ATTACHMENT 1

Environmental Assessment and Alternative Route Analysis for the 138 kV Kilgore Substation Project in Chambers County, Texas

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August 2023

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC

Kilgore Substation 138 kV Transmission Line Project

Environmental Assessment and Alternative Route Analysis

Chambers County, Texas

Docket No. 55365

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52121.001

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Kilgore Substation 138 kV Transmission Line Project

Environmental Assessment and Alternative Route Analysis

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EXECUTIVE SUMMARY

CenterPoint Energy Houston Electric, LLC (CenterPoint Energy) proposes to construct a new double-circuit 138 kilovolt (kV) transmission line south of the City of Mont Belvieu and located between Cedar Bayou and the Grand Parkway in Chambers County, Texas. The proposed new transmission line will provide a connection from the transmission grid to a proposed distribution substation identified as Kilgore Substation. The new transmission line will originate from one of the existing transmission circuits located in the existing east-west transmission corridor that crosses State Highway (SH) 146, approximately one-half mile north of Interstate Highway (IH) 10, to one of two potential Kilgore Substation sites located in the vicinity of Kilgore Parkway. The first potential site for the proposed Kilgore Substation is within a tract of land located immediately northeast of the intersection of Kilgore Parkway and Needlepoint Road (29.808599, -94.868389 NAD83), while the second potential site is located within a tract of land north of Kilgore Parkway and approximately 3,600 feet west of the first potential site (29.806782, -94.880784 NAD 83). CenterPoint Energy retained Halff Associates, Inc. (Halff) to prepare this Environmental Assessment (EA) and Alternative Route Analysis to support the Public Utility Commission of Texas (PUCT) application for a Certificate of Convenience and Necessity (CCN) for the proposed project.

Halff, with input from CenterPoint Energy, identified the study area boundaries utilizing the two proposed substation sites as endpoints, in addition to potential paralleling features and constraints. CenterPoint Energy provided the location of 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. Halff and CenterPoint Energy initially identified 76 geographically diverse initial preliminary transmission line segments. Input received from local agencies and reconnaissance surveys in conjunction with consideration of the project objectives, including geographic diversity, and input from the public meeting resulted in the identification of 20 proposed alternative routes.

The potential environmental and land use impacts for each proposed alternative route were tabulated by Halff for each evaluation criteria. CenterPoint Energy provided the engineering review and estimated construction cost for each proposed alternative route. Halff compared 20 proposed alternative routes and determined that Proposed Alternative Route 10 is the proposed alternative route that best addresses the requirements of the Public Utility Regulatory Act (PURA) and the PUCT Substantive Rules. CenterPoint Energy provided input and review throughout the routing study process and agreed that Proposed Alternative Route 10 is the proposed alternative route that best addresses the requirements of the PURA and the PUCT Substantive Rules.

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ACRONYMS AND ABBREVIATIONS

§	Section
A.D.	*anno Domini* (”the year of our Lord”)
AM	Amplitude modulation (e.g., AM Tower)
APLIC	Avian Power Line Interaction Committee
B.C.	Before Christ
BEG	Bureau of Economic Geology
BMP	Best Management Practice
B.P.	Before Present
C	Candidate
CCN	Certificate of Convenience and Necessity
CFR	Code of Federal Regulations
CMP	Texas Coastal Management Program
CMZ	Coastal Management Zone
CNRAs	Coastal Natural Resource Areas
Cornell	Cornell Lab of Ornithology
CR	County Road (e.g., CR 506)
CWA	Clean Water Act
DM	Recovered, Delisted, and Being Monitored
DoD	United States Department of Defense
E	State Listed Endangered Species
EA	Environmental Assessment
e.g.,	*exempli gratia* (for example)
EMST	Ecological Mapping Systems of Texas
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
et al.	*et alia* (and others)
etc.	*et cetera* (and the rest or and so forth)
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FM	Farm-to-Market Road (e.g., FM 565)
FM	Frequency Modulation (e.g., FM Tower)
GIS	Geographic Information System
GLO	Texas General Land Office
Halff	Halff Associates, Inc.
HPA	High Probability Area
i.e.,	*id est* (that is)
IH	Interstate Highway
ISD	Independent School District
IUCN	International Union for Conservation of Nature and Natural Resources
kV	kilovolt (1,000 volts)
LE	Federally Listed Endangered Species
LRR	Land Resource Region
LT	Federally Listed Threatened Species
ME	Miscellaneous Easement
MLRA	Major Land Resource Area
NEPA	National Environmental Policy Act
NHD	National Hydrology Dataset

NRCS	Natural Resources Conservation Service (an agency of the USDA)
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWP	Nationwide Permit
OTHM	Official Texas Historical Markers
PEM	Palustrine Emergent
PCN	Pre-construction Notification
PFO	Palustrine Forested
PSS	Palustrine Scrub-Shrub
PT	Proposed Threatened
PUCT	Public Utility Commission of Texas
PURA	Public Utility Regulatory Act
ROW	Right-of-Way
RRC	Railroad Commission of Texas
SAL	State Antiquities Landmarks
SCS	Soil Conservation Service (agency was renamed NRCS, see above)
Section 404	Section 404 of the Clean Water Act
SH	State Highway
sp.	Species
spp.	Species (plural)
subsp.	Subspecies
SWPPP	Storm Water Pollution Prevention Plan
T	State Listed Threatened Species
TAC	Texas Administrative Code
TARL	Texas Archeological Research Laboratory
TASA	Texas Archeological Sites Atlas
TDC	Texas Demographic Center
TCEQ	Texas Commission on Environmental Quality
THC	Texas Historical Commission
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
TxDOT	Texas Department of Transportation
TXNDD	Texas Natural Diversity Database
U.S.	United States
US	United States Highway
USACE	United States Army Corps of Engineers
U.S.C	United States Code
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USNPS	United States National Park Service
WOTUS	Waters of the United States

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1.0 DESCRIPTION OF THE PROPOSED PROJECT

1.1 SCOPE OF THE PROJECT

CenterPoint Energy proposes to construct a new double-circuit 138 kilovolt (kV) transmission line south of the City of Mont Belvieu and located between Cedar Bayou and the Grand Parkway in Chambers County, Texas. See **Figure 1-1** for a map of the project vicinity. The proposed new transmission line will provide a connection from the transmission grid to a proposed CenterPoint Energy owned distribution substation identified as Kilgore Substation. The new transmission line will originate from one of the existing transmission circuits located in the existing east-west transmission corridor that crosses SH 146, approximately one half mile north of IH 10, to one of two potential Kilgore Substation sites located in the vicinity of Kilgore Parkway. The first potential site for the proposed Kilgore Substation is within a tract of land located immediately northeast of the intersection of Kilgore Parkway and Needlepoint Road (29.808599, -94.868389 NAD83), while the second potential site is located within a tract of land north of Kilgore Parkway and approximately 3,600 feet west of the first potential site (29.806782, -94.880784 NAD 83).

CenterPoint Energy retained Halff to prepare this EA and Alternative Route Analysis to support the application for a 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 proposed alternative routes. This document provides information in compliance with the requirements of Section 37.056(c)(4)(A)-(D) of PURA, the PUCT CCN application form, and 16 Texas Administrative Code (TAC) Section (§) 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 Halff with the evaluation of the Project, CenterPoint Energy provided Halff with the project endpoints, information regarding the need for the project, and CenterPoint Energy's construction practices and right-of-way (ROW) requirements. CenterPoint Energy also provided information regarding engineering and design requirements, in addition to estimated cost information associated with the proposed alternative routes.

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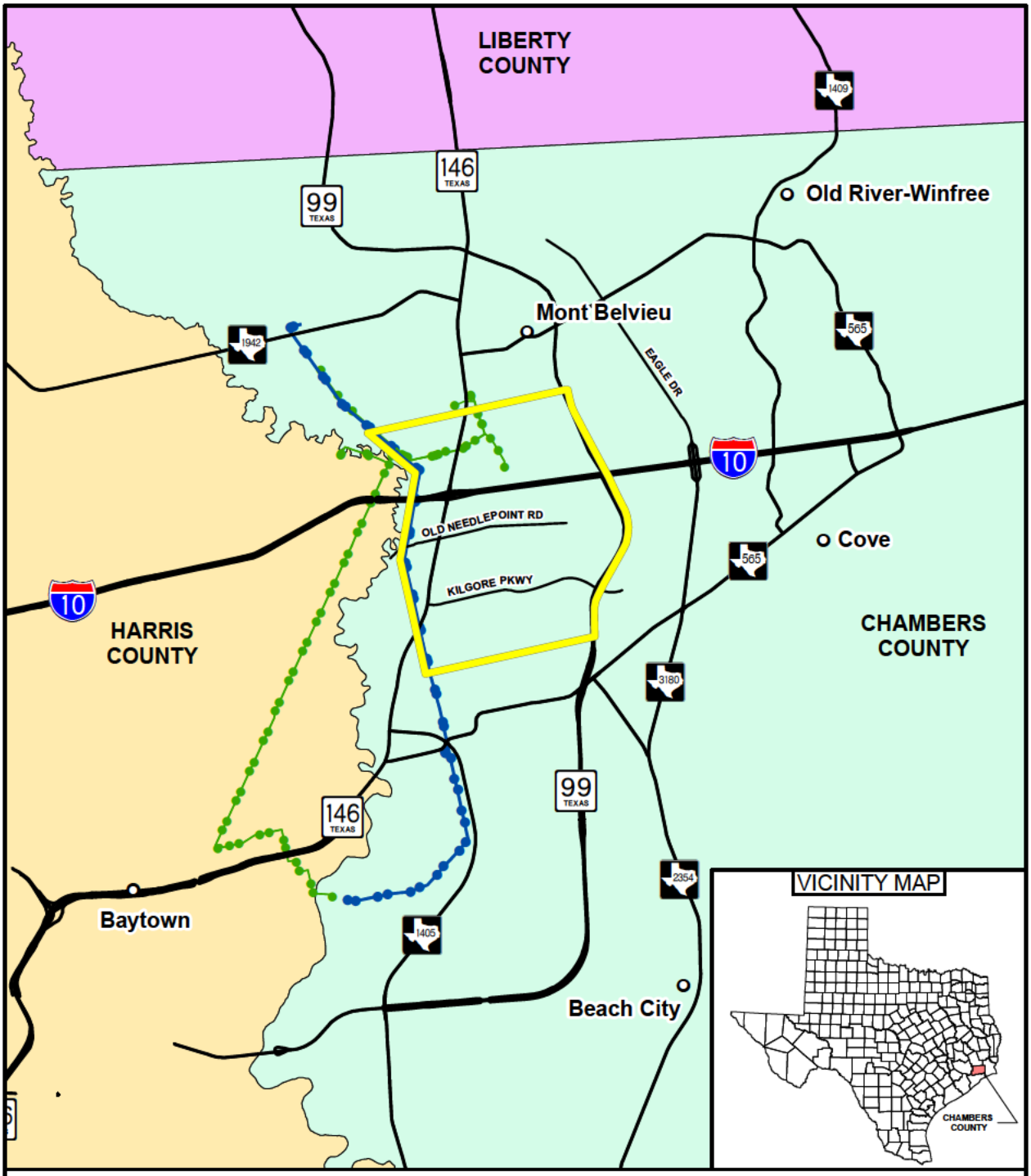

FIGURE 1-1. PROJECT LOCATION MAP
KILGORE SUBSTATION
138 kV TRANSMISSION LINE PROJECT

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

- 16 TAC § 25.101(b)(3)(B);
- 16 TAC § 22.52(a);
- Policy of prudent avoidance; and
- Certificate of Convenience and Necessity (CCN) application requirements.

This environmental assessment (EA) has been prepared by Halff in support of CenterPoint Energy's CCN application for this project to be filed at the PUCT for its consideration.

1.2.2 U.S. 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 (RHA) of 1899 (33 United States Code [U.S.C.] § 403) and Section 404 of the Clean Water Act (Section 404) (33 U.S.C. § 1344). Under Section 10 of the RHA, the USACE regulates all work or structures in or affecting the course, condition, or capacity of navigable waters of the United States (WOTUS). The intent of this law is to protect the navigable capacity of waters important to interstate commerce. Under Section 404, the USACE regulates the discharge of dredge and fill material into WOTUS, 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 WOTUS and aquatic ecosystems.

The project is located within the Galveston District of the USACE. Although the USACE-Galveston District does not publish a list of designated Section 10 (navigable) surface waters, based on Halff's permitting experience with the USACE-Galveston District, Cedar Point Lateral is

the only feature that could be considered a Section 10 surface water. The official designation of Cedar Point Lateral, if necessary, will rest with the USACE-Galveston District, who has the final authority on jurisdictional status for aquatic features within the study area. A review of the National Wetland Inventory (NWI) maps indicated numerous emergent, scrub/shrub, forested/shrub wetlands, freshwater ponds, lakes, and rivers, which may be considered jurisdictional by the USACE, occur throughout the study area.

Upon PUCT approval of a route, additional coordination, jurisdictional wetland verifications, and permitting with the USACE-Galveston District for a Section 404 permit may be required if the approved route is to be constructed within potential jurisdictional areas. If the facilities are constructed within jurisdictional areas, the construction of the proposed project may meet the conditions of Nationwide Permit (NWP) No. 57 – Electric Utility Line and Telecommunications Activities. NWP 57 authorizes activities for the construction, repair and removal of utility lines and associated facilities (i.e., substations, foundations, and access roads) in WOTUS, provided the general and regional conditions of the permit are met.

1.2.3 U.S. 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 Policy Act (NEPA), 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). Halff reviewed the USFWS listed species for Chambers County. 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) may occur within the study area. Although no longer protected under the ESA, bald eagles are still afforded protection by the BGEPA and MBTA. Upon PUCT approval of a route, CenterPoint Environmental will assess the need for bald eagle nest surveys.

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 14 CFR Part 77.9 (d) 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 14 CFR Part 77.9 (d) 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 14 CFR Part 77.9 (d).

14 CFR Part 77.9 (d) 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 United States (U.S.) Department of Defense (DoD), or an airport or heliport with at least one FAA-approved instrument approach procedure.

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

If any of the FAA notification criteria are met for the route approved for construction, 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 Military Aviation and Installation Assurance Siting Clearinghouse

The U.S. DoD Military Aviation and Installation Assurance Siting Clearinghouse (previously the U.S. 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. Title 16 TAC § 22.52 states that upon filing of the application, the DoD shall be notified and an affidavit attesting to the notification shall

also be provided with the application. The DoD shall also be provided written notice of the public meeting. 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 Texas Parks and Wildlife Department (TPWD) is the state agency with the primary responsibility of protecting the state's fish and wildlife resources in accordance with the TPWD Code Section 12.0011(b), 64.003, 68.015 and 1.011. Halff 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 PUCT. Halff also reviewed the Texas Natural Diversity Database (TXNDD) records of state-listed species occurrences and rare vegetation communities. Halff considered these during the route development process. Once the PUCT approves a route, CenterPoint Energy will complete a field review of the proposed ROW to determine potential impacts to any state-listed species prior to construction. Based on these results, additional coordination with TPWD may be necessary to determine avoidance measures to state-listed threatened or endangered species, and other state regulated fish and wildlife resources.

1.2.7 Floodplain Management

Flood Insurance Rate Maps (FIRM), published by the Federal Emergency Management Agency (FEMA), were reviewed to determine floodplain boundaries within the study area (FEMA, 2022). The mapped 100-year floodplains are associated with the larger creeks and streams or rivers within the study area. The 100-year floodplain represents a flood event that has a one percent chance of being equaled or exceeded for any given year. Construction of the proposed transmission line is not anticipated to create any significant changes in the existing topographical grades and is not anticipated to significantly alter existing flow regimes within the floodplain. Coordination with the Chambers County floodplain administrator will be completed after the PUCT route approval to determine if any permits are necessary.

1.2.8 Texas Commission on Environmental Quality

The Texas Commission on Environmental Quality (TCEQ) is the state agency with the primary responsibility for protecting the state's water quality. The construction of the project may require a Texas Pollution Discharge Elimination System General Construction Permit (TXR150000) as implemented by the TCEQ under the provisions of Section 402 of the Clean Water Act (CWA) and Chapter 26 of the Texas Water Code. Construction activities will be compliant with the

general construction permit conditions. Best Management Practices (BMPs) will be used, as required, to minimize erosion and sedimentation resulting from the construction.

1.2.9 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 (13 TAC § 2.26 (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. Halff contacted the THC to identify known cultural resources within the study area boundary. Halff 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 the Texas Historical Sites Atlas 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 PUCT, depending on a state or federal nexus, additional coordination with the THC will occur, if required, to determine the need for cultural resource surveys or additional permitting requirements. 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 for additional consultation.

1.2.10 Texas Department of Transportation

The Texas Department of Transportation (TxDOT) has been notified of the Project. If the route approved by the PUCT crosses TxDOT roadways, the Project will be constructed in accordance with the rules, regulations, policies, and expansion plans of TxDOT. 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.

1.2.11 Texas General Land Office

The Texas General Land Office (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 PUCT route approval, additional coordination with the Texas GLO may be required to determine the need for any MEs.

The Texas GLO administers the Texas Coastal Management Program (CMP) which intends to help ensure the environmental and economic well-being of the Texas coast within the CMP boundary through proper management of coastal natural resource areas. The CMP boundary, as defined by 31 TAC § 503.1, delineates the coastal zone of Texas. The Texas CMP has federal and state project and permit action review processes to evaluate consistency with the program. The Project is located within the coastal management zone (CMZ; GLO, 2022a; 2022b).

1.3 DESCRIPTION OF PROPOSED DESIGN AND CONSTRUCTION

1.3.1 Structure Design

CenterPoint Energy proposes to predominantly use 138 kV double-circuit steel lattice towers in a vertical configuration in an 80-foot-wide ROW for all of the proposed alternative routes (**Figure 1-2**). Depending on the terrain and other considerations, such as existing CNP structure designs and the length of span between structures and clearance requirements needed to cross waterways, wetlands areas, FAA determinations or utility and roadway crossings, CenterPoint Energy may require wider ROW widths and alternative structure types, such as tubular steel poles or concrete poles in a vertical configuration in a 80-foot wide ROW and flat-tap steel structure in a horizontal configuration in a 180-foot wide ROW to approach and dip under existing transmission lines (**Figures 1-3 and 1-5**). In the event where a structure is needed to terminate a fiber cable inside the substation, a concrete pole would be considered. The exact location or extent of the different ROW widths or the use of different structure types cannot be determined until a route is approved, surveys are conducted, and more detailed engineering designs are completed.

Construction of steel lattice towers will require drilled pier foundations made of steel-reinforced concrete. The span length between steel lattice towers will be approximately 600 to 800 feet. Typical lattice tower height in a vertical configuration will have a height range of approximately 90 to 140 feet depending on terrain and required National Electrical Safety Code (NESC) clearances (**Figure 1-2**).

Construction of tubular steel poles will require drilled shaft foundations made of steel-reinforced concrete. Typical tubular steel poles in a vertical configuration will have a height range of approximately 60 to 190 feet tall depending on the terrain and required NESC clearances and have a span length between 600 and 800 feet (**Figure 1-5**).

Construction of concrete poles will not require a drilled shaft foundation and instead would be direct embedded. Typical concrete poles in a vertical configuration will have a height range of approximately 90 to 120 feet tall depending on the terrain and required NESC clearances and have a span length between 250 and 350 feet (**Figure 1-3**).

Construction of flat-tap steel structures would be considered when crossing under existing transmission lines. Construction of flat-tap steel structures will require drilled shaft foundations made of steel reinforced concrete. Typical flat-tap steel structures in a horizontal configuration will have a height range of approximately 35 to 55 feet tall depending on the terrain and required NESC clearances and have a span length between 150 and 400 feet (**Figure 1-4**).

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

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 PUCT approves a route.

1.3.3 Clearing

All brush and undergrowth within the ROW will be removed and maintained. Mechanized cutters and hand tools will be used to remove vegetation to ground level. For areas requiring hand-clearing, vegetation will be cut level with the ground. No stump exceeding 2 inches above the ground will remain. Any tree located in a fence line having a diameter greater than 4 inches will be cut even with the top of the fence. Stumps located on hillsides or uneven ground will be cut where a mowing machine can pass over the ROW without striking any stumps, roots, or snags. If a Storm Water Pollution Prevention Plan (SWPPP) is required, it will be implemented along the approved route prior to the start of clearing.

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 several weeks before the steel lattice towers, flat-tap steel structures,

and tubular steel poles are erected to allow the foundations to cure and reach their maximum strength. Concrete poles will be delivered to the site location shortly before the poles are ready to be set. A large crane would then set the concrete pole directly into an excavated hole. The hole will be backfilled with crushed limestone. The steel lattice towers will be delivered in bundles and set next to the proposed structure location shortly before structure erection. The steel lattice towers will be assembled on-site, and a crane will be used to set the sections into place 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 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 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. Grade will be restored to pre-construction contours following the completion of construction.

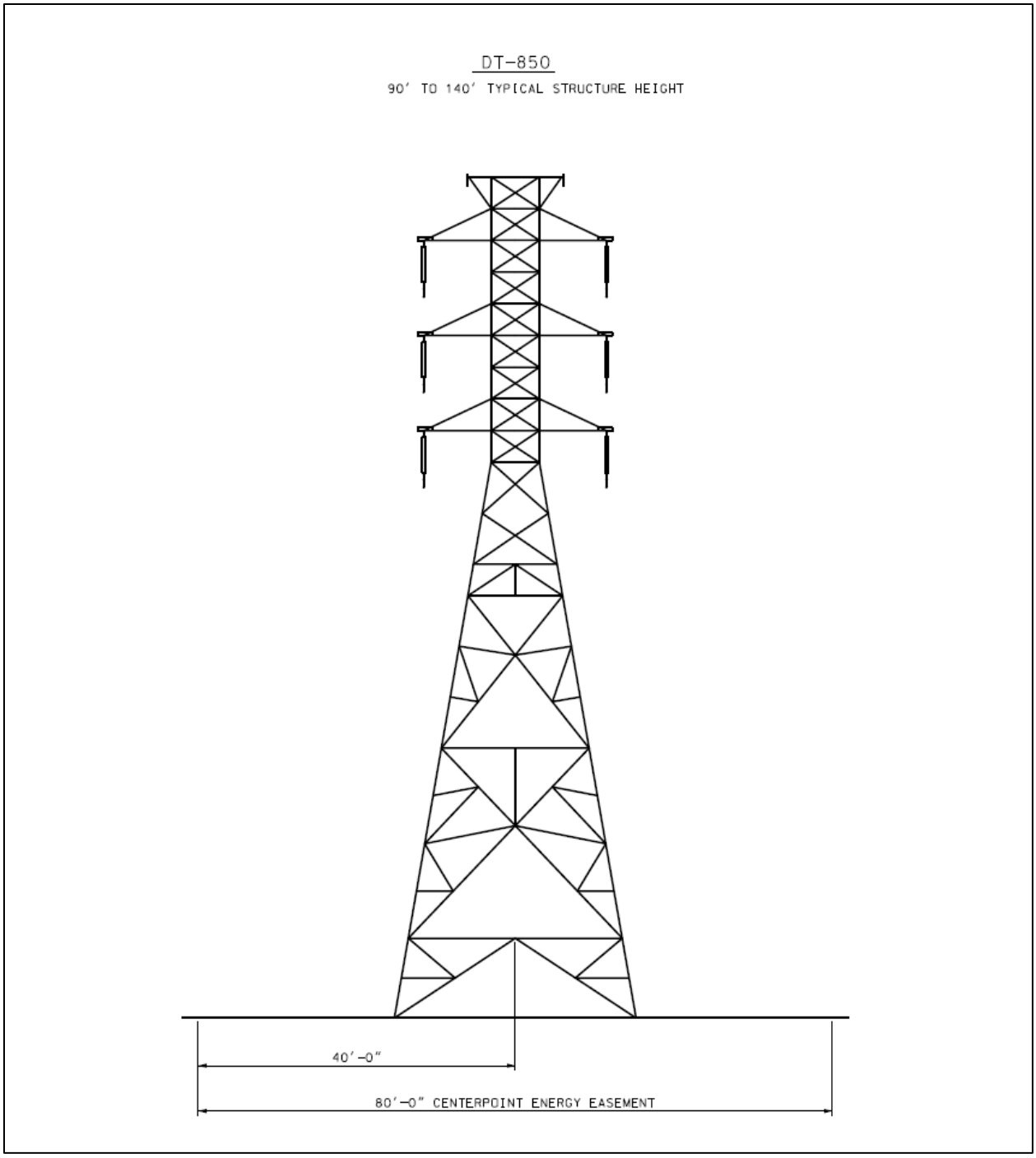

Figure 1-2. 138 kV DT-850

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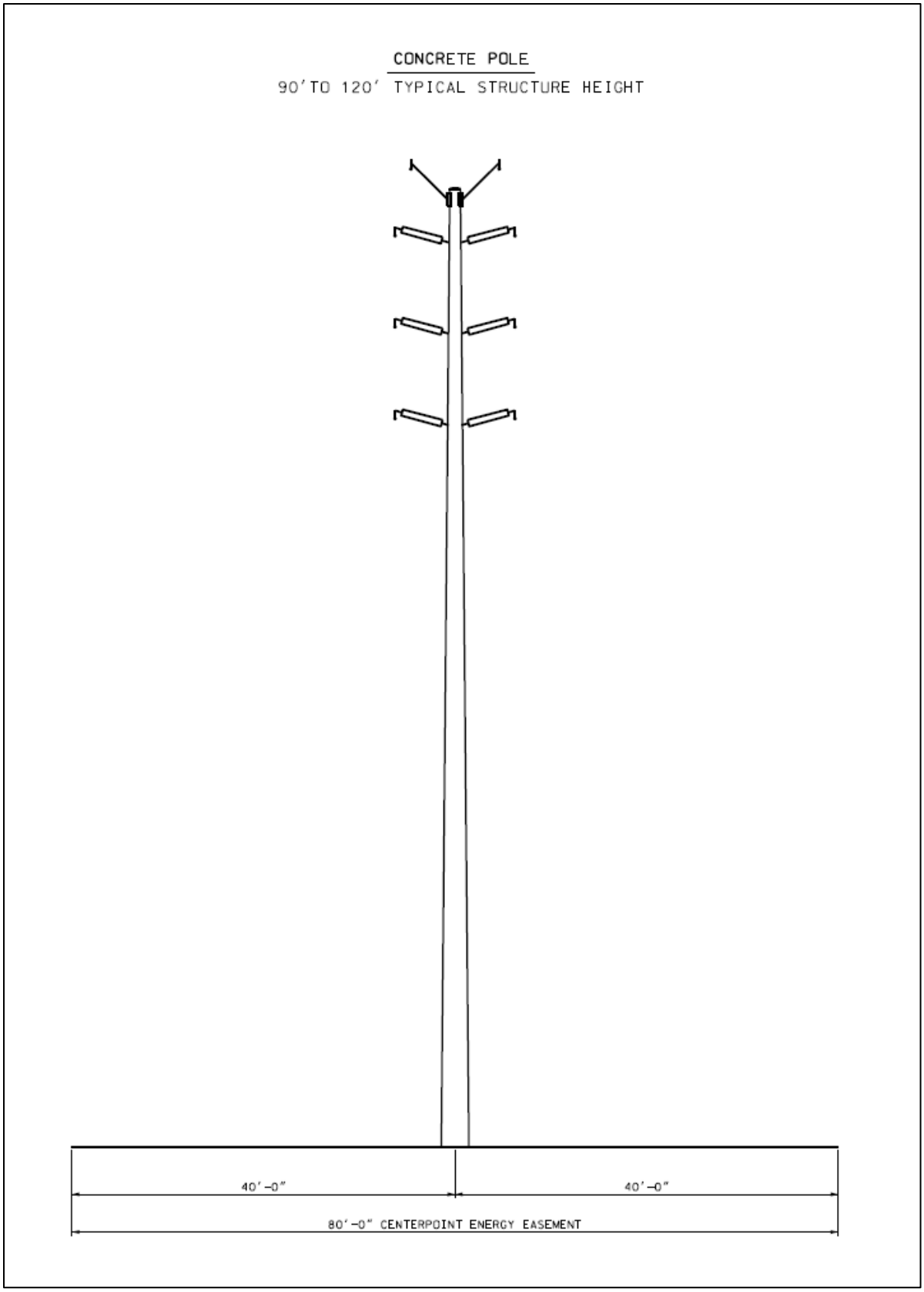

Figure 1-3. 138 kV Concrete Pole

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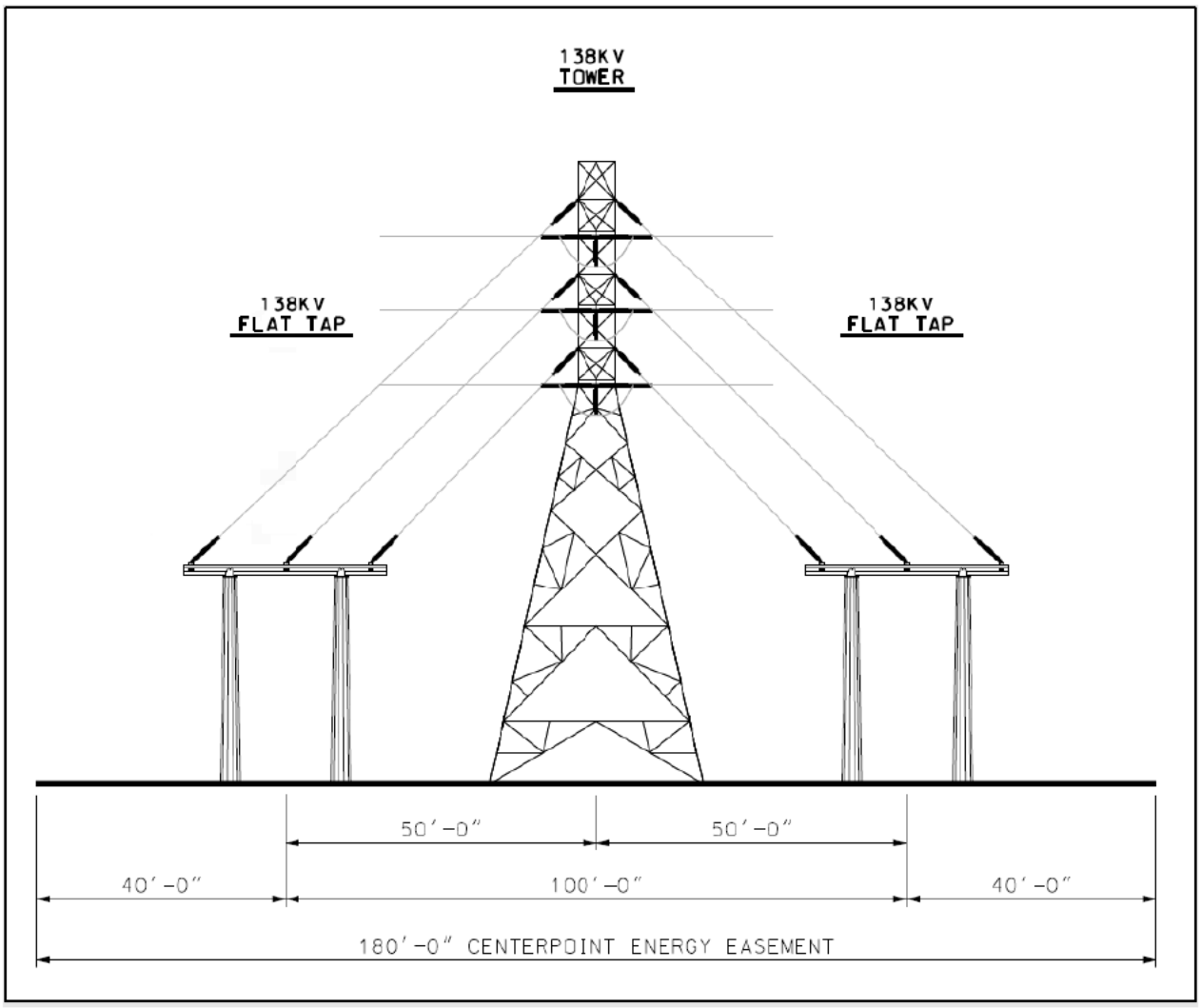

Figure 1-4. 138 kV Flat Tap and RM90 ISO

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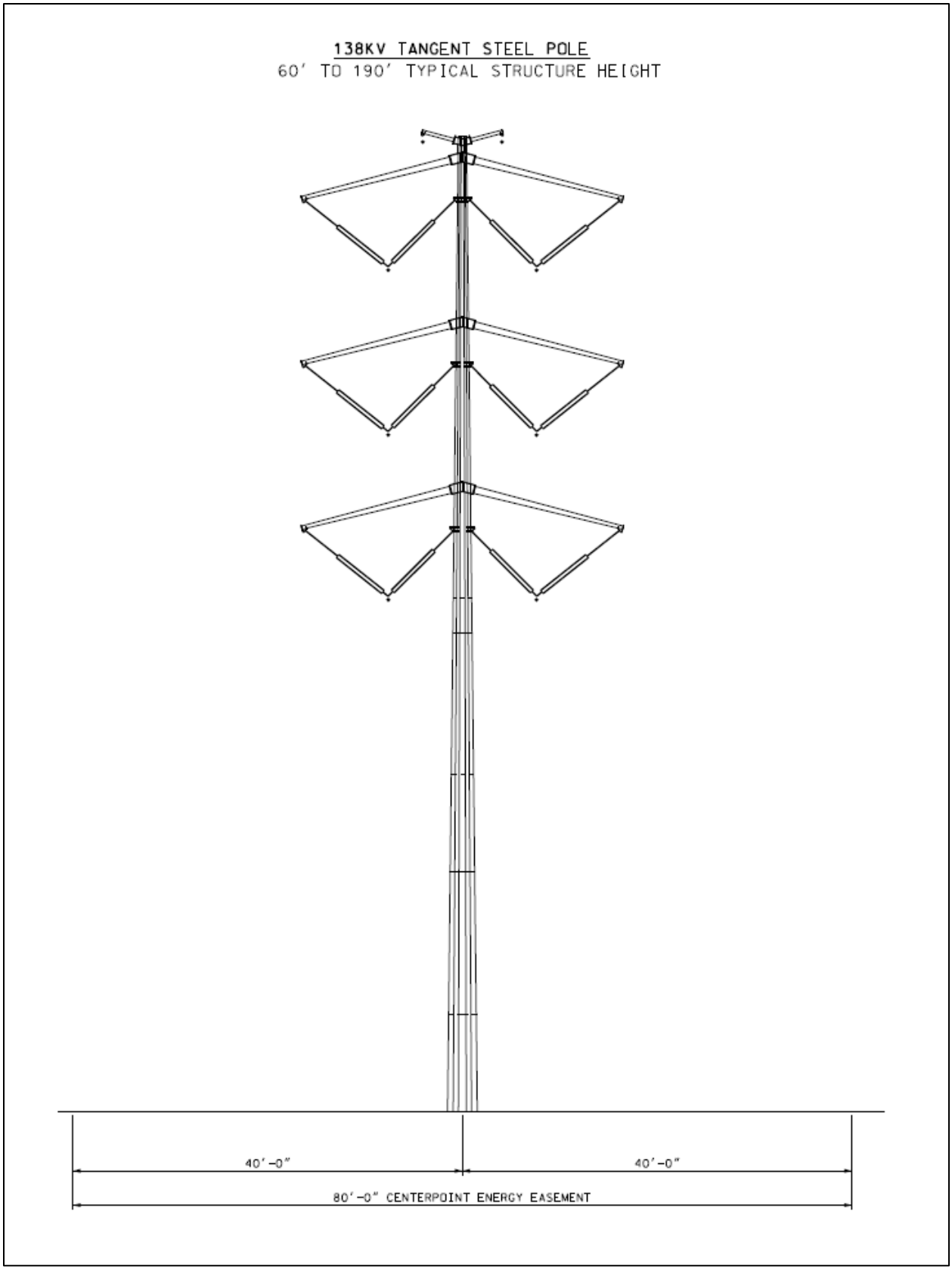

Figure 1-5. 138 kV Tangent Steel Pole

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2.0 DESCRIPTION OF THE STUDY AREA

Halff identified the study area boundary, considering the planned Kilgore Substation endpoints and origin points. 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 and to minimize potential land use conflicts within the study area. The western boundary of the study area is defined by an existing 345 kV transmission line which is paralleled for a portion of this boundary and is adjacent to the Chambers and Harris County line. The eastern boundary of the study area is defined by SH 99; a portion of this boundary parallels the western side of SH 99. The northern study area boundary is located north of IH 10 in the City of Mont Belvieu. The southern study area boundary is located south of Kilgore Parkway. To describe the environmental setting of the study area, land use and environmental resource data was collected for community values and environmental integrity.

2.1 COMMUNITY VALUES

The term “community values” is included for the consideration of transmission line certification under Section 37.056(c)(4) of the Texas Utilities Code. The PUCT CCN application requires an assessment of values and resources important to the local community. At times, community values and resources could include the following:

- habitable structure locations;
- AM, FM, microwave, and other electronic installations in the study area;
- FAA-registered airstrips, private airstrips, and heliports located in the study area;
- irrigated pasture or croplands utilizing center-pivot or other traveling irrigation systems;
- approvals or permits required from other governmental agencies;
- brief description of the area traversed; and
- comments received from community leaders and members of the public.

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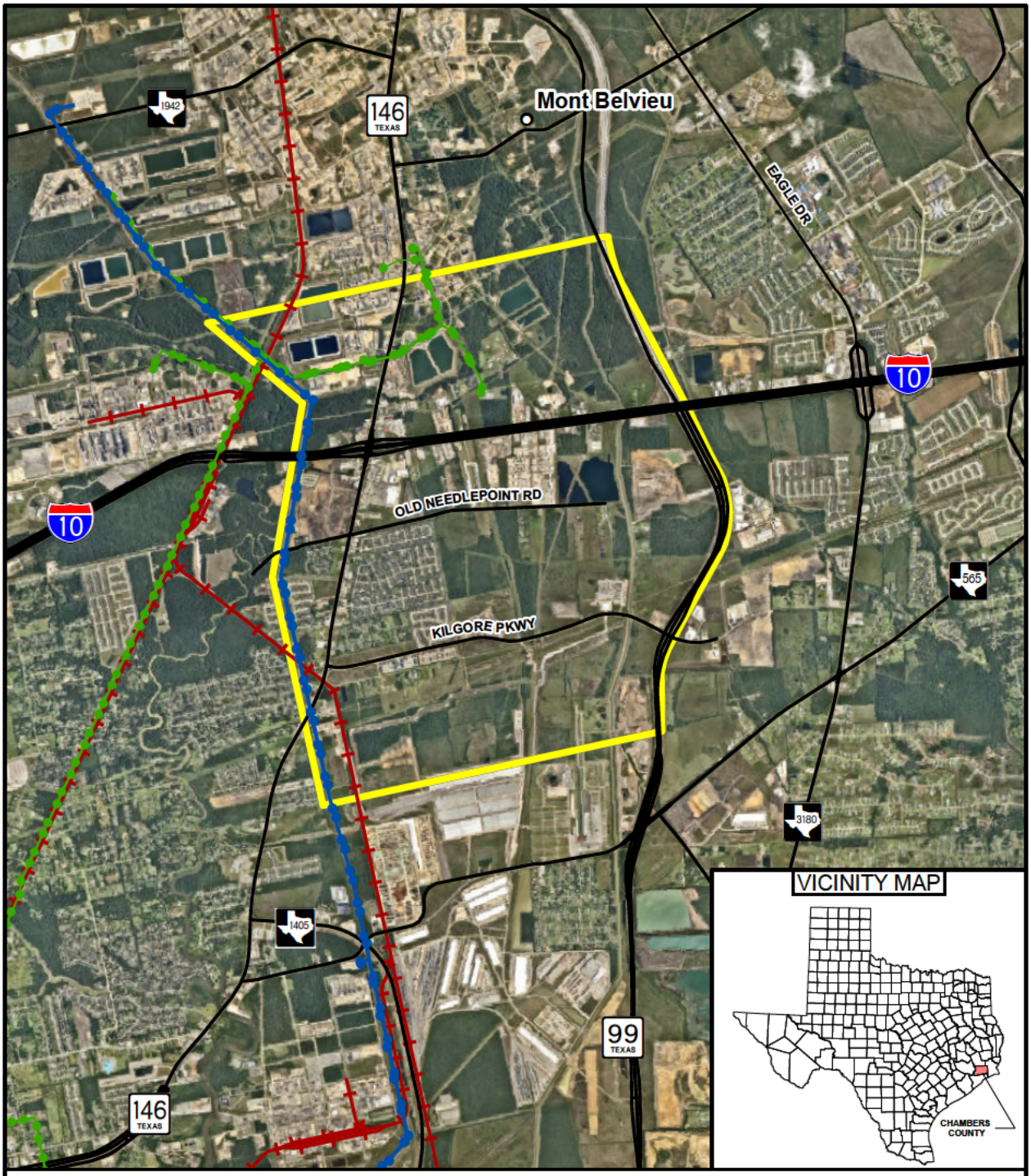

FIGURE 2-1. PROJECT AREA MAP
KILGORE SUBSTATION
138 kV TRANSMISSION LINE PROJECT

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In addition to the above-listed items, Halff evaluated the proposed project for community resources that may not be listed by the PUCT, but that may also be important to particular communities as a whole. Halff defines the term "community resources" to be areas or other natural resources recognized by a national, regional, or local community. Examples of community resources would be parks, recreation areas, historical or archeological sites, or a scenic vista. As discussed in **Section 2.2.1**, Halff mailed consultation letters to elected and appointed officials within the study area and collected information regarding community values and community resources. The above-listed values and resources important to the local community are discussed in the appropriate sections of this document.

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 138 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 geographic information system (GIS) metadata (NearMap, 2023).

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 study area is located in Chambers County, Texas. The City of Mont Belvieu and the City of Baytown are incorporated cities with boundaries extending into the study area. Portions of the study area consists of undeveloped land (e.g., agriculture/pastureland).

Schools

The study area is located within both the Barbers Hill Independent School District (ISD) and Goose Creek Consolidated ISD. No schools were identified within the study area.

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. Cities and counties typically prepare comprehensive land use plans to provide strategic direction for an individual city or county. The website of Chambers County was reviewed, and correspondence was submitted to county officials to identify any planned land use conflicts. No comprehensive land use plans were identified within the study area. Following the review of available county land use plans, the websites for City of Mont Belvieu and City of Baytown were reviewed for future land use planning within the study area.

The City of Mont Belvieu, which occupies areas north of IH 10 within the study area, has classified the zoning districts within the study area as mixed use, freeway commercial, rural, and suburban residential. The area zoned as suburban residential, from review of recent aerial imagery, has been developed for industrial use which contradicts the future land use plan. The majority of land within the study area is zoned as either freeway commercial or mixed use.

The City of Baytown, which occupies areas south of IH 10 within the study area, in their future land use plan shows that the majority of the study area is zoned for industrial or large-scale commercial, with areas located between Old Needlepoint Road and Kilgore Parkway zoned for low density residential.

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 specified terms and conditions. No conservation easements were identified to exist within the study area.

2.1.1.3 Agriculture

Agriculture in the region is represented primarily as ranchland and pastureland, as indicated by representative agricultural statistics from the United States Department of Agriculture (USDA) 2019 Census of Agriculture (USDA, 2019) shown in **Table 2-1**. The 2019 Census of Agriculture

identified cattle as the primary livestock and rice as the primary crop in Chambers County. In terms of statewide significance, Chambers County ranks significant on grain sales relative to other Texas counties. Chambers County livestock inventory does not rank substantially among other Texas counties for these categories.

Table 2-1. Agricultural Statistics for Chambers County

STATISTICAL CATEGORY	CHAMBERS COUNTY
Market Value of Products Sold (in $ millions)	
Crop Sales	$11.1M
Livestock Sales	$8.2M
TOTAL SALES	$19.3M
Top Crop Types and Livestock Inventory	
1st Crop Type and Acreage	Rice - 17,898 acres
2nd Crop Type and Acreage	Forage (hay/haylage) - 13,129 acres
3rd Crop Type and Acreage	Soybeans for beans - 600 acres
4th Crop Type and Acreage	Wheat for grain - 300 acres
1st Livestock Type and Number of Animals	Cattle and calves - 23,700
2nd Livestock Type and Number of Animals	Layers - 1,273
3rd Livestock Type and Number of Animals	Horses and ponies - 833
4th Livestock Type and Number of Animals	Goats - 559
SOURCE: USDA, 2019.	

2.1.1.4 Oil and Gas Facilities

Oil and natural gas production are prominent in Chambers County. There are approximately 16,000 well records in Chambers County, of which approximately 250 are within the study area. There are approximately 150 large pipelines (diameters greater than 8 inches) and approximately 70 small pipelines (diameters less than 8 inches) within the study area (Railroad Commission of Texas [RRC], 2022a).

2.1.1.5 Transportation/Aviation/Utility Features

An extensive network of Interstate Highways (IH), State Highways (SH), Farm-to-Market Roads (FM), County Roads (CR), and public/private residential roads facilitate transportation throughout the study area (TxDOT, 2022a). Federal and state highways and relevant CR include the following:

- IH 10 – located in the northern half, bisecting the study area generally in an easterly to westerly direction, and extends between the City of Cove (east of the study area), the City of Mont Belvieu, and the City of Baytown.
- SH 146 – located in the western half of the study area, bisecting in a generally northerly to southerly direction, and extends between the City of Mont Belvieu and the City of Baytown.
- SH 99 – located along the eastern boundary of the study area, traversing generally in a northerly to southerly direction. SH 99 extends between the City of Mont Belvieu and the City of Beach City (south of the study area).
- CR 506 – also known as Old Needlepoint Road, located in the middle of the study area in a generally easterly to westerly direction that originates within the study area west of Cedar Point Lateral and proceeds westerly beyond SH 146 towards the City of Baytown.
- CR 561 – also known as Kilgore Parkway, located in the southern half of the study area, originating at a junction with SH 146 and proceeds easterly beyond SH 99.

The Union Pacific Railroad crosses the northwestern and southwestern corners of the study area extending between the City of Mont Belvieu and the City of Baytown (RRC, 2022a).

A review of the FAA Southwest Region Airport Directory (FAA, 2022), TxDOT Airport Directory (TxDOT, 2022b), AirNav (2022), and USGS topographic maps (USGS, 1961-1977) identified six aircraft facilities within 20,000 feet of the study area, one of which is within the study area. **Table 2-2** lists aircraft facilities either within or near the study area. The following summarizes the types of aircraft facilities described in **Table 2-2**:

- FAA registered airports with a runway greater than 3,200 feet: four airports located outside of the study area (two public and two private);
- FAA registered airports with a runway less than 3,200 feet: none;
- Non-registered aircraft landing strips with all runways less than 3,200 feet: none; and
- FAA registered heliports: two heliports, one within the study area and one outside of the study area (private).

Table 2-2. Aircraft Landing Facilities in or Near the Study Area

FACILITY NAME[1]	FAA ID[2]	FACILITY USE	COUNTY	RELATIVE LOCATION
FAA Registered Airport with Runway Greater than 3,200 Feet				
RWJ Airpark	54T	Public	Chambers	Southeast of the study area in Beach City to the west of Dutton Lake.
Baytown	HPY	Public	Harris	West of the study area in the City of Baytown.
Ferris	25TA	Private	Harris	Northwest of the study area in the City of Baytown.
Slack	4TX0	Private	Chambers	Northeast of the study area in the City of Mont Belvieu.
FAA Registered Airport with Runway Less than 3,200 Feet				
--	--	--	--	--
Non-Registered Landing Strip				
--	--	--	--	--
Heliports				
Chevron Chemical Company	TA98	Private	Harris	West of the study area in the City of Baytown on the north side of IH 10.
Patients Emergency Room	TX73	Private	Chambers	Within the study area, near the southwestern boundary of the City of Mont Belvieu on the north side of IH 10.

SOURCES: AirNav, 2022; FAA, 2022; TxDOT, 2022b; USGS, 1961-1977
NOTES:
1. Aircraft support facilities are grouped by type of facility, whether the facility is registered with the FAA and length of runway. Aircraft facilities are within 20,000 feet of the study area.
2. Identification code assigned to facilities registered with the FAA.

2.1.1.6 Communication Towers

Several communication towers were located within the study area. Communication towers may include a mix of cellular phone communications, microwave towers, and other similar electronic installations located throughout the study area. No AM or FM radio transmitters were identified within the study area. No AM radio transmitters were located within 10,000 feet of the study area. No FM radio transmitters were located within 2,000 feet of the study area. There are two cellular and 13 microwave installations on six communication towers located within the study area (Federal Communications Commission [FCC], 2018; 2021a; 2021b; 2021c).

2.1.2 Socioeconomics

The following is a description of the socioeconomic patterns in population and employment in Chambers County, Texas. The trend analysis is based upon the most recent United States Census Bureau (USCB) information for the years 2010 and 2020, in addition to 2018 Texas Demographic Center (TDC) population projections.

2.1.2.1 Population Trends

The population in Chambers County increased by approximately 33.2 percent between 2010 and 2020. By comparison, the population in state of Texas increased by approximately 15.9 percent between 2010 and 2020 (USCB, 2010a; 2010b; 2020a; 2020b).

According to TDC, the population in Chambers County is projected to increase by approximately 24.3 percent (2020 to 2030), 21.8 percent (2030 to (2040), and 20.9 percent (2040 to 2050). The TDC over predicted a population of 42,320 individuals within Chambers County in 2020, which was 4,431 individuals fewer than the recorded total population represented in the 2020 U.S. Census. By comparison, the population in the state of Texas is projected to increase by approximately 17.6 percent, 16.6 percent, and 16.4 percent, respectively, during the same periods. The TDC over predicted a population of 29,677,668 individuals within the state of Texas in 2020, which was 532,163 individuals more than the total population recorded in the 2020 U.S. Census (TDC, 2018; USCB, 2020a; 2020b). **Table 2-3** presents the past population trends and projections for Chambers County and for the state of Texas for the years 2010, 2020, 2030, 2040, and 2050.

Table 2-3. Population Trends

STATE / COUNTY	PAST		PROJECTED		
	2010	2020	2030	2040	2050
Texas	25,145,561	29,145,505	34,894,452	40,686,496	47,342,105
Chambers County	35,096	46,751	52,605	64,091	77,491
SOURCES: TDC, 2018; USCB, 2010a; 2010b; USCB, 2020a; USCB, 2020b.					

2.1.2.2 Employment

Between 2010 to 2020, the civilian labor force in Chambers County increased by approximately 34.6 percent (i.e., approximately 5,475 individuals). By comparison, the civilian labor force in the state of Texas increased by 18.8 percent (i.e., approximately 2,251,395 individuals) during the same period (USCB, 2010a; 2010b; 2020a; 2020b). **Table 2-4** presents the civilian labor force for Chambers County and the state of Texas for the years 2010 and 2020.

Between 2010 and 2020, the unemployment rate for Chambers County increased from 6.2 percent to 7.1 percent. By comparison, the unemployment rate for the state of Texas decreased from 7.0 percent to 5.3 percent during the same period (USCB, 2010a; 2010b; 2020a; 2020b). **Table 2-4** presents the employment and unemployment data for Chambers County and the state of Texas for the years 2010 and 2020.

Table 2-4. Civilian Labor Force and Employment

STATE/COUNTY	2010	2020
Texas		
Civilian Labor Force	11,962,847	14,214,242
Employed	11,125,616	13,461,358
Unemployed	837,231	752,884
Unemployment Rate	7.0%	5.3%
Chambers County		
Civilian Labor Force	15,815	21,341
Employed	14,842	19,786
Unemployed	973	1,504
Unemployment Rate	6.2%	7.1%
SOURCES: USCB, 2010a; 2010b; 2020a; 2020b.		

2.1.2.3 Leading Economic Sectors

In 2020, the occupation categories that employed the most people in Chambers County were management, business, science, and arts, followed by sales and office (USCB, 2020a; 2020b). **Table 2-5** presents the number of persons employed in each occupation category in Chambers County for the year 2020.

Table 2-5. Occupations in Chambers County

OCCUPATION	CHAMBERS COUNTY
Management, business, science, and arts	8,199
Service	2,034
Sales and office	3,810
Natural resources, construction, and maintenance	2,150
Production, transportation, and material moving	3,593
SOURCES: USCB, 2020a; 2020b.	

In 2010 and 2020, the industries that employed the most people in Chambers County were manufacturing, educational services, and construction (USCB, 2010a; 2010b; 2020a; 2020b). **Table 2-6** presents the number of persons employed in each industry in Chambers County for the years 2010 and 2020.

Table 2-6. Industries in Chambers County

INDUSTRY GROUP	CHAMBERS COUNTY	
	2010	2020
Agriculture, forestry, fishing and hunting, and mining	613	500
Construction	2,149	2,299
Manufacturing	2,655	3,788
Wholesale trade	549	783
Retail trade	990	1,884
Transportation, warehousing, and utilities	1,010	1,591
Information	219	135
Finance, insurance, real estate, rental, and leasing	515	1,148
Professional, scientific, management and administrative, and waste management services	1,264	1,462
Educational services, health care, and social assistance	2,990	3,498
Arts, entertainment, recreation, accommodation, and food services	545	1,528
Other services, except public administration	563	631
Public administration	780	539
SOURCES: USCB, 2010a; 2010b; 2020a; 2020b.		

2.2 RECREATIONAL AND PARK AREAS

2.2.1 National, State, County, and Local Parks

A review of federal, state, and local websites and maps, in addition to a field reconnaissance survey on August 1, 2022, identified no conservation easements or wildlife management associations in the study area (National Conservation Easement Database [NCED], 2022). Correspondence with the Natural Resources Conservation Service (NRCS) did not identify any USDA-NRCS conservation easements (see **Appendix A**). No national parks, wild and scenic rivers, national battlefields, or national historic sites open to the public are located within the study area (USNPS, 2022a; 2022b; 2022c). There are no TPWD parks or public hunting units located within the study area (TPWD, 2022a; 2022b). McLeod Park is the only county park identified in the study area and is located north of IH 10. McLeod Park is owned and operated by Chambers County.

2.2.2 Wildlife Viewing Trails

A review of the TPWD Great Texas Wildlife Trails Upper Texas Coast - Great Texas Coastal Birding Trail indicated that no trails were within the study area (TPWD, 2022c).

2.3 HISTORICAL AND AESTHETIC VALUES

2.3.1 Cultural Background

A records review of previously recorded archeological historic properties was conducted to determine the likelihood of impacts to cultural resources within the study area. The research was conducted using the THC TASA database, which contains published and unpublished data on prior cultural resources surveys, districts and properties listed in or eligible for the NRHP, SALs, OTHMs, cemeteries, and previously recorded archeological historic properties, including those listed in or eligible for listing in the NRHP or SAL designation (THC, 2022a).

2.3.2 Prehistoric

The cultural chronology of the Southeast Texas archeological region (Perttula, 2004) spans from when humans first spread throughout North America to the time of first contact with European explorers. Within this framework, and for the purpose of this project, six generalized time periods established for Southeast Texas by Ricklis (2004) and Story (1990) are synthesized to characterize the prehistoric cultural chronology of the region (**Table 2-7**).

Table 2-7. Southeast Texas Cultural Chronology

TIME PERIOD	YEARS B.P.[1]	YEARS B.C.[2] A.D.[3]
Late Historic	150 B.P. – present	A.D. 1800 – present
Early Historic	250 – 150 B.P.	A.D. 1700 – 1800
European Contact	450 – 250 B.P.	A.D. 1500 – 1700
Ceramic	1850 – 450 B.P.	100 BC – AD 1500
Archaic	8000 – 1850 B.P.	6050 – 100 BC
Paleoindian	pre – 8000 B.P.	pre – 6050 B.C.

NOTES:
1. B.P. – Before Present
2. B.C. – Before Christ
3. A.D. – *anno Domini* (after Christ)

2.3.2.1 Paleoindian Period

Although there is a growing body of evidence that challenges the previously held notions on the earliest human inhabitation of North America, the first undisputed evidence of an initial presence on the continent is the Paleoindian period, which dates from around 11,700-8000 B.P. (9750-6050 B.C.). The Paleoindian period is marked by the waning of the Pleistocene epoch approximately 11,700 years ago and is characterized by small nomadic bands who hunted now-extinct megafauna (e.g., mammoth, mastodon, bison, camel, and horse) using lanceolate-shaped

and fluted projectile points hafted to wooden spears thrown with atlatls. Paleoindian projectile point technologies include Clovis, Folsom, Dalton, Scottsbluff, Golondrina and Plainview. In addition to distinct projectile point types, Paleoindian hunter-gatherers produced a variety of other stone tools, including prismatic blades, flake tools, end scrapers and gravers. Although widely characterized as "big game hunters," Paleoindian hunters also relied on smaller game, such as deer, turtle, mice, raccoons, and frogs (Collins, 1995). The reliance on small game and plant foraging likely increased over time as the large megafauna died out due to the drier and warmer climate conditions of the Late Pleistocene and Early Holocene (Bousman, 2004).

Paleoindian site types in Texas include kill sites, quarries, caches, open campsites, burials or isolated surface artifacts and mixed assemblages (Collins, 1995; Hester, 1995). According to Fields and Tomka (1993), it is possible that the low artifact densities observed at Paleoindian sites may be attributed to the small population sizes and their large territorial ranges, which discouraged prolonged site occupation. In addition, the lack of a high density of Early Paleoindian artifacts could be due to the absence of high-quality lithic material in Southeast Texas. According to Story (1990), such materials are rare along the coast, except an outcrop of siliceous stone found on the Pisgah Ridge in Navarro County. A few exceptions include the Horn Shelter No. 2 (41BQ46) site near Waco and the McFaddin Beach site (41JF50) in Jefferson County, Texas. At 41BQ46, cultural materials including two Folsom points from excellent stratigraphic context and skeletal remains were recovered in contexts that date to the Paleoindian Period (Story, 1990). At 41JF50, over 166 artifacts had been recovered, including 14 Clovis points along the Gulf Coast shoreline, where the sea water level was lower during Paleoindian times (Ricklis, 2004).

The latter half of the Paleoindian period is distinguished from the preceding subperiod by the appearance of unfluted lanceolate dart points, including San Patrice, Scottsbluff, Plainview, and Angostura. These technological changes may have been in response to the gradual warming trend that began during the Late Pleistocene and continued until around 6050 B.P. Points from the Late Paleoindian period are just as uncommon across Southeastern Texas as those defining the earlier half of the period (Ricklis, 2004). Ricklis (2004) argues that since recovered points are often of high-grade lithic material, it can be concluded that there is a widespread movement of people and materials throughout the region and subsistence consisted of a mix of hunting and gathering.

2.3.2.2 Archaic Period

The Archaic period in Southeast Texas spans from 8000 to 1850 B.P. and is marked by the intensification of broad-spectrum foraging that developed during the Late Paleoindian period. Climate fluctuations resulting in periodic rises in sea level and variable resource availability also characterizes the period, which is divided into early, middle, and late subperiods correlating to these fluxes (Story, 1990). Additionally, more xeric climatic conditions facilitated the proliferation of desert plant species across Southeast Texas, which were intensively processed via earth oven cooking technology. These xeric conditions may have led to a decrease in population size during the Early Archaic (Aten, 1983; Patterson, 1996). In terms of tool technology, there is a shift to predominantly local lower-grade lithic materials, which in turn led to more expedient tool forms compared to the Paleoindian Period as Archaic tool technologies are more functionally varied with an increased number of styles tied to certain geographic areas (Story, 1990). The Archaic Period, especially the early Archaic, is poorly understood due to mixed assemblages. Due to the weak data, chronological interpretations of the period are based on projectile points, which are compared to points of other regions with well-established dates (Story, 1990).

Early Archaic

Like Paleoindian sites, few Early Archaic (circa 8000 to 6000 B.P.) sites have been found in well stratified or preserved contexts in Southeast Texas. This is especially true for coastal groups, where changes in sea levels have destroyed the context at sites like 41JF50 with exception to site 41WH19 located along the San Bernard River in Wharton County, Texas (Long, 1977; Story, 1990). However, radiocarbon dates from the site are unreliable due to their large standard deviations (Story, 1990). Lithic technologies of the Early Archaic were dominated by expanded-stem point types, including early side-notched Keithville, Neches River, and Trinity points, and the barbed Bell and Calf Creek points, unstemmed Tortugas and stemmed Wells points (Ricklis, 2004; Patterson, 1996). Patterson (1996) argues that the presence of Bell points found at site 41HR354 in Southeast Texas is indicative of "wide-ranging settlement or trade pattern(s)" for Native Americans utilizing this point type. It was likely that the that the Brazos River would have served as a natural trade route to disperse this Central Texas style throughout the Southeast (Patterson, 1996). Sites 41SP136, 41SPI53, 41NU266 and 41NU281 produced layers of oyster shell, which points to a subsistence on estuarine shellfish. Other faunal remains are absent along the coast during this period (Ricklis, 1995). The most common points of the period consist of Wells points, which have been found in association with Middle Archaic point types at Southeast Texas sites (Patterson, 1996). Two examples include site 41AU37, and the Owens site

(41HR315), where a Yarbrough and Wells point were found associated in the same stratum (Patterson, 1980).

Middle Archaic

The transition to the Middle Archaic subperiod (circa 6000 to 3450 B.P.) is marked by a decreased grinding of point basal edges, and an increased emphasis on thinner and smaller dart points, such as Yarbrough, Bulverde, Travis, and Pedernales (Ricklis, 2004; Patterson, 1996). The increasingly xeric climate may have influenced the broadening of Middle Archaic hunter-gatherers' subsistence patterns. One example is at site 41FB34, where a significant use of freshwater shellfish, in addition to a wide variety of animals were recovered in association with Pedernales points (Patterson and Hudgins, 1986). Another Middle Archaic shift was in the rise of cemeteries in the western part of Southeast Texas (Ricklis, 2004). The most notable cemetery site dating to the Middle Archaic is Ernest Witte (41AU36) (Ricklis, 2004). The extended burials classified as Group 1 were the earliest known example of orienting human skulls, which were oriented southeast. The few observed funerary goods included a Pedernales point and six long pointed bone objects (Story, 1990).

Late Archaic

By the Late Archaic in Southeast Texas (circa 3450 to 1850 B.P.), cemeteries become an essential part of the cultural tradition, populations increase and become less mobile with defined territories (Story, 1990; Ricklis, 2004). Patterson (1996) argues that multiple factors, such as a wetter and more productive climate, the migration of newcomers into the region, and the availability and adaption to a greater range of food resources are potentially responsible for an increasingly high population growth rate during the Late Archaic. Site 41AU36 Group 2 burials demonstrate the growing importance and increased sophistication of burials in the Late Archaic. The burials in Group 2 consisted of 145 individuals in 141 burials (often extended), half of which contained exotic burial goods, such as dart points, comer-tang knives, marine shell ornaments, ground stone gorgets, and boat stones (Story, 1990). In addition, the interred were extended, and facing northeast.

During the Late Archaic, there is growing evidence of violent deaths found at multiple sites (41AUT, 41AU36, 41FB42, 41WH14, and 41WH39) caused from projectile points, which may have resulted from inter or intra-group warfare (Patterson, 1996). Other major mortuary sites in the region include Rudy Haiduk (41KA23), Rodd Field (41NU29), and Blue Bayou (41VT94)

(Ricklis, 1999). Late Archaic point types include Kent, Gary, Ensor, and Godley (Ricklis, 2004) manufactured from local and poor-quality materials, which supports a lack of population movement during this subperiod (Ricklis, 2004). Stable carbon isotope analyses conducted on skeletal remains recovered from 41AU36 revealed a Late Archaic diet of deer, nuts, and C4 grasses (Huebner and Boutton, 1992; Patterson, 1996). Along the coastline, sites, such as 41GV53 and the Eagle's Ridge site (41CH252), indicate an intensive gathering of shellfish (i.e., oyster and *Rangia cuneata*) by 4500 B.P. Late Archaic sites along the coast demonstrate a predominance of shell middens as a response to the ecological changes potentially linked to rising sea levels (Ricklis, 2004).

2.3.2.3 Ceramic Period

The introduction of pottery to Southeast Texas marks the transition into the Early Ceramic Period (1850 to 1250 B.P.). It is generally accepted that ceramic technology came to Southeast Texas as the result of cultural diffusion from Louisiana and the Lower Mississippi Valley. The earliest pottery is found in the upper Texas coast, and consists of thick vessel walls, contorted, poorly wedged, and un-tempered paste characteristic of the Tchefuncte cast (Ricklis, 2004). Ceramics would not be introduced to inland Southeast Texas until much later. Goose Creek sandy paste pottery is the main ceramic type in the region and is utilized from the Early Ceramic through the Historic Period (Patterson, 1996). One rare subtype variety (Goose Creek Stamped) is temporally specific to the Early Ceramic Period (Aten, 1983; Patterson, 1996). In contrast to Tchefuncte cast, Goose Creek pottery was well-wedged, thin-walled, and composed of a homogenous sandy paste temper (Ricklis, 2004).

Due to a lack of lithic materials along the coast, smaller dart points (especially those made of bone) are common during the Early Ceramic Period (Patterson, 1996; Story, 1990). Populations continued the increasing trend from the Late Archaic for the same reasons, as well increased hunting efficiency from the early adoption of the bow and arrow (Patterson, 1996; Story, 1990). However, early adoption of the bow and arrow is not generally accepted, due to the mixed deposits of the source material (Ricklis, 2004). Another continuity between the Late Archaic and Early Ceramic Periods for coastal groups are settlement and subsistence patterns, which consisted mainly of brackish water clams (*Rangia* spp.) identified in shell middens along riverine estuaries and secondary bay margins (Ricklis, 2004).

The Late Ceramic Period in Southeast Texas (1250 to 450 B.P.) is marked by the transition towards small, expanded stem arrow point types, such as Alba, Catahoula, and Scallom points

(Ricklis, 2004; Patterson, 1996). According to Ricklis (2004) the Ceramic Period can be subdivided into an Early subperiod characterized by the introduction of the bow and Scallorn arrow points, and a Late subperiod, characterized by the Toyah Phase within the inland areas, and the Rockport phase along the coastal areas. Lithic technology during the Late subperiod consisted of Perdiz arrow points, blade-cores, thin bifacial knives, unifacial end scrapers, expanded base drills, and prismatic blades (Ricklis, 2004). These changes were likely spurned by environmental changes that brought bison back into the region, leading to technologies suited for procuring and processing bison (Ricklis, 2004; Story, 1990). The reliance on bison hunting is supported by lithics and bison faunal remains found at the White Oak Bayou site (41HR541), located in northwestern Harris County, Texas (McReynolds et al., 1988).

The Mitchell Ridge site (41GV66) located on Galveston Island serves as one of the best examples of Late Ceramic sites along the Gulf coast. The Early subperiod was represented at the site in both middens and a burial where two Scallorn points were associated with a semi flexed adolescent female (Ricklis, 2004). Mitchell Ridge differs from neighboring inland sites in that the faunal remains indicated a subsistence pattern of fish and deer instead of bison along with a scarcity of scrapers (Ricklis, 2004). Although Goose Creek pottery continued to be utilized, newer pottery forms, such as bone and grog tempered pottery were developed and utilized to make jars, bowls, and constricted neck ollas. In addition, the decorative horizontal bands present along the exterior rims of pottery are wider than their Early Ceramic predecessors (Ricklis, 2004).

Sites 41B02, 41GV5, 41HR80, and 41GV66 give an insight to coastal burial practices (Patterson, 1996). At the Harris County Boys' School site (41HR80), burials were complex, and consisted of semi flexed or flexed burials placed on side positions facing in a variety of directions (Patterson, 1996). An abundance of grave goods were documented at the site and included marine shell pendants and beads, bone dice, bird bone flutes, awls, fishhooks, projectile points, and a potential rattle. Burial sites are also present along the inland sites (41HR5, 41HR7, 41HR273, and 41WH19) but do not appear associated with mortuary tradition (Patterson 1996).

2.3.3 Post Contact

In 1519, Francisco de Garay, the Spanish governor of Jamaica, sent Alonso Álvarez de Pineda on an exploratory expedition to the Gulf Coast (Chipman, 1992). Though none of the crew set foot on Texas soil, Pineda and his men sailed from Jamaica through the Yucatán Channel to southern Florida and proceeded to map the shoreline along the coast of Northeastern Mexico and Texas with relative accuracy (Chipman, 1992; Freeman, 1990). In 1528, two makeshift barges

carrying several dozen Spaniards wrecked on the Texas coast near Galveston Island. The group were members of a failed expedition led by Panfilo de Narváez to colonize Florida (Chipman, 1987). Alvar Nuñez Cabeza de Vaca was among the marooned crewmembers and spent the subsequent eight years wandering across the state, living as a trader among local indigenous groups (Freeman, 1990). Cabeza de Vaca and three additional survivors ultimately made their way to Mexico, where they recounted the earliest recorded information on the flora, fauna, and topography of Texas (Chipman, 1987).

Despite the extensive inventory of resources documented in Texas by Cabeza de Vaca and his counterparts, Spain made no attempts to establish permanent settlements in the region until the 17th century. This was caused by the Spanish government viewing the de Narvaez, de Soto, and other excursions as failures (Freeman, 1990). For Indigenous groups, this period contains many continuations of Late Ceramic period tool and subsistence adaptions observed by encroaching Europeans. A variety of bone tools (e.g., needles, fishhooks, pins, awls, and projectile points) have been found at both coastal (41GV66) and inland sites (Patterson, 1996). Cabeza de Vaca, a European explorer and trader, confirmed that there was infrequent trade between coastal and inland groups due to persisting hostilities (Patterson, 1996). Due to interactions with Europeans, Southeast Texas indigenous peoples gradually adopted some European traditions, such as replacing bone with metal and glass to produce projectile points (Turner et al., 2011).

Spanish interests in Texas were bolstered by news that French explorer René-Robert Cavalier, Sieur de la Salle had landed at Matagorda Bay in 1685, initially with the intention of establishing a military colony near the mouth of the Mississippi River (Foster, 2015). Due to navigational errors, La Salle and his men overshot the Mississippi River and ran aground on the Texas coast. The group subsequently established Fort Saint Louis near Garcitas Creek in present-day Victoria County and La Salle set off with an exploration party in search of the Mississippi River (Bruseth and Tumer, 2005). During La Salle's search for the Mississippi, the remaining settlers at Fort Saint Louis were subjected to bouts of disease and defense attacks by local Indigenous populations, such as the Karankawa in 1688 (Bruseth and Turner, 2005). Gilmore (1986) confirmed the location of Fort Saint Louis (41VT4) in 1973, and in 1996 THC archeologists discovered seven cannons buried by La Salle's crew, salvaged from the wreckage of L'Aimable (Bruseth and Turner, 2005).

The French incursion into territory claimed by Spain renewed the latter's interest in colonizing Texas. Alonso de León consequently led a series of expeditions to find Fort Saint Louis beginning

in 1686 (Chipman, 1995). De Leon successfully relocated the remnants of the fort in 1689 and returned to Texas the following year to establish Mission San Francisco de los Tejas in east Texas between the Trinity and Neches rivers (Bolton, 1912). The purpose of the mission was twofold: it served as a buffer between Spanish territory in Texas and French territory in Louisiana but was also intended to extend the reach and favorable influence of Spain over all Indians from Coahuila to Texas (Chipman, 1995). Once Christianized, the Spanish assumed native groups would act as loyal Spanish citizens to protect the frontier from foreign incursions (Walter, 2007). Despite these intentions, Mission San Francisco de los Tejas was abandoned in 1693 due to rising tensions between the occupying Spanish soldiers and local Hasinai groups.

2.3.4 Previous Investigations

Early Historic Period

The Early Historic Period (250 to 150 B.P.) represents a renewed interest in Texas by the Spanish, and the development of Texas as a Spanish Colony. Following the abandonment of Mission San Francisco de los Tejas, Spain did not pursue the establishment of any additional missions in Texas for roughly 20 years (Campbell, 2003), Father Francisco Hidalgo, a Franciscan priest who had served at Mission San Francisco de los Tejas prior to its abandonment, renewed Spanish interests in Texas settlement by appealing to French colonists in Louisiana to establish missions in East Texas, consequently reinvigorating the sense of a "French threat" among the Spanish colonial administration in Northern Mexico. In 1711, Father Hidalgo sent a letter to the French governor of Louisiana, Antione Laumet, Sieur de Cadillac, encouraging him to establish French missions among the Caddo (Campbell, 2003). When the letter finally reached Laumet in 1713, he was incentivized by the prospect of trade with the Caddo and subsequently charged Louis Juchereau de Saint-Denis to petition the Spanish government for assistance in creating an East Texas mission. In 1716, Saint-Denis returned to East Texas, accompanied by Captain Domingo Ramón and Spanish soldiers, priests, and colonizers intent on maintaining a Spanish presence in the region. The Ramón expedition founded four missions and a presidio in East Texas and present-day Louisiana, and Mission San Antonio de Valero soon followed (circa 1718) to serve as a halfway point between the East Texas missions and those in the Rio Grande Valley (Campbell, 2003).

Several of the missions located on the eastern margin of Spanish territory were abandoned in 1719 after a brief war broke out between Spain and France near the disputed frontier zone. The inhabitants fled to San Antonio, but the missions were reestablished shortly thereafter by the

Aguayo expedition (Campbell, 2003). Between 1722 and 1731, five additional missions were founded near present-day San Antonio, including San José y San Miguel de Aguayo, San Francisco Xavier de Najera, San Juan Capistrano, San Francisco de la Espada, and Nuestra Señora de la Purisima Concepción (Walter, 2007). Also, in 1722, Mission Nuestra Señora del Espíritu Santo de Zúñiga was founded on the banks of Garcitas Creek near the site of the former failed French colony of Fort St. Louis (on top of which a presidio was built in 1721). The mission was established to serve as a buffer along the east coast.

Attempts to formalize Spanish control over east Texas intensified during the mid-18th century (Freeman, 1990). An expedition by Captain Joaquin Orobio Bazterra (stationed at Presidio Nuestra Senora de Loreto) was authorized in response to the French presence in east Texas, which consisted of the establishment of trading posts in the region (Freeman, 1990). The initial expedition (1745-1746), which confirmed the French presence in Texas, was followed by one in 1748 to explore coastal areas lying between the Trinity and Guadalupe Rivers and determine if there were potential areas to settle (Freeman, 1990). In 1756, mission Nuestra Senora de la Luz was established to protect Spanish interests in east Texas. Conditions at the mission were turbulent and included infighting between the Spanish, which resulted in a significant portion of the complex being burned down. The final straw for the mission came in 1766, when a hurricane severely damaged most of the mission (Freeman, 1990). In 1773, all of east Texas was abandoned by the Spanish, who drew the east-most boundary lines for Spanish settlement at San Antonio. However, Spanish settlers, who were already residing in East Texas persuaded the King of Spain to return to the area. Initially, a new mission, Nuestra Senora del Pilar de Bucareli, was established in 1774. The residents eventually abandoned the mission due to floods, fires, and Comanche attacks, and reestablished their community in modern-day Nacogdoches. The community would eventually serve as a gateway to reach more eastern parts of Texas and as an important trade post with Eastern Indigenous tribes (Freeman, 1990).

Late Historic Period

The Late Historic Period (150 B.P. to Present) is marked by waning Spanish influence in Texas, and a growing Anglo-American influence in Texas. This transition began in 1803, when the Spanish ceded their claim on Louisiana Territory to the French, who in tum sold it to the U.S. (Freeman, 1990). This led to increased Anglo-American presence in the region. Spain faced a series of naval and other battle losses that culminated with Napoleon Bonaparte deposing King Ferdinand VII and occupying Spain in 1808 (Henderson, 2009). During the French occupation of

Spain, the Mexican Revolution (1810-1821) broke out in the name of King Ferdinand VII (Henderson, 2009). During these tumultuous times, American and French colonists started to settle east Texas and supported Mexican Republicans (Freeman, 1990). These Anglo-American adventurers were called "filibusters", who had come to Texas in order to make a living for themselves. It was by these filibuster expeditions that the first Anglo Americans explored parts of what is now Harris County (Feik et al., 1977). One notable filibuster was Jean Lafitte, who established a self-sufficient government on Galveston Island between 1816 and 1817 (Freeman, 1990). The increasing occurrence of filibusters coming into Texas suggested that the Spanish had difficulty maintaining and controlling their borders (Freeman, 1990). In 1821, Agustin de Iturbide joined forces with Vicente Guerrero and enacted his Plan de Iguala, which cemented Mexico's independence from Spain.

This remainder of this section contains an excerpt from the Handbook of Texas Online search for “Chambers County” (Kleiner, 2020) to characterize the historic context of the study area and surrounding region.

Chambers County

Chambers County, named for Thomas Jefferson Chambers is a rural county less than twenty miles east of Houston in the Coastal Prairie region of Southeast Texas. The county is divided by the Trinity River. The Union Pacific provides railroad service, and IH 10 was built through the county in 1955. Archeological excavations in the county have produced artifacts dating to A.D. 1000. Karankawa, Coapite, and Copane Indians lived in the area when the first expeditions traveled the lower Trinity River. The land that became Chambers County formed part of the Atascosito (or lower Trinity River) District, a subdivision of Nacogdoches in Spanish Texas. By the late seventeenth century the French intruded on Spanish interests by trading with the Indians as far as the Sabine River. French trader Joseph Blancpain’s expedition to the area along Galveston Bay and the lower Trinity in 1754 provoked Spanish efforts to protect the region with a system of missions guarded by adjoining presidios. In 1756 Spanish missionaries established Nuestra Señora de la Luz Mission near the site of present Wallisville, and, to gain strategic control of the lower Trinity, soldiers constructed San Agustín de Ahumada Presidio on its east bank near what is now the Chambers-Liberty County line. Missionaries worked with Orcoquiza Indians who inhabited the region. After the 1763 Treaty of Paris removed the French threat by awarding Louisiana to the Spanish, storms and constant Indian hostility

resulted in removal of the missions to another location in 1766 and abandonment of the settlements by 1772. In 1805 Spanish troops landed at what is now Smith's Point to reinforce the Atascosito ("Marshy") community, but by 1812 few Spanish settlers had moved into the region. It was subsequently used by filibusters as a staging ground to mount attacks against Spanish Mexico.

By the early 1800s, Alabama and Coushatta Indians had arrived in the area from Alabama, assimilated the local Bidais and Orcoquizas, taken over their livestock trade with settlers along the Atascosito Road, and planted crops. A colony of French exiles from Napoleon's Grand Army under Charles François Antoine Lallemand, planning to free Napoleon and put his brother Joseph on the Mexican throne, attempted to establish themselves near the site of present Anahuac in 1818, but were driven out by the Spanish. Jean Laffite left the area permanently around 1820.

Mexican influence in the area increased after the Mexican war of independence from Spain in 1821, and Mexican place names replaced many earlier designations. In 1825 Perry's Point, the principal port of entry for the colonial grant, was renamed Anahuac, after the ancient capital of the Aztecs. American settlement began in 1821 at the invitation of the Mexican government. Some of Laffite's men stayed, and empresarios Haden Edwards, Joseph Vehlein, David G. Burnet, and Lorenzo de Zavala received grants in the area. A major part of what is now Chambers County became Vehlein's grant. T.J. Chambers received land for serving as chief justice of the Supreme Court of Coahuila and Texas and, in 1829, as surveyor general. Chambers's home, built in 1835, today houses the county library. Other early settlers, largely from southern and western Louisiana, included Peter Ellis Bean, James Morgan, James Taylor White, and the Wallis family, which settled at the future site of Wallisville. White is believed to have introduced a herd of longhorn cattle at Turtle Bayou in 1827; other farmers raised rice and cotton, and the lumber industry became important by the 1850s. Antebellum education in Chambers County was private.

Struggles between Anglo settlers and Mexican authorities increased as officials sought to prevent further immigration from the United States and maintain control. The Mexican government established Fort Anahuac in 1830 and gave command of the port at Anahuac to John Davis Bradburn, whose difficulties with the settlers culminated in the Turtle Bayou Resolutions and the eventual withdrawal of the Mexican garrison. Bradburn also

arrested Francisco I. Madero, whose commission was to grant land titles to American immigrants. In a further foreshadowing of the Texas Revolution, discontented settlers rose against Mexican rule in 1835 in a conflict set off by disagreements over Mexican tariff policy. At the same time, others chose to get along with a lax Mexican government that levied no taxes and frequently failed to enforce the law. A substantial number of these moved eastward during the Texas Revolution.

In the 1840s, the western edge of the future county was developed. Among those who acquired land was Sam Houston, who established a home at Cedar Point around 1837. The first post office was established at Anahuac, then known as Chambersea, in 1844. When the area became part of Liberty County after independence, land quarrels broke out, among them the notorious conflict between Charles Willcox and Chambers, who, with property valued at more than half a million dollars by 1860, was the county's wealthiest resident.

Chambers County was formed in 1858 from Liberty and Jefferson counties and organized the same year with Wallisville as its county seat. By 1860, census returns reported merino sheep, 26,632 cattle, and 344 slaves countywide, a reflection of the importance of livestock in the local economy. Of sixty families that owned slaves in 1859, John White held thirty-three, and twelve families among the remainder owned more than ten. Cotton growing increased in the antebellum period, but by 1860 only 100 cotton farmers operated in a county population of 1,508. Industry was confined to a steam sawmill and a shipyard.

Chambers County residents voted 109 to 26 for secession, and many participated in the ensuing conflict. The Liberty Invincibles, formed in 1861, joined Company F of the Fifth Regiment of Texas Volunteers. Others joined the Twenty-sixth Regiment of Texas Cavalry, the Moss Bluff Rebels, which became Company F of the Twenty-first Regiment of Texas Cavalry, or Company B of the Texas State Troops. Fort Chambers was established by Confederate troops in 1862 to protect the Gulf Coast, and Union troops reached Liberty by July 1865, but no major fighting occurred in Chambers County.

During Reconstruction the county began to recover from the hardships of war, but by 1870 its population had dropped to 1,503, below the prewar total. Roughly one-third of this number were Black, and as many as 15 African Americans were property owners. The Freedmen's Bureau opened a Black school at Wallisville in 1869, and other Black and

White schools opened in 1871. By 1898 13 White schools were operating with an enrollment of 324, and 10 Black schools with 211. Local politics reflected a struggle for control between those seeking to institute reforms and others resistant to change. Among the most notable incidents was General Joseph J. Reynolds's attempt in 1869 to remove county and city officials who did not qualify under the Iron Clad Oath. Other conflicts arose from Ku Klux Klan opposition to the Union League, which sought to enroll Black voters, and from other opposition to improvements in the lives of former slaves. In 1876 the election of local officials reflected passage of a new Texas constitution that overturned many Radical Republican reforms. Thereafter, the white primary and the poll tax remained as obstacles to civil rights.

The opening of a meat-packing plant in Wallisville in the 1870s reflected the continuing importance of ranching in the Chambers County economy, though many cattlemen drove their herds north to Kansas City or shipped them after railroad service reached the area. The Whites and Jacksons maintained large ranches, and James Jackson introduced wire fencing on 26,000 acres in 1882. Price declines after the Civil War kept cotton farming to a minimum. Brickmaking on Cedar Bayou supported a Galveston building boom in the 1870s, while other manufacturers turned to boatbuilding, particularly at the Turtle Bayou Shipyard. The lumber industry centered at Wallisville helped that city to grow in the 1880s and 1890s, while Anahuac remained unoccupied.

Because railroad routes reached no farther than the county's eastern and western borders by the 1890s, with the exception of a single branch line that provided freight service to the interior, Chambers County remained isolated and dependent on steamer traffic and other water transportation to Galveston. No important towns developed in the county until 1896, when settlers from the Midwest, who also developed the port at Bolivar, helped to complete the Gulf and Interstate Railway from Beaumont to Bolivar Peninsula. Later, important railroad towns developed at Winnie and Stowell, in the extreme northeastern part of the county. Railroads in the western part of the county were first built from Dayton to the Goose Creek oilfield by Ross S. Sterling and later taken over by the Southern Pacific.

A disastrous fire at the county's wooden courthouse destroyed early records in 1875, hurricanes in 1875 and 1900 damaged crops and livestock, and a smallpox epidemic in 1877 killed many residents. Though some farmers left Chambers County after the 1875

hurricane, total farms increased from 146 to 327 between 1870 and 1900. In the latter year the total acres in farms reached 366,436; farm value had increased tenfold in the previous 10 years. General prosperity resulted in a near doubling of the population between 1880 and 1910 from 2,187 to 4,234. In 1900 county farmers owned a total of 49,000 cattle, the highest in the county's history.

Between 1910 and 1930, tenant farmers increased from roughly 27 percent to more than 35 percent of all farmers. Mules in use as draft animals reached a high of 1,022 in 1920. In the early 1900s, canal development by the Lone Star Canal Company and other firms enabled some farmers to begin rice farming, while others in the eastern part of the county turned to truck farming. A total of 210,000 barrels of rice was harvested in 1903, and significant quantities of sweet potatoes, Indian corn, and sugar were produced by 1910. Lumber peaked at Wallisville in 1906 but declined during the panic of 1907. The largest local mill and the community's only important industry, Cummings Export Lumber Company, built by the Cummings brothers in 1898, closed in 1915 when another major hurricane blew through.

In 1906, Wallisville adopted a stock law to prevent pigs from running loose. Anahuac had become a boomtown. In 1908, Anahuac supporters filed suit and, in spite of Wallisville's genteel swine law, succeeded in making their town the county seat. Efforts to dissolve the county itself were made in 1915, 1923, and 1925 as conflicts developed over stock laws, prohibition, and the county seat question; these were complicated by offers of lower taxes from Harris and Liberty counties, whose officials hoped to cash in on Chambers County oilfields.

Despite increased agricultural production, the Chambers County population declined from 4,234 to 4,162 between 1910 and 1920, then rose again to reach a high of 5,710 by 1930 as a growing oil boom brought new residents to the area. Barbers Hill oilfield, developed after 1918, reached its peak production of 8,082,000 barrels in 1933; the field was later serviced by five pipelines. Oilfields were subsequently discovered at Lost Lake, Anahuac, Monroe City, and Turtle Bay, and near Hankamer, and gas reserves were developed in the eastern part of the county. Oil production provided jobs and revenue that helped the county weather the Great Depression with relatively little discomfort and brought in workers who increased the population to 7,511 by 1940. Transportation gains after 1926 included the extension of SH 146 from Anahuac to Stowell.

During World War II, many Chambers County residents found employment in refineries and shipyards at Baytown, Houston, Beaumont, Port Arthur, and Orange. After September 1943 rice farmers employed German prisoners of war from camps in Liberty and Chambers counties. The establishment of the Fraternity of the White Heron, the Forward Trinity Valley Association, the Texas Water Conservation Association, and the Chambers-Liberty County Navigation District advanced area water interests, including the dredging of a channel from the Houston Ship Channel to Smith Point, Anahuac, and Liberty. The Trinity Bay Conservation District was started in 1949. Major highway improvements were made to Farm roads 563 and 565 and SH 73, later IH 10.

After the war the population grew to 7,871 by 1950 and 10,379 by 1960. By 1959, county farms totaled 483, of which roughly 62 percent were commercial and only 12.4 percent tenant-operated. Mining, contract construction, wholesale distribution, petroleum extraction, and natural-gas production were the chief county industries. Only four manufacturing firms were operating, among 112 mining and mineral establishments. By 1966, though the overall population continued to increase, no populated place in Chambers County had as many as 2,500 inhabitants; 22.5 percent of the population was described as living in poverty; and the population density was only 19 persons per square mile. In this period, many Black residents left for jobs in urban areas.

Growing national support for environmental preservation and passage of the 1967 National Environmental Policy Act had important effects on Chambers County. Relying upon an earlier study by the USACE in preparation for the construction of a saltwater barrier across the Trinity River to aid rice farmers, improve river navigation, and provide increased water supplies for adjacent counties, in 1960 state legislators proposed a 23,200-acre reservoir and wildlife refuge that would inundate Wallisville. Despite protests, engineers purchased the townsite, the plan was approved in 1962, and work began. Excavations led to the unearthing of a primitive burial site and other historic discoveries. Ultimately, the project drew the interest of the Sierra Club, and other environmental groups, in addition to a representative of the commercial shrimping industry filed suit against several state and national agencies. In 1973, a U.S. district judge ordered construction stopped, when the project was 75 percent complete. The USACE eventually wrote off the $23 million investment and in 1977 recommended a smaller project. Wallisville Heritage Park, established in 1979, henceforth preserved the townsite and some of the community's historic buildings.

Between 1970 and 1980, the rural population of Chambers County grew 52 percent, and in the early 1980s the total county population was 19,100. People of English origin comprised 27 percent, Irish 17 percent, French 6.5 percent, African American 14 percent, and Hispanic 3 percent. Forest products and cattle, along with rice and soybeans, potatoes, peaches, and pecans constituted the county's principal products. A total of 288 business establishments operated countywide, including 16 manufacturing establishments with 400 employees. Oil and gas extraction, agribusiness, petroleum refining, and the manufacture of plastics and resins topped the list of industries. The proximity to Houston enabled many residents to commute to jobs in that city. In the late 1980s, after a number of petroleum-industry-related accidents nearby, residents of Mont Belvieu were moved and the community was purchased by oil companies, which rebuilt it at another location. The county's three school districts included four elementary, three middle, and three high schools. Whereas in 1960, 10 percent of the population had completed high school and fewer than 3 percent had completed college, 57.5 percent of the county population had completed high school and 10 percent had finished college in 1982. By 1990, the county's population had grown to 20,088.

Incorporated communities in Chambers County include Anahuac (population, 2.288), the seat of government; Beach City (2,365); Cove (505); Mont Belvieu (4,418); Stowell (1,839); Old River-Winfree (1,248); and Wallisville (300). Several important wildlife areas are located in Chambers County, including Moody National Wildlife Refuge and Anahuac National Wildlife Refuge, at the juncture of Oyster Bay and East Bay. Lake Anahuac and Fort Anahuac Park were built in the 1940s, H. H. (Hub) McCollum Park in 1959, and Whites Park in 1965. The Texas Rice Festival, which began in 1969, is celebrated annually at Winnie-Stowell in September.

2.3.5 Records Review

Previous Archeological Investigations

According to a review of the TASA database on November 16, 2022, a total of four archeological historic properties, all of which have an undetermined NRHP eligibility, and one cemetery, are documented in the study area. In addition, the TASA records search revealed that approximately 14 percent of the study area has undergone previous archeological investigations. A list and description of the archeological historic properties and cemetery documented in the study area is provided below in **Table 2-8** followed by the historic-age resources in **Table 2-9**.

Table 2-8. Archeological Historic Properties and Cemeteries Documented within the Study Area

RESOURCE ID	RESOURCE TYPE	CHRONOLOGY	RESOURCE DESCRIPTION	NRHP/ SAL ELIGIBILITY	YEAR RECORDED
41CH394	Historic-age artifact scatter	Early to mid-20th century	Ceramic, glass, and metal fragments. Brick and a possible well-head	Undetermined	2014
41CH399	Historic material scatter	Mid-20th century	Exposed pipe in concrete. Brick fragments and nails	Undetermined	2012
41CH400	Historic dwelling	Early to mid-20th century	Pier and beam foundation with chimney remnant. Glass, metal, and ceramic artifacts	Undetermined	2016
41CH401	Industrial	Historic	Concrete features associated with several historic oil drilling platforms	Undetermined	2017
Benjamin F. Fisher Cemetery	Cemetery	1898	Vicinity boundary of a three-grave cemetery	NA	NA
SOURCE: THC, 2022a.					

Historic Period Sites

The TASA records show an OTHM, Barbers Hill Oil Field, documented within the study area (**Table 2-9**). No state historical sites, century farms or ranches are mapped in the study area.

Table 2-9. NRHP Properties/Districts, OTHMS and Cemeteries Documented in the Study Area

RESOURCE ID	RESOURCE TYPE	CHRONOLOGY	RESOURCE DESCRIPTION	YEAR RECORDED
Barbers Hill Oil Field	Historic Marker	1889	Early oil field	1977
SOURCE: THC, 2022a.				

Barbers Hill Oil Field

The OTHM for Barbers Hill Oil Field is located on the west side of SH146 and approximately 2 miles north of IH 10 in Mont Belvieu. The majority of the oil field itself is located to the north of the historical marker and outside of the study area. The following is a description of Barbers Hill Oilfield from the historical marker text:

> "While digging a 65-foot water well near his home in 1889, Elmer W. Barber (1854-1935), whose father Amos Barber first settled this area, encountered inflammable gas near the top of the salt dome known as Barbers Hill. After the Spindletop discovery in 1901, prospectors sought leases here. In 1902 Pattillo Higgins (1863-1955), an early Spindletop promoter, drilled on the northwest slope of the hill. His shallow well, like those of other early operations, yielded little, and the low price of crude oil discouraged large investment. The United Petroleum Company No. 1 Fisher, drilled in 1918, produced 70 barrels a day, the field's first oil in commercial quantities. Drilling resumed in 1926, when the Mills Bennett Production Company and the Humphreys Corporation brought in the A. E. Barber No. 1, yielding 500 barrels a day. The success later that year of their B-2 Kirby, reaching a depth of 4,174 feet, triggered a leasing campaign and launched a period of rapid expansion which lasted until the late 1930s. Rows of oil derricks and tent dwellings were a common sight during the boom. As the population of the community grew, oil money helped upgrade and enlarge school facilities. By 1977, the local economy had shifted from production to storage of petroleum."

The earliest available historic USGS topographic maps, the 1961 "Cove" and "Mont Belvieu, Texas" topographic quadrangles were examined for historic structures and farm/ranching features. These historic topographic maps depict the study area as largely undeveloped rural land flanked to the west by riparian woodland along Cedar Bayou. The southern extent of Barbers Hill Oilfield is depicted along the northern study area boundary. Historic aerial photography from the mid-20th century (Nationwide Environmental Title Research [NETR], 2022) also depict an undeveloped and rural setting boundary.

Few structures/features are depicted on the historic maps reviewed, indicating that historic land use was primarily for agricultural use as evidenced by unimproved roads, irrigation canals, stock ponds and a cleared and mostly flat physiographic setting. In addition, historic-age commercial activity in the study area appears to have been focused on the operations at the Barbers Hill Oil Field to the north.

Known and perceived disturbances within the study area include those associated with agricultural processes, such as clearing, plowing, and terracing, roadway construction and maintenance, installation of overhead and underground utilities, clear cutting of vegetation, irrigation canals and light industrial/commercial development practices.

2.3.6 Aesthetic Values

Aesthetics are included as a factor for consideration in the evaluation of transmission facilities in Section 37.056(c)(4)(A)-(D) of the Texas Utilities Code. For the purposes of this study, the term aesthetics is utilized by Halff to address the subjective perception of natural beauty in a landscape. This evaluation attempts to define and evaluate the scenic qualities of an area.

Consideration of the visual environment includes a determination of aesthetic values (where the major potential effect of an action 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). Halff considered the following aesthetic values in this study, which combine to give an area its aesthetic identity:

- topographical variation (hills and valleys);
- prominence of water in the landscape (rivers and lakes);
- vegetation variety (woodlands, meadows);
- diversity of scenic elements;
- degree of human development or alteration; and
- overall uniqueness of the scenic environment compared to the larger region.

The study area is intermixed between undeveloped, developed, stands of trees, and open fields. Several permanent rivers or streams were identified in the area. The primary aesthetic of the study area is the presence of undeveloped fields and stock ponds prevalent in the area. Residential buildings and developments occupy less of the study area compared to the open fields and tree cover making them persistent and prominent from most public viewsheds.

Halff conducted a review of Texas Scenic Drive locations that are identified as having particularly strong aesthetic views or settings and found that none of these 17 scenic drives were located within the study area (TripAdvisor, 2022). In 1997, the THC designated Heritage Trail Regions throughout the state of Texas to create a statewide heritage tourism program centered on the original 10 scenic driving routes identified in the 1968 Texas Heritage Trails Program. These Heritage Trail Regions incorporate the historic highways, historic sites, hiking and biking paths, natural beauty, and cultural attractions unique to the 10 regions. The study area is within the Texas Independence Trail Region. The suggested driving trail for this region is west of the study

area and does not extend into the study area (THC, 2022b; 2022c). No other aesthetic resources, designated as either scenic views, scenic roadways, or unique visual elements were identified from the literature review or field reconnaissance of the study area.

2.4 ENVIRONMENTAL INTEGRITY

Halff identified environmental and land use constraints within the study area to develop a constraints map. This constraints map depicts the locations of environmentally sensitive areas and other land use constraints, which are mapped atop a recent aerial photograph base and depicted on **Figure 4-1**. The information obtained and reviewed in completing the route evaluation, in addition to the environmental and land use constraints depicted in this figure, are described in detail in the following sections.

2.4.1 Physiography and Geology

The study area lies in the Coastal Prairies, a sub-region of the Gulf Coastal Plains physiographic region (or 'province'). The Coastal Prairies consist of nearly flat topography with geologic formation strata that are nearly flat and includes bedrock materials consisting of deltaic sands and muds. Elevation ranges from a minimum of 0 feet to a maximum of 300 feet (Bureau of Economic Geology [BEG], 1996).

As shown on **Figure 2-2**, rocks and unconsolidated deposits from the Quaternary geologic period are represented in the study area. The study area entirely consists of Beaumont Formations with some portions covered by a stippled overprint. The Beaumont Formation includes areas predominantly clay or sand. Permeability ranges from low to moderate, compressibility ranges from low to high, and shear strength ranges from low to high. Relief is level to depressed; however, local mounds and ridges are common. Deposits are mainly contributed by stream channels, point-bars, natural levees, backswamps, coastal marshes, and mud (BEG, 1992; BEG, 1996; USGS, 2022a).

2.4.1.1 Geologic Hazards

There are no historical or surface coal mining operations, permits for Texas uranium exploration, active landfill, or active superfund sites within the study area (United States Environmental Protection Agency [USEPA], 2022a; USEPA, 2022b; RRC 2022b; RRC, 2022c; RRC, 2022d; TCEQ, 2022a).

2.4.2 Soils

Data from the NRCS (formerly the Soil Conservation Service [SCS]) were used to identify and characterize the soils that encompass the study area. The NRCS Digital General Soil Map of the U.S. provides a broad inventory and mapping of general soil association units. Soil associations are main patterns of soils defined and delineated based on criteria, such as soil texture, parent material, slope, characteristics of horizons in soil profile, and degree of erosion (NRCS, 2019). The NRCS project merged soil association data from the myriad of county soil surveys into a seamless national data set. This soil mapping approach resolved a basic challenge in using individual county soil surveys, which often reflected different soil names for similar soils from one county to the next. A brief description of each soil association's general characteristics is in **Table 2-10**, and **Figure 2-3** shows the NRCS-mapped soil associations within the study area. The soil associations in the seamless NRCS map were compared graphically with the soil associations defined and mapped in the county-level soil surveys for Chambers County (NRCS, 2019; SCS, 1976), and the column on the right side of **Table 2-10** shows the names of the corresponding soil association(s) from each county soil survey, where applicable.

2.4.2.1 Mapped Soil Associations

There are two different soil associations within the study area, neither of which are associated with floodplains. The surface geology discussed in the previous section is the foundation for the soils found within the study area, and soil maps bear a general similarity with geologic maps of the area. These associations are primarily used for agriculture with irrigation supplied by the Trinity River, bayous, and canals in the area (NRCS, 2019; SCS, 1976).

Table 2-10. Soil Associations within the Study Area

SOIL ASSOCIATION MAP UNIT # - NAME[1]	STUDY AREA %	DESCRIPTION OF SOIL ASSOCIATION[2]	COUNTY SOIL SURVEY: SOIL ASSOCIATION NAME[3]
s7192 – Lake Charles-Beaumont	45	Acid to neutral, clayey and loamy soils.	Beaumont-Morey-Lake Charles
s7198 – Morey-Mocarey-Bernard	55	Acid to neutral, clayey and loamy soils.	

SOURCES: NRCS, 2019; SCS, 1976.
NOTES:
1. Map unit # and name correspond with the number and name assigned to each association in the 2016 NRCS Digital General Soil Map of the U.S., as shown for the study area in **Figure 2-3**.
2. The description used for the soil association is a composite of the descriptions for the soil associations from individual county soil surveys that correspond geographically with the 2016 NRCS Digital General Soil Map.
3. This column shows the soil association names from the county soil surveys that correspond to the 2016 NRCS Digital General Soil Map.

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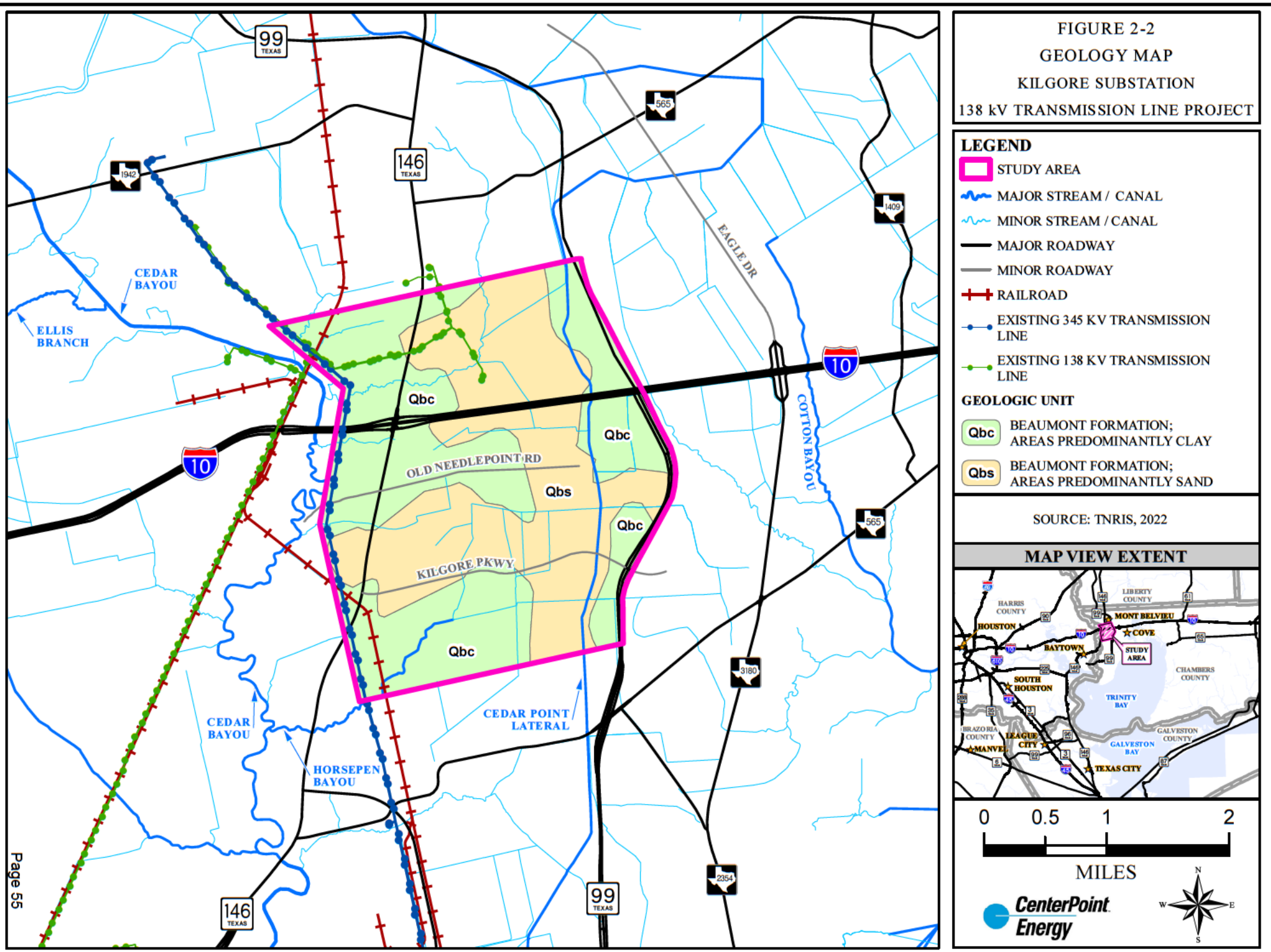
99
TEXAS
146
TEXAS
1942
565
1409
10
CEDAR
BAYOU
ELLIS
BRANCH
EAGLE DR
COTTON BAYOU
Qbc
Qbs
OLD NEEDLEPOINT RD
KILGORE PKWY
CEDAR
BAYOU
HORSEPEN
BAYOU
CEDAR POINT
LATERAL
3180
2354
FIGURE 2-2
GEOLOGY MAP
KILGORE SUBSTATION
138 kV TRANSMISSION LINE PROJECT
LEGEND
STUDY AREA
MAJOR STREAM / CANAL
MINOR STREAM / CANAL
MAJOR ROADWAY
MINOR ROADWAY
RAILROAD
EXISTING 345 KV TRANSMISSION LINE
EXISTING 138 KV TRANSMISSION LINE
GEOLOGIC UNIT
Qbc BEAUMONT FORMATION; AREAS PREDOMINANTLY CLAY
Qbs BEAUMONT FORMATION; AREAS PREDOMINANTLY SAND
SOURCE: TNRIS, 2022
MAP VIEW EXTENT
HARRIS COUNTY
LIBERTY COUNTY
HOUSTON
MONT BELVIEU
COVE
BAYTOWN
STUDY AREA
SOUTH HOUSTON
CHAMBERS COUNTY
TRINITY BAY
BRAZORIA COUNTY
LEAGUE CITY
MANVEL
GALVESTON COUNTY
GALVESTON BAY
TEXAS CITY
0 0.5 1 2
MILES
N
W
E
S
CenterPoint Energy

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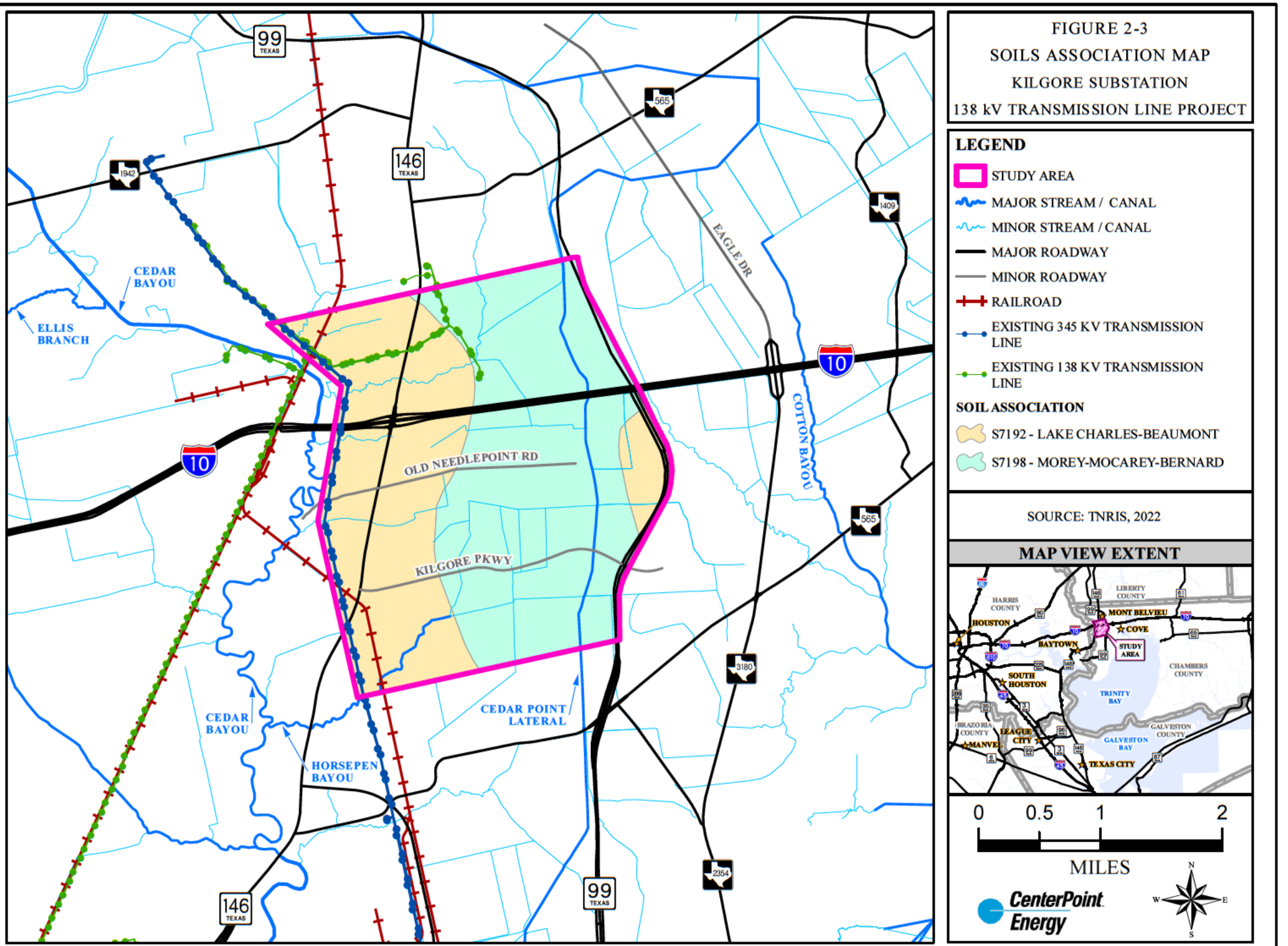
FIGURE 2-3
SOILS ASSOCIATION MAP
KILGORE SUBSTATION
138 kV TRANSMISSION LINE PROJECT
LEGEND
STUDY AREA
MAJOR STREAM / CANAL
MINOR STREAM / CANAL
MAJOR ROADWAY
MINOR ROADWAY
RAILROAD
EXISTING 345 KV TRANSMISSION LINE
EXISTING 138 KV TRANSMISSION LINE
SOIL ASSOCIATION
S7192 - LAKE CHARLES-BEAUMONT
S7198 - MOREY-MOCAREY-BERNARD
SOURCE: TNRIS, 2022
MAP VIEW EXTENT
HARRIS COUNTY
LIBERTY COUNTY
CHAMBERS COUNTY
GALVESTON COUNTY
BRAZORIA COUNTY
HOUSTON
MONT BELVIEU
COVE
BAYTOWN
STUDY AREA
SOUTH HOUSTON
TRINITY BAY
LEAGUE CITY
MANVEL
GALVESTON BAY
TEXAS CITY
0 0.5 1 2
MILES
N
W
E
S
CenterPoint Energy
CEDAR BAYOU
ELLIS BRANCH
OLD NEEDLEPOINT RD
KILGORE PKWY
EAGLE DR
COTTON BAYOU
CEDAR POINT LATERAL
HORSEPEN BAYOU
99 TEXAS
146 TEXAS
1942
565
1409
10
3180
2354

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2.4.2.2 Hydric Soils

Soils that have characteristics or features that cause permanent or seasonal saturation for a long enough period during a growing season to develop anaerobic conditions are classified as "hydric" soils. Within the Lake Charles-Beaumont and Morey-Mocarey-Bernard general soil associations listed in **Table 2-10**, there are bottomland riparian corridors associated with many of the soil map units, which incorporate hydric soil components (NRCS, 2019; SCS, 1976). Soil map units with hydric components within the study area are listed in **Table 2-11**.

Table 2-11. Hydric Soil Types within the Study Area

SOIL ID	SOIL SERIES	TOPOGRAPHY	HYDRIC COMPONENTS	LANDFORM	HYDRIC CRITERIA
AnhA	Anahuac-Aris complex	0 to 1 percent slopes	Leton	Meandering channels	2*, 3**
BeaA	Beaumont clay	0 to 1 percent slopes	Beaumont	Flats	2
BecA	Beaumont-Urban land complex	0 to 1 percent slopes	Beaumont	Flats	2
BevA	Bevil clay	0 to 1 percent slopes	Bevil	Depressions	2
LeaA	League clay	0 to 1 percent slopes	Beaumont	Flats	2
MonA	Morey loam	0 to 1 percent slopes	Aris	Flats	2
OriA	Orcadia-Anahuac complex	0 to 1 percent slopes	Aris	Flats	2

SOURCES: NRCS, 2019; 2022a.
NOTES:
* Criteria 2 includes components in "Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, or Andic, Cumulic, Pachic, or Vitrandic subgroups."
** Criteria 3 includes components that exhibit frequent ponding for long durations during the growing season.

2.4.2.3 Prime Farmland

In the Farmland Protection Policy Act, federal law defines prime farmland as "land that has the best combination of physical and chemical characteristics for producing food, feed fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor..." (7 U.S. Code Section 4201(c)(1)(A)). Such lands 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. Additionally, potential prime farmlands are areas with soils that meet most of the requirements of prime farmland but fail, because they lack water management facilities, such as irrigation systems, or they lack sufficient natural moisture. Potential prime farmland areas would be regarded as prime farmland if these areas were irrigated. Several of the mapped soil units within the study area are designated as either "all areas are prime farmland," "farmland of statewide importance," or "prime farmland if drained." Soils of the "all areas are prime farmland" designation are largely in the western half along the SH 146 corridor and the eastern boundary of the study area. Soils of the

"farmland of statewide importance" designation are predominantly in the eastern half of the study area. Soils of the "prime farmland if drained" designation are adjacent to Cedar Point Lateral and east of the stream. Areas that are not considered prime farmland are generally developed portions of the study area. The NRCS encourages the use of accepted erosion control methods during the construction of all projects, regardless of exemption status (NRCS, 2019; SCS, 1976).

2.4.3 Water Resources

2.4.3.1 Surface Water

The study area lies primarily within the North Galveston Bay Sub-basin. The portion of the study area east of Cedar Point Lateral is located within the Lower Trinity Sub-basin. The majority of the study area is located within the Adlong Ditch-Cedar Bayou watershed, while the eastern limits of the study area is within the Old River-Trinity River watershed, similar to the sub-basin limits (TPWD, 2022d). Two named streams (i.e., Cedar Point Lateral and Horsepen Bayou), numerous unnamed streams and canals, stock ponds, and water treatment ponds are the surface water features present within the study area. The streams and canals continue outside of the study area where several have confluence with Trinity Bay, which is approximately 5 miles south of the study area. As shown on any of the figures in **Section 2.0**, numerous smaller tributaries identified in the National Hydrology Data Set (NHD) are common along the unnamed streams and canals. Topographic maps and aerial imagery support that several of these stream features in the NHD exhibit a riparian vegetation community (NearMap, 2023; USGS, 2022b).

2.4.3.2 Ground Water

A review of the Texas Water Development Board (TWDB) databases for nine major and 22 minor aquifers determined that the Gulf Coast is the only major aquifer and there are no minor aquifers within the study area (TWDB, 2006; 2017). The Gulf Coast Aquifer parallels the Gulf of Mexico coastline. The Gulf Coast Aquifer consists of discontinuous sand, silt, clay, and gravel beds. The freshwater saturated thickness averages around 1,000 feet throughout the aquifer. Groundwater is generally good with total dissolved solids below 500 milligrams per liter in the central and northeastern portions of the aquifer, but to the south the water quality declines and may be very hard with total dissolved solids ranging between 1,000 and 10,000 milligrams per liter (i.e., slightly to highly saline). The rate of pumping from the Gulf Coast Aquifer has not declined in recent decades as water management strategies are using the aquifer for municipal, industrial, and irrigation purposes (George et al., 2011). Groundwater resources for the study area are located

within the TWDB Groundwater Management Area #14, which encompasses five Groundwater Conservation Districts (TWDB, 2022a).

2.4.3.3 Special Status Waters

State legislation in 1997 (see Texas Water Code Section 16.051) modified the state-wide water resources planning process by authorizing regional planning groups to recommend ecologically unique river and stream segments to the Texas State Legislature in regional and state water plans (TWDB, 2022b). A primary purpose for this approach is to ensure that future water impoundments do not destroy stream segments that are considered unique under specified designation criteria (see 31 TAC Section 357.8), which include biological functions and habitat for threatened and endangered species. State designation as ecologically unique would also prevent state agencies or municipalities from acquiring property or easements that would destroy the ecological values forming the basis for the designation. Part of the process for designating ecologically unique stream segments requires regional water planning groups to coordinate with TPWD about candidate stream segments (TWDB, 2022b). No stream within or immediately adjacent of the study area is designated as ecologically significant under the relevant designation criteria (TPWD, 2002).

No rivers or streams within the study area are listed by the TCEQ under Section 303(d) of the CWA as being monitored for impairment or having other water quality concerns. However, the Cedar Bayou, tidal segment, which is immediately adjacent to the study area, and the Cary Bayou, which is 1.5 miles southwest of the study area, are listed as impaired stream segments. The Cedar Bayou Tidal was categorized under 5a in 2002 for dioxin in edible tissue, 5c in 2006 for bacteria in water (recreation use), and 5c in 2008 for PCBs in edible tissue. The Cary Bayou was categorized under 5c twice in 2018 for bacteria in water and depressed dissolved oxygen in water. Category 5a indicates a total maximum daily load study is underway, scheduled, or will be scheduled in the future. Category 5c indicates that additional data and information will be collected or evaluated prior to the implementation of a management strategy (TCEQ, 2022b; 2022c).

2.4.3.4 Floodplains

The 100-year and 500-year floodplains represent areas that have one percent and 0.2 percent annual chance flood hazard, respectively. Cedar Bayou, as identified by the FEMA FIRM, is the most prominent feature immediately adjacent to the western boundary of study area. The study

area is within the floodway, the 100-year floodplain, and the 500-year floodplain of Cedar Bayou in the western portion of the study area and of an unnamed stream in the eastern portion of the study area (FEMA, 2022).

2.4.3.5 Future Surface Water Developments

Review of the 2022 Texas State Water Plan for Region H indicated no proposed surface water development project within or immediately adjacent to the study area (TWDB, 2021; 2022b).

2.4.3.6 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 (GLO, 2022a, 2022b). 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 majority of the study area is within the CMZ, as defined under the Texas Coastal Management Program and Coastal Facilities Designation Line as defined in 31 TAC § 503.1 while the northeastern corner is not within the Coastal Zone Boundary (GLO, 2022a, 2022b).

Halff 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 § 503.1(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 wetlands (freshwater emergent wetlands; [USFWS 2023a]) and special hazard areas (FEMA 100-floodplains; [FEMA 2022]). Upon PUCT approval of a route, on the ground verifications of the CNRAs may be required. Refer to **Section 4.4.3.5** for further discussion of potential impacts to CNRAs.

2.4.4 Ecological Resources

Data and information on ecological resources within the study area were obtained from a variety of sources, including aerial photograph interpretation, field reconnaissance surveys, correspondence with the USFWS, TPWD, and published literature and technical reports. All biological resource data for the study area were mapped utilizing GIS.

2.4.4.1 Ecological Region

The NRCS has studied the characteristics of ecological regions for decades to better understand the biology and management of natural resources. The NRCS published a handbook in 2022 that maps general Land Resource Regions (LRRs) that share similar geology and land physiography, moisture and climate, and soils characteristics. The study area is located within the Atlantic and Gulf Coast Lowland Forest and Crop Region LRR, which extends across the Gulf Coast from Texas to Northern Florida and along the Atlantic coast of the eastern states from Georgia to Pennsylvania. Average annual precipitation ranges from 39 to 62 inches, commonly exceeding 65 inches, with more frequent rainfall occurring during fall and winter (NRCS, 2022b).

As shown on **Figure 2-4**, NRCS soil scientists have further subdivided the LRR within the Major Land Resource Areas (MLRAs). As the criteria used to define both MLRAs and the larger LRRs focus fundamentally on soils and soil-forming factors, the delineation of MLRAs is therefore closely linked to the various soil associations that have been mapped over the past half century. This approach to the study of vegetation focuses on the land's potential for supporting natural vegetation or agricultural practices, rather than simply reporting a snapshot of vegetation as it may exist at a single point in time.

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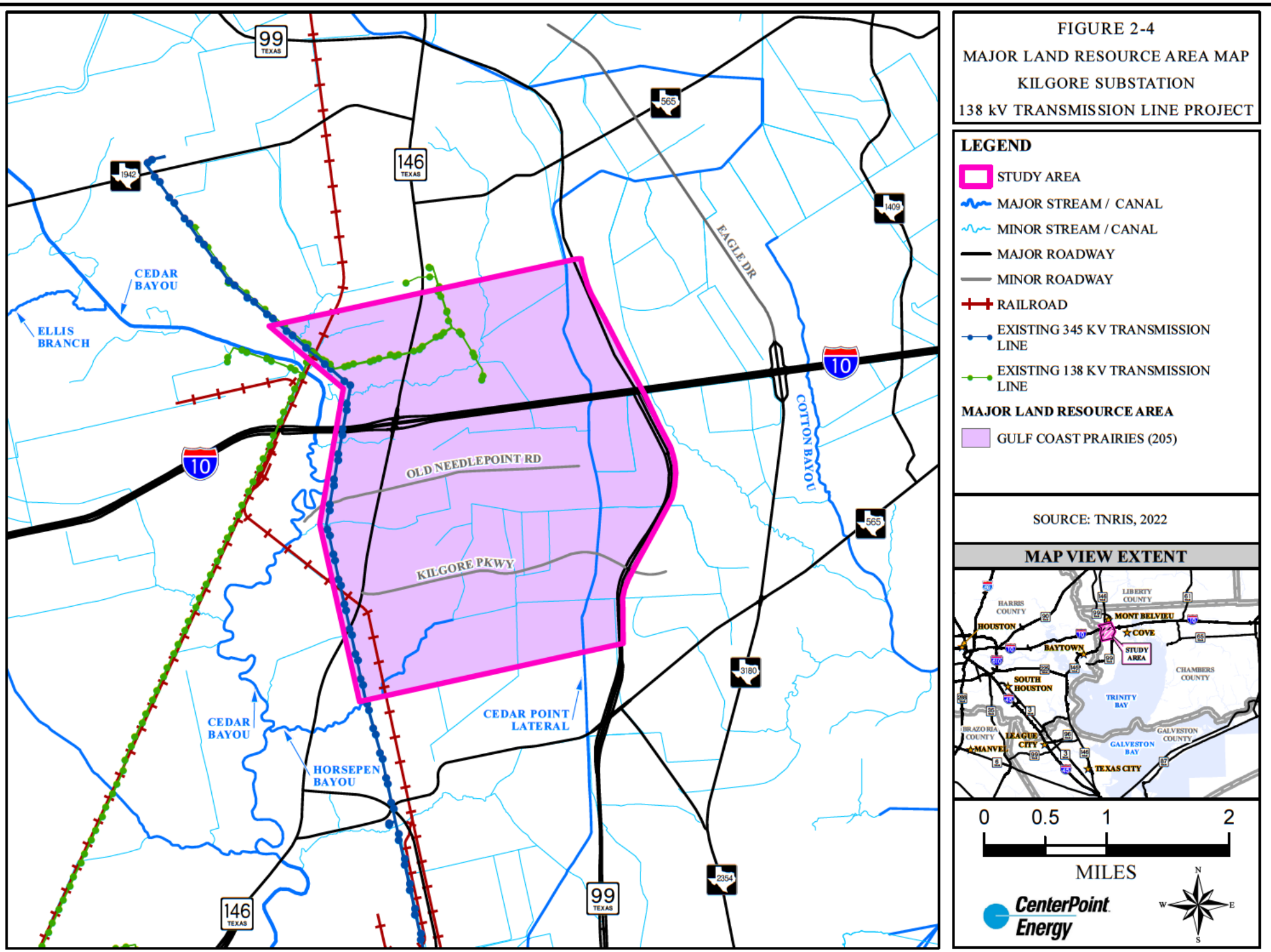
FIGURE 2-4
MAJOR LAND RESOURCE AREA MAP
KILGORE SUBSTATION
138 kV TRANSMISSION LINE PROJECT
LEGEND
STUDY AREA
MAJOR STREAM / CANAL
MINOR STREAM / CANAL
MAJOR ROADWAY
MINOR ROADWAY
RAILROAD
EXISTING 345 KV TRANSMISSION LINE
EXISTING 138 KV TRANSMISSION LINE
MAJOR LAND RESOURCE AREA
GULF COAST PRAIRIES (205)
SOURCE: TNRIS, 2022
MAP VIEW EXTENT
CEDAR BAYOU
ELLIS BRANCH
OLD NEEDLEPOINT RD
KILGORE PKWY
EAGLE DR
COTTON BAYOU
CEDAR POINT LATERAL
HORSEPEN BAYOU
HARRIS COUNTY
LIBERTY COUNTY
HOUSTON
MONT BELVIEU
COVE
BAYTOWN
STUDY AREA
SOUTH HOUSTON
CHAMBERS COUNTY
TRINITY BAY
BRAZORIA COUNTY
LEAGUE CITY
MANVEL
GALVESTON BAY
GALVESTON COUNTY
TEXAS CITY
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The study area is located within the boundary of the Gulf Coast Prairies (MLRA 150A). This MLRA extends over 17,000 square miles along the Gulf coast of Texas and Louisiana that is about 50 to 80 miles wide. The Gulf Coast Prairies MLRA has an average annual precipitation of 45 to 63 inches in the northern two-thirds of the range (including the study area), whereas the southwestern extent of the MLRA averages 30 to 45 inches of annual rainfall. Most of the rainfall occurs during mid to late summer in the western portion and during winter in the eastern portion. The growing season averages 325 days, ranging from 290 to 365 days. The physiography of this MLRA is distinguished by nearly level plains with low local relief dissected with steeper slopes along entrenched river networks that flow toward the Gulf of Mexico. The geology of this MLRA has been influenced by the weight of recent alluvial deposits from the Brazos and Trinity Rivers that has caused a tilt towards the Gulf of Mexico. The dominant soil orders in this MLRA are Alfisols, Mollisols, and Vertisols. The soils generally are very deep and well-drained in very gently to gently sloping soils in convex areas or very poorly drained in enclosed depressions. The surface layer is loamy or clayey with either a loamy or clayey subsoil.

The Gulf Coastal Prairies supports tall and mid prairie grass mixes with hardwood trees along rivers and streams. The dominant grass species include little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and big bluestem (*Andropogon gerardii*). Hardwood species include small groves of live oak (*Quercus virginiana*). Most of the MLRA is grassland or cropland. Nearly two-fifths of this area remains as rangeland or pastureland. Urban development is rapidly expanding onto agricultural lands adjacent to cities (NRCS, 2022b; 2022c).

2.4.4.2 Vegetation Types

2.4.4.2.1 Terrestrial Vegetation

GIS data from the TPWD Ecological Mapping Systems of Texas (EMST) were used to estimate areas of major types of existing vegetation cover within the study area. Data were developed from satellite imagery with 10-meter by 10-meter mapping resolution collected from 2005 to 2007 and refined with in situ data. Using this refined imagery, TPWD created a statewide land cover data set that includes a sufficient number of land cover classes to provide insights for planning and management at a variety of scales (Elliott, 2014; Elliott et al., 2015; TPWD, 2014). For this study area, the more specific ecological classifications were grouped into six general land cover classes. Use of these digital data yielded the following estimates of cover as applied to the study area: 25 percent woodland-shrubland; 24 percent grassland; 23 percent row crops; 16 percent

urban; 8 percent wetland; and 4 percent open water. This review of land cover in the study area is dominated with woodland-shrubland species vegetation types.

Figure 2-5 displays the TPWD land cover data by different land/vegetation cover types, as it was grouped for the purposes of this study (TPWD, 2022e). The description of study area terrestrial vegetation that follows is based on field observations, and a review of reports and maps produced by NRCS (2022b), TPWD (1984; 2011), and TCEQ (Griffith et al., 2007). Cover types are provided in the general order as shown on **Figure 2-5**.

Upland woodland-shrubland is the most prevalent land cover type within the study area. A list of major associated species for these upland woodland-shrubland EMST cover types is available in **Table 2-12**. Upland woodland-shrubland is composed of six EMST cover types (in order of prevalence):

- Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland;
- Pine Plantation greater than 3 meters tall;
- Chenier Plain: Mixed Live Oak – Deciduous Hardwood Fringe Forest;
- Native Invasive: Deciduous Woodland;
- Chenier Plain: Live Oak Fringe Forest; and
- Native Invasive: Juniper Shrubland.

The Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland EMST cover type is characterized by dense stands of Chinese tallow (*Triadica sebifera*) with diverse invasive deciduous shrublands and sparse woodlands. It is the most common woodland-shrubland cover type found and represents the majority of the woodland-shrubland depicted in **Figure 2-5**.

The Pine Plantation greater than 3 meters tall EMST cover type include dense stands predominantly of loblolly pine (*Pinus taeda*), which also can be mixed with shortleaf pine (*Pinus echinata*) or plantations of slash pine (*Pinus elliottii*). Portions of the cover type can include a mix of deciduous trees. This cover type is primarily concentrated in the western half of the study area with a few isolated habitats located north of IH 10.

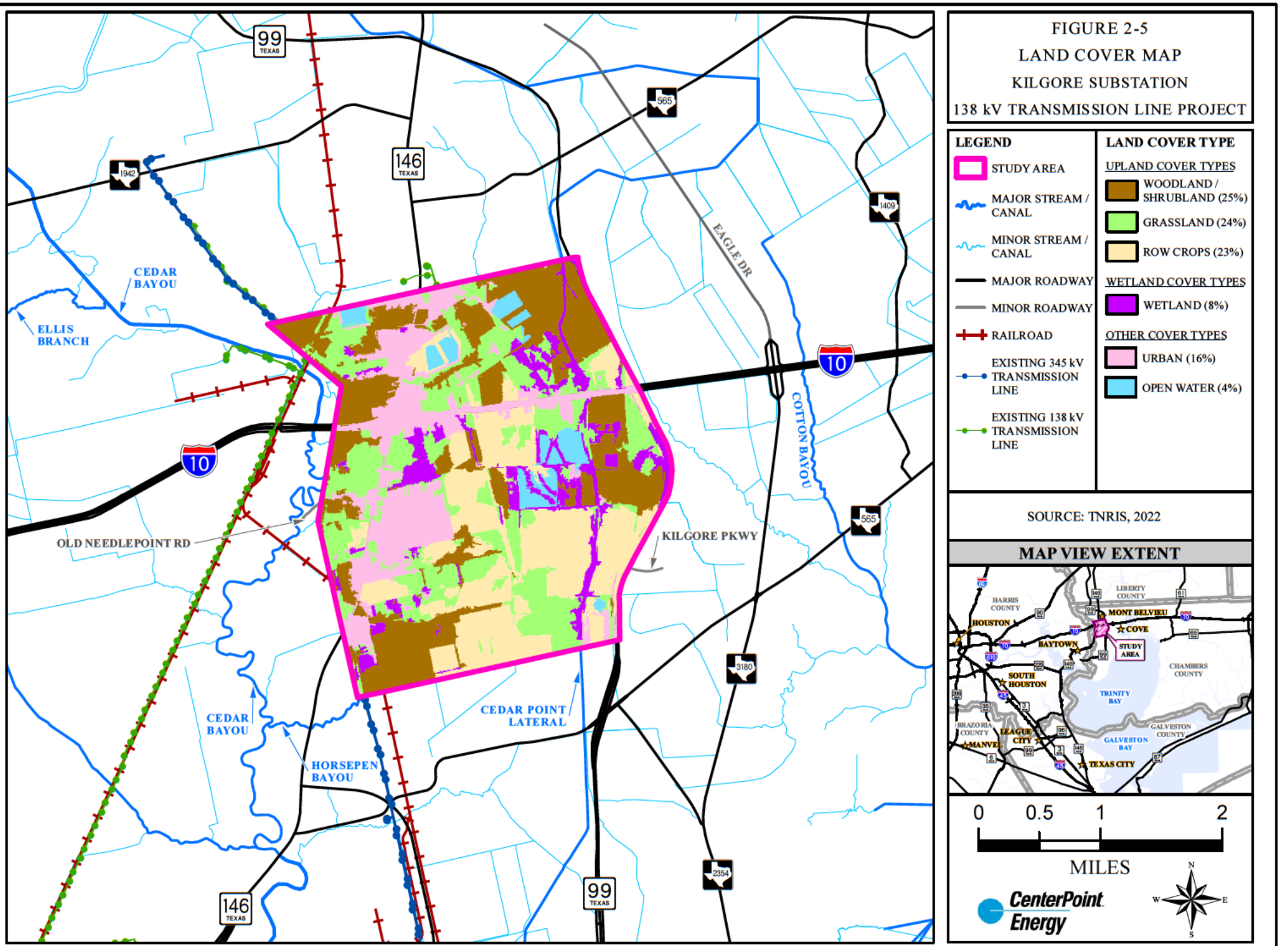
FIGURE 2-5
LAND COVER MAP
KILGORE SUBSTATION
138 kV TRANSMISSION LINE PROJECT
LEGEND
STUDY AREA
MAJOR STREAM / CANAL
MINOR STREAM / CANAL
MAJOR ROADWAY
MINOR ROADWAY
RAILROAD
EXISTING 345 kV TRANSMISSION LINE
EXISTING 138 kV TRANSMISSION LINE
LAND COVER TYPE
UPLAND COVER TYPES
WOODLAND / SHRUBLAND (25%)
GRASSLAND (24%)
ROW CROPS (23%)
WETLAND COVER TYPES
WETLAND (8%)
OTHER COVER TYPES
URBAN (16%)
OPEN WATER (4%)
SOURCE: TNRIS, 2022
MAP VIEW EXTENT
HARRIS COUNTY
LIBERTY COUNTY
HOUSTON
MONT BELVIEU
COVE
BAYTOWN
STUDY AREA
CHAMBERS COUNTY
SOUTH HOUSTON
TRINITY BAY
BRAZORIA COUNTY
LEAGUE CITY
MANVEL
GALVESTON BAY
GALVESTON COUNTY
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ELLIS BRANCH
OLD NEEDLEPOINT RD
KILGORE PKWY
EAGLE DR
COTTON BAYOU
CEDAR POINT LATERAL
HORSEPEN BAYOU
99 TEXAS
146 TEXAS
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The Chenier Plain: Mixed Live Oak – Deciduous Hardwood Fringe Forest EMST cover type is comprised of woody vegetation, generally a mix of deciduous and evergreen species. This cover type is scattered in isolated habitat fragments throughout the study area and represents less than one percent of the overall cover type.

The Native Invasive: Deciduous Woodland EMST cover type is a broadly defined woodland area with woody vegetation, generally deciduous. This cover type is found primarily in the eastern half of the study area and represents less than one percent of the overall cover type.

The Chenier Plain: Live Oak Fringe Forest EMST cover type is dominated by coastal live oak (*Quercus virginiana*). Approximately three percent of the Western Gulf Coastal Plain Chenier and Upper Texas Coast Fringe Forest and Woodland system is mapped as the Chenier Plain: Live Oak Fringe Forest cover type located in the central-western portion of the study area. This cover type represents less than one percent of the overall cover type.

The Native Invasive: Juniper Shrubland EMST cover type are typified by the prevalence of juniper species (*Juniperus* spp.), particularly eastern redcedar (*Juniperus virginiana*) located in the south-central portion of the study area among habitat fragments. This cover type represents less than one percent of the overall cover type.

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Table 2-12. Upland Woodland or Shrubland Cover Types

Common Name	Scientific Name	EMST Cover Type[1]					
		Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland	Pine Plantation greater than 3 meters tall	Chenier Plain: Mixed Live Oak – Deciduous Hardwood Fringe Forest	Native Invasive: Deciduous Woodland	Chenier Plain: Live Oak Fringe Forest	Native Invasive: Juniper Shrubland
Major Associated Woody Plants							
American beautyberry	*Callicarpa americana*			X			
Ashes	*Fraxinus* spp.				X		
Ashe juniper	*Juniperus ashei*						X
Baccharis	*Baccharis* spp.	X					
Blackgum	*Nyssa sylvatica*		X				
Cedar elm	*Ulmus crassifolia*	X			X		X
Chinese privet	*Ligustrum sinense*	X		X			
Chinese tallow	*Triadica sebifera*	X		X			
Coastal live oak	*Quercus virginiana*	X	X	X	X	X	
Colima	*Zanthoxylum fagara*				X		
Dwarf palmetto	*Sabal minor*			X			
Eastern redcedar	*Juniperus virginiana*		X		X		X
Granjeno	*Celtis ehrenbergiana*				X		
Green ash	*Fraxinus pennsylvanica*			X			
Green hawthorn	*Crataegus viridis*			X			
Gum bumelia	*Sideroxylon lanuginosum*			X			
Hercules-club pricklyash	*Zanthoxylum clava-herculis*			X			
Honey mesquite	*Prosopis glandulosa*	X			X		X
Huisache	*Acacia farnesiana*	X			X		
Juniper species	*Juniperus* spp.						X
Laurel oak	*Quercus laurifolia*			X			
Loblolly pine	*Pinus taeda*	X	X		X		X
Macartney rose	*Rosa bracteate*	X					
Pecan	*Carya illinoinensis*			X			
Plateau live oak	*Quercus fusiformis*	X	X		X		
Post oak	*Quercus stellata*		X		X		
Redberry juniper	*Juniperus pinchotii*						X
Shortleaf pine	*Pinus echinate*		X				
Slash pine	*Pinus elliottii*		X				
Southern magnolia	*Magnolia grandiflora*			X			
Southern red oak	*Quercus falcata*		X				
Sugar hackberry	*Celtis laevigata*	X		X	X		X
Sweetgum	*Liquidambar styraciflua*	X	X	X	X		X
Texas persimmon	*Diospyros texana*				X		

Table 2-12. Upland Woodland or Shrubland Cover Types

Common Name	Scientific Name	EMST Cover Type[1]					
		Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland	Pine Plantation greater than 3 meters tall	Chenier Plain: Mixed Live Oak – Deciduous Hardwood Fringe Forest	Native Invasive: Deciduous Woodland	Chenier Plain: Live Oak Fringe Forest	Native Invasive: Juniper Shrubland
Water oak	*Quercus nigra*	X	X	X	X		X
Wax-myrtle	*Morella cerifera*			X			
White oak	*Quercus alba*		X				
Willow oak	*Quercus phellos*	X		X			
Winged elm	*Ulmus alata*				X		X
Yaupon	*Ilex vomitoria*	X	X	X	X		X

SOURCES: Elliott, 2014; Griffith et al., 2007; NRCS, 2022b; TPWD, 1984; TPWD, 2011; TPWD, 2014; TPWD, 2022e.
NOTES:
1. Potential presence of a species within an EMST cover type is denoted with an 'X.'
Vegetation is categorized by major associations that correlate with either: grass species, forb, or herbaceous species (i.e., non-woody plants), woody plant species (e.g., trees or shrubs), vine species, or succulent species. Not all of these major associated plant classes may be present in a given EMST cover type.

Upland grassland is the second most dominant cover type found throughout the study area. A list of major associated species for the upland grassland EMST cover type is available in **Table 2-13**. This land cover type is composed of two EMST cover types (in order of prevalence):

- Gulf Coast: Coastal Prairie; and
- Pineywoods: Disturbance or Tame Grassland.

The Gulf Coast: Coastal Prairie EMST cover type is the most prevalent cover type within the study area. It is a good representation of the parent system Texas-Louisiana Coast Prairie, which is a mid- to tallgrass prairie dominated by graminoid species. Some woody vegetation that can be found in this cover type can include Chinese tallow, honey mesquite, or sugar hackberry.

The Pineywoods: Disturbance or Tame Grassland EMST cover type is the least prominent cover type found in the eastern half of the study area adjacent to the Cedar Point Lateral and comprising less than one percent of the overall cover type. Generally, this cover type is found in areas where woody vegetation would naturally exist but has experienced disturbances, such as fire. Non-native grasses dominate this cover type over native grasses. With no management or other disturbances woody vegetation will increase significantly.

Table 2-13. Upland Grassland Cover Types

COMMON NAME	SCIENTIFIC NAME	EMST COVER TYPE[1]	
		GULF COAST: COASTAL PRAIRIE	PINEYWOODS: DISTURBANCE OR TAME GRASSLAND
Major Associated Grasses			
Bahiagrass	*Paspalum notatum*	X	X
Beaksedges	*Rhynchospora* spp.	X	
Bermuda grass	*Cynodon dactylon*	X	X
Big bluestem	*Andropogon gerardii*	X	
Broomsedge bluestem	*Andropogon virginicus*	X	X
Brownseed paspalum	*Paspalum plicatulum*	X	
Bushy bluestem	*Andropogon glomeratus*	X	
Carpetgrasses	*Axonopus* spp.	X	
Dallisgrass	*Paspalum dilatatum*	X	
Deep-rooted sedge	*Cyperus entrerianus*	X	
Eastern gamagrass	*Tripsacum dactyloides*	X	
Fewflower panicgrass	*Dichanthelium oligosanthes*	X	
Florida paspalum	*Paspalum floridanum*	X	
Gulf muhly	*Muhlenbergia capillaris*	X	
Hairy fimbry	*Fimbristylis puberula*	X	
Indiangrass	*Sorghastrum nutans*	X	
Italian ryegrass	*Lolium perenne*	X	X

Table 2-13. Upland Grassland Cover Types

COMMON NAME	SCIENTIFIC NAME	EMST COVER TYPE[1]	
		GULF COAST: COASTAL PRAIRIE	PINEYWOODS: DISTURBANCE OR TAME GRASSLAND
King Ranch bluestem	*Bothriochloa ischaemum*	X	
Little bluestem	*Schizachyrium scoparium*	X	X
Longspike tridens	*Tridens strictus*	X	
Old world bluestems	*Dichanthium* spp.	X	
Rat-tail smutgrass	*Sporobolus indicus*	X	
Rescuegrass	*Bromus catharticus*		X
Sideoats grama	*Bouteloua curtipendula*	X	
Silver bluestem	*Bothriochloa laguroides* sspp. *torreyana*	X	
Switchgrass	*Panicum virgatum*	X	
Tall dropseed	*Sporobolus compositus*	X	
Tall fescue	*Schedonorus phoenix*	X	X
Texas wintergrass	*Nassella leucotricha*	X	
Thin paspalum	*Paspalum setaceum*	X	
Major Associated Herbaceous and Forbs			
Blackeyed Susan	*Rudbeckia hirta*	X	
Button snakeroot	*Eryngium yuccifolium*	X	
Compassplant	*Silphium laciniatum*	X	
Gayfeathers	*Liatris* spp.	X	
Goldenrods	*Solidago* spp.	X	
Goldentops	*Euthamia* spp.	X	
Green milkweed	*Asclepias viridis*	X	
Heath aster	*Symphyotrichum ericoides*	X	
Low wild petunia	*Ruellia humilis*	X	
Meadow pink	*Sabatia campestris*	X	
Mexican hat	*Ratibida columnifera*	X	
Narrowleaf sumpweed	*Iva angustifolia*	X	
Narrowleaf sunflower	*Helianthus angustifolius*	X	
Partridge pea	*Chamaecrista fasciculata*	X	
Smallhead doll's daisy	*Boltonia diffusa*	X	
Snow-on-the-prairie	*Euphorbia bicolor*	X	
Western ragweed	*Ambrosia psilostachya*	X	
Wild indigos	*Baptisia* spp.	X	
Yellow neptunia	*Neptunia lutea*	X	
Major Associated Woody Plants			
Baccharis	*Baccharis halimifolia*	X	
Chinese tallow	*Triadica sebifera*	X	
Honey mesquite	*Prosopis glandulosa*	X	
Huisache	*Acacia farnesiana*	X	
Macartney rose	*Rosa bracteata*	X	
Sugar hackberry	*Celtis laevigata*	X	

SOURCES: Elliott, 2014; Griffith et al., 2007; NRCS, 2022b; TPWD, 1984; TPWD, 2011; TPWD, 2014; TPWD, 2022e.
NOTES:
1. Potential presence of a species within an EMST cover type is denoted with an 'X.'
- Vegetation is categorized by major associations that correlate with either: grass species, forb or herbaceous species (i.e., non-woody plants), woody plant species (e.g., trees or shrubs), vine species, or succulent species. Not all of these major associated plant classes may be present in a given EMST cover type.

The row crop cover type includes the cropland, converted previous agricultural land, and maintained greenspaces where Bermuda grass is the dominant ground cover (e.g., golf course fairways, parks, etc.). Agriculture cover types are concentrated in the eastern and southern portions of the study area.

The urban cover type includes areas where little or no vegetation cover existed at the time of image data collection and are located generally along major throughfare corridors of SHs and IHs. The barren cover type is dominated by predominantly unvegetated development areas. Barren land within the study area is proportionately small compared to other cover types. Urban landscape in relation to this study area constitutes developed land that has been built on but is not entirely covered with impervious surfaces. Urban landscape incorporates the City of Mont Belvieu, the City of Baytown, and residential neighborhoods located throughout the western portion of the study area.

The wetland cover type is found throughout the study area. A list of major associated species for the wetland EMST cover type is available in **Table 2-14**. This cover type is composed of four EMST cover types (in order of prevalence):

1) Gulf Coast: Coastal Prairie Pondshore;
2) Marsh;
3) Pineywoods: Wet Hardwood Flatwoods; and
4) Swamp.

The Gulf Coast: Coastal Prairie Pondshore EMST cover type is found throughout the study area. It is a good representation of the parent system Texas-Louisiana Coastal Prairie Pondshore that occurs in ponds or swales within the coastal prairie matrix which has poorly drained soils. This wetland system is dominated by herbaceous vegetation but can have sparse wood vegetation. Most of the wetland cover type depicted in **Figure 2-5** is represented by this cover type.

The Marsh EMST cover type is dominated by herbaceous vegetation and shrubs such as cattails (*Typha* spp.), common buttonbush (*Cephalanthus occidentalis*), and black willow (*Salix nigra*). This cover type is concentrated along the Cedar Point Lateral stream that crosses the eastern portion of the study area.

The Pineywoods: Wet Hardwood Flatwoods EMST cover type is found within the northeastern and southwestern corners of the study area. It is a good representation of the parent system (i.e., West Gulf Plain Nonriverine Wet Hardwood Flatwoods), which occurs within low positions of swales and other wet environments. Oak species (*Quercus* spp.) dominate the closed canopy of this cover type leaving an under-developed herbaceous layer.

The Swamp EMST cover type is dominated by woody vegetation and occurs at the upper ends of reservoirs, stock tanks, or stock ponds. Common species include American elm, cedar elm, black willow, and common buttonbush. It is found in the eastern portion of the study area making up less than one percent of the EMST cover types.

Table 2-14. Wetland Cover Types

COMMON NAME	SCIENTIFIC NAME	EMST COVER TYPE [1]			
		GULF COAST: COASTAL PRAIRIE PONDSHORE	MARSH	PINEYWOODS: WET HARDWOOD FLATWOODS	SWAMP
Major Associated Grasses					
Beaksedges	*Rhynchospora* spp.	X			
Bermuda grass	*Cynodon dactylon*		X		
Bulrushes	*Schoenoplectus* spp.		X		
Bushy bluestem	*Andropogon glomeratus*	X			
Cattails	*Typha* spp.		X		
Clubhead cutgrass	*Leersia hexandra*	X			
Eastern gamagrass	*Tripsacum dactyloides*	X			
Erect centella	*Centella erecta*	X			
Gaping panicum	*Steinchisma hians*	X			
Green flatsedge	*Cyperus virens*	X			
Hairy umbrellasedge	*Fuirena squarrosa*	X			
Johnsongrass	*Sorghum halepense*		X		
Nipplebract arrowhead	*Sagittaria papillosa*	X			
Richard's yellow-eyed grass	*Xyris jupicai*	X			
Sheathed umbrellasedge	*Cyperus haspan*	X			
Smartweeds	*Polygonum* spp.		X		
Spikerushes	*Eleocharis* spp.		X		
Squarestem spikesedge	*Eleocharis quadrangulata*	X			
Switchgrass	*Panicum virgatum*	X			
Major Associated Herbaceous and Forbs					
Coontail	*Ceratophyllum demersum*	X			
Hierba del marrano	*Symphyotrichum subulatum*	X			
Largeleaf floating heart	*Nymphoides aquatica*	X			
Longlobe arrowhead	*Sagittaria longiloba*	X			
Narrowleaf water-primrose	*Ludwigia linearis*	X			
Pennyworts	*Hydrocotyle* spp.	X			
Rattleboxes	*Sesbania* spp.	X			
Sago pondweed	*Stuckenia pectinata*	X			
Schreber watershield	*Brasenia schreberi*	X			
Torrey water-primrose	*Ludwigia glandulosa*	X			
Waterhyssops	*Bacopa* spp.	X			

Table 2-14. Wetland Cover Types

COMMON NAME	SCIENTIFIC NAME	EMST COVER TYPE [1]			
		GULF COAST: COASTAL PRAIRIE PONDSHORE	MARSH	PINEYWOODS: WET HARDWOOD FLATWOODS	SWAMP
Yellow lotus	*Nelumbo lutea*	X			
Major Associated Woody Plants					
American elm	*Ulmus americana*				X
Baldcypress	*Taxodium distichum*				X
Black willow	*Salix nigra*		X		X
Bur oak	*Quercus macrocarpa*				X
Cedar elm	*Ulmus crassifolia*				X
Chinese tallow	*Triadica sebifera*			X	
Common buttonbush	*Cephalanthus occidentalis*		X		X
Laurel oak	*Quercus laurifolia*			X	
Loblolly pine	*Pinus taeda*			X	
Overcup oak	*Quercus lyrate*			X	
Swamp chestnut oak	*Quercus michauxii*			X	
Sweetgum	*Liquidambar styraciflua*			X	X
Water oak	*Quercus nigra*			X	X
Willow oak	*Quercus phellos*			X	
Winged elm	*Ulmus alata*			X	

SOURCES: Elliott, 2014; Griffith et al., 2007; NRCS, 2022b; TPWD, 1984; TPWD, 2011; TPWD, 2014; TPWD, 2022e.
NOTES:
1. Potential presence of a species within an EMST cover type is denoted with an 'X.'
Vegetation is categorized by major associations that correlate with either: grass species, forb, or herbaceous species (i.e., non-woody plants), woody plant species (e.g., trees or shrubs), vine species, or succulent species. Not all of these major associated plant classes may be present in a given EMST cover type.

Open water is the smallest cover type reparented in the study area. It is comprised of stock ponds and water treatment ponds not affiliated with the streams and canals within the study area.

2.4.4.3 Wetlands

Wetland information for the study area was obtained through the USFWS NWI database. A review of the NWI database indicated numerous mapped wetland types within the study area including freshwater forested and scrub wetlands ("PFO" and "PSS"), freshwater emergent wetlands ("PEM"), freshwater ponds ("PUB" and "PAB"), riverine ("R"), lake ("L"), and other ("Pf") systems (USFWS, 2023a).

2.4.4.4 Wildlife and Fisheries

2.4.4.4.1 Terrestrial Wildlife

A wide variety of vertebrate species including amphibians, reptiles, mammals, and birds may occur throughout the study area. These animals are addressed below in two groups: commonly occurring (i.e., "common") species; and species that are considered threatened, endangered, or

rare by TPWD or USFWS. The information about common wildlife species presented in **Tables 2-15 through 2-23** are generally based on reference sources that provide species distribution information on a county-by-county basis. Species with broad habitat requirements or not geographically bound within Chambers County may be expected to occur within the study area, where suitable habitat is present.

Habitat types for the wildlife discussed below are grouped into seven general categories: woodland; desert; shrubland; open; water; cultivated; and urban. Woodland habitat is home to species that live on or in the ground within forested areas or are arboreal in nature. Woodlands may also include riparian forest areas found in stream floodplains that may overlap water habitats to some extent. Deserts are found in arid regions and may contain a mix of grassland, shrubland, or open habitat. Shrubland habitat is dominated by woody vegetation but is generally low-growing and lacks taller trees. Open habitat includes grasslands or arid/semi-arid rocky areas. Water habitat is for all aquatic species, in addition to those which live exclusively near water (e.g., frogs or wading birds). Cultivated areas consist of row crops, orchards, or grain fields. Hay meadows were excluded from the cultivated habitat type and characterized as grassland habitat. Urban habitats are favored by those animals which thrive in man-made environments and succeed in disturbed areas.

Amphibians

Amphibian species native to Texas include caudate species (i.e., salamanders and newts) and anuran species (i.e., frogs and toads). Salamanders and newts are restricted to aquatic or moist habitats, but some frogs or toads inhabit more arid environments. All species require water during reproduction, either during the act of mating or for rearing young. Amphibians are ectothermic (i.e., "cold blooded," lacking the ability to internally regulate body temperature) and are particularly vulnerable to pollution because they respire through their skin. Refer to **Table 2-15** for the amphibian species known to occur within Chambers County.

Table 2-15. Amphibian Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	HABITAT PREFERENCE(S)
Order: Anura (frogs and toads)		
American bullfrog	*Lithobates catesbeianus*	Water
American green treefrog	*Dryophytes cinereus*	Water
Bronze frog	*Lithobates clamitans*	Water – Woodland
Cajun chorus frog	*Pseudacris fouquettei*	Open – Shrubland – Woodland – Water
Couch's spadefoot toad	*Scaphiopus couchii*	Open
Crawfish frog	*Lithobates areolatus*	Open – Water – Woodland
Cricket frog	*Acris crepitans*	Shrubland – Woodland – Water
Eastern narrowmouth toad	*Gastrophryne carolinensis*	Shrubland – Woodland – Water
Gray treefrog	*Dryophytes versicolor*	Woodland – Water
Great Plains narrow-mouthed toad	*Gastrophryne olivacea*	Open
Green treefrog	*Dryophytes cinereus*	Woodland - Water
Gulf coast toad	*Incilius valliceps*	Cultivated
Hurter's spadefoot	*Scaphiopus hurterii*	Open – Shrubland – Woodland – Water
Pickerel frog	*Lithobates palustris*	Water – Open – Woodland
Red-spotted toad	*Anaxyrus punctatus*	Open
Southern crawfish frog	*Lithobates areolatus areolatus*	Open – Water – Woodland
Southern leopard frog	*Lithobates sphenocephalus*	Water – Woodland – Shrubland
Spotted chorus frog	*Pseudacris clarkii*	Open – Shrubland – Water
Spring peeper	*Pseudacris crucifer*	Water - Woodland
Squirrel treefrog	*Dryophytes squirellus*	Water – Open - Woodland
Strecker's chorus frog	*Pseudacris streckeri*	Open – Shrubland – Woodland – Water
Texas toad	*Anaxyrus speciosus*	Open – Cultivated
Upland chorus frog	*Pseudacris feriarum*	Water - Open
Woodhouse's toad	*Anaxyrus woodhousii*	Open – Water
Order: Caudata (salamanders and newts)		
Eastern newt	*Notophthalmus viridescens*	Water – Woodland
Lesser siren	*Siren intermedia*	Water
Marbled salamander	*Ambystoma opacum*	Woodland - Water
Small-mouthed salamander	*Ambystoma texanum*	Water – Woodland
Southern dusky salamander	*Desmognathus auriculatus*	Woodland - Water
SOURCES: AmphibiaWeb, 2022; Conant and Collins, 1998; International Union for Conservation of Nature and Natural Resources (IUCN), 2022.		

Reptiles

Reptile species native to the Gulf Coast of Texas include turtles, snakes, and lizards. Reptiles have thick, scaly skin to protect their bodies. Most lay soft, leathery eggs, although some bear live young. Reptiles, like amphibians, are ectothermic. Refer to **Table 2-16** for reptile species known to occur within Chambers County.

Table 2-16. Reptile Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	HABITAT PREFERENCE(S)
Order: Crocodylia (crocodilians)		
American alligator	Alligator mississippiensis	Water
Order: Squamata (snakes and lizards)		
Broadhead skink	*Plestiodon laticeps*	Woodland – Water
Central plains milksnake	*Lampropeltis gentilis*	Open – Shrubland – Woodland
Coachwhip	*Masticophis flagellum*	Open – Desert
Common kingsnake	*Lampropeltis getula*	Open – Shrubland – Woodland Water
Copperhead	*Agkistrodon contortrix*	Woodland – Water
Cottonmouth	*Agkistrodon piscivorus*	Shrubland – Woodland – Water
Crayfish snake	*Liodytes rigida*	Water – Shrubland - Woodland
Diamond-backed watersnake	*Nerodia rhombifer*	Water
Dusty hognose snake	*Heterodon gloydi*	Open
Eastern garter snake	*Thamnophis sirtalis sirtalis*	Open
Eastern hognose snake	*Heterodon platirhinos*	Open – Shrubland – Woodland
Eastern yellowbelly racer	*Coluber constrictor flaviventris*	Open – Shrubland – Woodland
Five-lined skink	*Plestiodon fasciatus*	Woodland – Water
Flathead snake	*Tantilla gracilis*	Open – Shrubland – Woodland
Florida redbelly snake	*Storeria occipitomaculata subsp. obscura*	Woodland - Open
Graham's crayfish snake	*Regina grahamii*	Water
Great Plains ratsnake	*Pantherophis emoryi*	Open
Green anole	*Anolis carolinensis*	Shrubland – Woodland – Water Urban
Ground skink	*Scincella lateralis*	Woodland
Gulf salt marsh snake	*Nerodia clarkii clarkii*	Water
Marsh brown snake	*Storeria dekayi*	Water - Woodland
Mediterranean house gecko	*Hemidactylus turcicus*	Urban
Mississippi Green Watersnake	*Nerodia cyclopion*	Water – Woodland
North American racer	*Coluber constrictor*	Open – Shrubland – Woodland
Northern fence lizard	*Sceloporus undulatus subsp. hyacinthinus*	Woodland
Plain-bellied watersnake	*Nerodia erythrogaster*	Water
Prairie lizard	*Sceloporus undulatus*	Open
Prairie racerunner	*Aspidoscelis sexlineata viridis*	Open
Pygmy rattlesnake	*Sistrurus miliarius*	Woodland – Water
Red-belled mudsnake	*Farancia abacura*	Water
Ring-necked snake	*Diadophis punctatus*	Open
Rough earthsnake	*Virginia striatula*	Open – Shrubland – Woodland
Rough green snake	*Opheodrys aestivus*	Open – Shrubland – Woodland Water
Slender glass lizard	*Ophisaurus attenuates*	Open – Woodland
Smooth earthsnake	*Virginia valeriae*	Open – Woodland
Smooth green snake	*Opheodrys vernalis*	Woodland – Open - Shrubland
Southern prairie skink	*Plestiodon septentrionalis*	Open – Woodland – Urban
Southern watersnake	*Nerodia fasciata*	Water

Table 2-16. Reptile Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	HABITAT PREFERENCE(S)
Speckled kingsnake	*Lampropeltis holbrooki*	Open – Shrubland – Woodland Water
Texas blind snake	*Rena dulcis*	Desert – Open
Texas brown snake	*Storeria dekayi texana*	Water – Woodland – Urban
Order: Squamata (snakes and lizards) continued		
Texas coral snake	*Micrurus tener*	Open – Shrubland – Woodland Water
Texas horned lizard	*Phrynosoma cornutum*	Open
Timber rattlesnake	*Crotalus horridus*	Woodland – Water
Texas ratsnake	*Pantherophis obsoletus*	Open – Shrubland – Woodland Water
Texas spiny lizard	*Sceloporus olivaceus*	Open – Woodland – Urban
Texas spotted whiptail	*Aspidoscelis gularis*	Open -- Shrubland
Western diamondback rattlesnake	*Crotalus atrox*	Open
Western hognose snake	*Heterodon nasicus*	Open - Woodland
Western Massasauga	*Sistrurus tergeminus*	Woodland – Open
Western ribbonsnake	*Thamnophis proximus*	Water
Yellow-bellied kingsnake	*Lampropeltis calligaster*	Open – Shrubland – Woodland
Order: Testudines (turtles)		
Alligator snapping turtle	*Macrochelys temminckii*	Water
Chicken turtle	*Deirochelys reticularia*	Water
Common snapping turtle	*Chelydra serpentina*	Water
Eastern box turtle	*Terrapene carolina*	Shrubland – Woodland – Water
Eastern mud turtle	*Kinosternon subrubrum*	Shrubland – Woodland – Water
Eastern musk turtle	*Sternotherus odoratus*	Water
Mississippi map turtle	*Graptemys pseudogeographica*	Water
Ornate box turtle	*Terrapene ornata ornata*	Open
Razor-backed musk turtle	*Sternotherus carinatus*	Water
Red-eared slider	*Trachemys scripta*	Water
River cooter	*Pseudemys concinna*	Water
Smooth softshell	*Apalone mutica*	Water
Spiny softshell	*Apalone spinifera*	Water
Texas diamond-backed terrapin	*Malaclemys terrapin littoralis*	Water
SOURCES: Conant and Collins, 1998; Global Biodiversity Information Facility (GBIF), 2022; iNaturalist, 2022; IUCN, 2022; NatureServe Explorer, 2022; Texas Turtles, 2022.		

Birds

Birds differ from other animal groups in that feathers cover part or all of their bodies, and they lay hard, calcium-rich eggs. **Tables 2-17 through 2-20** present bird species, which could occur in the study area at various times throughout the year. Refer to the tables divided into groups based on residency: permanent residents (**Table 2-17**); breeding (i.e., summer) residents (**Table 2-18**); winter residents (**Table 2-19**); and those which migrate through the area between their breeding and winter grounds (**Table 2-20**).

Table 2-17. Bird Species which may Permanently Reside within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Anhinga	*Anhinga anhinga*	Suliformes	Water
American coot	*Fulica americana*	Gruiformes	Water
American crow	*Corvus brachyrhynchos*	Passeriformes	Woodland – Urban
American oystercatcher	*Haematopus palliatus*	Charadriiformes	Water
American robin	*Turdus migratorius*	Passeriformes	Open – Woodland
Barn owl	*Tyto alba*	Strigiformes	Woodland – Urban
Barred owl	*Strix varia*	Strigiformes	Woodland
Belted kingfisher	*Megaceryle alcyon*	Coraciiformes	Water
Bewick's wren	*Thryomanes bewickii*	Passeriformes	Woodland
Black-bellied whistling-duck	*Dendrocygna autumnalis*	Anseriformes	Water – Woodland
Black-crowned night-heron	*Nycticorax nycticorax*	Pelecaniformes	Water
Black-necked stilt	*Himantopus mexicanus*	Charadriiformes	Water
Black skimmer	*Rynchops niger*	Charadriiformes	Water
Black vulture	*Coragyps atratus*	Cathartiformes	Open
Blue-gray gnatcatcher	*Polioptila caerulea*	Passeriformes	Woodland
Blue jay	*Cyanocitta cristata*	Passeriformes	Woodland
Blue-winged teal	*Anas discors*	Anseriformes	Water
Boat-tailed grackle	*Quiscalus major*	Passeriformes	Water – Open – Urban
Brown-headed cowbird	*Molothrus ater*	Passeriformes	Woodland – Open
Brown thrasher	*Toxostoma rufum*	Passeriformes	Shrubland
Carolina chickadee	*Poecile carolinensis*	Passeriformes	Open – Woodland – Urban
Carolina wren	*Thryothorus ludovicianus*	Passeriformes	Woodland
Caspian tern	*Hydroprogne caspia*	Charadriiformes	Water
Cassin's sparrow	*Peucaea cassinii*	Passeriformes	Shrubland
Cattle egret	*Bubulcus ibis*	Pelecaniformes	Open – Water
Clapper rail	*Rallus crepitans*	Gruiformes	Water – Open
Common gallinule	*Gallinula galeata*	Gruiformes	Water
Common grackle	*Quiscalus quiscula*	Passeriformes	Open – Urban
Common ground dove	*Columbina passerina*	Columbiformes	Open – Woodland
Common moorhen	*Gallinula chloropus*	Gruiformes	Water
Common yellowthroat	*Geothlypis trichas*	Passeriformes	Shrubland
Crested caracara	*Caracara cheriway*	Falconiformes	Desert – Open – Shrubland
Curve-billed thrasher	*Toxostoma curvirostre*	Passeriformes	Shrubland - Desert
Double-crested cormorant	*Phalacrocorax auritus*	Suliformes	Water
Downy woodpecker	*Dryobates pubescens*	Piciformes	Woodland
Eastern bluebird	*Sialia sialis*	Passeriformes	Woodland
Eastern meadowlark	*Sturnella magna*	Passeriformes	Open
Eastern screech-owl	*Megascops asio*	Strigiformes	Woodland
Eurasian-collared dove	*Streptopelia decaocto*	Columbiformes	Urban
European starling	*Sturnus vulgaris*	Passeriformes	Woodland – Urban
Forster's tern	*Sterna forsteri*	Charadriiformes	Water

Table 2-17. Bird Species which may Permanently Reside within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Glossy ibis	*Plegadis falcinellus*	Pelecaniformes	Water
Grasshopper sparrow	*Ammodramus savannarum*	Passeriformes	Open
Great blue heron	*Ardea herodias*	Pelecaniformes	Water
Great egret	*Ardea alba*	Pelecaniformes	Water
Greater roadrunner	*Geococcyx californianus*	Cuculiformes	Woodland – Open barn
Great horned owl	*Bubo virginianus*	Strigiformes	Woodland – Open – Urban
Great-tailed grackle	*Quiscalus mexicanus*	Passeriformes	Open – Urban
Green heron	*Butorides virescens*	Pelecaniformes	Water
Gull-billed tern	*Gelochelidon nilotica*	Charadriiformes	Open – Water
Hairy woodpecker	*Dryobates villosus*	Piciformes	Woodland
Horned lark	*Eremophila alpestris*	Passeriformes	Open
House finch	*Haemorhous mexicanus*	Passeriformes	Woodland – Open – Urban
House sparrow	*Passer domesticus*	Passeriformes	Urban
Inca dove	*Columbina inca*	Columbiformes	Urban
Killdeer	*Charadrius vociferus*	Charadriiformes	Open
King rail	*Rallus elegans*	Gruiformes	Water
Ladder-backed woodpecker	*Picoides scalaris*	Piciformes	Shrubland
Laughing gull	*Leucophaeus atricilla*	Charadriiformes	Open
Least bittern	*Ixobrychus exilis*	Pelecaniformes	Water
Little blue heron	*Egretta caerulea*	Pelecaniformes	Water
Loggerhead shrike	*Lanius ludovicianus*	Passeriformes	Open
Mottled duck	*Anas fulvigula*	Anseriformes	Water
Mourning dove	*Zenaida macroura*	Columbiformes	Woodland – Open – Urban
Neotropic cormorant	*Phalacrocorax brasilianus*	Suliformes	Water
Northern bobwhite	*Colinus virginianus*	Galliformes	Open
Northern cardinal	*Cardinalis cardinalis*	Passeriformes	Woodland
Northern flicker	*Colaptes auratus*	Piciformes	Woodland
Northern mockingbird	*Mimus polyglottos*	Passeriformes	Woodland – Open – Urban
Northern rough-winged swallow	*Stelgidopteryx serripennis*	Passeriformes	Water
Pied-billed grebe	*Podilymbus podiceps*	Podicipediformes	Water
Pileated woodpecker	*Dryocopus pileatus*	Piciformes	Woodland
Red-bellied woodpecker	*Melanerpes carolinus*	Piciformes	Woodland
Reddish egret	*Egretta rufescens*	Pelecaniformes	Water
Red-headed woodpecker	*Melanerpes erythrocephalus*	Piciformes	Woodland
Red-shouldered hawk	*Buteo lineatus*	Accipitriformes	Woodland
Red-tailed hawk	*Buteo jamaicensis*	Falconiformes	Woodland – Open
Red-winged blackbird	*Agelaius phoeniceus*	Passeriformes	Open
Rock dove	*Columba livia*	Columbiformes	Open – Urban
Roseate spoonbill	*Platalea ajaja*	Pelecaniformes	Water – Woodland
Royal tern	*Thalasseus maximus*	Charadriiformes	Open – Water
Sandwich tern	*Thalasseus sandvicensis*	Charadriiformes	Open – Water
Seaside sparrow	*Ammospiza maritima*	Passeriformes	Water
Snowy egret	*Egretta thula*	Pelecaniformes	Water
Tricolored heron	*Egretta tricolor*	Pelecaniformes	Water
Tufted titmouse	*Baeolophus bicolor*	Passeriformes	Woodland – Urban
Turkey vulture	*Cathartes aura*	Falconiformes	Woodland – Open – Urban
White-eyed vireo	*Vireo griseus*	Passeriformes	Shrubland
White-faced ibis	*Plegadis chihi*	Pelecaniformes	Water
White ibis	*Eudocimus albus*	Pelecaniformes	Water
White-tailed hawk	*Geranoaetus albicaudatus*	Accipitriformes	Woodland – Open
White-tailed kite	*Elanus leucurus*	Accipitriformes	Open – Woodland
White-winged dove	*Zenaida asiatica*	Columbiformes	Woodland – Open
Wild turkey	*Meleagris gallopavo*	Galliformes	Open – Woodland
Willet	*Tringa semipalmata*	Charadriiformes	Water

Table 2-17. Bird Species which may Permanently Reside within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Wood duck	*Aix sponsa*	Anseriformes	Water – Woodland

SOURCES: Cornell Lab of Ornithology (Cornell), 2022; eBird, 2022; IUCN, 2022; NatureServe Explorer, 2022; Sibley, 2003.
NOTE: Any species determined to potentially reside within the study area permanently may also breed within the study area.

Table 2-18. Bird Species which may Breed within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Ash-throated flycatcher	*Myiarchus cinerascens*	Passeriformes	Woodland – Shrubland
Barn swallow	*Hirundo rustica*	Passeriformes	Open – Urban
Bell's vireo	*Vireo bellii*	Passeriformes	Shrubland
Black-and-white warbler	*Mniotilta varia*	Passeriformes	Woodland
Black-chinned hummingbird	*Archilochus alexandri*	Caprimulgiformes	Woodland
Blue grosbeak	*Passerina caerulea*	Passeriformes	Woodland
Cave swallow	*Petrochelidon fulva*	Passeriformes	Open
Chimney swift	*Chaetura pelagica*	Caprimulgiformes	Open – Urban
Chuck-will's-widow	*Antrostomus carolinensis*	Caprimulgiformes	Woodland
Cliff swallow	*Petrochelidon pyrrhonota*	Passeriformes	Open – Water
Common nighthawk	*Chordeiles minor*	Caprimulgiformes	Open
Dickcissel	*Spiza americana*	Passeriformes	Open
Eastern kingbird	*Tyrannus tyrannus*	Passeriformes	Open – Woodland
Fulvous whistling-duck	*Dendrocygna bicolor*	Anseriformes	Water
Great crested flycatcher	*Myiarchus crinitus*	Passeriformes	Woodland
Hooded warbler	*Setophaga citrina*	Passeriformes	Woodland
Indigo bunting	*Passerina cyanea*	Passeriformes	Woodland
Interior least tern	*Sternula antillarum athalassos*	Charadriiformes	Water
Northern parula	*Setophaga americana*	Passeriformes	Woodland
Orchard oriole	*Icterus spurius*	Passeriformes	Woodland
Painted bunting	*Passerina ciris*	Passeriformes	Shrubland
Purple gallinule	*Porphyrio martinica*	Gruiformes	Water
Purple martin	*Progne subis*	Passeriformes	Water
Red-eyed vireo	*Vireo olivaceus*	Passeriformes	Woodland
Ruby-throated hummingbird	*Archilochus colubris*	Caprimulgiformes	Woodland – Urban
Scissor-tailed flycatcher	*Tyrannus forficatus*	Passeriformes	Open
Summer tanager	*Piranga rubra*	Passeriformes	Woodland
Swainson's warbler	*Limnothlypis swainsoni*	Passeriformes	Woodland
Western kingbird	*Tyrannus verticalis*	Passeriformes	Open
Wilson's plover	*Charadrius wilsonia*	Charadriiformes	Water – Open
Yellow-billed cuckoo	*Coccyzus americanus*	Cuculiformes	Woodland
Yellow-crowned night-heron	*Nyctanassa violacea*	Pelecaniformes	Water
Yellow-throated vireo	*Vireo flavifrons*	Passeriformes	Woodland

SOURCES: Cornell, 2022; eBird, 2022; NatureServe Explorer, 2022; Sibley, 2003.
NOTES:

- Listed species include those that do not permanently reside within the study area but may breed in the study area.
- The list of species that may permanently reside within the study area, **Table 2-17**, may also breed within the study area.

Table 2-19. Bird Species which may Winter within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
American avocet	*Recurvirostra americana*	Charadriiformes	Water
American bittern	*Botaurus lentiginosus*	Pelecaniformes	Water
American goldfinch	*Carduelis tristis*	Passeriformes	Woodland – Open
American kestrel	*Falco sparverius*	Falconiformes	Open
American pipit	*Anthus rubescens*	Passeriformes	Open
American white pelican	*Pelecanus erythrorhynchos*	Pelecaniformes	Water
American wigeon	*Anas americana*	Anseriformes	Water
American woodcock	*Scolopax minor*	Charadriiformes	Woodland
Bald eagle	*Haliaetus leucocephalus*	Accipitriformes	Woodland
Black-bellied plover	*Pluvialis squatarola*	Charadriiformes	Water
Black rail	*Laterallus jamaicensis*	Rallidae	Water
Black scoter	*Melanitta americana*	Anatidae	Water – Open
Blue-headed vireo	*Vireo solitarius*	Passeriformes	Woodland
Bonaparte's gull	*Chroicocephalus philadelphia*	Charadriiformes	Open – Water
Brewer's blackbird	*Euphagus cyanocephalus*	Passeriformes	Urban – Cultivated – Open
Brown creeper	*Certhia americana*	Passeriformes	Woodland
Buff-bellied hummingbird	*Amazilia yucatanensis*	Caprimulgiformes	Urban – Woodland
Bufflehead	*Bucephala albeola*	Anseriformes	Water
Burrowing owl	*Athene cunicularia*	Strigiformes	Open
Canada goose	*Branta canadensis*	Anseriformes	Open – Water
Canvasback	*Aythya valisineria*	Anseriformes	Water
Cedar waxwing	*Bombycilla cedrorum*	Passeriformes	Woodland – Open
Chipping sparrow	*Spizella passerina*	Passeriformes	Woodlands – Open
Common goldeneye	*Bucephala clangula*	Anseriformes	Water
Common loon	*Gavia immer*	Gaviiformes	Water
Cooper's hawk	*Accipiter cooperii*	Falconiformes	Woodland
Dark-eyed junco	*Junco hyemalis*	Passeriformes	Woodland
Eastern phoebe	*Sayornis phoebe*	Passeriformes	Shrubland – Woodland – Urban
Eared grebe	*Podiceps nigricollis*	Podicipediformes	Water
Eastern towhee	*Pipilo erythrophthalmus*	Passeriformes	Open – Shrubland – Woodland
Field sparrow	*Spizella pusilla*	Passeriformes	Open
Fox sparrow	*Passerella iliaca*	Passeriformes	Woodland – Open
Gadwall	*Anas strepera*	Anseriformes	Water
Golden eagle	*Aquila chrysaetos*	Accipitriformes	Woodland
Golden-crowned kinglet	*Regulus satrapa*	Passeriformes	Woodland
Gray catbird	*Dumetella carolinensis*	Passeriformes	Woodland
Greater scaup	*Aythya marila*	Anseriformes	Water
Greater yellowlegs	*Tringa melanoleuca*	Charadriiformes	Water
Greater white-fronted goose	*Anser albifrons*	Anseriformes	Open – Water
Green-winged teal	*Anas crecca*	Anseriformes	Water
Henslow's sparrow	*Centronyx henslowii*	Passeriformes	Open
Harris's sparrow	*Zonotrichia querula*	Passeriformes	Woodland
Hermit thrush	*Catharus guttatus*	Passeriformes	Woodland – Open
Herring gull	*Larus argentatus*	Charadriiformes	Open – Water
Hooded merganser	*Lophodytes cucullatus*	Anseriformes	Water – Woodland
Horned grebe	*Podiceps auritus*	Podicipediformes	Water
House wren	*Troglodytes aedon*	Passeriformes	Woodland
Lapland longspur	*Calcarius lapponicus*	Passeriformes	Open
Lark bunting	*Calamospiza melanocorys*	Passeriformes	Shrubland
Lark sparrow	*Chondestes grammacus*	Passeriformes	Open
Least sandpiper	*Calidris minutilla*	Charadriiformes	Water
Le Conte's sparrow	*Ammospiza lecontei*	Passeriformes	Open

Table 2-19. Bird Species which may Winter within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Lesser black-backed gull	*Larus fuscus*	Charadriiformes	Open – Water
Lesser scaup	*Aythya affinis*	Anseriformes	Water
Lincoln's sparrow	*Melospiza lincolnii*	Passeriformes	Woodland – Open
Long-billed curlew	*Numenius americanus*	Charadriiformes	Open
Long-billed dowitcher	*Limnodromus scolopaceus*	Charadriiformes	Water
Mallard	*Anas platyrhynchos*	Anseriformes	Water – Open
Marbled godwit	*Limosa fedoa*	Charadriiformes	Water
Marsh wren	*Cistothorus palustris*	Passeriformes	Water
Merlin	*Falco columbarius*	Falconiformes	Open
Nelson's sparrow	*Ammospiza nelsoni*	Passeriformes	Open – Water
Northern harrier	*Circus cyaneus*	Falconiformes	Open
Northern pintail	*Anas acuta*	Anseriformes	Water
Northern shoveler	*Anas clypeata*	Anseriformes	Water
Orange-crowned warbler	*Leiothlypis celata*	Passeriformes	Woodland – Water
Osprey	*Pandion haliaetus*	Falconiformes	Water
Palm warbler	*Setophaga palmarum*	Passeriformes	Woodland - Shrubland
Peregrine falcon	*Falco peregrinus*	Falconiformes	Water
Pine siskin	*Spinus pinus*	Passeriformes	Woodland – Open
Pine warbler	*Setophaga pinus*	Passeriformes	Woodland
Piping plover	*Charadrius melodus*	Charadriiformes	Water
Prairie falcon	*Falco mexicanus*	Falconiformes	Open
Prothonotary warbler	*Protonotaria citrea*	Passeriformes	Woodland
Purple finch	*Haemorhous purpureus*	Passeriformes	Woodland
Red-breasted merganser	*Mergus serrator*	Anseriformes	Water
Red-breasted nuthatch	*Sitta canadensis*	Passeriformes	Woodland
Redhead	*Aythya americana*	Anseriformes	Water
Red knot	*Calidris canutus*	Charadriiformes	Water
Ring-billed gull	*Larus delawarensis*	Charadriiformes	Open – Water
Ring-necked duck	*Aythya collaris*	Anseriformes	Water
Ross's goose	*Anser rossii*	Anseriformes	Open – Water
Rough-legged hawk	*Buteo lagopus*	Falconiformes	Open
Ruby-crowned kinglet	*Regulus calendula*	Passeriformes	Woodland
Ruddy duck	*Oxyura jamaicensis*	Anseriformes	Water
Ruddy turnstone	*Arenaria interpres*	Charadriiformes	Water
Rufous hummingbird	*Selasphorus rufus*	Caprimulgiformes	Urban
Rusty blackbird	*Euphagus carolinus*	Passeriformes	Woodland
Sanderling	*Calidris alba*	Charadriiformes	Water
Sandhill crane	*Antigone canadensis*	Gruiformes	Open – Water
Savannah sparrow	*Passerculus sandwichensis*	Passeriformes	Open
Say's phoebe	*Sayornis saya*	Passeriformes	Open
Sedge wren	*Cistothorus platensis*	Passeriformes	Open
Semipalmated plover	*Charadrius semipalmatus*	Charadriiformes	Open
Sharp-shinned hawk	*Accipiter striatus*	Falconiformes	Woodland
Short-billed dowitcher	*Limnodromus griseus*	Charadriiformes	Water
Short-eared owl	*Asio flammeus*	Strigiformes	Open
Snow goose	*Chen caerulescens*	Anseriformes	Water
Snowy plover	*Charadrius nivosus*	Charadriiformes	Water
Song sparrow	*Melospiza melodia*	Passeriformes	Woodland
Sora	*Porzana carolina*	Gruiformes	Water
Spotted sandpiper	*Actitis macularius*	Charadriiformes	Water
Spotted towhee	*Pipilo maculatus*	Passeriformes	Shrubland
Sprague's pipit	*Anthus spragueii*	Passeriformes	Open
Stilt sandpiper	*Calidris himantopus*	Charadriiformes	Water
Surf scoter	*Melanitta perspicillata*	Anatidae	Water - Open
Swamp sparrow	*Melospiza georgiana*	Passeriformes	Open – Water

Table 2-19. Bird Species which may Winter within the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Tree swallow	*Tachycineta bicolor*	Passeriformes	Woodland
Vermilion flycatcher	*Pyrocephalus rubinus*	Passeriformes	Woodland – Shrubland - Urban
Vesper sparrow	*Pooecetes gramineus*	Passeriformes	Open
Virginia rail	*Rallus limicola*	Gruiformes	Water
Western meadowlark	*Sturnella neglecta*	Passeriformes	Open
Western sandpiper	*Calidris mauri*	Charadriiformes	Water
Whimbrel	*Numenius phaeopus*	Charadriiformes	Water – Open
White-crowned sparrow	*Zonotrichia leucophrys*	Passeriformes	Woodland – Open
White-throated sparrow	*Zonotrichia albicollis*	Passeriformes	Woodland
Wilson's snipe	*Gallinago delicata*	Charadriiformes	Water
Wilson's warbler	*Cardellina pusilla*	Passeriformes	Woodland
Winter wren	*Troglodytes hiemalis*	Passeriformes	Woodland - Shrubland
Yellow-bellied sapsucker	*Sphyrapicus varius*	Piciformes	Woodland
Yellow rail	*Coturnicops noveboracensis*	Gruiformes	Water – Open
Yellow-rumped warbler	*Dendroica coronata*	Passeriformes	Woodland
SOURCES: Cornell, 2022; eBird, 2022; NatureServe Explorer, 2022; Sibley, 2003.			

Table 2-20. Bird Species which may Migrate through the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Acadian flycatcher	*Empidonax virescens*	Passeriformes	Woodland
Alder flycatcher	*Empidonax alnorum*	Passeriformes	Shrubland
American golden-plover	*Pluvialis dominica*	Charadriiformes	Open – Water
American redstart	*Setophaga ruticilla*	Passeriformes	Woodland
Baird's sandpiper	*Calidris bairdii*	Charadriiformes	Water
Bank swallow	*Riparia riparia*	Passeriformes	Open – Water
Baltimore oriole	*Icterus galbula*	Passeriformes	Woodland
Bay-breasted warbler	*Setophaga castanea*	Passeriformes	Woodland
Black-billed cuckoo	*Coccyzus erythropthalmus*	Cuculiformes	Woodland
Blackburnian warbler	*Setophaga fusca*	Passeriformes	Woodland
Black tern	*Chlidonias niger*	Charadriiformes	Water
Black-throated green warbler	*Setophaga virens*	Passeriformes	Woodland
Blue-winged warbler	*Vermivora cyanoptera*	Passeriformes	Shrubland – Woodland
Bobolink	*Dolichonyx oryzivorus*	Passeriformes	Open
Broad-winged hawk	*Buteo platypterus*	Accipitriformes	Woodland
Buff-breasted sandpiper	*Calidris subruficollis*	Charadriiformes	Open
Canada warbler	*Cardellina canadensis*	Passeriformes	Woodland
Cerulean warbler	*Setophaga cerulea*	Passeriformes	Woodland
Chestnut-sided warbler	*Setophaga pensylvanica*	Passeriformes	Woodland
Cinnamon teal	*Spatula cyanoptera*	Anseriformes	Water
Clay-colored sparrow	*Spizella pallida*	Passeriformes	Shrubland
Common tern	*Sterna hirundo*	Charadriiformes	Water
Eastern wood-pewee	*Contopus virens*	Passeriformes	Woodland
Dunlin	*Calidris alpina*	Charadriiformes	Water
Franklin's gull	*Leucophaeus pipixcan*	Charadriiformes	Water
Golden-winged warbler	*Vermivora chrysoptera*	Passeriformes	Open
Gray-cheeked thrush	*Catharus minimus*	Passeriformes	Woodland
Hudsonian godwit	*Limosa haemastica*	Charadriiformes	Water
Kentucky warbler	*Geothlypis formosa*	Passeriformes	Woodland
Least flycatcher	*Empidonax minimus*	Passeriformes	Woodland
Lesser yellowlegs	*Tringa flavipes*	Charadriiformes	Water

Table 2-20. Bird Species which may Migrate through the Study Area

COMMON NAME	SCIENTIFIC NAME	ORDER	HABITAT PREFERENCE(S)
Louisiana waterthrush	*Parkesia motacilla*	Passeriformes	Water
Magnolia warbler	*Setophaga magnolia*	Passeriformes	Woodland
Mississippi kite	*Ictinia mississippiensis*	Accipitriformes	Open – Woodland
Mourning warbler	*Geothlypis philadelphia*	Passeriformes	Woodland - Shrubland
Nashville warbler	*Leiothlypis ruficapilla*	Passeriformes	Woodland
Northern waterthrush	*Parkesia noveboracensis*	Passeriformes	Woodland – Water
Olive-sided flycatcher	*Contopus cooperi*	Passeriformes	Woodland
Ovenbird	*Seiurus aurocapilla*	Passeriformes	Woodland
Pectoral sandpiper	*Calidris melanotos*	Charadriiformes	Water
Philadelphia vireo	*Vireo philadelphicus*	Passeriformes	Woodland
Prairie warbler	*Setophaga discolor*	Passeriformes	Open – Shrubland – Woodland
Red-breasted merganser	*Mergus serrator*	Anseriformes	Water
Rose-breasted grosbeak	*Pheucticus ludovicianus*	Passeriformes	Woodland
Scarlet tanager	*Piranga olivacea*	Passeriformes	Woodland
Semipalmated sandpiper	*Calidris pusilla*	Charadriiformes	Water
Solitary sandpiper	*Tringa solitaria*	Charadriiformes	Water
Swainson's hawk	*Buteo swainsoni*	Accipitriformes	Open
Swainson's thrush	*Catharus ustulatus*	Passeriformes	Woodland
Tennessee warbler	*Leiothlypis peregrina*	Passeriformes	Woodland
Upland sandpiper	*Bartramia longicauda*	Charadriiformes	Open
Veery	*Catharus fuscescens*	Passeriformes	Water – Woodland
Warbling vireo	*Vireo gilvus*	Passeriformes	Woodland – Open
Whip-poor-will	*Antrostomus vociferus*	Caprimulgiformes	Woodland
White-rumped sandpiper	*Calidris fuscicollis*	Charadriiformes	Water
Whooping crane	*Grus americana*	Gruiformes	Open – Water
Willow flycatcher	*Empidonax traillii*	Passeriformes	Open
Wilson's phalarope	*Phalaropus tricolor*	Charadriiformes	Water
Wood stork	*Mycteria americana*	Ciconiiformes	Water – Woodland
Wood thrush	*Hylocichla mustelina*	Passeriformes	Woodland
Worm-eating warbler	*Helmitheros vermivorum*	Passeriformes	Woodland
Yellow-bellied flycatcher	*Empidonax flaviventris*	Passeriformes	Woodland
Yellow-breasted chat	*Icteria virens*	Passeriformes	Shrubland
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	Passeriformes	Open
Yellow-throated warbler	*Setophaga dominica*	Passeriformes	Woodland
Yellow warbler	*Setophaga petechia*	Passeriformes	Woodland
SOURCES: Cornell, 2022; eBird, 2022; NatureServe Explorer, 2022; Sibley, 2003.			

Mammals

According to Schmidly and Bradley (2016), 202 species of mammals reside in Texas. Mammals are distinct from other groups in that their bodies are covered with hair and they feed milk to their young. Nearly all mammals in Texas bear live young using a placenta (i.e., Eutherian or "placental" mammals). A notable exception is the Virginia opossum (*Didelphis virginiana*), which is a pouch-rearing mammal (Marsupial). Refer to **Table 2-21** for mammals that are expected to occur in Chambers County if suitable habitat is present within in the study area.

Table 2-21. Mammal Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	HABITAT PREFERENCE(S)
Order: Artiodactyla (even-toed ungulates)		
Feral pig	*Sus scrofa*	Woodland – Open
White-tailed deer	*Odocoileus virginianus*	Woodland
Order: Carnivora (carnivores)		
American badger	*Taxidea taxus*	Open
American mink	*Vison vison*	Water
Bobcat	*Lynx rufus*	Woodland
Common gray fox	*Urocyon cinereoargenteus*	Woodland
Common raccoon	*Procyon lotor*	Woodland – Water
Coyote	*Canis latrans*	Open
Eastern spotted skunk	*Spilogale putorius*	Open – Woodland
Long-tailed weasel	*Mustela frenata*	Open
Northern river otter	*Lontra canadensis*	Water
Red fox	*Vulpes vulpes*	Woodland – Cultivated – Open
Ringtail	*Bassariscus astutus*	Woodland – Open
Striped skunk	*Mephitis mephitis*	Woodland – Open
Order: Chiroptera (bats)		
Big brown bat	*Eptesicus fuscus*	Woodland – Urban
Big free-tailed bat	*Nyctinomops macrotis*	Woodland
Brazilian free-tailed bat	*Tadarida brasiliensis*	Woodland – Urban
Eastern red bat	*Lasiurus borealis*	Woodland
Evening bat	*Nycticeius humeralis*	Woodland – Urban
Hoary bat	*Lasiurus cinereus*	Woodland
Northern yellow bat	*Lasiurus intermedius*	Woodland - Open
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	Woodland - Urban
Seminole bat	*Lasiurus seminolus*	Woodland
Silver-haired bat	*Lasionycteris noctivagans*	Woodland – Urban
Southeastern myotis	*Myotis austroriparius*	Urban - Woodland
Tricolored bat	*Perimyotis subflavus*	Woodland - Urban
Order: Cingulata (armadillos and allies)		
Nine-banded armadillo	*Dasypus novemcinctus*	Open – Woodland – Urban – Shrubland – Water
Order: Lagomorpha (hares, rabbits, and picas)		
Black-tailed jackrabbit	*Lepus californicus*	Open
Eastern cottontail	*Sylvilagus floridanus*	Open
Swamp rabbit	*Sylvilagus aquaticus*	Shrubland – Water
Order: Didelphimorphia (opossums and allies)		
Virginia opossum	*Didelphis virginiana*	Woodland – Open – Urban
Order: Rodentia (rodents)		
Allegheny woodrat	*Neotoma magister*	Woodland - Shrubland
American beaver	*Castor canadensis*	Woodland – Water
American deermouse	*Peromyscus maniculatus*	Open

Table 2-21. Mammal Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	HABITAT PREFERENCE(S)
Baird's pocket gopher	*Geomys breviceps*	Woodland
Black rat	*Rattus rattus*	Urban
Common muskrat	*Ondatra zibethicus*	Water
Cotton deermouse	*Peromyscus gossypinus*	Woodland
Eastern fox squirrel	*Sciurus niger*	Woodland
Eastern gray squirrel	*Sciurus carolinensis*	Woodland
Eastern harvest mouse	*Reithrodontomys humulis*	Open - Cultivated
Eastern woodrat	*Neotoma floridana*	Desert – Open – Woodland
Fulvous harvest mouse	*Reithrodontomys fulvescens*	Desert – Open – Shrubland
Golden mouse	*Ochrotomys nuttalli*	Woodland - Shrubland
Hispid cotton rat	*Sigmodon hispidus*	Open – Urban
Hispid pocket mouse	*Chaetodipus hispidus*	Open
House mouse	*Mus musculus*	Open – Urban
North American deermouse	*Peromyscus maniculatus*	Woodland – Open
North American porcupine	*Erethizon dorsatum*	Open – Shrubland – Woodland
Northern pygmy mouse	*Baiomys taylori*	Open – Woodland
Norway rat	*Rattus norvegicus*	Open – Urban
Nutria	*Myocastor coypus*	Water
Prairie vole	*Microtus ochrogaster*	Shrubland - Open
Plains harvest mouse	*Reithrodontomys montanus*	Open
Southern flying squirrel	*Glaucomys volans*	Woodland
Texas marsh rice rat	*Oryzomys texensis*	Water
Thirteen-lined ground squirrel	*Ictidomys tridecemlineatus*	Open
White-footed mouse	*Peromyscus leucopus*	Woodland
Woodland vole	*Microtus pinetorum*	Woodland
Order: Soricomorpha (moles and shrews)		
Eastern mole	*Scalopus aquaticus*	Open
Least shrew	*Cryptotis parva*	Open
Southern short-tailed shrew	*Blarina carolinensis*	Woodland
SOURCES: Schmidly and Bradley, 2016; NatureServe Explorer, 2022.		

2.4.4.4.2 Fish and Aquatic Wildlife

All streams in the study area are likely to experience wide variations in flow discharge during any given year. The streams in the study area appear to be perennial streams with the ability to support aquatic life, such as fish, crayfish, or mollusks. These streams flow year-round and receive groundwater inflow. Ponds do not experience the extreme variations in flow relative to streams, and ponds are nearly always exposed to full sunlight. As a result, the organisms which inhabit ponds are adapted to the different environments found in both streams and ponds. Ponds and smaller reservoirs are more likely to experience higher water temperatures and lower dissolved oxygen compared to streams and larger reservoirs. Algae and phytoplankton, which thrive on sunlight, fare better in slower moving systems, such as ponds. Larger species, including many types of fish, fare better in streams, rivers, and large lakes.

Freshwater Fish

Table 2-22 presents some of the common fish species expected within the study area, the majority of which would be found in Cedar Bayou, Cedar Point Lateral, Horsepen Bayou, or the numerous unnamed streams and canals.

Table 2-22. Fish Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Alligator gar	*Atractosteus spatula*	Orangespotted sunfish	*Lepomis humilis*
Bigscale logperch	*Percina macrolepida*	Redbreast sunfish	*Lepomis auritus*
Black bullhead	*Ameiurus melas*	Redear sunfish	*Lepomis microlophus*
Black crappie	*Pomoxis nigromaculatus*	Red shiner	*Cyprinella lutrensis*
Blackstripe topminnow	*Fundulus notatus*	Rio Grande cichlid	*Herichthys cyanoguttatus*
Blue catfish	*Ictalurus furcatus*	Rio Grande shiner	*Notropis jemezanus*
Bluegill sunfish	*Lepomis macrochirus*	River carpsucker	*Carpiodes carpio*
Bullhead minnow	*Pimephales vigilax*	River goby	*Awaous banana*
Central stoneroller	*Campostoma anomalum*	Sailfin molly	*Poecilia latipinna*
Channel catfish	*Ictalurus punctatus*	Sand shiner	*Notropis stramineus*
Common carp	*Cyprinus carpio*	Slough darter	*Etheostoma gracile*
Flathead catfish	*Pylodictis olivaris*	Smallmouth bass	*Micropterus dolomieu*
Fathead minnow	*Pimephales promelas*	Smallmouth buffalo	*Ictiobus bubalus*
Florida largemouth bass	*Micropterus floridanus*	Speckled chub	*Macrhybopsis aestivalis*
Freshwater drum	*Aplodinotus grunniens*	Spotted gar	*Lepisosteus oculatus*
Ghost shiner	*Notropis buchanani*	Striped bass	*Morone saxatilis*
Gizzard shad	*Dorosoma cepedianum*	Tamaulipas shiner	*Notropis braytoni*
Golden shiner	*Notemigonus crysoleucas*	Tadpole madtom	*Noturus gyrinus*
Goldfish	*Carassius auratus*	Texas shiner	*Notropis amabilis*
Green sunfish	*Lepomis cyanellus*	Threadfin shad	*Dorosoma petenense*
Inland silverside	*Menidia beryllina*	Walleye	*Sander vitreus*
Largemouth bass	*Micropterus salmoides*	Western mosquitofish	*Gambusia affinis*
Longear sunfish	*Lepomis megalotis*	White bass	*Morone chrysops*
Longnose gar	*Lepisosteus osseus*	White crappie	*Pomoxis annularis*
Mexican tetra	*Astyanax mexicanus*	Yellow bullhead	*Ameiurus natalis*
SOURCES: Hendrickson and Cohen, 2022; IUCN, 2022; NatureServe Explorer, 2022; USFWS, 2023b; USGS, 2022c.			

Freshwater Mollusks

There are over 300 freshwater mussel species known to reside within North America, over 50 of which have been observed within Texas waters. Freshwater mussels are highly susceptible to habitat degradation and loss. Currently, 15 native Texas mussel species are state listed as threatened. The USFWS has listed six of the TPWD listed species as candidate species, which await determination for potential federal listing as threatened or endangered. Within Texas, the Asian clam (*Corbicula fluminea*), purple-nacre corbicula (*Corbicula* sp.), and zebra mussel (*Dreissena polymorpha*) are prevalent and wide-spread exotic invasive species (Howells, 2014). **Table 2-23** provides a list of potential mussel species found within the study area.

Table 2-23. Mollusk Species within the Study Area

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Asian clam	*Corbicula fluminea*	Pink papershell	*Potamilus ohiensis*
Bankclimber	*Plectomerus dombeyanus*	Pistolgrip	*Tritogonia verrucosa*
Bleufer	*Potamilus purpuratus*	Pondhorn	*Uniomerus tetralasmus*
Carolina marshclam	*Polymesoda caroliniana*	Pondmussel	*Sagittunio subrostratus*
Creeper	*Strophitus undulatus*	Rock pocketbook	*Arcidens confragosus*
Dark falsemussel	*Mytilopsis leucophaeata*	Round pearlshell	*Glebula rotundata*
Deertoe	*Truncilla truncata*	Sandbank pocketbook	*Lampsilis satura*
False spike	*Fusconaia mitchelli*	Southern mapleleaf	*Quadrula apiculata*
Fawnsfoot	*Truncilla donaciformis*	Tampico pearlymussel	*Cyrtonaias tampicoensis*
Fingernailclams	*Eupera spp., Musculium spp., Pisidium spp., Sphaerium spp.*	Tapered pondhorn	*Uniomerus declivis*
Flat floater	*Utterbackiana suborbiculata*	Texas fawnsfoot	*Truncilla macrodon*
Fragile papershell	*Leptodea fragilis*	Texas heelsplitter	*Potamilus amphichaenus*
Giant floater	*Pyganodon grandis*	Texas Lilliput	*Toxolasma texasiense*
Gulf mapleleaf	*Tritogonia nobilis*	Texas pigtoe	*Fusconaia askewi*
Lilliput	*Toxolasma parvum*	Threehorn wartyback	*Obliquaria reflexa*
Louisiana fatmucket	*Lampsilis hydiana*	Threeridge	*Amblema plicata*
Louisiana pigtoe	*Pleurobema riddellii*	Trinity pigtoe	*Fusconaia chunii*
Mapleleaf	*Quadrula quadrula*	Wabash pigtoe	*Fusconaia flava*
Ouachita creekshell	*Obovaria arkansasensis*	Washboard	*Megalonaias nervosa*
Paper pondshell	*Utterbackia imbecillis*	Yellow sandshell	*Lampsilis teres*
Pimpleback	*Cyclonaias pustulosa*	Zebra mussel	*Dreissena polymorpha*
SOURCES: Charles et al., 2020; Howells, 2014; IUCN, 2022; NatureServe Explorer, 2022.			

2.4.4.5 Threatened and Endangered Species

The USFWS has authority under the ESA to list and monitor the status of species whose populations are considered imperiled. USFWS regulations that implement the ESA are codified and regularly updated in 50 CFR Part 17. The federal process identifies potential candidates based upon the species' biological vulnerability. The vulnerability decision is based upon many

factors affecting the species within its range and is linked to the best scientific data available to the USFWS at the time. Species listed as threatened or endangered by the USFWS are provided full protection under the ESA including a prohibition of indirect take such as destruction of known critical habitat (i.e., areas formally designated by USFWS in the Federal Register).

Texas endangered species legislation in 1973 and subsequent amendments have established a state regulatory program for the management and protection of endangered species (i.e., species in danger of extinction) and threatened species (i.e., likely to become endangered within the foreseeable future). Chapters 67 and 68 of the Texas Parks and Wildlife Code authorize the TPWD to formulate lists of threatened and endangered fish and wildlife species and to regulate the taking or possession of the species. Under this statutory authority, the TPWD regulates the taking, possession, transport, export, processing, selling, or offering for sale, or shipping of threatened or endangered species of fish and wildlife (Texas Legislature Online, 2022).

Table 2-24 lists wildlife species that are considered endangered or threatened by the USFWS and/or TPWD, and whose geographic range includes any portion of Chambers County. It should be noted that inclusion in the table does not imply that a species is known to occur in the study area but only acknowledges the potential for occurrence. An estimate of the likelihood of a species to occur within the study area is based on an analysis of existing habitat that is available and the known habitat preferences for each species. Only federal and state listed threatened and endangered species are included in **Table 2-24**, no species of greatest concern are listed. A discussion of each species' habitat follows **Table 2-24**, grouped first by federal then state listed threatened or endangered species. No marine environments are located within the study area. As such, marine species denoted in **Table 2-24** that solely occupy marine environments do not have the potential to occur within the study area. Considering that these marine species do not have the potential to occur within the study area, a description of these species' habitat has not been provided.

In evaluating species endangered or threatened, Halff assessed TPWD and USFWS county lists to include Chambers County. Species with broad habitat requirements or not geographically bound within Chambers County may be expected to occur within the study area, where suitable habitat is present.

Plant Species and Sensitive Vegetation Communities

No records of sensitive vegetation communities within the study area were included in the TXNDD (TPWD, 2022f).

Texas Prairie Dawn-flower

The Texas prairie dawn-flower (*Hymenoxys texana*) is a federally listed endangered species. This flowering plant is endemic to the Houston Coastal Prairie. The preferred habitat has fine-sandy loamy, compacted, cryptogamic, and slightly saline soils. It occupies sparsely vegetated areas in open grasslands at the base of small mounds or in mostly barren areas (NatureServe Explorer, 2022; USFWS, 2023c). According to TPWD (2022g), the current known extent is in Fort Bend, Gregg, Harris, and Trinity counties. Due to the majority of the study area having clay soils and lack of undisturbed open grassland, it is unlikely for the Texas prairie dawn-flower to be present.

Wildlife Species

The discussion that follows describes habitat preferences and other characteristics for the state and federally listed threatened or endangered species shown in **Table 2-24**. Unless otherwise noted, the information below is drawn primarily from TPWD (2022h; 2022i), USFWS (2023b; 2023d) online data and publications, and NatureServe Explorer (2022). Many of the listed threatened or endangered species that may be found in the study area are migratory birds. These species may utilize the area primarily as a travel corridor, where suitable habitats are used for resting and feeding stops. Some of the more important migratory habitats within the study area include grasslands, wetlands, and upland woods/brush.

Table 2-24. Endangered, Threatened, or Rare Wildlife Potentially in the Study Area

COMMON NAME	SCIENTIFIC NAME	LISTING STATUS[1]		SPECIES LIKELY TO OCCUR WITHIN STUDY AREA?
		Federal	State	
Birds				
Black rail	*Laterallus jamaicensis*	LT	T	Yes
Piping plover	*Charadrius melodus*	LT	T	No
Reddish egret	*Egretta rufescens*	--	T	No
Rufa red knot	*Calidris canutus rufa*	LT	T	No
Swallow-tailed kite	*Elanoides forficatus*	--	T	Yes[2]
White-faced ibis	*Plegadis chihi*	--	T	Yes
White-tailed hawk	*Buteo albicaudatus*	--	T	Yes
Whooping crane	*Grus americana*	LE	E	No
Wood stork	*Mycteria americana*	--	T	Yes
Insects				
Monarch butterfly	*Danaus plexippus*	C	--	Yes

Table 2-24. Endangered, Threatened, or Rare Wildlife Potentially in the Study Area

COMMON NAME	SCIENTIFIC NAME	LISTING STATUS[1]		SPECIES LIKELY TO OCCUR WITHIN STUDY AREA?
		Federal	State	
Mammals				
Blue whale*	*Balaenoptera musculus*	LE	E	No
Gulf of Mexico Bryde's whale*	*Balaenoptera ricei*	LE	E	No
Humpback whale*	*Megaptera novaeangliae*	LE	--	No
Louisiana black bear	*Ursus americanus luteolus*	DM	T	No
North Atlantic right whale*	*Eubalaena glacialis*	LE	E	No
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	--	T	No
Sei whale*	*Balaenoptera borealis*	LE	E	No
Sperm whale*	*Physeter macrocephalus*	LE	E	No
Reptiles				
Alligator snapping turtle	*Macrochelys temminckii*	PT	T	Yes
Green sea turtle*	*Chelonia mydas*	LT	--	No
Hawksbill sea turtle*	*Eretmochelys imbricata*	LE	--	No
Kemp's Ridley sea turtle*	*Lepidochelys kempii*	LE	--	No
Leatherback sea turtle*	*Dermochelys coriacea*	LE	--	No
Loggerhead sea turtle*	*Caretta caretta*	LT	--	No
Texas horned lizard	*Phrynosoma cornutum*	--	T	No
Fish				
Oceanic whitetip shark*	*Carcharhinus longimanus*	LT	T	No
Shortfin mako shark*	*Isurus oxyrinchus*	--	T	No

SOURCES: NatureServe Explorer, 2022; TPWD, 2022h; TPWD, 2022i; USFWS, 2023b; USFWS, 2023d.
NOTES:
* Species that solely inhabits marine environments
1. **USFWS listing codes:** C = Candidate; DM = Recovered, delisted, and being monitored; LE = Federally Listed Endangered Species (i.e., in danger of extinction); LT = Federally Listed Threatened Species (i.e., severely depleted population that may become endangered); PT = Proposed Threatened; blank = no federal status
TPWD listing codes: E = State Listed Endangered Species; T = State Listed Threatened Species; blank = no state status.
2. Assumed to be a transient species, potentially migrating through the study area, and using suitable habitat for stopovers.
3. The USFWS list supersedes information provided for federal status in TPWD Annotated County List of Rare Species, in the case of a discrepancy. The species is listed by USFWS for the county but is not expected to occur within the study area.

Federally-Listed Species

BIRDS

Black Rail

The black rail prefers mesic environments, including salt, brackish, and freshwater marshes, pond margins, wet meadows, and grassy swamps. This elusive species nests in or along the edges of marshes and damp ground. Typically, nests are hidden in dense marsh grass cover over a mat of prior years' dead grass material. Black rails forage on aquatic invertebrates in shallow wetlands. Numerous records for this species are included within the TXNDD database, the closest of which is approximately three miles east of the study area. The federal status of listed threatened is for the subspecies eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*). According to the TPWD EMST report, there is marsh habitat associated with the Cedar Point

Lateral stream. Thus, there is very limited potential for the black rail to occur in the study area. (Cornell, 2022; eBird, 2022; Sibley, 2003; TPWD, 2022e; TPWD, 2022i).

Piping Plover

Piping plovers nest on sandy beaches along the ocean or lakes. Along rivers, piping plovers use the bare areas of islands or sandbars. Piping plovers also nest on the pebbly mud of interior alkali lakes and ponds. During the winter, piping plovers use algal, mud, and sand flats along the Gulf Coast. Piping plovers migrate through Texas each spring and fall (TPWD, 2022i). Based on relevant background information, no suitable nesting habitat exists within the study area as there are no sandy beaches or riverine sandbars. Dutton Lake and Trinity Bay are two and four miles southeast of the study area, respectively, and would provide more suitable habitat than habitats that exist within the study area. As such, occurrence of the piping plover within the study area is unlikely and any sightings should be considered incidental relative to the close proximity of large open water features.

Rufa Red Knot

The red knot is a medium-sized shorebird that breeds in the tundra of the Artic and summers as far south as South America. This species has one of the longest migrations of any bird. During migration, red knots prefer tidal flats and shorelines as preferred stopover habitat (TPWD, 2022i). Based on relevant background information, no suitable nesting habitat exists within the study area due to the lack of tidal flats, shorelines, or coastal beaches within the study area. As such, there is limited to no potential for the red knot to occur within the study area or for the red knot to utilize the study area for stopovers. Due to the proximity of the study area to the Gulf Coast, it should be viewed as reasonable that red knots may be observed aerially, and any sightings should be considered incidental relative to the large migration corridor.

Whooping Crane

Preferred whooping crane habitat includes freshwater marshes, tidal flats, barrier islands, and wet prairies. Whooping cranes breed in the wetlands of Wood Buffalo National Park, Northwest Territory, Canada, and winter in the coastal wetlands of the Aransas National Wildlife Refuge in Aransas, Calhoun, and Refugio Counties, Texas approximately 130 miles southwest of the study area (USFWS, 2023e). The whooping crane migration route is generally a straight corridor 220 miles wide extending north to south from West Central Canada to the Texas Gulf Coast (TPWD, 2022i; USFWS, 2009). The study area lacks tidal flats, barrier islands, significant marshes, and emergent wetlands. The EMST map (**Figure 2-5**) indicates that marsh habitats represent a small

percentage of the overall cover type compared to other cover types within the study area (TPWD, 2022e). The study area includes residential and commercial developments and roads impeding the line of sight needed for whooping cranes to take flight. The pond features in the northern portion of the study area do not provide preferred stopover habitat as they are well-maintained, manicured, and used for industrial processes. Thus, it is unlikely that the whooping crane would occur within the study area. Due to the proximity of the study area to the Gulf Coast, it should be viewed as reasonable but unlikely that whooping cranes may be observed aerially, and any sightings should be considered incidental relative to the large migration corridor.

INSECTS

Monarch Butterfly

In the southwestern states, migrating monarch butterflies tend to occur more frequently near water sources, such as rivers, creeks, roadside ditches, and irrigated gardens. Typically, in Texas, monarch butterflies are found during the later spring and summer migration periods. During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (*Asclepias spp*.). Given the large migration corridor through this region of Texas, there is potential that the monarch butterfly may be present within the study area where suitable habitat is present (TPWD, 2016).

REPTILES

Alligator Snapping Turtle

The alligator snapping turtle is a highly aquatic species that rarely emerges from the water except to nest. Preferred habitat includes a slow-moving, deep-water rivers, canals, swamps, and off-channel ponds. Flotant, or dense floating vegetation, and logs are frequently used as cover by this species. Nesting can include three to six nests in sand mounds along riverbanks and sandbars in the channel. Numerous records for this species are included in the TXNDD, the closest of which is located 12 miles northwest of the study area (NatureServe Explorer, 2022; USGS, 2022d). Due to the presence of streams and canals, there is potential for the alligator snapping turtle to utilize the study area.

State-Listed Species

BIRDS

Reddish Egret

The reddish egret resides along the Texas coast in salt and brackish water wetlands. Nests usually occur on the ground in Texas near shrubs, in mangroves, or on sandy beaches. They are commonly found among inlets, salt flats, both natural or man-made, lagoons, and freshwater ponds. No sightings have been reported within the study area according to *eBird*. There have been *eBird* reports approximately three miles southeast of the study area near Dutton Lake (Cornell, 2022; eBird, 2022; TPWD, 2022i). Due to the lack of preferred habitat, it is unlikely the reddish egret will occur within the study area.

Swallow-tailed Kite

The swallow-tailed kite occurs in the Southeastern U.S., primarily for breeding purposes, and migrates to South America. The range is limited to the easternmost and southernmost portions of Texas. Two reported *eBird* sightings are in the northeastern and southwestern portions of the study area. Typical habitat includes wooded wetlands, swamps, marshes, large rivers, ponds, wet prairies, and lowland forests. Nesting requires tall trees in open woodlands or stands of trees and open areas for foraging. Communal roosts during nesting season and before migration is common. It is possible the swallow-tailed kite would utilize the study area as a stopover for migration or for nesting. Any sightings should be considered incidental relative to the large area considered part of the migration corridor (Cornell, 2022; eBird, 2022).

White-faced Ibis

Habitat preference of the white-faced ibis includes freshwater marshes, sloughs, and irrigated rice fields. Occasionally, the white-faced ibis occupies brackish and saltwater habitats. This colonial nesting species prefer to nest in low trees, in marshes, on the ground among bulrushes or reeds, or on floating mats. The white-faced ibis is also known to utilize livestock pastureland, wooded streams, and sewage ponds. Large colonies, also referred to as rookeries, almost exclusively occur near the coast. According to one *eBird* sighting, the white-faced ibis was spotted in the northwestern portion of the study area along IH 10. EMST data indicates marsh habitat and wooded areas along Cedar Point Lateral. There is potential for the white-faced ibis to occur in the study area due to the presence of marshes, woodland habitat along Cedar Point Lateral, and industrial ponds. However, Dutton Lake two miles southeast, Trinity Bay four miles southeast,

and the Trinity River National Wildlife Refuge five miles northeast of the study area would provide more suitable habitat than habitats that exist within the study area (Cornell, 2022; eBird, 2022; TPWD, 2022e).

White-tailed Hawk

The white-tailed hawk inhabits grasslands, prairies, savannas, and pastures in Southern Texas near the coast. It prefers natural prairies with species such as yucca (*Yucca* spp.) and mesquite (*Prosopis* spp.). During brush fires, the white-tailed hawk can be found hunting rodents and other small vertebrates. White-tailed hawks are not usually found in agricultural areas unless there is a fire. According to eBird sightings, the white-tailed hawk has several reports within the northern portion of the study area along IH 10 (Cornell, 2022; eBird, 2022). There is potential for the white-tailed hawk to occur within the study area due to the presence of agricultural fields and pastureland.

Wood Stork

Wood storks prefer to nest in large tracts of bald cypress or red mangrove (*Rhizophora mangle*) and forages in shallow standing water environments of prairie ponds, flooded pastures or fields, ditches, or saltwater marshes. Roosts are found among tall standing snags, occasionally with other wading birds. Historically, this species did breed in Texas, but no breeding pair has been recorded since 1960. Review of eBird sightings indicates two reports of the wood stork within the study area and numerous reports east of the study area near Cotton Lake and Old River Lake. According to the TPWD EMST report, there is marsh habitat associated with the Cedar Point Lateral stream. Thus, there is potential for the wood stork to utilize the study area (Cornell, 2022; eBird, 2022; Sibley 2003; TPWD, 2022e).

MAMMALS

Louisiana Black Bear

The Louisiana black bear is generally found in bottomland forests in undeveloped areas with little to no human activity. Conifer, hardwood and mixed forests, and forested wetlands are preferred habitats. In areas with human disturbance, large hollow cypress (*Cupressus* spp.), bald cypress, and tupelo gum (*Nyssa sylvatica*) trees are commonly used for winter dens (NatureServe Explorer, 2022). Urban development is significant within, and immediately surrounding the study area. Woodland habitats present in the study area is immature regrowth that began around 2008

after heavy agricultural use. This species has been largely extirpated from Texas and bears that remain have generally been immature and transient males. Resident breeding populations have not been observed in East Texas since 1992 where populations were previously found in the Big Thicket area (Texas A&M Forest Service, 1992; TPWD, 2022i; USFWS, 2016). Thus, there is little to no potential that the Louisiana black bear would utilize the study area. More suitable habitat exists in the Big Thicket Preserve approximately 50 miles northeast of the study area.

Rafinesque's Big-eared Bat

The Rafinesque's big-eared bat prefers forested areas, such as pineywoods from the Southeastern U.S. to eastern Texas. The range of this mammal includes counties surrounding Chambers County, such as Harris, Liberty, and Jefferson counties. Roosts are often found near bodies of water and in cave entrances, hollow trees, under leaves, under bridges, and buildings. Several states found abandoned buildings were utilized more than inhabited buildings. Hardwood floodplain forests are important foraging grounds, especially for pregnant females. The pineywoods EMST cover types are small, isolated portions of the study area along Cedar Point Lateral and the wetland cover type is scattered in small portions across the study area. One record is included in the TXNDD located 22 miles north of the study area (NatureServe Explorer, 2022; Schmidly and Bradley, 2016; TPWD, 2022e; TPWD, 2022i). Forested areas exist along Cedar Point Lateral in the eastern portion of the study area and along Cedar Bayou immediately to the west of the study area. Thus, there is potential for the Rafinesque's big-eared bat to utilize the study area.

REPTILES

Texas Horned Lizard

The historical range of the Texas horned lizard included the entire state of Texas in arid and semiarid areas of flat, open terrain with scattered vegetation and sandy or loamy soils. Sandy or loamy soils are necessary for hibernation, nesting, and insulation. Population declines have been linked to loss of habitat, insecticides, over-collection, and the accidental introduction of the imported fire ant (*Solenopsis invicta*). Despite declines in eastern and central Texas, the Texas horned lizard is still common in portions of the Rio Grande Plains of South Texas, the Rolling and High Plains of Northwest Texas, and the Trans Pecos of far West Texas (NatureServe Explorer, 2022; NRCS; 2019; TPWD, 2022i). The site consists largely of agricultural cropland that is primarily composed of clay or clay loam soils and developed areas. Due to the overall disturbed

nature of the site and lack of sandy soils necessary for hibernation and nesting, it is highly unlikely that the Texas horned lizard would occur within the study area.

3.0 PROPOSED ALTERNATIVE ROUTE IDENTIFICATION

3.1 ROUTING STUDY METHODOLOGY

The objective of the routing study is to identify and evaluate alternative transmission line routes for the proposed project. Throughout this report, the terms “environment” or “environmental” are used to include the human and natural environment. Halff utilized a comprehensive transmission line routing methodology to identify and evaluate proposed alternative transmission line routes. Potential routes were identified and evaluated in accordance with Section 37.056(c)(4)(A)-(D) of the Texas Utilities Code, PUCT Substantive Rules Section 25.101, including the PUCT policy of prudent avoidance, PUCT Procedural Rules Section 22.52(a)(4), and the PUCT CCN Application Form for a Proposed Transmission Line.

The following subsections provide a description of the route selection methodology, including study area delineation, data collection, reconnaissance surveys, constraints mapping, identification of preliminary transmission line segments, public involvement program, adjustment of the preliminary transmission line segments following field review and the public participation meeting, and evaluation of the proposed alternative routes.

3.1.1 Base Map Development

A project base map was prepared at a scale of 1:6,000 (1 inch = 500 feet). The base map is a single sheet 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. The base map provides a broad overview of various resource locations indicating obvious routing constraints and areas of potential routing opportunities.

Data displayed on the base map include:

- Major land jurisdictions and uses;
- Major roads, including CR, FM, U.S. highways, and State highways;
- Existing transmission line and pipeline corridors;

- Parks and recreational areas;
- Major political subdivision boundaries; and
- Lakes, canals, creeks, and ponds.

3.1.2 Study Area Delineation

The first step in the identification of the initial preliminary transmission line segments was to define a study area. This area needed to encompass the proposed endpoints (e.g., the Kilgore Substation), in addition to include an area large enough that a reasonable number of forward progressing, geographically diverse proposed alternative routes could be investigated and identified. The purpose of delineating the study area for the proposed project was to establish boundaries and limits for the information gathering process (i.e., identifying environmental and land use constraints). The delineation of the study area also allowed Halff to focus its evaluation within a specific area.

Halff reviewed USGS 1:24,000 scale topographic maps (USGS, 1961-1977) and aerial photography (NearMap, 2023) to develop and refine the study area boundary for the proposed project. Halff located and depicted the project endpoints on the various maps and identified major features in the study area, such as IH 10, SH 99, SH 146, the City of Mont Belvieu, and the City of Baytown. **Figure 2-1** shows the study area boundary Halff delineated overlaid on aerial photography and general constraints as a result of the above-described process.

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 information identified in Section 37.056(c)(4)(A)-(O) of PURA, the PUCT CCN application and PUCT Substantive Rule 25.101. 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 compared (**Section 4** and **Appendix C**) for each resulting primary transmission line segment and ultimately used as a basis for the recommendation of the proposed alternative routes (**Section 5**).

Table 3-1. Environmental Data for Proposed Alternative Route Evaluation Criteria

LAND USE
Length of alternative route (feet)
Length of alternative route (miles)
Length of route parallel to existing electric transmission lines
Length of route parallel to railroads
Length of route parallel to existing public roads/highways
Length of route parallel to pipelines
Length of route parallel to apparent property boundaries
Total length of route parallel to existing compatible rights-of-way
Length of route using existing transmission line ROW
Length of route not utilizing/paralleling existing transmission line ROW
Length of new ROW required for route
Length of route not parallel to railroad ROW, apparent property lines, or other existing ROW (roadways, railways, canals, etc.)
Percent of route parallel with apparent features (existing ROWs or property lines)
Number of habitable structures within 300 feet of the route centerline[1]
Number of directly affected habitable structures [1] also within 300 feet of an existing transmission line
Number of parks or recreational areas within 1,000 feet of the route centerline[2]
Length of the route across parks/recreational areas
Length of route through commercial/industrial areas
Length of the route across cropland/hay meadow
Length across rangeland pasture
Length of route across agricultural cropland with mobile irrigation systems
Number of pipeline crossings
Number of transmission line crossings
Number of private airstrips within 10,000 feet of the route centerline
Number of FAA-registered airports with at least one runway more than 3,200 feet in length within 20,000 feet of route centerline
Number of FAA-registered airports with no runway greater than 3,200 feet in length within 10,000 feet of the route centerline
Number of heliports located within 5,000 feet of the route centerline
Number of commercial AM radio transmitters located within 10,000 feet of the route centerline
Number of FM, microwave, and other electronic installations within 2,000 feet of the route centerline
Number of U.S. or State Highway crossings by the route
Number of Farm to Market (FM), county roads, or other street crossings by the route
Number of water wells within the ROW
Number of oil and gas wells within the ROW
ECOLOGY
Length of route across upland woodlands
Length of route across riparian areas
Length of route across Coastal Management Zone
Length of route across National Wetland Inventory mapped wetlands
Number of stream crossings by the route
Length of route parallel to streams (within 100 feet)
Length across lakes or ponds (open waters)
Length of route across 100-year floodplains
Number of known rare/unique plant locations within the right-of-way
Length of route through known habitat of endangered or threatened species
CULTURAL RESOURCES
Number of cemeteries within 1,000 feet of the route centerline
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
Number of recorded cultural resource sites crossed by the route within ROW
Number of recorded cultural resources within 1,000 feet of the route centerline
Length of route across areas of high archeological/historical site potential
AESTHETICS
Estimated length of right-of-way within foreground visual zone of U.S. and State Highways
Estimated length of right-of-way within foreground visual zone of FM and county roads
Estimated length of right-of-way within foreground visual zone of park/recreational areas

LAND USE
NOTES: [1] Structures normally 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. [2] Defined as parks and recreational areas owned by a government body or an organized group, club, or church.

3.2 DATA COLLECTION AND CONSTRAINTS MAPPING

Once the study area boundary was identified, Halff initiated a variety of data collection activities. One of the first such activities was the development of a list of officials to whom a consultation letter regarding the proposed project would be mailed. The purpose of the consultation letters was to inform the various officials and agencies of the proposed project and give them the opportunity to provide information they may have regarding the study area. Halff utilized regional planning websites and confirmation via telephone calls to identify incorporated cities and towns within and near the study area and identify the local officials within each city or town. State and federal agencies that may have potential permitting requirements or other interests in the proposed project were also identified. Correspondence was sent to the following federal or state agencies, and local officials and departments. Copies of all correspondence to and from these agencies are included in **Appendix A**.

FEDERAL AGENCIES

- FAA
- FEMA – Region IV
- NRCS
- USACE – Galveston District Regulatory Division
- DoD – Military Aviation and Installation Assurance Siting Clearinghouse
- USFWS – Corpus Christi Field Office
- USEPA
- USNPS – Region 6

STATE AGENCIES

- RRC – Austin Office
- TARL
- TCEQ
- TxDOT – Houston District, Aviation, and Office of Environmental Affairs
- GLO

- THC
- TPWD
- Texas State Soil and Water Conservation Board – Harris County
- TWDB

COUNTY AGENCIES/OFFICIALS

- Chambers County Officials (County Judge, County Commissioners)
- Chambers County Historic Commission
- Chambers County Water District

CITY AGENCIES/OFFICIALS

(includes council members, city staff, and economic development boards)

- City of Mont Belvieu
- City of Baytown

SCHOOL DISTRICTS

- Goose Creek ISD
- Barbers Hill ISD

Other data collection activities included a file and record review of various regulatory agency databases, a review of published literature, and a review of a variety of maps, including recent aerial photography (NearMap, 2023), seamless USGS topographic maps (USGS, 1961-1977; National Geographic Society [NGS], 2019), county highway maps, and county appraisal district land parcel boundary maps (Texas Natural Resources Information System [TNRIS], 2022). Findings of the data collection activities are detailed in **Section 2.0**.

The data and information collected from the activities outlined above were used to develop an environmental and land use constraints map. The constraints map, public maps, aerial photography, reconnaissance surveys, and other research were used to identify and select potential preliminary alternative routes within the study area. In this context, constraints are land use or landscape features that may affect or be affected by the location of a transmission line. The goal of this approach is to identify opportunity areas, which are areas where constraints are absent or fewer, or those areas with a lower likelihood of containing existing natural or human

resources that could be affected by a transmission line. For linear projects, crossing over or near certain constraints is often unavoidable. In these instances, special considerations or mitigation measures may be used, even though there is no law or regulation that would otherwise prohibit the proximity of a transmission line.

3.3 RECONNAISSANCE SURVEYS

Halff conducted multiple reconnaissance surveys of the study area to develop and confirm the findings of the above-mentioned research and data collection activities and to identify existing conditions or constraints that may not have been previously noted. Results from the site visits were also utilized to assist in the alternative route selection process. Ground reconnaissance surveys were conducted by visual observations of study area characteristics from public roads and public ROW located within the study area. Reconnaissance survey information was noted in the field and geographically referenced to digital aerial photography base maps. Reconnaissance surveys were conducted on August 8, 2022, September 10, 2022, and October 14, 2022.

The data collection started with gathering information from public sources and continued up to the point of finalization of all proposed alternative routes. Results of the various data collection activities (e.g., solicitation of information from local, state, and federal officials and agencies, file/record review, and visual reconnaissance surveys) are included in **Section 1.0** and **Section 2.0** of this report.

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, and 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, distribution lines, roadways, and property boundaries provided routing opportunities.

3.5.1 Existing Linear Corridors

Within the areas of opportunity, Halff identified existing linear corridor features as potential paralleling opportunities in accordance with 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 (unpublished data), aerial imagery (NearMap, 2023), USGS topographical maps (USGS, 1961-1977), CAD files from CenterPoint Energy (Chambers County Appraisal District, 2020), additional available planning documents and reconnaissance surveys (NearMap, 2023).

3.5.2 Apparent Property Boundaries

Apparent property boundaries and fence lines were initially identified using parcel data that was downloaded and purchased (Chambers County Appraisal District, 2020) supplemented by readily available existing aerial photography (NearMap, 2023). CenterPoint Energy downloaded and purchased parcel information for the study area boundary directly from the Chambers County Appraisal District. The July 2020 parcel information was relied on to identify potential paralleling opportunities within the study area.

3.5.3 Roadway ROWs

Halff evaluated paralleling SH 99 and SH 146 and 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

Halff identified several existing transmission line corridors in the area, which include two 345 kV transmission lines and six 138 kV transmission lines. Some 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. A single existing transmission line ROW parallels the entire western boundary of the study area.

3.5.5 Existing Pipeline ROWs

Halff reviewed aerial photography and RRC data to identify pipeline ROWs within the study area. Pipeline locations were verified, where possible, during field reconnaissance surveys. Halff identified multiple existing pipeline ROWs traversing the study area. The existing pipeline ROWs were considered but did not always provide suitable paralleling opportunities. The PUCT rulemaking Project No. 42740 regarding the removal of the presumption that the PUCT has a preference for transmission lines paralleling pipelines was also taken into consideration. The ruling in Project No. 42740 also stated that pipelines are not included on the list of compatible ROWs for transmission lines (PUCT, 2015).

3.6 PROPOSED ALTERNATIVE ROUTE DEVELOPMENT

CenterPoint Energy provided the location of the origin points and two endpoints representing proposed Kilgore Substation sites to Halff. Multiple subsequent preliminary transmission line segments were developed to connect the proposed project endpoints.

3.6.1 Alternative Route Identification

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. Halff 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 county appraisal district;
- Existing compatible opportunity areas; and
- Location of existing developments.

The preliminary transmission line segments were identified in accordance with PURA § 37.056 (c)(4)(A)-(D), 16 TAC § 25.101, including the PUCT's policy of prudent avoidance, while also considering the evaluation criteria in **Table 3-1**. It was Halff'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. Halff, with CenterPoint Energy's input, identified 76 preliminary transmission line segments illustrated on **Figure 3-1**.

3.6.2 Public Involvement Program

3.6.2.1 Public Meeting

After developing the 76 preliminary transmission line routing segments, a public meeting was held in the City of Baytown which is located in the study area. The in-person public meeting was intended to solicit comments and input from residents, landowners, public officials, and other interested parties concerning the proposed project, preliminary alternative routes, and the overall transmission line routing process. In addition to gathering public input, the purpose of the meeting was to:

- Promote a better understanding of the proposed project including the need, purpose, potential benefits, potential impacts, and the PUCT regulatory approval process;

- Inform the public of the routing process, project schedule, and the decision-making process; and
- Identify the values and concerns of the public and community leaders.

The public meeting was held on October 13, 2022, from 5:00 to 8:00 p.m. at the Baytown Community Center, at 2407 Market St, Baytown, Texas 77520. CenterPoint Energy mailed a written notice of the public meeting to owners of property crossed or within 320 feet of the centerline of the preliminary alternative routes. CenterPoint Energy used a distance of 320 to determine the landowners to notice to account for any horizontal inaccuracies in the GIS aerial and the parcel shapefile. A total of 368 invitation letters were mailed to individuals and entities for the in-person public meeting. Each invitation letter included a map of the project. CenterPoint Energy also publicized the meeting through a public notice in local newspapers published on October 4, 2022, in the *Baytown Sun* and on October 4, 2022, in the *Houston Chronicle*. The public notice announced the location, time, and purpose of the meeting. A copy of the notices can be found in **Appendix B**.

At the in-person landowner public meeting, CenterPoint Energy and Halff set up information stations in the meeting room. Each station was devoted to an aspect of the proposed project and was staffed by CenterPoint Energy and/or Halff representatives. Each station had maps, illustrations, photographs, and/or text explaining each topic. Interested citizens and property owners were encouraged to visit each station so that the entire process could be explained in the general sequence of project development. The information station format is advantageous, because it allows attendees a chance to receive the information in a relaxed manner and allows them to focus on their area of interest and ask specific questions. Furthermore, the one-on-one discussions with CenterPoint Energy and Halff representatives encouraged more information from those who might be hesitant to speak out in a speakers/audience forum. The names of the information stations were Registration and Questionnaire Pick Up; Project Need; Routing and Environmental; Right-of-Way; Construction; Electromagnetic Fields Information; GIS Computer Station; and Questionnaire Drop Off.

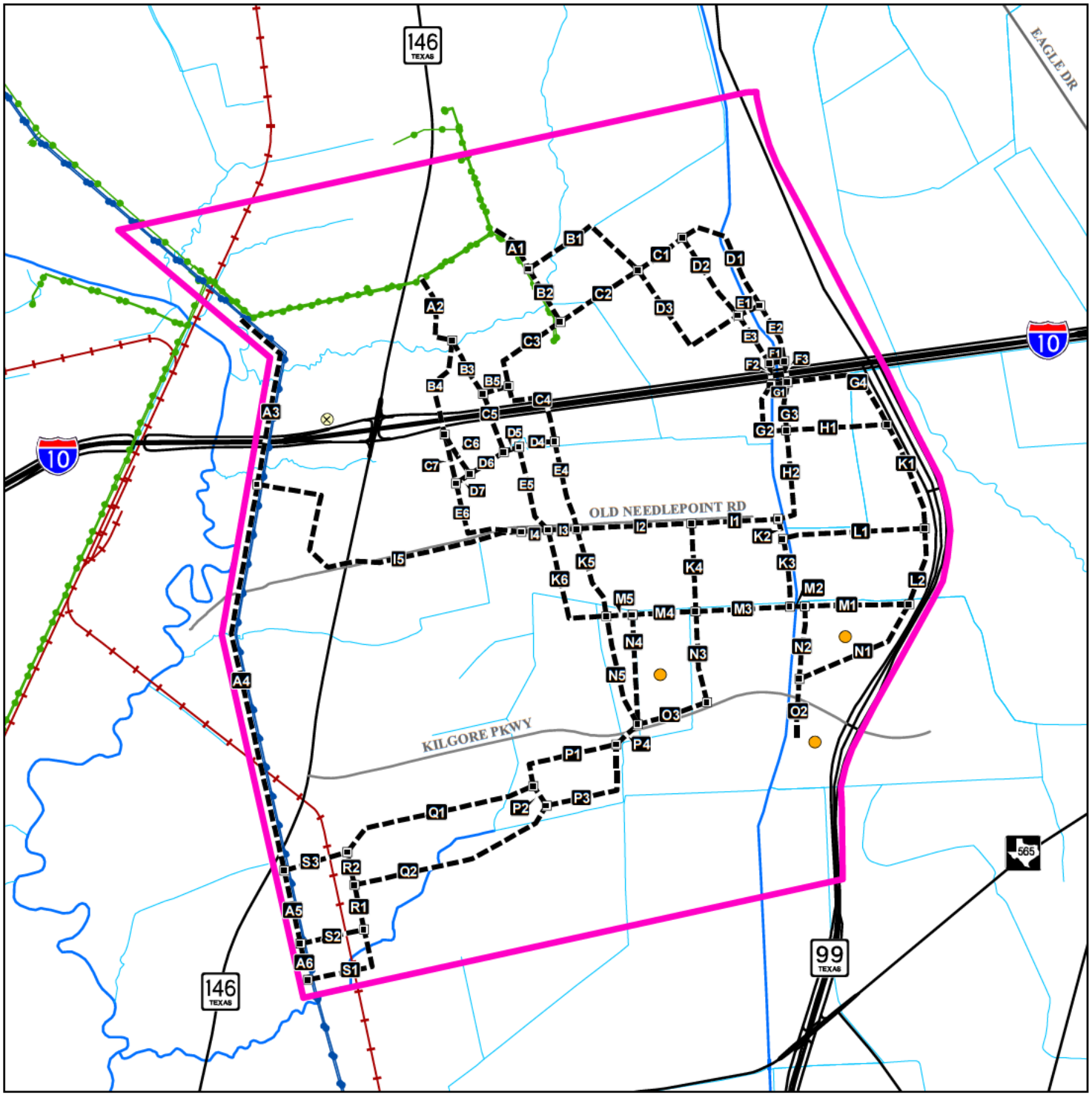


FIGURE 3-1

PRELIMINARY TRANSMISSION LINE SEGMENTS

KILGORE SUBSTATION

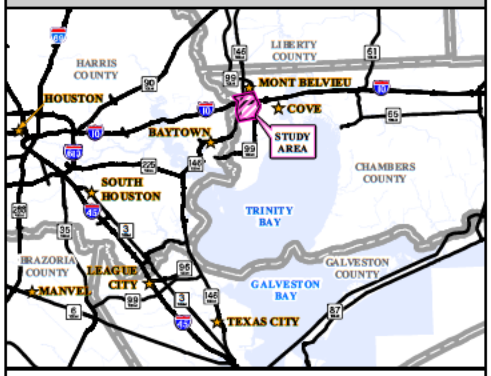
138 kV TRANSMISSION LINE PROJECT

LEGEND

- STUDY AREA
- PROJECT ENDPOINT
- NODE BETWEEN ADJACENT PRELIMINARY TRANSMISSION LINE SEGEMENT
- PRELIMINARY TRANSMISSION LINE SEGMENT
- HELIPORT
- MAJOR STREAM / CANAL
- MINOR STREAM / CANAL
- MAJOR ROADWAY
- MINOR ROADWAY
- RAILROAD
- EXISTING 345 KV TRANSMISSION LINE
- EXISTING 138 KV TRANSMISSION LINE

SOURCE: TNRIS, 2022

MAP VIEW EXTENT



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CenterPoint Energy established a project website, Kilgore Substation Project | CenterPoint Energy, to further provide information to the public. The website content explains the scope of the proposed project including the need for the project and the construction and routing options in addition to the PUCT's process to review and approve the project. The website also provides several project documents, a project questionnaire, electromagnetic fields information, maps and aerial photos, and a link to the PUCT website.

Upon entering, 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 proposed Kilgore Substation sites. The questionnaire solicited comments on the proposed project and an evaluation of the information presented at the meeting. The information packet also included a question sheet that could be submitted to the panel during the discussion, a welcome sheet that explained how the meeting was organized, a Frequently Asked Questions sheet about the project, a project schedule, the transmission need display, and several construction displays. Copies of the information packet documents are located in **Appendix B**.

Of the 368 notification letters, 15 people signed in at the public meeting, which represents approximately 3 percent of the notified landowners. Five questionnaires were submitted at the public meeting. Halff reviewed and evaluated each questionnaire. As a result, the analysis indicated that four (33 percent) of the attendees agreed that the need for the project has been adequately explained, while one (8 percent) attendee indicated that the need was not adequately explained.

The questionnaire also 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 their greatest concerns from one, which was the greatest concern, to 11, which was the 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. Wildlife (17 percent), wetlands (8 percent), residential areas (8 percent), and other: noise and health (8 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 pertaining to 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 one (most important) to seven (least important) from a list of features which included: roads, telephone lines, property lines, electrical lines, railroads, ditches, and others. The responses that received a rank of one (most important) indicated that roads and highways (17 percent), electrical lines (8 percent), other: noise and health (8 percent), and natural features (8 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 questionnaires indicated that no other factors should be considered (25 percent), future development sites (8 percent), and noise, health, eye sore (8 percent), should be considered and avoided, if possible.

Four of the questionnaires received (33 percent) indicated that the respondents were not aware of any incorrect or missing features on the Environmental and Land Use Constraints Map (see **Figure 4-1** [**Appendix D**]); one (8 percent) indicated that features were missing or incorrectly plotted on the map.

When asked on the questionnaire if respondents had a concern with a particular preliminary transmission line segment, four of the respondents (33 percent) did not respond or responded with “N/A” and one (8 percent) responded with “Segment A3 in Mont Belvieu is preferred. Follow existing easements.”

When asked on the questionnaire if respondents had a preference for the type of transmission line structure that is being proposed for the project, four of the respondents (33 percent) answered no and one (8 percent) indicated that they would prefer a steel pipe. Based on the low number (less than 10 percent) of respondents specifying a specific structure type preference, no strong indication for a particular transmission line structure type was indicated.

When asked on the questionnaire which of the 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, three (25 percent) indicated that none of situations applied, one (8

percent) indicated other: City of Mont Belvieu, and one (8 percent) indicated that the preliminary transmission line segment was near their home, near their business, and is on their land.

The questionnaire asked if the information that was provided and the exhibits displayed at the public meeting met their needs. Four (33 percent) responded yes, while one (8 percent) responded no.

The questionnaire asked whether the respondent had visited the 138kV Kilgore Substation Project website to view the information about the project. Of those that responded, three (25 percent) answered no, and two (17 percent) answered yes.

The questionnaire also provided space for additional comments from attendees. None of the individuals provided additional comments.

3.6.3 Comments from Agencies, Officials and Organizations

Halff developed a list of federal, state, and local agencies and organizations that would potentially have an interest in the proposed project. **Section 3.2** lists agencies, organizations, and public officials that were sent scoping letters regarding the proposed project. A map of the study area was included in each letter. Copies of the agency scoping letters sent and responses received are located in **Appendix A**.

Responses received are summarized below.

- The City of Baytown, Public Works and Engineering Department, responded with an email dated August 10, 2022, indicating that a Limited Purpose Annexation (LPA)/ Extraterritorial Jurisdiction (ETJ) Developments “ETJ Engineering Development” permit, a miscellaneous “Stormwater Permit”, and a non-residential “Floodplain Permit” could potentially be required for the project. Links for permit submittal were also provided.

- The USDA responded with an email dated August 10, 2022, stating no USDA-NRCS easements are within the study area; however, several soils within the study area have potential limiting properties. Limiting properties include hydric soils, high potential for erosion by wind, high risk for soil-induced steel corrosion, and moderate to high risk for

soil-induced concrete corrosion. The USDA recommends soil erosion prevention practices. A report of relevant soil interpretations for the study area was provided.

- TARL responded with a letter dated August 12, 2022, indicating four documented archeological sites, one OTHM, and several linear archeological surveys for pipeline projects are within the study area. No SALs or properties listed in the NRHP are within the study area. They also directed Halff to the Archeology Division of the THC for regulatory matters.

- The THC responded with emails dated August 12, 2022, and September 6, 2022, providing a tracking number (202213453) and several comments. They stated that an archeological survey is required, known archeological sites are within the study area, and the study area contains areas with a high probability of containing intact archeological sites. The area has not been surveyed by a professional archeologist. It was also stated that a Texas Antiquities Permit will be required if the study area contains land owned or controlled by a state agency prior to field work.

- The RRC responded with an email dated August 17, 2022, directing Halff to the RRC's GIS website. They stated that no coal mining or uranium exploration operations exist in Chambers County.

- The City of Mont Belvieu responded with an email dated August 19, 2022, stating that some construction activities are restricted within zoning districts and that permits are required for work within the jurisdiction of the city. Links to the Mont Belvieu GIS and building department permit page were provided.

- The USACE, Real Estate Division, responded with an email dated August 19, 2022, stating that the USACE does not own any real property within the study area.

- TxDOT responded with emails dated August 23, 2022, September 6, 2022, and September 9, 2022, directing Halff to the District Engineer for Beaumont and the TxDOT project tracker website. The Beaumont District provided comments on ROWs, a Keyhole Markup Language Zipped file with pond locations, and indicated the study area crosses the SH 99 (i.e., Grand Parkway) project for which they also included design plans.

- The GLO responded with a letter dated August 24, 2022, stating they see no environmental issues or land use constraints within the study area. The GLO would like to re-assess the project once a final route has been chosen to review potential stream or Permanent School Fund land crossings.

- FEMA responded with an email dated August 30, 2022, requesting that the community floodplain administrator be contacted for project review and potential permitting required.

- TPWD responded with an email dated September 19, 2022, providing a project number (49022) and numerous recommendations relating to general construction, international dark skies designation and lighting, federal regulations, state regulations, species of greatest conservation need, vegetation, invasive species, monarch, and pollinator conservation, and the TXNDD.

- The FAA responded with an email dated September 20, 2022, the letter requested compliance with its guidelines for the construction of structures that may affect navigable airspace and provided instructions on the procedure for obtaining FAA approval for transmission lines proposed near a navigable airspace.

3.6.4 Proposed Alternative Routes

Halff and CenterPoint Energy considered comments received from agencies and officials, reviewed the preliminary transmission line segments (**Figure 3-1**), and determined that minor modifications or revisions were necessary. Three potential substation sites were initially identified. It was determined that the substation site at the southwest corner of SH 99 and Kilgore Parkway had been sold and was no longer available. Development has started on this parcel and therefore was removed from consideration as a potential substation site following the public meeting. Modifications and revisions to preliminary transmission line segments are summarized below.

- **Removal of Preliminary Route Segment D7**

  Preliminary route segment D7 was removed to eliminate non-forward progressing routes generated for routes utilizing preliminary route segment B4.

- **Removal of Preliminary Route Segment L1**

  Preliminary route segment L1 was removed as a result of a future residential development that is currently under construction and further information received following the public meeting.

- **Removal of Preliminary Route Segments A5, A6, S2, S1, and R1**

  Preliminary route segments A5, A6, S2, S1, and R1 were removed to eliminate non-forward progressing routes generated for routes unitizing segment A4.

- **Removal of Preliminary Route Segments O2 and N1**

  Preliminary route segments O2 and N1 were removed when it was determined that one of the three proposed Kilgore Substation Sties was no longer a viable option following the public meeting.

- **Modifications to Preliminary Route Segment M1 by Addition of Segment M13**

  Preliminary route segment M1 was split into segments M11 and M12, resulting from the addition of segment M13. Route segment M13 provides an opportunity for alternative routes to access central portions of the tract associated with the eastern proposed Kilgore Substation site.

- **Modification to Preliminary Route Segment M4**

  Preliminary route segment M4 was split into segments M41 and M42, resulting from the addition of route segment M43. Route segment M43 provided an opportunity for alternative routes to access central portions of the tract associated with the western proposed Kilgore Substation site; however, it was determined that progression to the center of the tract was preferred to be from the south or east, as such route segment M43 was removed.

- **Modifications to Preliminary Route Segment N2 by Addition of Segment N23**

  Preliminary route segment N2 was split into segments N21 and N22, resulting from the addition of segment N23. Route segment N23 provides an opportunity for alternative routes to access central portions of the tract associated with the eastern proposed Kilgore Substation site. Route segment N22 was then removed due to one of the original three proposed Kilgore Substation Sites no longer being considered as a viable option.

- **Modifications to Preliminary Route Segment N3 and Addition of Segment N33**
  Preliminary route segment N3 was split into segments N31 and N32, resulting from the addition of segment N33. Route segment N33 provides an opportunity for alternative routes to access central portions of the tract associated with the western proposed Kilgore Substation site.

- **Modifications to Preliminary Route Segment N4**
  Preliminary route segment N4 was split into segments N41 and N42, resulting from the addition of segment M43. Route segment N43 provides an opportunity for alternative routes to access central portions of the tract associated with the western proposed Kilgore Substation site; however, it was determined that progression to the center of the tract was preferred to be from the south or east, as such segment N43 was removed.

- **Modifications to Preliminary Route Segment O3 and Addition of Segment O33**
  Preliminary route segment O3 was split into segments O31 and O32, resulting from the addition of segment O33. Route segment O33 provides an opportunity for alternative routes to access central portions of the tract associated with the western proposed Kilgore Substation site.

Following modifications and revisions to preliminary transmission line segments that resulted from the consideration of comments received from agencies and officials, further modifications were required by CenterPoint Energy engineering department. Modifications and revisions to preliminary transmission line segments are summarized below.

- **Modification to Preliminary Route Segment A1 and Segment B2**
  Preliminary route segment A1 was removed and was relocated south of preliminary route segment B1 to a new tie-in (origin point) location. Due to the relocation, preliminary route segment B2 was shortened and no longer shares a connection to preliminary route segment B1

- **Modification to Preliminary Route Segment B1**
  Preliminary route segment B1 was minorly extended to a new tie-in (origin point) location.

- **Modification to Preliminary Route Segment A2**
  Preliminary route segment A2 was minorly shortened to better represent the proposed tie-in (origin point) location.

- **Modification to Preliminary Route Segment A3**
  Preliminary route segment A3 was extended to provide for a more adequate tie-in (origin point) location.

Following the revisions and modifications the preliminary transmission line segments were then considered to be the primary transmission line segments. The project team used the primary transmission line segments to identify the proposed alternative routes to be evaluated by Halff in this EA.

Of the numerous possible forward progressing route combinations, 20 proposed alternative routes were identified and selected by Halff and CenterPoint Energy. They provide geographically diverse alternatives across the study area to connect the proposed origin points with the Kilgore Substation. Each of the 76 proposed transmission line segments is used in at least one of the 20 proposed alternative routes.

The 20 proposed alternative routes and their segment combinations are presented in **Table 3-2** below. **Figure 3-2** depicts the location of the primary transmission line segments that, when combined, form the proposed alternative routes.

Table 3-2. Segment Composition of the Proposed Alternative Routes

PROPOSED ALTERNATIVE ROUTES	SEGMENT COMPOSITION
1	B1-C1-D2-E3-F2-G2-H1-K1-L2-M12-M13
2	B1-D3-E1-E2-F3-G3-H2-K2-K3-M2-M11-M13
3	B1-D3-E3-F1-F3-G3-H2-K2-K3-M2-N21-N23
4	B1-D3-E3-F2-G1-G3-H2-I1-K4-N31-N33
5	A1-B2-C2-C1-D1-E2-F3-G4-K1-L2-M12-M13
6	A1-B2-C3-C4-E4-K5-M5-M41-M42-M3-M2-M11-M13
7	A1-B2-C3-C4-E4-K5-M5-M41-M42-N31-N33
8	A2-B3-B5-C4-E4-K5-N5-O31-O33
9	A2-B3-C5-D5-D4-E4-K5-M5-M41-M42-N31-N33
10	A2-B3-C5-D5-E5-I3-I2-K4-N31-N33
11	A2-B3-C5-D5-E5-I3-K5-N5-O31-O33
12	A2-B3-C5-D5-E5-K6-N5-O31-O33
13	A2-B4-C6-D6-D5-D4-E4-K5-M5-M41-M42-M3-M2-N21-N23
14	A2-B4-C7-E6-I4-I3-I2-I1-K2-K3-M2-N21-N23
15	A3-A4-S3-Q1-P1-P4-N42-N41-M41-M42-M3-M2-N21-N23
16	A3-A4-S3-Q1-P1-P4-O31-O33

Table 3-2. Segment Composition of the Proposed Alternative Routes

PROPOSED ALTERNATIVE ROUTES	SEGMENT COMPOSITION
17	A3-A4-S3-Q1-P1-P4-O31-O33
18	A3-A4-S3-R2-Q2-P2-P1-P4-O31-O32-N32-N31-M3-M2-N21-N23
19	A3-A4-S3-R2-Q2-P3-P4-O31-O33
20	A3-I5-I4-I3-I2-I1-K2-K3-M2-N21-N23

These 20 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.

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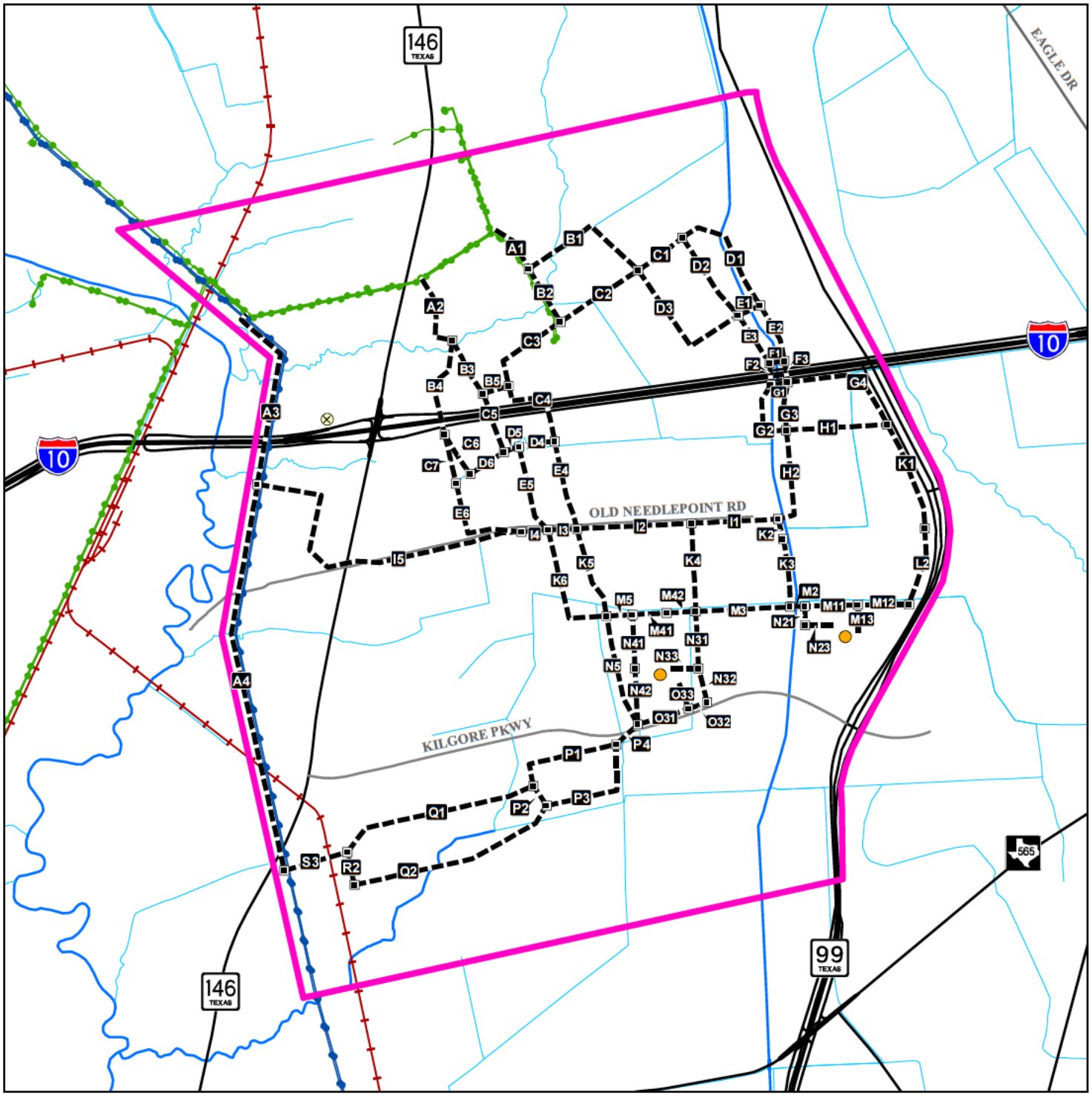


FIGURE 3-2

PROPOSED ALTERNATIVE ROUTE LINE SEGMENTS

KILGORE SUBSTATION

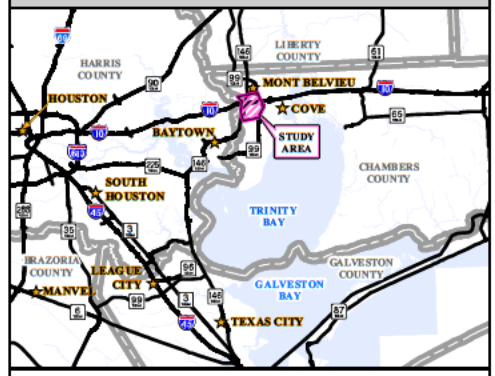
138 kV TRANSMISSION LINE PROJECT

LEGEND

- STUDY AREA
- PROJECT ENDPOINT
- NODE BETWEEN ADJACENT PROPOSED TRANSMISSION LINE SEGEMENT
- PROPOSED TRANSMISSION LINE SEGMENT
- HELIPORT
- MAJOR STREAM / CANAL
- MINOR STREAM / CANAL
- MAJOR ROADWAY
- MINOR ROADWAY
- RAILROAD
- EXISTING 345 KV TRANSMISSION LINE
- EXISTING 138 KV TRANSMISSION LINE

SOURCE: TNRIS, 2022

MAP VIEW EXTENT



0 1,500 3,000 6,000

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CenterPoint Energy

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4.0 IMPACTS OF THE PROPOSED ALTERNATIVE ROUTES

Evaluation of the 20 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 Halff and CenterPoint Energy used to identify the set of proposed alternative routes, evaluated in **Section 5.0**, for inclusion in the PUCT 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 **Table 4-1**, located in **Appendix C**. This section provides a summary and discussion of the comparison between the 20 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 potential impacts to land use resulting from the construction of a transmission line are 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 20 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 fewer potential impacts. The total lengths of the proposed alternative routes vary from approximately 12,901 feet for Proposed Alternative Route 9, to approximately 29,873 feet for Proposed Alternative Route 18. The differences in route lengths reflect the direct or indirect pathway of each proposed alternative route between the proposed 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 4-1** (**Appendix C**).

4.1.3 Compatible ROW

16 TAC § 25.101(b)(3)(B) requires that the PUCT 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 to existing transmission line ROW, length of route parallel to other existing linear ROWs and length of ROW parallel to apparent property lines. Although pipeline ROW was not generally treated as a routing opportunity, Halff 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.

Three of the 20 proposed alternative routes are parallel to some length of existing transmission line ROW. The total proposed alternative route lengths parallel to existing transmission line ROW vary from zero each for Proposed Alternative Routes 1 through 4 and 8 through 20 to approximately 202 feet for Proposed Alternative Routes 5 through 7. The length parallel to

existing transmission line ROW for each of the proposed alternative routes are presented in **Table 4-1** (**Appendix C**).

Six of the 20 proposed alternative routes are within some length of existing transmission line ROW. The total proposed alternative route lengths located within existing transmission line easements vary from zero each for Proposed Alternative Routes 1 through 14 to approximately 12,870 feet for Proposed Alternative Routes 15 through 19. Proposed Alternative Route 20 is located within an existing transmission line easement for a length of 4,554 feet. The length within existing transmission line easement for each of the proposed alternative routes are presented in **Table 4-1** (**Appendix C**).

The proposed alternative routes with lengths parallel to existing pipeline ROW ranges from approximately 372 feet for Proposed Alternative Routes 10, 14, and 20 to approximately 12,870 feet for Proposed Alternative Routes 15 through 19. The lengths parallel to existing pipeline ROW for each of the proposed alternative routes are presented in **Table 4-1** (**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 range from approximately 393 feet for Proposed Alternative Route 5, to approximately 8,615 feet for Proposed Alternative Route 15. The lengths paralleling apparent property lines for each of the proposed alternative routes are presented in **Table 4-1** (**Appendix C**).

The proposed alternative routes with lengths paralleling other existing linear features, including roadways, railways, etc. range from zero feet for Proposed Alternative Routes 9, 13, 15, to approximately 10,455 feet for Proposed Alternative Route 20. The lengths paralleling other existing linear features for each of the proposed alternative routes are presented in **Table 4-1** (**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, other existing ROW, and apparent property lines and then dividing the result by the total length of the route.

The percentage of each route that parallels existing linear features ranges from 28 percent for Proposed Alternative Route 9, to 80 percent for Proposed Alternative Route 17. The percentage of each proposed alternative route parallel with existing linear features is presented in **Table 4-1** (**Appendix C**).

4.1.4 Urban and Residential Areas

Important measures of potential land use impacts include the number of habitable structures located near each alternative route and the proximity of each habitable structure to the alternative route. Halff determined the number and distance of habitable structures located within 300 feet of the centerline of each alternative route through the interpretation of aerial photography and verification during reconnaissance surveys, where practical. To account for photographic interpretation limitations such as shadows, tree canopies, and horizontal accuracy of the photography, Halff identified all habitable structures within a measured distance of 300 feet of the alternative route centerline.

All of the alternative routes have habitable structures located within 300 feet of their centerlines. Proposed Alternative Route 1 has the least number of habitable structures located within 300 feet of its centerline with only one habitable structure. Proposed Alternative Route 20 includes the highest number of habitable structures located within 300 feet of its centerline, which is 198 habitable structures. No habitable structures are located within 300 feet of an existing transmission line for Proposed Alternative Routes 1 through 4. There are as many as 161 habitable structures within 300 feet of an existing transmission line for Proposed Alternative Routes 15, 16, 17, 18, and 19. The number of habitable structures located within 300 feet of each of the proposed alternative route centerlines are presented in **Table 4-1** (**Appendix C**).

Table 4-2 (**Appendix C**) presents detailed information on habitable structures within 300 feet of each of the proposed alternative route centerlines. The number of habitable structures within 300 feet of each of the proposed alternative route centerlines are presented in **Table 4-1** (**Appendix C**). All known habitable structure locations are shown on **Figure 4-1** (**Appendix D**).

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 commercial and industrial areas, agricultural land or cropland, rangeland or pastureland, and open water.

All of the proposed alternative routes cross commercial and industrial areas. None of the proposed alternative routes cross agricultural land or cropland, nor do they cross areas of mobile irrigated cropland or pastureland. Therefore, no impacts will occur on these land use types.

4.1.6 Transportation, Aviation, and Utilities

4.1.6.1 Transportation

Potential impacts to transportation could include temporary disruption of traffic and conflicts with proposed roadway and/or utility improvements and may include slightly increased traffic during construction of the proposed project. However, such impacts are usually temporary and short-term. CenterPoint Energy would be required to obtain road-crossing permits from TxDOT for any crossing of state-maintained roadways.

There are several U.S. highway, SH, and FM or other roads crossed by the proposed alternative routes. The number of U.S. highway and SH crossings range from one for Alternative Routes 1 through 14, and two for Alternative Routes 15 through 20. The number of FM or other road crossings range from one for Alternative Routes 1 and 5, to six for Alternative Routes 15 and 18. The number of U.S. highway, SH, FM road, or other road crossings for each of the proposed alternative routes are presented in **Table 4-1** (**Appendix C**).

4.1.6.2 Aviation

Typical transmission line structure heights would be approximately 100 feet. According to the FAA Regulation (14 CFR Part 77), notification of the construction of the proposed project is required if structure heights exceeds an imaginary slope extending outward and upward at a slope of 100 to 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 in length; 50 to 1 for a horizontal distance of 10,000 feet from the nearest runway of a public or military airport where all runways are less than 3,200 feet in length; or 25 to 1 for a horizontal distance of 5,000 feet for heliports.

Two public and two private FAA registered airports with at least one runway longer than 3,200 feet are located within 20,000 ft of the proposed alternative routes. There are no public or military FAA registered airports where no runway is longer than 3,200 feet is located within 10,000 feet of any of the proposed alternative routes. There is one heliport located with 5,000 feet of the proposed alternative routes.

Following PUCT 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 (FAA, 2000).

The number of heliports within 5,000 feet of the proposed alternative routes ranges from zero for Proposed Alternative Routes 1 through 5, to one for Proposed Alternative Routes 6 through 20. None of the proposed alternative routes have private airstrips located within 10,000 feet of the route centerline. None of the proposed alternative routes have FAA-listed airports located within 10,000 feet of route centerline having no runway more than 3,200 feet. The number of FAA-listed airports within 20,000 feet of route centerline having at least one runway more than 3,200 feet includes one for Proposed Alternative Routes 6 and 7, two for Proposed Alternative Routes 1 through 5 and 8 through 14, and three for Proposed Alternative Routes 15 through 20. **Table 4-3 (Appendix C)** presents detailed airport, airstrip, and heliport information for each of the proposed alternative routes.

Table 4-3 (**Appendix C**) presents 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 4-1** (**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** [**Appendix C**]). Heliport locations are shown on **Figure 4-1** (**Appendix D**), while all other aviation facilities mentioned above are located outside the view extent.

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 22 crossings on Proposed Alternative Routes 4, to 84 crossings for Proposed Alternative Route 17. The number of pipeline crossings for each of the proposed alternative routes is presented in **Table 4-1** (**Appendix C**).

Two existing electric transmission line corridors were identified within the study area. Routes 6 and 7 that utilize primary transmission line segment C3 cross one of these corridors, while Routes 15 through 20 which utilize the primary transmission line segments A3 and A4 will presumably cross transmission lines as the project leaves the existing transmission line corridor. 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 4-1** (**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 or FM radio towers were identified within 10,000 feet of any of the route centerlines for the proposed alternative routes. The number of microwave or other electronic installation structures identified within 2,000 feet for the proposed alternative routes includes one for Proposed Alternative Routes 1 through 5, two for Proposed Alternative Routes 6 through 14 and 20, and three for Proposed Alternative Routes 16 through 19.

Table 4-4 (**Appendix C**) 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 4-1** (**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** [**Appendix C**]). All known communication tower locations are shown on **Figure 4-1** (**Appendix D**).

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 proposed 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.

Impacts on Agriculture

Of the 20 alternative routes, none have lengths across cropland or hay meadows. Refer to **Table 4-1** (**Appendix C**) for the length across cropland for each of the proposed alternative routes.

Impacts on Oil and Gas Facilities

A few of the proposed alternative routes have oil and gas wells that would be located within the ROW. The number of oil and gas wells within the ROW range from zero for Proposed Alternative Routes 1 and 5 through 20, to three for Proposed Alternative Routes 2 through 4. Refer to **Table 4-1** (**Appendix C**) for the number of oil and gas wells within the ROW of the proposed alternative routes.

4.2 RECREATIONAL AND PARK AREA

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 proposed project. There is one park identified within the study area.

Where the ROW crosses, or is within 1,000 feet of, certain recreational facilities designated for active recreation (e.g., playing fields, trails), the areas might be temporarily unavailable for access or play during construction. After construction, none of the alternative route segments would be anticipated to permanently disrupt or preempt recreational facilities associated with these different areas. No significant impacts are anticipated for any of the fishing or hunting areas from the construction of any of the proposed alternative routes.

Three of the proposed alternative routes cross a park or recreation area. The length of route across parks or recreation areas ranges from zero for Proposed Alternative Routes 1 through 4 and 8 through 20, to approximately 315 feet for Proposed Alternative Routes 5 through 7. The number of additional parks or recreation areas that are located within 1,000 feet of proposed alternative route centerline ranges from zero for Proposed Alternative Routes 5 through 20, to one for Proposed Alternative Routes 1 through 4. Refer to **Table 4-1** (**Appendix C**) for the number of parks or recreation areas crossed and located within 1,000 feet of the proposed alternative routes.

Impacts on Lands with Conservation Easements

No lands with conservation easements will be crossed by any of the proposed alternative routes. No adverse impacts are anticipated for conservation easements.

Table 4-5 (**Appendix C**) presents detailed information on park and recreational facilities. The number of parks located within 1,000 feet or crossed by a proposed alternative route centerlines are presented in **Table 4-1** (**Appendix C**). The distance of park and recreational facilities from the nearest proposed alternative route was measured using GIS software and aerial photograph interpretation (see **Table 4-5** [**Appendix C**]). The location of all known recreational areas and parks are shown on Figure 4-1 (**Appendix D**).

4.3 HISTORICAL AND AESTHETIC VALUES

Construction activities associated with the proposed project have the potential to adversely impact cultural resources through changes in the quality of the archeological, historical, or cultural characteristics that qualify a property under the eligibility requirements for listing in the NRHP. Adverse impacts occur when an undertaking alters the integrity of location, design, setting, materials, construction, or association that contribute to a resource's significance in accordance with the NRHP criteria.

As discussed in 36 CFR Part 800, adverse impacts on the NRHP listed or eligible properties may occur under conditions that include, but are not limited to:

- Destruction or alteration of all or part of a property;
- Isolation from or alteration of the property's surrounding environment (setting); or
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

Direct impacts typically occur during construction, whereas indirect impacts include those caused by construction that occurs later in time or are farther removed but foreseeable. These impacts may include alterations in the pattern of land use, changes in population density, or accelerated growth rates, all of which may have an impact on properties with historic, architectural, archeological, or cultural significance.

The preferred form of mitigation for direct or indirect impacts for cultural resources is avoidance. An alternative form of mitigation of direct impacts can be developed for archeological historic

properties with the implementation of a program of detailed data retrieval. Additionally, relocation may be possible for some historic structures. Indirect impacts on above-ground historic resources and landscapes can be lessened through careful design considerations and landscaping.

The method utilized to assess an area for potential archeological resources is outlined in the pre-approved research design developed by CenterPoint Energy and THC for new transmission line studies. This method involves the preliminary identification of high probability areas (HPAs) through background research performed ahead of any fieldwork. Physiographic settings identified as HPAs for archeological sites generally consist of areas that contain deep soils and are in proximity to natural water sources. More specifically, such areas include interfluve summits overlooking alluvial valleys, interfluve toe slopes and alluvial and colluvial fans adjacent to alluvial valleys, natural levees or levee remnants, alluvial terraces, rises within floodplains, upland edges adjacent to alluvial valleys and stream confluences, near springs and within floodplain deposits.

HPAs are typically defined by a distance relationship of approximately 1,000 feet from any of the above physiographic settings, which may have attracted past human activity and are therefore deemed appropriate for the presence of cultural resources. Areas identified as HPAs are to undergo intensive pedestrian archeological surveys. Survey methods in these areas include careful ground surface inspection and survey transects no more than 100 feet apart, with shovel tests to be placed arbitrarily in locations determined at the discretion of the professional archeologist in the field. Identification of HPAs for historic sites depends on the results of archival and historic research, which is conducted prior to conducting any fieldwork. The approximate lengths of HPAs crossed by each proposed alternative route are presented in **Table 4-1** (**Appendix C**).

4.3.1 Archeological and Historical Values

4.3.1.1 Archeological and Historic Resources

There is one OTHM, Barbers Oil Field, that is within the study area. Although Barbers Hill Oil Field is not listed as eligible for the NRHP, construction impacts to portions of the oil field located in the study area are recommended for avoidance given its potential historical significance. Most of the study area retains a rural, agricultural character intermixed with modern commercial and residential land use. In addition to the previously documented cultural resources listed above in **Table 2-7** and **Table 2-8**, typical historic resources in the study area may include homesteads and farmsteads or remnants thereof, farmhouses, associated barns and outbuildings, industrial facilities, fencing, water storage tanks, troughs, animal pens, and windmills. These observations

are based on historic map reviews and views of areas in the region from public roadways, and additional potentially historic features may be found in areas that are not visually accessible.

As documented in **Table 2-8**, a total of four archeological historic properties and one historical cemetery are located within the study area. All four of the archeological sites have an undetermined NRHP eligibility status and are thus recommended for avoidance.

The file review, including data from TASA, indicated four documented historical and archeological sites within 1,000 feet of the proposed alternative routes. The number of historical and archeological sites within the ROW (i.e., 40 feet from the route centerline) is zero for Proposed Alternative Routes 1 through 14 and Route 20, one for Proposed Alternative Routes 15, 16, and 17, and two for Proposed Alternative Routes 18 and 19. The number of additional historical and archeological sites not within the ROW but located within 1,000 feet of the route centerline is zero for Proposed Alternative Routes 1 through 7, one for Proposed Alternative Routes 8 through 14 and Routes 18 & 19, and two for Proposed Alternative Routes 15 through 17. The length of routes across HPAs is zero feet for Proposed Alternative Routes 8 through 14, 24 feet for Proposed Alternative Routes 5, 6, and 7, 1,073 feet for Proposed Alternative Routes 1 through 4, 3,869 feet for Proposed Alternative Route 20, 7,503 feet for Proposed Alternative Routes 15, 16, and 17, and 9,215 feet for Proposed Alternative Routes 18 and 19.

Table 4-6 (**Appendix C**) presents detailed information on documented historical and archeological sites within 1,000 feet of the proposed alternative routes centerline and/or within the proposed ROW, while the numbers associated with proposed alternative route centerlines are presented in **Table 4-1** (**Appendix C)**.

4.3.1.2 Cemeteries

A review of the TASA and topographic maps indicated that no cemeteries will be crossed by or are located within 1,000 feet of the proposed alternative routes.

4.3.1.3 Architectural Sites

A review of the TASA and NRHP Register indicated no additional NRHP-listed or determined eligible properties crossed by or within 1,000 feet of the proposed alternative routes.

4.3.1.4 Summary

The TASA database shows that a total of five previous cultural resources studies have been conducted in the study area, roughly half of which has been developed for residential and commercial use following the mid-20th century. While intact undocumented archeological sites are unlikely in these previously disturbed areas, intact archeological deposits could be present in undeveloped portions of the study area. Therefore, proposed ground disturbing activity associated with transmission construction within the study area may have effects on archeological historic properties, including those with sufficient integrity warranting NRHP eligibility consideration. As such, an intensive cultural resources surveys may be required within areas where ground disturbing activity is proposed for the project.

Following PUCT approval of the proposed project, a cultural resources survey will be conducted in accordance with the pre-approved research design developed by CenterPoint Energy and THC for new transmission line studies. Any potential impacts to significant cultural resources discovered during this initial survey will be mitigated, if required, through consultation with the THC. In the event CenterPoint Energy or its contractors encounter any archeological materials or other cultural resources during construction within the study area, CenterPoint Energy will cease work in the immediate vicinity of the resource and report the discovery to the THC.

4.3.2 Aesthetic Values

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

Construction of the proposed project could have both temporary and permanent aesthetic effects. Temporary impacts may include views of the actual assembly and erection of the structures. Where wooded areas are cleared, the brush and wood debris could have an additional negative temporary impact on the local visual environment. Permanent aesthetic impacts from the proposed project may include the views of the structures and lines.

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 (i.e., one-half mile, unobstructed by topography, structures, or vegetation) of the following viewpoints or corridors was tabulated:

- U.S. Highways and SHs within one-half mile with unobstructed views;
- FM and CRs within one-half mile with unobstructed views; and
- Parks and recreational areas within one-half mile with unobstructed views.

All of the 20 proposed alternative routes are located within the foreground visual zone of any U.S. highway or SHs. The length of the route within the foreground visual zone of highways ranges from approximately 6,299 feet for Proposed Alternative Route 7, to approximately 17,283 feet for Proposed Alternative Route 5.

All of the 20 proposed alternative routes are located within the foreground visual zone of any FM roads or CRs. The length of route within the foreground visual zone of FM roads and CRs range from approximately 3,644 feet for Proposed Alternative Route 5, to approximately 24,017 feet for Proposed Alternative Route 15.

Of the 20 proposed alternative routes, 14 are located within the foreground visual zone of any parks or recreational areas. The length of route within the foreground visual zone of parks ranges from zero feet for Proposed Alternative Routes 15 through 20, to approximately 6,089 feet for Proposed Alternative Route 1.

A summary of the lengths for each of the proposed alternative routes within the foreground visual zone of the parks and recreational areas, U.S. highways, SHs, FM roads, and CRs is presented in **Table 4-1** (**Appendix C**).

4.4 ENVIRONMENTAL INTEGRITY

4.4.1 Physiography and Geology

Construction of the proposed project would have no significant effect on the physiographic or geologic features/resources of the area. The erection of the structures would require the removal

and/or minor disturbance of small amounts of surface and near-surface materials but would have no measurable impact on the geologic resources or features along any of the alternative routes, and no geologic hazards are anticipated.

4.4.2 Soils

The construction and operation of transmission lines normally create very few long-term adverse impacts on soils. The major potential impact upon soils from transmission line construction would be erosion and soil compaction. The potential for soil erosion is generally greatest during the initial clearing of the ROW until vegetation cover reestablishes.

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, if required, of woody vegetation including trees, brush and undergrowth will be conducted within the ROW area prior to the start of construction. Areas where vegetation is removed have the highest potential for soil erosion, and the use of heavy equipment on the cleared ROW creates the greatest potential for soil compaction. Prior to construction, CenterPoint Energy will develop a SWPPP, if required, to minimize potential impacts associated with soil erosion, compaction, and off-ROW sedimentation. Implementing the SWPPP will incorporate temporary and permanent BMPs to minimize soil erosion on the ROW during significant rainfall events. The SWPPP will also establish the criteria for revegetation and mitigating soil compaction to ensure adequate soil stabilization during the construction and post-construction phases. The existing herbaceous layer of vegetation will be maintained during construction to the extent practicable. Denuded areas will require seeding and/or implementation of permanent BMPs to stabilize disturbed areas and minimize soil erosion potential during the ROW restoration phase. The ROW will be inspected prior to and during construction to ensure that BMPs are implemented and maintained in accordance with the Stormwater General Permit.

Potential impacts to soils, primarily erosion and compaction, would be minimized with the development and implementation of a SWPPP. Therefore, the magnitude of potential soil impacts is considered equivalent for all of the alternative routes.

4.4.3 Water Resources

4.4.3.1 Surface Water

All of the proposed alternative routes would cross multiple surface waters within the study area. These surface waters may include ephemeral, intermittent, and perennial streams, wetlands, and ponds. These features often attract wildlife and can support fisheries if they are perennial. CenterPoint Energy proposes to span all surface waters crossed by any of the proposed alternative routes. Structures would be located outside of the ordinary high-water mark of surface waters, when feasible. Removal of vegetation to meet conductor to ground clearances would be implemented, where necessary. Vegetation removal could result in increased erosion potential of the affected areas, so that slightly higher than normal sediment yields may be delivered to area streams following a heavy rainfall. However, these short-term effects should be minor as a result of the relatively small area to be disturbed at any particular time; the short duration of the construction activities; preservation of stream side vegetation where practical; CenterPoint Energy's efforts to manage runoff from construction areas through the use of best management practices (BMPs); and implementation of the SWPPP, if required. The shorter understory and herbaceous layers of vegetation would remain, where allowable, and BMPs would be implemented in accordance with the SWPPP to minimize the potential for sedimentation into surface waters.

All of the proposed alternative routes cross streams and canals. The number of stream and canal crossings for the proposed alternative routes ranges from four crossings for Proposed Alternative Route 5, 8, 10, 11, and 14, to nine crossings for Proposed Alternative Routes 18. The number of stream and canal crossings for each of the proposed alternative routes is presented in **Table 4-1** (**Appendix C**).

All of the proposed alternative routes cross open water. The length of route across open water ranges from approximately 11 feet for Proposed Alternative Routes 10 and 12, to approximately 259 feet for Proposed Alternative Route 2. The approximate length across open water features for each of the proposed alternative routes is presented in **Table 4-1** (**Appendix C**).

Thirteen of the 20 proposed alternative routes parallel streams and canals (within 100 feet of each route centerline) for portions of their lengths. The length of route parallel to streams and canals ranges from zero feet for Proposed Alternative Routes 8, 10, 11, 12, 16, 17, and 19, to 5,733 feet

for Proposed Alternative Route 15. The approximate length parallel to streams and canals for each of the proposed alternative routes is presented in **Table 4-1** (**Appendix C**).

All surface waters are proposed to be spanned and a SWPPP will be implemented during construction. No significant impacts to these surface waters are anticipated for any of the proposed alternative routes. In some instances, temporary surface water crossings may be required. These types of crossings will incorporate BMPs to minimize potential sedimentation into surface waters. Surface waters located within the study area are subject to USACE regulations as WOTUS under Section 404 of the CWA. Upon PUCT approval of a route, additional coordination with the USACE-Galveston District may be required to determine any permitting needs.

4.4.3.2 Groundwater

The construction, operation, and maintenance of the proposed project are not expected to adversely affect groundwater resources in the study area or its vicinity. The amount of recharge area disturbed by construction is insignificant compared with the total amount of recharge area available for the groundwater systems in the region. No measurable alteration of aquifer recharge capacity should occur, and the likelihood of groundwater contamination would not be significant.

The main potential impact on groundwater resources from any construction project is pollution resulting from the accidental spillage of petroleum or other chemical products. CenterPoint Energy will take all necessary and available precautions to avoid and minimize the occurrence of such spills, and remediation and disposal activities associated with any accidental spills will be in accordance with state and federal regulations. Therefore, the proposed project should have no significant impacts to groundwater.

4.4.3.3 Floodplains

All of the 20 proposed alternative routes cross portions of the FEMA mapped 100-year floodplains. The length of route across mapped 100-year floodplains ranges from approximately 75 feet for Alternative Routes 8 through 12, to approximately 5,484 feet for 18 and 19. The approximate length across FEMA mapped 100-year floodplains for each of the proposed alternative routes is presented in **Table 4-1** (**Appendix C**).

Construction of the proposed transmission line is not anticipated to have a significant impact on the overall function of the floodplain, nor adversely affect adjacent or downstream properties. 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. CenterPoint Energy will coordinate with the appropriate local floodplain administrator to determine any additional permit requirements.

4.4.3.4 Future Surface Water Developments

Review of the TWDB 2022 State Water Plan indicated that no planned future surface water developments within or immediately adjacent to the project study area. Thus, no impacts to future surface water developments are anticipated.

4.4.3.5 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. All but the northeast portion of the study area lies within the designated CMZ. CNRAs potentially occurring in the study area may include coastal wetland areas, Special Hazard Areas (FEMA 100-year floodplains; [FEMA; 2022]), state submerged lands, submerged aquatic vegetation, tidal sand or mud flats, and waters under tidal influence. Upon PUC approval of a route, on-the-ground verifications of CNRAs may be required.

All 20 alternative routes are located either wholly within or partially within the coastal management program boundary as defined in 31 TAC §503.1. Alternative Routes 1 through 12 are partially located within the coastal management program boundary, ranging from 1.24 miles for Alternative Route 3 to 2.51 miles for Alternative Route 12. Alternative Routes 13 through 20 are located wholly within the coastal management program boundary, ranging from 2.97 miles for Alternative Route 14 to 5.66 miles for Alternative Route 18. All the alternative routes are located wholly or partially seaward of the Coastal Facilities Designation Line as defined in 31 TAC §19.2(a)(21). The proposed alternative routes are not anticipated to cross any known designated critical dune areas, Gulf beaches, hard substrate reefs, oyster reefs, submerged aquatic vegetation, tidal sand, or mud flats. These coastal natural resource types typically occur within the coastal estuarine and marine areas located south of and wholly outside of the study area.

Coastal Natural Resource Areas potentially impacted by alternative routes include coastal wetlands (NWI mapped freshwater emergent wetlands) and special hazard areas (FEMA mapped floodplains). Alternative Routes 8 through 20 will cross special hazard areas within the coastal management program boundary. 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 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.

Alternative Routes 2, 3, and 9 through 20 likely cross coastal wetlands (NWI mapped freshwater emergent wetlands within the CMZ). All 20 alternative routes cross waters that may be under tidal influence within the coastal management program boundary. Centerpoint Energy proposes to span all surface water 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 or waters under tidal influence crossed for any of the proposed alternative routes. None of the proposed alternative routes cross coastal preserve lands. No adverse impacts are anticipated to any coastal preserves for any of the proposed routes.

4.4.4 Ecological Resources

4.4.4.1 Vegetation Types

Potential impacts to vegetation types would result from clearing the ROW of woody and/or herbaceous vegetation. These activities facilitate ROW access for proposed project construction, line stringing, and future maintenance activities of the proposed transmission line. Removal of woody vegetation within the ROW will be required within upland and bottomland/riparian woodland areas. Prior to construction, mowing or shredding of herbaceous vegetation will occur within rangeland and pasture areas. Mowing activities will continue periodically (every three to five years) within the ROW for maintenance purposes. Impacts to vegetation will be limited to that necessary for the construction, operation and maintenance of the proposed transmission line. ROW clearing activities would be completed while maintaining the existing herbaceous layer or groundcover to the extent practical.

Clearing trees and shrubs from woodland areas typically causes a degree of habitat fragmentation. Habitat fragmentation is reduced when a proposed alternative route parallels or utilizes existing linear features such as electrical transmission lines, roads, railroads, pipelines, etc. During the route development process, consideration was given to maximize the length of the routes parallel to existing linear corridors to minimize the potential effects of habitat fragmentation.

All of the proposed alternative routes cross areas of upland woodlands. The approximate lengths of each proposed alternative route crossing upland woodlands range from 1,843 feet for Proposed Alternative Route 10, to 7,964 feet for Proposed Alternative Route 3. The approximate lengths of each proposed alternative route crossing upland woodlands are presented in **Table 4-1** (**Appendix C**).

Of the 20 proposed alternative routes, 12 cross areas of bottomland/riparian woodlands. The approximate lengths of each proposed alternative route crossing bottomland/riparian woodlands range from zero feet for Proposed Alternative Routes 6 and 7, to approximately 1,157 feet for Proposed Alternative Routes 1 through 4. The approximate lengths of each proposed alternative route crossing bottomland/riparian woodlands are presented in **Table 4-1** (**Appendix C**).

4.4.4.2 Wetlands

Wetlands are important to water quality and serve as habitat to numerous wildlife species and are often used as migration corridors and stopover habitat by birds. Removal of vegetation within wetlands increases the potential for erosion and sedimentation. Additional potential impacts to wetlands include the temporary or permanent fill associated with structure construction and temporary impacts associated with access and new ROW.

Wetlands can often be spanned with impacts limited to the clearing of woody vegetation necessary to obtain conductor to ground clearance requirements. CenterPoint Energy proposes to span wetland areas where feasible and hand clear shrubs and trees located within PFO/PSS wetland areas to minimize potential impacts. Permanent impacts may include the conversion of PSS wetlands to PEM wetlands. Temporary impacts to wetlands may occur as necessary to access each structure during construction. Impact minimization measures, such as the use of equipment mats during construction within all wetland areas, can minimize potential temporary impacts by limiting the level of soil disturbance generated by heavy equipment.

Of the 20 proposed alternative routes, 16 cross areas of NWI mapped wetlands, including PSS and PEM. The USFWS NWI dataset is a conservative approach to estimating wetlands. The approximate lengths of each proposed alternative route across NWI mapped wetlands ranges from zero feet for Proposed Alternative Routes 5 through 8, to approximately 845 feet for Proposed Alternative Routes 2 and 3. The approximate lengths of each proposed alternative route crossing NWI mapped wetlands are presented in **Table 4-1** (**Appendix C**).

The temporary and/or permanent placement of fill material within jurisdictional surface waters and associated wetlands may require a permit from the USACE under Section 404. A delineation of the wetlands crossed by the preferred route will be completed to determine USACE permit requirements prior to construction. NWP 57 requires the submittal of a Pre-Construction Notice (PCN) to the USACE if either a Section 10 permit is required, or the discharge will result in the loss of greater than 1/10-acre of WOTUS. If required, CenterPoint Energy will coordinate with the USACE prior to clearing and construction to ensure compliance with Section 404 to avoid, minimize, or mitigate wetland impacts. The construction of the transmission line may qualify under the NWP 57, if the general and regional permit conditions are not exceeded.

4.4.4.3 Wildlife and Fisheries

The primary impact of construction activities on wildlife would be the result of vegetation clearing and associated ground disturbances. Increased noise and activity levels during construction may also affect wildlife outside the perimeter of the construction area, temporarily displacing animals for a short distance on either side of the transmission line corridor. The impacts of transmission lines on wildlife can be divided into short-term effects resulting from physical disturbance during construction and long-term effects resulting from habitat modification. The net effect on local wildlife of these two types of impacts is usually minor given the narrow focus of transmission line corridors. A general discussion of the impacts of transmission line construction and operation on terrestrial wildlife is presented below.

The increased noise and activity levels during construction could potentially disturb breeding or other activities of species inhabiting the areas adjacent to the ROW. Wildlife could be minimally affected by dust and gaseous emissions. Although the normal behavior of many wildlife species could be disturbed during construction, little permanent damage to the populations of such organisms should result.

Any required clearing and other construction-related activities could directly and/or indirectly affect most animals that reside or wander within the transmission line ROW. Some small, low-mobility animals may be harmed by the heavy machinery. These include several species of amphibians, reptiles, and mammals. If ROW clearing and construction occurs during the breeding season, impacts may occur to the young of many species including nestling and fledgling birds. Impacts to nesting birds will require mitigating measures to ensure compliance with the Migratory Bird Treaty Act.

Fossorial animals (i.e., those that live underground), such as mice and gophers, may be harmed or displaced because of soil compaction caused by heavy machinery. Larger, more mobile species like birds, white-tailed deer, rabbits, and coyotes would likely vacate the area upon initial clearing and move into adjacent areas outside the ROW. Wildlife in the immediate area may experience a slight loss of browse or other forage material. However, the prevalence of similar habitats in adjacent areas and regrowth of vegetation in the ROW following construction would minimize the effects of this loss.

After construction is completed and grasses, forbs, and shrubs are allowed to recover, many forms of wildlife are anticipated to re-occupy the ROW area. Periodic vegetation maintenance within the ROW may temporarily cause some negative impacts to wildlife habitat. Maintenance clearing activities during the breeding season may destroy some nests and broods. With the increase in sunlight penetration to a previously dense shrub/tree stratum, more perennial forbs and grasses would be expected to germinate. Such edge habitats are preferred by many species, for example the eastern cottontail rabbit and white-tailed deer.

Transmission line structures could benefit some bird species, particularly raptors, by providing resting and hunting perches, especially in open, treeless habitats (Avian Power Line Interaction Committee [APLIC], 2006). Study area resident raptors, such as the American kestrel and the red-tailed hawk, often utilize the support structures as nesting sites, in addition to hunting or resting perches. By such benefits, transmission lines have increased raptor populations in some areas of the U.S. (APLIC, 2006). The danger of electrocution to birds would be insignificant since the distance between conductors, or between conductor and ground wire on 138 kV transmission lines, is greater than the wingspan of any bird in the area (i.e., greater than 8 feet).

If ROW clearing occurs during bird nesting season, potential impacts could occur within the ROW area related to migratory bird eggs and/or nestlings. Increases in noise and equipment activity levels during construction could also potentially disturb breeding or other activities of bird species nesting in habitat areas immediately adjacent to the ROW. CenterPoint Energy proposes to complete all ROW clearing and construction activities in compliance with the Migratory Bird Treaty Act to avoid or minimize potential impacts. ROW clearing would occur outside of the bird nesting season (March 15th to September 15th), if practical. If clearing occurs during the bird nesting season, nest surveys completed ahead of construction would facilitate identification and avoidance of active bird nests.

Transmission lines pose some risk to birds in flight, particularly near water features. CenterPoint Energy maintains a robust avian protection program, established in 2010, and managed through its Environmental Department. CenterPoint Energy is an active member of Edison Electric Institute's Avian Power Line Interaction Committee, made up of 77 member utilities and the U.S. Fish and Wildlife Service, and closely follows state of the art avian protection techniques and approaches. CenterPoint Energy has extensive experience in proactively and reactively addressing avian contact concerns, and will employ proven techniques, where appropriate, to minimize harmful avian interactions along the PUCT approved final route.

All of the proposed alternative routes cross upland woodland and bottomland forest (including potential forested wetlands), and therefore may potentially impact wildlife. However, these impacts are anticipated to be temporary and minimal. The greatest potential impact to wildlife from the project would result from the clearing of brushland/woodland habitat, clearing the ROW within 100 feet of streams, and clearing or crossing bottomland/riparian woodlands and wetlands. Direct impacts to wildlife and woodland fragmentation are greatly reduced by utilizing or paralleling existing ROW to the greatest practical extent.

4.4.4.4 Threatened and Endangered Species

A review of the federally- and state-listed threatened and endangered 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 listed species and unique vegetation communities within the study area were obtained from a variety of sources, including correspondence with the USFWS, TPWD, and TXNDD (see **Appendix A**). No federally designated critical habitat occurs

within the study area and no impacts to critical habitat will occur as a result of the proposed project (USFWS, 2023d).

Impacts on Plant Species and Sensitive Vegetation Communities

No federal or state-listed sensitive vegetation communities were listed for the study area. The Texas prairie dawn-flower was listed as endangered in the USFWS Information for Planning and Consultation species list as possibly occurring within the study area. It was determined that this flowering species is unlikely to occur within the study area. Thus, no significant impacts to federal or state-listed plant species are anticipated (USFWS, 2023d).

Impacts on Animal Species

Federally-listed Species

Federally-listed species that are not expected to occur due to the lack of marine habitat within the study area include the blue whale, Gulf of Mexico Bryde's whale, humpback whale, North Atlantic right whale, sei whale, sperm whale, and the oceanic whitetip shark. The green sea turtle, hawksbill sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle and loggerhead sea turtle are not expected to occur due to the lack of marine habitat and beaches for nesting. The piping plover, rufa red knot, and whooping crane are not expected to occur in the study area due to the lack of preferred stopover or nesting habitat. No impacts from the proposed project are anticipated to occur to the aforementioned species.

The black rail is a highly mobile species that may occur within the study area and be susceptible to disturbances during construction efforts. The black rail may be susceptible to collisions with the transmission line, which can be minimized using line markers.

If federally-listed threatened or endangered species or their habitat are identified during a field survey of the PUCT approved route, CenterPoint Energy will further coordinate with the USFWS to determine any permitting requirements and avoidance or mitigation strategies.

Other Federally Protected Species

The monarch butterfly is a federally-listed candidate species that would potentially utilize the study area if suitable stopover habitat were present. This species may also be susceptible to minor

temporary disturbances during construction efforts. No impacts from the proposed project are anticipated to occur to this species' migration or stopover habitat.

The alligator snapping turtle has been proposed to be listed as a federally-listed threatened species and may utilize streams and canals within the study area. CenterPoint Energy proposes to span all surface waters crossed by any of the proposed alternative routes. Structures would be located outside of the ordinary high-water mark of surface waters, when feasible. Thus, no impacts from the proposed project are anticipated to occur to the alligator snapping turtle.

The Louisiana black bear is not anticipated to occur within the study area. Thus, no impacts from the proposed project are anticipated.

State-listed Species

State-listed species for the study area include reddish egret, swallow-tailed kite, white-faced ibis, white-tailed hawk, wood stork, Rafinesque's big-eared bat, alligator snapping turtle, Texas horned lizard, and shortfin mako shark.

The reddish egret, Rafinesque's big-eared bat, Texas horned lizard, and shortfin mako shark are not anticipated to occur within the study area. Thus, no impacts from the proposed project are anticipated to occur to these species.

The swallow-tailed kite may occur within the study area as migrants that could utilized suitable stopover or nesting habitats. The white-faced ibis, white-tailed hawk, and wood stork are highly mobile species that may occur within the study area and utilize suitable habitat where present. The swallow-tailed kite, white-faced ibis, white-tailed hawk, and wood stork may be susceptible to collisions with the transmission line, which can be minimized using line markers. The swallow-tailed kite, white-faced ibis, white-tailed hawk, and wood stork may also be susceptible to minor temporary disturbances during construction efforts. No impacts from the proposed project are anticipated to impact these species' foraging, stopover, or nesting habitats.

Construction activities may temporarily displace animal species within and along the ROW. If federally- or state-listed species are observed during construction, they would be allowed to leave the area of their own accord. State-listed species can be relocated by a TPWD permitted biologist

to suitable habitat outside of the proposed project workspaces. None of the proposed alternative routes cross critical habitat of federally listed threatened or endangered species.

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5.0 ROUTE EVALUATION

The purpose of this routing study was to delineate and evaluate alternative routes for CenterPoint Energy's proposed transmission line in Chambers County. Halff developed and completed an environmental analysis of 20 alternative routes, the results of which are shown in **Table 4-1** (**Appendix C**). The environmental evaluation was a comparison of the potential impacts of each alternative route from a strictly environmental, land use, and cultural resource viewpoint based upon the measurement of 49 environmental criteria (**Table 4-1**). Halff used this information to evaluate the alternative routes and to select an alternative route for recommendation to CenterPoint Energy that provides the best balance between land use and aesthetic, ecological, and cultural resource impacts (**Section 5.2**). CenterPoint Energy considers Halff's recommendations in addition to engineering and constructability constraints, cost estimates, and comments from agencies and the public; and then selects one alternative route that CenterPoint Energy believes best addresses the requirements of applicable portions of PURA and PUCT Substantive Rules, as is required for the CCN Application.

5.1 HALFF'S ENVIRONMENTAL EVALUATION

Halff used a consensus process to evaluate the potential land use, ecological, and cultural resource impacts of the alternative routes. Halff professionals with expertise in different environmental disciplines (land use, ecology, and cultural resources), in addition to transmission line routing projects in general, evaluated all proposed alternative routes based on their potential impacts. The recommended approach is to compare the relationship and relative sensitivity among the different land use, ecological, and cultural resource factors.

Data provided in **Table 4-1** (**Appendix C**) illustrated trends and observable differences that correlated to the geography of the different routes. To facilitate the comparison and selection of the proposed alternative routes for inclusion in the PUC CCN Application, the 20 alternative routes were divided into three geographically diverse route groups: the Eastern, Central, and Western Route Groups. Following the sorting of alternative routes into route groups, a sub-set of routes within each route group were then chosen through a consensus process. The proposed alternative routes selected from each group were then further compared by Halff staff to determine which alternative route best addresses the requirements of PURA and PUC Substantive Rules.

Eastern Route Group (Alternative Transmission Line Routes 1 through 7)

Alternative transmission line routes that include route segment A1 and B1 are grouped into the Eastern Route Group, which includes Alternative Transmission Line Routes 1 through 7. Transmission line routes in the eastern route group utilize existing corridors associated with Grand Parkway (SH 99) and Cedar Point Lateral. Transmission line routes within this route group progress through portions of the study area that are less developed/industrialized. These routes tend to impact habitable structures the least when compared to other route groups; while woodland impacts tend to be greater for these routes.

Central Route Group (Alternative Transmission Line Routes 8 through 14)

Alternative transmission line routes that include route segment A2 are grouped into the Central Route Group, which includes Alternative Transmission Line Routes 8 through 14. Transmission line routes in the Central Route Group cross IH 10 through an industrialized portion of the study area and utilize existing corridors associated with pipelines and property lines. Lengths of transmission line routes within this route group are typically shorter when compared to other route groups.

Western Route Group (Alternative Transmission Line Routes 15 through 20)

Alternative transmission line routes that include route segment A3 are grouped into the Western Route Group, which includes Alternative Transmission Line Routes 15 through 20. Transmission line routes in the Western Route Group utilize an existing transmission line ROW located west of SH 146. The development of this corridor considered the opportunity of constructing the project in an existing compatible corridor, albeit at the expense of generating longer, less direct paths. These transmission line routes progress through portions of the study area that include residential neighborhoods and commercial developments resulting in markedly higher number of habitable structures proximal to the project. These alternative routes progress further south to the extent that the remaining route length outside of the corridor is comparable to the total length of alternative routes within the Central and Eastern Route groups.

Alternative Route Cost Estimates

For further comparison purposes, CenterPoint Energy provided construction cost estimates for each alternative route, including ROW acquisition. The estimated total costs for the 20 alternative routes are summarized in **Table 5-1**.

Table 5-1. Summary of Cost Estimates

PROPOSED ALTERNATIVE ROUTE	INCLUSIVE SEGMENTS	TOTAL LENGTH (MILES)	ESTIMATED CONSTRUCTION COST (ROUTE)[1]	ESTIMATED OTHER COST[2]	TOTAL
1	B1-C1-D2-E3-F2-G2-H1-K1-L2-M12-M13	3.27	$43,171,000	$22,832,000	$66,003,000
2	B1-D3-E1-E2-F3-G3-H2-K2-K3-M2-M11-M13	2.93	$40,787,000	$22,832,000	$63,619,000
3	B1-D3-E3-F1-F3-G3-H2-K2-K3-M2-N21-N23	2.75	$41,652,000	$22,832,000	$64,484,000
4	B1-D3-E3-F2-G1-G3-H2-I1-K4-N31-N33	3.19	$43,323,000	$20,832,000	$64,155,000
5	A1-B2-C2-C1-D1-E2-F3-G4-K1-L2-M12-M13	3.08	$43,698,000	$22,832,000	$66,530,000
6	A1-B2-C3-C4-E4-K5-M5-M41-M42-M3-M2-M11-M13	2.69	$43,087,000	$22,832,000	$65,919,000
7	A1-B2-C3-C4-E4-K5-M5-M41-M42-N31-N33	2.27	$41,704,000	$20,832,000	$62,536,000
8	A2-B3-B5-C4-E4-K5-N5-O31-O33	2.55	$43,503,000	$20,832,000	$64,335,000
9	A2-B3-C5-D5-D4-E4-K5-M5-M41-M42-N31 N33	2.44	$40,450,000	$20,832,000	$61,282,000
10	A2-B3-C5-D5-E5-I3-I2-K4-N31-N33	2.49	$38,909,000	$20,832,000	$59,741,000
11	A2-B3-C5-D5-E5-I3-K5-N5-O31-O33	2.50	$43,615,000	$20,832,000	$64,447,000
12	A2-B3-C5-D5-E5-K6-N5-O31-O33	2.52	$42,396,000	$20,832,000	$63,228,000
13	A2-B4-C6-D6-D5-D4-E4-K5-M5-M41-M42-M3-M2-N21-N23	2.99	$45,481,000	$22,832,000	$68,313,000
14	A2-B4-C7-E6-I4-I3-I2-I1-K2-K3-M2-N21-N23	2.97	$44,395,000	$22,832,000	$67,227,000
15	A3-A4-S3-Q1-P1-P4-N42-N41-M41-M42-M3-M2-N21-N23	5.42	$64,627,000	$25,361,000	$89,988,000
16	A3-A4-S3-Q1-P1-P4-O31-O33	4.43	$57,909,000	$23,361,000	$81,270,000
17	A3-A4-S3-Q1-P2-P3-P4-O31-O33	4.55	$65,670,000	$23,361,000	$89,031,000
18	A3-A4-S3-R2-Q2-P2-P1-P4-O31-O32-N32-N31-M3-M2-N21-N23	5.66	$73,418,000	$25,361,000	$98,779,000
19	A3-A4-S3-R2-Q2-P3-P4-O31-O33	4.63	$64,232,000	$23,361,000	$87,593,000
20	A3-I5-I4-I3-I2-I1-K2-K3-M2-N21-N23	3.89	$54,273,000	$26,354,000	$80,627,000

NOTES: [1] Costs for alternative routes are estimated with predominantly double-circuit capable lattice towers in a vertical configuration within an 80-foot-wide ROW and include estimated ROW acquisition costs.
[2] Costs incurred for adjustments needed to other transmission lines and for construction of new substation.

With few environmental variables to distinguish between routes, Halff considered other information not necessarily reflected in the tables, such as public meeting input, agency coordination, and location relative to apparent land use. Through this process, Halff identified a selection of routes as the best-balanced routes considering these criteria and the evaluation criteria in **Table 4-1** (**Appendix C**). Any of the alternative routes are considered viable, acceptable routes that provide geographic diversity between project endpoints. Halff identified

seven routes as the alternative routes that best balance land use, ecology, cultural resources, and PUCT routing criteria.

Alternative Route 2 (Eastern Route Group)

- Provides an alternative route option to the easternmost proposed Kilgore Substation site.
- Is slightly less than the average length of all routes at approximately 2.93 miles in length.
- Crosses Cedar Point Lateral three times
- Has one of the highest lengths across upland woodlands for routes in the eastern grouping, however much of this length is paralleling existing ROW (pipeline and Cedar Point Lateral) or cleared property lines, which minimizes fragmentation of this habitat type within the study area
- Is within 300 feet of four habitable structures which includes two industrial/commercial buildings

Alternative Route 4 (Eastern Route Group)

- Provides an alternative route option to the westernmost proposed Kilgore Substation site.
- Crosses Cedar Point Lateral three times
- Is near the average length of all routes at approximately 3.19 miles
- Similar to Alternative Route 2 but provides an alternative crossing of IH 10
- Is within 300 feet of seven habitable structures which includes three industrial/commercial buildings
- Parallels a greater length of existing ROW (pipelines, county roads, Cedar Point Lateral) than Alternative Route 2

Alternative Route 5 (Eastern Route Group)

- Provides an alternative route option to the easternmost proposed Kilgore Substation site
- Crosses Cedar Point Lateral two times
- Is near the average length of all routes but is one of the longest alternative routes within the eastern grouping at 3.08 miles
- Is within 300 feet of nine habitable structures which includes three industrial / commercial / recreational buildings
- Included to provide geographic diversity of routes within the Eastern Route Group

Alternative Route 9 (Central Route Group)

- Provides an alternative route option to the westernmost proposed Kilgore Substation site.
- Is the second shortest route of all alternative routes at 2.44-miles
- Crosses IH 10 within an industrialized area
- Parallels existing utility line ROW (pipelines) when crossing upland forests to minimize further fragmentation of this habitat within the study area.
- Is within 300 feet of 38 habitable structures which includes 31 industrial/commercial buildings

Alternative Route 10 (Central Route Group)

- Provides an alternative route option to the westernmost proposed Kilgore Substation site.
- Is the third shortest route of all alternative routes at approximately 2.49-miles in length
- Similar to Alternative Route 9 but parallels Old Needlepoint Rd ROW as it progresses east resulting in an increased length parallel to compatible ROW when compared to Alternative Route 10
- Is the shortest length of all alternative routes across upland forests
- Is within 300 feet of 39 habitable structures which includes 30 industrial/commercial buildings

Alternative Route 13 (Central Route Group)

- Provides an alternative route option to the easternmost proposed Kilgore Substation site.
- Is one of the longer routes within the Central Route Group at approximately 3 miles in length
- Utilizes a second crossing location of IH 10 outside a previously developed industrial/commercial area
- Included to provide geographic route diversity within the Central Route Group
- Is within 300 feet of 37 habitable structures which includes 28 industrial/commercial buildings

Alternative Route 16 (Western Route Group)

- Provides an alternative route option to the westernmost proposed Kilgore Substation site.
- Is one of the longer alternatives of all route alternatives but is one of the shortest within the Western Route Group at 4.43 miles in length

- Minimizes impacts to existing landcover/land use through the utilization of an existing transmission line ROW
- Avoids the crossing of a large existing pipeline utility corridor; therefore, minimizes pipeline crossings
- Affects 167 habitable structures within 300 feet, 161 of these habitable structures are within 300 feet of the existing transmission lines. Of the 169 habitable structures, 157 are single or multifamily residences
- Crosses one recorded historical and archeological site

5.2 SELECTION OF THE ROUTE WHICH BEST ADDRESSES THE REQUIREMENTS OF PURA AND PUCT SUBSTANTIVE RULES

Among the subset of seven alternative routes, Halff specialists evaluated the relative value and importance among land use, ecology, and cultural resources in relation to the proposed project.

Halff specialists identified Alternative Route 10 as the alternative transmission line route that balances land use, ecology, cultural resources, and PUCT routing criteria, as according to PURA § 37.056(c)(4) and the PUC Substantive Rules. In summary, Alternative Route 10 was assessed on the following notable criteria:

Proposed Alternative Route 10 (Alternative Route Segments: A2-B3-C5-D5-E5-I3-I2-K4-N31-N33):

- Third to the shortest in overall length of all alternative routes
- Affects 39 habitable structures within 300 feet of which 30 are industrial/commercial buildings
- Crosses no park/recreational areas
- Shortest length across upland forests
- The alternative route does not parallel any streams and has the least amount of stream crossings
- The alternative route has the second to shortest distance across a 100-year floodplain
- The second to least amount of pipeline crossings and shortest length parallel to pipeline ROW

- Exhibits shorter lengths within the foreground visual zone of U.S. and state highways, FM and county roads, and park and recreational areas when compared to all alternative routes
- The alternative route does not cross an area of high archeological/historic site potential
- Crosses no recorded archeological sites
- A high percentage (53%) of the alternative route is parallel to apparent features including existing ROW and property lines.

The next alternative transmission line routes that balance land use, ecology, cultural resources, and PUCT routing criteria, as according to PURA § 37.056(c)(4) and the PUC Substantive Rules, include, in order, Alternative Route 9, 2, 5, and 16 which were assessed as having the least potential cumulative impacts among all the other alternative routes.

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6.0 LIST OF PREPARERS

This EA and Alternative Route Analysis was prepared for CenterPoint Energy by Halff. A list of the Halff Employees with primary responsibility for the preparation of this document is presented below.

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Map Name	Original Map	Photo-Revision
Cove	1961	1977
Mont Belvieu	1691	1970

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