://www.rivers.gov/map.php (accessed August 2017).

Newcomb, W.W. 1961. *The Indians of Texas: From Prehistoric to Modern Times*. Austin: University of Texas Press.

Patterson, L.W. 1980. *The Owen Site, 41HR315: A Long Occupation Sequence in Harris County, Texas.* Report No. 3. Houston: Houston Archeological Society.

_____. 1995. *Southeast Texas Archeology*. Report Number 12. Houston Archeological Society.

PLATTS. 2017. McGraw Hill Financial, Inc., 2 Penn Plaza, New York, New York. (accessed August 2017).

Railroad Commission of Texas (RRC). 2017. Public GIS Map Viewer for Oil, Gas and Pipeline Data. Available on the internet: http://www.rrc.state.tx.us/about-us/resource-center/research/gis-viewers/ (accessed August 2017).

_____. 2018. Historical Coal Mining. Available on the internet: http://www.rrc.state.tx.us/mining-exploration/historical-coal-mining/ (accessed April 2018).

Ricklis, Robert A. 2004. *The Archaeology of the Native American Occupation of Southeast Texas.* In "The Prehistory of Texas." Ed. Timothy Pertulla. Texas A & M University Press. College Station.

Schmidly, David J. and Robert D. Bradley. 2016. The Mammals of Texas, seventh edition. University of Texas Press, Austin, Texas. 720pp.

Soil Conservation Service (SCS). 1974. Soil Survey of Wharton County, Texas. In cooperation with Texas Agriculture Experiment Station. Available on the Internet: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/texas/whartonTX1974/whartonTX1974.pdf / (accessed April 2018).

_____. 1981. Soil Survey of Brazoria County, Texas. In cooperation with Texas Agriculture Experiment Station. Available on the Internet:

https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/texas/TX039/0/brazoria.pdf/ (accessed April 2018).

Southern Avionics Company (SAC). 2018. Non-Directional Beacon. Available on the internet: https://www.southernavionics.com/blog/bid/50999/What-is-an-NDB-or-Non-Directional-Beacon (accessed May 2018).

Story, Dee Ann. 1985. *Adaptive Strategies of Archaic Cultures of the West Gulf Coastal Plain*. *In* Prehistoric Food Production in North America. R.I. Ford, ed. Pp 19-56. Anthropological Papers No. 75. Ann Harbor: Museum of Anthropology, University of Michigan.

Story, Dee Ann, Janice A. Guy, Barbara A. Burnett, Martha Doty Freeman, Jerome C. Rose, D. Gentry Steele, Ben W. Olive and Karl J. Reinhard. 1990. *The Archeology and Bioarcheology of the Gulf Coastal Plain*: Volume 1. Research Series No. 38. Fayetteville: University of Arkansas, Arkansas Archeological Survey.

Texas Commission on Environmental Quality (TCEQ). 2014. 2014 Texas Integrated Report of Surface Water Quality for the Clean Water Act Sections 305(b) and 303(d). Available on the internet: https://www.tceq.texas.gov/waterquality/assessment/14twqi (accessed April 2018).

_____. 2018. *Index to superfund sites by county*. Available on the Internet: http://www.tceq.texas.gov/remediation/superfund/sites/county/ (accessed April 2018).

Texas Department of Transportation (TxDOT). 2017a. County Grid Map Search. Available on the internet: http://www.dot.state.tx.us/apps-cg/grid_search/county_grid_search.htm (accessed August 2017).

_____. 2017b. Project Tracker. Available on the internet: http://www.txdot.gov/project_information/project_tracker.htm (accessed August 2017).

_____. 2018. NRHP Listed and Eligible Bridges. Available on the internet: https://txdot.maps.arcgis.com/apps/webappviewer/index.html?id=cc9cf3452a324 d0bb961a0c8b4edd898 (accessed April 2018).

Texas Education Agency (TEA). 2017. School District Locator. Available on the internet: http://tea.texas.gov/Texas_Schools/General_Information/School_District_Locator/School_District_Locator/ (accessed August 2017).

Texas General Land Office (GLO). 2018. GIS Map Viewer. Available online: http://gisweb.glo.texas.gov/glomapjs/index.html (Accessed April 2018).

Texas Historical Commission (THC). 2018a. Texas Historic Sites Atlas. Available on the internet: http://atlas.thc.state.tx.us/ (accessed April 2018).

_____. 2018b. Texas Archeological Sites Atlas. Available on the internet (Restricted Access): http://nueces.thc.state.tx.us/ (accessed April 2018).

_____. 2018c. Texas Historical Commission. Texas Heritage Trails Program – Texas Independence Trail Region. Available on the Internet: http://texasindependencetrail.com/map (accessed April 2018).

Texas Natural Diversity Database (TXNDD). 2017. Texas Parks and Wildlife Department. Texas Biological and Conservation Data System. Austin, Texas. Received: August 31, 2017.

Texas Parks and Wildlife Department (TPWD). 2017a. Texas Parks and Wildlife - Find a Park. Available on the internet: http://www.tpwd.state.tx.us/spdest/findadest/ (accessed August 2017).

_____. 2017b. Texas Parks and Wildlife Department. Hunting. Wildlife Management Areas. Find a Wildlife Management Area. Ordered by County. Available on the internet: https://tpwd.texas.gov/huntwild/hunt/wma/find_a_wma/list/?option=county (accessed August 2017).

_____. 2017c. Great Texas Wildlife Trail. Great Texas Coastal Birding Trail – Upper Texas Coast. Available on the Internet: https://tpwd.texas.gov/huntwild/wildlife/wildlife-trails/utc (accessed August 2017).

_____. 2018a. Ecologically significant stream segments. Available on the Internet: http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/ (accessed April 2018).

_____. 2018b. Rare, Threatened and Endangered species of Texas by County. Available on the Internet: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/ (accessed April 2018).

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

_____. 2018. Karst regions of Texas. Available on the Internet: http://www.texasspeleologicalsurvey.org/karst_caving/karst_regions.php (accessed April 2018).

Texas State Data Center (TXSDC). 2014. TX Population Estimates & Projections. Population Projections. 2014 Population Projections Data Downloads. Available on the internet: http://osd.texas.gov/Data/TPEPP/Projections/ (accessed August 2017).

Texas Water Development Board (TWDB). 2011. Aquifers of Texas. Report 380. Texas Water Development Board. Austin, Texas.

_____. 2014. *Major Surface Water Features in the State of Texas*. Available on the Internet: http://www.twdb.texas.gov/mapping/doc/maps/Major_Surface_Water_Features_36x36.pdf?d=1523481588519 (accessed April 2018).

_____. 2017a. Water Wells. Groundwater Database/Submitted Drillers Reports. Available on the internet: http://www.twdb.texas.gov/groundwater/data/drillersdb.asp (accessed August 2017).

_____. 2017b. *Water for Texas: 2017 State Water Plan*. Austin, Texas. Available on the https://www.twdb.texas.gov/waterplanning/swp/2017/doc/SWP17-Water-for-Texas.pdf?d=1523482951743 (accessed April 2018).

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

Thomas, C., T.H. Bonner and B.G. Whiteside. 2007. *Freshwater Fishes of Texas*. Texas A&M University Press. College Station, Texas. 202 pp.

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. 309 pp.

United States Bureau of the Census (USBOC). 2000. Census 2000 Gateway. State and County Quick Facts. Available on the Internet: http://www.census.gov/main/www/cen2000.html (accessed August 2017).

_____. 2010. Census 2010. Available on the Internet: http://www.census.gov/2010census/ (accessed August 2017).

_____. 2015. American Fact Finder. Available on the Internet: http://factfinder2.census.gov/main.html (accessed August 2017).

United States Department of Agriculture (USDA). 2012. 2012 Census of Agriculture – Texas – State and County Profiles. Available on the Internet: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Texas/ (accessed August 2017).

United States Environmental Protection Agency (USEPA). 2018. Region 6 Superfund Program. Superfund National Priorities List (NPL). Available on the Internet: http://www.epa.gov/superfund/sites/npl/index.htm (accessed April 9, 2018).

United States Fish and Wildlife Service (USFWS). 2009. Whooping Cranes and Wind Development, An issue Paper. USFWS Region 2 and Region 6, April 2009

_____. 2010. Attwater's Prairie-Chicken Recovery Plan, Second Revision. Albuquerque, New Mexico.

_____. 2013. Bird Checklists of the United States. Brazoria, San Bernard and Big Boggy National Wildlife Refuges. Northern Prairie Wildlife Research Center Online. Available online: http://www.npwrc.usgs.govbrazoria.htm (accessed April 2018).

_____. 2017. National Wildlife Refuges (NWR). San Bernard NWR. Available on the internet: https://www.fws.gov/refuge/san_bernard/ (accessed August 2017).

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

_____. 2018b. IPaC Information for Planning and Consultation. Species List requested and received May 14, 2018. ((Consultation Code: 02ETTX00-2018-SLI-1481).

_____. 2018c. Critical Habitat Mapper. Available on the Internet: http://criticalhabitat.fws.gov/crithab/flex/crithabMapper.jsp (accessed November 2017).

United States Geological Survey (USGS). 2004. *Hydrogeology and Simulation of Ground-Water Flow and Land-Surface Subsidence in the Northern Part of the Gulf Coast Aquifer System, Texas.* U.S. Geological Services. Scientific Investigations Report 2004–5102. Available on the Internet: http://pubs.usgs.gov/sir/2004/5102/pdf/sir2004-5102.pdf (accessed April 2018).

_____. 2018a. United States Geologic Survey - 7.5 minute quadrangle maps. Note: Most quads have different print dates and these were not cited but referenced. The quadrangle maps were accessed through. ESRI ArcGIS Explorer Desktop. Available for download on the internet: http://www.esri.com/software/arcgis/explorer (accessed April 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 (accesses April 2018).

_____. 2018c. Quaternary Fault and Fold Database of the United States, Texas. Available on the internet: http://earthquake.usgs.gov/hazards/qfaults (accessed November April 2018).

Werler, J.E. and J.R. Dixon. 2005. *Texas Snakes: Identification, Distribution, and Natural History*. University of Texas Press. Austin, Texas. 437 pp.

Wheat, Joe Ben. 1953. *The Addicks Dam Site: An Archeological Survey of the Addicks Dam Basin, Southeast Texas*. River Basin Surveys Papers No. 4, Part 1. Bureau of American Ethnology Bulletin 154. Pp. 143-252.

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

(This page left blank intentionally.)