



Biological Resources Technical Report

North Houston Highway Improvement Project
From US 59/I-69 at Spur 527 to I-45 at Beltway 8 North,
Harris County, Texas
CSJ: 0912-00-146

Prepared by: TxDOT Houston District

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The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 9, 2019, and executed by FHWA and TxDOT.

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1.0 Introduction

The Texas Department of Transportation (TxDOT) proposes to construct improvements to Interstate Highway 45 (I-45) in the northern portion of the City of Houston. The proposed project, referred to as the North Houston Highway Improvement Project (NHHIP), begins at the interchange of I-45 and Beltway 8 North and continues south along I-45 to Downtown Houston where it terminates at the interchange of U.S. Highway (US) 59/I-69 and Spur 527 south of Downtown Houston. The project area also includes portions of I-10 and US 59/I-69 near Downtown Houston. The project area is composed of three study segments, Segments 1 through 3.

This Biological Resources Technical Report supports the Final Environmental Impact Statement (Final EIS) that evaluates the social, economic, and environmental impacts potentially resulting from the Preferred Alternative for the proposed project.

The purpose of this report is to describe the biological resources within the Preferred Alternative NHHIP area (right-of-entry information for the Preferred Alternative is contained within **Figures 2a-2d**), analyze possible impacts to those resources, and provide the necessary information to conduct coordination with the Texas Parks and Wildlife Department (TPWD) under the TxDOT-TPWD Memorandum of Understanding (MOU), effective September 1, 2013. This assessment of biological resources within the NHHIP area included a desktop review of materials and field investigations of vegetation, wildlife, and threatened and endangered species. This report fulfills the requirements of a Tier II Site Assessment as described in the TxDOT-TPWD Tier II Site Assessments Programmatic Agreement (TxDOT 2017).

Figure 1 in **Attachment A** shows the project location and limits, and **Figures 2a-2d** depicts the parcels that were granted right-of-entry at the time of field investigation in December 2017. **Photographs 1–27** in **Attachment B** provide a representative depiction of land use and vegetation communities within the project area.

2.0 Project Description

2.1 Existing Facility

2.1.1 Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop)

I-45 within this segment consists of eight general purpose lanes (i.e., mainlanes; four lanes in each direction), four frontage road lanes (two lanes in each direction), and a reversible high occupancy vehicle (HOV) lane in the middle, all within a variable right-of-way (ROW) width of 250 to 300 feet. The existing posted speed limit along the general purpose lanes and reversible HOV lane is 60 miles per hour (mph). The existing posted speed limit for the frontage roads is 45 mph. The length of Segment 1 is approximately 8.8 miles, and the area of the existing ROW is approximately 349 acres.

2.1.2 Segment 2: I-45 from north of I-610 (North Loop) to I-10

I-45 within this segment primarily consists of eight at-grade general purpose lanes (four lanes in each direction), six frontage road lanes (three lanes in each direction), and a reversible HOV lane in the middle, all within a variable ROW width of 300 to 325 feet. Segment 2 also includes a depressed section that consists of eight general purpose lanes (four lanes in each direction) and a reversible HOV lane in the middle, all below grade, within a 245-foot ROW. The six frontage road lanes associated with the depressed section (three lanes in each direction) are located at-grade. The existing posted speed limit is 60 mph along the general purpose lanes, 55 mph along the reversible HOV lane, and 40 mph along the frontage road lanes. The I-45 and I-610 frontage

roads are discontinuous at the I-45/I-610 interchange. The length of Segment 2 is approximately 4.5 miles, and the area of the existing ROW is approximately 220 acres.

2.1.3 Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10)

The Downtown Loop System consists of three interstate highways that create a loop around Downtown Houston. I-45 forms the western and southern boundaries of the loop and is known locally as the Pierce Elevated because it partially follows the alignment of Pierce Street. I-10 forms the northern boundary of the loop, and US 59/I-69 forms the eastern boundary of the loop. The loop includes three major interchanges: I-45 and I-10, I-10 and US 59/I-69, and US 59/I-69 and I-45. The interchange of US 59/I-69 and Spur 527 is located south of Downtown Houston.

I-45 along the western and southern sides of Downtown consists of six elevated general purpose lanes (three lanes in each direction) within a variable ROW that is typically 205 feet to 320 feet wide. I-10 north of Downtown, between I-45 and US 59/I-69, consists of six general purpose lanes (three lanes in each direction) within an existing ROW width of 420 feet. US 59/I-69 along the east side of Downtown consists of six general purpose lanes (three lanes in each direction) within an existing ROW width of 225 feet. US 59/I-69 south of Downtown from I-45 to Spur 527 has eight general purpose lanes (four in each direction). Generally, local streets serve as one-way frontage roads within Segment 3, except near the I-10 and US 59/I-69 interchange, where the frontage roads are discontinuous. The length of Segment 3, which includes the Downtown Loop System, is approximately 13.1 miles, and the existing ROW is approximately 638 acres.

2.2 Proposed Facility

The Preferred Alternative for the proposed project is described below, by study segment. The Preferred Alternative includes changes to the Recommended Alternative (for each segment) presented and evaluated in the Draft Environmental Impact Statement (Draft EIS). Section 2.0 of the Final EIS discusses the design changes, including the proposed locations of storm water detention areas.

2.2.1 Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop)

The Preferred Alternative would widen the existing I-45 primarily on the west side of the roadway to accommodate four managed express (MaX) lanes. The proposed typical section would include eight to ten general purpose lanes (four to five lanes in each direction), four MaX lanes (two lanes in each direction), and four to six frontage road lanes (two to three lanes in each direction). The general purpose lanes and MaX lanes would be at-grade except at major cross streets, where they would be elevated over the intersecting streets. Approximately 200 to 225 feet of new ROW would be required for the roadway widening, mostly to the west of the existing I-45. New ROW would also be required on the west side of I-45 for proposed storm water detention areas. New ROW would be required to the east of the existing I-45 ROW at intersections with major streets and between Crosstimbers Street and I-610. Approximately 246 acres of new ROW would be required in Segment 1.

2.2.2 Segment 2: I-45 from north of I-610 (North Loop) to I-10 (including the interchange with I-610)

The Preferred Alternative would widen the existing I-45 to accommodate four MaX lanes. The proposed typical section would include ten general purpose lanes (five lanes in each direction), four MaX lanes (two lanes in each direction), and four to six frontage road lanes (two to three lanes in each direction). From north of Cottage Street to Norma Street, the general purpose lanes and the Max lanes would be depressed, while the frontage road lanes would be at-grade. The proposed I-45 and I-610 frontage roads would be continuous through the I-45/I-610 interchange. New ROW would be required from both the east and west sides of the existing I-45. The new ROW would include proposed storm water detention areas on the east side of I-45, south of Patton Street. Approximately 44 acres of new ROW would be required in Segment 2.

The Preferred Alternative provides a structural “cap” over a portion of the depressed lanes of I-45 from north of Cottage Street to south of N. Main Street. Future use of the structural cap area for another purpose would require additional development and funding by entities other than TxDOT.

2.2.3 Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10)

The Preferred Alternative would reconstruct all the existing interchanges in the Downtown Loop System and reroute I-45 to be parallel to I-10 on the north side of Downtown and parallel to US 59/I-69 on the east side of Downtown. Access to the west side of Downtown would be provided via “Downtown Connectors” that would consist of entrance and exit ramps for various Downtown streets. A section of the Downtown Connectors would be below-grade (depressed) between approximately W. Dallas Street to Andrews Street. The existing elevated I-45 roadway along the west and south sides of Downtown would be removed. The portion of I-45 (Pierce Elevated) between Brazos Street and US 59/I-69 could be left in place for future use and redevelopment by others; however, an alternative use for the structure is not proposed by TxDOT and is not evaluated in this Final EIS.

To improve safety and traffic flow in the north and east portions of Segment 3, portions of both I-10 and US 59/I-69 would be realigned (straightened) to eliminate the current roadway curvature. I-45 and US 59/I-69 would be depressed along a portion of the alignment east of Downtown. South of the George R. Brown Convention Center, the rerouted I-45 would begin to elevate to tie to existing I-45 southeast of Downtown, while US 59/I-69 would remain depressed as it continues southwest toward Spur 527. US 59/I-69 would be widened from eight to twelve general purpose lanes between I-45 and SH 288, and would be reconstructed to ten general purpose lanes from SH 288 to Spur 527.

The four proposed I-45 MaX lanes in Segments 1 and 2 would terminate/begin in Segment 3 at Milam Street/Travis Street, respectively. I-10 express lanes (two lanes in each direction) would be located generally in the center of the general purpose lanes within the proposed parallel alignment of I-10 and I-45 on the north side of Downtown. The I-10 express lanes would vary between being elevated and at-grade.

New ROW to the east of the existing US 59/I-69 along the east side of Downtown would be required to accommodate the proposed realigned I-45. A new continuous southbound access road would be provided adjacent to US 59/I-69 and would tie to existing Hamilton Street on the south side of the Convention Center. The existing St. Emanuel Street would serve as a northbound access road. The project ROW would include areas to be developed as storm water detention. Approximately 160 acres of new ROW would be required, the majority of which would be for the I-10 and US 59/I-69 realignments (straightening) and to construct the proposed I-45 lanes adjacent to US 59/I-69 along the east side of Downtown.

The Preferred Alternative provides a structural “cap” over the proposed depressed lanes of I-45 and US 59/I-69 from approximately Commerce Street to Lamar Street. There would also be a structural cap over the depressed lanes of US 59/I-69 between approximately Main Street and Fannin Street, and in the area of the Caroline Street/Wheeler Street intersection. Future use of the structural cap areas for another purpose would require additional development and funding by entities other than TxDOT.

2.3 Natural Setting and Land Use

2.3.1 Natural Setting

The project area is located within the Western Gulf Coastal Plain (WGCP) ecoregion of Texas, as described by Gould and colleagues (1960) and mapped by the Ecological Mapping System of Texas (EMST; Elliott et al. 2014). This ecoregion is characterized by relatively flat topography and historically was dominated by tallgrass grasslands with scattered oak (*Quercus* spp.) mottes and maritime woodlands. This area has a long history of alteration, including cattle grazing, agriculture, and urban development. Almost all coastal prairies within the region have been converted to cropland, rangeland, pasture, or urban and industrial land uses. Additionally,

drainage and irrigation canals have been constructed, and stream channelization has occurred throughout the area.

2.3.2 Land Use

The proposed project area is located within the City of Houston, a densely populated urban center in Harris County, Texas. The existing ROW is dedicated to transportation use. Land surrounding the existing ROW consists of high-density commercial uses with some adjacent single- and multi-family residential development and small tracts of undeveloped land. The majority of the areas proposed for ROW acquisition are developed land. Although several parks, community facilities, and open spaces are adjacent to the project area, no state parks or wildlife management areas occur within 1.5 miles of the project area.

2.4 Geology

The project area is underlain by two geologic formations: Beaumont Formation (sand) and the Lissie Formation (**Figure 3**; TNRI 2007). The Beaumont Formation in this area is mostly clay, silt, and sand. It includes stream channels, point bars, natural levees, back swamps, and occasionally coastal marsh and mudflat deposits (TNRI 2007). This formation is often 9 to 30 feet deep on outcrops and thickens to 100+ feet deep in a southeastward direction; it is characterized by moderate permeability and drainage, low to moderate compressibility and shrink-swell potential, and displays a mostly level relief with local mounds and ridges (TNRI 2007). The Lissie Formation is a gently rolling formation that is typically greater than 200 feet; it is comprised of clay, silt, sand, and small siliceous gravel. This formation is fairly flat and featureless except for numerous rounded shallow depressions and pimple mounds (TNRI 2007).

2.5 Soils

According to the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS) data, the project area is primarily mapped as urban soil mapping units, with the exception of the Clodine fine sandy loam mapping unit in the northern portion of the project area (**Table 1** and **Figure 3**). Urban land consists of soils that have been altered or covered by buildings and other structures, making classification impractical. It was determined from site visits that the majority of soils mapped non-Urban land complexes in the project area have been disturbed or developed. Prime farmland soils are discussed in **Section 4.10** as they relate to the Farmland Protection Policy Act (FPPA).

Table 1: Soils within the NHHIP Area

Soil ID	Soil Series Name	Prime Farmland (Yes/No)
Ak	Addicks—Urban land complex	No
As	Aris—Urban land complex	No
BadA	Bacliff—Urban land complex, 0 to 1 percent slope	No
Bg	Bernard—Urban land complex	No
Cd	Clodine fine sandy loam, 0 to 1 percent slopes	No
Ce	Clodine—Urban land complex	No
Gu	Gessner occasionally ponded—Urban land complex, 0 to 1 percent slopes	No
Mu	Verland—Urban land complex	No

Soil ID	Soil Series Name	Prime Farmland (Yes/No)
TeuB	Texla—Urban land complex, 0 to 2 percent slopes	No
URLX	Urban Land	No
VauA	Vamont—Urban land complex, 0 to 1 percent slopes	No
W	Water	No

Source: USDA NRCS 2018.

2.6 Water Resources

The project area is located within the San Jacinto River Basin (**Figures 4a-4d**). Buffalo Bayou, White Oak Bayou, Little White Oak Bayou, Halls Bayou, and numerous unnamed tributaries, drainage canals, and ditches occur within the project area. Buffalo Bayou, east and south of I-610 to the junction of I-10, is located within the salt water boundary according to TPWD (TPWD 2018a). A review of the TPWD Planning Data by Region database (TPWD 2018b) did not identify any waters within the project area that meet the criteria for this designation.

The main branches of Buffalo Bayou, White Oak Bayou, Little White Oak Bayou, and Halls Bayou within the project area are designated as perennial waters by the U.S. Geological Survey (USGS) National Map National Hydrography Dataset (NHD) (USGS 2017). Several of their tributaries also cross the project area but are recorded as intermittent or ephemeral. All of these water features displayed various channel morphologies, substrates, water depths, and levels of instream or bankside vegetation (**Photographs 9–12, 14–21, and 25–26**). Although many sections of the bayous and tributaries were trapezoidal channels lined in concrete, the larger water bodies were discontinuously concrete lined and displayed sandy, muddy, and rocky substrates in the natural channel areas, which could provide suitable habitat for aquatic species. During field observation in December 2017, small fish (unidentified) and common water birds (Snowy Egret [*Egretta thula*], Great Blue Heron [*Ardea herodias*], White Ibis [*Eudocimus albus*], Yellow-crowned Night Heron [*Nyctanassa violacea*], and Double-crested Cormorant [*Phalacrocorax auritus*]) were noted utilizing many of these areas.

Additional information about water resources, including wetlands within the project area, can be found in the Waters of the United States Technical Report provided under separate cover.

3.0 Project Area Vegetation

Based on field investigations conducted by qualified biologists in December 2017, it was determined that the majority of vegetation within the current ROW consists mainly of maintained ROW grasses, which appear to be mowed regularly, and landscaped assemblages of trees and shrubs along roadway medians. Therefore, the majority of the existing ROW fits the description of the “Urban Low Intensity” EMST vegetation type. The proposed ROW is a mixture of native and non-native invasive vegetation that is best described as unmaintained mixed Chinese tallow (*Triadica sebifera*) forests, native and non-native mixed woodlands along riparian edges, maintained ROW grasses and forbs, and disturbance grasslands. These vegetation types are best described by the EMST as “Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland;” “Pineywoods: Disturbance or Tame Grassland;” “Native Invasive: Deciduous Woodland;” “Pineywoods: Small Stream and Riparian Temporarily Flooded Hardwood Forest;” or “Urban Low Intensity.” Existing vegetation in the project area, as observed during the field investigations, is described below and shown on **Figures 5a-5y**, and impact acreages for the proposed project are summarized in **Table 2**. The table below also includes the generic “MOU Type” vegetation description that is used to determine coordination thresholds with TPWD, which is further discussed in **Section 9.0** below.

Table 2: Impacts to Observed Vegetation Types

	MOU Type	Observed Vegetation Type (EMST)	Impacts (acres)	MOU Threshold (acres)	Threshold Exceeded?
	Urban	Urban Low Intensity	346.18	None	N/A
	Riparian	Pineywoods: Small Stream and Riparian Temporarily Flooded Hardwood Forest	11.76	0.1	Yes
	Disturbed Prairie	Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland	78.01	3.0	Yes
		Pineywoods: Disturbance or Tame Grassland	20.43		
		Native Invasive: Deciduous Woodland	13.40		
	Open Water	Open Water: No vegetation	11.06	None	N/A
		Total	480.84		

Source: Elliott et al. 2014.

The Urban Low Intensity vegetation type was the dominant community observed within the existing and proposed ROW. This community was characterized as recently cleared, ornamentally planted and maintained, paved, or significantly disturbed. Species primarily consisted of maintained ROW grasses and forbs dominated by Bermudagrass (*Cynodon dactylon*), St. Augustine grass (*Stenotaphrum secundatum*), Johnsongrass (*Sorghum halepense*), green sprangletop (*Leptochloa dubia*), Canada goldenrod (*Solidago canadensis*), dayflower (*Commelina erecta*), pampas grass (*Cortaderia selloana*), and giant ragweed (*Ambrosia trifida*). Various shrubs were also noted throughout the existing and proposed ROW, including oleander (*Nerium oleander*), crape myrtle (*Lagerstroemia indica.*), Chinese privet (*Ligustrum sinense*), and red tip photinia (*Photinia x fraseri*). Additionally, the following tree species were dominant overstory components throughout the Urban Low Intensity vegetation type: Chinese tallow, hackberry (*Celtis laevigata*), Chinese pistache (*Pistacia chinensis*), and the occasional

Chinese parasol (*Firmiana simplex*). The occasional loblolly pine (*Pinus taeda*) or oak species was present as a landscaped overstory component within these areas but was not an integral species in these communities (see **Photographs 1-10, 14, 18, 22, and 26**).

The Pineywoods: Small Stream and Riparian Temporarily Flooded Hardwood Forest occurred adjacent to several of the water bodies (Little White Oak Bayou, Buffalo Bayou, and White Oak Bayou) in discontinuous patches throughout the project area. The dominant overstory species consisted of live oak (*Quercus virginiana*), green ash (*Fraxinus pennsylvanica*), hackberry, red mulberry (*Morus rubra*), American sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), and the occasional Chinese privet, mimosa (*Albizia julibrissin*), Chinaberry (*Melia azedarach*), or Chinese tallow tree. The understory vegetation in these areas included a mixture of poison ivy (*Toxicodendron radicans*), giant reed (*Arundo donax*), bushy bluestem (*Andropogon glomeratus*), trumpet creeper (*Campsis radicans*), mustang grape (*Vitis mustangensis*), and saw-tooth greenbriar (*Smilax bona-nox*). This vegetation type often overlapped with the Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland communities (described below); however, this community had a notably larger assemblage of native and riparian dependent species than the Non-Native Invasive vegetation type (see **Photographs 19–21 and 25**).

The Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland vegetation type was observed throughout unmaintained portions of the existing and proposed project ROW and primarily consisted of trees and shrubs dominated by Chinese tallow, loblolly pine, water oak (*Quercus nigra*), hackberry, mimosa tree, and Chinese privet. The occasional oak and green ash were also present in unmaintained areas. The understory in these areas consisted of a mixture of shrubby hackberry, loblolly pine, St. Augustine grass, and Johnsongrass (see **Photographs 5, 11–14 and 16–17**).

The Pineywoods: Disturbance or Tame Grassland vegetation type was observed in areas that had been previously cleared of overstory and mid-story vegetation but were not actively maintained. These areas were located adjacent to the riparian areas along White Oak Bayou and Buffalo Bayou. The dominant herbaceous species included many common volunteer grasses such as Bermudagrass, switchgrass (*Panicum virgatum*), Johnsongrass, bushy bluestem, and St. Augustine grass. The occasional Rooseveltweed (*Baccharis neglecta*) and giant ragweed were scattered throughout these areas as well (see **Photographs 5 and 23–24**).

The Native Invasive: Deciduous Woodland was observed in several locations within the existing transportation ROW. These areas appeared to be intentionally landscaped to include a mixture of native and introduced large tree species. These communities were often overgrown and densely vegetated with crape myrtle, American sycamore, loblolly pine, Chinese privet, various oak species, and hackberry. A mixture of native and introduced grasses were observed in the understory. These communities differed from the Non-Native Invasive and Urban vegetation types by the lack of Chinese tallow and prominent herbaceous and mid-story vegetation layers (see **Photographs 11 and 13**).

4.0 Fish and Wildlife Resources

The vegetation of the WGCP ecoregion provides habitat for a wide range of reptilian, mammalian, and avian species that are common to the Gulf Coast environment. Common species such as the marsh rice rat (*Orzomys palustris*), coyote (*Canis latrans*), eastern cottontail (*Sylvilagus floridanus*), northern raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus*), and white-tailed deer (*Odocoileus virginianus*) are expected to occur within the project location and within the adjacent undeveloped land. In addition to the common mammals, a number of birds, snakes, frogs, and insects would also be expected to occur within the project area.

It is anticipated that some wildlife species could be present within undeveloped portions of the existing and proposed ROW. Required clearing or other construction-related activities may directly or indirectly affect animals that reside within or adjacent to the project area ROW. Heavy machinery could kill small, low-mobility animals, or could cause soil compaction, impacting animals that live underground. Larger, more-mobile species will typically avoid construction activities and move into adjacent areas. In order to minimize disturbance to inert microhabitats (e.g., snags, brush piles), clearing within vegetated areas of the existing and proposed ROW would be minimized to the extent practicable.

A discussion of potential impacts/effects to rare, threatened, or endangered wildlife species and their habitats is included in **Section 5.0**

4.1 Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) regulates the take of federally listed threatened and endangered species. No suitable habitat for any federally listed threatened or endangered species was identified within or adjacent to the proposed project area; therefore, no effect to any federally listed species is anticipated as a result of the proposed project. Measures to avoid harm to any federally protected species would be taken should any such species be observed during construction of the proposed project. No coordination with the USFWS is required. See **Section 5.0** and **Table 3** for additional information on threatened and endangered species.

4.2 Essential Fish Habitat

According to TPWD's Freshwater/Saltwater boundary descriptions (2018a) and the TCEQ stream segments a portion of Buffalo Bayou (Segments 1007 and 1013) and the lower portion of White Oak Bayou (Segment 1017) are identified as tidally influenced waters within the project area. The National Oceanographic and Atmospheric Administration Essential Fish Habitat (EFH) mapper was accessed for the proposed project area. No Habitat Areas of Particular Concern or EFH areas protected from fishing were identified within or adjacent to the project area. Therefore, no impacts to protected areas or EFH are anticipated for this project.

4.3 Coastal Barrier Resources Act

The USFWS's CBRA mapper was accessed for the project area. No Coastal Barrier Resources Act (CBRA) units are located within or adjacent to the project area.

4.4 Marine Mammal Protection Act

The USFWS Official Species List indicates that the proposed project area is within range of suitable habitat for the West Indian manatee. However, the waterways within the NHHIP area do not contain suitable habitat for this species. Additionally, no portion of the proposed project occurs within intertidal or beach areas where marine mammals would be routinely expected to occur. Therefore, no impacts to marine mammals are expected as a result of the proposed project.

4.5 Migratory Bird Treaty Act

The project area was investigated for any structures containing migratory birds or indications of nesting migratory birds. Evidence of nesting birds (vacant nests) was observed throughout the proposed project area in the tree canopies within stands of woody vegetation. Measures would be taken to avoid the take of migratory birds, their occupied nests, eggs, or young, in accordance with the Migratory Bird Treaty Act (MBTA), through phasing of work or preventative measures. Bird Best Management Practices (BMPs) would be followed to minimize impacts: not disturbing, destroying, or removing active nests, including ground nesting birds, during the nesting season;

avoiding the removal of unoccupied, inactive nests, as practicable; preventing the establishment of active nests during the nesting season on TxDOT-owned and operated facilities and structures proposed for replacement or repair; and not collecting, capturing, relocating, or transporting birds, eggs, young, or active nests without a permit.

4.6 *Bald and Golden Eagle Protection Act*

Bald eagles are primarily piscivorous and prefer habitats associated with large bodies of water. In Texas, the bald eagle is found along quiet rivers, coastal areas, and lakeshores with large, tall trees. Man-made reservoirs also provide excellent habitat. They breed in the eastern third of the state and winter wherever open water occurs. Wintering and nesting activity occurs mainly near large freshwater impoundments with standing timber located in or around water. The proposed project area does not contain any rivers or stream channels that would be suitable for Bald Eagle foraging. A review of TPWD's Texas Natural Diversity Database (TXNDD) did not record any eagle occurrences within 1.5 miles of the project area. Although forested parcels within the project area may be used as flyover or stopover habitat for the species, no nests were observed, and no eagles were identified during field investigations; these findings were verified by a qualified biologist. The NHHIP area is a highly disturbed urbanized area; due to the distance between the proposed project and the known nesting eagles at Spring Creek and between the proposed project and the higher quality foraging and nesting habitat near other suitable water bodies (e.g., the San Jacinto River and Lake Houston), it is unlikely that the proposed project would have any impact on Bald Eagles. The project area is outside the known range for Golden Eagles; therefore, no impact to this species is anticipated. The project would comply with the National Bald Eagle Management Guidelines of 2007.

4.7 *Fish and Wildlife Coordination Act*

The Fish and Wildlife Coordination Act (FWCA), as amended in 1964, was enacted to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife resources, take action to prevent loss or damage to these resources, and provide for the development and improvement of these resources. Preliminary design indicates that the proposed project may be authorized by Nationwide Permit (NWP) 14 from the U.S. Army Corps of Engineers (USACE). Compliance with the NWP #14 satisfies FWCA coordination requirements. If a USACE Individual Permit becomes necessary for construction of the NHHIP, then additional coordination with the USFWS would need to occur for compliance under FWCA.

A detailed description of waters of the U.S., including wetlands in the project area, is presented in the Waters of the United States Technical Report, provided under separate cover.

4.8 *Executive Order 13112 on Invasive Species*

In accordance with Executive Order (EO) 13112 on Invasive Species, the Executive Memorandum on Beneficial Landscaping, and the 1999 Federal Highway Administration guidance on invasive species, all revegetation would, to the extent practicable, use only native species. Upon completion of earthwork activities, disturbed areas would be reseeded according to TXDOT specifications and in compliance with EO 13112, where applicable.

4.9 *Executive Memorandum on Beneficial Landscaping*

All landscaping that would be implemented as part of the proposed project would be in accordance with EO 13112 on Invasive Species and the April 26, 1994, Executive Memorandum on Beneficial Landscaping.

TxDOT would adhere to the following sustainable landscape measures and practices where cost-effective and to the extent practicable.

- Use regionally native plants for landscaping
- Design, use, or promote construction practices that minimize adverse effects on the natural habitat
- Reduce fertilizer and pesticide use
- Implement water-efficient and runoff-reduction practices
- Create outdoor demonstration projects employing the above measures and practices

Where possible, the ROW of the proposed project would be revegetated upon completion of roadway construction. Open areas would be revegetated and maintained according to standard TxDOT practices. Other landscape measures may include tree and shrub plantings.

4.10 Farmland Protection Policy Act

The FPPA, as detailed in Subtitle I of Title XV of the Agricultural and Food Act of 1981, provides protection to the following: (1) prime farmland, (2) unique farmland, and (3) farmland of local or statewide importance. Transportation projects conducted by a federal agency or with federal agency assistance that irreversibly convert protected farmland (directly or indirectly) to nonagricultural use are required to coordinate with the NRCS under the FPPA.

The proposed project would require new ROW, but it is not located within a “non-urbanized area” as designated by the U.S. Census Bureau (U.S. Census Bureau, 2010); additionally, no soils were designated as prime or unique farmlands within the project area. Therefore, no coordination with the NRCS would be required for this project.

5.0 Habitat for Threatened or Endangered Species

Table 3 lists the federally and state-listed threatened and endangered species and Species of Greatest Conservation Need (SGCN) of potential occurrence in Harris County, along with habitat descriptions for each species, a determination of whether appropriate habitat for the species occurs within the project area, and a discussion of potential effects/impacts to the species. This information has been updated since the issuance of the Draft EIS and species effect/impact determinations reflect the results of field investigation conducted in December 2017.

Coordination with TPWD for this project was completed in 2016. In July 2019, TPWD revised the Harris County species list to include additional protected species. Environmental scoping for the proposed project was already complete at this time. Per the TxDOT and TPWD MOU, changes to TPWD county lists are not required to be considered in cases in which environmental scoping has already occurred prior to the revision of the lists. In addition, SGCNs are not afforded regulatory protection under state or federal law; therefore, potential impacts to recently-added SGCNs are not evaluated in the Final EIS or this technical report. However, three new state-listed species (Reddish Egret, Swallow-tailed Kite, and Texas tortoise) were added to the Harris County list since the original documentation was prepared and have been added to the discussion below.

Table 3: Threatened and Endangered Species and Species of Greatest Conservation Need of Potential Occurrence in Harris County, Texas

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Plants						
Awnless bluestem <i>Bothriochloa exaristata</i>	NL	SGCN	Coastal prairies on black clay; Perennial; Flowering April-Dec; Fruiting	No	No impact	No coastal prairies occur within the project area.
Coastal gay-feather <i>Liatris bracteata</i>	NL	SGCN	Texas endemic; coastal prairie grasslands of various types, from salty prairie on low-lying, somewhat saline clay loams to upland prairie on nonsaline, clayey to sandy loams; flowering in fall	No	No impact	No coastal prairies occur within the project area.
Giant sharpstem umbrella-sedge <i>Cyperus cephalanthus</i>	NL	SGCN	In Texas on saturated, fine sandy loams, along nearly level fringes of deep prairie depressions; also in depressional areas within coastal prairie remnant on heavy black clay; soils include very strongly acidic to moderately alkaline silt loams and silty clay loams; flowering/fruitletting May-June, August-September, and possibly other times in response to rainfall	No	No impact	Although ditches and other depressional areas occur within the project area, no coastal prairie remnant was observed within the proposed or existing ROW.
Goldenwave tickseed <i>Coreopsis intermedia</i>	NL	SGCN	In deep sandy soils of sandhills in openings in or along margins of post oak woodlands and pine-oak forests of east Texas; perennial; flowering/fruitletting May-August	No	No impact	No deep sandy soils of sandhills or post oak woodlands occur in the project area.
Houston daisy <i>Rayjacksonia aurea</i>	NL	SGCN	Texas endemic; on and around naturally barren or sparsely vegetated saline slick spots or pimple mounds on coastal prairies, usually on sandy to sandy loam soils, occasionally in pastures and on roadsides in similar soil types where mowing may mimic natural prairie disturbance regimes; flowering late September-November/December	No	No impact	No sparsely vegetated slick spots or pimple mounds on sandy to sandy loam soils occur in the project area. Roadside areas are urbanized and are unlikely to mimic natural prairies. This species was not observed during field investigations conducted in December 2017.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Indianola beakrush <i>Rhynchospora indianolensis</i>	NL	SGCN	Locally abundant in cattle pastures in some areas (at least during wet years), possibly becoming a management problem in such sites; perennial; flowering/fruitleting April-November	No	No impact	No cattle pastures occur within the project area.
Panicled indigobush <i>Amorpha paniculata</i>	NL	SGCN	A stout shrub, 9 feet tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of the Saline Prairies in East Texas; perennial; flowering summer	No	No impact	No acid seep forests, peat bogs, wet floodplain forests, or seasonal wetlands on the edge of the Saline Prairies occur within the project area.
Texas ladies'-tresses <i>Spiranthes brevilabris</i> var. <i>brevilabris</i>	NL	SGCN	Sandy soils in moist prairies, including blackland/Fleming prairies, calcareous prairie pockets surrounded by pines, pine-hardwood forest, open pinelands, wetland pine savannahs/flatwoods, and dry to moist fields, meadows, and roadsides; delicate, nearly ephemeral orchid producing winter rosettes, flowers February-April; historically endemic to southeastern coastal plain	No	No impact	No moist prairies, pine-hardwood forests, or pine savannahs/flatwoods occur within the project area. Roadside areas are urbanized and are unlikely to provide suitable sandy soils, This species was not observed during field investigations conducted in December 2017.
Texas meadow-rue <i>Thalictrum texanum</i>	NL	SGCN	Texas endemic; mostly found in woodlands and woodland margins on soils with a surface layer of sandy loam, but it also occurs on prairie pimple mounds; both on uplands and creek terraces, but perhaps most common on claypan savannahs; soils are very moist during its active growing season; flowering/fruitleting January/February-May, withering by midsummer, foliage reappears in late fall (November) and may persist through winter	Yes	May impact	Woodland margins and upland creek terraces occur within the project area adjacent to Halls, Little White Oak, and Buffalo Bayous. This species was not observed during field investigations conducted in December 2017 but may occur adjacent to isolated woodland margins.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Texas prairie dawn <i>Hymenoxys texana</i>	LE	E	Texas endemic; in poorly drained, sparsely vegetated areas (slick spots) at the base of mima mounds in open grassland or almost barren areas on slightly saline soils that are sticky when wet and powdery when dry; flowering late February-early April	No	No effect	No mima mounds in open grassland or almost barren areas on slightly saline soils occur within the project area.
Texas tauschia <i>Tauschia texana</i>	NL	SGCN	Occurs in loamy soils in deciduous forests or woodlands on river and stream terraces; Perennial; Flowering/Fruiting Feb-April	Yes	May impact	Loamy soils along Halls, Little White Oak, White Oak, and Buffalo Bayous may be present where natural channels and woodland margins exist.
Texas windmill-grass <i>Chloris texensis</i>	NL	SGCN	Texas endemic; sandy to sandy loam soils in relatively bare areas in coastal prairie grassland remnants, often on roadsides where regular mowing may mimic natural prairie fire regimes; flowering in fall	Yes	May impact	Native-invasive dominant grasslands (Disturbed Prairie) occur along roadsides and proposed detention pond locations within the project area. This species was not observed during field investigations conducted in December 2017.
Threeflower broomweed <i>Thurovia triflora</i>	NL	SGCN	Texas endemic; near coast in sparse, low vegetation on a veneer of light colored silt or fine sand over saline clay along drier upper margins of ecotone between salty prairies and tidal flats; further inland associated with vegetated slick spots on prairie mima mounds; flowering September-November	No	No impact	Project area is not located near the coast. No prairie mima mounds occur within the project area.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Mollusks						
Louisiana pigtoe <i>Pleurobema riddellii</i>	NL	T	Streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins	Yes	May impact	Halls, Little White Oak, and Buffalo Bayous occur within the project area. All three water bodies appear perennial and may contain suitable substrate for this species. TPWD MOU BMPs will be implemented for this species, which includes conducting a survey where suitable habitat exists when work is in the water.
Sandbank pocketbook <i>Lampsilis satura</i>	NL	T	Small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River	Yes	May impact	Halls, Little White Oak, and Buffalo Bayous occur within the project area. All three water bodies appear perennial and may contain suitable substrate for this species. TPWD MOU BMPs will be implemented for this species, which includes conducting a survey where suitable habitat exists when work is in the water.
Texas pigtoe <i>Fusconaia askewi</i>	NL	T	Rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas river basins, Sabine through Trinity rivers as well as San Jacinto River	Yes	May impact	Halls, Little White Oak, and Buffalo Bayous occur within the project area. All three water bodies appear perennial and may contain suitable substrate for this species. TPWD MOU BMPs will be implemented for this species, which includes conducting a survey where suitable habitat exists when work is in the water.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Fish						
American eel <i>Anguilla rostrata</i>	NL	SGCN	Coastal waterways below reservoirs to Gulf; spawns January-February in ocean, larvae move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries	Yes	May impact	Halls, Little White Oak, and Buffalo Bayous occur within the project area. All three water bodies appear perennial and may contain suitable habitat for this species.
Smalltooth sawfish <i>Pristis pectinata</i>	LE*	E	Different life history stages have different patterns of habitat use; young found very close to shore in muddy and sandy bottoms, seldom descending to depths of greater than 32 feet; in sheltered bays, on shallow banks, and in estuaries or river mouths; adults are encountered in various habitat types (mangrove, reef, seagrass, and coral), in varying salinity regimes and temperatures, at various water depths	No	No effect	No estuaries, bays, river mouths, mangrove, reef, seagrass, or coral are present within the project area.
Western creek chubsucker <i>Erimyzon claviformis</i>	NL	T	Eastern Texas streams from the Red River to the San Jacinto drainage. Habitat includes silt-, sand- and gravel-bottomed pools of clear headwaters, creeks, and small rivers; often near vegetation; occasionally in lakes. Spawning occurs in river mouths or pools, riffles, lake outlets, or upstream creeks. Prefers headwaters, but seldom occurs in springs.	Yes	May impact	Halls, Little White Oak, and Buffalo Bayous occur within the project area. All three water bodies appear perennial and may contain suitable habitat for this species.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Amphibians						
Houston toad <i>Anaxyrus houstonensis</i>	LE*	E	Endemic; sandy substrate, water in pools, ephemeral pools, stock tanks; breeds in spring especially after rains; burrows in soil of adjacent uplands when inactive; breeds February-June; associated with soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, and Willis geologic formations	No	No effect	No soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, or Willis geologic formations are present within the project area. Harris County is located outside the currently known occupied range for this species.
Southern crawfish frog <i>Lithobates areolatus areolatus</i>	NL	SGCN	Abandoned crawfish holes and small mammal burrows, moist meadows, pasturelands, pine scrub, and river floodplains; eggs are laid, and larvae develop in temporary water such as flooded fields, ditches, farm ponds and small lakes. Habitat: Shallow water, Herbaceous Wetland, Riparian, Temporary Pool, Cropland/hedgerow, Grassland/herbaceous, Suburban/orchard, Woodland Conifer	No	No impact	No moist meadows, pasturelands, pine scrub, or unmodified river floodplains lie within the project area. Riparian areas adjacent to the bayous are urbanized; banks of these water features are mostly channelized and do not provide suitable habitat for this species. No crayfish holes were identified during field investigation.
Reptiles						
Alligator snapping turtle <i>Macrochelys temminckii</i>	NL	T	Perennial water bodies; deep water of rivers, canals, lakes, and oxbows; swamps, bayous, and ponds near deep running water; brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; active March-October; breeds April-October	Yes	May impact	No deep waters occur within the project area; however, Halls, Little White Oak, and Buffalo Bayous occur within the project area. All three water bodies appear perennial and may contain suitable habitat for this species. TPWD MOU BMPs will be implemented for this species.
Green sea turtle <i>Chelonia mydas</i>	LT*	T	Gulf and bay system; shallow water seagrass beds, open water between feeding and nesting areas, barrier island beaches; nesting March-October, with peak activity in May-June	No	No effect	The project is not located within or immediately adjacent to the Gulf of Mexico.

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
	Kemp's Ridley sea turtle <i>Lepidochelys kempii</i>	LE*	E	Gulf and bay system; adults stay within shallow waters of Gulf; nests April-August	No	No effect	The project is not located within or immediately adjacent to the Gulf of Mexico.
	Leatherback sea turtle <i>Dermochelys coracea</i>	LE*	E	Gulf and bay systems; in U.S. portion of western Atlantic nesting territories, nesting season ranges March-August	No	No effect	The project is not located within or immediately adjacent to the Gulf of Mexico.
	Loggerhead sea turtle <i>Caretta caretta</i>	LT*	T	Gulf and bay system primarily for juveniles; adults are pelagic; nests April-November	No	No effect	The project is not located within or immediately adjacent to the Gulf of Mexico.
	Texas horned lizard <i>Phrynosoma cornutum</i>	NL	T	Open, arid and semi-arid regions with sparse vegetation, soil varies in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September	No	No impact	No arid areas with sparse vegetation occur within the project area. No harvester ant mounds were observed during field investigations.
	Texas tortoise <i>Gopherus berlandieri</i>	NL	T	Open brush with a grass understory is preferred; open grass and bare ground are avoided. Seasonally flooded tidal flats are not utilized. When inactive, occupies shallow depression at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November, breeds April-November.	No	No impact	No open brush with grass understory occurs within the project area.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Timber rattlesnake <i>Crotalus horridus</i>	NL	T	Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e., grapevines or palmetto	Yes	No impact	Riparian areas and woodland edges occur within the project area; however, these areas are isolated within a completely urbanized area. No dense ground cover or palmetto occurs within the proposed roadways' alignment or detention pond locations. Although small patches of suitable habitat may be present within the project area, this species is unlikely to occur. TPWD MOU BMPs for terrestrial reptiles will be implemented for this project.
Birds						
American peregrine falcon <i>Falco peregrinus anatum</i>	DL	T	Resident of west Texas, migrant across the rest of the state; winters along coast; occupies wide range of habitats during migration, including urban; stopovers at leading landscape edges	No	No impact	The species is a potential migrant; any use of the project area would be incidental.
Arctic peregrine falcon <i>Falco peregrinus tundrius</i>	DL	SGCN	Migrant throughout state from far northern breeding range, winters along coast; occupies wide range of habitats during migration, including urban; stopovers at leading landscape edges	No	No impact	The species is a potential migrant; any use of the project area would be incidental.
Bald eagle <i>Haliaeetus leucocephalus</i>	DL	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water	No	No impact	Although several perennial bayous occur within the project area, these water bodies do not support the typical roosting or nesting habitat for this species. These water bodies occur within a densely populated urban environment that is unlikely to provide suitable habitat for this species.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Black rail <i>Laterallus jamaicensis</i>	NL	SGCN	Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous year's dead grasses; nest usually hidden in marsh grass or at base of Salicornia	No	No impact	No salt, brackish, or freshwater marshes, pond borders, wet meadows, or grassy swamps occur within the project area.
Brown pelican <i>Pelecanus occidentalis</i>	DL	SGCN	Largely coastal and near shore areas, where it roosts and nests on islands and spoil banks	No	No impact	No coastal areas or shores occur within the project area.
Henslow's sparrow <i>Ammodramus henslowii</i>	NL	SGCN	Wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking	No	No impact	No weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles occur within the project area.
Interior least tern <i>Sterna antillarum athalassos</i>	LE+	E	Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc.); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony	No	No effect	USFWS requires consideration of this species for wind energy projects only. No braided streams with sand or gravel bars occur within the project area.
Mountain plover <i>Charadrius montanus</i>	NL	SGCN	Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields	No	No impact	No breeding or non-breeding habitat occurs within the project area.
Piping plover <i>Charadrius melodus</i>	LT+	T	Wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats	No	No effect	USFWS requires consideration of this species for wind energy projects only. No beaches, mud flats, or salt flats occur within the project area.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Red knot <i>Calidris canutus rufa</i>	LT	SGCN	Prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore	No	No effect	USFWS requires consideration of this species for wind energy projects only. The species is a potential migrant. No wintering habitat such as seacoasts, tidal flats, or beaches occur within the project area.
Red-cockaded woodpecker <i>Picoides borealis</i>	LE*	E	Cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly pine	No	No effect	No old growth pine forests occur within the project area.
Reddish egret <i>Egretta rufescens</i>	NL	T	Resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear.	No	No effect	No marshes, salt ponds, or tidal flats occur within the project area.
Snowy plover <i>Charadrius alexandrinus</i>	NL	SGCN	Formerly an uncommon breeder in the Panhandle; potential migrant; winter along coast	No	No impact	The species is a potential migrant; however, the project area is not located on or adjacent to the beach and does not contain typical foraging habitat.
Sprague's pipit <i>Anthus spragueii</i>	NL	SGCN	Only in Texas mid-September to early April; strongly tied to native upland prairie; sensitive to patch size and avoids edges	No	No impact	No native upland prairie that lacks edge occurs within the project area.
Swallow-tailed kite <i>Elanoides forficatus</i>	NL	T	Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees.	No	No impact	No lowland forested regions or rivers with suitable nesting trees occur within the project area. Incidental observations may occur, but species will not be impacted.

	Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
	White-faced ibis <i>Plegadis chihi</i>	NL	T	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats	No	No impact	No freshwater marshes, sloughs, irrigated rice fields, brackish water, or saltwater occur within the project area.
	White-tailed hawk <i>Buteo albicaudatus</i>	NL	T	Near coast on prairies, cordgrass flats, and scrub-live oak; farther inland on prairies, mesquite and oak savannah, and mixed savannah-chaparral; breeds March-May	No	No impact	No coastal prairies, cordgrass flats, scrub-live oak, mesquite and oak savannah, or mixed savannah-chaparral occur within the project area.
	Whooping crane <i>Grus americana</i>	LE*	E	Potential migrant via plains throughout state to coast; winters in coastal marshes	No	No effect	The species is a potential migrant across Texas; any use of the project area would be incidental and temporary. The project area contains no coastal marshes and is not located near Aransas National Wildlife Refuge, where wintering individuals are typically found.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Wood stork <i>Mycteria americana</i>	NL	T	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow water, including saltwater; roosts communally in tall snags in active heronries; breeds in Mexico	Yes	No impact	The species is a potential migrant; any use of the project area would be incidental. No nesting habitat occurs in the project area and no active heronries were identified by the TXNDD or during field investigations in December 2017. This species could utilize the natural channel areas of bayous temporarily, but due to the intensity of urban development within the project area, more than incidental use would be unlikely. TPWD MOU BMPs will be implemented for this species.
Mammals						
Louisiana black bear <i>Ursus americanus luteolus</i>	DL	T	Possible as transient in Texas; bottomland hardwoods and large tracts of inaccessible forested areas	No	No impact	No bottomland hardwoods or inaccessible forested areas occur within the project area.
Rafinesque's big-eared bat <i>Corynorhinus rafinesquii</i>	NL	T	Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures	Yes	May impact	Concrete culverts and abandoned man-made structures occur within the project area. No evidence of resident populations under bridges (i.e., staining, odor, bat noise) was observed during field investigation in December 2017. TPWD MOU BMPs will be implemented for this species
Red wolf <i>Canis rufus</i>	LE*	E	Extirpated; formerly known throughout eastern half of Texas	No	No effect	The species is considered extirpated.

Species	Federal Status	State Status	Habitat Description	Habitat Present in Project Area?	Species Effect/Impact	Pertinent Project Information
Southeastern myotis bat <i>Myotis austroriparius</i>	NL	SGCN	Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures	Yes	May impact	Concrete culverts, abandoned man-made structures, and bridges occur within the project area. No evidence of resident populations under bridges (i.e., staining, odor, bat noise) was observed during field investigation in December 2017. TPWD MOU BMPs will be implemented for this species
West Indian manatee <i>Trichechus manatus</i>	LE†	E	Gulf and bay system; opportunistic, aquatic herbivore	No	No effect	Major waterways intersecting the project area include Buffalo Bayou and White Oak Bayou. These waters support little submerged aquatic or floating vegetation and are primarily channelized or concrete lined within the project limits. The project area is located approximately 20 stream miles upstream of Trinity Bay. No suitable habitat was observed during field investigations in December 2017.
<p>Status Codes: LE = Federally Listed Endangered LT = Federally Listed Threatened E = State-Listed Endangered T = State-Listed Threatened</p> <p>SGCN = Species of Greatest Conservation Need NL = Not listed DL = Delisted</p> <p>* = Species not recognized by the USFWS as occurring within the project area but designated by TPWD as potentially occurring within the county. † = Species not recognized by TPWD as occurring within the county but designated by USFWS as potentially occurring within the project area.</p>						

Sources: TPWD 2017, 2020; USFWS 2020.

6.0 TPWD Analysis Section

Based on a revised 2020 analysis, the project is within range with suitable habitat present for the following SGCNs: American eel (*Anguilla rostrata*), Southeastern myotis bat (*Myotis austroriparius*), Texas meadow-rue (*Thalictrum texanum*), Texas tauschia (*Tauschia texana*), and Texas windmill-grass (*Chloris texensis*). The project is within range with suitable habitat for the state-threatened alligator snapping turtle (*Macrochelys temminckii*), timber rattlesnake (*Crotalus horridus*), Louisiana pigtoe (*Pleurobema riddellii*), sandbank pocketbook (*Lampsilis satura*), Texas pigtoe (*Fusconaia askewi*), Rafinesque’s big-eared bat (*Corynorhinus rafinesquii*), Wood stork (*Mycteria americana*), and western creek chubsucker (*Erimyzon claviformis*).

In accordance with the *Best Management Practices Programmatic Agreement* between TxDOT and TPWD under the 2013 MOU, BMPs have been defined for implementation by TxDOT in order to minimize impacts to federally and state-listed species and SGCNs. **Table 4** summarizes those BMPs related to species that have suitable habitat within the proposed project area. There are no TPWD-approved BMPs for the SGCN plant species.

Table 4: BMPs for State-listed Species and SGCNs

Species Name	BMP
Southeastern myotis bat Rafinesque’s big-eared bat	<p>To determine the appropriate BMP to avoid or minimize impacts to bats, review the habitat description for the species of interest on the TPWD Rare, Threatened, and Endangered Species of Texas by County List or other trusted resources. All bat surveys and other activities that include direct contact with bats shall comply with TPWD-recommended white-nose syndrome protocols located on the TPWD Wildlife Habitat Assessment Program website under “Project Design and Construction.”</p> <p>The following survey and exclusion protocols should be followed prior to commencement of construction activities. For the purposes of this document, structures are defined as bridges, culverts (concrete or metal), wells, and buildings.</p> <ul style="list-style-type: none"> • For activities that have the potential to impact structures, cliffs or caves, or trees; a qualified biologist will perform a habitat assessment and occupancy survey of the feature(s) with roost potential as early in the planning process as possible or within one year before project letting. • For roosts where occupancy is strongly suspected but unconfirmed during the initial survey, revisit feature(s) at most four weeks prior to scheduled disturbance to confirm absence of bats. • If bats are present or recent signs of occupation (i.e., piles of guano, distinct musky odor, or staining and rub marks at potential entry points) are observed, take appropriate measures to ensure that bats are not harmed, such as implementing non-lethal exclusion activities or timing or phasing of construction. • Exclusion devices can be installed by a qualified individual between September 1 and March 31. Exclusion devices should be used for a minimum of seven days when minimum nighttime temperatures are above 50 °F AND minimum daytime temperatures are above 70 °F. Prior to exclusion, ensure that alternate roosting habitat is available in the immediate area. If no suitable roosting habitat is available, installation of alternate roosts is recommended to replace the loss of an occupied roost. If alternate roost sites are not provided, bats may seek shelter in other inappropriate sites, such as buildings, in the surrounding area. See Section 2: Standard Recommendations for recommended acceptable methods for excluding bats from structures. • If feature(s) used by bats are removed as a result of construction, replacement structures should incorporate bat-friendly design or artificial roosts should be constructed to replace these features, as practicable. • Conversion of property containing cave or cliff features to transportation purposes should be avoided where feasible.

Species Name	BMP
	<ul style="list-style-type: none"> • Large hollow trees, snags (dead standing trees), and trees with shaggy bark should be surveyed for colonies and, if found, should not be disturbed until the bats are no longer occupying these features. Post-occupancy surveys should be conducted by a qualified biologist prior to tree removal from the landscape. • Retain mature, large-diameter hardwood forest species and native/ornamental palm trees where feasible. • In all instances, avoid harm or death to bats. Bats should only be handled as a last resort and after communication with TPWD.
<p>Louisiana pigtoe</p> <p>Sandbank pocketbook</p> <p>Texas pigtoe</p>	<ul style="list-style-type: none"> • When work is in the water; survey project footprints for state-listed species where appropriate habitat exists. • When work is in the water and mussels are discovered during surveys; relocate state-listed and SGCN mussels under TPWD authorization and implement Water Quality BMPs. • When work is adjacent to the water; Water Quality BMPs implemented as part of the Storm Water Pollution Prevention Plan (SWPPP) for a construction general permit or any conditions of the 401 water quality certification for the project will be implemented. (Note, SWPPP and 401 BMPs are not listed in this PA). No TPWD Coordination required.
American eel	<ul style="list-style-type: none"> • For projects within the range of a SGCN or state-listed fish and work is adjacent to water: Water Quality BMPs. No TPWD Coordination required. • For projects within the range of a SGCN or State-Listed fish, and work is in the water: TPWD coordination required.
Alligator snapping turtle	<ol style="list-style-type: none"> 1) Minimize impacts to wetland and riverine habitats 2) Amphibian and Aquatic Reptile BMPs <p>Unless absence of the species can be demonstrated, assume presence in suitable habitat and implement the following BMPs. Absence can only be demonstrated using TPWD-approved survey efforts (contact TPWD for minimum survey protocols for species and project site conditions).</p> <ul style="list-style-type: none"> • For projects within one mile of a known occupied location or observation of the species recorded from 1980 until the current year and suitable habitat is present, coordinate with TPWD. • For new location roadway projects, coordinate with TPWD. • For projects within existing ROW when work is in water or will permanently impact a water feature and potential habitat exists for the target species complete the following: <ol style="list-style-type: none"> a) Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered. b) Minimize impacts to wetland, temporary and permanent open water features, including depressions, and riverine habitats. c) Maintain hydrologic regime and connections between wetlands and other aquatic features. d) Use barrier fencing to direct animal movements away from construction activities and areas of potential wildlife-vehicle collisions in construction areas directly adjacent, or that may directly impact, potential habitat for the target species. e) Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, using erosion control blankets or mats that contain no netting, or only contain loosely woven natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable. f) Project specific locations (PSLs) proposed within state-owned ROW should be located in uplands away from aquatic features. g) When work is directly adjacent to the water, minimize impacts to shoreline basking sites (e.g., downed trees, sand bars, exposed bedrock) and overwinter sites (e.g., brush and debris piles, crayfish burrows) where feasible.

Species Name	BMP
	<ul style="list-style-type: none"> h) Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter, which may be refugia for terrestrial amphibians, where feasible. i) If gutters and curbs are part of the roadway design, where feasible install gutters that do not include the side box inlet and include sloped (i.e., mountable) curbs to allow small animals to leave roadway. If this modification to the entire curb system is not possible, install sections of sloped curb on either side of the storm water drain for several feet to allow small animals to leave the roadway. Priority areas for these design recommendations are those with nearby wetlands or other aquatic features. • For projects that require acquisition of additional ROW and work within that new ROW is in water or will permanently impact a water feature, implement a-i above plus j-l below, where applicable: <ul style="list-style-type: none"> j) For sections of roadway adjacent to wetlands or other aquatic features, install wildlife barriers that prevent climbing. Barriers should terminate at culvert openings in order to funnel animals under the road. The barriers should be of the same length as the adjacent feature or 80 feet long in each direction, or whichever is the lesser of the two. k) For culvert extensions and culvert replacement/installation, incorporate measures to funnel animals toward culverts such as concrete wingwalls and barrier walls with overhangs. l) When riprap or other bank stabilization devices are necessary, their placement should not impede the movement of terrestrial or aquatic wildlife through the water feature. Where feasible, biotechnical streambank stabilization methods using live native vegetation or a combination of vegetative and structural materials should be used.
Timber rattlesnake	<p>Terrestrial Reptile BMPs</p> <ul style="list-style-type: none"> • Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, using erosion control blankets or mats that contain no netting or contain loosely woven, natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable. • For open trenches and excavated pits, install escape ramps at an angle of less than 45 degrees (1:1) in areas left uncovered. Visually inspect excavation areas for trapped wildlife prior to backfilling. • Inform contractors that if reptiles are found on project site allow species to safely leave the project area. • Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter where feasible. • Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered.
Wood Stork	<p>Bird BMPs</p> <p>In addition to complying with the MBTA, perform the following BMPs:</p> <ul style="list-style-type: none"> • Prior to construction, perform daytime surveys for nests including under bridges and in culverts to determine if they are active before removal. Nests that are active should not be disturbed. • Do not disturb, destroy, or remove active nests, including ground nesting birds, during the nesting season; • Avoid the removal of unoccupied, inactive nests, as practicable; • Prevent the establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair; • Do not collect, capture, relocate, or transport birds, eggs, young, or active nests without a permit

Source: Best Management Practices Programmatic Agreement between TxDOT and TPWD Under the 2013 MOU. Reapproved in 2017

Note: TPWD coordination was completed in 2016. At that time, the Plains Spotted Skunk and Creek Chubsucker were listed as rare by the TPWD Harris County List. BMPs for those species were coordinated with TPWD and are included in the Final EIS.

6.1 Elements of Occurrence within 1.5 Miles of the Project

TPWD’s TXNDD was reviewed on February 25, 2020, using data obtained from TPWD. Information files were reviewed for the known locations of species in the *Aldine*, *Houston Heights*, *Settegast*, *Bellaire*, and *Parkplace*, Texas USGS 7.5-minute topographic quadrangle maps (including the project area and surrounding vicinity). It should be noted that the TXNDD cannot be used for presence/absence determinations.

One element of occurrence (EO) was recorded within 1.5 miles of the project area: EO 11461, the Southern crawfish frog. Several additional EOs were recorded within a 10-mile radius of the project area. **Table 5** below and **Figure 6** depict this information in a tabular and visual format. **Table 5** also identifies the last recorded occurrence of the species.

Table 5: TXNDD Results for the NHHIP

Elemental Occurrence #	Scientific Name	Common Name	Status	Buffer Distance from ROW (miles)	Last Recorded Observation
3159	<i>Anaxyrus houstonensis</i>	Houston Toad	LE/E	10	1976
1901	<i>Chloris texensis</i>	Texas Windmill Grass	SGCN	10	1976
3565	<i>Hymenoxys texana</i>	Texas prairie dawn	LE/E	10	1999
26	<i>Hymenoxys texana</i>	Texas prairie dawn	LE/E	10	2013
1954	<i>Hymenoxys texana</i>	Texas prairie dawn	LE/E	10	1988
6775	<i>Hymenoxys texana</i>	Texas prairie dawn	LE/E	10	1988
11463	<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	SGCN	10	1957
11462	<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	SGCN	10	1950
11461	<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	SGCN	1.5	1944
7944	<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	SGCN	10	1948
1329	<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	SGCN	10	1952

Elemental Occurrence #	Scientific Name	Common Name	Status	Buffer Distance from ROW (miles)	Last Recorded Observation
7552	<i>Macrochelys temminckii</i>	Alligator Snapping Turtle	T	10	1968
1657	<i>Quercus nigra-Quercus phellos series</i>	Water Oak-Willow Oak Series	--	10	1984
4408	<i>Rayjacksonia aurea</i>	Houston daisy	SGCN	10	1964
7697	<i>Thalictrum texanum</i>	Texas meadow-rue	SGCN	10	2004
472	<i>Haliaeetus leucocephalus</i>	Bald eagle	SGCN	10	2003
6663	<i>Chloris texensis</i>	Texas windmill grass	SGCN	10	1999
1957	<i>Hymenoxys texana</i>	Texas prairie dawn	LE	10	1988
6278	<i>Liochlorophis vernalis</i>	Smooth green snake	T	10	1964
7337	<i>Hymenoxys texana</i>	Texas prairie dawn	LE	10	1988
7144	<i>Rayjacksonia aurea</i>	Houston daisy	SGCN	10	1998
3071	<i>Rayjacksonia aurea</i>	Houston daisy	SGCN	10	1999
4284	<i>Chloris texensis</i>	Texas windmill grass	SGCN	10	1984
2586	<i>Rayjacksonia aurea</i>	Houston daisy	SGCN	10	1998
3268	<i>Leitneria pilosa ssp. pilosa</i>	Corkwood	SGCN	10	2002
6244	<i>Picoides borealis</i>	Red-cockaded woodpecker	LE	10	1989
2849	<i>Rayjacksonia aurea</i>	Houston daisy	SGCN	10	2002
3746	<i>Anaxyrus houstonensis</i>	Houston toad	LE	10	1976
1609	<i>Coreopsis intermedia</i>	Goldenwave tickseed	SGCN	10	1944
2082	<i>Hymenoxys texana</i>	Texas prairie dawn	LE	10	1998
6508	<i>Liatris bracteata</i>	Coastal gay-feather	SGCN	10	1978

Elemental Occurrence #	Scientific Name	Common Name	Status	Buffer Distance from ROW (miles)	Last Recorded Observation
4891	<i>Liatrix bracteata</i>	Coastal gay-feather	SGCN	10	1985
17	<i>Hymenoxys texana</i>	Texas prairie dawn	LE	10	2003
1574	<i>Hymenoxys texana</i>	Texas prairie dawn	LE	10	1988
12770	<i>Spilogale putorius</i>	Eastern spotted skunk	SGCN	10	1980
4660	<i>Lithobates areolatus areolatus</i>	Southern crawfish frog	SGCN	10	1960
11233	<i>Amorpha paniculate</i>	Panicled indigobush	SGCN	10	1992
10084	<i>Sporobolus tharpii</i>	Tharp's dropseed	SGCN	10	1986
10742	<i>Bothriochloa exaristata</i>	Awnless bluestem	SGCN	10	1986
10481	<i>Bothriochloa exaristata</i>	Awnless bluestem	SGCN	10	1986
Status Codes: LE = Federally Listed Endangered SGCN = Species of Greatest Conservation Need LT = Federally Listed Threatened E = State-Listed Endangered -- = No Federal or State Designation T = State-Listed Threatened					

Source: TXNDD, 2020

7.0 Special Habitat Features

As defined in the 2013 MOU, special habitat features can include bottomland hardwoods, caves, cliffs and bluffs, native prairies, seeps or springs, snags or groups of snags, existing bridges with known or observed bird or bat colonies, rookeries, and prairie dog towns. No special habitat features were observed within the project area.

8.0 Unusual Vegetation Features

Unusual vegetation features can include unmaintained vegetation, fencerow vegetation, riparian vegetation, significant (historically or ecologically) or locally important trees, or unusual stands or islands of vegetation. Unusual vegetation features identified within the project area include riparian vegetation and unmaintained vegetation. Approximately 123.60 acres of unmaintained and 11.76 acres of riparian vegetation would be impacted by the proposed project. This vegetation includes non-native invasive woodlands, disturbance grasslands, native invasive woodlands, and riparian areas. Although these areas are currently unmaintained, much of the adjacent vegetation communities are ornamental vegetation communities associated with transportation ROW or commercial and residential landscaping. No old growth forest patches were observed within the project area. No remnant vegetation was observed within the project area by qualified biologists at

the time of the field survey. Several large trees were noted during the field investigation within stands of unmaintained vegetation and adjacent to parks and greenbelts associated with the bayous; however, no evidence of historical, ecological, or local significance was observed. A review of the Texas Big Tree Registry determined that no Champion or locally significant trees were present within the proposed project area (Texas A&M Forest Service 2018).

9.0 TPWD Coordination Requirements

A Tier I site assessment in accordance with TxDOT’s 2013 *Memorandum of Understanding (MOU) with the Texas Parks and Wildlife Department* was performed to determine whether coordination with TPWD would be required for the proposed project. The Tier I Site Assessment defines the type and amount of habitat impacted using information from the Texas Conservation Action Plan, EMST, TXNDD, lists of threatened and endangered species and SGCNs maintained by TPWD and USFWS, information collected during field investigations, and the most current aerial photography available. **Table 6** lists the coordination triggers and responses to each.

Table 6: Tier 1 Site Assessment—TPWD Coordination Triggers

Trigger	Applies to the Project?	Explanation
The project is within the range of a state threatened or endangered species or SGCN, as identified by the TPWD county list, and there is suitable habitat for the species within the project area unless BMPs as defined in the MOU are implemented as provided by a programmatic agreement.	Yes	The alligator snapping turtle, timber rattlesnake, Louisiana pigtoe, sandbank pocketbook, Texas pigtoe, Rafinesque’s big-eared bat, Western creek chubsucker, American eel, Southeastern myotis bat, Texas meadow-rue, Texas tauschia, Texas windmill-grass, and the Wood stork have potentially suitable habitat within the proposed project area. Prior to TPWD coordination in 2016, the plains spotted skunk and creek chubsucker were included on the Harris County list and were determined to have suitable habitat within the project area. No BMPs have been established for the state-designated SGCN plant species or Western creek chubsucker. The BMPs for the remainder of these species are defined in the MOU PA, as listed in Table 4 .
The project may adversely impact important remnant vegetation based on the judgment of a qualified biologist or as mapped in the TXNDD.	No	No remnant vegetation occurs in the project area.
The project requires a nationwide permit with pre-construction notification or an individual permit issued by the USACE.	Yes	An identification and delineation of waters of the U.S., including wetlands, was conducted for the proposed project, and is documented in the Waters of the United States Technical Report. Approximately 23.6 acres of potentially jurisdictional waters and wetlands are located within the limits of the proposed project. Conceptual design plans indicate that some of these potentially jurisdictional waters and wetlands could be unavoidably impacted by construction activities. These impacts may qualify for USACE authorization by NWP 14, with or without Pre-construction Notification. Should permanent impacts be determined during the design phase of the project to exceed the NWP threshold(s), an

Trigger	Applies to the Project?	Explanation
		Individual Permit application would be prepared and coordinated prior to the commencement of construction activities.
The project includes in the TxDOT ROW or conservation, construction, or drainage easement, more than 200 linear feet of stream channel for each single and complete crossing of one or more of the following that is not already channelized or otherwise maintained: a) channel realignment; or b) stream bed or stream bank excavation, scraping, clearing, or other permanent disturbance.	No	All streams, ditches, and tributaries, including Halls Bayou, Little White Oak Bayou, White Oak Bayou, and Buffalo Bayou are channelized or maintained within the project area.
The project contains known isolated wetlands outside existing TxDOT ROW that will be directly impacted by the project.	No	Project would not impact known isolated wetlands outside of the existing TxDOT ROW.
The project may impact at least 0.10 acre of riparian vegetation based on the judgment of a qualified biologist or as mapped in the EMST.	Yes	Approximately 11.76 acres of riparian vegetation may be impacted as a result of the proposed project.
The project disturbs habitat in an area equal to or greater than the area of disturbance indicated in the <i>Threshold Table Programmatic Agreement</i> .	Yes	The project will disturb more than the allowable threshold for the following field-verified vegetation types: Riparian and Disturbed Prairie. Discrepancies between mapped EMST habitat and observed vegetation communities are identified in the Tier I Site Assessment (provided under separate cover).

As described in **Table 6**, the proposed project required coordination with TPWD in accordance with the 2013 TxDOT-TPWD MOU. TPWD coordination was completed on December 1, 2016.

10.0 Limitations

The site visit was conducted in December 2017. At the time of the field survey, limited right-of-entry had been obtained for the proposed ROW (**Figures 2a-2d**). The findings and recommendations summarized in this report reflect an analysis based on data from aerial imagery (historic and current), soil surveys, geologic atlas, National Wetlands Inventory (NWI) maps, and a pedestrian survey conducted in the transportation ROW and adjacent parcels for which right-of-entry had been granted. Species composition for areas where right-of-entry had not been obtained was field verified to the extent visually accessible from adjacent roads and parcels. The species and vegetation impact determinations (**Sections 3 - 8**) reflect this right-of-entry limitation where applicable.

11.0 References Cited

- Elliott, Lee F., Amie Treuer-Kuehn, Clayton F. Blodgett, C. Diane True, Duane German, and David D. Diamond. 2009-2014. *Ecological Systems of Texas: 391 Mapped Types*.
- Gould, F.W., G.O. Hoffman, and C.A. Rechenhain. 1960. *Vegetational Areas of Texas*. Texas A&M University, Texas Agricultural Experiment Station leaflet No. 492.
- Perkins, Clint J., Plains Spotted Skunk Working Group Webinar, Presentation Title: Distribution of the Plains Spotted Skunk in Texas, Sponsored by the Texas Comptroller of Public Accounts, Economic Growth & Endangered Species Management Division. Research conducted by J. Clint Perkins, Alexandra A. Shaffer, Brad D. Wolaver, Jon Paul Pierre, Ben J. Labay, and Dr. Robert C. Dowler at Angelo State University. December 19, 2017.
- Texas A&M Forest Service. Big Tree Registry. 2018. <http://txforests.tamu.edu/main/article.aspx?id=1336>. Accessed January 9, 2018.
- Texas Department of Transportation (TxDOT). 2017. Tier II Site Assessments Programmatic Agreement between TxDOT and TPWD under the 2013 MOU—2017 Revision. April 2017.
- Texas Natural Diversity Database (TXNDD). 2020. Element Occurrence data export. Wildlife Diversity Program of Texas Parks & Wildlife Department. Accessed February 25, 2020.
- Texas Natural Resource Information System (TNRIS). 2007. “Geologic Atlas of Texas – GIS Data.” <http://www.tnr.org/get-data>. Accessed January 3, 2018.
- Texas Parks and Wildlife Department (TPWD). 2020. Annotated County Lists of Rare Species: Harris County (last revisions July 17, 2019). <http://tpwd.texas.gov/gis/rtest/>. Accessed February 21, 2020.
- 2018a. Outdoor Annual. Freshwater/Saltwater Boundary. <https://tpwd.texas.gov/regulations/outdoor-annual/fishing/general-rules-regulations/freshwater-saltwater-boundaries>. Accessed January 3, 2018.
- 2018b. Planning Data by Region—Ecologically Significant Stream Segments. https://tpwd.texas.gov/landwater/water/conservation/water_resources/water_quantity/sigsegs/index.phtml. Accessed January 9, 2018.
- U.S. Census Bureau. 2010. Urban Area Reference Maps. <https://www.census.gov/geo/maps-data/maps/2010ua.html>. Accessed January 3, 2018.
- U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS). 2018. Web Soil Survey. <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>. Accessed January 3, 2018.
- U.S. Geological Survey (USGS), The National Map National Hydrography Dataset, 2017. <https://viewer.nationalmap.gov/advanced-viewer/>. Accessed January 9, 2018.
- U.S. Fish and Wildlife Service (USFWS). 2020. IPaC Information for Planning and Conservation. Official Species List for Proposed Project Area. Accessed February 21, 2020.

Attachment A

Figures

Attachment B
Project Area Photographs