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ARCHEOLOGICAL AND GEOARCHEOLOGICAL INVESTIGATIONS FOR THE NEW BAYLOR UNIVERSITY FOOTBALL STADIUM IN WACO, MCLENNAN COUNTY, TEXAS

by

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by

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ABSTRACT

Between May 21 and 31, 2012, Prewitt and Associates, Inc., conducted archeological and geoarcheological investigations over a 93-acre area proposed for construction of the new Baylor University football stadium in Waco, Texas. The work included visual assessment of the project area, excavation of 63 trenches, and collection of 4 Geoprobe sediment core samples. Deep trench excavations were hampered by an elevated water table. As a result, most observations were limited to deposits at depths of 3 m or less, though the sediment cores did provide information to depths of 5.5–11.0 m. The investigations determined that all but the northern edge of the project area is on a lower alluvial surface that was created by a series of Brazos River flood events over the last 200–300 years and that has a very low potential for prehistoric archeological sites. The higher alluvial surface at the north edge of the project also is blanketed with these recent deposits, with a buried soil found through coring at a depth of 7.5 m suggesting that deep burial of cultural material of Holocene age is possible here.

The survey identified a single historic archeological site, 41ML301, consisting of a railroad bed that was abandoned between 1957 and 1970; it is not considered eligible for listing in the National Register of Historic Places. The potential for the project to impact undiscovered archeological resources is low to nonexistent because of the recent age of the deposits, the fact that the area never saw much historic development, and the fact that much of it has been disturbed. Prewitt and Associates, Inc., recommends that the project be allowed to proceed without additional archeological work.

CURATION

No artifacts were collected during this archeological investigation and thus none are curated. The records generated are curated at the Texas Archeological Research Laboratory of The University of Texas at Austin.

INTRODUCTION

Between May 21 and 31, 2012, Prewitt and Associates, Inc., conducted an intensive archeological survey of 93 acres designated for the new Baylor University football stadium in Waco, Texas (Figure 1). Charles Frederick and Brittney Gregory of Frederick Consulting assisted in the fieldwork, conducting a geoarcheological study of the project area. The work was performed under a subcontract with Freese and Nichols, Inc., for Baylor University. Given the proposed stadium's location adjacent to the Brazos River, its construction called for a permit from the U.S. Army Corps of Engineers under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, which in turn invoked Section 106 of the National Historic Preservation Act of 1966, as amended through 1992. The project area is immediately north of the Brazos River and will connect with the Baylor campus south of the river via a new pedestrian bridge. Plans call for construction of the stadium in the western third of the project area. Cast-in-place concrete piers extending to the underlying limestone bedrock 11.3–16.0 m below the surface will support the stadium. Parking and recreational vehicle lots with accompanying utilities will be constructed over parts of the rest of the project area, with the depth of impacts here being shallow (typically less than 3 m) compared to the stadium and pedestrian bridge support impacts.

The project area is roughly rectangular measuring 885 m east-west by 425 m north-south, encompassing 93 acres within the city limits of Waco. It occupies the floodplain of the Brazos River and lies on the left (north) bank of the stream just east of Interstate Highway 35; it is bordered on the north by Martin Luther King Jr. Blvd. and on the east by the channelized course of Marlin Branch. The entire project area is within the 100-year floodplain of the Brazos River, and prior to completion of the present system of reservoirs upstream of Waco, this area was subject to frequent flooding (Elder 1965:31). Portions of the project area are undisturbed and heavily wooded, while others are cleared and modified or disturbed to varying degrees. Two apartment buildings, a gas station, and a hotel were at one time within the project area. By the time of the current investigations, only one of the apartment buildings remained. The hotel had been recently demolished, and its location was serving as a storage area for fill material to be used in stadium construction. No evidence existed for the other apartment building or the gas station, except for some abandoned pipes encountered during trenching. An old sand pit, now a small artificial pond with an outlet to the Brazos River, is in the south-central part of the project area. Three overhead high-voltage transmission lines traverse the project area from west to east. These three utility corridors also contain a number of buried utility lines, including a 54-inch sewer main.

ENVIRONMENTAL BACKGROUND

The City of Waco is on the western edge of the Black Prairie, separated from the Grand Prairie to the west by the Balcones Fault Zone (Hill 1901:72). In the Waco area, the westward-facing White Rock escarpment, which rises ca. 60 m above Waco Lake, marks the western edge of the Balcones Fault Zone (Burket 1965:158). The Black Prairie is underlain by limestones and shales of the Upper Cretaceous South Bosque and Lake Waco Formations and by chalks and marls of the Austin Chalk Formation (Bureau of Economic Geology 1970; Hayward 1988:332; Hill 1901:331–332). Gently rounded landforms supporting tall grass prairies and deep, dark clayey soils characterize the Black Prairie landscape. The Grand Prairie sits on the limestones of the Georgetown, Main Street, Pawpaw, Weno, Edwards, Duck Creek, Fort Worth, Comanche Peak, and Glen Rose Formations, as well as on marls, shales, and sands of the Grayson, Walnut, and Paluxy Formations (Bureau of Economic Geology 1970). In general, the Grand Prairie landscape associated with these lithological units consists of flat to gently rolling uplands, with the major streams and rivers being entrenched and often bordered by limestone cliffs.

Incised in the Waco area landscape is a portion of the Brazos River drainage basin. Major tributaries of the Brazos in this portion of the basin include the Bosque, North Bosque, and South Bosque Rivers and Aquilla, Tehuacana, and Hog Creeks. Above Waco, the Brazos River basin encompasses about 73,800 km^2 (Epps 1973; Spencer 1966:15) and has its headwaters on the Southern High Plains of eastern New Mexico.

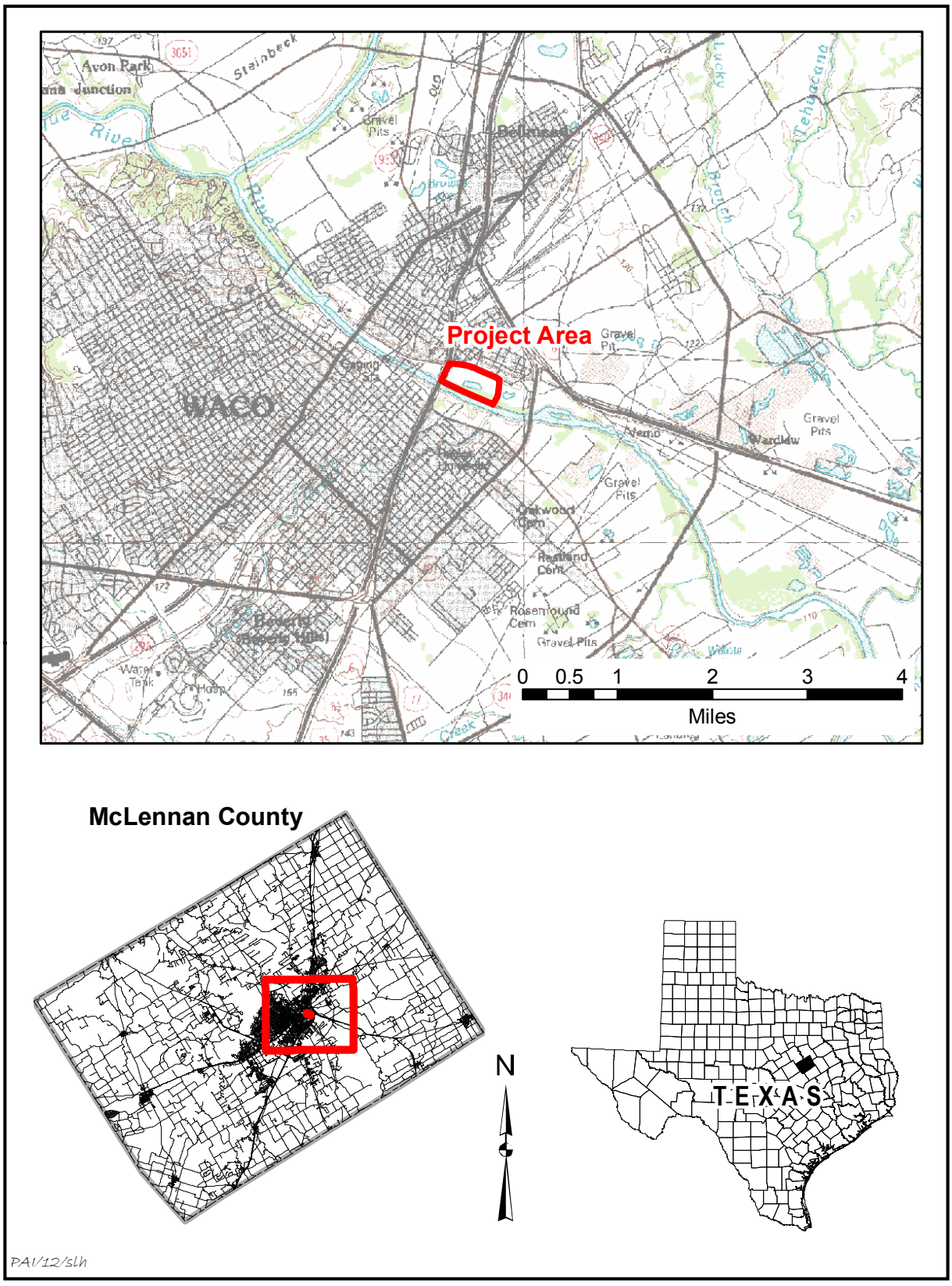


Figure 1. Project area map.

It drains a diverse range of sedimentary rocks that range in age from Ordovician to Recent, and the fine-grained sediments of the Brazos River have a distinct red color which is largely derived from the Permian and Triassic red bed strata exposed on the Rolling Plains immediately east of the Llano Estacado. Today, there are several reservoirs on the Brazos River upstream of Waco (Possum Kingdom, Lake Whitney, and Lake Granbury) as well on tributaries (e.g. Lakes Alan Henry, Waco, Aquilla, Palo Pinto, Squaw Creek, Pat Cleburne, Hubbard Creek, and Eddleman) that provide domestic water supplies and serve as points of recreation and flood control. The closest significant reservoir is Lake Waco, which dams the Bosque River just above its confluence with the Brazos River on the west side of Waco. Although the original Lake Waco was built as a source for domestic water supply, a series of floods in 1936 stimulated creation of the modern lake. The Bosque River drains approximately 4,325 km^2 of Lower Cretaceous limestones that are particularly prone to rapid runoff (Proctor 1969:7–11).

Geomorphology of the Project Area

The project area is at the head of a transitional reach, where the modern Brazos River floodplain emerges from a relatively narrow bedrock-entrenched valley and opens into a broad meandering valley. The floodplain, as mapped by the Bureau of Economic Geology (1970), is slightly wider than 500 m where crossed by Interstate Highway 35, but a short distance downstream (ca. 13 km) it widens to more than 7 km.

Two constructional geomorphic surfaces are present within the project area, which hereafter are referred to as the lower surface and the upper surface. The majority of the project area occupies the lower surface. The southern edge of this surface starts at a ca. 3–4-m scarp immediately adjacent to Lake Brazos (the Brazos River), and it extends northward almost to the northern side of the project area where it is separated from the upper surface by a 3–4-m scarp that parallels and lies immediately south of Martin Luther King Jr. Blvd. Only a small fragment of the upper surface lies within the project area. Examination of topographic maps made prior to the construction of Lake Brazos indicate that the lower surface was at an elevation slightly greater than 9.1 m above the Brazos River channel (Burket 1965:Plate II). The Web Soil Survey (2012) maps the soils on the lower surface as Ships clay, Yahola-Gaddy complex, and Yahola loam, while the upper surface soils are mapped as Bastsil fine sandy loam and Weswood silt loam.

Today, the lower surface has a gently corrugated appearance and is marked by several significant human modifications. The dominant feature is a man-made pond that occupies the center of the property and is connected to Lake Brazos by an excavated inlet. The pond is about 400 m long from east to west and about 100 m wide north to south, and the center lies about 200 m from the northern margin of Lake Brazos. This pond is an old borrow pit that was excavated sometime between 1963 and 1995. The other significant alterations to this surface are associated with buildings, specifically an elevated platform, which supported a hotel in the northwest corner of the property, and a similar structure associated with an apartment building immediately southwest of the pond.

Natural features associated with the lower surface consist of several constructional ridges close to the river and a broad, gently concave plain that lies at the foot of the scarp bordering the upper surface. West of the pond there are two ridges, and east of the pond there are three. The southernmost constructional ridge is a levee that is centered about 30 to 40 m from the edge of Lake Brazos and lies immediately adjacent to the river. Today, this levee lies about 1.5 m above the majority of the lower surface. Most topographic maps of the area show a narrow man-made levee upon the crest of the natural levee in the western half of the project area (Burket 1965), but there is no sign of this structure on the ground surface today. This man-made levee was discovered during trenching, however, and it apparently was buried by either additional levee construction or the addition of fill for building construction (Figure 2). A second ridge (or scroll bar) lies to the north of the levee, and on the western end of the project area this ridge is about 145 m north of the river, about 30 to 40 m wide, and about 1–2 m above most of the lower surface. West of the pond, this feature is almost in line with the center of the pond. On the eastern side of the project area east of the pond inlet, three

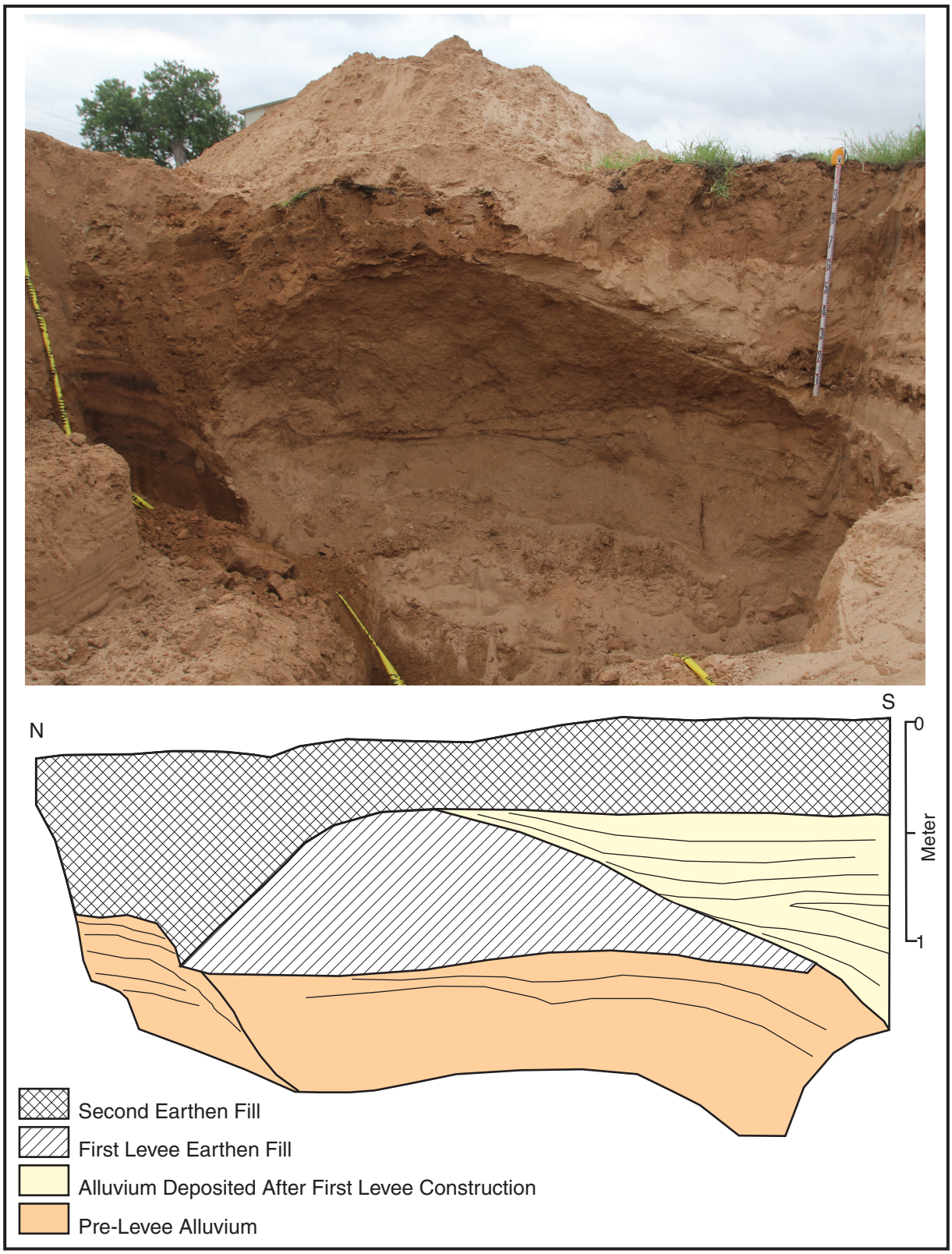


Figure 2. Photograph of the east wall of Trench 20 showing the buried levee and a profile interpreting the photograph.

ridges are present south of the pond, and these features are narrower and closer to the river than those west of the pond.

North of the pond and east of the former hotel pad lies a broad, flat to gently concave surface that is between the northernmost constructional ridge and the scarp that separates the lower and upper surfaces. Prior to excavation of the pond, this portion of the lower surface would have been about 200 m wide and relatively featureless.

As noted, the upper surface starts immediately south of Martin Luther King Jr. Blvd. and extends more than 200 m to the north. Along the leading edge of this surface in the northeastern part of the project area is an earthen embankment that is an abandoned grade for the Southern Pacific (Texas and New Orleans) railroad.

Previous Work on Brazos River Alluvial Stratigraphy

The terraces of the Brazos River have been examined by a number of authors with the earliest description found in Hill (1901:356); the first detailed description is provided by Deussen (1924:114–115), who recognized six terrace surfaces below the Uvalde gravels on the coastal plain reach of the river. The two lowest surfaces recognized by Duessen, which correlate with those present in the project area, are the first terrace at 30–35 ft (9–11 m) above the stream channel (the lower surface within the project area) and the second terrace at about 40–55 ft (12–17 m) above the channel (the upper surface within the project area). Much later, Bronaugh (1950a, 1950b) examined the Brazos River terraces in the vicinity of Waco and divided them into two groups: the low group and the high group. The low group terraces are described as occurring at elevations between 20 and 50 ft (6 to 15 m) above the river channel and as forming minimally dissected elongate flats that parallel the general river course. Bronaugh (1950a:15) believed the deposits of the 30-ft terrace and modern floodplain were of Holocene age owing to the presence of archeological sites within these deposits. In specific, Bronaugh (1950a:29–32) cites two prehistoric archeological sites known to lie within the deposits of the 30-ft terrace, one 4 miles southeast of Waco near the State Highway 6 bridge over Tehuacana Creek that was buried about 15 ft below the surface and a second 4 miles north of Waco where a midden zone was buried about 20 ft below the modern surface.

When mapping the alluvial deposits on the Waco East Quadrangle, Burket (1965:21) retained Bronaugh's "lower levels" designation for the Brazos River terraces and mapped both surfaces in the project area as Qbr1, which he described as "the lower levels (Qbr1 = 0 to 50 feet) which comprise terrace material representing the 20 to 50 foot terraces." Burket (1965) mapped the ground below the man-made levee on the leading edge of the lower surface as the Brazos River floodplain (Qbrf). The Bureau of Economic Geology (1970) mapped the deposits of the lower surface as Qal (floodplain alluvium) and the upper surface as Qta (fluviatile terrace deposits), which is the lowest of four terraces mapped above the floodplain in the Waco area.

Waters and Nordt (1995) describe the sequence of deposits in a 75-km reach of the Brazos River between Hearne and Navasota, Texas. This paper identifies five major stratigraphic units representing alluvial deposition during the last 18,000 years, and in the floodplain setting, these deposits are sheetlike in nature and capped by a distinctive paleosol. The oldest deposit, Unit I, was dated between approximately 18,000 and 8,400 years B.P., and the floodplain assemblage is capped by a paleosol called the A&M soil. Unit II was deposited between 8,200 and 6,500 years B.P., and the soil formed at the top of this unit, the Buffalo paleosol, may have remained exposed until as late as 4,200 years B.P. Unit III was deposited in the late Holocene between about 2,500 years B.P. and slightly after 880 B.P., and the floodplain assemblage of this deposit is capped by the Asa paleosol. Deposition of Unit IV was radiocarbon dated to between 530 and 270 years B.P., and the soil capping this deposit is referred to as the Katie paleosol. The youngest deposit, Unit V, buries the Katie soil and represents sedimentation in the last 300 years.

Detailed radiocarbon-dated stratigraphic studies of the Brazos River deposits near Waco are uncommon. Only one was identified in this study, and it was situated about 6.3 km southeast of the project area. It is a cultural resource management report done in association with bank stabilization work proposed by the U.S.

Army Corps of Engineers for a sewage treatment plant (Lim and Kahl 2001). Fieldwork for this study occurred during two phases, one that logged cutbank exposures and a second phase that excavated 6-m-deep trenches a short distance back from the modern cutbank. The cutbank study identified three depositional units (Units I, II and III), the lower two of which were capped by buried soils. Unit I was tentatively correlated with Waters and Nordt's (1995) Unit III (ca. 500 to 2,500 years B.P.), and Unit II was correlated with Unit IV (ca. 300 to 500 years B.P.). The youngest deposit, which Lim and Kuhl (2001) called Unit III, was correlated with Waters and Nordt's Unit V (ca. <300 years old). Two radiocarbon ages were obtained on scattered charcoal collected from alluvial deposits exposed by trenches immediately south of a cutbank on the right (southern) bank of the Brazos River. Both of these samples were collected from Lim and Kahl's Unit I, which was presumably deposited between 500 and 2,500 years ago. The upper sample was collected from 2.5 m below the surface in Trench 2 (Unit I), and this sample yielded an age of 220±40 years B.P. (Beta-147047). The second sample was collected from a depth of 4.5 m within Unit I and returned an age of 340±40 years B.P. (Beta-147048). Both of these assays are too young for Waters and Nordt's (1995) Unit III, clearly indicating that deposits of the floodplain surface are quite young to considerable depths near Waco.

Overall, it is clear that the alluvial deposits present within the project area have the potential to contain in situ archeological remains that could date from the modern period back to the terminal Pleistocene. The average thickness of alluvial deposits beneath the Brazos River floodplain are described by Cronin and Wilson (1967:21) as 13.7 m below Waco and about 10.6 m above Waco, so the potential for deeply buried archeological desposits is clearly present. How well the stratigraphic model presented by Waters and Nordt (1995) applies to the transitional reach where the project is situated is presently unknown. If their model is accepted at face value, the youngest deposit (Unit V), which is less than 300 years old, may range in thickness from about 1 m to more than 3.5 m, and this would be consistent with the radiocarbon ages obtained by Lim and Kahl (2001) a short distance downstream.

ARCHEOLOGICAL AND HISTORICAL BACKGROUND

Prehistoric Period

The prehistoric culture history in the Waco area is considered part of the central Texas archeological region, which is defined based on decades of research (Collins 1995, 2004; Hester et al. 1989). Typically, the prehistoric period is divided into Paleoindian, Archaic, and Late Prehistoric subperiods beginning traditionally with Clovis hunters at 13,500 B.P. (Collins 1995). However, with the discovery of the Monte Verde site in South America and other very early sites elsewhere, the initial peopling of Texas has come into question, and sites predating Clovis are of great interest (Dillehay et al. 2008). Recent investigations at the Debra L. Friedkin site in Bell County have yielded lithic tools and debris stratigraphically below the Clovis component and in association with dates (14,350 to 16,170 B.P.) that predate Clovis (Waters et al. 2011). There is, however, some debate over the contextual integrity of these early cultural materials (see Pinson 2012).

Paleoindian

The earliest definitive archeological evidence in central Texas belongs to the Clovis culture, the earliest culture within the Paleoindian period. The Paleoindian period is often subdivided into early and late subperiods. The Early Paleoindian subperiod is defined by the Clovis and Folsom cultures dating between 13,500 and 11,500 years ago (Taylor et al. 1996). A chipped stone technology of fluted lanceolate point styles and distinctive flake and blade technologies characterizes the Clovis culture (Collins 1990). Sites include the Gault and Friedkin sites in Bell County and the Triple S Ranch site in Hamilton County, as well as many isolated finds (Collins and Brown 2000; Hatfield 1997; Meltzer 1986; Meltzer and Bever 1995; Waters et al. 2011). Based on the cultural materials recovered from Clovis sites, these populations were highly mobile, well-adapted hunter-gatherers focused on a wide variety of prey.

The Folsom culture dates between 12,500 and 11,500 B.P. and is documented far less frequently than Clovis in central Texas (Hatfield 2001; Taylor et al. 1996). Folsom peoples

practiced hunting and gathering with a notable specialization in bison hunting (Hofman and Todd 2001). Folsom sites are mostly restricted to the northern parts of the region and are likely correlated with bison populations of the northern and western prairies of Texas that moved into central Texas intermittently (Blackmar 1998; Hofman 1999; Johnson 1995). Folsom tool kits consist of Folsom and Midland points, large thin bifaces, and end scrapers (Collins 1995:382). Folsom sites include Friedkin and Horn Shelter No. 2, as well as isolated artifacts (Largent 1995; Largent and Waters 1990; Largent et al. 1991; Redder 1985; Waters et al. 2011; Watt 1978).

The following Late Paleoindian subperiod dates from 11,500 to ca. 8,000 B.P. and is characterized by a wider variety of lanceolate and basally thinned point styles and includes a few stemmed varieties as well (Bousman et al. 2002; Collins et al. 2011). These point styles include Plainview, Dalton, Scottsbluff, San Patrice, Wilson, Golondrina, St. Mary's Hall, and Angostura (Bousman et al. 2002; Collins et al. 1993; Collins et al. 2011; Hatfield 2001). The Late Paleoindian populations reflect a shift in subsistence from highly mobile hunting and gathering to more intensive and localized resource exploitation typical of later Archaic period lifeways (Black 1989:25; Johnson 1964, 1967, 1995). These subsistence changes are documented at the Wilson-Leonard site and Levi Rockshelter, as evidenced by increased use of burned rock features and new chipped stone tool technologies (Alexander 1963; Bousman et al. 2002; Collins 1998; Collins et al. 1993). Additional sites include Acton, Louis Obshner, Gault, and Triple S Ranch (Blaine et al. 1968; Collins and Brown 2000; Crook and Harris 1955; Hatfield 1997; Johnson 1995).

Archaic

The Archaic period in central Texas dates from ca. 8,000 to ca. 1,200 B.P. (Perttula 2011). This period is defined by a more generalized hunting and gathering lifeway focused on a wider array of plant and animal resources and a decrease in mobility (Willey and Phillips 1958). It is generally divided into early, middle, and late subperiods (Collins 1995, 2004; Johnson and Goode 1994).

Early Archaic sites date from 8,000 to 6,000 B.P. and include open campsites and rockshelter sites with diverse tool assemblages suggestive of mobile hunter-gatherers (Collins 1995, 2004; Prewitt 1985). Early Archaic projectile point styles include Gower, Wells, Martindale, and Uvalde. Manos, metates, hammerstones, Clear Fork and Guadalupe bifaces, and a variety of other bifacial and unifacial tools are common to this period. Burned rock hearths and ovens appeared during the Early Archaic and were used for processing roots and bulbs, as seen at Wilson-Leonard and the Armstrong site (Collins 1998; Schroeder 2002; Schroeder and Oksanen 2002). These burned rock features are the technological predecessors of the larger burned rock middens documented in the Middle and Late Archaic periods (Collins 1995:383). The Wilson-Leonard, Gault, Armstrong, and Youngsport sites have Early Archaic components (Bousman et al. 2002; Collins 1998; Collins et al. 2011; Schroeder 2002; Schroeder and Oksanen 2002; Shafer 1963).

The Middle Archaic period (6,000–4,000 B.P.) saw an increase in the number and distribution of sites as well as an increase in site size, correlating with increased population density (Collins 1995, 2004; Prewitt 1981; Weir 1976). Plant foods were processed in burned rock features repeatedly at the same locales resulting in the formation of burned rock middens, which were common by the end of the period even though tool kits still reflected a generalized hunting and gathering lifeway (Prewitt 1985:222–226). The Middle Archaic of the eastern Edwards Plateau is considered by some to be a transitional period from generalized Early Archaic hunting and gathering to intensive plant collecting and hunting seen during the Late Archaic (Johnson 1995:88). The Middle Archaic Calf Creek complex, which includes Calf Creek, Bell, and Andice projectile points innovated by populations in the Oklahoma rolling plains region, appeared in central and north-central Texas during an environmental shift to slightly more-xeric conditions around 5,600 years ago and likely was associated with the movement of bison into the region (Johnson 1995; Johnson and Goode 1994). Bell points and bison remains were recovered from the Landslide site in Bell County (Sorrow et al. 1967).

A steady shift toward aridity allowed semisucculents to become a more-significant food source during the latter part of the Middle Archaic, and burned rock middens are common in sites dating to this interval. These features

were used for baking geophytes and xerophytic plants, as well as other floral and faunal resources (Black 1989; Black et al. 1997; Boyd et al. 2004; Collins 1998; Creel 1991; Hester 1991; Johnson 1995; Mehalchick et al. 2004).

During the succeeding Late Archaic period (4,000 to ca. 1,200 B.P.), populations continued to increase and plant resources were used intensively (Prewitt 1985:217). Large cemeteries along drainages appeared at this time (Story 1985:40). The large populations of the Late Archaic utilized an efficient economy with burned rock features being a major part of the food-processing strategy, as were manos and metates (Johnson 1995; Johnson and Goode 1994). Stratified sites with Late Archaic components include Youngsport, Baylor, Britton, McMillan, Higginbotham, and Steele (Kibler and Mehalchick 2010; Stephenson 1970; Story and Shafer 1965).

Late Prehistoric

The Late Prehistoric period (ca. 1,200 to 300 B.P.) is marked by the introduction of the bow and arrow and, later, ceramics into central Texas. Population density appears to have decreased from the Late Archaic, although subsistence strategies continued much as before, with the continued use of burned rock hearths and ovens (Black et al. 1997; Prewitt 1985). Bison returned as an economic resource during the latter part of the Late Prehistoric period (Prewitt 1981:74).

Austin phase sites define the early part of this period in central Texas and are associated with Scallorn and Edwards arrow points (Jelks 1962; Prewitt 1974, 1981). Austin phase sites date from 1,200 to 800 B.P. (Harris 1985; Hester 1986; Prewitt 1974). Cemeteries for disposal of the dead and as territorial markers are associated with Austin phase populations (Hester 1986; Prewitt 1974).

The Toyah phase dates from 750 to 300 B.P., and its sites are found throughout south and central Texas (Jelks 1962; Prewitt 1974, 1981). The Toyah tool kit included Perdiz arrow points, end scrapers, four-beveled-edge knives, and plain bone-tempered ceramics (Story and Shafer 1965; Suhm et al. 1954). Bison returned to central Texas in large numbers, and bison hunting became an important subsistence strategy, at least in some parts of central Texas (Arnn 2012; Black 1986; Huebner 1991; Johnson 1994; Karbula 2003; Toomey et al. 1993). Interactions between Toyah peoples and peoples in neighboring regions are evidenced by exotic materials, though rare and few in number, recovered from Toyah sites along the margins of central Texas (Kibler 2012). Relations with Caddo peoples are quite evident based on Caddo ceramics in sites along the eastern and northern edges of central Texas (Arnn 2012; Stephenson 1970).

Historic Period

Interactions during the late seventeenth and early eighteenth centuries between Europeans and Native Americans included the movement of the Spanish into Texas to establish forts, missions, and settlements on their northern frontier and the movement of the French along the Red River establishing trading posts. Historically, three Native American groups occupied the Waco area: the Wichita-speaking groups of the Tawakoni, Waco, and Kichai; the Caddoan tribes associated with the Anadarko, Hasinai, and Kadohadacho; and the Tonkawa. Later, Apaches and Comanches appeared in the Waco area

Athanase de Mézières's expedition along the Brazos River in the 1770s encountered two large Tawakoni villages along a stretch from present-day Waco to the vicinity of the Nolan River (Jelks 1970; Krieger 1996). Archeological and historical evidence indicates the Tawakoni occupied the Stansbury site near Lake Whitney in the 1770s and 1780s (Jelks 1970). The Hasinai also occupied this site in the 1830s. By 1846, the village was located approximately 16 km up the Brazos near what would become Fort Graham in 1849, a fort established to protect the growing number of Euro-American settlements in the area; the fort was abandoned in 1853 (Jelks 1970). Tonkawa groups seeking protection from Comanche raids settled nearby (see Hester [1989], Jelks [1970], La Vere [2003], and Newcomb [1961] for historical accounts of Native Americans and their interactions throughout the region with the Spanish, Republic of Mexico, the Texas Republic, and the United States).

Euro-American settlement of the Waco area began with the establishment of Fort Fisher, a Texas Ranger outpost, in 1837 (currently the location of the Texas Ranger Museum) (Roberts 1988:762). Notable early settlers included Neil

McLennan, who moved to land on the South Bosque River, and George B. Erath, who initially came to the area as a Texas Ranger and returned as a surveyor, eventually laying out the first city block in Waco in 1849 (D. Young 2012). Following formal talks in 1844 and 1845 between the Republic of Texas and Native Americans, settlement slowly increased, but widespread settlement really only occurred after Native American resettlement (Prikryl and Jackson 1985:28–29). The county was established on January 20, 1850, and was named in honor of McLennan (Kelly 1972:174).

During the Civil War, 1,500 men, including 6 generals, from McLennan County joined the Confederate army (Smyrl 1996:431). Waco was occupied by U.S. troops during Reconstruction. Emancipated African Americans in McLennan County stayed in the area and found work in Waco, on plantations, or on their own farms (Smyrl 1996:432). Cash crop farming and sharecropping became the main economic industry during Reconstruction (Prikryl and Jackson 1985:34). By 1866, cattle drives began moving tens of thousands of cattle north along the Chisholm Trail and through McLennan County, crossing the Brazos River at Waco. Cattle drives, an influx of capital from the north, increased European immigration, and improved access to transportation through railroads brought economic improvements to the Waco area by the late 1870s. The Waco Bridge Company opened a suspension bridge in 1870 spanning the Brazos. It was designed by John Roebling, who later built the Brooklyn Bridge relying on the Waco bridge as a model (Smyrl 2012).

Several major railroads were constructed in the 1870s and 1880s and included the Waco and Northwestern Railroad in 1871 and the St Louis and Southwestern and Missouri-Kansas-Texas railroads in the early 1880s. Other railroads built or operated in the Waco area at this time included the Texas Central Railway, the Houston and Texas Central Railway, the Texas and New Orleans Railway, and the Southern Pacific. With this, Waco became a primary junction and a large center of urban development (Smyrl 1996). By the 1880s, cotton became the primary economic resource, and, via the railroad and increased access to markets, the region transitioned from subsistence farming to a single commercial cash crop. Farmers relied more heavily on goods supplied by railroads, and the cotton boom brought prosperity (Conger 1971). Around the same time, Paul Quinn College and Baylor University were founded in 1872 and 1886, respectively.

Though the economy began to diversify, cotton agriculture remained important up to World War I (Conger 1971; Smyrl 1996:432). Cotton prices soared in 1918 and 1919, allowing for further development of marginal lands for cotton production. In 1917, the U.S. Army purchased land to the west of Waco near the edge of the Bosque valley and built a training camp, Camp MacArthur, for the World War I American effort. Camp MacArthur served to further stimulate the local economy and also caused more urban development (Smyrl 1996). Also established near Waco was Rich Field, a military airfield used for training during World War I. Many of the military personnel who had been stationed in the Waco area during the war chose to remain in Waco, which in turn contributed to the economic growth. Industrial ventures became an increasingly important part of the economy, alongside agriculture (Smyrl 1996:432).

The 1925 drought and the Great Depression resulted in dramatic losses for cotton farmers (Prikryl and Jackson 1985:45). Relatively few new buildings were constructed during these difficult economic times, and farmland prices plummeted (Poage 1981:117). The construction of the Waco Lake dam in 1929 offered some economic recovery for impoverished farmers. Investors such as W. H. Forrester began buying lakeshore property in 1928 for residential and recreational development (Prikryl and Jackson 1985:45). Urban and industrial development as well as mechanization of farms led to a decrease in small farms and small town populations surrounding Waco throughout the first half of the twentieth century. With the expansion of Waco Lake in 1962, the Corps of Engineers purchased most of the shoreline property and constructed a larger dam to allow for the impoundment of the additional water needed to supply the growing city of Waco. Today, agriculture and related activities account for about 5 percent of the income earned in McLennan County, and industrial and commercial development and enterprises centered in Waco make up a large portion of the local economy. For more about the history and settlement of Waco and McLennan County, see Baker (1936), Kelly (1972), and Poage (1981).

METHODS OF INVESTIGATION

Prefield Investigations

The current investigations began with a search for previously recorded sites within the project area using the Texas Historical Commission's online archeological sites atlas. No recorded archeological sites occur within the project area, but there are seven archeological sites within 1.6 km of this area. The closest known site is 41ML238, a landfill dating to ca. 1900 located just south of the project area on the south side of the Brazos River (Griffith and Boyd 2008; Quigg and Matchen 2006). Located 0.40 km south of the project area is a historic site (41ML296) consisting of three brick-lined wells, a building foundation, and artifacts dating to the twentieth century. This site was identified during construction of the Texas Sports Hall of Fame. Another site located 0.68 km south of the project area is 41ML212, a multicomponent site with prehistoric and historic occupations. Two sites, 41ML94 and 41ML203, are 0.68 km and 0.88 km west of the project area on the west side of Interstate Highway 35. Site 41ML94 is the Waco Suspension Bridge, which was completed in 1869. It is a single-span iron bridge with a wooden deck, two double-brick cable towers, and four anchor houses. The Eureka Gas Light Works site (41ML203) is near the bridge and is buried where it once stood. This was an early industrial plant for making naphtha-illuminating gas from coal. Approximately 1.2 km north-northwest of the project area is site 41ML298, which consists of the remnants of the Davis Memorial Hall, General Assembly Hall of the Living God, dating between 1955 and 1965. East of the project area is 41ML28, the Gas Plant site, which is a historic Wichita village.

The terminus of the proposed pedestrian bridge on the south side of the river will intersect site 41ML238. This site, consisting of thick deposits of early-twentieth-century trash and debris from the 1953 tornado that devastated Waco, was recently investigated by Griffith and Boyd (2008) and Quigg and Matchen (2006). These investigations concluded that the site is not eligible for listing in the National Register of Historic Places or designation as a State Archeological Landmark. The area where the south end of the bridge will be constructed also has been disturbed by construction of the adjacent Baylor law school. Based on these factors, and after consultation with the U.S. Army Corps of Engineers, it was concluded that investigations at this location were not warranted during the current project.

Although there are no standing structures 50 years or older in the project area, its close proximity to downtown Waco led to concerns about the potential for archeological remains of early houses, farmsteads, and other historic features within the project area. To address this, online Sanborn maps from the late nineteenth and early twentieth centuries, historic aerial photographs (one dating to 1938 and the other imprinted with a 1929 date but appearing later than the 1938 aerial), and a series of historic maps were examined for evidence of historic structures within the project area. These sources revealed that the project area, though platted as early as the first quarter of the twentieth century, was never developed, possibly due to frequent flood inundation. The few structures and improvements that were noted on the aerial photographs and maps were in the western third of the project area, in and around the proposed stadium footprint (Figures 3 and 4). These potential site areas were marked on project maps so that they could be targeted during the field investigations.

Field Investigations

The archeological survey consisted of pedestrian examination of the entire project area, excavation of 63 trenches (20 backhoe trenches and 43 trackhoe trenches), and collection of 4 sediment core samples (Figure 5). Ground surface visibility in the project area was poor because of dense vegetation. The previously mentioned disturbances (i.e., apartment complexes, hotel, gas station, pond, and buried utilities) essentially reduced the project area from 93 to approximately 73 acres that would be subjected to subsurface investigations. The trenches were systematically placed within the stadium footprint in the western third of the project area and randomly across the remaining portion to look at the stratigraphy and depositional sequence and to identify any cultural deposits buried in the upper 2–3 m. The trenches sampled the stratigraphy of both alluvial surfaces, as well as various landforms on the lower surface (e.g., swales, ridges, and natural levees). The sediment

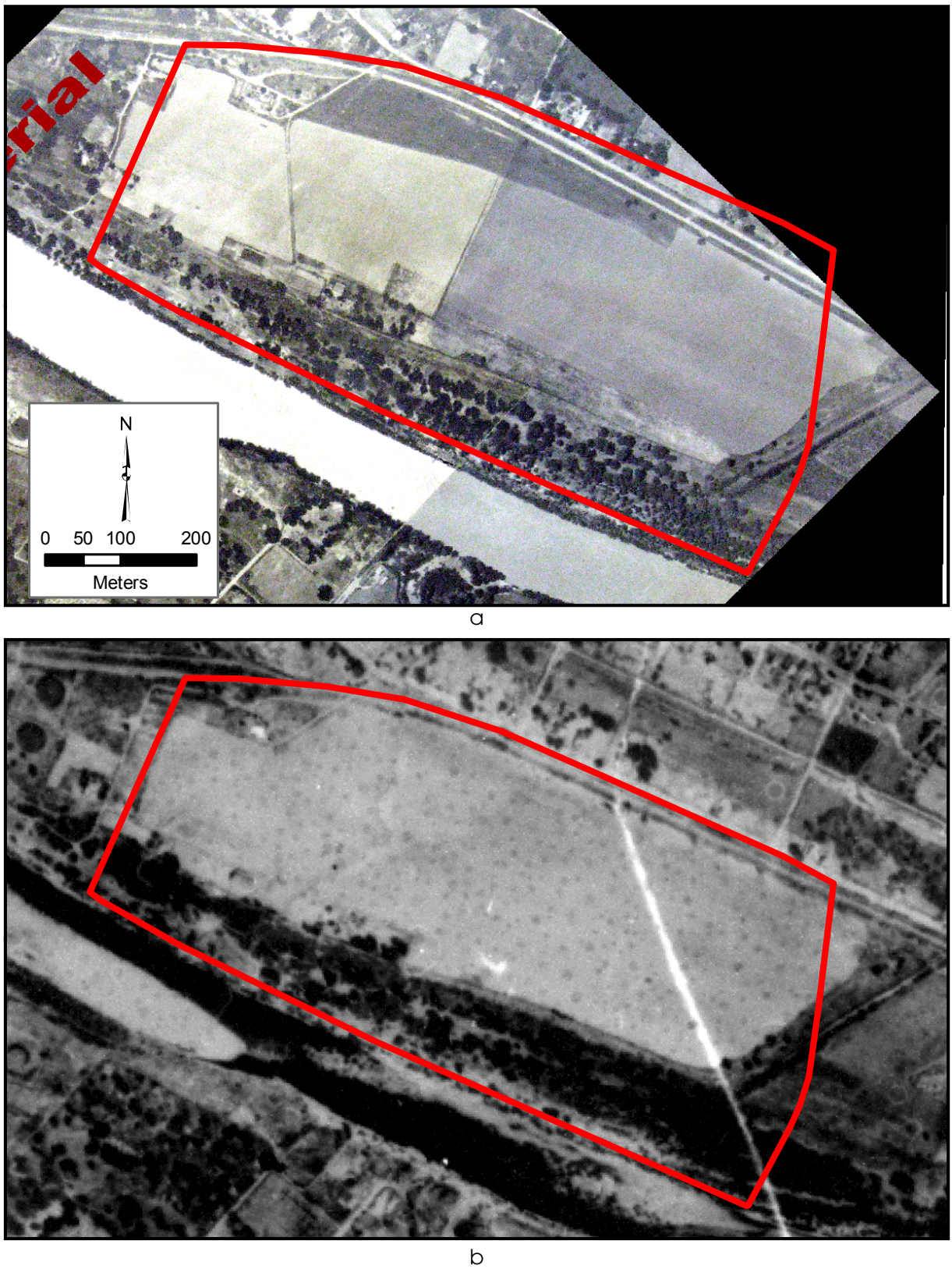
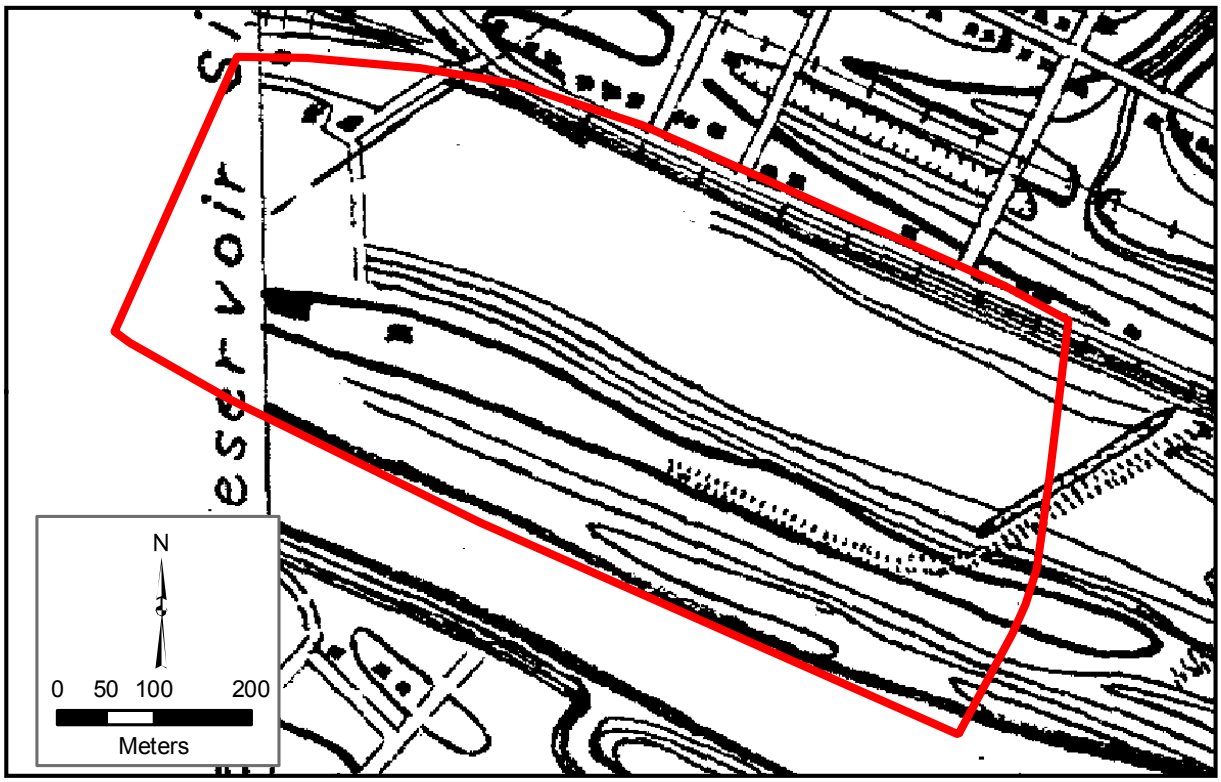
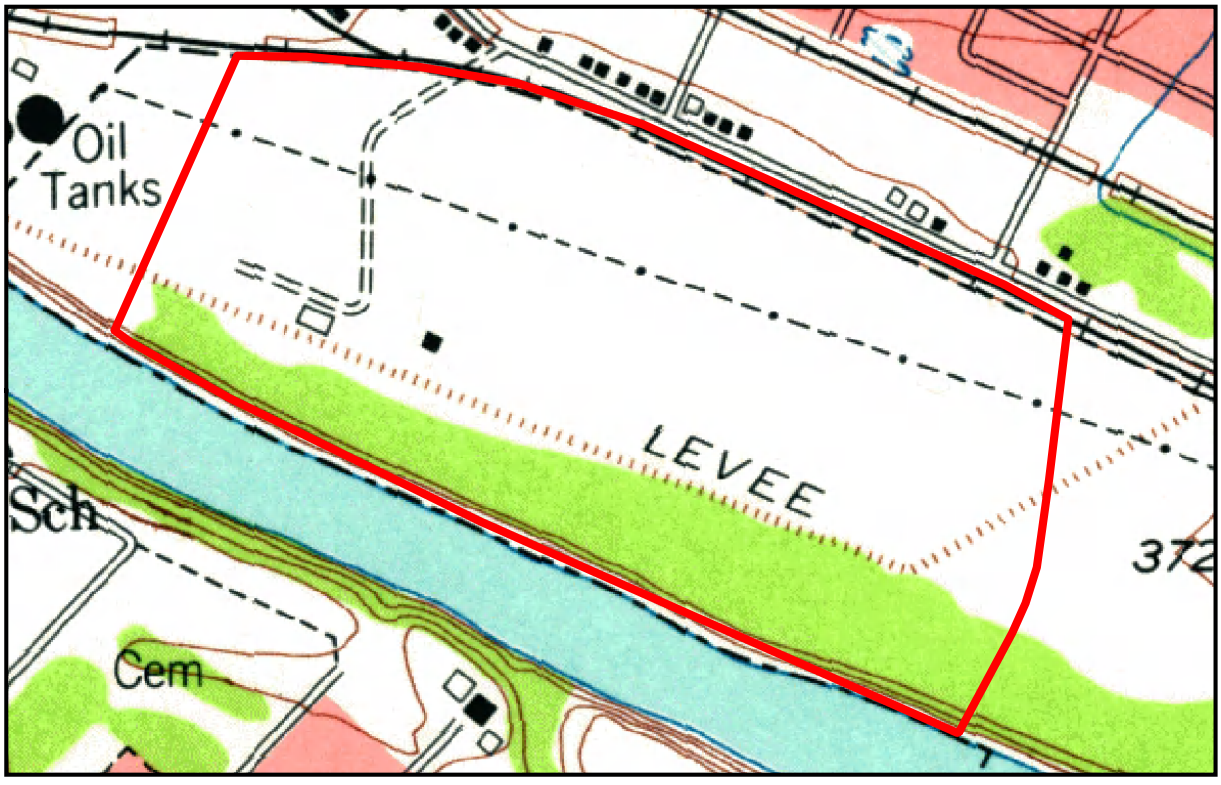


Figure 3. Historic aerial photographs of the project area. (a) Photograph with 1929 date imprinted but probably postdating 1938; (b) photograph taken in 1938.



a



b

Figure 4. Historic maps of the project area. (a) 1928 Waco East Sheet, Texas State Reclamation Department; (b) 1957 Waco East USGS quadrangle.

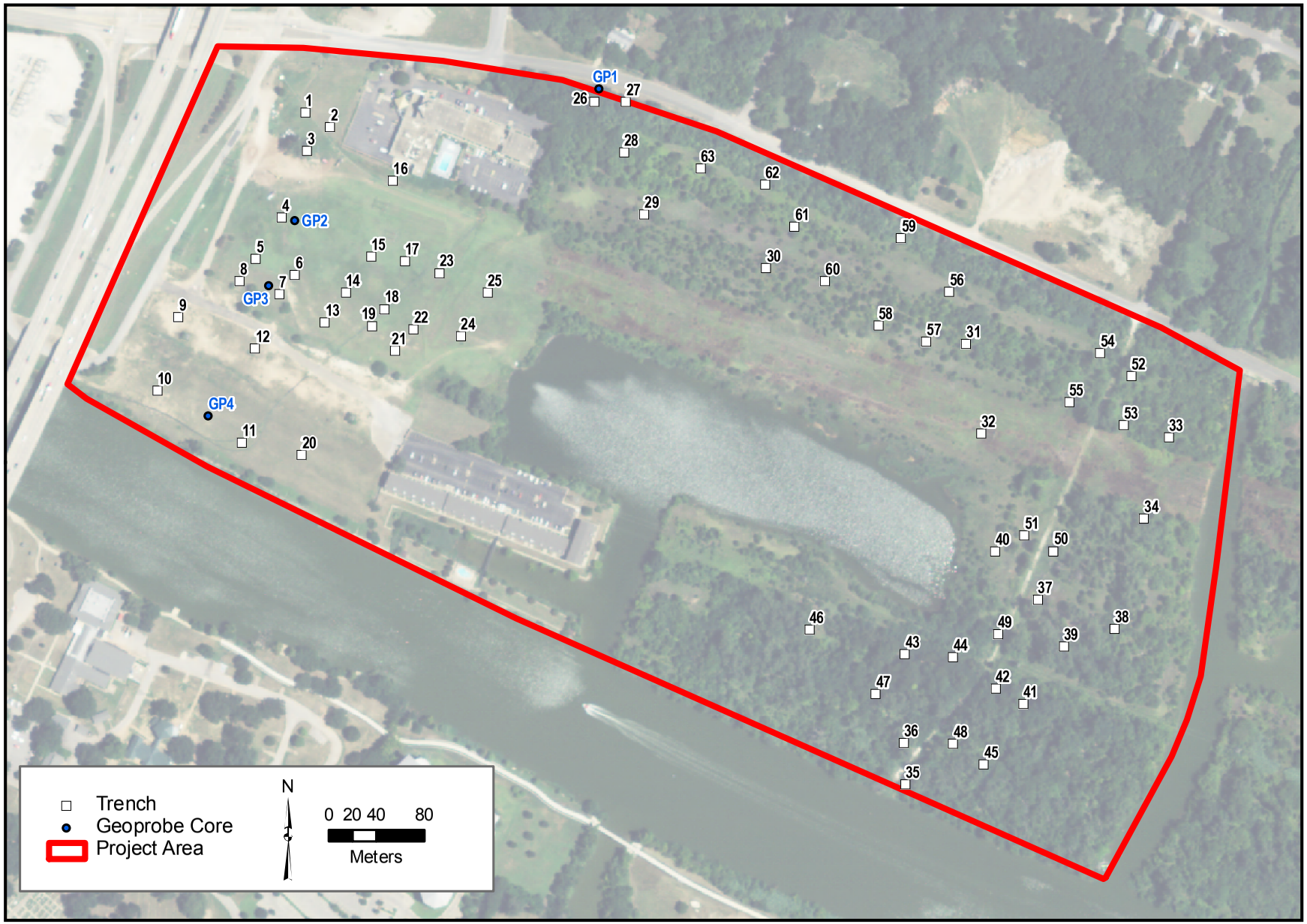


Figure 5. Aerial photograph of the project area showing trench and Geoprobe core locations.

cores also targeted and sampled the stratigraphy of the two surfaces and the landforms of the lower surface.

Subsurface investigations were most intensive in the stadium footprint where impacts will be deepest and where the potential for historic archeological sites was greatest. In this area, 25 trenches were excavated to the top of the water table, which ranged in depth from 1.9 to 3.5 m, averaging 2.5 m (Table 1). An additional 38 trenches were placed in areas where parking lots will be constructed. These also were excavated to the top of the water table, which ranged from 1.4 to 3.3 m deep with a mean of 2.2 m. The water table was encountered in every trench except Trench 27, which was the only trench on the higher alluvial surface. The water table was approximately 5 m above the level of the Brazos River, with some variation depending on the distance from the river and the elevation of the landform.

Trenches 1–37 were profiled and described by geoarcheologists Charles Frederick and Brittney Gregory, and consequently excavation of these trenches involved large stepped areas perpendicular to the profiled walls to allow for safe entry into them (Figure 6). The excavated areas were roughly square with a sloped and stepped wall on one side. The length of the trench was not always the longest axis, however, since the trench wall was the target of investigations, the length listed in Table 1 and described herein denotes the length of the wall that was profiled. The mean length was 5.1 m, ranging from 3.9 to 8.5 m, and the mean width was 4.8 m, ranging from 2.8 to 5.8 m. Trenches 1–37 ranged from 1.6 to 3.5 m in depth, with a mean of 2.4 m. Trench depth was limited by a high water table. Efforts were made to avoid exposing the water table during trench excavation to minimize the potential of trench collapse.

These trench profiles were examined in detail to assess the age and nature of the alluvial deposits present. Upon completion of excavation, a single trench wall was cleaned with a trowel and knife, and then the exposed deposits were described in general accordance with the methods of Schoeneberger et al. (2002), although the fundamental unit of observation was a zone rather than a horizon. For each zone, the Munsell color, field texture, consistence, structure, reaction with dilute hydrochloric acid, boundary thickness and topography, and pedofeatures were recorded. Zones were subsequently assigned a soil horizon upon completion of the description. The trench wall was closely examined for the presence of cultural materials during and after cleaning. Descriptions of the deposits exposed by each trench are provided in the appendix to this report.

Trenches 38–63 were not profiled nor were their sediments and stratigraphy recorded in detail; therefore, the trench walls were not stepped back for safety reasons as there was no reason to enter the trenches. These trenches were excavated as a means of archeological prospecting, with the walls and backdirt examined from the surface for archeological materials. The mean length of Trenches 38–63 was 4.3 m, ranging from 3.7 to 5.2 m. The mean width was 1.3 m, ranging from 1.1 to 1.5 m. In depth, these trenches ranged from 1.4 to 3.3 m, with a mean of 2.2 m. After examination, all of the trenches were backfilled.

A few areas were not trenched because of existing disturbances. These included the area where the hotel once stood in the northwest corner of the project area, the existing apartment complex area, and areas containing buried utilities. The area around the hotel was built up extensively with artificial fill, and trenching would have revealed very little information. Also, the southeast portion of the project area was heavily wooded and included some large trees that prevented excavation equipment from gaining access to parts of the area.

After the trench excavations were completed, a Geoprobe® Model 7822DT operated by Riomar Environmental Drilling was used to extract sediment core samples from four areas (Figure 7). The Geoprobe was used to sample and document the sediments and stratigraphy below the top of the water table and potentially to the underlying bedrock. The first core (Core 1) was extracted on the higher alluvial surface near Trench 27 along Martin Luther King Jr. Blvd. and reached a depth of 11.0 m. Core 2 was taken from a location east of Trench 4; it reached a depth of 4.8 m before encountering a zone of highly saturated sandy sediment that immediately slid out off the collection sleeve. Core 3 between Trenches 7 and 8 reached a depth of 5.5 m before encountering highly saturated sand. Core 4 was between Trenches 10 and 11 and reached a depth of 6.1 m before reaching waterlogged sand.

Table 1. Backhoe and trackhoe trench dimensions and orientations

Trench	Location	Type	Length (m)	Width (m)	Depth (m)	Orientation (degrees)
1	Stadium footprint	Trackhoe	5.7	4.4	2.5	20
2	Stadium footprint	Trackhoe	6.3	4.4	2.7	20
3	Stadium footprint	Trackhoe	5.7	4.2	2.2	26
4	Stadium footprint	Trackhoe	5.6	4.5	2.7	20
5	Stadium footprint	Trackhoe	4.7	5.8	3.1	22
6	Stadium footprint	Trackhoe	5.2	5.5	2.5	18
7	Stadium footprint	Trackhoe	5.2	5.0	2.5	18
8	Stadium footprint	Trackhoe	5.3	4.5	3.5	26
9	Stadium footprint	Trackhoe	5.6	5.4	3.0	26
10	Stadium footprint	Trackhoe	5.5	5.3	2.2	22
11	Stadium footprint	Trackhoe	5.1	4.2	2.3	12
12	Stadium footprint	Trackhoe	5.4	4.9	2.3	38
13	Stadium footprint	Backhoe	4.3	4.4	2.9	28
14	Stadium footprint	Backhoe	4.5	5.4	2.7	28
15	Stadium footprint	Backhoe	4.4	5.4	2.1	22
16	Stadium footprint	Backhoe	5.0	5.6	2.7	20
17	Stadium footprint	Backhoe	4.5	5.1	2.2	10
18	Stadium footprint	Backhoe	5.1	5.4	2.8	22
19	Stadium footprint	Backhoe	4.3	4.9	2.8	23
20	Stadium footprint	Backhoe	4.5	5.7	2.4	20
21	Stadium footprint	Backhoe	4.8	4.9	2.2	21
22	Stadium footprint	Backhoe	4.0	5.4	2.9	34
23	Stadium footprint	Backhoe	4.2	5.3	1.9	26
24	Stadium footprint	Backhoe	4.2	5.5	1.9	18
25	Stadium footprint	Backhoe	4.3	5.5	2.1	14
26	Parking area	Backhoe	6.5	4.3	3.1	0
27	Parking area	Backhoe	4.8	2.8	2.8	18
28	Parking area	Backhoe	4.1	4.8	2.3	28
29	Parking area	Backhoe	4.3	4.8	2.3	32
30	Parking area	Backhoe	3.9	4.7	1.9	38
31	Parking area	Backhoe	4.3	4.3	1.8	22
32	Parking area	Backhoe	4.3	4.3	1.6	12
33	Parking area	Trackhoe	5.3	4.7	2.9	2
34	Parking area	Trackhoe	8.0	3.7	1.9	40
35	Parking area	Trackhoe	5.0	3.7	2.2	50
36	Parking area	Trackhoe	8.5	4.5	1.7	0
37	Parking area	Trackhoe	6.5	5.5	1.8	42
38	Parking area	Trackhoe	5.2	1.2	2.1	22
39	Parking area	Trackhoe	4.8	1.3	2.1	340
40	Parking area	Trackhoe	4.2	1.1	2.1	36
41	Parking area	Trackhoe	4.3	1.4	2.3	300
42	Parking area	Trackhoe	4.4	1.3	1.5	18
43	Parking area	Trackhoe	4.6	1.3	2.6	134
44	Parking area	Trackhoe	4.5	1.3	3.3	60
45	Parking area	Trackhoe	4.5	1.2	2.2	320
46	Parking area	Trackhoe	4.2	1.3	2.7	22
47	Parking area	Trackhoe	4.5	1.1	2.5	34
48	Parking area	Trackhoe	4.4	1.3	2.5	302
49	Parking area	Trackhoe	4.1	1.1	1.6	20
50	Parking area	Trackhoe	4.5	1.3	2.1	12
51	Parking area	Trackhoe	4.5	1.2	1.4	18
52	Parking area	Trackhoe	4.3	1.5	1.8	210

Table 1, continued

Trench	Location	Type	Length (m)	Width (m)	Depth (m)	Orientation (degrees)
53	Parking area	Trackhoe	4.2	1.2	2.1	25
54	Parking area	Trackhoe	3.7	1.3	1.4	184
55	Parking area	Trackhoe	4.2	1.3	2.0	38
56	Parking area	Trackhoe	4.3	1.3	1.7	180
57	Parking area	Trackhoe	4.0	1.5	2.2	40
58	Parking area	Trackhoe	4.5	1.3	2.5	52
59	Parking area	Trackhoe	4.2	1.3	2.4	198
60	Parking area	Trackhoe	4.3	1.2	2.3	60
61	Parking area	Trackhoe	4.4	1.3	2.2	42
62	Parking area	Trackhoe	4.5	1.4	2.7	186
63	Parking area	Trackhoe	4.3	1.2	2.4	40

Figure 6. Trench 11, view to the east-northeast.

RESULTS OF INVESTIGATIONS

Archeological Results

No archeological sites were encountered in any of the trenches. The majority of the trenches were devoid even of historic-age materials such as glass and metal fragments, including those in areas designated as potential historic localities based on the aerial photographs and maps. All trenches revealed Holocene alluvial deposits, but virtually all of these deposits appear too young to contain prehistoric sites. Some trenches contained a surface layer of artificial or recently

Figure 7. South-southwest view of coring by the Geoprobe near Trench 4.

introduced fill that may have been used to fill in swales or simply to raise the level of the lower surface (see discussion below under Introduced Fill). For example, Trenches 15, 17, and 18 in the west-central portion of the project area exposed introduced fill including a few handmade bricks and brick fragments and modern concrete and debris in the upper 1 m, and Trenches 41–44, 46, and 47 in the southeast part of the project area contained modern trash—large concrete pieces, modern bricks, glass, metal cans, pull-tab soda and beer cans, toilets, mattresses, assorted tires, roof tiles, and other debris—within the upper 1.0–1.4 m and in piles on the surrounding surface (Figure 8). The latter area roughly parallels a high-voltage transmission line with an accompanying maintained dirt road, which likely facilitated illegal dumping in this area.

The pedestrian survey encountered one archeological site. Site 41ML301 is an abandoned railroad grade of the Southern Pacific Railway (Figure 9). It consists of an elevated surface along the edge of the higher alluvial surface paralleling Martin Luther King Jr. Blvd. The steel rails and wooden cross ties have been removed from the grade, which is covered with dense vegetation that includes vines, grasses, and a variety of trees. The extant rail bed within the project area measures 782 m long and 1.7 m wide, although the rail line obviously extended beyond the boundaries of the project area. The grade rises ca. 0.8 m above the surrounding surface.

The eastern and western ends of the railroad grade have been obliterated. On the western end, the construction of a gas station and later a hotel contributed to complete removal of the railroad grade to level the surface. On the eastern end, the railroad grade was removed approximately 36 m from where it crossed Marlin Branch. It was probably removed when Marlin Branch was dredged and rerouted south to the Brazos River in the recent past. On the USGS Waco East topographic quadrangle dating to 1957 (photo revised 1970 and 1975), Marlin Branch is a small creek that flowed eastward, entering the Brazos River ca. 1.8 km downstream from where it enters today. Sometime after 1975, Marlin Branch was shortened and redirected south along the eastern boundary of the project area, as indicated on the 2008 USGS Waco East topographic quadrangle.

Figure 8. Modern bricks and concrete in trash fill within Trench 41.

The railroad grade is depicted as an intact railway on the 1890 USGS topographic quadrangle; on this map it is labeled as the Texas Central Railroad. On the 1918 USGS topographic quadrangle, it is labeled as the Houston and Texas Central Railway. On the 1954 USGS topographic map, the railway line is labeled as Southern Pacific, but on the 1957 USGS quadrangle it is labeled as Texas and New Orleans (Southern Pacific). Finally, on the 1970 USGS Waco East quadrangle it is not labeled and is illustrated as a dashed line indicating the railroad no longer existed. The 1975 USGS Waco East quadrangle has a dashed line labeled as "old R.R. grade". Where this dashed line connects with an active rail line, the railroad is labeled as Southern Pacific.

As indicated by these maps, this segment of railroad within the project area was owned or operated by several different companies through time. The earliest to claim this segment, perhaps even to construct it, was the Texas Central Railway Company, as noted on the 1890 map. This company was chartered in 1879, and the tracks they built or operated served as feeder lines for the Houston and Texas Central (H&TC) Railway Company. The Texas Central Railway Company was eventually subsumed within the H&TC (N. Young 2012).

The Houston and Texas Central Railway was initially chartered as the Galveston and Red River Railway by Ebenezer Allen in 1848 but was not active until 1852 (Baughman 1968). Construction for tracks from Houston to the Brazos River occurred between 1853 and 1855, and then the company name changed to the Houston and Texas Central Railway company. Construction continued, with a break in 1861–1866 during the Civil War (Baughman 1968). The H&TC acquired the Waco and Northwestern (Waco Tap) Company and completed the line between Bremond and Waco. They also acquired several other railroads. The Houston and Texas Central Railway came under Southern Pacific control when Charles Morgan purchased it in 1877, but it was operated under its own organization until 1927 when it was leased to the Texas and New Orleans (T&NO). The H&TC merged with the T&NO in 1934 (Baughman 1968). The Texas and New Orleans Railroad Company was founded

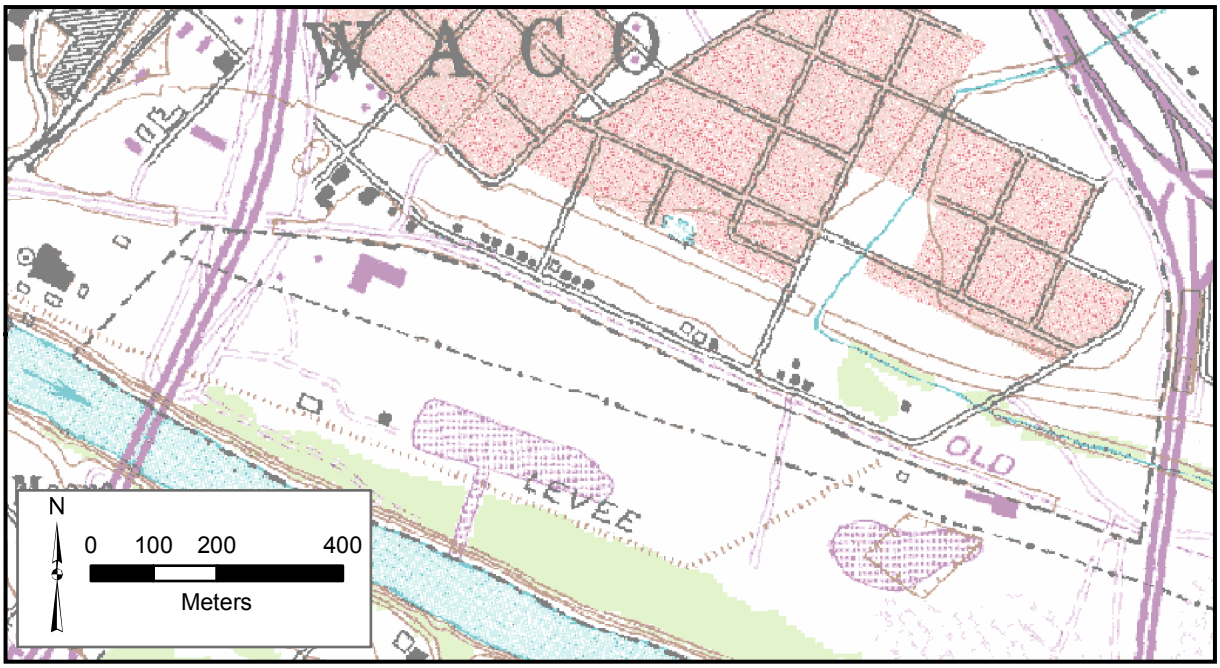


Figure 9. Site map for 41ML301. Site locations are not shown in report copies for public distribution.

in 1856 and primarily constructed lines in the southeastern part of Texas (Williams 2012). Southern Pacific acquired this company in 1881 (Hofsommer 1986; N. Young 2012). Following the H&TC and T&NO merger, portions of railroad track were subsequently abandoned or sold, including the track between Bremond and Waco, which was abandoned in 1967. The Southern Pacific Company operated the lines that were not abandoned (Braughman 1968; Hofsommer 1986; N. Young 2012).

The Southern Pacific Railroad was the largest of these companies, having emerged from many small companies. This railway came about due to the California Gold Rush in the mid 1800s (Orsi 2005; Solomon 2007). The Southern Pacific Railroad was founded by a group of businessmen, led by Timothy Phelps, in 1865, but was soon bought by "the Big Four" in 1868 and became a partner of the Central Pacific Railroad. The Central Pacific Railroad began with Theodore Judah, a railroad engineer, and four big investors—Collis P. Huntington, Mark Hopkins, Charles Crocker, and Leland Stanford—often referred to as "the Big Four." This merger included several smaller railroads throughout California. Following completion of lines through much of California, the company built or acquired railroads through Arizona, New Mexico, Texas, and Louisiana. Due to various state laws and other financial issues, the various companies held by the "Big Four" were all consolidated under a holding company called the Southern Pacific Company (Orsi 2005). In 1996, the Southern Pacific was folded within the Union Pacific (Werner 2012).

Site 41ML301 consist of a segment of a railroad that changed ownership several times through history and ultimately was abandoned between 1957 and 1970 based on how it is depicted and labeled on various maps. It is probable that the line was abandoned in 1967 when the line between Bremond and Waco was abandoned after the H&TC and T&NO merger. What remains within the project area is the elevated rail bed or grade, without tracks, that was constructed for the railway.

For a railroad to be eligible for listing in the National Register of Historic Places, it should retain integrity of location, setting, design, materials, workmanship, feeling, and association. In this case, the railroad bed is in its original location but retains no other aspects of integrity. The immediate surroundings have witnessed residential and urban development, and trees and other vegetation are growing within the raised grade of the railroad bed. With the exception of the railroad bed itself, all original materials have

been removed, thus, no semblance of materials, design, or workmanship is present. As a result, the resource lacks integrity of feeling, and its associative qualities have been compromised. Applying the contexts of community planning and development, transportation, and engineering to the railroad bed, it does not have strong enough historical associations with important historical trends, events, or people to be considered eligible for the National Register under Criterion A or B. It does not embody the distinctive characteristics of a style, type, period, or method of construction or represent design or engineering complexity, and thus it could not be considered eligible for the National Register under Criterion C. It is not eligible for the National Register under Criterion D because it contains no important archeological information.

Stratigraphic, Sedimentologic, and Pedogenic Observations

Macrostratigraphy

Given the depth of the alluvium and the high water table, a broad image of the alluvial deposits within the project area is best illustrated by means of data obtained from cores and geotechnical borings. Three suites of information are currently available: conventional geotechnical borings, electric cone (CPT) borings, and cores. Langerman Foster Engineering Company (2011) reports two types of geotechnical logs from the site: conventional borings and electric cone borings. Conventional borings were made, and these records provide a basic impression of the alluvial deposits but lack descriptive detail. Electric cone boring logs (also known as electric cone penetration tests or CPT) record penetration resistance and are used to record stratigraphy as well as classify the "soil behavior type" of the deposits. The soil behavior type classification is achieved by pushing a penetrometer into the subsurface at a constant rate and comparing the resistance at the tip to the sleeve resistance which is known as the friction ratio (United States Department of the Interior 2001:400) with knowledge of the pore pressure. Although the soil behavior type cannot directly classify a soil to systems that employ grain size distributions and plasticity such as the Unified Soil Classification System or USDA soil texture classification, Robertson (2010) notes that in situ behavior is often in good agreement with such grain-size-based soil classifications in most instances, and exceptions to this are fairly well understood.

Given that the CPT logs do not recover a physical sample of the deposits below the ground surface and can be related primarily to lithology (soil behavior type), pedogenic features typically used to discriminate different-age alluvial deposits in Quaternary geologic studies, such as color and pedofeatures, are not represented. For this reason, we decided to obtain a limited suite of core samples that would permit recovery of this information from below the water table at depths greater than the trenches. Of the four cores collected, one was on the upper surface (Core 1) and three were on the lower surface (Cores 2–4). Core 1 reached 11 m below the surface and terminated upon resistant strata, presumably limestone bedrock. Cores 2–4 reached depths between 5 and 6 m and were terminated when the core catcher was unable to retain the water-saturated sediment. Examination of these cores revealed that all of Cores 2–4 and the top 7.5 m of Core 1 were similar to the sediments observed in the trenching, with none exhibiting evidence of significant pedogenic alteration or buried soils such as those used by Waters and Nordt (1995) to distinguish the top portions of their depositional units. All of these deposits exhibited abrupt boundaries and bedding, and for this reason they are interpreted as Waters and Nordt's (1995) Unit V, which is less than 300 years old, at least to a depth of about 6 m on the lower surface.

A buried soil was noted in Core 1 at a depth of 7.5 m beneath the upper surface, and this soil marks the top of an older body of alluvium (hereafter simply referred to as the "older alluvium"). This paleosol exhibits an Ak-ABk-Bk soil profile with 5–10 percent calcium carbonate nodules that generally ranged in size from 2 to 7 mm. The basic attributes of this soil could fit either the A&M paleosol at the top of Unit I or the Buffalo paleosol at the top of Unit II described by Waters and Nordt (1995). However, the buried soil in Core 1 did not exhibit any slickensides, unlike both the A&M and Buffalo paleosols.

With the limitations of the CPT logs in mind, Figure 10 shows an interpretation of the alluvial deposits present along a north-south cross section through the project area west of the pond. This figure uses hatching to depict depositional facies and color to show the inferred stratigraph-

ic units. Three facies are readily apparent on the CPT logs: (1) a thin- to medium-bedded, variable-texture floodplain facies; (2) a massive distal flood basin facies; and (3) a thick sand facies. The thin- to medium-bedded, variable-texture floodplain facies is thickest (9 m) adjacent to the modern river channel (Lake Brazos), thinning and rising away from the channel and eventually giving way to the massive flood basin mud facies in the northern third of the lower surface. As the thin-bedded floodplain facies rises away from the channel, the thick sand facies thickens. The latter consists of thick packages of sand and loamy sand that range from slightly more than 1 m to more than 3 m thick; if they are like the thick sands observed during trenching, each package of sand most likely represents deposition during a single flood event. A few discrete sections of thin-bedded floodplain deposits lie at depth within the massive sands. Massive flood basin muds are present near the modern ground surface in the gently concave area that lies along the northern margin of the lower surface and at depth in the middle of the lower surface (around 9 m depth in CPT borings B-6 and B-14). This facies is also present at the top of the older alluvium in Core 1.

Although it is impossible to assess the stratigraphic affinity of the deposits below 6 m with certainty, most of the deposits beneath the lower surface are inferred to be less than 300 years old. The older alluvium at depth beneath the upper surface is most likely older than 4,000 years.

Observations from the Trenches

All 37 trench exposures examined during the survey revealed sediments deposited from suspension by overbank floods of the Brazos River. These deposits range in texture from sand to clay, and the facies described above for the macrostratigraphy also were observed in the trenches. One other deposit was common in the trench excavations that was not prominent in the cores, namely modern introduced fill.

INTRODUCED FILL

Given the urban setting, it is not surprising that a variety of modern fill deposits were observed. Trenches were placed to avoid the obvious introduced fills, like the foundation pad for the hotel that once stood on the northwest corner of the project area. Nevertheless, a considerable variety of materials were added to the ground surface of the project area in the last 150 years or less with at least three distinct fill types noted: (1) variable-textured earthen fill; (2) construction rubble; and (3) concrete truck cleanout. In addition to these deposits, many profiles exhibited evidence of having been compacted, presumably from being driven over by heavy equipment.

The most common introduced material was earthen fill that ranged widely in composition and appearance. In most cases, it appeared to consist of sheet-like deposits of sandy loam and sandy clay loam, but in a few instances thick sheets of earthen materials comprising two or more distinct types of sediment were found. Trench 12 contained the thickest such deposit at 1.55 m (Figure 11a).

In addition to the instances of modern debris noted above in discussing the archeological results, several trenches in the northwest part of the project area contained construction rubble in the upper 0.4 m of the profile. This material was highly variable in appearance and composition but often contained large blocks of concrete, rebar, electrical conduit and wire as well as metal sheeting and electrical boxes.

One of the more unusual human additions to the project area are deposits created where concrete trucks were cleaned and the residue dumped onto the ground surface. These deposits typically consisted of slightly gravelly sandy loam that was interbedded with thin beds of indurated concrete. Deposits of this type were noted in Trenches 4, 6, and 8, close to Interstate Highway 35.

Although not a deposit per se, one common attribute of the near-surface deposits in the project area are features associated with compaction. Platy structure as well as apparently elevated bulk density were observed widely across the project area, and these attributes are interpreted to be the result of heavy equipment having been used in this area.

LATE HOLOCENE ALLUVIUM

As noted, all of the deposits observed in the trenches and cores on the lower surface lack significant pedogenic alteration and are tentatively correlated with Waters and Nordt's (1995) Unit

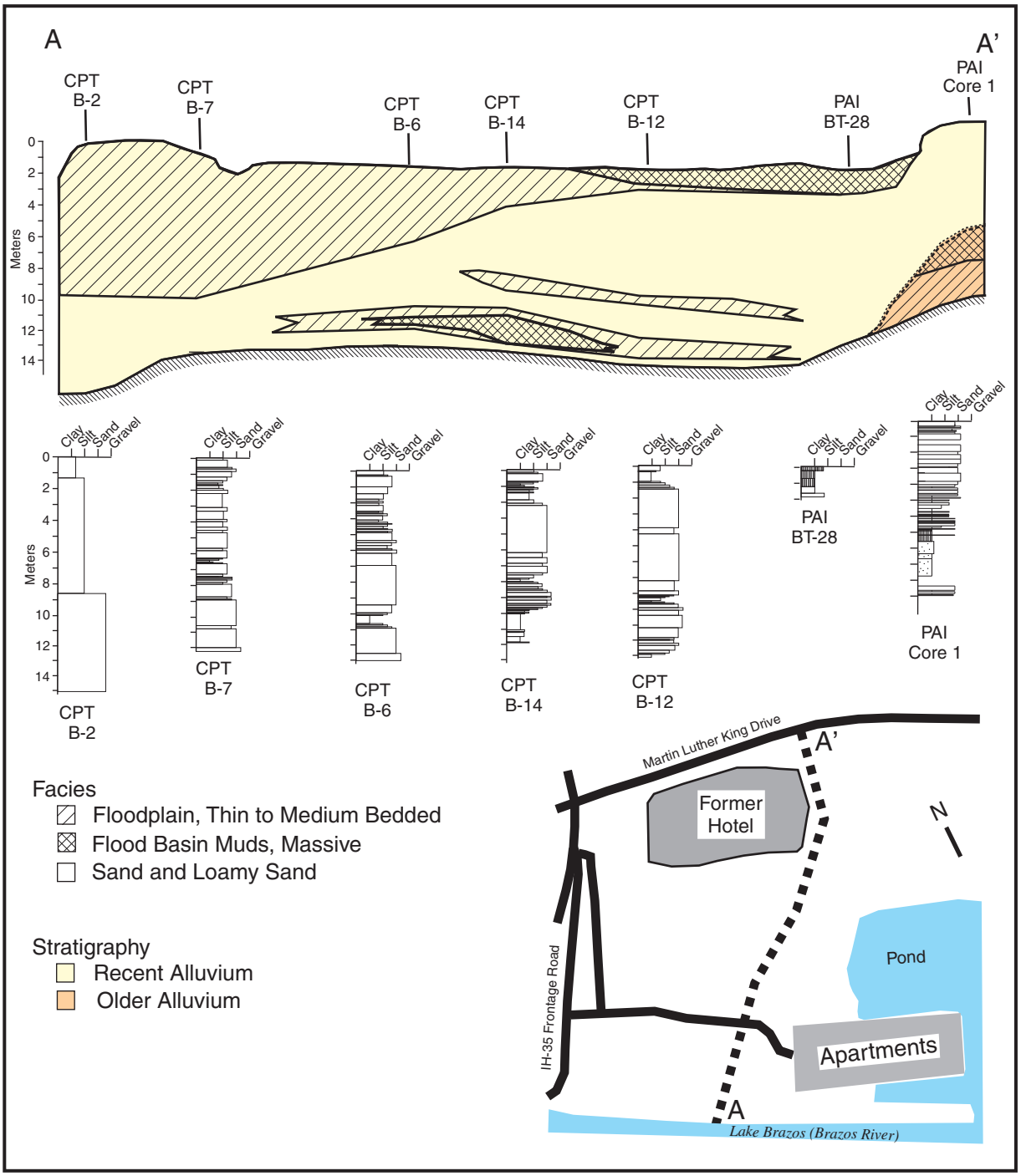


Figure 10. Interpretive north-south cross section through the project area showing the major stratigraphic units observed and an interpretation of the facies present (upper) and schematic logs of geotechnical and electric cone borings (CPT B-2, B-7, B-6, B-14, and B-12) and one Prewitt and Associates (PAI) trench and one Geoprobe core (lower).

V, which was deposited in the last 300 years. The same depositional facies noted in the cores were also observed in the trench excavations and are briefly discussed below.

The most common depositional facies encountered during the trenching was a vertical accretion deposit that consisted of alternating thin to medium beds of variable-textured sedi-

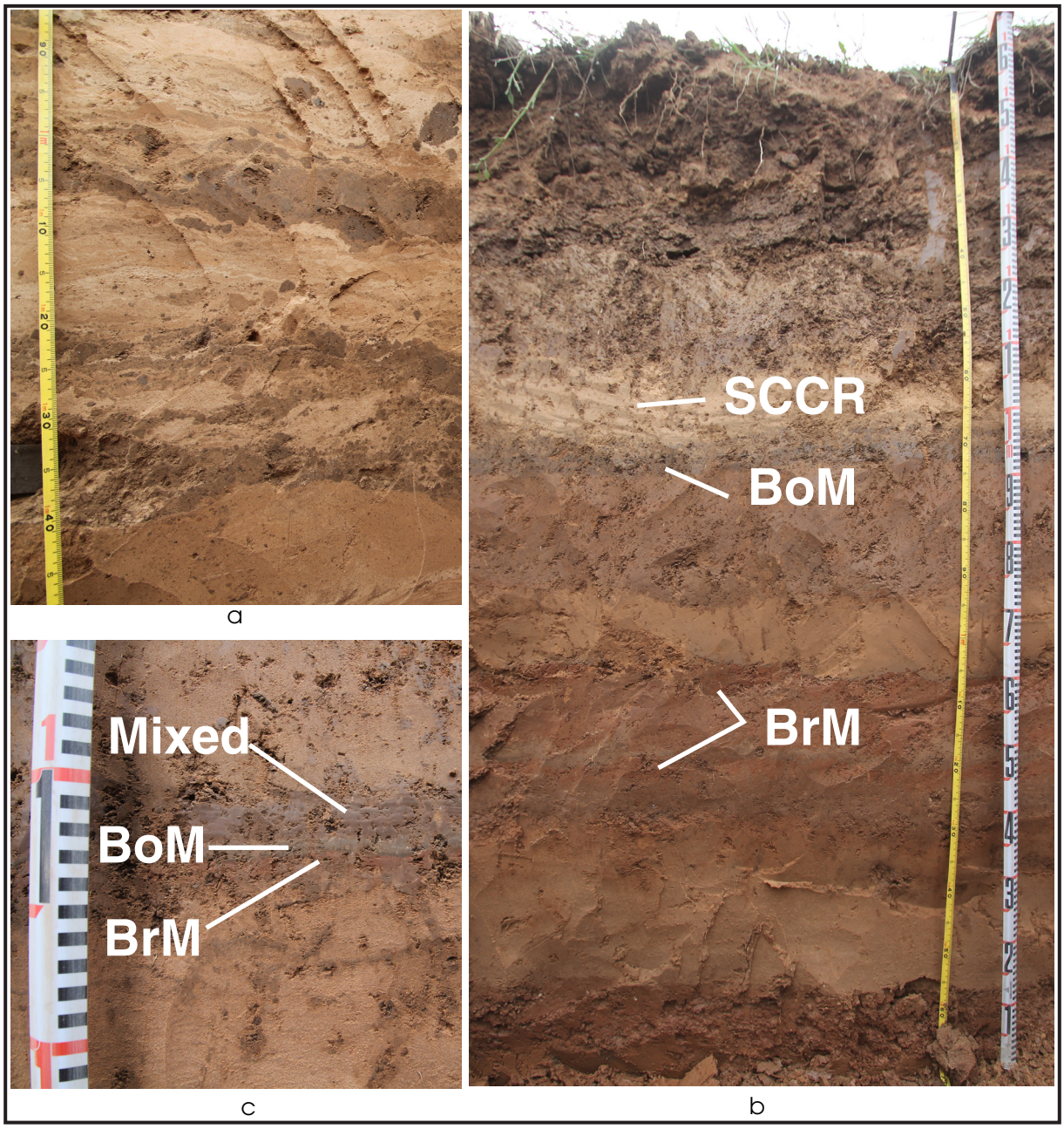


Figure 11. Photographs of Trenches 12, 23, and 22. (a) Stratified introduced earthen fill in Trench 12 (note the subrounded fragments of dark brown fine earth suspended in light-colored sandy sediment); (b) view of Trench 23 showing the thin- to medium-bedded, alternating-texture floodplain facies (note the variable-colored muds, such as the dark brown mud interpreted as a Bosque River deposit [BoM] and the strong reddish brown mud interpreted as Brazos River mud derived from the upper catchment [BrM], along with the prominent supercritical climbing ripples [SCCR] in the sand above the Bosque River mud); (c) view of thin-bedded muds derived from different-source floodwaters in Trench 22.

ment that ranged from sand to clay. Most beds exhibited abrupt lower boundaries that were either flat or wavy, and in many cases these boundaries were significantly blurred by the passage of soil fauna across the deposition interface. In some cases, these deposits consisted of distinct fining-upward couplets that most likely represent single flood events, whereas in other instances they were individual massive beds. The sandy beds often exhibited lamina-

tions, with ripple laminations (normal ripples, climbing ripples, critical climbing ripples, and even supercritical climbing ripples) common (Figure 11b). Finer-textured beds were generally massive and lacked clear evidence of lamination or other sedimentary structures. None of these deposits exhibited evidence of significant pedogenic alteration.

In their study immediately south of Waco, Lim and Kahl (2001:12) noted the presence of "alternating strata of very firm, dark gray to dark reddish brown clay sometimes interbedded with thin strata of very fine sand." We observed a similar color continuum within the overbank muds in this project, with colors that ranged from dusky red to black, but two distinct groups emerged as end members, a dark-colored mud and a red mud (see Figure 11b, c). This color variation is the result of floods originating in different parts of the Brazos River catchment upstream of Waco.

The dark-colored muds are typical of streams that drain Cretaceous limestones in central Texas. There are several major Brazos River tributaries that may contribute such mud (e.g., the Bosque River, Aquilla Creek, the Paluxy River, and the Nolan River), but of these the most significant is the Bosque River, which accounts for about 6 percent of the Brazos River catchment above Waco and is the largest Brazos River tributary draining Cretaceous strata. Evidence that the muds of these streams are dark in color is readily available in the literature. For instance, Templin et al. (1958:47, as cited in Kvernes et al. 2000:3) described the deposits of the Bosque River as "grayish brown to dark grayish-brown calcareous alluvial soils made up of little-altered recent stream sediments," and the Holocene floodplain of the Bosque River immediately downstream of Lake Waco is mapped by Miller and Greenwade (2001) as the Frio Series, which consists of dark-colored (dark gray [10YR 3/1] to dark brown [7.5YR 3/2]) clay and silty clay.

During the fieldwork for this project, muds attributed to Bosque River floods were generally dark brown (7.5YR 3/2), dark gray (7.5YR 4/1), and brown (7.5YR 4/2 to 7.5YR 4/3) clay to silty clay. These deposits were generally thin (<2 cm), exhibited strong fine subangular blocky structure, and yielded a violent effervescent reaction with dilute hydrochloric acid. Rarely were these muds observed with sedimentary structures, and when they were they generally had horizontal laminations.

Although all of the deposits observed within the project area are Brazos River deposits, the muds attributed to floods originating in the upper Brazos River catchment were clearly much redder than the Bosque River muds, ranging in color from dusky red (2.5YR 3/3 to 2.5YR 3/4) to dark reddish brown (5YR 3/4 to 5YR 3/3) and reddish brown (5YR 4/3 to 5YR 4/4). These sediments were primarily clay to silty clay, generally exhibited strong fine angular blocky structure, occasionally exhibited pressure faces, and generally yielded a strong to violent reaction with dilute hydrochloric acid. There also was a wide range of muds with colors between these two ends, which represent floodwaters from both catchments.

As was common in the cores, several trenches exposed thick deposits of sand that appear to represent rapid sedimentation during single flood events. These deposits generally exhibited little variation in particle size and were prominently bedded with ripple laminations being the most common sedimentary structure, although parallel laminations/plane beds were also observed. Figure 12a shows one such deposit exposed in Trench 21, which was situated on the crest of the northern scroll bar ridge west of the pond, and another can be seen in Figure 13 (Zone 3). As with the thin-bedded, variable-texture floodplain facies deposits, none of the massive sands exhibited significant pedogenic alteration.

At the other end of the depositional spectrum were deposits associated with the flood basin facies. These deposits were primarily found north of the scroll bar ridges and south of the upper surface, on a broad, gently concave portion of the lower surface. These deposits generally consisted of clay and silty clay that, within the upper 60 to 80 cm of the profile, contained little or no evidence of bedding and occasionally exhibited pressure faces and slickensides. The flood basin muds were the only facies observed in the near-surface trench exposures that exhibited any significant evidence of pedogenic alteration, and generally these deposits exhibited weakly developed soils with either an A-AB-C or A-ABk-Bk soil profile where the Bk horizon was a stage I (filamentous) calcic horizon. One exposure of this facies (Trench 33, Figure 12b) contained a small number (<1 percent) of calcium carbonate

Figure 12. Photographs of Trenches 21 and 33. (a) View of Trench 21 showing a nearly 2-m-thick package of ripple-laminated sand (note the distinct 20–30-cm-thick bed sets that dip gently to the left [north]); (b) view of Trench 33 showing a massive distal flood basin facies shallowly buried beneath 85 cm of introduced earthen fill (note the soil formed in the deposit and the appearance of alternating-colored thin beds of mud below 1 m on the scale).

nodules that were 1–3 mm in diameter, but this deposit is thought to be of recent age. Trench 26 was excavated on the scarp between the upper and lower surfaces and revealed that the flood basin muds pinch out against the scarp (see Figure 13). Metal was present within the middle of Zone 1 (the flood basin muds) near the southern end of the trench.

Discussion

The depositional setting of the project area is ideal for in situ preservation of discrete occupation surfaces, but despite close inspection of 37 trench excavations, only one possible cultural feature was observed. This feature is a possible two-track dirt road observed near the southern end of Trench 35 (Figure 14). This trench was on the levee adjacent to the Brazos River east of the pond and exposed a series of discretely disturbed sediments that had abrupt concave lower boundaries and thin-bedded, laminated sandy sediment immediately above the concave base. The shape and appearance of these features bear a strong resemblance to a two-track dirt road, and examination of a historic aerial

Figure 13. Photograph and profile of the west wall of Trench 26 showing the distal floodplain deposit (Zone 1) pinching up the scarp toward the upper surface and massive sand deposit (Zone 3); note repeated cutting and filling represented by Zones 5–8.

image shows there was such a road close to this area at that time (Figure 15). There are quite a few animal burrows in the same stratigraphic position, which hinders complete confidence in this interpretation, but if this is a road it is worth noting that today it lies buried about 1 m below the ground surface. The only other place where cultural materials were observed in situ within alluvium (this excludes the introduced fills) was within Zone 1 in Trench 26, where wire nails were found in the middle of Zone 1 at a depth of approximately 50 cm.

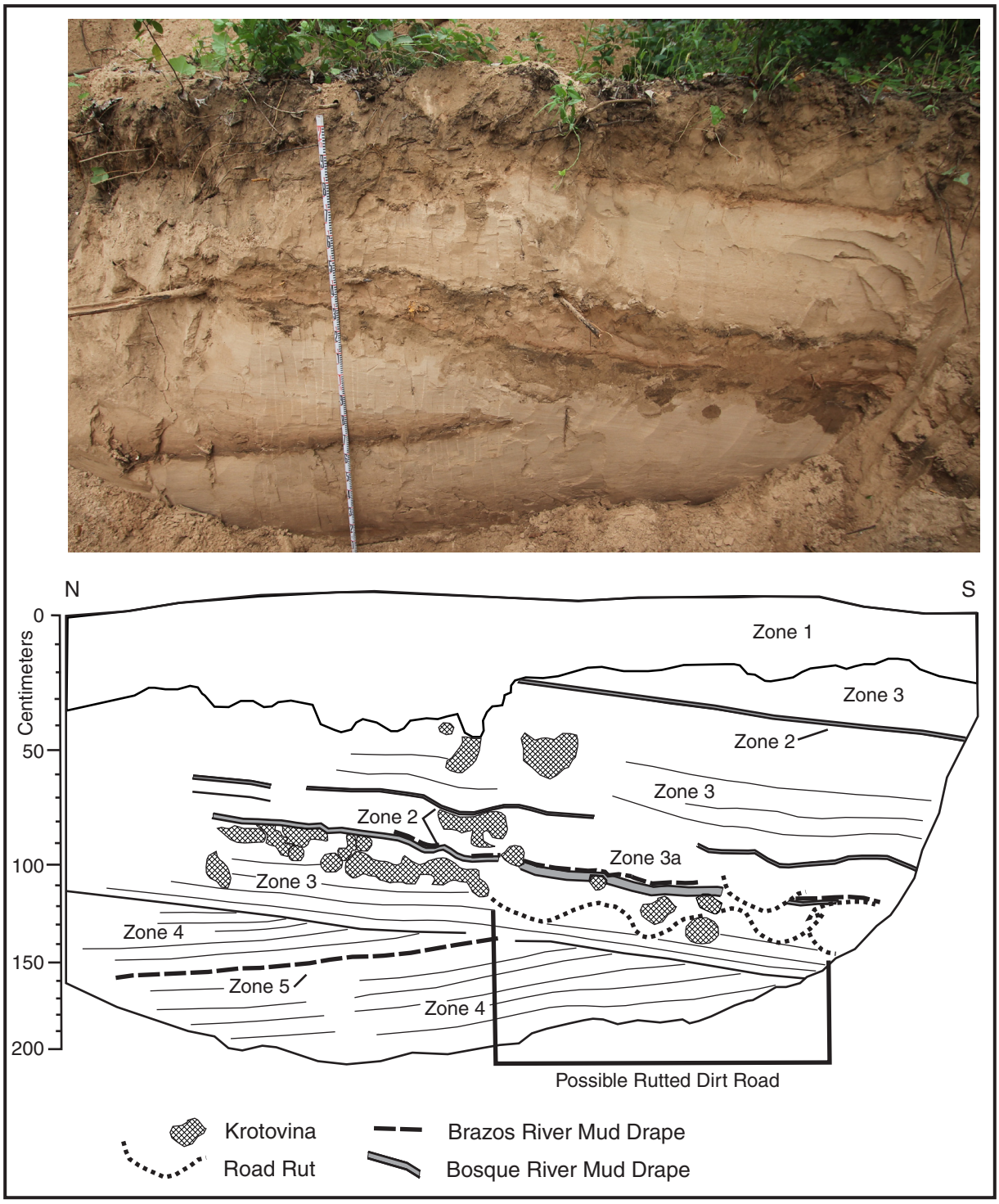


Figure 14. Photograph and profile of the east wall of Trench 35; note the concave features that may be stratigraphic vestiges of a two-track dirt road.

These observations, together with the lack of significant pedogenic alteration and well-preserved sedimentary structures in the sediments exposed by trenching and similar observations from the Geoprobe cores to depths of about 6 m, suggest that the near-surface deposits within

Figure 15. Historic aerial photograph showing location of Trench 35 near possible road.

the project area are of recent age, most likely correlating with Waters and Nordt's (1995) Unit V, which was deposited in the last 300 years or so. The lack of core samples from below 6 m makes it impossible to be certain of the age of the deposits below this depth, but it is likely that most of these deposits are associated with the same depositional unit. The presence of a buried soil 7.5 m below the top of the upper surface suggests that deep burial of cultural material of Holocene age is possible here, but confirmation of this would require radiocarbon dating of the soil.

ASSESSMENT AND RECOMMENDATIONS

Archeological and geoarcheological investigations consisting of pedestrian survey, excavation of 63 trenches, and extraction of 4 sediment cores were conducted for the 93-acre site of the proposed new Baylor University football stadium. Deep trench excavations were hampered by an elevated water table. As a result, most observations and interpretations of the alluvial history of the project area are limited to deposits at depths of 3 m or less, though the sediment cores did provide information to depths of 5.5–11.0 m. The investigations determined that all but the northern edge of the project area is on a lower alluvial surface that was created by a series of Brazos River flood events over the last 200–300 years and that has a very low potential for prehistoric archeological sites. All of the sediments exposed to depths of 2–3 m in the trenches relate to this recent deposition, and core data and other evidence suggest that these deposits extend to depths of at least 6 m and perhaps more, maybe even all the way to bedrock at depths of 11–16 m. The higher alluvial surface at the north edge of the project also is blanketed with these recent deposits, with a buried soil found through coring at a depth of 7.5 m suggesting that deep burial of cultural material of Holocene age is possible here.

Much of the project area will consist of parking and recreational vehicle lots where construction-related impacts will be no deeper than ca. 3 m, i.e., comparable to what was explored through trenching. The potential for impacts to archeological resources, particularly prehistoric sites, in these areas is low to nonexistent.

Even in the proposed stadium area where deep impacts will occur, the potential for encountering prehistoric archeological remains is low given the likelihood that the entire depositional sequence below the lower surface is less than 300 years old. The potential for the project to impact significant historic archeological sites also is considered low, since the area never saw much historic development and the parts that did have improvements in the early twentieth century have been disturbed extensively.

The survey identified a single historic archeological site on the surface along the north edge of the project area. This site, 41ML301, is a railroad bed that was abandoned between 1957 and 1970 and that was last owned and operated by the Southern Pacific Railroad. The railroad bed is a byproduct of the growth in transportation and development of Waco as a commercial hub that occurred in the late nineteenth century. This site is not considered significant because it lacks integrity and connections to significant events and people. Because of these factors, it is recommended that 41ML301 be considered ineligible for listing in the National Register of Historic Places.

Based on the results of these investigations, Prewitt and Associates, Inc., recommends that the project be allowed to proceed without additional archeological work. The single site found lacks significance, and the potential for significant undiscovered resources in the deeper deposits not examined through trenching is very low.

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Appendix: Trench Descriptions

Many of the trenches exposed repeated sequences of flood sediments alternating in texture and color; where these deposits occurred, they were grouped and deposits of similar color and texture were described as a single bed, in order to avoid long repetitive descriptions. All deposits are recent alluvium unless otherwise noted.

Trench 1

Location: 678772 E 3493179 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–54	Ap1	Yellowish red (5YR 5/6, m) silty clay loam, very firm, strong medium platy structure, abrupt wavy boundary, violently effervescent, heavily compacted introduced fill earth.
2	54–69	Ap2	Black (10YR 2/1, m) sandy clay, very firm, strong medium to coarse angular blocky structure, abrupt wavy boundary, violently effervescent, 3–5 percent coarse fragments which are 1–3 cm rounded limestone gravel, introduced fill earth heavily compacted by machinery.
3	69–122, 130–182, 189–215	C	Reddish brown (5YR 4.5/4, m) sandy loam, very friable, massive, clear to gradual smooth boundary, violently effervescent, prominent horizontal laminations, few ripple laminations, few (3–5 percent) <1-cm-wide worm passage features.
4	122–130, 182–189, 215–230	C	Reddish brown (5YR 5/4, m) to light reddish brown (5YR 6/4, m) loamy sand, very friable, massive, abrupt to clear smooth boundary, slightly effervescent, low-angle foresets to plane bed laminations, few (3–5 percent) <1-cm-wide worm passage features.
5	230–250	C	Reddish brown (5YR 4/4, m) silt loam, very friable, massive, violently effervescent, no obvious bedding.

Trench 2

Location: 678794 E 3493173 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–30	Ap1	Reddish brown (5YR 4/4, m) rubble-filled sandy clay loam, loose, single grain, clear irregular boundary, violently effervescent, 30–60 percent coarse fragments which range from concrete blocks to electrical wire, metal sheeting, and other construction material; modern introduced fill.
2	30–85	Ap2	Light reddish brown-reddish yellow (5YR 6/5, m) sandy loam, very friable, weak coarse platy structure, abrupt smooth boundary, violently effervescent, 3–5 percent coarse fragments which are mostly 1–3 cm rounded limestone gravel, moderately compacted introduced fill earth.
3	85–105	Ap3	Brown (7.5YR 4/3, m) sandy clay loam, friable, weak to moderate coarse subangular blocky structure, abrupt smooth boundary, violently effervescent, introduced earthen fill.
4	105–140	C	Reddish yellow (5YR 6/6, m) loamy sand, very friable, massive, abrupt smooth boundary, slightly effervescent, prominent horizontal laminations, 5–15 percent <1-cm-wide worm passages.
5	140–193	C	Reddish brown – yellowish red (5YR 5/5, m) sandy loam, very friable, massive, abrupt smooth boundary, violently effervescent, prominent ripple laminations, 5–15 percent <1-cm-wide worm passages.
6	193–226	C	Reddish yellow (5YR 6/6, m) loamy sand, very friable, massive, abrupt smooth boundary, slightly effervescent, prominent horizontal laminations, 1–3 percent <1-cm-wide worm passages.
7	226–245	C	Light reddish brown (5YR 6/4, m) loamy sand, very friable, massive to single grain, slightly effervescent, horizontal laminations.

Trench 3
Location: 678773 E 3493148 N NAD83
Comment: Entire trench exposure was introduced fill.

Zone	Depth (cm)	Horizon	Description
1	0–40	Ap1	Very dark gray (10YR 3/1, m) rubbly clay loam (but very variable texture), friable to very friable, weak to moderate coarse platy structure, clear wavy boundary, violently effervescent, 3–5 percent coarse fragments primarily composed of 1–3 cm rounded limestone gravel with a few large chunks of concrete (30x10 cm), includes some charcoal.
2	40–66, 72–86, 95–115	Ap2	Reddish brown (5YR 4/3, m) sandy clay, very friable, massive, abrupt irregular boundary, violently effervescent, few yellowish red (5YR 4/6) coats on ped faces.
3	66–72, 86–95	Ap3	Reddish brown (5YR 4/4, m) sandy clay loam, very friable, massive, abrupt irregular boundary, violently effervescent, 15 percent rounded aggregates of very dark gray (5YR 3/1) to dark reddish gray (5YR 4/2) silty clay.
4	115–175	Ap4	Brown (7.5YR 5/4, m) sandy clay loam, very friable, massive, abrupt smooth boundary, violently effervescent, many (10–15 percent) dark reddish gray (5YR 4/2) silty clay and a few lenticular beds of very dark gray (5YR 3/1) silty clay.
5	175–200	Ap5	Dark brown (7.5YR 3/2, m) clay to silty clay, very friable, massive, violently effervescent, many small (3–5 mm) rounded aggregates of reddish brown (5YR 4/4, m) mud.

Trench 4
Location: 678752 E 3493091 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–30	Ap	Dark brown (7.5YR 3/2, m) sandy clay loam, friable, moderate to strong medium platy structure, abrupt wavy boundary, violently effervescent, few (3–15 percent) coarse fragments, heavily compacted by equipment, introduced fill earth.
2	30–75	Ap	Light brown (7.5YR 6/4, m) sandy loam to weakly cemented concrete, rigid to very friable, massive, abrupt wavy boundary, violently effervescent, 15–30 percent coarse fragments, zone consists of a few 3–10-cm-thick discontinuous lenticular beds of concrete alternating with clean sandy aggregate, interpreted as concrete truck cleanout debris.
3	75–90	Ap	Dark brown (7.5YR 3/2, m) and reddish brown (5YR 4/4, m) silty clay loam, friable, weak coarse subangular blocky structure, clear wavy boundary, violently effervescent, fill earth composed of two similar-textured but different-colored materials dominated by dark brown silty clay loam which comprises about 70 percent of the deposit, introduced fill earth.
4	90–100	Ap	Dark brown (7.5YR 3/2, m) silty clay loam (40 percent) and reddish brown (5YR 5/4, m) sandy loam (60 percent), very friable, weak coarse subangular blocky structure, abrupt smooth boundary, violently effervescent, introduced fill earth.
5	100–130	C	Brown (7.5YR 4/3, m) clay loam to sandy clay, very friable, moderate coarse subangular blocky structure, gradual smooth boundary, violently effervescent, structure best expressed in the top 10 cm of the zone.
6	130–140, 154–162, 182–205	C	Reddish brown-yellowish red (5YR 5/5, m) loamy sand, very friable, massive, abrupt smooth boundary, slightly effervescent, no obvious bedding, few worm passages, interbedded with zones 7 and 8.

Zone	Depth (cm)	Horizon	Description
7	140–152, 173–178	C	Dark brown (7.5YR 3/2, m) silty clay loam, very friable, massive to weak fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River flood drape.
8	152–154, 167–173, 178–182, 205–220	C	Dark reddish brown (5YR 3/3, m) clay, firm, moderate very fine angular blocky structure, abrupt smooth boundary, slightly effervescent, few pressure faces, Brazos River flood muds.

Trench 5

Location: 678730 E 3493058 N NAD83

Note: Trenches 5 and 6 are on the north flank of a linear ridge. Trenches 7 and 8 are on the crest of the same ridge, and Trench 9 is on the south side of this ridge close to the modern Brazos River channel.

Zone	Depth (cm)	Horizon	Description
1	0–45	Ap	Brown (7.5YR 4/3, m) sandy clay loam, very friable, weak to moderate medium subangular blocky structure, abrupt wavy boundary, violently effervescent, looks disturbed.
2	45–54, 55–63	C	Brown (7.5YR 4/3, m) sandy clay loam, very friable, massive, abrupt irregular boundary, violently effervescent, horizontally laminated but only about 50 percent are preserved owing to extensive bioturbation.
3	54–55, 63–66, 106–107	C	Dark brown (7.5YR 3/2, m) silty clay, firm, strong fine subangular blocky structure, abrupt discontinuous, slightly effervescent, many worm passages, Bosque River mud.
4	66–97	C	Brown (7.5YR 5/4, m) sandy loam, very friable, massive, abrupt irregular boundary, strongly effervescent, traces of ripple laminations.
5	97–103, 107–110	C	Reddish brown (5YR 4/3, m) sandy clay loam, friable, moderate to strong fine subangular blocky structure, abrupt smooth boundary, few to common (3–5 percent) calcium carbonate filaments, Brazos River mud.
6	110–240	C	Brown (7.5YR 5/4, m) sand to loamy sand, very friable, massive to single grain, slightly to strongly effervescent, prominent ripple laminations.

Trench 6

Location: 678762 E 3493040 N NAD83

Note: Situated on north flank of linear floodplain ridge. Same basic position as Trench 5.

Zone	Depth (cm)	Horizon	Description
1	0–22	Ap	Brown (7.5YR 5/4, m) sandy loam to gravelly sandy loam, loose to slightly hard, weak medium to coarse platy structure, abrupt smooth boundary, violently effervescent, residuum from cement truck cleaning, introduced fill.
2	22–43	Ap	Dark brown (7.5YR 3/2, m) silty clay loam, firm, strong medium to coarse platy structure most prominent in top 20 cm, abrupt smooth boundary, strongly effervescent, few (3–5 percent) calcium carbonate filaments, compacted by machinery.
3	43–49	C	Brown (7.5YR 5/4 to 4/3, m) sandy loam to loam, very friable, massive, abrupt irregular boundary, laminated in places, more than 50 percent worm passages.
4	49–57, 78–80, 107–109, 112–114	C	Brown (7.5YR 4/2, m) clay, firm, strong fine angular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.

Zone	Depth (cm)	Horizon	Description
5	57–78, 82–105, 114–230	C	Light reddish brown (5YR 6/4, m) sand to loamy sand, very friable, massive, abrupt smooth boundary, slightly effervescent, prominent ripple laminations (critical and supercritical climbing ripples) and plane bed at the very base of the profile.
6	80–82, 105–107	C	Dark reddish brown (5YR 3/3, m) clay, friable to firm, moderate to strong fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Brazos River mud.

Trench 7

Location: 678749 E 3493025 N NAD83

Note: Mud drapes that were prominent components of the deposits in Trenches 5 and 6 are not visible as distinct beds here but as dark bands that look like soil A horizons.

Zone	Depth (cm)	Horizon	Description
1	0–25	A	Brown (7.5YR 4.5/3, m) sandy clay loam, very friable, weak to moderate medium subangular blocky structure, clear smooth boundary, violently effervescent, few (1–3 percent) coarse fragments; looks like an A horizon but may simply be welded and bioturbated mud drapes.
2	25–55	C	Brown (7.5YR 5/4, m) loamy sand, very friable, massive, abrupt irregular boundary, violently effervescent, prominent ripple laminations (critical and supercritical climbing ripples).
3	55–67	2Ab	Brown (7.5YR 4/3, m) sandy loam, friable, weak medium subangular blocky structure, gradual smooth boundary, strongly effervescent, common (5–7 percent) calcium carbonate filaments; a disturbance containing charcoal and small snail shells penetrating this zone is probably a burned tree stump or fence post.
4	67–240	2C	Brown (7.5YR 5/4, m) sand, very friable, massive to single grain, slightly effervescent, ripple laminated down to 200 cm below which it exhibited plane bedding.

Trench 8

Location: 678717 E 3493041 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–15	Ap	Brown (7.5YR 4/3, m) to white (10YR 8/1, m) sandy loam to slightly gravelly sandy loam, very friable to rigid, massive, abrupt smooth boundary, violently effervescent, 15–25 percent coarse fragments, few thin lenticular beds of cement interbedded with washed sandy residue derived from the cleaning of concrete trucks, introduced fill.
2	15–45	Ap	Brown (7.5YR 4/3, m) sandy loam, firm to friable, strong medium to fine platy structure, abrupt smooth boundary, violently effervescent, prominent platy structure caused by compaction, possibly an introduced fill earth.
3	45–63	Ab	Brown (7.5YR 4/3 to 3/3, m) loam to silt loam, friable, moderate medium subangular blocky structure, clear smooth boundary, violently effervescent, few (1–3 percent) calcium carbonate filaments.
4	63–81	C	Brown (7.5YR 4/3 to 5/3, m) sandy loam to loam, friable, moderate medium subangular blocky structure, clear to abrupt smooth boundary, violently effervescent, horizontal laminations, 40–50 percent disturbed by worm passages.
5	81–84	C	Dark brown (7.5YR 3/2, m) silty clay, firm to friable, strong fine to very fine subangular blocky structure, abrupt smooth boundary, violently effervescent, few (1–3 percent) calcium carbonate filaments, Bosque River mud.
6	84–90	C	Brown (7.5YR 4/3, m) silty clay, very friable, weak fine subangular blocky structure, clear smooth boundary, violently effervescent, few (1–3 percent) calcium carbonate filaments, Brazos River mud.

Zone	Depth (cm)	Horizon	Description
7	90–119, 130–200	C	Light brown (7.5YR 6/4, m) loamy sand to sand, very friable, massive, abrupt smooth boundary, slightly effervescent, prominent ripple laminations (critical and supercritical climbing ripples).
8	119–130	C	Reddish brown (5YR 4/4, m) sandy clay loam, very friable, weak fine subangular blocky structure, violently effervescent, probably multiple thin mud drapes but cannot distinguish individual laminae.

Trench 9

Location: 678662 E 3493005 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–30	Ap	Brown (7.5YR 5/3, m) loamy sand to slightly gravelly loamy sand, slightly hard, moderate fine to medium platy structure, abrupt smooth boundary, violently effervescent, 5–20 percent coarse fragments, introduced fill.
2	30–65, 69–205	C	Light brown (7.5YR 6/4, m) sand to loamy sand, very friable to loose, massive to single grain, abrupt smooth boundary, slightly effervescent, prominent ripple laminations (critical and supercritical climbing ripples).
3	65–70	C	Pink (7.5YR 7/4, m) sand, loose, single grain, clear smooth boundary, slightly effervescent, prominent ripple laminations.
4	205–206, 224–225	C	Brown (7.5YR 4/2, m) silty clay loam, firm, weak medium to fine subangular blocky structure, abrupt smooth boundary, violently effervescent, common (3–5 percent) calcium carbonate filaments, Bosque River mud.
5	206–213, 225–240	C	Reddish brown (5YR 4/4, m) silty clay loam, firm, weak medium subangular blocky structure, abrupt smooth boundary, violently effervescent, 3 percent calcium carbonate filaments, Brazos River mud.
6	213–224	C	Brown (7.5YR 4/3, m) loamy sand, very friable, massive, strongly effervescent.

Trench 10

Location: 678648 E 3492940 N NAD83

Note: This trench was placed into the levee adjacent to modern Brazos River.

Zone	Depth (cm)	Horizon	Description
1	0–60	Ap	Reddish brown (5YR 4/4, m) sandy loam, friable, massive to strong fine prismatic structure, abrupt smooth boundary, strongly effervescent, contains 3–10 percent coarse fragments some of which are asphalt and other construction material, introduced fill earth.
2	60–82	C	Brown (7.5YR 5/4, m) loamy sand, very friable, massive, abrupt smooth boundary, slightly effervescent.
3	82–84, 152–155	C	Brown (7.5YR 4/3, m) sandy loam, very friable, weak fine subangular blocky structure, abrupt smooth to irregular boundary, violently effervescent.
4	84–90, 114–152, 156–200	C	Light brown (7.5YR 6/3, m) medium sand, loose to very friable, single grain, abrupt smooth boundary, strongly effervescent, ripple laminated in places.
5	90–100, 133–140	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, massive, abrupt smooth boundary, violently effervescent.
6	100–113, 120–133	C	Brown (7.5YR 5/4, m) loamy sand to sand, very friable, massive, abrupt smooth boundary, strongly effervescent, prominent ripple laminations.
7	113–120	C	Reddish brown (5YR 4/3, m) sandy loam, very friable, massive abrupt smooth boundary, violently effervescent.

Trench 11
Location: 678717 E 3492899 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–63	Ap	Brown (7.5YR 5/4, m) sandy loam with ca. 15 percent inclusions of rounded fragment of brown (7.5YR 4/2, m) silty clay loam, very friable, massive, abrupt smooth boundary, introduced fill.
2	63–80	C	Pink (7.5YR 7/4, m) sand, very friable, massive, abrupt smooth boundary, slightly effervescent, crevasse splay deposit, pinches significantly within the trench away from the river, plane bedded to low-angle foresets.
3	80–105	C	Reddish brown (5YR 5/4, m) loamy sand, very friable, massive abrupt wavy boundary, slightly effervescent.
4	105–108, 128–130, 132–134, 146–150, 176–182	C	Brown (7.5YR 4/2, m) clay loam, friable, weak fine to medium subangular blocky structure, abrupt wavy boundary, strongly effervescent, Bosque River mud.
5	108–128, 130–132, 134–146, 150–176	C	Light reddish brown-reddish yellow (5YR 6/4, m) sand to loamy sand, very friable, massive to single grain, abrupt wavy boundary, ripple laminated.
6	182–200	C	Reddish brown (5YR 4/3, m) sandy clay loam to silty clay loam, friable to firm, weak to moderate fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Brazos River mud.

Trench 12
Location: 678728 E 3492928 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–155	Ap	Pink (7.5YR 7/4, m) sand with variable amounts (<5 to >75 percent) of brown (7.5YR 4/2, m) silty clay loam rounded aggregates, the lower part of which is a dirt clod diamicton with a sand matrix, very friable, massive to strong medium to fine platy structure, abrupt wavy boundary, violently effervescent.
2	155–250	C	Reddish yellow (5YR 6/6, m) loamy sand, very friable, massive, abrupt smooth boundary, strongly effervescent, plane bed at 220–250 cm and supercritical climbing ripples above that.
3	250–260	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, massive, strongly effervescent.

Trench 13
Location: 678785 E 3493011 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–19	Ap	Brown (7.5YR 4/3, m) sandy loam, very friable, weak medium to very coarse platy structure, abrupt smooth boundary, violently effervescent, slightly disturbed and compacted.
2	19–21	C	Dark brown (7.5YR 3/2, m) loam, friable to firm, moderate to strong fine to medium subangular blocky structure, abrupt smooth boundary, violently effervescent, heavily bioturbated by worms, Bosque River mud.
3	21–25	C	Reddish brown (5YR 4/4, m) loamy sand to sand, loose to very friable, massive, abrupt smooth boundary, slightly effervescent.
4	25–54	C	Reddish brown (5YR 5/4, m) sand, very friable, massive, abrupt wavy boundary, strongly effervescent, supercritical climbing ripples, few worm passages.

Zone	Depth (cm)	Horizon	Description
5	54–58	C	Light reddish brown (5YR 6/4, m) sand, loose, single grain, abrupt wavy to irregular boundary, strongly effervescent, few worm passages.
6	58–68	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, weak fine subangular blocky structure, clear smooth boundary, violently effervescent, looks like a soil but is most likely several welded mud drapes disturbed by numerous worm passage features.
7	68–85	C	Reddish brown-light reddish brown (5YR 5.5/4, m) loamy sand, very friable, massive, gradual smooth boundary, violently effervescent, few traces of lamination.
8	85–280	C	Light brown (7.5YR 6/4, m) sand, loose to very friable, massive slightly effervescent, prominent supercritical climbing ripples down to 220 cm after which deposit exhibits plane bed laminations.

Trench 14

Location: 678800 E 3493034 N NAD83

Comment: Trench is situated in a swale

Zone	Depth (cm)	Horizon	Description
1	0–30		Dark brown (7.5YR 3/2, m) sandy clay loam, friable, weak to moderate fine subangular blocky structure parting to moderate fine to medium platy structure, abrupt smooth boundary, violently effervescent, 3–10 percent coarse fragments, introduced fill.
2	30–55		Brown (7.5YR 4/3, m) sandy clay, firm, moderate fine to medium subangular blocky structure, abrupt smooth boundary, violently effervescent, few (1–3 percent) calcium carbonate filaments, common (30–40 percent) calcium carbonate coats n ped faces, probably Bosque River mud.
3	55–75		Brown (7.5YR 5/4, m) loamy sand, very friable, massive, violently effervescent, clear irregular boundary, violently effervescent, many worm passages (35–40 percent), traces of supercritical climbing ripple laminations.
4	75–80, 93–94, 138–142, 144–152		Brown (7.5YR 4/3, m) sandy clay, firm, moderate to strong fine angular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.
5	80–92, 90–93, 94–95, 132–138, 142–144		Dark reddish brown (5YR 3/3, m) to reddish brown (5YR 4/3, m) clay, friable, weak fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Brazos River mud.
6	152–170		Yellowish red (5YR5/6, m) loamy sand, very friable, massive, gradual smooth boundary, strongly effervescent, few (1 percent) calcium carbonate filaments, traces of laminations.
7	170–200		Light brown (7.5YR 6/4, m) sand, very friable, massive, slightly effervescent, prominent supercritical climbing ripple laminations.

Trench 15

Location: 678824 E 3493060 N NAD83

Comment: Trench is situated in a swale.

Zone	Depth (cm)	Horizon	Description
1	0–10	Ap1	Variable-textured introduced gravelly fill, not described in detail.
2	10–65	Ap2	Dark brown (7.5YR 3/2, m) clay, hard, strong medium to coarse platy structure, abrupt smooth boundary, violently effervescent, few (3–10 percent) coarse fragments, introduced fill.

Zone	Depth (cm)	Horizon	Description
3	65–85	Akp	Brown (7.5YR 4/3, m) clay, very firm, strong very coarse angular blocky structure, gradual smooth boundary, strongly effervescent, common to many (3–15 percent) calcium carbonate filaments, common very dark gray (7.5YR 3/1) organic matter(?) coats on ped faces, few snails, possibly disturbed.
4	85–105	AC	Brown (7.5YR 4/3, m) clay, firm, moderate to strong very coarse angular blocky structure, clear smooth boundary, strongly effervescent, few (1 percent) calcium carbonate filaments.
5	105–112, 140–154, 175–180	C	Reddish brown (5YR 4/4, m) sandy loam, friable, massive, abrupt smooth to wavy boundary, strongly effervescent.
6	113–125, 132–138, 158–164	C	Dark brown (7.5YR 3/3, m) clay, friable, strong fine angular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.
7	125–127, 138–140, 154–158, 164–166	C	Dusky red (2.5YR3/4, m) to reddish brown (5YR 4/4, m) clay, friable, moderate fine angular blocky structure, abrupt smooth boundary, violently effervescent, Brazos River mud.

Trench 16

Location: 678844 E 3493116 N NAD83

Comment: Trench is situated in a swale.

Zone	Depth (cm)	Horizon	Description
1	0–25	Ap	Brown (7.5YR 4/3, m) sandy clay loam, friable, strong medium to coarse platy structure, abrupt smooth boundary, violently effervescent, few (1–3 percent) coarse fragments, disturbed.
2	25–66	Ak	Brown (7.5YR 4/4, m) silty clay, firm, strong medium to coarse subangular blocky structure, abrupt smooth boundary, violently effervescent, few (1–3 percent) calcium carbonate filaments on ped faces, many (30–40 percent) worm passage features.
3	66–68, 78–80	C	Very dark gray-very dark grayish brown (10YR 3/1.5, m) clay, firm, strong very fine angular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.
4	68–78, 80–98	C	Dark reddish brown (5YR 3/3, m) clay, friable, moderate medium to fine subangular blocky structure, clear smooth boundary, strongly effervescent, Brazos River mud.
5	98–105	C	Reddish brown-yellowish red (5YR 4/5, m) sandy loam, very friable, massive to weak fine subangular blocky structure, gradual smooth boundary, strongly effervescent, few very dark gray (10YR 3/1) clay (or manganese?) coats on ped faces.
6	105–180	C	Reddish brown (5YR 4/4, m) to yellowish red (5YR 5/6, m) sand, very friable, massive, slightly effervescent, prominent horizontal plane bed laminations.

Trench 17

Location: 678854 E 3493054 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–35	Ap	Dark brown (7.5YR 3/2, m) silty clay, very hard, strong medium subangular blocky structure parting to strong fine to medium platy structure, clear smooth boundary, violently effervescent, compacted by heavy machinery.
2	35–72	A	Dark brown (7.5YR 3/2.5, m) sandy clay, very hard, strong medium to fine angular blocky structure, abrupt smooth boundary, strongly effervescent, few (1–3 percent) calcium carbonate filaments.

Zone	Depth (cm)	Horizon	Description
3	72–92	C	Brown (7.5YR 5/4, m) loam, very friable, weak medium subangular blocky structure to massive, abrupt smooth boundary, violently effervescent, many (30–45 percent) worm passage features, prominent supercritical climbing ripples.
4	82–85, 130–133	C	Dark brown (7.5YR 3/2, m) clay, friable to firm, moderate fine subangular blocky structure, abrupt smooth boundary, violently effervescent, few (10 percent) worm passage features, Bosque River mud.
5	85–108, 118–121, 121–130, 133–146	C	Dark reddish brown (5YR 3/3, m) clay, friable to firm, strong medium subangular blocky structure, abrupt smooth boundary, violently effervescent, few pressure faces, Brazos River mud.
6	108–118, 146–180	C	Brown (7.5YR 5/4, m) sand to loamy sand, very friable, massive, slightly effervescent, no obvious bedding.

Trench 18

Location: 678833 E 3493015 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–76	Ap	Dark brown (7.5YR 3/2, m) silty clay, extremely hard, strong coarse to very coarse platy structure parting to strong coarse to medium angular blocky structure, abrupt smooth boundary, strongly effervescent, 1 percent calcium carbonate filaments, 1–3 percent coarse fragments which are mostly rounded limestone gravels, introduced fill.
2	76–92	C	Brown (7.5YR 5/4, m) loam, very friable, massive, abrupt smooth boundary, strongly effervescent, 1 percent calcium carbonate filaments, few ripple laminations, many (20–30 percent) worm passage features.
3	92–94, 100–104, 137–142	C	Dark brown (7.5YR 3/2, m) sandy clay, friable, moderate fine subangular blocky structure, abrupt smooth boundary, strongly effervescent, Bosque River mud.
4	94–100, 104–108, 131–137, 142–145, 150–154	C	Dusky red (2.5YR 3/4, m) clay, friable, moderate very fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Brazos River mud.
5	154–170	C	Reddish brown (5YR 5/4, m) sand to loamy sand, very friable, massive, clear smooth boundary, strongly effervescent.
6	170–230	C	Light brown (7.5YR 6/4, m) sand, very friable to loose, massive, slightly effervescent, prominent parallel horizontal laminations.

Trench 19

Location: 678826 E 3492997 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–27	Ap	Brown (7.5YR 4/3, m) sandy loam, slightly hard, weak very coarse platy structure, abrupt smooth boundary, strongly effervescent, 15–20 percent coarse fragments which are 2–5 cm rounded limestone gravel, introduced fill.
2	27–60	Ap	Brown (7.5YR 4/3, m) silty clay to loam, extremely hard, strong very coarse to coarse angular blocky structure, abrupt smooth boundary, strongly effervescent, 15–20 percent dark brown (7.5YR 3/2, m) coats on ped faces.
3	60–80	C	Brown (7.5YR 5/3, m) loamy sand, friable, massive to weak coarse subangular blocky structure, abrupt smooth boundary, strongly effervescent, 20–30 percent worm passage features.
4	80–82, 92–93, 126–127	C	Dark brown-brown (7.5YR 3.5/2, m) clay, firm, moderate to strong fine subangular blocky structure, abrupt smooth boundary, strongly effervescent, Bosque River mud.

Zone	Depth (cm)	Horizon	Description
5	82–85, 93–95, 122–126, 127–135	C	Dark reddish brown (5YR 3/4, m) clay, friable, weak very fine subangular blocky structure, abrupt smooth boundary, strongly effervescent, Brazos River mud.
6	93–122	C	Brown (7.5YR 5/4, m) loamy sand, very friable, weak medium subangular blocky structure, abrupt smooth boundary, strongly effervescent, 10–15 percent worm passages.
7	135–160	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, massive, gradual smooth boundary, slightly effervescent.
8	160–200	C	Brown (7.5YR 5/4, m) to pink (7.5YR 7/3, m) sand, loose to very friable, massive, slightly effervescent, prominent low-angle foresets.

Trench 20
Location: 678767 E 3492883 N NAD83
Trench was not entered due to instability.

Trench 21
Location: 678843 E 3492980 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–17	Bw	Reddish brown-yellowish red (5YR 5/5, m) loamy sand, very friable, massive, clear wavy boundary, strongly effervescent, no obvious sedimentary structures or bedding.
2	18–185	C	Light brown (7.5YR 6/4, m) sand to loamy sand, very friable, massive, slightly effervescent, above 140 cm sediments are ripple laminated and grouped into ca. 20-cm-thick bed sets that dip gently to the northeast at about 3˚ away from the river, below 140 cm this zone exhibits horizontal parallel laminations.

Trench 22
Location: 678862 E 3493005 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–20	Ap	Dark brown (7.5YR 3/3, m) sandy clay loam, very friable, weak to moderate coarse platy structure, abrupt smooth boundary, violently effervescent, 1–3 percent coarse fragments that are 1–5 cm diameter rounded limestone gravels, introduced fill.
2	20–32	Ap	Brown (7.5YR 5/4, m) sandy loam, very friable, massive to weak fine platy structure, abrupt smooth boundary, violently effervescent, introduced fill.
3	32–70	Akb	Dark reddish gray (5YR 4/2, m) silty clay, firm, strong very coarse platy structure in top 15 cm of zone and moderate to strong coarse subangular blocky structure below that, clear wavy boundary, violently effervescent, common (5–7 percent) calcium carbonate filaments, top of zone compacted by machinery.
4	70–86, 109–131	C	Brown (7.5YR 5/4, m) sandy loam, very friable, massive, abrupt irregular boundary, violently effervescent, 40–40 percent worm passage features, prominent super-critically climbing ripples.
5	86–90, 105–106, 138–140	C	Dark gray (7.5YR 4/1, m) silty clay, friable, moderate fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.
6	90–92, 103–105, 106–109, 131–138, 140–150	C	Reddish brown (5YR 4/3, m) clay, friable to firm, weak very fine subangular blocky structure, abrupt smooth boundary, strongly to violently effervescent, Brazos River mud.

Zone	Depth (cm)	Horizon	Description
7	92–103	C	Reddish brown (5YR 4/4, m) loam, very friable, massive, abrupt irregular boundary, strongly effervescent.
8	150–170	C	Reddish brown (5YR 4/4, m) loam, very friable, weak medium to fine subangular blocky structure, gradual smooth boundary, strongly effervescent, 3–10 percent worm passage features.
9	170–220	C	Brown (7.5YR 5/4, m) sand to loamy sand, very friable, massive, slightly effervescent, ripple laminated.

Trench 23

Location: 678884 E 3493050 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–37	Ap	Brown (7.5YR 4/3, m) silty clay, very firm, strong very coarse platy structure parting to strong medium to coarse subangular blocky structure, abrupt smooth boundary, strongly effervescent, few to common dark brown-brown (7.5YR 3.5/2) coats on ped faces, zone appears to be disturbed by heavy machinery.
2	37–58	A	Brown (7.5YR 4/2, m) clay, firm, strong medium to fine subangular blocky structure, clear irregular boundary, strongly to violently effervescent.
3	58–68	C	Light brown (7.5YR 6/4, m) sandy loam, very friable, weak medium subangular blocky structure to massive, abrupt irregular boundary, violently effervescent, many (15–30 percent) worm passage features, prominent super critically climbing ripple laminations.
4	68–73	C	Dark brown-brown (7.5YR 3.5/2, m) clay, firm, strong medium to fine subangular blocky structure, abrupt smooth boundary, strongly effervescent, Bosque River mud.
5	73–95, 106–115, 120–122, 122–132, 156–165	C	Dusky red (2.5YR 3/4, m) to reddish brown (5YR 4/3, m) clay, firm, strong medium to fine subangular blocky structure, abrupt smooth to wavy boundary, strongly effervescent, Brazos River mud.
6	132–156, 165–170	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, massive, violently effervescent.

Trench 24

Location: 678898 E 3492989 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–12	Ap	Brown (7.5YR 4/3, m) loam, friable, moderate coarse platy structure, abrupt smooth boundary, violently effervescent, introduced fill?
2	12–24	Ap	Brown (7.5YR 4/3, m) loam, very friable, moderate fine to medium platy structure, abrupt wavy boundary, violently effervescent, few (1 percent) calcium carbonate filaments on ped faces.
3	24–26, 30–34, 72–74, 75–80	C	Dark brown (7.5YR 3/2, m) silty clay, firm, moderate to strong fine angular blocky structure, abrupt smooth boundary, violently effervescent, occasionally horizontal laminations, Bosque River mud.
4	26–28, 34–43, 65–70, 73–75, 80–92	C	Dusky red (2.5YR 3/3, m) to dark reddish brown (5YR 3/3, m) clay, firm, moderate to strong fine subangular blocky structure, abrupt smooth boundary, strongly effervescent, Brazos River mud.
5	28–30, 43–65	C	Reddish brown (5YR 5/4, m) loamy sand, very friable, massive, abrupt smooth boundary, strongly effervescent, prominent super critical climbing ripple laminations.

Zone	Depth (cm)	Horizon	Description
6	92–160	C	Brown-light brown (7.5YR 5/4, m) sand, very friable, massive, slightly effervescent.

Trench 25

Location: 678922 E 3493025 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–23	Ap	Dark brown (7.5YR 3/2, m) loam, firm, strong extremely coarse subangular blocky structure, abrupt wavy boundary, violently effervescent, compacted by machinery.
2	23–29	C	Brown (7.5YR 5/4, m) and very dark gray (7.5YR 3/1, m) loam, very friable, weak to moderate fine subangular blocky structure, abrupt smooth boundary, violently effervescent, many (50–60 percent) worm passage features.
3	29–60	C	Very dark gray-dark brown (7.5YR 3/1.5, m) sandy clay, very firm, strong coarse to medium subangular blocky structure parting to strong fine subangular blocky structure, clear to abrupt smooth boundary, violently effervescent.
4	60–67	C	Brown (7.5YR 5/4, m) and brown (7.5YR 4/2, m) clay loam, friable, weak to moderate fine subangular blocky structure, abrupt smooth boundary, violently effervescent, many (50–60 percent) worm passage features.
5	67–75, 90–92, 105–106, 132–135, 138–150	C	Very dark gray-dark brown (7.5YR 3/1.5, m) silty clay, firm to friable, strong fine to very fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.
6	75–90, 110–122	C	Brown (7.5YR 5/4, m) loam, very friable, massive, abrupt smooth boundary, violently effervescent.
7	92–105, 106–110, 122–132, 135–138	C	Dusky red (2.5YR 3/4, m) clay, firm, weak to moderate fine subangular blocky structure, abrupt smooth boundary, strongly effervescent, Brazos River mud.
8	150–175	C	Brown (7.5YR 5/4, m) loamy sand, very friable, massive strongly effervescent.

Trench 26

Location: 679014 E 3493186 N NAD83

Comment: The trench was placed on the scarp between the lower surface and the upper surface and revealed a suite of deposits that dipped towards the modern river (south). Multiple beds within this trench dipped significantly.

Zone	Depth (cm)	Horizon	Description
1	--	A	Brown (7.5YR 5/2, m) sandy clay, firm, strong coarse to moderate subangular blocky structure, gradual smooth boundary, violently effervescent, cumulic A horizon.
2	--	C	Reddish brown (5YR 4/4, m) loam, very friable, massive clear wavy boundary, violently effervescent.
3	--	C	Light brown (7.5YR 6/3, m) sand, loose to very friable, single grain, abrupt smooth boundary, slightly effervescent, prominent parallel laminations that follow the lower boundary of this zone.
4	--	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, massive, abrupt smooth boundary, slightly effervescent, few faint laminations.
5	--	C	Brown (7.5YR 4/3, m) sandy loam, very friable, massive, abrupt wavy boundary, violently effervescent, faintly visible ripple and parallel laminations, top of this deposit was eroded prior to deposition of Zone 3.

Zone	Depth (cm)	Horizon	Description
6	--	C	Light brown (7.5YR 6/4, m) sand to loamy sand, very friable, massive, abrupt smooth boundary, slightly effervescent, distinct parallel laminations that dip gently to the south, this deposit was eroded before deposition of zone 5.
7	--	C	Brown (7.5YR 5/4, m) slightly gravelly sandy loam to sand, very friable to loose, single grain, abrupt smooth boundary, violently effervescent, 2–15 percent coarse, few of which are rounded 1–4 mm rip up clasts of reddish brown (5YR 4/4, m) mud.
8	--	C	Reddish brown (5YR 4/4, m) loam, very friable, massive to weak medium subangular blocky structure, slightly effervescent, an eroded fragment of stratified floodplain sediment truncated before deposition of Zones 6 and 7.

Trench 27

Location: 679038 E 3493188 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–47	Ap	Brown (7.5YR 4/3, m) slightly gravelly loamy sand, slightly hard, weak very coarse subangular blocky structure parting to moderate fine platy structure, abrupt wavy boundary, violently effervescent, 15–20 percent coarse fragments which are primarily 103 mm rounded siliceous pebbles.
2	20–35	C	Pinkish gray (7.5YR 7/2, m) sand, loose, single grain, abrupt smooth boundary, slightly effervescent, prominent parallel horizontal laminations.
3	47–183	C	Reddish brown (5YR 5/4, m) sand, loose to very friable, massive, abrupt wavy boundary, slightly effervescent, prominent super critically climbing ripple laminations, slightly obscured in top 20 cm of zone.
4	183–185	C	Reddish brown (5YR 4/4, m) sandy clay, very friable, massive, abrupt irregular boundary, strongly effervescent.
5	185–220	C	Light brown (7.5YR 6/4, m) sand, very friable to loose, massive, abrupt irregular boundary, slightly effervescent, low angle foresets to ripple laminations.

Trench 28

Location: 679040 E 3493149 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–40	A1	Dark brown (7.5YR 3/2, m) sandy clay, firm, weak to moderate coarse subangular blocky structure, diffuse smooth boundary, strongly effervescent.
2	40–90	A2	Dark reddish brown (5YR 3/2, m) clay, friable, weak medium subangular blocky structure, gradual smooth boundary, strongly effervescent.
3	90–120	ACss	Dark gray (5YR 4/1, m) clay, firm, moderate to strong medium subangular blocky structure, diffuse smooth boundary, strongly effervescent, many pressure faces, few prominent slickensides on ped faces.
4	120–160	Css	Dusky red (2.5YR 3/3, m) clay, firm, moderate to strong fine to medium subangular blocky structure, abrupt smooth boundary, many distinct pressure faces and a few prominent slickensides on ped faces.
5	160–180	C	Reddish brown (5YR 4/4, m) loam, very friable, weak medium subangular blocky structure, strongly effervescent, few fine (1–3 mm) dark gray (7.5YR 3/1) redox (iron) depletions around pores.

Trench 29
Location: 679056 E 3493094 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–40	A	Dark brown (7.5YR 3/2, m) sandy clay, firm to friable, strong very coarse platy structure parting to strong medium to coarse subangular blocky structure, clear smooth boundary, strongly effervescent.
2	40–80	Bw	Strong brown (7.5YR 4/6, m) loam, friable, moderate to strong medium subangular blocky structure, clear smooth boundary, common (3–5 percent) calcium carbonate filaments, common brown (7.5YR 4/3, m) clay coats on ped faces, 20–30 percent 0.5 cm wide worm passages, no obvious bedding or sedimentary structures.
3	80–190	C	Reddish brown (5YR 4/4, m) sand, vey friable, massive, strongly effervescent, prominent horizontal parallel laminations.

Trench 30
Location: 679157 E 3493049 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–35	A	Dark brown (7.5YR 3/2, m) clay loam, firm, strong medium to coarse subangular blocky structure, gradual smooth boundary, strongly effervescent.
2	35–65	ABkss	Reddish brown (5YR 4/3, m) clay, very friable to firm, strong medium to very fine subangular blocky structure, clear smooth boundary, strongly effervescent, common (3–5 percent) calcium carbonate filaments, many pressure faces, few slickensides.
3	65–75	Bw	Brown (7.5YR 4/4, m) loam, very friable, weak to moderate subangular blocky structure, clear smooth boundary, few (1 percent) calcium carbonate filaments, slightly effervescent, 20–30 percent 0.5 cm wide worm passages.
4	75–140	C	Brown (7.5YR 4/4, m) loamy sand, very friable, massive, slightly effervescent, prominent ripple laminations.

Trench 31
Location: 679327 E 3492975 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–10	A	Dark brown (7.5YR 3/2, m) silty clay loam, very hard, weak to moderate subangular blocky structure, clear smooth boundary, strongly effervescent.
2	10–43	A	Very dark brown (7.5YR 2.5/2) silty clay, very hard, strong very coarse platy structure parting to strong coarse to medium subangular blocky structure, gradual smooth boundary, strongly effervescent, few 1–2 mm faint manganese coats on ped faces, cumulic soil.
3	43–70	AB	Dark reddish brown (5YR 3/4, m) and brown (7.5YR 4/2, m) sandy clay, firm, weak coarse subangular blocky structure parting to weak to moderate coarse subangular blocky structure, gradual smooth boundary, strongly effervescent, colors are about equal amounts of both.
4	70–81, 90–110	C	Reddish brown (5YR 4/4, m) loam, friable, weak to moderate medium subangular blocky structure, abrupt irregular boundary, strongly effervescent.
5	81–90	C	Dark reddish brown (5YR 3/3, m) sandy clay, firm, massive, abrupt irregular boundary, slightly effervescent, few (1–3 percent) calcium carbonate filaments.
6	110–150	C	Reddish brown (5YR 4/4, m) sandy loam, very friable, massive, slightly effervescent, ripple laminated.

Trench 32

Location: 67933 E 3492902 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–28	Ap	Light brown (7.5YR 6/4, m) sand, loose to single grain, massive, abrupt wavy boundary, slightly effervescent, contains suspended fragments up to 7 cm in diameter of Zone 2, introduced fill, probably mining related.
2	28–47	2Ab	Dark brown (7.5YR 3/2, m) clay, firm, strong medium to coarse subangular blocky structure, abrupt wavy boundary, violently effervescent, partially cut away and replaced with Zone 1.
3	47–50, 55–60, 69–72	2C	Light brown (7.5YR 6/4, m) sandy clay (originally beds of fine sand, prior to post-depositional disturbance), friable, weak fine subangular blocky structure, abrupt irregular boundary, slightly effervescent, many (~50 percent) worm passage features.
4	50–55, 60–63	2C	Dark brown (7.5YR 3/2, m) silty clay, friable to firm, strong fine to very fine subangular blocky structure, abrupt irregular boundary, violently effervescent, Bosque River mud.
5	63–69, 72–75, 75–88, 97–108	2C	Dusky red (2.5YR 3/3, m) to dark reddish brown (5YR 3/3, m) clay, firm to friable, strong fine subangular blocky structure, abrupt smooth to irregular boundary, slightly effervescent, few clay coats and pressure faces on ped faces, Brazos River mud.
6	88–97	2C	Reddish brown (5YR 4/4, m) sandy loam, friable, massive, slightly effervescent, clear smooth boundary, slightly effervescent, 15 percent worm passage features.

Trench 33

Location: 679500 E 3492910 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–71	Ap1	Very dark gray (5YR 3/1, m) sandy clay and reddish brown (5YR 4/4, m) loam and sandy loam, firm, strong medium to coarse platy structure, abrupt wavy boundary, strongly effervescent, >90 percent coarse fragments which are primarily small blocks of clay suspended in reddish brown sandy loam and loam; introduced fill.
2	71–85	Ap2	Reddish brown (5YR 4.5/4, m) loamy sand, very friable, weak to moderate medium to coarse platy structure, abrupt wavy boundary, strongly effervescent, 15–30 percent coarse fragments of dark reddish gray (5YR 4/2, m) mud; introduced fill.
3	85–115	2Ab	Very dark brown (7.5YR 2.5/2) silty clay, firm, strong very coarse subangular blocky structure, diffuse smooth boundary, strongly effervescent, few black (N 2/0) manganese coats on ped faces and lining pores.
4	115–180	2AB	Dark reddish brown (5YR 3/2, m) clay, firm, massive to weak very coarse subangular blocky structure, abrupt wavy boundary, strongly effervescent, common pressure faces, may have better structure than it shows but it is very moist.
5a	180–182, 196–200, 216–220	2C	Dark brown (7.5YR 3/2, m) clay, firm, moderate medium to fine subangular blocky structure, abrupt wavy boundary, strongly effervescent, many pressure faces on 1–3 mm size patches of ped faces, probably Bosque River mud.
5b	182–196, 200–216	2C	Dusky red (2.5YR 3/4, m) clay, firm, moderate to strong fine subangular blocky structure, abrupt wavy boundary, many pressure faces on 1–5 mm wide ped faces, Brazos River mud.
6a	220–228, 236–248	2Bk	Same as 5a but with < 1 percent 1–3 mm spherical white calcium carbonate nodules.
6b	228–236, 248–262	2Bk	Same as 5b but with < 1 percent 1–3 mm spherical white calcium carbonate nodules.

Trench 34
Location: 679477 E 3492842 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–3	Ap	Dark brown (7.5YR 3/3, m) clay and silty clay, firm, massive to weak medium subangular blocky structure, abrupt wavy boundary, violently effervescent, introduced fill.
2	37–133	Ap	Brown (7.5YR 4/4, m) loamy sand, very friable, massive, abrupt wavy boundary, violently effervescent, crudely stratified, 5–60 percent coarse fragments where the coarse fragments are subrounded to angular 2–20 cm diameter fragments of dark gray clay, possible dredge spoil, clearly introduced fill.
3	133–142	C	Dark brown (7.5YR 3/3, m) clay, firm, massive, abrupt smooth to wavy boundary, violently effervescent, few (3–5 percent) dark gray (7.5YR 4/1, m) 1 mm wide redox (iron) depletions lining pores and ped faces, Bosque River mud?
4	142–160	C	Dusky red (2.5YR 3/4, m) clay, friable, massive, slightly effervescent, few (3–5 percent) >1 mm wide redox (iron) depletions lining pores and ped faces.

Trench 35
Location: 679276 E 3492620 N NAD83

Zone	Depth (cm)	Horizon	Description
1	--	Ap	Brown (7.5YR 5/3 to 7.5YR 5/4, m) loamy sand, loose, massive, abrupt irregular boundary, violently effervescent, disturbed, contains many krotovina.
2	--	C	Dark brown (7.5YR 3/2, m) sandy loam, friable, weak fine subangular blocky structure, abrupt smooth to wavy, violently effervescent, zone comprises multiple thin beds, Bosque River mud.
3	--	C	Pink (7.5YR 7/4, m) sand, loose, single grain, abrupt wavy boundary, slightly effervescent, parallel laminated to ripple laminated, laminations dip towards south (toward river).
3a	--	C	Brown (7.5YR 5/3, m) sandy loam to loamy sand, very friable, massive, abrupt irregular boundary, slightly effervescent, looks extensively disturbed, some of which appear to be wheel ruts of a dirt road.
4	--	C	Light brown (7.5YR 6/4, m) sand, loose, single grain, abrupt smooth boundary, parallel to ripple laminated.
5	--	C	Reddish brown (5YR 4/4, m) sandy clay loam, firm to friable, weak fine subangular blocky structure, abrupt smooth boundary, violently effervescent, Brazos River mud.

Trench 36
Location: 679279 E 3492649 N NAD83

Zone	Depth (cm)	Horizon	Description
1	0–20	Ap	Brown (7.5YR 4/2, m) sandy clay loam, friable, strong fine to medium platy structure, abrupt smooth boundary, violently effervescent, introduced fill.
2	20–25, 35–36, 42–43, 59–61	C	Dark brown (7.5YR 3/2, m) clay loam, firm, weak fine to medium subangular blocky structure, abrupt smooth boundary, violently effervescent, Bosque River mud.
3	25–35, 36–42	C	Brown (7.5YR 5/4, m) sandy loam, firm, weak medium subangular blocky structure, abrupt smooth boundary, violently effervescent.
4	43–59	C	Brown (7.5YR 5/4, m) sand, very friable, massive, abrupt wavy boundary, slightly effervescent, prominent ripple laminations.

Zone	Depth (cm)	Horizon	Description
5	61–67	C	Reddish brown (5YR 4/3, m) loam, friable, massive, abrupt smooth boundary, violently effervescent.
6	67–120	C	Brown (7.5YR 5/4, m) sand, very friable, massive, abrupt smooth boundary, violently effervescent.

Trench 37

Location: 679380 E 3492777 N NAD83

Comment: Trench filled with water before it could be safely examined, so only a brief description was compiled.

Zone	Depth (cm)	Horizon	Description
1	0–30	Ap	Gray brown loamy sand
2	30–32	C	Bosque River mud drape
3	32–52	C	Light gray sand
4	52–60	C	Brazos River mud drape
5	60–70	C	Gray sand
6	70–72	C	Bosque River mud drape
7	72–90	C	Gray sand
8	90–108	C	Pink silt loam
9	108–112	C	Brazos River mud drape
10	112–130	C	Brazos River mud drape

Geoprobe Core 1: (0 to 11 m)

This core consists of 10 segments collected at 4-ft intervals. Zones 61–64 are of questionable integrity because more core was collected than was pushed. The core appears to record two deposits, recent alluvium to 7.6 m and an older alluvial fill with an Ak-ABk-Bk soil profile from 7.6 to 11 m.

Zone	Depth (cm)	Horizon	Description
1	0–10	OA	(7. 5YR 2.5/1), loamy sand , clear boundary, non-effervescent; introduced fill
2	10–25	Ap1	(7. 5YR 2.5/1), sandy loam, clear boundary, non-effervescent; introduced fill
3	25–38	Ap2	(7. 5YR 3/3), sandy loam, clear boundary, violently effervescent; introduced fill
4	38–46	C	(7. 5YR 3/3), fine sand, abrupt boundary, violently effervescent
5	46–52	C	(7. 5YR 4/3), fine sand, abrupt boundary, violently effervescent
6	52–64	C	(7. 5YR 3/2), loam, abrupt boundary, violently effervescent
7	64–69	C	(7.5YR 3/4), sandy loam to loamy sand, clear boundary, violently effervescent
8	69–75	C	(7.5YR 2.5/3), sandy loam, clear boundary, violently effervescent
9	75–86	C	(7.5YR 3/3),sandy loam , abrupt boundary, violently effervescent
10	86–122	C	(7.5YR 4/4), sand, abrupt boundary, slightly effervescent
11	122–153	C	(5YR 5/4), sand, clear boundary, violently effervescent
12	153–196	C	(5YR 5/6), medium sand, clear boundary, slighty effervescent
13	196–215	C	(5YR 5/4), loamy sand to fine sand, clear boundary, violently effervescent
14	215–241	C	(5YR 4/4), sand, clear boundary, moderate to violently effervescent
15	241–272	C	(5YR 4/4), sand, clear boundary, slightly effervescent
16	272–290	C	Reddish brown (5YR5/4, m) loamy sand, clear boundary, slightly effervescent.
17	290–295	C	Reddish brown (5YR 4/4, m) silt loam, clear boundary, violently effervescent.
18	295–331	C	Reddish brown (5YR5/4, m) loamy sand, clear boundary, slightly effervescent.

Zone	Depth (cm)	Horizon	Description
19	331–383	C	Reddish brown (5YR 4/4, m) sand, clear boundary, slightly effervescent.
20	383–401	C	Reddish brown (5YR5/4, m) loamy sand, clear boundary, slightly effervescent.
21	401–414	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly effervescent.
22	414–423	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
23	423–434	C	Reddish brown (5YR5/4, m) loamy sand, clear boundary, slightly effervescent.
24	434–437	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly effervescent.
25	437–461	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly effervescent.
26	461–472	C	Reddish brown (5YR5/4, m) loamy sand, clear boundary, slightly effervescent.
27	472–499	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
28	499–502	C	Yellowish red (5YR 4/6, m) silt loam, abrupt boundary, violently effervescent.
29	502–516	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
30	516–530	C	Yellowish red (5YR 4/6, m) silt loam, abrupt boundary, violently effervescent.
31	530–552	C	Yellowish red (5YR 4/6, m) silty clay loam, abrupt to clear boundary, slightly effervescent.
32	552–571	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
33	571–575	C	Yellowish red (5YR 5/8, m) silt loam, abrupt boundary, violently effervescent.
34	575–588	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
35	588–589	C	Yellowish red (5YR 5/8, m) silt loam, abrupt boundary, violently effervescent.
36	589–592	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
37	592–593	C	Yellowish red (5YR 5/8, m) silt loam, abrupt boundary, violently effervescent.
38	593–594	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
39	594–595	C	Yellowish red (5YR 5/8, m) silt loam, abrupt boundary, violently effervescent.
40	595–601	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
41	601–603	C	Yellowish red (5YR 5/8, m) silt loam, abrupt boundary, violently effervescent.
42	603–615	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
43	615–616	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly to violently effervescent.
44	616–627	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
45	627–631	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly to violently effervescent.
46	631–635	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.

Zone	Depth (cm)	Horizon	Description
47	635–641	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly to violently effervescent.
48	641–646	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
49	646–660	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly to violently effervescent.
50	660–669	C	Reddish brown (5YR4/4, m) silty clay to silty clay loam, abrupt boundary, slightly effervescent.
51	669–677	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
52	677–681	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly to violently effervescent.
53	681–683	C	Dark brown (7.5YR 3/2, m) clay, abrupt boundary, violently effervescent, Bosque River mud.
54	683–691	C	Dark reddish brown (5YR 3/4, m) clay, abrupt boundary, slightly to violently effervescent, Brazos River mud.
55	691–717	C	Dark brown (7.5YR 3/2, m) clay, abrupt boundary, violently effervescent, Bosque River mud.
56	717–720	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, strongly to violently effervescent.
57	720–759	C	Dark brown (7.5YR 3/2, m) clay, abrupt boundary, violently effervescent, Bosque River mud.
58	759–835	2Abk?	Dark brown (7.5YR 3/2.5, m) clay to silty clay, gradual boundary, slightly effervescent, few (1–2 percent) fine (1–2 mm) white friable calcium carbonate nodules.
59	835–866	2ABk1	Dark brown (7.5YR 3/2, m) clay, gradual to clear boundary, slightly effervescent, few (1–2 percent) fine (1–2 mm) white friable, calcium carbonate nodules
60	866–975	2ABk2	Dark grayish brown (10YR 4/2, m) and very dark grayish brown (10YR 3/2, m) clay, moderate to strongly effervescent, common (2–5 percent) fine (2 mm) white firm calcium carbonate nodules, mixed Brazos River and Bosque River muds.
61	975–	2Bk	Reddish brown (5YR 4/3, m) clay, abrupt boundary, violently effervescent, common (5–7 percent) medium to coarse (5–7 mm) white firm, calcium carbonate nodules.
62		2Bk	Dark reddish gray (5YR 4/2, m) sandy clay, gradual boundary, slightly effervescent, many (7–10 percent) medium to coarse (5–7 mm) white firm irregular calcium carbonate nodules.
63		2Bk	Dark reddish brown (5YR 3/2, m) and light reddish brown (5YR 6/4, m) sandy loam, gradual boundary, violently effervescent; many (7 percent) fine (1–2 mm) white firm irregular calcium carbonate nodules.
64	–1036	2Bk	Brown (7.5YR 4/3, m) sandy clay, violently effervescent; many (20–40 percent) coarse (5–10 mm), white firm irregular calcium carbonate nodules.
65	1036–1062	2Bk	Dark brown (7.5YR 3/3, m) sandy clay loam to sandy loam, gradual boundary, slightly effervescent; few (1–2 percent) fine (1–2 mm) white friable irregular calcium carbonate nodules
66	1062–1071	2Bk	Dark brown (7.5YR 3/2, m) clay, abrupt boundary, slightly effervescent, few (1–2 percent) fine (1–2 mm) white friable irregular calcium carbonate nodules, Bosque River mud.
67	1071–1083	2Bk	Dark brown (7.5YR 3/3, m) sandy clay loam to sandy loam, gradual boundary, slightly effervescent; few (1–2 percent) fine (1–2 mm) white friable irregular calcium carbonate nodules
68	1083–1091	2Bk	Brown (7.5YR 4/3, m) clay, abrupt boundary, violently effervescent; few (1–2 percent) fine (1–2 mm) white friable, irregular calcium carbonate nodules; Brazos River mud.

Zone	Depth (cm)	Horizon	Description
69	1091–1097	2Bk	Dark brown (7.5YR 3/3, m) sandy clay loam to sandy loam, gradual boundary, slightly effervescent; few (1–2 percent) fine (1–2 mm) white friable irregular calcium carbonate nodules

Geoprobe Core 2: (0 to 6.1 m)

This core consists of five core segments collected at 4-ft intervals.

Zone	Depth (cm)	Horizon	Description
1	0–16	A	Dark brown (7.5YR 3/2, m) loam, clear boundary, strongly effervescent.
2	16–41	AC	Dark brown (7.5YR 3/4, m) silt loam, clear boundary, violently effervescent.
3	41–53	C	Brown (7.5YR 4/3, m) loam, clear boundary, violently effervescent.
4	53–69	C	Brown (7.5YR 4/3, m) silty clay, abrupt boundary, violently effervescent.
5	69–80	C	Brown (7.5YR 4.5/3, m) silty clay loam, abrupt boundary, violently effervescent.
6	80–89	C	Brown (7.5 YR 5/3, m) silty clay, abrupt boundary, violently effervescent.
7	89–122	C	Brown (7.5 YR4/2, m) clay, abrupt boundary, violently effervescent.
8	122–153	C	Brown (7.5YR 5/4, m) sandy clay loam, abrupt boundary, slightly effervescent, this bed consists of mixed sand, as well as Brazos River and Bosque River muds.
9	153–157	C	Reddish brown (5YR 4/3, m) clay, abrupt boundary, slightly effervescent, Brazos red clay deposits.
10	157–172	C	Brown (7.5YR 5/4, m) sandy clay loam, abrupt boundary, slightly effervescent, this bed consists of mixed sand, as well as Brazos River and Bosque River muds.
11	172–175	C	Reddish brown (5YR 4/3, m) clay, abrupt boundary, slightly effervescent, Brazos red clay deposits.
12	175–181	C	Dark reddish brown (5YR 3/3, m) clay, abrupt boundary, slightly effervescent, mixed Bosque River-Brazos River mud.
13	181–186	C	Brown (7.5YR 5/4, m) sandy clay loam, abrupt boundary, slightly effervescent, this bed consists of mixed sand, as well as Brazos River and Bosque River muds.
14	186–192	C	Yellowish red (5YR 5/6, m) coarse sand, abrupt boundary, slightly effervescent.
15	192–200	C	Dark reddish brown (5YR 3/3, m) clay, abrupt boundary, slightly effervescent, mixed Bosque River-Brazos River mud.
16	200–206	C	Reddish brown (5YR 4/3, m) clay, abrupt boundary, slightly effervescent, Brazos River mud.
17	206–219	C	Yellowish red (5YR 4/6, m) silt to silt loam, abrupt boundary, slightly effervescent.
18	219–225	C	Dark reddish brown (5YR 3/3, m) clay, abrupt boundary, slightly effervescent, mixed Bosque River-Brazos River mud.
19	225–244	C	Yellowish red (5YR 4/6, m) silt to silt loam, abrupt boundary, slightly effervescent.
20	244–259	C	Yellowish red (5YR 4/6, m) sandy loam, abrupt boundary, slightly effervescent
21	259–275	C	Reddish brown-yellowish red (5YR 5/5, m) sand, abrupt boundary, strongly effervescent
22	275–325	C	Yellowish red (5YR 5/6, m) sand, clear boundary, strongly effervescent
23	325–610	C	Light brown (7. 5YR 6/4, m) sand, strongly effervescent, undifferentiated coarse sand.

Geoprobe Core 3: (0 to 5.4 m)

This core consists of five core segments, four of which were 4-ft intervals and one of which was a 2-ft interval. The last segment was a 2-ft push but contained 4 ft of sediment with no easily discernible disturbed sediment; therefore, it was considered to be of questionable integrity and was not described.

Zone	Depth (cm)	Horizon	Description
1	0–18	Ap	Very dark brown (7. 5YR 2.5/2, m), sandy loam, abrupt boundary, violently effervescent, 50 percent coarse, introduced fill.
2	18–37	Ap	Brown (7.5YR 4/3, m), sandy loam to sandy clay loam, abrupt boundary, violently effervescent, 3 percent coarse, introduced fill.
3	37–65	Ap	Brown (7.5YR 4.5/4, m), sandy clay loam, abrupt boundary, violently effervescent, 3 percent coarse, introduced fill.
4	65–95	C	Light brown (7.5YR 6/4, m), loamy sand to sandy loam, abrupt boundary, violently effervescent.
5	95–108	C	Brown (7. 5YR 4/4, m), sandy loam, abrupt boundary, violently effervescent.
6	108–122	C	Brown, (7. 5YR 5/4, m), sand, abrupt boundary, violently effervescent.
7	122–164	C	Strong brown (7.5YR 5/6, m), sand, abrupt boundary, slightly effervescent, laminated.
8	164–188	C	Strong brown (7. 5YR 4.5/6, m), sand, abrupt boundary, strongly effervescent.
9	188–212	C	Light brown (7. 5YR 6/4, m), sand, abrupt boundary, slightly effervescent.
10	212–270	C	Light brown (7. 5YR 6/4, m), sand, abrupt boundary, slightly effervescent, laminated.
11	270–316	C	Yellowish red (5YR 5/6, m), sand, abrupt boundary, moderately effervescent.
12	316–324	C	Yellowish red (5YR 4/6, m), clay, abrupt boundary, moderately effervescent, Brazos River mud.
13	324–366	C	Yellowish red (5YR 4/6, m), loamy sand, moderately effervescent.
14	366–396	C	Reddish brown (5YR 4/4, m), sandy clay to clay, abrupt boundary, moderate to violently effervescent
15	396–402	C	Dark reddish brown (5YR 3/4, m), sandy clay, abrupt boundary, violently effervescent, Brazos River mud.
16	402–403	C	Brown (7.5YR 4/2, m), sandy clay to clay, abrupt boundary, violently effervescent, Bosque dark brown clay drapes
17	403–409	C	Reddish brown (5YR 4/4, m), sandy clay to clay, abrupt boundary, moderate to violently effervescent
18	409–476	C	Yellowish red (5YR 4/6, m), sand, abrupt boundary, slightly effervescent
19	476–488	C	Yellowish red (5YR 4/6, m), sandy clay loam, abrupt boundary, slightly effervescent.

Geoprobe Core 4: (0 to 6.1 m)

This core consists of five core segments at 4-ft intervals. This core was taken near the modern channel of the Brazos River.

Zone	Depth (cm)	Horizon	Description
1	0–39	Ap	White (10YR 8/3, m) dark yellowish brown (10YR 3/4,m) and very dark brown (7.5YR 2.5/3), loamy sand, abrupt boundary, violently effervescent, 80– 5 percent coarse, introduced fill.
2	39–78	C	Strong brown (7.5YR 5.5/6), sand, abrupt boundary, strongly effervescent.
3	78–80	C	Very dark brown (7.5YR 2.5/3), sandy clay loam, abrupt boundary, strong to violently effervescent, Bosque River mud.
4	80–108	C	Strong brown (7.5YR 5.5/6), sand, abrupt boundary, strongly effervescent.

Zone	Depth (cm)	Horizon	Description
5	108–110	C	Very dark brown (7. 5YR 2.5/3), sandy clay loam, abrupt boundary, strong to violently effervescent, Bosque River mud.
6	110–114	C	Strong brown (7. 5YR 5.5/6), sand, abrupt boundary, strongly effervescent
7	114–122	C	Very dark brown (7. 5YR 2.5/3, m), sandy clay loam, abrupt boundary, strong to violently effervescent, Bosque River mud.
8	122–136	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
9	136–152	C	Strong brown (7.5YR 4/6, m), sand, abrupt boundary, violently effervescent, laminated.
10	152–157	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
11	157–181	C	Strong brown (7.5YR 4/6, m), sand, abrupt boundary, violently effervescent, laminated.
12	181–183	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
13	183–260	C	Pink (7.5YR 7/4-3, m), coarse sand, abrupt boundary, violently effervescent.
14	260–263	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
15	263–266	C	Light brown (7.5YR 6/4, m), medium sand, abrupt boundary, slightly effervescent.
16	266–269	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
17	269–286	C	Light brown (7.5YR 6/4, m), medium sand, abrupt boundary, slightly effervescent.
18	286–289	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
19	289–320	C	Pink (7.5YR 7/4-3, m), coarse sand, abrupt boundary, violently effervescent.
20	320–338	C	Light brown (7.5YR 6/4, m), medium sand, abrupt boundary, slightly effervescent.
21	338–341	C	Brown (7.5YR 4/4, m), sandy clay loam, abrupt boundary, slightly effervescent, probably mixed Brazos River and Bosque River mud.
22	341–366	C	Pink (7.5YR 7/4-3, m), coarse sand, abrupt boundary, violently effervescent.
23	366–410	C	Brown (5YR 4/4, m), sand, abrupt boundary, slightly effervescent
24	410–441	C	Brown (7.5YR 4/3, m), loamy sand to sand, abrupt boundary, violently effervescent.
25	441–450	C	Brown (5YR 4/4, m), sand, abrupt boundary, slightly effervescent
26	450–475	C	Brown (7.5YR 4/3, m), loamy sand to sand, abrupt boundary, violently effervescent.
27	475–488	C	Yellowish red (5YR 4/6, m), loam to loamy sand, abrupt boundary, slightly effervescent.
28	488–510	C	Brown (7.5YR 4/4, m), loamy sand to sandy loam, abrupt boundary, slightly effervescent.
29	510–550	C	Brown (7.5YR 4/3, m), loamy sand to sand, abrupt boundary, violently effervescent.
30	550–579	C	Yellowish red (5YR 4/6, m), loam to loamy sand, abrupt boundary, slightly effervescent.
31	579–591	C	Brown (7.5YR 4/3, m), loamy sand to sand, abrupt boundary, violently effervescent.
32	591–610	C	Brown (7.5YR 4/4, m), sand, violently effervescent.