Volume 2015 Article 170

2015

Archaeological Survey of a Proposed Copano NGL Services (Markham), LLC, 2.8-mile Pipeline, Matagorda County, Texas

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Archaeological survey, shovel tests, and backhoe trenches were conducted on the west bank of the Colorado River for the 2.8-mile Copano pipeline, in Matagorda County, Texas.

January 2015
WSA Technical Report No. 2015-02
Texas Antiquities Permit 7079

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WSA

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ABSTRACT

Report Title: *Archaeological Survey of a Proposed Copano NGL Services (Markham), LLC, 2.8-mile Pipeline, Matagorda County, Texas*

Report Date: January 2015

Report Number: WSA Technical Report No. 2015-02

Agency: Texas Historical Commission (THC).

Permit Number: Texas Antiquities Permit 7079.

Project Description: William Self Associates, Inc. (WSA), conducted cultural resources agency coordination and an archaeology survey for a proposed new 2.8-mile (4.5 kilometer [km]) segment of the 12-inch Copano NGL Services (Markham), LLC (Copano NGL), pipeline in Matagorda County, Texas. Coordination with the Texas Historical Commission (THC) and the archaeology survey were conducted consistent with the requirements of the Texas Natural Resources Code Title 9, Chapter 191 (Antiquities Code of Texas) and accompanying Rules of Practice and Procedure for the code (Texas Administrative Code, Title 13, Chapter 26). The proposed project crosses Texas A&M University property. Texas A&M University is a state entity, and therefore the investigations were subject to regulation by the THC through the Texas Antiquities Code (TAC) and the TAC permitting process. Proposed survey methods were approved by the THC in an initial project coordination letter dated September 25, 2014 (Karbula 2014). The project was conducted under TAC Permit 7079.

Pedestrian and reconnaissance survey supplemented with shovel testing was conducted in undisturbed portions of the 2.8-mile (4.5 km) linear survey corridor, which was 30 meters (m) in width (200 feet) and covered a total of 6.8 acres. As per the minimum survey standards of the THC, transects were spaced 30 m apart, and shovel tests were placed at a rate of 16 per mile along the transects, though no transects or shovel tests were conducted in highly disturbed or developed areas, which represented a large portion of the project area. In total, 22 negative shovel tests and three negative backhoe trenches were excavated in support of the investigation. No archaeological sites or any prehistoric or historic-age cultural materials were recorded, recovered, or observed. No features or evidence of prehistoric- or historic-age occupation were identified.

Acres Surveyed: 6.8

Project Number: WSA 2014-60

Project Location: Matagorda County, Texas

Unevaluated Properties: 0

NRHP Eligible Properties: 0

NRHP Ineligible Properties: 0

NRHP Listed Properties: 0

Isolated Occurrences: 0

Total Project Resources: 0

Recommendations: WSA concludes that there exists a low probability that cultural resources eligible for listing on the National Register of Historic Places (NRHP) or for designation as a State Antiquities Landmark (SAL) exist on the surveyed property due to the broad extent of existing disturbances and a preponderance of negative shovel tests and backhoe trenches. WSA respectfully requests THC concurrence with the conclusion that there exists a low probability that significant NRHP- or SAL-eligible cultural resources will be impacted by the proposed project. WSA recommends and respectfully requests THC concurrence that with regards to SALs, project construction within the areas of ground disturbance and physically impacted areas of approximately 2.8 miles (4.5 km) be allowed to proceed under the TAC, and that all TAC permit consultation for the proposed project be considered concluded and complete.

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CHAPTER 1. MANAGEMENT SUMMARY

William Self Associates, Inc. (WSA), is supporting Brown & Gay Engineers, Inc. (BGE), in providing cultural resource coordination for a proposed new 2.8-mile (4.5 kilometer [km]) segment of the 12-inch Copano NGL Services (Markham), LLC (Copano NGL), pipeline in Matagorda County, Texas (Figure 1). WSA conducted project cultural resource investigations and coordination with the Texas Historical Commission (THC) consistent with the requirements of the Texas Natural Resources Code Title 9, Chapter 191 (Antiquities Code of Texas) and accompanying Rules of Practice and Procedure (Texas Administrative Code, Title 13, Chapter 26). It is our understanding the project will cross Texas A&M University property. Texas A&M University is a state entity and as such the investigations were subject to the Texas Antiquities Code (TAC) and TAC permitting. Proposed survey methods were approved by the THC in an initial project coordination letter dated September 25, 2014 (Karbula 2014). The project was conducted under Texas Antiquities Permit 7079.

Pedestrian and reconnaissance survey supplemented with shovel testing was conducted in undisturbed portions of the 2.8-mile (4.5 km) linear survey corridor. The survey corridor was 60 meters (m), or 200 feet, in width, 30 m (100 feet) on either side of the centerline, and covered a total of 6.8 acres. As per the minimum survey standards of the THC, transects were spaced 30 m apart, and shovel tests were placed at a rate of approximately 16 per mile along transects, though no transects or shovel tests were conducted in highly disturbed or developed areas, which represented a large portion of the project area. In addition, there is a potential for deep Holocene sediments and buried archaeological sites adjacent to the Colorado River. The areas of identified deep Holocene sediments were subjected to deep backhoe trenches to identify any potential buried sites in high-probability areas, at horizontal directional drilling (HDD) locations, and in floodplain areas of open-cut trenching. The survey consisted of a total of 22 negative shovel tests and three negative backhoe trenches. No sites were recorded during these investigations. No prehistoric or historic cultural materials were recovered. No features or evidence of prehistoric- or historic-age occupation were identified.

WSA concludes that there exists a low probability that cultural resources eligible for listing on the National Register of Historic Places (NRHP) or for designation as a State Antiquities Landmark (SAL) exist on the surveyed property due to the broad extent of existing disturbances and a preponderance of negative shovel tests and backhoe trenches. WSA respectfully requests THC concurrence with the conclusion that there exists a low probability that significant NRHP- or SAL-eligible cultural resources will be impacted by the proposed project. WSA recommends and respectfully requests THC concurrence that with regards to SALs, project construction within the areas of ground disturbance and physically impacted areas of approximately 2.8 miles (4.5 km) be allowed to proceed under the TAC, and that all TAC permit consultation for the proposed project be considered concluded and complete.

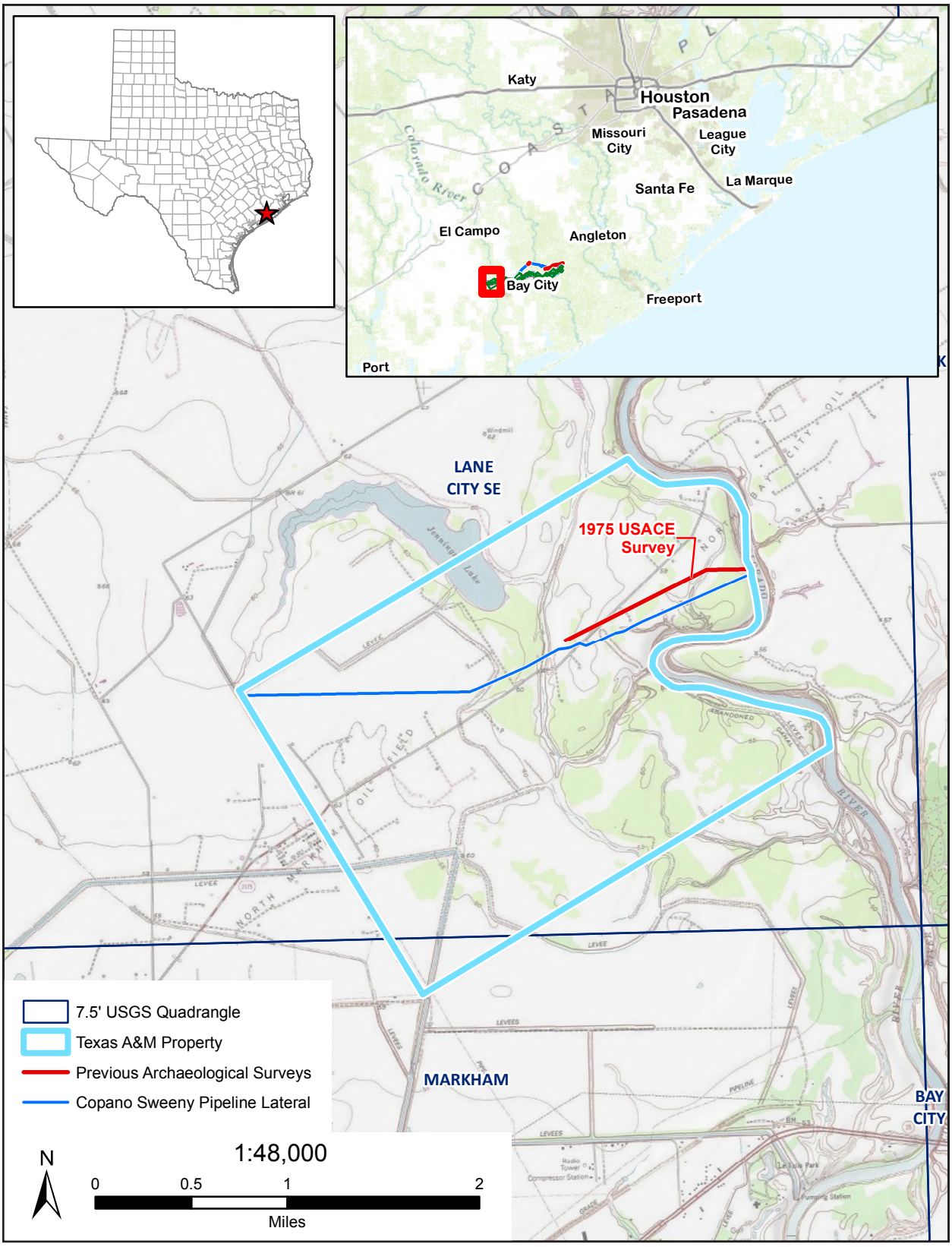

Figure 1. Project area and archival research.

No archaeological sites were identified. In the absence of collected artifacts, all project records will be permanently housed at the WSA Austin office.

CHAPTER 2. INTRODUCTION

WSA, in support of BGE, has conducted intensive Phase I pedestrian survey with shovel testing and backhoe trenching of a proposed new 2.8-mile (4.5 km) segment of the 12-inch Copano NGL pipeline in Matagorda County, Texas, north of the city of Markham, Texas (see Figure 1).

Survey investigations were conducted under Texas Antiquities Permit 7079, and within the requirements of the Texas Natural Resources Code Title 9, Chapter 191 (Antiquities Code of Texas), and the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716-44742). The investigations were conducted in accordance with the Archeological Survey Standards for Texas, the guidelines established by the Council of Texas Archeologists (CTA).

Project Area Description

The proposed pipeline segment is located in northeast Matagorda County, Texas, and crosses property owned by Texas A&M University (see Figure 1). The pipeline extends from the Markham (Williams) delivery line located approximately 5 miles (8 km) northwest of Bay City, Matagorda County, Texas, at an industrial facility that fronts onto Tommy Le Tulle Road, to another proposed line situated on the east bank of the Colorado River, located approximately 2.8 miles (4.5 km) to the east. Roughly half of the proposed pipeline corridor route is collocated to existing subsurface pipelines and other infrastructure.

The surface-disturbing impacts to the area will consist of the excavation of the trench and any HDD entry/exist points to bury the pipeline, as well as shallow, minor disturbances by the excavation and installation equipment.

Summary of Archaeological Work Performed

WSA conducted background research of available publications, manuscripts, site records, and the Texas Archeological Sites Atlas. The purpose of the archival research was to identify any previously recorded archaeological sites, cemeteries, historic structures, markers, properties, and districts listed on the NRHP, as well as SALs located in the proposed project area. In addition, prior to fieldwork, WSA examined U.S. Department of Agriculture (USDA) soil maps and U.S. Geological Survey (USGS) geologic maps to determine the probability and relative depth of Quaternary or Holocene alluvial deposits in the proposed project area.

WSA conducted a complete, 100 percent pedestrian inventory that included systematic and judgmental shovel testing and deep backhoe trenching of undisturbed areas within the proposed project area. The pedestrian survey was conducted along two 30-m transect

intervals within the 200-foot cultural resources survey corridor, which was centered on the proposed centerline. During survey, the archaeological crew used a Trimble handheld GPS unit to map tests and place shovel tests. An area of potentially deep Holocene alluvium was identified adjacent to the Colorado River and was subject to deep subsurface testing with backhoe trenches.

The archaeological survey was performed in December 2014. All work met acceptable professional and safety standards. WSA personnel met all requirements necessary to carry out archaeological investigations in areas subject to TAC jurisdiction, including the requirements of Section 106, as well as those listed under the Secretary of the Interior's Standards for Archaeology and Historic Preservation. The project area largely exists on ancient and/or heavily disturbed landforms. No cultural resources were identified.

Typically, projects that are subject to TAC permit and Section 106 of the NHPA require collection, analysis, publication, and professional curation or accession of all temporally diagnostic artifacts found in surface contexts, and all subsurface artifacts from excavated shovel test units, whether located within archaeological sites or encountered as isolated finds, as well as project records at a recognized state or federal repository subsequent to reporting. During the reported investigations, no artifacts were found in any shovel tests and no cultural features were observed on the surface. Therefore, in the absence of collected artifacts, WSA will curate all project notes, photographs, maps, and records in-house at the WSA Austin office.

Personnel Commitment

WSA personnel time commitment consisted of pre-field archival research, pre-field preparation, fieldwork, and report preparation. The pre-field archival research consisted of one day conducted by Deidra Black. The pre-field preparation involved coordination with Texas 811 One-Call intermittently over the course of two days, which was conducted by senior archaeologist Deidra Black. Field research consisted of four days (December 4–5, 8, and 12, 2014), including travel time to and from the project area from Austin, Texas, and was conducted by Deidra Black, staff archaeologist Zach Jamieson, and principal investigator James Karbula. The report was prepared by Deidra Black and James Karbula. WSA editor Maggie McClain was responsible for assembling the draft into InDesign and for quality control. Jimmy Mack, WSA cartographer and GIS technician, is credited with GIS production of the report illustrations and plates.

Report Organization

The orientation sections of the report are organized into an Abstract, Management Summary, and Introduction. Subsequent sections include Environmental Setting, Previous

Investigations and Archaeological Background, and Survey Methods. The Results of Field Investigations is presented from east to west, with a separate trenching section. These are then followed by a Summary and Recommendations section detailing TAC recommendations for the project area, followed by References Cited.

CHAPTER 3. PREVIOUS INVESTIGATIONS AND ARCHAEOLOGICAL BACKGROUND

A records and literature search was conducted for the location of the proposed 2.8-mile (4.5 km) Copano NGL pipeline segment in northeast Matagorda County, assuming a 304-m-wide (1,000 feet) archival corridor centered on the proposed centerline, with 152 m (500 feet) on either side of the centerline. The records and literature search included a search of the Texas Archeological Sites Atlas, an online resource hosted by the THC that contains restricted cultural resources information. The Texas Archeological Sites Atlas (THC 2014) and WSA project files were consulted for information on previously conducted surveys or the presence of previously discovered prehistoric and historic archaeological sites that may be located within or adjacent to the proposed project area. These included properties or districts listed on the NRHP, as well as SALs, Historic Markers, and Registered Texas Historic Landmarks (RTHLs). WSA also examined U.S. Geological Survey (USGS) topographic maps for existing cemeteries and historic sites.

One previously conducted survey is located within the archival corridor (see Figure 1). No previously identified archaeological sites, historic markers, SALs, RTHLs, NRHP properties, or cemeteries were identified within the archival corridor (THC 2014; USGS 1972). The existing survey, a 1975 U.S. Army Corps of Engineers (USACE) Survey, is associated with previous pipeline construction and is located roughly 91 m (300 feet) north of the proposed pipeline route at the Colorado River (THC 2014).

The project area lies on the northeast end of the Southern Coastal Corridor Archeological Region as defined in Central and Southern Planning Region archaeological planning document for Texas, in the Colorado/Matagorda Subarea (Mercado-Allinger et al. 1996); this overlaps the Central Texas Coast as defined by Ricklis (1995). The culture history of the area can be broadly divided into prehistoric and historic periods. The prehistoric period begins with the first introduction of humans in the area; the historic period begins with the first well-documented European arrivals in the area (Mercado-Allinger et al. 1996).

Prehistoric Period

The prehistory of the Central Texas Coast is commonly discussed in terms of the Paleoindian, Archaic, and Late Prehistoric periods. These periods are differentiated based primarily on artifact assemblages, with dates that are heavily reliant on projectile point styles.

The Paleoindian period (11,000–7950 BP) is the earliest recognized period of human occupation in the region. Along this segment of the Texas coast, Paleoindian sites are rare. Projectile points found in the area that date to this period include Clovis, Folsom/Midland, Scottsbluff, and Angostura types. In addition, megafauna remains have been found on the coast, some in context with stone tools (Mercado-Allinger et al. 1996). One reason behind the (apparent) site scarcity, in addition to generally small populations and perhaps a lack of identification, is that most coastal

Paleoindian sites are now submerged under the Gulf of Mexico, inundated with water from the sea level rise that accompanied glacial retreat at the beginning of the Holocene (Ricklis 1995).

The Archaic period (7950–950 BP) in the region is marked by human adaptations to changing coastal ecoregions as sea levels stabilized following the end of the Pleistocene. The Archaic period is subdivided into the Early Archaic (7950–4450 BP), the Middle Archaic (4450–2950 BP), and the Late Archaic (2950–950 BP). While the Early and Late Archaic are well represented in the region, sites dating to the the Middle Archaic are virtually absent along the Central Texas Coast (Mercado-Allinger et al. 1996).

The Early Archaic period is characterized by generally low populations that utilized large territories (Mercado-Allinger et al. 1996). Coastal occupations during the Early Archaic are often marked by dense but thin shell middens, typically overlooking bays and other drainages. Indeed, oysters are the most significant faunal remains in the archaeological record for this period; while bone of terrestrial creatures that may have been exploited decays quickly in the acidic soils of the region, the lack of fish otoliths, typically well preserved, suggests fishing was not yet a major food economy for coastal inhabitants. Projectile points associated with the Early Archaic on the coast include Uvalde, Gower, Andice, and Early Triangular types. Tools made from shell, such as edge-flaked knives and scrapers, are first seen in the Early Archaic in this region (Ricklis 1995).

The Middle Archaic has not been identified at sites on the Central Texas Coast (Mercado-Allinger et al. 1996). There have been no radiocarbon assays that produced Middle Archaic dates, and projectile point styles that date to the Middle Archaic have not been found in central and southern Texas. This is likely not a product of sampling bias, because sites with otherwise complete, stratified occupation remains of the whole of the Archaic have no Middle Archaic cultural materials in them. In the whole of the Central Texas Coast, there exists only a single site that may have evidence of an ephemeral Middle Archaic occupation, or it may be a later occupation atop a natural shell lens deposited during the Middle Archaic. The reason behind the absence of human occupation of the coastline during this period is likely ecological. During the Middle Archaic, sea levels in Texas bays and estuaries fluctuated wildly, sometimes by several meters within one century. When sea levels fluctuate like this, the normally resource-rich estuaries and bays experience significant die-off and become relative food deserts. This lack of resources is likely the source behind human abandonment of the coast during this time (Ricklis 1995).

The Late Archaic is well represented in the region. Many of the sites that date to the Late Archaic in this region show a broad marine and terrestrial subsistence strategy and repeated occupation, with sites especially overlooking bays. There are also a number of cemeteries in the region that date to this period (Mercado-Allinger et al. 1996). The return of people to the region corresponds with sea levels stabilizing at relatively modern levels; the stabilization meant resources again became abundant in the estuaries and bays. Large shell middens become common during the Late Archaic, some nearly 2 m thick. An important change from the Early Archaic assemblages of the Central Texas Coast is the presence of fish otoliths and other bones, showing evidence for fish as

a significant resource for the first time in the region. This increase may be partly cultural and/or technological, but it is also partly ecological. The modern sea level was accompanied by the formation of barrier islands, which allowed for vegetation in the mainland bays and estuaries that served as spawning grounds for large populations of fish. Projectile points found at Late Archaic sites in the region include Kent, Ensor, Godley, Marcos, Catan, and Matamoros types; Clear Fork gouges, Olmos bifaces, knives, scrapers, shell tools, and worked bone artifacts are also found in Late Archaic assemblages in the area. Basketry is also evident in Late Archaic assemblages, mostly in the form of asphaltum and burned clay with impressions of baskets on them. The larger sites, locally specialized resources and tools, and cemeteries point to an increase in population and the emergence of well-defined group territories in the region during the Late Archaic (Ricklis 1995).

The Late Prehistoric period (950–250 BP) is defined by the arrival of the bow and arrow, as well as by the presence of pottery (Mercado-Allinger et al. 1996). The Late Prehistoric period is subdivided into Initial Late Prehistoric (950–700 BP) and the Final Late Prehistoric (700–250 BP); this subdivision largely correlates to the Austin and Toyah phases in central and south Texas, including some similarities in projectile point types. On the Central Texas Coast, the Initial Late Prehistoric is marked by the presence of Scallorn and Fresno arrow points and sandy-paste pottery. The Final Late Prehistoric is marked by the presence of Perdiz arrow points, and by assemblages including small unifacial scrapers, alternately beveled knives, bowls, jars, constricted-neck ollas, and increased decoration of pottery, including with asphaltum. Clay pipes are also found in some Final Late Prehistoric contexts. The Rockport phase, defined by the presence of Rockport pottery, occurs in a limited geographic context of the Central Texas Coast during the Final Late Prehistoric. At the transition between the Initial and Final Late Prehistoric, mesic conditions allowed bison to travel within 40 km of the coastline, and for that brief time there are sites in the Central Texas Coastal area with evidence of seasonal bison hunting. Otherwise, the Late Prehistoric was a time of increased regional specialization, and sites show evidence that groups traveled set, seasonal paths between resource areas within their territories. These paths appear to have overlapped between groups during winter, when there is evidence of large aggregate camps on shorelines; this pattern continued into the historic period and was recorded as a practice of early historic Karankawa groups in the area (Ricklis 1995).

Historic Period

The project area is located in modern day Matagorda County. In this area, the historic period begins in the sixteenth century (Kleiner 2014), and is described in terms of the following subperiods: European Exploration, Texas Revolution, Texas Statehood and American Civil War, and After the Civil War.

European exploration occurred during the sixteenth and seventeenth centuries. At the time of initial European exploration of the area, the area that is now Matagorda County was occupied by several groups of Karankawa who spoke linguistically related languages and

practiced a hunter-gatherer lifestyle. The first documented European exploration of the area was conducted by two Spaniards: the area was mapped in 1519 by Alonso Álvarez de Pineda, and was likely visited by Álvar Núñez Cabeza de Vaca around 1528. The interior was surveyed by Guido de Lavazares in 1558 and claimed for France. The Spanish expeditions of Llanos-Cárdenas and Alarcón passed through the area in 1718 and 1719, respectively. Although Spain made plans throughout the eighteenth century to settle the area and establish a port, little action was taken towards those goals. After the Mexican Revolution, Anglo-Americans, including members of the Austin colony, began to settle the area. The town of Matagorda was founded in 1829 as a military post to protect Anglo settlers from the indigenous population (Kleiner 2014).

During the Texas Revolution in 1835–1836, citizens of Matagorda largely participated on the Texan side of the conflict, and Matagorda County was formed as one of the first counties of Texas in 1836. Matagorda Bay served as the second largest port for Texas, after the Galveston-Houston port. This status allowed for immigration to the area and for the development of industry and transportation by linking it to the rest of Texas as well as the world. Cash-crop agriculture and livestock played a large role in the local economy through the early nineteenth century (Kleiner 2014).

Texas became a state in 1845. Shortly thereafter, cotton became a growing and dominant percentage of the agricultural economy. Along with the cotton, a large number of slaves were brought to the area to work the plantations. As part of increasingly tense race relations in the county, plantation owners attempted to expel Mexican-born citizens because they felt they were a threat to their control of slaves. The population of the county voted in favor of secession in 1861. During the Civil War, there was a Confederate garrison in the county, and skirmishes with Union gunboats took place just offshore. Restrictions on foreign and domestic trade caused by the war greatly depressed the local economy (Kleiner 2014).

After the Civil War, most of the cotton planters left; although other cash crops, as well as cattle, still formed the base of the local economy, the total acreage under cultivation had greatly decreased. The decades after the Civil War saw a slow increase in agricultural production. This included a revival of cotton in the 1870s, and a beef packing plant established in 1866. At the turn of the century, rice was introduced to the area, and by the 1910s it had become a major cash crop. The rise of rice was boosted by boll weevils destroying much of the cotton crop after the turn of the twentieth century. During the 1920s and through the 1930s, agriculture experienced a slow demise in Matagorda County. During the 1900s and 1910s, oil was discovered in the county. Oil extraction and manufacturing slowly grow in the area during the 1920s, and then sped up in the 1930s as oil and land speculators drew people to the area. In the 1940s, a U.S. military base was established in the county, and German prisoners of war were imprisoned in facilities in the county. After World War II, farming continued to decline, though the population has continued to increase steadily, largely due to petroleum and other industry (Kleiner 2014).

CHAPTER 4. ENVIRONMENTAL BACKGROUND

The project area is located on the coastal plain of Texas, on the Coastal Prairies province; this province has a nearly flat general topography, with an elevation rise of less than one foot per mile (Bureau of Economic Geology [BEG] 1992). The surrounding ecoregion is Gulf Coast Prairies and Marshes (BEG 2010), and the river basin is Brazos-Colorado Coastal Bend (BEG 1996). The major vegetative/cover is a mix of Pecan-Elm Forest and cropland (BEG 2000). The climate is warm and subtropical, with the weather largely dominated by the Gulf of Mexico. Hurricanes and tropical storms are not uncommon in the area (United States Air Force 1986).

Soils, and Geology

The Geologic Atlas of Texas, Seguin and Beeville-Bay City Sheets (BEG 1979, 1987) show that the greater valley of the Colorado River in the project area is mapped as Qal (Holocene alluvium), including a small tributary to the Colorado River that the project area crosses west of the river and south of Jennings Lake. The areas between and around them are mapped as Pleistocene-age Beaumont Formation (Qb).

The mapped soil complexes are Lake Charles-Dacosta (Lake Charles, Dacosta, Marcado, Contee, and Edna), Texana-Edna-Cieno (Texana, Edna, Cieno, Fordtran, Livia, Telferner), and Brazoria-Asa (Brazoria, Asa, Clemville, Norwood, Pledger) (United States Department of Agriculture [USDA] 2014a). Of particular interest are the soils with buried A horizons in their typical pedon, Norwood below 130 centimeters below surface (cmbs), and Clemville below 75–100 cmbs (USDA 2014b).

Wetlands and Drainages (West–East)

The proposed route crosses at least one canal and two streams, and abuts a river.

1. Unnamed canal
    a. Location: 1.9 km (1.2 miles) east of beginning of project.
    b. Dredged canal with levee
    c. Historic, present on 1943 aerial maps (Google Earth 2014)
2. Unnamed tributary to Colorado River (outflow of Jennings Lake)
    a. Location: 0.56 km (0.35 miles) east of canal
    b. May represent a meander channel of the Colorado River
3. Colorado River
    a. Location: eastern terminus of project area
    b. There also appears to be at least one flood channel west of the river that is crossed by the proposed route.

Disturbances

Roughly half the project area is collocated to existing subsurface infrastructure; the other half has been heavily terraced behind a levee. The majority of the project area runs through apparent pasture crisscrossed by a number existing subsurface pipelines and other infrastructure, although the areas near the streams are less disturbed.

CHAPTER 5. SURVEY METHODOLOGY

The pedestrian archaeological survey consisted of a 100 percent pedestrian survey with intensive shovel testing in accordance with the THC survey standards for linear projects, which require 16 shovel tests per mile per 100 foot of width in undisturbed areas, focusing on the terraces and floodplains of streams and areas adjacent to wetlands. Pedestrian survey and shovel tests were conducted along two transects spaced 30 m apart within the 60-m-wide (200-foot) project survey corridor. Sufficient shovel tests were placed to satisfy the minimum survey standards of the THC. Shovel tests were placed judgmentally to thoroughly sample areas adjacent to wetlands. No shovel testing or pedestrian survey occurred in disturbed or developed areas, which represented the majority of the project area.

There are two drainages of different sizes and/or wetlands that intersect or are located adjacent to the proposed pipeline corridor. The major drainage is the Colorado River; the minor drainage is a tributary to the river. There is also at least one historic-age canal that intersects or is located adjacent to the proposed pipeline corridor. The areas of identified deep Holocene sediments were subject to deep backhoe trenches to identify any potential buried sites in high-probability areas, at HDD locations, and floodplain areas of open-cut trenching. Backhoe trenches were placed based on a combination of geomorphic data, field survey results, and physical accessibility. No shovel tests or backhoe trenches were placed in hazardous areas of existing collocated subsurface pipelines or other areas of similar pipeline-related disturbance.

CHAPTER 6. RESULTS OF FIELD INVESTIGATIONS

The field investigations consisted of a 100 percent pedestrian survey with both systematic and judgmental shovel testing of undisturbed areas of proposed ground disturbance. The areas of proposed ground disturbance are crossed by two intermittent streams and terminate at the perennial Colorado River (Figure 2). One transect was investigated for this survey, as roughly half of the 60-m (200 feet) survey corridor was disturbed by existing subsurface pipelines. In total, 22 shovel tests were excavated. Shovel test results are depicted in Figure 2 and presented in Table 1. All shovel tests were negative for cultural materials, and no cultural materials were observed during pedestrian survey. Three backhoe trenches were excavated; all backhoe trenches were negative for cultural materials. In general, a significant portion of the areas of proposed ground disturbance and physically impacted areas was occupied by previous ground-disturbing activities, including multiple pipelines, levee and canal construction, and field grading. These activities have significantly affected the integrity of the natural deposits within the area.

The survey narrative is presented from the eastern to the western end of the areas of proposed ground disturbance, in four sections (1–4) based on the landscape. This section is then followed by a summary of backhoe trench investigations.

Section 1: Start of Project to Levee

This section is approximately 2,104 m (1.32 miles) in length and is underlain entirely by ancient Pleistocene clays. The section begins at an existing industrial facility on Tommy LeTulle Road, approximately 7.1 km (4.4 miles) north of the intersection with State Highway (SH) 35. From the point of origin, the proposed project extends generally east for 1.9 km (1.2 miles) before turning generally east-northeast and ending at a levee. The majority of this section is heavily disturbed (Photo 1). The levee and adjoining canal (Photo 2) were in place no later than 1942 (Google Earth 2014), but have had multiple alterations and maintenance events since then. The field over the due east portion of this section has been particularly disturbed. In addition to multiple pipelines and agricultural two-track roads crossing it, a review of the available aerial images show that it has been subject to grading and other highly destructive ground-disturbing activities. On aerial images from the 1950s–1990s, the large field has the telltale appearance of a rice field, which means it has undergone significant and fairly deep ground alteration in the form of ponding and berming.

The vegetation over the field portion of this section is mostly pasture grasses and small weeds, with sparse bushes and small trees. The area adjacent to the levee and canal is lightly forested by live oak and other mixed hardwoods, with an understory of pasture grass, greenbrier, poison ivy, and small woody brush. The ground surface visibility throughout this section was zero. The western 1.9 km (1.2 miles) of this section is entirely disturbed. In the investigated portion of the section, the southern half of the corridor is disturbed by existing pipelines.

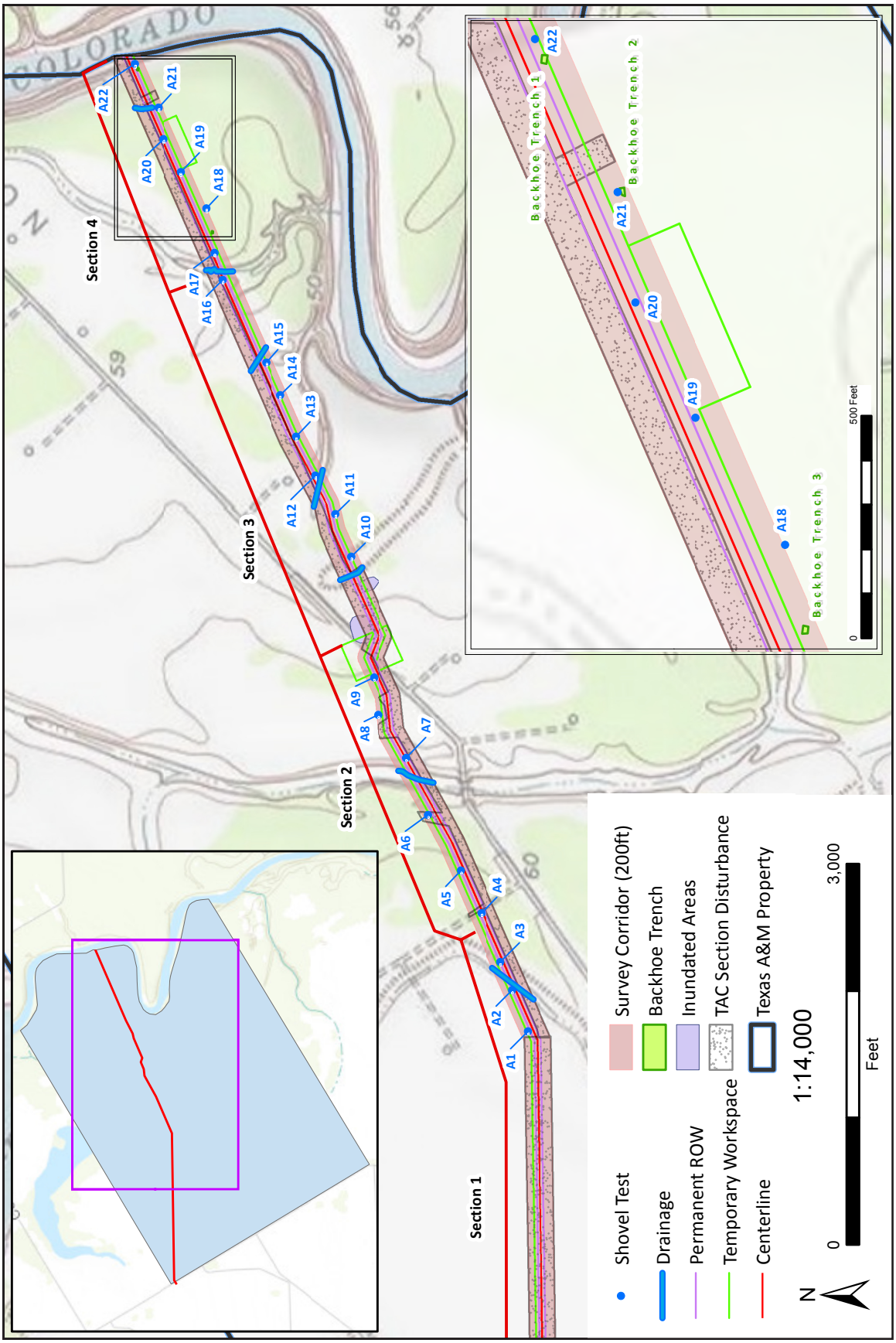

Figure 2. Results of field investigations.

Table 1. Shovel test results.

ST No.	Profile	Depth (cmbs)	Reason For Termination	+/-	Site Assoc.	Artifacts
A1	0–40 cmbs 10YR 4/1 dark gray fine sandy clay	40	Beaumont Formation	neg	n/a	n/a
A2	0–35 cmbs 10YR 5/1 gray sandy clay	35	Beaumont Formation	neg	n/a	n/a
A3	0–37 cmbs 10YR 5/1 gray sandy clay	37	Beaumont Formation	neg	n/a	n/a
A4	0–32 cmbs 10YR 5/1 gray sandy clay	32	Beaumont Formation	neg	n/a	n/a
A5	0–40 cmbs 10YR 4/1 dark gray sandy clay	40	Beaumont Formation	neg	n/a	n/a
A6	0–33 cmbs 10YR 5/6 yellowish brown clay with road base gravels	33	Disturbed	neg	n/a	n/a
A7	0–35 cmbs 10YR 5/1 gray clay	35	Mottled Red Clay	neg	n/a	n/a
A8	0–40 cmbs 10YR 5/6 yellowish brown clay	40	Beaumont Formation	neg	n/a	n/a
A9	0–30 cmbs 10YR 5/1 gray clay	30	Beaumont Formation	neg	n/a	n/a
A10	0–32 cmbs 10YR 5/1 gray clay	32	Beaumont Formation	neg	n/a	n/a
A11	0–32 cmbs 10YR 5/6 yellowish brown clay	32	Beaumont Formation	neg	n/a	n/a
A12	0–28 cmbs 10YR 5/6 yellowish brown clay	28	Beaumont Formation	neg	n/a	n/a
A13	0–29 cmbs 10YR 5/4 yellowish brown clay	29	Impenetrable Clay	neg	n/a	n/a
A14	0–33 cmbs 10YR 5/1 gray clay	33	Beaumont Formation	neg	n/a	n/a
A15	0–35 cmbs 10YR 5/1 gray clay	35	Beaumont Formation	neg	n/a	n/a
A16	0–28 cmbs 10YR 4/1 dark gray clay	28	Impenetrable Clay	neg	n/a	n/a
A17	0–33 cmbs 10YR 5/1 gray clay	33	Beaumont Formation	neg	n/a	n/a
A18	0–39 cmbs 10YR 5/1 gray clay	39	Impenetrable Clay	neg	n/a	n/a
A19	0–35 cmbs 10YR 5/1 gray clay	35	Impenetrable Clay	neg	n/a	n/a
A20	0–40 cmbs 10YR 5/1 gray clay	40	Impenetrable Clay	neg	n/a	n/a
A21	0–37 cmbs 10YR 5/1 gray clay	37	Impenetrable Clay	neg	n/a	n/a
A22	0–40 cmbs 10YR 5/6 yellowish brown sandy clay; 40–45 cmbs 10YR 5/1 gray sandy clay	45	Impenetrable Clay	neg	n/a	n/a

Photo 1. View of the disturbed western mile of the project area, view to the west. The orange and red stakes mark some of the many existing pipelines that are located within the survey corridor; there is an industrial facility that connects to many of the pipelines on the horizon in the right of the photo, and the field itself is the result of grading, berming, and other ground-disturbing activities. The photo was taken from the canal and levee that mark the edge of the highly modified field.

Photo 2. Heavily modified canal and levee, view to the south-southwest.

Three shovel tests (STs A1–A3, see Table 1) were placed within the vicinity of the levee and canal to investigate the possibility of intact historic irrigation and other water control features. These shovel tests were all negative for cultural material, and no cultural resources were observed within the survey corridor.

Section 2: Levee to Oil Field Road

This section is approximately 796 m (0.5 miles) in length and is underlain partly by Pleistocene clays and partly by clay of potential Holocene deposition. This section begins at an old levee and runs east-northeast to a well-used oil field gravel road. The portion of this section underlain by potentially Holocene clay occurs in the middle of the section at an ephemeral to intermittent drainage that is likely a relic channel of the Colorado River. However, field observation of this area showed that the drainage and surrounding area have been highly modified by deep earth-moving activities. These activities are indicated by the presence of oil and gas wells, channelization of the drainage with adjacent tall berms, and roads with bar ditches on the sides.

The vegetation in this section grades from lightly forested on the west side (Photo 3) to grassland on the east. The forested area is mostly live oak with other mixed hardwoods, with an understory of grasses, greenbrier, poison ivy, and small woody brush. The ground surface visibility throughout this section was zero. The disturbances in this section include multiple pipelines in the southern half of the survey corridor, a large pipeline corridor on the east end near the road, several small pipeline corridors associated with oil and gas wells (Photo 4), additional roads related to the oil and gas wells in the area, and the large berms associated with the channelization of the drainage in the relic channel in the section.

Six shovel tests (STs A4–A9, see Table 1) were excavated in this portion. Disturbed areas were avoided. The tests in the potentially Holocene portion (STs A4–A7) generally found either highly disturbed sediments or very truncated landforms, based on the typical pedon for the soil mapped in the area. The shovel tests excavated in this segment were all negative for cultural material, and no cultural resources were observed within the survey corridor.

Section 3: Oil field Road to Relic Channel

This section is approximately 1,013 m (0.64 miles) in length. It is underlain mostly by Pleistocene clays and partly by clay of potential Holocene deposition. This section begins at an easterly angle in the proposed project area at a maintained oil field gravel road, and then proceeds east-northeast to a potentially early Holocene relic channel of the Colorado River. The western 206 m (0.13 miles) of this section is heavily disturbed by a large gas pipeline corridor and has several sections that were inundated with standing water. There are three ephemeral to intermittent drainages within this section, located approximately 206 m (0.13 miles), 429 m (0.27 miles), and 768 m (0.48 miles) east of the oil field road. The first of

Photo 3. The forested area west of the oil field road, view to the northwest.

Photo 4. An active oil pumpjack west of the oil field road, whose infrastructure disturbs the survey corridor; view to the north.

these is a small canal with a levee, located just east of the inundated area. The other two are fingers of the same small tributary to the Colorado River that have undergone extreme modification in the form of channelization and berming.

The vegetation in this section is generally lightly maintained grassland with small stands of hardwoods including live oak, with sunflowers, greenbrier, poison ivy, and small woody brush found throughout. Ground visibility throughout the section was zero. The disturbed portion of this segment included the inundated western portion, existing pipelines in the northern half of the survey corridor, oil field accoutrements, and the channelized drainages.

Seven shovel tests (STs A10–A16, see Table 1) were excavated in this segment (Photo 5). Disturbed areas were avoided. The tests excavated on the potentially Holocene portion (STs A14–A16) generally found a highly truncated landform. The shovel tests excavated in this section were all negative for cultural material, and no cultural resources were observed within the survey corridor.

Photo 5. Staff archaeologist Zach Jamieson attempts to find places to test that are not disturbed in the segment between the oil field road and relic channel; view to the north.

Section 4: Relic Channel to Colorado River

This section is approximately 550 m (0.34 miles) in length. It is underlain by clay of potential Holocene age, with likely Holocene-age alluvium just east of the drainage that marks the potentially early Holocene relic channel of the Colorado River. The section begins at the relic channel and extends east-northeast to the Colorado River (Photo 6) and the end of the proposed project area. There is a small ephemeral drainage or wetland located approximately 140 m (459 feet) west of the riverbank.

The vegetation in this segment is lightly maintained grasslands with small stands of hardwoods including live oak, with sunflowers, greenbrier, poison ivy, and small woody brush found throughout. Ground visibility was zero. The disturbances in this section include several pipelines in the northern half of the survey corridor, a two-track road that parallels the river within the survey corridor about 109 m (360 feet) from the bank, and potential channelization and berming of the relic channel that includes large cobble bank stabilization within the existing pipeline corridor.

Six shovel tests (STs A17–A22, see Table 1) were excavated in this section, with attempts to avoid the disturbed areas. The tests excavated in the likely Holocene-age alluvium (STs A17 and A18) found a partly truncated landform. The tests nearer to the river (STs A19–

Photo 6. The Colorado River as seen from the east end of the survey corridor, view to the east.

A22) generally had to terminate at impenetrably dense clay and did not reach pre-Holocene sediments before termination. Shovel tests in this section were all negative, and no cultural materials were observed within the survey corridor.

Backhoe Trench Testing

Because of the potential for Holocene material and impenetrable nature of the shovel tests in the final segment, three backhoe trenches were excavated to supplement the investigation (Photo 7). Backhoe Trench 1 was placed near the modern terrace edge of the Colorado River. Backhoe Trench 2 was placed just east of the proposed HDD work area and adjacent to the small ephemeral drainage or wetland west of the riverbank. Backhoe Trench 3 was placed on the terrace east of the potentially early Holocene relic channel, within the area mapped as likely Holocene alluvium but away from the lightly modified relic channel and its possible berms.

Backhoe Trench 1 (Photo 8) was placed in a roughly east–west direction approximately 25 m (82 feet) west of the Colorado River on the prominent upper terrace in a high-probability area for buried prehistoric sites. Backhoe Trench 1 was placed at the southern edge of the proposed permanent right-of-way (ROW) within the temporary workspace. In finished

Photo 7. Staff archaeologists at Backhoe Trench 1, view to the west.

Photo 8. Backhoe Trench 1, south wall profile, view to the west-northwest.

form, Backhoe Trench 1 was approximately 7.15 m (23.5 feet) in length and 2.9 m (9.5 feet) in depth in the deepest, west end of the trench, and tapered up in elevation with slope to the east. Backhoe Trench 1 was widened for ingress and egress beyond the width of the 38-inch backhoe bucket, with two benches, one on each side; each bench was 1.2 m (4 feet) deep and 1.2 m and (4 feet) wide. The east end of the trench was sloped and pulled back at a significant angle to allow easy ingress and egress for recording purposes. Backhoe Trench 1 revealed approximately 1.2 m (4 feet) of dark brown clay with some degree of pedogenic development overlying several thick layers of lighter-colored sand and silt or sand and clay lamellae at depth. The observation of this trench (Photo 9) and resulting profile is evidence of frequent, recent, Holocene-age overbank deposits of the Colorado River (Figure 3). Pure unconsolidated sand was breached at approximately 2.75 m (9 feet) in the center of the trench, indicating a deep profile of Holocene-age deposition on this west bank Colorado River terrace. Backhoe Trench 1 was terminated in the unconsolidated sands due to negative cultural results and safety reasons.

Backhoe Trench 2 (Photo 10) was placed in a roughly east–west direction, adjacent to a proposed HDD borehole and approximately 130 m (426 feet) west of the Colorado River, in the attempt to both test the HDD location and also to provide systematic trenching within the deep Holocene-age overbank flood deposits. Backhoe Trench 2 was placed immediately south of the proposed temporary workspace and within the 60-m (200 feet) survey corridor approved by the THC. In finished form, Backhoe Trench 2 was approximately 6 m (19.8 feet) in length and 1.93 m (6.4 feet) in depth. Backhoe Trench 2 was widened for ingress

Photo 9. WSA PI James Karbula examines Holocene flood alluvium in Backhoe Trench 1, view to the northeast.

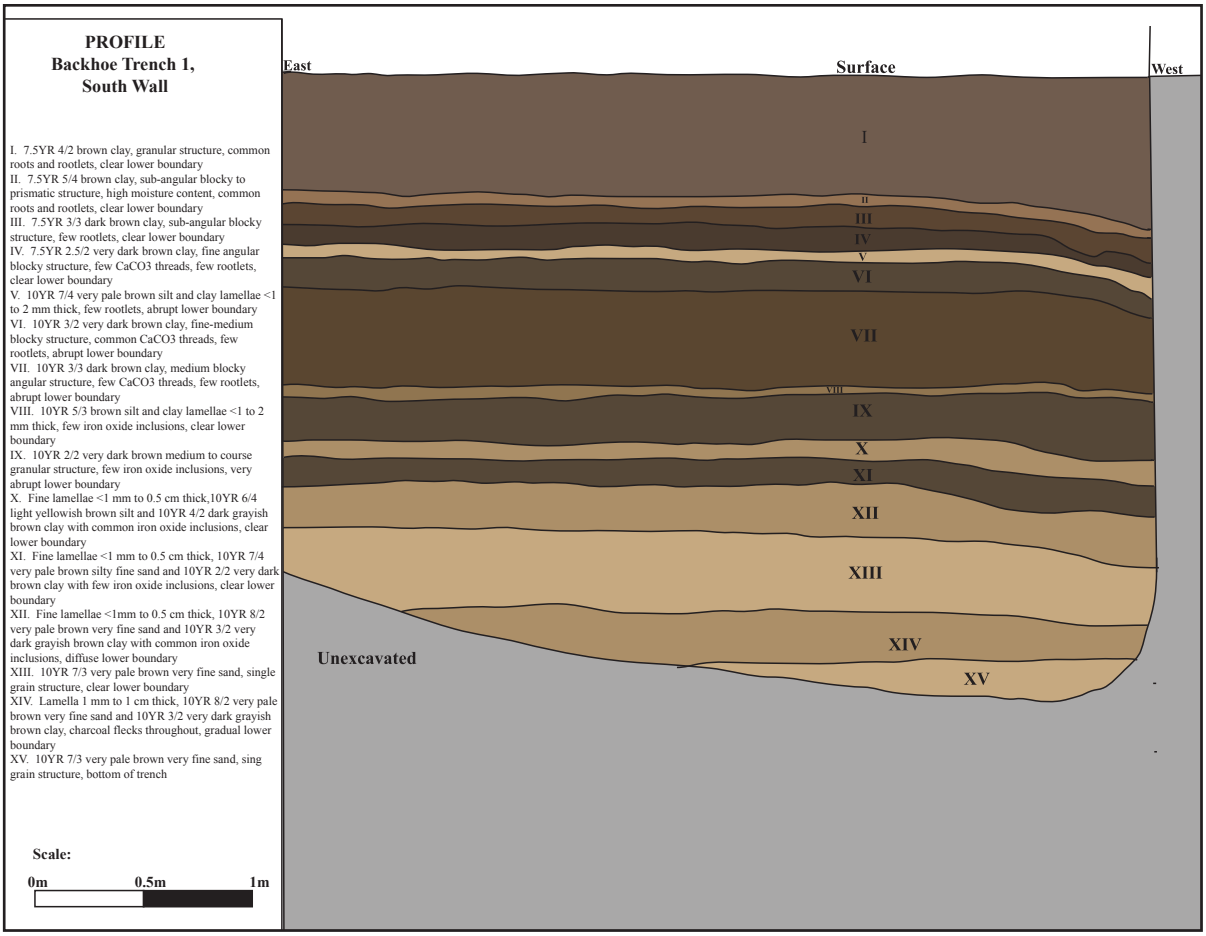

Figure 3. Profile of Backhoe Trench 1.

Photo 10. Backhoe Trench 2, south wall profile, view to the south-southeast.

and egress beyond the width of the 38-inch backhoe bucket, with two benches, one on each side; each bench was 1.2 m (4 feet) deep and 1.2 m and (4 feet) wide. The west end of the trench was sloped and pulled back at a significant angle to allow easy ingress and egress for recording purposes. Backhoe Trench 2 exposed just under a meter of dark brown clay, with some degree of pedogenic development overlying a few lenses of silt and clay. Dense reddish brown clays with red mottling were observed grading into a more friable light brown blocky, clayey silt with calcium carbonate ($CaCo_3$) filaments at approximately 1.1 m (3.7 feet), and then below 1.15 m (3.9 feet) shifted into dense red brown clays with grey mottling of the Pleistocene-age Beaumont and Lissie soil formations. The trench was terminated at approximately 1.93 m (6.4 feet) in depth in Pleistocene-age and older deposits that predate human occupation. The observation of this trench and the resulting profile is evidence that the overbank deposits observed in Backhoe Trench 1 are "pinching out" to the west, and the potential for intact buried Holocene or very late Pleistocene surfaces becomes virtually non-existent further to the west (Figure 4).

Backhoe Trench 3 (Photo 11) was placed in a roughly east–west direction approximately 100 m (328 feet) east of a relict paleochannel representing a meander scar of the ancient thalweg of the Colorado River. The trench was placed on a high spot overlooking the paleochannel. The area is documented to contain a buried A soil horizon. Relict paleochannels are high-probability locations for buried prehistoric sites. Areas located to the west between Backhoe Trench 3 and the relict channel were extremely disturbed by previous existing pipeline construction that overlaps the proposed permanent and temporary workspace. Backhoe Trench 3 was placed immediately adjacent to and south of the temporary workspace within the 60-m (200 feet) survey corridor approved by the THC. In final form, Backhoe Trench 3

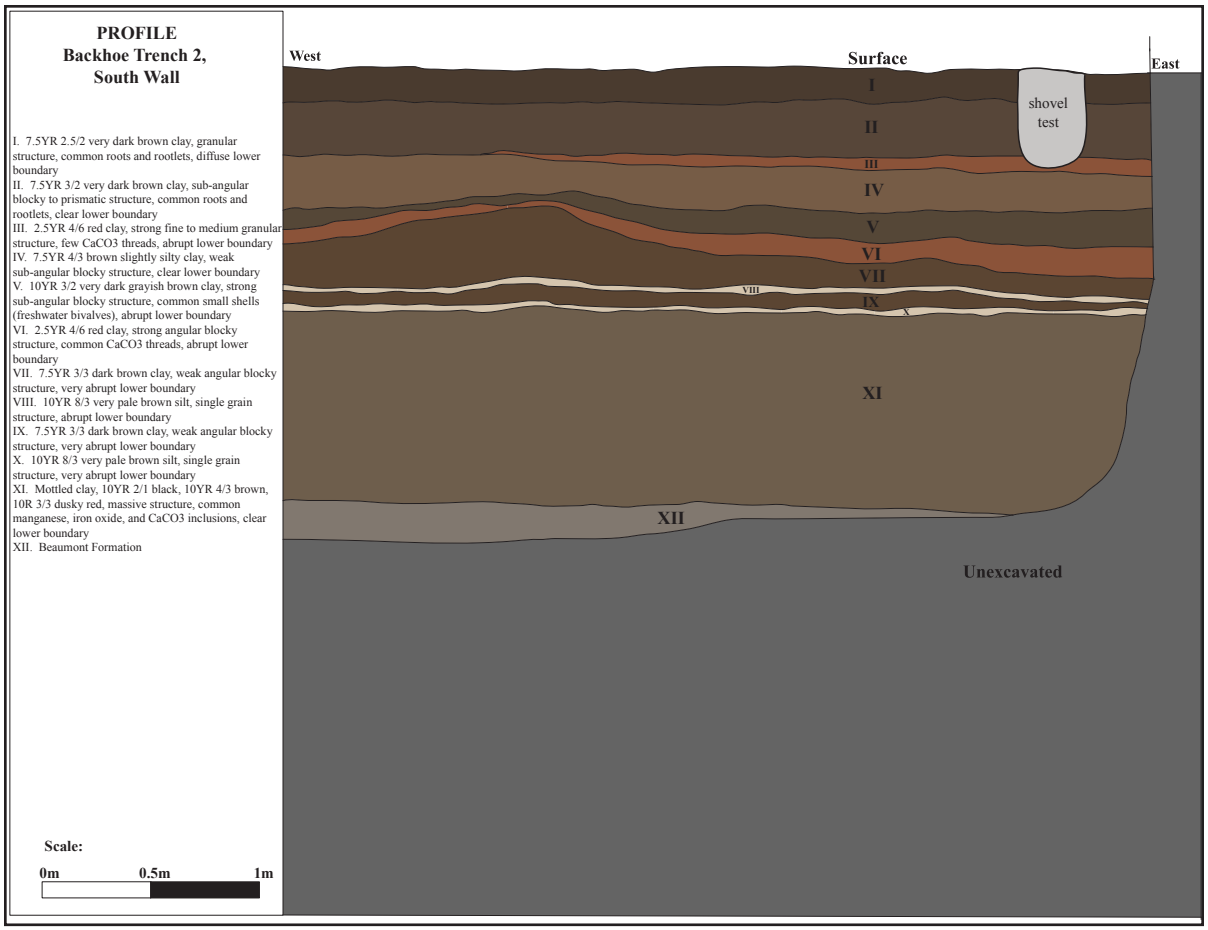

Figure 4. Profile of Backhoe Trench 2.

Photo 11. Backhoe Trench 3, north wall profile, view to the north.

was 6 m (19.8 feet) in length and 2.1 m (7 feet) in depth. Backhoe Trench 3 was widened for ingress and egress beyond the width of the 38-inch backhoe bucket, with two benches, one on each side; each bench was 1.2 m (4 feet) deep and 1.2 m and (4 feet) wide. The west end of the trench was sloped and pulled back at a significant angle to allow easy ingress and egress for recording purposes. Backhoe Trench 3 uncovered just under a meter of dark brown clay with some degree of pedogenic development overlying a thin lens of light-colored silt and clay lamellae, overlying an ancient, truncated soil profile with a base of Pleistocene-age Beaumont Formation. Dense black and gray mottled clays with large $CaCO_3$ nodules were observed below 1.2 m (4 feet), and black, gray, orange and brown mottled clays with caliche signifying pre-human sediments were observed at depth to the point of trench termination (2.1 m [7 feet]). The evidence from this trench verifies the trend observed in Backhoe Trench 2, and confirms there is virtually no possibility of an intact buried Holocene surface any further west from the river.

In a broad generalization, the evidence from these backhoe trenches, combined with the soil maps, topographic maps, and aerial photographs, suggests a general nature of the Colorado River after it abandoned an ancient channel in the area that is now the valley of Caney Creek. The Colorado River, in the narrow segment of the project area, was travelling and cutting east and depositing west through the end of if not most of the Pleistocene, and into the early Holocene. At some point, likely during the early to mid-Holocene, these actions reversed, and the modern profile of westerly cutting and easterly deposition in this one small section of the Colorado River was initiated. This is a much generalized history of this segment of the river, and there were likely smaller reversals in the course of the general directions of thalweg travel.

This pattern of travel fits within the general known history of the lower extent of the Colorado River. The fact that Caney Creek follows an old channel of the Colorado River has been known for over a century, but the timing and nature of the change of the course of the Colorado River is more difficult to ascertain from the available resources. Some sources state that the creek follows an "ancient" course, without defining ancient; other sources give a general "thousands of years ago" for the time the river flowed through the old channel; and still others argue for either a very recent change in course sometime around the mid-sixteenth century, or else multiple shifts in main flow between the known modern course of the river and the modern course of Caney Creek across the wide, flat river valley. The results from the trenches generally fit with the Colorado River abandoning the Caney Creek channel sometime in the Pleistocene (Clay and Kleiner 2014; Davenport and Wells 1918; Hyde 2001; MCHC 1986; Sawyer 2012).

The depositional history observed in Backhoe Trench 1 also fits within the known history of the main course of the river. The Colorado River has a generally slow and moderately low flow out of the frequently drought-stricken source in northwest Texas, punctuated by occasional high-volume flood events. Logjams of unknown size were noted near the mouth of the river as early as 1690 by Alonso de Leon in western literature. This logjam

caused frequent flooding of upland settings, depositing nearly yearly lenses of silt and clay. The logjam likely varied in size or even existence over the years, but by the turn of the nineteenth century, a logjam at most 10 miles upstream from the community of Matagorda was over twenty miles in length, creating a sort of inland sea and caused many navigation and flooding issues. The logjam caused flooding that deposited red clays and light-colored silts on upland terraces. The logjam was removed from 1925 to 1927 by Howard Kenyon and others. The century's worth of backwater flotsam, combined with regular flood events such as the great flood of 1929, increased the extent of the river delta by over six miles in less than a decade, splitting Matagorda Bay into two and land-locking the beachside community of Matagorda. The deltaic growth only slowed after dams, spillways, dredged channels, and other flood control and navigation accessibility measures were instituted on the river (Clay and Kleiner 2014; Davenport and Wells 1918; Hyde 2001; MCHC 1986; Sawyer 2012).

CHAPTER 7. CONCLUSIONS AND RECOMMENDATIONS

WSA has conducted Phase I archaeological survey of one project consisting of the linear areas of proposed ground disturbance and physically impacted areas for the proposed Copano NGL 2.8-mile (4.5 lm) pipeline segment between Tommy LeTulle Road and the Colorado River in Matagorda County. The project areas of proposed ground disturbance and physically impacted areas consisted of approximately 2.8 miles (4.5 km) of proposed pipeline corridor that includes one perennial drainage (Colorado River) and two smaller drainages, canals, and wetlands. The survey covered a total of approximately 6.8 acres. The linear survey covered approximately 2.8 miles (4.5 km). In total, 22 negative shovel tests and three negative backhoe trenches were excavated in support of pedestrian survey. No archaeological sites or other cultural resources were identified during the survey.

WSA concludes that there exists a low probability that NRHP- or SAL-eligible cultural resources exist on the surveyed property due to the broad extent of existing disturbances and a preponderance of negative shovel tests and backhoe trenches. WSA respectfully requests THC concurrence with the conclusion that there exists a low probability that significant NRHP- or SAL-eligible cultural resources will be impacted by the proposed project. WSA recommends and respectfully requests THC concurrence that with regards to SALs, project construction within the areas of ground disturbance and physically impacted areas of approximately 2.8 miles (4.5 km) be allowed to proceed under the TAC, and that all TAC permit consultation for the proposed project be considered concluded and complete.

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