# CHAPTER 6
# ANALYSIS OF GEOMORPHICAL INVESTIGATIONS, OLMOS BASIN CENTRAL WATERSHED (C-3), REACHES 1–4

## GENERAL INTRODUCTION

The study area forms a narrow strip that is located to the east of the current channel of the San Antonio River, on either the floodplain itself or the low fluvial terraces that border the floodplain's eastern margin. Initially, 19 borings were made to gather geotechnical data in this area. Later, an additional 15 boring were made to collect samples for geomorphological study because the earlier samples were no longer available for the geologist to analyze. These 34 borings were located along a southwest-to-northeast-trending line directly adjacent to and slightly west of Avenue B or, in some cases, Broadway Street (see Figures 3a and 3b). After analyzing the data provided by the borings, a series of six relatively shallow (under 2 m in depth) backhoe trenches were excavated in the central portion of the study area: two of the trenches directly adjacent to Avenue B and the other four falling in the southern portion of Lion's Field west of Broadway Street. Needless to say, this area has been heavily modified in historic times by the emplacement of utilities, irrigation ditches, building and road construction, borrow and fill operations, and similar activities. Because of this, the upper portions of the soil profile have been altered in most areas and many of the features typical of an active fluvial system have been modified or removed.

Geologically, this area is underlain by bedrock composed of the shales, claystones, siltstones, and sandstones of the Tertiary-aged Midway Group and the Upper Cretaceous-aged Navarro Group with the Pecan Gap Chalk outcropping and subcropping in the immediate study area. These beds

dip gently to the southeast and are deformed by numerous "down to the coast" faults that trend northeast to southwest and are downthrown to the southeast. The fine-grained nature of most of these sediments helps explain the overwhelming presence of clay and silt in most of the boring samples observed and the general lack of sand. Unconformably overlying this bedrock are Pleistocene and Holocene fluvial and alluvial deposits. Some of these deposits are Quaternary-aged fluvial terrace sediments representing times when the ancestral San Antonio River's floodplain was located at a higher elevation than it is presently. Particularly of note in these earlier terrace deposits is the Uvalde Gravel, a unit that contains large amounts of coarse, rounded chert gravels and cobbles (BEG:San Antonio Sheet; Nordt 1999). The presence of the Uvalde Gravel deposits in or near the study area may help explain the large amount of chert gravel that was observed and the curious juxtaposition of large, well-rounded chert gravels in a very fine-grained silty clay matrix.

As noted above, the line of borings and trenches is located no more than a few hundred meters from the currently active channel of the San Antonio River, and in some cases (Boreholes B-17–B-19 and Core 17A) much less. The trenches and Boreholes B-1 through B-8 and Cores 1A through 7A appear to be located very close to a prominent meander scar of the river that has now been widened, deepened, and lined with concrete to form an approximately 15-m-wide artificial channel along the eastern side of Brackenridge Park. Additionally, a number of smaller streams cross the line of borings draining onto the floodplain from the higher ground to the east. Data from Boreholes B-3 and B-9 indicate that depth to bedrock in this area is around 7.3 to 10 m, indicating that the entire study area is comfortably within the current or ancestral floodplain of the San Antonio River.

The historic 1903 topographic map shows that the valley of the San Antonio River is less than 500 m wide from upland edge to upland edge just north of the study area, but that it widens rapidly south of this narrow point to well over 1 km (Figure 17). Much of this extra width is occupied by large fluvial terraces on both sides of the valley, with the active modern floodplain being roughly 400 to 500 m wide. This increase in width may be due in part to a change in the underlying bedrock from more erosionally resistant units of the Navarro Group to the north to the more easily eroded claystones of the Upper Taylor Group, in particular the Marlbrook Formation, to the south (Caran and Speer 2006). Today, the modern river is moderately sinuous to straight in the study area, with the channel being sinuous just north of the narrow point noted above, straight

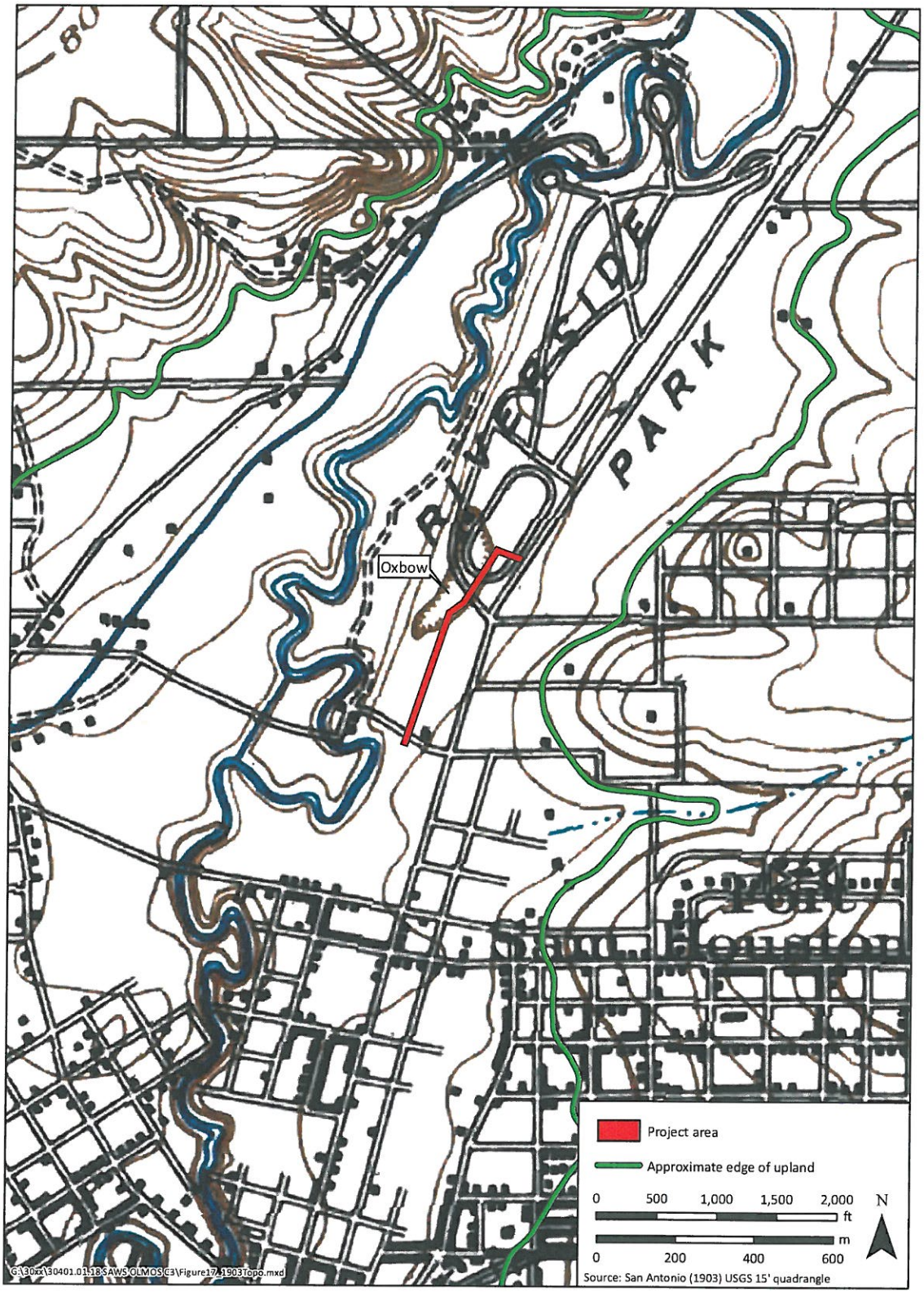


Figure 17. 1903 topographic map showing the San Antonio River valley.

immediately south of this point, and then more sinuous again in the southern portion of the area. This change is probably due to flow being restricted, with consequent deposition north of the narrow choke point, then flow increasing after the river passes the choke point with reduced deposition, and then a return to more normal conditions in the wider portion of the floodplain. The modern river appears to be more deeply entrenched in its floodplain where the channel is straight and less so north and south of that point. Since the upland edges of the valley are quite sharp and show signs particularly on the eastern side of fluvial sculpting, it is likely that the shape of the ancestral San Antonio River's floodplain was much the same as the current one (see Figure 17). Caran and Speer (2006) speculate that the ancestral San Antonio River was much different from the present one, with a larger, more constant spring-fed channel, a number of small, spring-fed tributaries crossing the active floodplain particularly near its headwaters, and a noticeable amount of marshland on the floodplain. Further, they speculate that the river channel was more braided in the past compared to the current sinuous, meandering style (Caran and Speer 2006). However, the data from the borings done for this study, the work done by Nordt north and west of the present study area, and the study done south of the present study area by Caran and Speer do not appear to indicate that the ancestral river channel was braided. Instead, the deposits observed indicate that the river's meander belt contained the levee, bar, and lateral accretion deposits that are distinctive of a sinuous, meandering system. Indeed, braided streams tend to be products of fluvial systems that have a large variation between their peak and average water flow with the consequent variation in ability to transport sediment. The larger channel with fairly constant water flow described by Caran and Speer would be expected to produce a sinuous, meandering style of river. Further, although there are undoubtedly paludal deposits in the sedimentary package filling the river valley, they may be difficult to differentiate from purely fluvial deposits.

A series of topographic and historic maps spanning the period from 1889 to 1992 shows that the river has occupied its current meander belt for at least that length of time with very little change in channel shape. This would seem to indicate that the river changes the location of its active meander belt in its floodplain by the process of avulsion rather than sweeping completely from one side of the valley to the other. This view is reinforced by the apparent abandoned slough or oxbow prominently visible on the 1903 USGS topographic map (see Figure 17). This is important since channel shifting by avulsion would help preserve earlier deposits but a thorough sweeping of the valley from one side to the other would tend to remove or badly truncate older, preexisting deposits. Nevertheless, given the narrow width of the valley compared to the width of

the active floodplain, it is likely that earlier deposits will be progressively truncated or removed and then buried under younger sediments over time as the river shifts its channel and active meander belt.

Work done by Lee Nordt in the area of site 41BX323 in 1997 and 1998 just west of the northern portion of the study area near the Witte Museum indicate that this type of truncation and burial has taken place. Nordt recognized three distinct naturally deposited units spanning the period from late Pleistocene or earliest Holocene to the present, with each younger unit resting unconformably on truncated remnants of the underlying unit (Nordt 1999). Further, the erosional surfaces that Nordt observed had significant topography with variations of 50 cm to over 2 m in very short distances (Nordt 1999:Figure 6.2). This indicates both that buried "terraces" of older deposits exist at shallow depths within the modern floodplain and that abandoned sloughs and ox bows of earlier channels of the ancestral channels of the San Antonio, now filled, are also hidden beneath the modern floodplain surface. Caran and Speer observed exactly the same situation south of the present study area where late Pleistocene fluvial deposits were found under 4 to 5 m of late Holocene material but in other areas late Holocene deposits rest directly on eroded Cretaceous bedrock. Although much of the sediment they observed was mid- to late Holocene in age based on radiocarbon dates from soil humates, even in these late Holocene deposits, there is considerable evidence of "cut and fill" as older fluvial deposits are removed and replaced by younger ones (Caran and Speer 2006). Thus, the shape of the modern surface may not be a good predictor of the age and nature of the deposits that lie beneath the drape of recent or late Holocene deposits.

## DISCUSSION OF CORING AND BACKHOE TRENCH SAMPLES

Soil samples recovered from the coring sampling tubes and backdirt from the backhoe trenches were examined to determine their texture, Munsell color, composition, and other characteristics. These observations were used to construct soil profiles and estimate the thicknesses of the soil zones. These data along with other remarks concerning the soil samples are presented in Appendices A (geomorphological core data) and B (backhoe trench data). The more extensive coring samples will be described and discussed first and then the samples from the backhoe trenching.

As can be seen from Figure 4 and the descriptions in Appendix A, all of the sediments observed were composed of clastics of differing sizes with varying levels of organic and mineral content. With the exception of Cores 6A and 7A, the vast majority of the sediments observed were fine- to very fine-grained silts and clays with minor amounts of sand and gravel. This would seem logical given the fine-grained composition of most of the underlying bedrock units in this area. The coarser clastics seen tend to be found at the base of thick, fining upward sequences that have gravels, sands, and silts at the base and clays at the top (see Figure 4:Cores 1A–5A and 8A; and Appendix A). Virtually all of the logs from the previous geotechnical borings show this same type of fining upwards from sand and gravel to clay (Fugro 2010). Fining upward sequences are typical of deposits in fluvial point bars where the energy of deposition decreases over time as the river's channel moves slowly away from the site of deposition. The presence of an old channel or meander scar of the San Antonio River immediately adjacent to the area where these borings were taken seems to confirm this line of thinking. Further, since the present San Antonio River in most of this area has a meandering pattern in which coarser materials are concentrated in the active meander belt and finer clastics in the surrounding back swamp of the floodplain, it strongly suggests that this type of pattern existed in the past when these sediments were laid down. If so, this type of depositional system could also help explain the very thick cumulic soils observed, since areas in the fluvial back swamp would continue to receive fine grained, organically enriched sediment during flood events. The geotechnical borings would suggest that these fining upward deposits may be as much as 6–8 m thick, although most appear to be more in the 4–5-m range. This same range of thickness was observed both north and south of the study area (Figueroa et al. 2006; Nordt 1999).

However, a number of the geomorphological cores in these same areas did not exhibit this fining upward pattern or any other noticeable pattern of variation in sedimentary grain size (see Figure 4:Cores 12A–16A). This could be because the later borings did not penetrate as deeply as the earlier ones and so did not encounter the fining upward sequences. It could also indicate that these areas were located in the river's back swamp for longer periods of time, thus developing a thicker, clay-rich sedimentary package with little grain size variation above the coarser sediments compared to those to the south. Another more likely explanation is that these thick, fine-grained deposits were produced by the same depositional history proposed by Nordt for the sediments he observed at site 41BX323 just to the west and northwest of this series of cores. There, a truncated late Pleistocene to early Holocene fluvial terrace composed of calcium carbonate-rich, yellowish

brown to grayish brown clays (Nordt's Unit 1) is unconformably overlain by early to mid-Holocene-aged fluvial deposits composed of dark gray clays (Nordt's Unit 2). The lower sediments encountered in Cores 12A to 17A in this portion of the study area certainly appear to match the basic description of Nordt's Unit 1 with similar colors, amounts of calcium deposits, and grain size. Similarly, the very dark gray to very dark brown sediments that overlie these deposits appear to be very similar to Nordt's Unit 2 based on color, grain size, and noticeable, but limited, amounts of calcareous deposits. Although the clear stratigraphic break observed by Nordt was not seen in the core samples, this could be due to both the poor quality of many samples and the difference between observing a boundary in a 6-cm-wide core and a 4–5-m-long backhoe trench (Nordt 1999).

If this interpretation is correct, the late Pleistocene to early Holocene fluvial terrace proposed by Nordt extends much farther to the east and south, buried beneath a thin veneer of later Holocene sediment. Given the cuspate shape of the upland edge just east of the line of borings, it seems likely that the ancestral San Antonio River's channel was once located to the east of the line of borings and that the late Pleistocene fluvial terrace was probably a product of that channel's meander belt. When the meander belt shifted to areas farther west, this area was then exposed to erosion that removed the upper, organic-rich portions of the soil profile. The shifting of the active channel would have also left this area in the river's fluvial back swamp, which would have been periodically flooded bringing in clay-rich sediments to bury the eroded terrace surface. Caran and Speer (2006) point out that this geographic area is known for its frequent, often catastrophic, flooding that would periodically inundate the fluvial back swamp or, as they call it, the "flood terrace," depositing new layers of clay-rich mud.

Cores 6A and 7A were different from the remaining borings in that they encountered large amounts of coarse clastics. Further, both profiles contain coarsening upward profiles in which finer-grained materials at the base such as clay and silt are overlain by coarser materials such as sand and gravel, indicating increasing water energy over time. This type of deposits is common in the levees or crevasse splay portions of a river's active meander belt where water energy can be expected to increase over time. Again, the presence of an abandoned channel or meander scar near the line of borings would seem to support this interpretation. These deposits can also be the product of deflating an exposed meander belt deposit such as a point bar, crevasse splay, or levee over time, creating a lag surface. In this situation, the finer-grained silts and clays are winnowed

out leaving behind a gravel-rich deposit that then "armors" the surface against further erosion due to the high level of energy that would be required to remove the gravels. It seems more likely that the deposits in Core 7A with their noticeable progression from clayey silt at the base to silty sand to sand and coarse gravel would appear to be an in situ channel belt deposit, but the deposit of coarse gravel in a clay matrix resting directly on dark-colored clays in Core 6A appears to be more of a lag surface. The deposits in these two borings will be discussed more below since they sit in the area that was investigated further with backhoe trenching.

As noted above, a few of the borings contained moderately large (1–6 cm) chert gravels mixed in the finer-grained portions of the sediments (see Figure 4:Cores 4A and 8A, for example). This mix of clay and moderately large gravels is somewhat unusual given the large difference in the levels of water energy needed to transport them. This may indicate a fairly local source for the gravels requiring only brief pulses of energy to move and deposit them. It might also be taken to indicate that there were very large differences between very low normal water levels and energy and short periods of higher water flow and energy during floods or heavy rains. Of course, the possibility that some of these chert gravels may have been transported by humans to these areas cannot be ruled out either.

Keeping in mind the historic impact on the observed soil profiles noted above, taken as a whole and the limitations of the soil samples themselves, the soil profiles observed in the boring samples were fairly well developed and showed a reasonable level of maturity. Underneath the fill or disturbed zone, almost all the areas tested exhibited a well defined and developed A-B-C style of soil profile with thick to overthickened A soil zones (e.g., Cores 1A, 2A, 3A, and 14A). In several cases, the A soil horizon had been removed either by natural causes or historic human activities (e.g., Cores 13A and 15A), but there seems little doubt given the presence and thickness of the B soil horizons observed that an A horizon had been present and that soil formation had been well advanced prior to the removal of the A zone. Only one profile exhibited a less mature A-C profile (Core 7A), but the thickness of the A zone indicates that soil formation had been going on for some time. Core 7A also encountered more coarse clastics (sand, gravel) than many of the other areas and the soil profile also exhibited the only coarsening upwards sequence observed. Both these things may indicate that this area experienced sedimentation in environments with more depositional energy or more of a "cut and fill" style of deposition that retarded the formation of a B soil horizon.

In addition to there having been enough time for the formation of thick, cumulic A zones and well-developed B zones, there is considerable evidence that there has been sufficient time for extensive leaching and redeposition of minerals, particularly calcium, iron, and manganese within these sediments. As can be seen from the descriptions in Appendix A, virtually all the samples examined show evidence that water has had time to leach and concentrate these minerals in the form of calcareous and FeMn concretions as well as calcareous deposits along rootlet traces and orange iron-rich mottles. The sand, silt, and clay coats on soil ped faces and on soil partings also indicate that ground water has had sufficient time to transport and redeposit these materials within the soil profile. Taken together, the thick, organic-rich A and B soil zones and indications of considerable time for movement of minerals and sediment grains within the soil profile suggest that the sediments observed have been in place for a reasonable amount of time, probably from at least the early to mid-Holocene. This view is supported by radiocarbon age dates from soil humates taken from the upper portions of the soil profiles observed by Nordt at site 41BX323 that range from 3960 $\pm$ 80 years before present (BP) to 5500 $\pm$ 110 years BP (Nordt 1999) with the older date being from a depth of 1 m below the surface. Given typical sedimentation rates and the thickness of the deposits involved, this would give the lower fluvial terrace deposits encountered by Nordt an age in the late Pleistocene without taking into account periods of erosion or nondeposition. It is likely that some of the typical hallmarks of Pleistocene sediments—Bt soil horizons, fully leached E soil zones, and sediment reddening—are missing from these lower units because the deposits are terminal Pleistocene in age and, more importantly, because they are at or below the level of the river's current floodplain. This means that a number of factors—constant wetting, addition of fresh sediment, removal organic material—could lead to the observed sediments appearing "younger" than they actually are significantly from their age.

At this point it should be noted that the geotechnical boreholes penetrated deeper on average than the cores taken for geomorphological purposes. These deeper borings generally went completely through the fining upward sequences and into underlying clay-rich layer. It is unknown whether this underlying clayey zone represents in situ weathering of the local bedrock or another alluvial or fluvial unit resting on bedrock underneath the more fully examined surface units. Based on their seemingly uniform nature and the gradual transition from clayey sediments to rock would seem to suggest that this lower unit is deeply weathered bedrock. Boring samples observed by Caran and Speer (2006) further to the south appeared much the same and they speculate that in

some places a soil horizon had begun to develop on the weathered, eroded surface prior to it being buried by younger sediments.

Turning at last to the series of six backhoe trenches that were excavated in the targeted project area to further test the deposits observed in Cores 3A to 8A, it can be seen from the descriptions in Appendix B that the upper portions of the sediments in this area have been heavily disturbed by historic activities. Figure 18 shows the relationship among trenches 1–6 and Cores 4a–8a. BHT 1 encountered 80 cm of what appeared to be a gravel-rich spoil pile from the excavation of the nearby drainage canal overlying natural deposits. BHT 2 fell completely inside of the utility trench holding a 16-inch water line. BHTs 3–BHT 6 all encountered 30 to 80 cm of brown, loamy fill dirt used to level and construct Lion's Field and containing sprinkler system lines above the underlying natural deposits. Underlying disturbed or fill zone, the five trenches that penetrated natural deposits all encountered dark gray, clay-rich deposits. In every case, a thick soil profile was observed as was typical of the majority of the borings taken in this area. However, there was a significant difference in the amount and distribution of gravel that was observed in the sediments. BHTs 3, 4, and 6 all encountered thick (50–60-cm), gravel-rich zones that extended deeper than the base of the trench. In BHT 3, this gravel-rich zone was immediately below the historic fill, but in BHTs 4 and 6, there was a thin layer (20–30 cm) of very dark gray clay with increasing numbers of gravels before the amount of gravel reached that found in BHT 3. This difference could be due to slight variations in depositional and erosional history or to historic construction activity. The gravels were quite large (being up to 10 cm in size) and many had white, calcareous coats or patina. The spaces between the gravels were filled with dark gray to dark grayish brown clay. These deposits were very similar to that observed in the upper portion of Core 6A described above, and it is thought that they represent a lag surface where the original fluvial deposit has been deflated and partially eroded during a period of exposure. The finer-grained portions of the natural deposit have been removed, leaving behind an increasingly gravel-rich zone that becomes increasingly difficult to erode because of the high energy level that would be required to transport and remove the large gravels. The space between the gravels is then filled with clay or other material at a later time. If this line of reasoning is correct, then it is likely that these sediments are roughly time-equivalent to Nordt's Unit 2 (early to mid-Holocene) since these deposits lack the characteristics of Nordt's Unit 1 (late Pleistocene to early Holocene) but are old enough to have been eroded and then buried under late Holocene sediments (Nordt's Unit 3) (Nordt 1999).

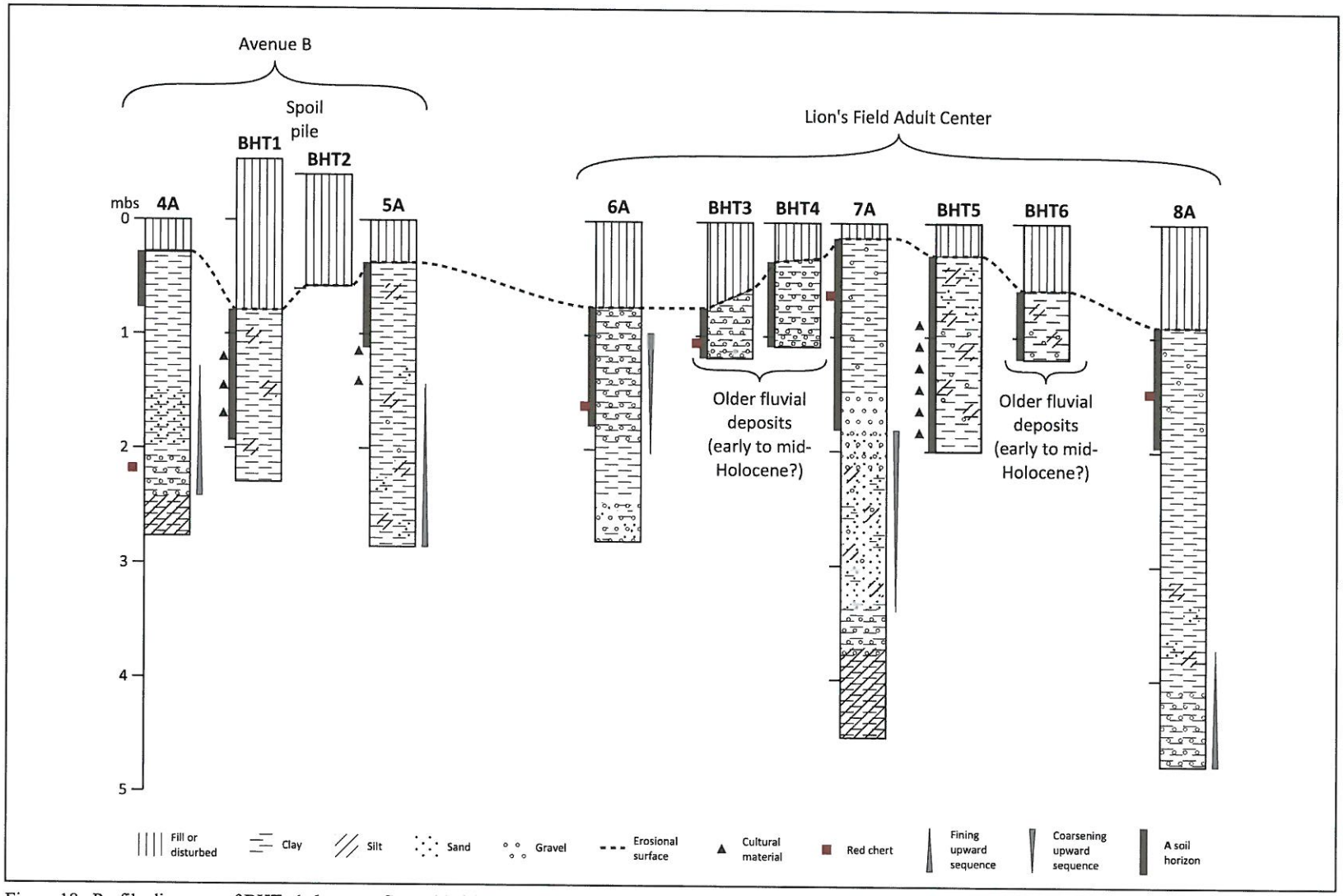


Figure 18. Profile diagrams of BHTs 1-6 among Cores 4A-8A.

In contrast to these backhoe trenches, BHT 1 had almost no gravel but BHT 5 encountered gravel that was smaller in size and concentrated in bands or lenses. BHT 1 was the only one of the trenches to encounter nothing but very fine-grained clastics and to penetrate deep enough to encounter what appeared to be a B soil horizon. This is exactly what was observed in Core 4A just to the south. BHT 5, on the other hand, closely mirrored what had been observed in Core 7A where thin lenses of gravel were encountered in a zone otherwise composed of very dark gray clay. This juxtaposition of clastic particle size and energy levels required for transport is extremely unusual. The presence of clay usually indicates quiet, low-energy portions of the floodplain such as the fluvial flood basin or abandoned sloughs and oxbows whereas gravel indicates high energy areas such as point bars and other portions of the active channel or meander belt. The most logical explanation for this unusual situation is to interpret this deposit as one that formed in an abandoned channel or cut-off meander loop. Normally, the energy level is very low and clay is accumulating in these types of settings. However, during periods of periodic flooding or heavy rains, high-energy water may have swept gravel into this old channel or oxbow from either surrounding higher ground or nearby portions of the active meander belt. There was no evidence of graded bedding, sedimentary varves, or sharp erosional contacts to help support this, but these could have been removed by later bioturbation and other natural actions. However, when a cross section through this area is made using information from the borings and backhoe trenches, it does appear that BHT 5 and Core 7A are located in a channel, now filled, that cut into an old fluvial terrace or bench (see Figure 18). As can be seen from this section, there appears to be a remnant of an earlier floodplain now covered in a lag gravel surface in the area of BHTs 3, 4, and 6 and Core 6A. This older surface was then cut and removed by younger fluvial channels in the area of Cores 4A and 5A, and BHT 1 south of Core 6A, in the area of BHT 5 and Core 7A north of BHT 4 and southwest of BHT 6, and north of BHT 6 in the area of Core 8A. The stark contrast between the basically fine-grained, clay-rich sediments filling the younger incised channels and the coarse lag gravel found in the upper portions of the older fluvial deposits that these channels have truncated is very apparent in Figure 18. This would place these younger channels very close to a gravel-covered surface providing a nearby source for the gravel lenses observed there but not in trenches and borings located farther from the older floodplain remnant. It would also help explain why only clay and gravel are found in the channel fill of BHT 5 and Core 7A since all the intermediate size clastics (silt and sand) had already been removed. Stratigraphically, this would place the channel fill in the late Holocene, making it approximately time-equivalent to Nordt's Unit 3.

In closing the discussion of the data from the backhoe trenches, it should be mentioned that a series of backhoe trenches had been excavated just on the eastern side of Brackenridge Golf Course on the opposite side of the concrete-lined drainage canal (Houk 2002) in preparation for the construction of the 16-inch water line that BHT 2 encountered. Trenches 4 through 7 of that survey were located directly across the drainage canal from the area tested by BHTs 1–5 of this study. The soil profiles and descriptions from those trenches were very similar to those observed in BHT 1 and BHT 5, seeming to indicate that the older fluvial surface now covered by lag gravel and buried under a thin veneer of late Holocene sediment does not extend that far to the west into the current floodplain. Further, trenches 5 and 6 of that survey both contained cultural materials at a depth of 100 cm and 80 cm, respectively, thought to be associated with site 41BX321, which is located on the opposite side of the drainage canal from the southwestern portion of Lion's Field (Houk 2002). A number of the borings (Cores 4A and 5A) and trenches (BHT 1, BHT 3, and BHT 5) from this study in that same area also contained chipped stone and reddened chert indicating that 41BX321 may have extended into this portion of the present study area or that materials from it have been transported into it by later fluvial activity. In this regard, it is interesting to note the amount of flakes and chipped stone in BHT 5. These cultural materials seem to be concentrated in the gravel lenses, which, as noted above, appear to have been produced by heavy rains or floodwaters sweeping gravel from nearby higher portions of the floodplain or active meander belt into an abandoned slough or oxbow. If this is the case, then these cultural materials have been moved from their area of creation or initial deposition. This seems reasonable since the bottom of a mud-filled oxbow is not a typical habitation site. The higher, gravel-covered surface of the adjacent floodplain remnant would probably have been much more attractive as an occupation site, and a heavy, flooding rain could have easily washed materials from that surface into the nearby oxbow. Further, known site 41BX321, immediately west of BHT 5, could be the source from which cultural materials could have been eroded and transported a short distance into the abandoned channel. Additionally, many of the flakes and chipped stone pieces from BHT 5 show evidence of rounded edges, further evidence that these materials have been transported by water from other areas and redeposited rather than representing in situ deposits.

To summarize, the observed sediments are a mix of coarse and finer clastics that appear to be of fluvial origin. Most of the profiles are dominated by fine-grained clastics such as silt and clay and indicate deposition in fluvial point bar and back swamp environments in which the coarser

material is concentrated in the base. Data from the borings indicate that this sedimentary package is 4.5–8 m thick. The observed level of soil development and data from detailed sedimentary studies done on areas just north and west of the present study area suggest that these deposits date from the closing stages of the Pleistocene to the late Holocene. Although the uppermost portions of these deposits have been disturbed or removed in virtually all of the study area, the bulk of the sedimentary package remains intact. These late Pleistocene to Holocene sediments in turn appear to rest on deeply weathered bedrock of the Late Cretaceous-age Navarro and Taylor Groups, in particular the Pecan Gap Chalk and Marlbrook Formation.

# CHAPTER 7
# SUMMARY AND RECOMMENDATIONS

## INTRODUCTION

San Antonio Water System plans to construct the Olmos Basin Central Watershed (C-3), Reaches 1–4, sewer main in the city of San Antonio, Bexar County, Texas. Weston Solutions, the contractor for SAWS, subcontracted with Geo-Marine, Inc., of Plano, Texas, to provide archeological investigations for the project. The APE begins north of downtown San Antonio at Josephine Street, proceeds north on Avenue B, crosses into Lion's Field Adult Center, then east to the front of the club house paralleling Broadway Street. The project corridor then shifts west and crosses Mulberry Avenue and proceeds north on Avenue B to the Witte Museum at 3801 Broadway Street.

Fieldwork was divided into two phases. The first phase consisted of a series of 34 geotechnical and geomorphological borings within the APE (Fugro 2010, 2011; Shanabrook and Green 2012). Fugro drilled 19 geotechnical boreholes and supplied Geo-Marine with their report, but the samples were no longer available for geoarchaeological analysis. Therefore, Geo-Marine drilled an additional 15 cores, which were examined by a geoarcheologist to determine the placement of backhoe trenches. The analysis of core samples suggests that no further investigation is necessary in the area south of Mill Race Road (Cores 1A–3A) or north of the Lion's Field headquarters to the Witte Museum (Cores 8A–17A). The portion of APE between Josephine Street and Mill Race Road has been heavily impacted by construction for road, utilities, and the Catalpa-Pershing storm drainage. The replacement of the new sewer would not occur outside of the current trench and therefore not impact archeological deposits in the area since any cultural

deposits have likely been destroyed by prior disturbances. The potential for intact cultural deposits also decreases significantly north of Core 8A, where the A soil horizon has been removed (Cores 13A and 15A), the level of disturbance is higher (Core 17A), or the thickness of the fluvial back swamp deposits is much greater (Cores 12A through 16A).

However, the area from Mill Race Road to the southern portion of the Lion's Field Adult Center suggests the potential for buried, stratified, preserved cultural deposits. Cultural material was observed in core samples 3A and 5A. Reddened, possibly heat-treated chert fragments and gravels were found in Cores 4A, 6A, 7A, and 8A. All of these coring locations are located just east of the prominent meander scar noted previously (see Figure 17). Further, cultural materials dated to the early Holocene have been found at a depth of approximately 3 m (10 ft) in floodplain sediments just to the west of these corings (personal communication with Kay Hindes concerning 41BX1396, an Early Archaic site located in Brackenridge Park). Based on the examination of these core samples (3A–8A), Geo-Marine recommended a second phase of investigation that consisted of the excavation of six backhoe trenches within the targeted area of the APE to determine the level of disturbance below the surface and the potential for intact Holocene horizons containing archeological deposits.

Two backhoe trenches were excavated along Avenue B north of Mill Race Road and four trenches excavated at Lion's Field Adult Center. The two trenches along Avenue B revealed an area that has been heavily impacted by utility, road, and storm drainage construction. Furthermore, BHT 2 encountered a 16-inch SAWS water line at 100 cmbs, and the trench was terminated at that depth. Based upon analysis of the backhoe trenches, the likelihood of intact archeological deposits in the Avenue B area is minimal. Of the four backhoe trenches placed in Lion's Field Adult Center, three of those trenches (BHT 3, BHT 4 and BHT 6) encountered (below the fill level) large gravels intermixed with silty clay. The presence of the gravels suggests a lag surface where the original fluvial deposit has been deflated and partially eroded during a period of exposure. Additionally, a 3-inch galvanized water line was encountered in BHT 3 within the fill zone. In the Lion's Field area, the likelihood of intact archeological deposits is also minimal.

Cultural material was encountered in several trenches. From BHT 1, a piece of debitage was observed in the backfill from the 80–160 cmbs level. BHT 3 yielded a stamped, decorated brass clip or hinge found in the backfill associated with the fill level. A wire nail and a ceramic floor tile fragment were found in the backfill from the upper 60-cm level of BHT 6. Chert debitage and fire-cracked rock were noted in the backfill in BHT 5, necessitating further investigations through excavation of a 1-x-.5-m test unit. This trench and unit yielded 33 pieces of lithic debitage: three possibly edge-modified flakes (although the modification could be natural on two specimens); 22 pieces of debitage; two possible exhausted core fragments; and six pieces of fire-cracked rock. Based upon site criteria, the extent of BHT 5 warranted definition as an archeological site and was designated 41BX1953. However, based on geoarcheological analysis, the cultural material was determined to be in a secondary context, likely the result of downwashes during significant rain or flood events. In addition, site 41BX1953 lacks context because no temporal diagnostics or datable $^{14}C$ materials were encountered. However, the site may extend beyond the extent of the trench and those portions remain unevaluated. Therefore, the site as a whole is recommended to be of unknown NRHP eligibility, but the portion of 41BX1953 within the current right-of-way is recommended ineligible for NHRP inclusion or designation as an SAL. No further work is required within the investigated site area.

## RECOMMENDATIONS

As a result of intensive archeological survey consisting of 34 borings and six backhoe trenches as well as the identification of the portion of 41BX1953 within the current right-of-way, it is recommended that the proposed construction will have no effect on significant cultural deposits in the project right-of-way. However, should in situ cultural deposits be encountered during the construction, all work should cease and the Texas Historical Commission and the city of San Antonio archeologist notified.

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# APPENDIX A

# SOIL DESCRIPTIONS FOR GEOMORPHOLOGICAL CORE SAMPLES ALONG AVENUE B, SAN ANTONIO WATER SYSTEM, OLMOS BASIN CENTRAL WATERSHED (C-3), REACHES 1–4: JOSEPHINE TO WITTE MUSEUM

## SOIL DESCRIPTIONS FOR GEOMORPHOLOGICAL CORE SAMPLES

A line of borings running roughly NNE–SSW along Avenue B along fluvial terraces or the upland edge immediately west of the San Antonio River and some of its main tributaries. The SSW end of the line, Core 1A, is very close to the intersection of US 281 and Avenue B, and the line runs along the east side of Brackenridge Park for most of its length.

### Core 1A

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–43 / 0–1.4' | Fill | Disturbed zone with dark clay mixed with large limestone gravels and chunks of stone |
| 43–135 / 1.4–4.4' | A1ca | Black to very dark gray (10YR 2/1 to 10YR 3/1) slightly sandy clay, fine to medium blocky with clay skins on ped faces; very firm; common small shell fragments; few extremely fine rock fragments that increase in number with depth; common open rootlet traces that have dark reddish orange mottling with depth; few light gray, hard calcareous concretions; gradual boundary |
| 135–196 / 4.4–6.4' | A2ca to B1ca | Very dark brownish gray (10YR 3/2) lightening with depth to dark grayish brown (10YR 4/2) very slightly sandy, silty clay, weak blocky to massive with sand coats on ped faces and partings; very firm to dense; common open rootlet traces with dark reddish orange mottling; common fine shell fragments; few fine hard light gray calcareous concretions that increase in number with depth; clear boundary |
| 196–244 / 6.4–8.0' | B2cca | Brown to yellowish brown (10YR 5/3 to 10YR 5/4) grading with depth to pale brown (10YR 6/3) silty clay, fine blocky with sand coats on ped faces; very firm; common off-white hard calcareous concretions; common fine shell fragments; few fine black FeMn concretions in lower part along with small amounts of orange Fe staining; one 5-cm chert gravel at base; clear boundary |
| 244–318 / 8.0–10.0' | C1c | Light gray (10YR 7/1 to 10YR 7/2) very silty clay grading to clayey silt @ 285 cm, massive; firm to increasingly friable; common open rootlet traces; few fine to small chert gravels; few fine black FeMn concretions; gradual to clear boundary |
| 318–366 / 10.0–12.0' | C2C | Light gray (10YR 7/1 to 10YR 7/2) clayey, sandy silt, massive; friable; abundant gravel 0.5 cm in size. |

**Core 2A**

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–43 / 0–1.4' | Fill | Dark clay with concrete |
| 43–86 / 1.4–2.8' | A | Very dark gray (10YR 3/1) very slightly sandy, silty clay, blocky with silt coats on ped faces; very firm; common fine shell fragments; common extremely fine rock fragments; gradual boundary |
| 86–183 / 2.8–6.0' | ABca to B1ca | Dark gray (10YR 4/1) gradually lightening to dark grayish brown (10YR 4/2) very slightly sandy, silty clay to slightly silty clay, fine to medium blocky with silt and sand coats on ped faces; very firm; few fine light gray to off-white hard calcareous concretions that increase in number with depth, some white calcareous deposits along rootlet traces; few fine open krotovina; gradual boundary |
| 183–300 / 6.0–9.8' | B2cca | Grayish brown (10YR 5/2) sandy, silty clay, fine blocky with silt and clay coats on ped faces; firm to slightly plastic; common fine to medium off-white to white calcareous concretions with some white calcareous deposits along rootlet traces that increase with depth; few fine black FeMn concretions with orange Fe stain haloes; sand and clay coats on soil partings; gradual boundary |
| 300–397 / 9.8–13.0' | C1cca | Gray to light brownish gray (10YR 6/1 to 10YR 6/2) slightly silty, sandy clay, weak fine blocky with clay skins on ped faces in upper part to massive to plastic with depth; zone 10–20% mottled orange (10YR 6/6) at top to 40% mottled with depth; common open rootlet traces often with dark reddish brown staining; few fine shell fragments; variable amounts of fine black FeMn concretions; clear textural boundary |
| 397–427 / 13.0–14.0' | C2 | Gray (10YR 6/1) medium to coarse gravel with slightly sandy clay matrix, plastic in part; very moist to wet. |

**Core 3A**

Unusually large amounts of "fill" on the top of each core section, indicating large amounts of sloughing during boring operations.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–41 / 0–1.3' | Fill | Mixed-colored clay with limestone gravel and asphalt; abrupt boundary. |
| 41–152 / 1.3–5.0' | A1ca | Black to very dark gray (10YR 2/1 to 10YR 3/1) silty clay, fine blocky with sand and silt coats on ped faces with depth; firm; few fine shell fragments and few whole gastropod shells; few extremely fine rock fragments; few open rootlet traces; few hard light gray calcareous concretions in lower part; some parts slightly lighter in color; gradual boundary |
| 152–201 / 5.0–6.6' | A2ca | Very dark gray to dark gray (10YR 3/1 to 4/1) clay, blocky with silt and sand coats on ped faces; firm; several rounded chert gravels, 3–6 cm in size in upper part, lens of chert gravels @ 175 cm; common fine shell fragments; few light gray hard calcareous concretions and white calcareous deposits along rootlet traces; this boring appears to have intersected a previous boring for above 20–30 cm; gradual boundary |
| 201–292 / 6.6–9.6' | Bcca | Dark grayish brown to grayish brown (10YR 4/2 to 10YR 5/2) sandy, silty clay, weak fine blocky with clay skins on ped faces; firm; common fine shell fragments; common fine to medium light gray to off-white calcareous concretions; few krotovina filled with dark clay; common open rootlet traces with orange Fe stain; few fine black FeMn concretions in lower part; color slowly lightens to brown and light brownish gray (10YR 5/3 to 10YR 6/2); clear boundary. **Note: chert flake in sloughed material at roughly 275 cm (9 ft).** |
| 292–378 / 9.6–12.0' | Cox | Very pale brown (10YR 8/3 to 10YR 8/4) sandy, silty clay, massive; firm to friable; few krotovina filled with dark clay; abundant white calcareous deposits along rootlet traces; common open rootlet traces with dark blackish red Fe stain; heavily mottled, from 40–80% of zone, dark to light orange (10YR 8/6, 10YR 7/6, 10YR 7/8); lower portion grayer being light gray to white (10YR 7/1 to 10YR 8/1). |

**Core 4A**

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–30 / 0–0.9' | Fill | Dark clay with limestone gravel, asphalt, and decaying white calcareous concretions |
| 30–75 / 0.9–2.5' | A | Very dark gray (10YR 3/1) clay, weak fine blocky with light sand coats on ped faces; very firm; few shell fragments; common extremely fine rock fragments; few fine open krotovina; few small tan-colored chert gravels; gradual boundary |
| 75–137 / 2.5–4.5' | B1ca | Dark grayish brown (10YR 4/2) sandy, silty clay, weak fine blocky with sand coats on ped faces; firm; few fine shell fragments; few extremely fine rock fragments; few fine krotovina filled with dark clay; few light gray to off-white calcareous concretions; gradual boundary |
| 137–198 / 4.5–6.5' | B2ca | Brown to yellowish brown (10YR 5/3 to 10YR 5/4) sandy clay, sand content increases slightly with depth, massive to weak fine blocky; firm; few hard off-white calcareous concretions that increase in number with depth; common open rootlet traces; gradual boundary |
| 198–244 / 6.5–8.0' | B3ca | Pale brown (10YR 6/3) slightly sandy clay, massive; firm; increasing number of chert gravels, 2–5 cm in size, with several lenses of cherty gravel, a few of the cherts are reddened; zone noticeably whitened with large white calcareous concretions and white calcareous deposits along rootlet traces; clear boundary |
| 244–274 / 8.0–9.0' | Cca | Very pale brown (10YR 8/2 to 10YR 8/3) silty clay grading to clayey silt, massive; firm to friable; abundant white calcareous concretions and white calcareous deposits along rootlets; common medium to large rounded chert gravels |

**Core 5A**

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–38 / 0–1.2' | Fill | Dark clay with large limestone gravels, asphalt, and decaying white calcareous concretions |
| 38–109 / 1.2–3.6' | A | Very dark gray (10YR 3/1) clay, slightly silty with depth, fine blocky with silt coats on ped faces; very firm; common fine shell fragments; common extremely fine rock fragments; one angular chert @ 64 cm (2.1 ft); common fine krotovina filled with lighter-colored clay; slowly lightens to very dark grayish brown (10YR 3/2); gradual boundary |
| 109–201 / 3.6–6.6' | Bca | Brown (10YR 5/3) slightly sandy, silty clay, massive to weak blocky with sand coats on ped faces and soil partings; very firm; open rootlet traces; increase in rock fragments and few angular gravels, few more chert gravels than zone above up to 0.5 cm in size; calcareous concretions, light gray and hard at top becoming more common, white, and soft with depth; few fine krotovina filled with dark clay; zone lightens to pale brown (10YR 6/3) near base; clear boundary. **Note: red chert flake @ 121 cm (3.9 ft) and another reddened chert fragment @ 140 cm (4.6 ft).** |
| 201–282 / 6.6–9.3' | Ccca | Very pale brown to light gray (10YR 7/3 to 10YR 7/1 to 10YR 7/2) sandy, silty clay, increasingly silty and sandy with depth, texture obscured; firm to friable; zone noticeably whitened with calcareous deposits along rootlet traces and soil partings; abundant white soft calcareous concretions; few fine black FeMn concretions with dark orange haloes that increase in number with depth; lower part slightly darker being light brownish gray (10YR 6/2) |

**Core 6A**
Sample available for examination for top 79 cm very small in size.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–79 / 0–2.6' | Fill | Mixed-colored clays with abundant chert gravels |
| 79–180 / 2.6–5.9' | A | Black to very dark brown to very dark gray (10YR 2/1 to 10YR 2/2 to 10YR 3/1) clay, fine blocky with light silt coats on ped faces; firm to very firm; abundant chert gravels (30–50% of zone), 1 to 5 cm in size, a few reddened, with fewer gravels towards the base; zone is almost like gravel bed with clay matrix; common extremely fine rock fragments; clear boundary |
| 180–201 / 5.9–6.6' | Bca | Dark grayish brown to grayish brown (10YR 4/2 to 10YR 5/2) clay, massive to fine blocky with silt coats on ped faces; firm to very firm; common light gray to off-white hard calcareous concretions which increase in number with depth; few large chert gravels that decrease in number with depth; clear boundary |
| 201–262 / 6.6–8.6' | Cc | Light brownish gray to very pale brown (10YR 6/2 to 10YR 7/3) slightly sandy clay, weak fine blocky with sand coats on ped faces; firm; common fine black FeMn; zone 20–30% mottled orange; common fine shell fragments; common open rootlet traces; abrupt boundary |
| 262–282 / 8.6–9.3' | 2C | Light gray to very pale brown (10YR 7/2 to 10YR 7/3) gravel in sandy, silty clay matrix, massive; gravels mainly chert, 0.5 to 4 cm in size, but few orange siltstone pieces |

**Core 7A**

Some samples very strange in appearance due to being broken up during extraction from boring tubes. Sample size available for examination very small for the depths 137 cm to 183 cm (4.5–6.0 ft), 206 cm to 244 cm (6.8–8.0 ft), and 259 cm to 315 cm (8.5–10.3 ft). It is possible much of what was sampled in these intervals was slough from upper portions of the boring. Care was taken to try to differentiate what was in situ material from slough in these intervals.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–10 / 0–0.3' | Fill | Mixed-colored clays with abundant chert gravels and concrete |
| 10–122 / 0.3–4.0' | A1 | Black to very dark gray (10YR 2/1 to 10YR 3/1) clay, strong fine blocky with light silt and sand coats on ped faces; very firm to dense; several lenses of tan chert gravels, 3 to 5 cm in size, a few reddened, with fewer gravels toward the base; common extremely fine rock fragments; clear textural boundary |
| 122–183 / 4.0–6.0' | A2 | Black to very dark gray (10YR 2/1 to 10YR 3/1) clay, fine blocky with silt coats on ped faces; firm to very firm; abundant sharp to angular 0.25 to 1 cm sized pieces and slivers of chert; white calcareous deposits along rootlet traces; clear to abrupt boundary |
| 183–206 / 6.0–6.8' | C1 | Light gray to very pale brown (10YR 7/2 to 10YR 7/3) slightly silty, sandy gravel, loose; friable; gravel angular to rounded and 0.25 to 2 cm in size; clear to abrupt boundary |
| 206–315 / 6.8–10.0' | C2 | Very pale brown (10YR 7/3 to 10YR 7/4) clayey, silty sand, massive; friable; common 0.25 to 0.5 cm angular chert gravels with a few clay interbeds; clear boundary |
| 315–366 / 10.0–12.0' | C3gca | Light gray (5Y 7/1) silty clay, massive to weak blocky; firm; zone becomes more silty with depth; few lenses of fine rounded gravel; few large calcareous concretions; zone mottled 50% orange (10YR 6/6); gray reduction haloes around open rootlet traces; gradual boundary |
| 366–457 / 12.0–15.0' | C4ca | Very pale brown (10YR 7/4) clayey silt, massive with sand on soil partings; firm; common calcareous concretions in upper part; large gray (5Y 6/1) reduction spots |

**Core 8A**

Sample size available for examination very small for the depths 244 cm to 472 cm (8.0–15.5 ft). Many of the samples had been pulverized when removing them from the boring tubes, destroying some stratigraphic information and reducing sample size to roughly 1 liter in size. Some of these samples contain what appears to be slough from the upper portion of the hole. Care was taken to try to differentiate what was in situ material from slough in these samples.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–91 / 0–3.0' | Fill | Dark-colored clay with abundant limestone and chert gravels |
| 91–193 / 3.0–6.3' | Aca | Very dark gray to black (10YR 3/1 to 10YR 2/1) clay, weak fine blocky; very firm to dense; common fine shell fragments; few rounded chert gravels, 1 to 5 cm in size, a few reddened possibly burned; open rootlet traces with some white calcareous deposits, common extremely fine rock fragments; common light gray hard calcareous concretions in lower part; slightly lighter at base being very dark grayish brown (10YR 3/2); clear boundary |
| 193–457 / 6.3–15.0' | Bca | *SAMPLES IN EXTREMELY POOR STATE IN LOWER PART.* Light brownish gray to gray (10YR 6/2 to 10YR 5/1) slightly sandy, silty clay, massive; firm; common decaying fine woody roots; abundant large soft white calcareous concretions; few fine rounded gravels; common woody roots in lower part; common fine shell fragments; few chert gravels, 2–4 cm in size, in lower part; gradual boundary |
| 457–472 / 15.0–16.0' | Bg | Light olive brown (2.5Y 5/4) clay, massive; plastic; wet; abundant fine angular chert gravel |

**Core 9A**

Many of coring samples had large amounts of slough in upper parts and a number had been pulverized when removing them from the boring tubes.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–91 / 0–3.0' | Fill | Light- and dark-colored clay mixed with limestone gravels and angular cherts |
| 91–183 / 3.0–6.0' | A | Black to very dark gray (10YR 2/1 to 10YR 3/1) clay, fine blocky with clay skins on ped faces; very firm; common krotovina filled with lighter clay; common open rootlet traces; common fine shell fragments; common extremely fine rock fragments; gradual to clear boundary |
| 183–245 / 6.0–8.0' | B | Dark gray to gray (10YR 4/1 to 10YR 5/1) slightly sandy clay, massive to weak medium blocky with clay skins on ped faces and soil partings; very firm; few fine rounded gravels and rock fragments; boundary unknown |
| 245–457 / 8.0–15.0' | Unknown | EXTREMELY POOR SAMPLES consisting of 3 partial quart bags of pulverized material for entire interval; much sloughed material. Fine angular chert fragments mixed with dark-colored clay and sandy clay; moist. |

**Core 9A**

Many of coring samples had large amounts of slough in upper parts and a number had been pulverized when removing them from the boring tubes.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–91 / 0–3.0' | Fill | Light- and dark-colored clay mixed with limestone gravels and angular cherts |
| 91–183 / 3.0–6.0' | A | Black to very dark gray (10YR 2/1 to 10YR 3/1) clay, fine blocky with clay skins on ped faces; very firm; common krotovina filled with lighter clay; common open rootlet traces; common fine shell fragments; common extremely fine rock fragments; gradual to clear boundary |
| 183–245 / 6.0–8.0' | B | Dark gray to gray (10YR 4/1 to 10YR 5/1) slightly sandy clay, massive to weak medium blocky with clay skins on ped faces and soil partings; very firm; few fine rounded gravels and rock fragments; boundary unknown |
| 245–457 / 8.0–15.0' | Unknown | EXTREMELY POOR SAMPLES consisting of 3 partial quart bags of pulverized material for entire interval; much sloughed material. Fine angular chert fragments mixed with dark-colored clay and sandy clay; moist. |

**Core 12A**
Sample from 208 to 269 cm (6.8–8.8 ft) still in steel sampling tube. Quality of lower boring samples poor.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–25 / 0–0.8' | Fill? | Not sampled |
| 25–86 / 0.8–2.8' | A | Very dark brown to very dark grayish brown (10YR 2/2 to 10YR 3/2) silty clay, weak blocky; very firm; common fine shell fragments; common extremely fine rock fragments; gradual boundary |
| 86–152 / 2.8–5.0' | AB to B1ca | Dark brown to dark grayish brown (10YR 3/3 to 10YR 4/2) silty clay, weak fine blocky; firm to very firm; slight increase in sand and silt with depth; few hard light gray calcareous concretions in lower part; few woody roots; few extremely fine rounded gravels; few krotovina filled with dark clay; gradual boundary |
| 152–183 / 5.0–6.0' | B2ca | Dark grayish brown to dark brown (10YR 4/2 to 10YR 4/3) sandy, silty clay, weak blocky with sand coats on ped faces; very firm; common small white calcareous concretions and white calcareous deposits along rootlet traces; common fine shell fragments; few fine rounded gravels; clear boundary |
| 183–269 / 6.0–8.8' | B3k | Brown (10YR 5/3) clay, texture obscured; calcareous deposits comprise 60–70% of zone; large white soft calcareous concretions and white calcareous deposits in pore spaces and on soil partings; boundary unknown |
| 269–305 / 8.8–10.0' | Ck | Yellowish brown (10YR 5/4?) clay; firm; calcareous deposits comprise 60–70% of zone; large white soft calcareous concretions and white calcareous deposits in pore spaces and on soil partings; boundary unknown |
| 305–366 / 10.0–12.0' | Unknown | Sample is almost all slough from overlying zones with some 0.5-cm sized rounded gravels. |

**Core 13A**
Samples from 330 to 390 cm (10.8–12.8 ft) and 432 to 457 cm (14.2–15.0 ft) very poor (in plastic quart bags; pulverized).

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–65 / 0–2.1' | Fill | Dark clay with angular limestone gravels |
| 65–86 / 2.1–2.8' | B1ca | Dark grayish brown to dark brown (10YR 4/2 to 10YR 4/3) slightly sandy clay, massive; firm; common fine krotovina filled with light-colored clay; common light gray to off-white calcareous concretions; common open rootlet traces; common fine shell fragments, common extremely fine rock fragments; clear boundary |
| 86–117 / 2.8–3.8' | B2ca | Pale brown (10YR 6/3) slightly sandy clay, weak blocky; firm; common white soft calcareous concretions; common woody fine roots; common open rootlet traces; very mottled appearance due to abundant krotovina filled with orange (10YR 6/6) and dark-colored clays; gradual boundary |
| 117–269 / 3.8–8.8' | C1cca | Light yellowish brown to brownish yellow (10YR 6/4 to 10YR 6/6) slightly sandy, silty clay, massive to weak blocky; sand and silt content varies slightly with depth; firm to very firm; common to abundant white soft calcareous concretions in upper part with very few in lower portion; common white calcareous deposits along open rootlet traces; few very fine black FeMn concretions that increase rapidly in number with depth, concretions have dark orange haloes in lower part; common fine shell fragments; few fine woody roots; common orange Fe mottles in lower part; few light gray reduction spots in lower part; clear to gradual boundary |
| 269–330+ / 8.8–11.0+' | C2cca | Light gray to very pale brown (10YR 7/2 to 10YR 7/3) slightly sandy, silty clay, massive to weak medium blocky; dense; few white soft calcareous concretions in lower part; common fine black FeMn concretions that increase in number with depth; 40–50% of zone mottled orange (10YR 6/8); white calcareous deposits along rootlet traces; |
| 330–390 / 11.0–13.0' | | Poor sample; suspect sloughed material. |
| 390–432+ / 13.0–14.0' | C3gca | Light gray to white (2.5Y N/7 to 2.5Y N/8) sandy, silty, clay, massive with clay skins on soil partings; firm; abundant soft white calcareous concretions and white calcareous deposits along rootlet traces; dark red staining along rootlet traces; maroon–purple fine decaying woody roots; few orange Fe mottles as above that increase in number with depth |
| 432–457 / 14.0–15.0' | | Poor sample; suspect sloughed material |

**Core 14A**

Samples below 193 cm (6.3 ft) very poor (in plastic quart bags; pulverized) and sample from 255 to 315 cm (8.4–10.3 ft) still in steel sampling tube.

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–35 / 0–1.1' | Fill | Dark clay with angular limestone gravels |
| 35–147 / 1.1–4.8' | Aca | Very dark grayish brown to dark brown (10YR 3/2 to 10YR 3/3) slight sandy, silty clay, fine blocky with silt coats on ped faces; very firm to dense; common fine shell fragments; common extremely fine rock fragments; few hard off-white calcareous concretions in lower part; few fine krotovina filled with light-colored clay; some white calcareous deposits along rootlet traces; gradual boundary |
| 147–168 / 4.8–5.5' | Bkca | Dark brown (10YR 4/3) silty clay, texture obscured; very firm to dense; abundant off-white hard calcareous concretions; zone "cemented" with calcareous deposits; abrupt boundary |
| 168–193+ / 5.5–6.3+' | Ckca | Light yellowish brown to brownish yellow (10YR 6/4 to 10YR 6/6) silty clay, texture obscured by calcareous cement; very firm to dense; abundant large white soft calcareous concretions, zone whitened and pore spaces filled with white calcareous cement; few open rootlet traces; fine krotovina filled with darker clay; common fine shell fragments; boundary unknown |
| 193–396 / 6.3–13.0' | | *POOR SAMPLES; suspect sloughed material in part. Bagged samples dominantly dark brown (7.5YR 4/2) clay covered in light gray-colored dust. Lowest bagged sample contained several large limestone gravels. Portion of sample that could be observed at base of steel sampling tube was very pale yellow (10YR 8/4) sandy clay.* |

**Core 15A**
Samples from 147 to 274 cm (4.8–9.0 ft) very poor (in plastic quart bags; pulverized).

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–30 / 0–0.9' | Fill | Dark clay with angular limestone gravels |
| 30–86 / 0.9–2.8' | Bca | Dark brown (10YR 4/3) slightly sandy, silty clay, strong fine blocky with silt and sand coats on ped faces; very firm; common krotovina filled with darker clay; common medium woody roots; common fine shell fragments; common fine off-white to white calcareous concretions; clear boundary |
| 86–274 / 2.8–9.0' | C1ca | Light yellowish brown to brownish yellow (10YR 6/4 to 10YR 6/6) slightly sandy, silty clay, massive with clay skins on soil partings; firm to very firm; very common medium off-white hard calcareous concretions; common krotovina filled with darker clay; some decaying woody roots; abundant white calcareous deposits along rootlet traces in lower part; clear boundary |
| 274–335 / 9.0–11.0' | C2cca | Light gray (10YR 7/1 to 10YR 7/2) silty clay, massive to weak fine blocky; firm; heavily mottled orange (10YR 6/4, 10YR 6/6 to 10YR 6/8); common open rootlet traces; very common fine black FeMn concretions with dark orange haloes; very common white soft calcareous concretions; gradual boundary |
| 335–396 / 11.0–13.0' | C3gcca | Light gray (2.5Y 7/2) silty clay, massive with clay skins on soil partings; firm; zone mottled 10–20% orange; very common to abundant fine black FeMn concretions; very common to abundant medium white soft calcareous concretions; concretions reach a maximum at a depth of 365 cm (12.0 ft) and decrease below that point; gradual boundary |
| 396–457 / 13.0–15.0' | C4gcca | White (2.5Y N/8) silty clay, massive with clay skins on soil partings; firm; common soft white to hard light gray calcareous concretions, comprise up to 25% of zone; common fine black FeMn concretions with dark orange haloes; 20–30% of zone mottled orange (10YR 6/8); color varies slightly to light gray (2.5Y 7/2) and light brownish gray (2.5Y 6/2) |

**Core 16A**

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–38 / 0–1.2' | A | Very dark gray (10YR 3/1) very slightly silty clay, weak blocky with silt coats on ped faces; firm; few fine woody roots; common extremely fine rock fragments; clear boundary |
| 38–122 / 1.2–4.0' | Bca | Brown to yellowish brown (10YR 5/3 to 10YR 5/4) slightly silty clay, weak fine blocky to massive; firm; common krotovina filled with light- and dark-colored clays; few fine off-white hard calcareous concretions becoming more common with depth; few fine shell fragments; gradual boundary |
| 122–203 / 4.0–6.7' | C1cca | Light yellowish brown to brownish yellow (10YR 6/4 to 10YR 6/6) silty clay, massive with clay skins on soil partings; firm; common open rootlet traces; common krotovina filled with dark-colored clay; common large white soft calcareous concretions; zone becomes slightly darker being pale brown (10YR 6/3) with pale orange mottles (10YR 6/4); few fine black FeMn concretions; few decaying woody roots; gradual boundary |
| 203–325 / 6.7–11.0' | C2cca | Very pale brown (10YR 7/4) slightly silty clay, massive to weak blocky; firm; common large white soft calcareous concretions and white calcareous deposits along rootlet traces; common fine black FeMn concretions; few gray (10YR 7/2) reduction spots; in lower part, zone mottled 10% dark orange; zone's color varies slightly being darker, pale brown (10YR 6/3), in some places; gradual boundary |
| 325–386 / 11.0–13.0' | C3cca | Light gray to white (10YR 7/2 to 10YR 8/2) very slightly sandy, silty clay, massive; firm; common orange Fe mottles; abundant large soft white calcareous concretions comprising 25–40% of zone, especially in lower part pf zone; white calcareous deposits along rootlet traces; few to common fine black FeMn concretions; clear boundary |
| 386–427 / 13.0–14.0' | C4cca | White (10YR 8/2) clayey silt, massive; soil partings look like bedding planes; firm; few soft white to hard light gray calcareous concretions; common fine black FeMn concretions; white calcareous deposits on soil partings and rootlet traces |

**Core 17A**

| Depth (cm/ft) | Soil Zone | Description |
|---|---|---|
| 0–371 / 0–12.0' | Fill | Mixed-colored clays with chunks of asphalt, decaying organic material, limestone gravels, large chert gravels, and pieces of sandstone or decaying cement; abrupt, irregular boundary |
| 371–399 / 12.0–13.0' | B1 | Brown to yellowish brown (10YR 5/3 to 10YR 5/4) slightly silty clay, massive to weak blocky with silt coats on soil partings and ped faces; firm to plastic; few fine shell fragments; gradual boundary |
| 399–457 / 13.1–15.0' | B2ca | Dark brown (10YR 4/3) slightly sandy clay, massive to fine blocky; plastic; zone very moist; few hard light gray calcareous concretions; increasing amounts of white calcareous deposits along rootlet traces; light gray reduction spots and mottles (10YR 6/3); few orange Fe mottles |

# APPENDIX B

# SOIL DESCRIPTIONS OF GEOARCHAEOLOGICAL BACKHOE TRENCHES, SAN ANTONIO WATER SYSTEM, OLMOS BASIN CENTRAL WATERSHED (C-3), REACHES 1–4: JOSEPHINE TO WITTE MUSEUM

## OLMOS BASIN CENTRAL WATERSHED (C-3), REACHES 1–4
## AVENUE B TRENCHES

**BHT 1**

In narrow portion between Avenue B to east and concrete lined canal to west just north of Mill Race near crest of spoil pile from digging of canal. Location appears to be just north of Core 4A.

| Depth (cm) | Soil Zone | Description |
|---|---|---|
| 0–80 | Fill | Mixed dark- colored clay with common to abundant limestone and chert gravels and angular chert fragments; boundary is abrupt, slightly wavy, and marked by a layer of orange- colored sand. |
| 80–160 | A | Very dark grayish brown (10YR 3/2) slightly silty clay, strong coarse to fine blocky with trace of silt coats on ped faces; very firm to dense; common fine shell fragments; common very fine light colored rock fragments; common open rootlet traces and few black decaying rootlets; clear to gradual boundary. Chipped chert in back dirt. Stone "smear" on west trench wall at a depth of 120 cm. Large reddened, broken chert gravel from this zone or zone below. |
| 160–195 | ABca | Dark grayish brown to dark brown (10YR 4/2 to 10YR 4/3) silty clay, strong fine blocky with silt coats on ped faces; very firm; common fine shell fragments; common fine white calcareous concretions; common fine rootlet traces; gradual to clear boundary. Stone 'smear" on west trench wall at a depth of 170 cm. |
| 195–230 | Bca | Dark brown (10YR 4/3) silty clay, medium blocky with orange colored silt on ped faces; firm; common fine to large white calcareous concretions; common open rootlet traces with trace of FeMn stain along open traces; common shell fragments but fewer than overlying zones. |

**BHT 2**

Approximately 30 meters north of BHT 1 but near east edge of narrow sliver, closer Avenue B, and on eastern fringe of spoil pile. Location appears to be midway between Cores 4A and 5A.

| Depth (cm) | Soil Zone | Description |
|---|---|---|
| 0–100 | Fill | Mixed dark-colored clay, limestone and chert gravels, and orange-colored cushion sand. This trench intersected trench containing large, blue PVC water line with top water line exposed at a depth of approximately 50 cm in western wall of trench. |

**BHT 3**

At southwest end of Lion's Field adjacent to west side of track between two probable spoil piles from digging of concrete-lined canal just to the west. Location is approximately halfway between Cores 6A and 7A.

| Depth (cm) | Soil Zone | Description |
|---|---|---|
| 0–60/80 | Fill | Brown colored clay with abundant grass roots, some chert and limestone gravel, one very large chunk of degraded cement. This trench intersected 2-inch, galvanized steel sprinkler system line at a depth of roughly 30 cm. Boundary is abrupt, smooth, slightly wavy, and marked by white calcareous concretions and cement fragments. Brass hinge or clip in backdirt from this layer. |
| 60/80–100 | A | Very dark grayish brown (10YR 3/2) slightly silty clay, blocky but structure obscured by amount of gravel; firm to very firm; abundant rounded chert and limestone gravels to 10 cm in size, most with calcareous coats or patina; upper portion of zone contains a few angular chunks of light brown colored clay indicating that it was partially disturbed during the construction of the park facilities or the nearby canal; clear boundary |
| 100–120 | AB | Dark gray (10YR 4/1) clay with abundant large rounded chert and some limestone gravels, 2 to 10 cm in size; very firm to dense; most gravels have calcareous coats or patina; some .5-cm-sized, burnt or reddened, fractured or broken chert pieces in backdirt from this zone |

**BHT 4**

43 meters north of BHT 3 at outer edge of left field in Lion's Park just south of location of Core 7 A

| Depth (cm) | Soil Zone | Description |
|---|---|---|
| 0–36 | Fill | Dark brown (10YR 3/3) sandy, silty clay, massive; firm to semi-friable; abundant grass roots; several large woody roots; encountered a 2-inch galvanized irrigation system line buried to the base of this zone; abrupt, smooth boundary marked by abundant white calcareous concretions and tan colored sand |
| 36–70 | A1ca | Very dark grayish brown (10YR 3/2) clay, blocky with silt coats on ped faces; firm to very firm; common fine white calcareous concretions; increasing amounts of large, rounded chert gravels with depth, most with white calcareous coatings or patina; gradual to clear boundary. |
| 70–110 | A2ca | Black to very dark gray (10YR 2/1 to 10YR 3/1) clay, strong blocky with clay skins on ped faces and soil partings; common fine white calcareous concretions; some shell fragments and few fine whole gastropod shells; common open rootlet traces; increasing amounts of large rounded gravels with white calcareous coatings or patina |

**BHT 5**

Approximately 45 meters north of BHT 4 just south of horseshoe pits and a little north of the location of Core 7 A. Trench oriented roughly E–W.

| Depth (cm) | Soil Zone | Description |
|---|---|---|
| 0–29/30 | Fill | Dark brown (10YR 3/3) sandy, silty clay; abundant grass roots; boundary is abrupt, smooth, slightly wavy and marked by common fine white calcareous deposits and rock fragments. |
| 29/30–90/100 | A1 | Very dark gray to very dark grayish brown (10YR 3/1 to 10YR 3/2) slightly sandy, silty clay, weak blocky with silt coats on ped faces; firm; common white shell fragments and fine to very fine rock fragments, give zone a "speckled" look; few 1–2-cm-sized light tan colored rounded chert gravels; common prominent krotovina filled with orangish brown-colored (10YR 5/3 to 10YR 5/4) sandy silt begin at a depth of 70 to 80 cm, go vertically down for 30–40 cm into underlying zone before turning and running mainly horizontal; when, dry upper 8 to 10 cm of zone is visibly whitened with calcareous deposits moved down from fill above, it is possible that this area was disturbed during park construction and emplacement of fill; boundary gradual to diffuse |
| 90/100–200 | A2 to ABca | Very dark gray to dark gray (10YR 3/1 to 10YR 4/1) very slightly sandy, silty clay, weak coarse blocky with clay skins on soil partings and ped faces; very firm; more clayey with depth; common open rootlet traces; common white shell and fine rock fragments as zone above; few fine calcareous concretions which increase to abundant with depth and white calcareous deposits along open rootlet traces; zone is slightly lighter with depth being dark gray (10YR 4/1); common round gravels, mainly chert, 1 to 2 cm in size with the largest gravels being 3 to 4 cm, most gravels have white calcareous coatings or patina; gravels seem to occur in bands or indistinct layers; considerable number of chipped chert pieces varying from fine to 3 cm in size, some of pieces have white calcareous patina and appears to have rounded edges, these flakes appear to be more concentrated in gravel-rich portions of zone. |

**BHT 6**

Roughly 45 meters east of BHT 5 at northeast corner of Lion's Field located between old sewer line to southwest and electric utility trench to north and east

| Depth (cm) | Soil Zone | Description |
|---|---|---|
| 0–60 | Fill | Dark brown (10YR 3/3) sandy, silty clay, massive; loose to friable; abundant grass roots; abrupt, irregular base marked by abundant white calcareous concretions and white calcareous deposits |
| 60–80 | Fill to Disturbed | Dark grayish brown to dark brown (10YR 3/2 to 10YR 3/3) slightly sandy, silty clay, massive to very weak blocky; firm; contains floor tile, machine nails; appears disturbed or a mix of natural deposits with overlying fill; clear boundary. |
| 80–110 | AB | Dark gray (10YR 4/1) silty clay, massive to weak fine blocky; firm to plastic; abundant small pieces of decaying white limestone; few to common chert gravels with white calcareous coatings or patina, 1 to 4 cm in size; several small, square pieces of metal |

# APPENDIX C

# LITHIC ARTIFACTS ANALYSIS DATA

Geo-Marine, Inc.
GMI 30401.01.18, SAWS Olmos C-3
Lithic Artifact Data

| Unit No. | Depth (cm) | FS No. | Lot No. | Art. No. | Class | Type | Other | Modification | Condition | Percent of cortex | Material | Heat Treat. | Qty | Size (in mm) | Weight (in g) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Site 41BX1953*** | | | | | | | | | | | | | | | | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 2 | Chipped Stone Tool | Uniface | Edge Modified Flake | Straight/ convex | Whole | 1-99% (secondary) | Edwards chert | No | 1 | 36.85x30.92 x4.97 | 6.5 | Minimal modification along one lateral edge |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 3 | Core | Exhausted | N/A | N/A | | 1-99% (secondary) | Edwards chert | No | 1 | 28.07x22.75 x20.37 | 17.7 | Small exhausted core fragment |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 4 | Debitage | Flake | Biface Thinning | N/A | Whole | 0% (tertiary) | Edwards chert | No | 1 | 38.1-50.8 | 11.8 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 5 | Debitage | Flake | Indeterminate (Fragment-medial/ distal) | N/A | Fragment-distal | Indeterminate/ Not applicable | Edwards chert | No | 1 | 25.4-38.1 | 3.2 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 6 | Debitage | Flake | Biface Thinning | N/A | Whole | 0% (tertiary) | Edwards chert | Pot lidded | 1 | 19-25.4 | 1.4 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 7 | Debitage | Flake | Biface Thinning | N/A | Whole | Indeterminate/ Not applicable | Edwards chert | No | 0 | 6.4-12.7 | 0.3 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 8 | Debitage | Flake | Core Flake | N/A | Whole | 100% (primary) | Edwards chert | No | 0 | 25.4-38.1 | 16.4 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 9 | Debitage | Flake | Biface Thinning | N/A | Whole | 1-99% (secondary) | Edwards chert | No | 1 | 6.4-12.7 | 0.4 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 10 | Debitage | Shatter | N/A | N/A | Blocky chunk | 1-99% (secondary) | Edwards chert | Pot lidded / fractured | 2 | 25.4-38.1 | 17.9 | |

| Unit No. | Depth (cm) | FS No. | Lot No. | Art. No. | Class | Type | Other | Modification | Condition | Percent of cortex | Material | Heat Treat. | Qty | Size (in mm) | Weight (in g) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Backhoe Trench 5, Backfill | - | 1 | 1 | 11 | Unworked | FCR | N/A | N/A | N/A | Indeterminate/Not applicable | Unidentifiable | Burned | 1 | 19-25.4 | 3.7 | |
| Backhoe Trench 5, Backfill | - | 1 | 1 | 1 | Chipped Stone Tool | Uniface | Edge Modified Flake | Multiple edges | Whole | 1-99% (secondary) | Ogallala quartzite | Pot lidded | 1 | 31.27x37.35 x9.84 | 9.0 | Small flake removals along 12.29 mm, possible use wear along two other edges; large potlid removed bulb |
| Backhoe Trench 5, Backfill (Bottom Horizon) | - | 2 | 2 | 5 | Debitage | Shatter | N/A | N/A | Blocky chunk | 100% (primary) | Edwards chert | No | 1 | 12.7-19 | 1.2 | |
| Backhoe Trench 5, Backfill (Bottom Horizon) | - | 2 | 2 | 1 | Debitage | Flake | Blade | N/A | Whole | 0% (tertiary) | Edwards chert | No | 1 | 12.7-19 | 0.5 | |
| Backhoe Trench 5, Backfill (Bottom Horizon) | - | 2 | 2 | 2 | Debitage | Flake | Core Flake | N/A | Fragment-lateral | 1-99% (secondary) | Edwards chert | No | 1 | 25.4-38.1 | 9.6 | |
| Backhoe Trench 5, Backfill (Bottom Horizon) | - | 2 | 2 | 4 | Debitage | Shatter | N/A | N/A | Fragment (indeterminate) | 0% (tertiary) | Edwards chert | Pot lidded | 1 | 6.4-12.7 | 0.3 | |
| Backhoe Trench 5, Backfill (Bottom Horizon) | - | 2 | 2 | 6 | Unworked | FCR | N/A | N/A | Fragment (indeterminate) | Indeterminate/Not applicable | Edwards chert | Fractured | 2 | 12.7-19 | 1.4 | |
| Backhoe Trench 5, Backfill (Bottom Horizon) | - | 2 | 2 | 3 | Debitage | Shatter | N/A | N/A | Blocky chunk | 100% (primary) | Edwards chert | No | 1 | 19-25.4 | 1.5 | |

| Unit No. | Depth (cm) | FS No. | Lot No. | Art. No. | Class | Type | Other | Modification | Condition | Percent of cortex | Material | Heat Treat. | Qty | Size (in mm) | Weight (in g) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 13 | Unworked | FCR | N/A | N/A | N/A | Indeterminate/Not applicable | Edwards chert | Pot lidded / fractured | 2 | 25.4-38.1 | 16.4 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 1 | Debitage | Flake | Biface Thinning | N/A | Whole | 1-99% (secondary) | Edwards chert | No | 1 | >50.8 | 33.3 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 2 | Debitage | Flake | Core Flake | N/A | Whole | 100% (primary) | Edwards chert | No | 1 | | 34.7 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 3 | Debitage | Flake | Indeterminate (Fragment-medial/ distal) | N/A | Fragment-distal | 0% (tertiary) | Edwards chert | No | 1 | 19-25.4 | 1.2 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 4 | Debitage | Flake | Core Flake | N/A | Whole | Platform only | Edwards chert | No | 1 | 12.7-19 | 0.9 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 5 | Chipped Stone Tool | Uniface | Edge Modified Flake | Concave | Whole | 1-99% (secondary) | Edwards chert | No | 1 | 17.86x20.39 x4.93 | 1.9 | Possible edge modification on one edge of a broken flake; two small concavities with possible intional modification, but could also be from natural causes |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 6 | Debitage | Shatter | N/A | N/A | Blocky chunk | 100% (primary) | Edwards chert | No | 1 | 12.7-19 | 1.5 | |

Geo-Marine, Inc.
GMI 30401.01.18, SAWS Olmos C-3
Lithic Artifact Data

| Unit No. | Depth (cm) | FS No. | Lot No. | Art. No. | Class | Type | Other | Modification | Condition | Percent of cortex | Material | Heat Treat. | Qty | Size (in mm) | Weight (in g) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 7 | Debitage | Flake | Core Flake | N/A | Whole | 100% (primary) | Edwards chert | Discolored | 1 | 25.4-38.1 | 5.5 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 8 | Debitage | Flake | Indeterminate (Fragment-medial/ distal) | N/A | Fragment (indeterminate) | 1-99% (secondary) | Edwards chert | Fractured | 1 | 6.4-12.7 | 0.3 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 9 | Debitage | Flake | Indeterminate (Fragment-medial/ distal) | N/A | Fragment (indeterminate) | Indeterminate/Not applicable | Edwards chert | Discolored/ fractured | 1 | 19-25.4 | 0.9 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 10 | Debitage | Flake | Core Flake | N/A | Whole | 100% (primary) | Edwards chert | No | 1 | 25.4-38.1 | 13.4 | |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 11 | Core | Exhausted | N/A | N/A | Fragment (indeterminate) | 100% (primary) | Edwards chert | No | 1 | 35.10x25.06 x18.47 | 15.6 | Possible exhausted core fragment |
| Backhoe Trench 5, Unit 1 (Northwall) | 0 - 20 | 3 | 3 | 12 | Unworked | FCR | N/A | N/A | Blocky chunk | Indeterminate/Not applicable | Unidentifiable | Fractured/ discolored | 1 | 19-25.4 | 3.4 | |

# APPENDIX D

# HISTORIC ARTIFACTS ANALYSIS DATA

Geo-Marine, Inc.
GMI 30401.01.18, SAWS Olmos C-3
Historic Artifact Data

| Unit Type | Depth (cm) | FS No. | Lot No. | Artifact No. | Class | Type | Other | Dates | Group | Qty | Analysis Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Site 41BX1953*** | | | | | | | | | | | |
| Backhoe Trench 3, Backfill | - | 4 | 4 | 1 | Metal | Brass/Copper | Clip or hinge | Indeterminate | Personal | 1 | Embossed decoration along one surface |