



# INDEX OF TEXAS ARCHAEOLOGY

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Volume 2018

Article 38

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2018

## Cultural Resources Investigations for the Proposed Delek Big Sandy Hannathon Crude Oil Gathering System, Big Spring, Howard County, Texas

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## Cultural Resources Investigations for the Proposed Delek Big Sandy Hannathon Crude Oil Gathering System, Big Spring, Howard County, Texas

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The logo for SWCA (Southwest Cultural Resources Associates) is positioned vertically on the left side of the page. It consists of the letters 'S', 'W', 'C', and 'A' stacked vertically in a large, light blue, serif font.

CULTURAL RESOURCES INVESTIGATIONS  
FOR THE PROPOSED DELEK BIG SANDY  
HANNATHON CRUDE OIL GATHERING  
SYSTEM, BIG SPRING, HOWARD COUNTY,  
TEXAS

AUGUST 2018

PREPARED FOR  
**Olsson Associates**

PREPARED BY  
**SWCA Environmental Consultants**

**Redacted**



**CULTURAL RESOURCES INVESTIGATIONS FOR THE  
PROPOSED DELEK BIG SANDY HANNATHON CRUDE OIL  
GATHERING SYSTEM, BIG SPRING, HOWARD COUNTY,  
TEXAS**

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USACE File No. SWF-2018-00248  
SWCA Project No. 049782.01

SWCA Cultural Resources Report No. 18-343

August 2018



## **ABSTRACT**

At the request of Olsson Associates (Olsson), and on behalf Delek Logistics Operating, L.P. (Delek), SWCA Environmental Consultants (SWCA) conducted an intensive cultural resources survey on a portion of the proposed approximately 11.4-mile-long Delek Big Sandy Hannathon (BSH) Crude Oil Gathering System (Project) in Big Spring, Howard County, Texas. Investigations were conducted in support of Delek's acquisition of a U.S. Army Corps of Engineers (USACE) Section 404 permit in accordance with 33 Code of Federal Regulations (CFR) Part 325, Appendix C and Section 106 of the National Historic Preservation Act (NHPA) (54 United States Code 306108) and its implementing regulations (36 CFR 800). All investigations were conducted in accordance with the standards and guidelines of the Secretary of the Interior, Texas Historical Commission, and the Council of Texas Archeologists.

The proposed pipeline will be constructed primarily by conventional trenching methods. Horizontal directional drilling will be employed at certain sensitive resource crossings and existing infrastructure (e.g., rivers and highways). Horizontal bores will be employed to cross smaller infrastructure, such as county roads and railroads. Construction will occur within a typical right-of-way (ROW) width of 100 feet, which will consist of a 50-foot-wide permanent easement and 50-foot-wide temporary construction ROW. Construction of the proposed pipeline will employ best management practices for clearing vegetation, excavating the pipeline trench, welding and laying the pipe, backfilling the pipeline trench, re-establishing pre-construction contours, and restoring permanent vegetation.

Investigations included a cultural resources background review and an intensive pedestrian survey augmented by shovel testing to systematically identify, record, delineate, and, if possible, determine the significance of any cultural resources located within the area of potential effects (APE). Rather than surveying the entire 11.4-mile-long alignment, the cultural survey targeted anticipated USACE permit review areas (PRAs) within the APE. Specifically, this approach identified areas of anticipated impacts to U.S.-regulated waterways or nearby previously identified cultural resources. Using these criteria, SWCA identified and surveyed 10 individual PRAs within the proposed pipeline alignments. During the investigations, SWCA surveyed 1.74 miles of proposed pipeline alignment at the 10 delineated PRAs (22.83 acres).

As a result of the recent survey effort, SWCA archaeologists identified no cultural resources at the 10 PRAs. The survey revealed that the APE is extensively disturbed by previous oil and gas extraction activities and existing two-track and gravel roads that make up parts of the oil and gas extraction infrastructure. Additionally, at the majority of the defined PRAS, field investigations revealed only minor drainages with little to no channel development.

In accordance with 33 CFR 325, Appendix C, Section 106 of the NHPA, and 36 CFR 800.4 (b)(1), SWCA has made a reasonable and good faith effort to identify historic properties within the anticipated PRAs. Based on the negative results of the survey, it is the opinion of SWCA that the proposed BSH Project will have NO EFFECT on any archaeological historic properties listed on or otherwise eligible for the National Register of Historic Places at 10 PRAs associated with the BSH Project. Consequently, no further cultural resources work is recommended for the current BSH Project as currently configured.

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## **INTRODUCTION**

At the request of Olsson Associates (Olsson), and on behalf Delek Logistics Partners, LP (Delek), SWCA Environmental Consultants (SWCA) conducted an intensive cultural resources survey on a portion of the proposed approximately 11.4-mile-long Delek Big Sandy Hannathon Crude Oil Gathering System (BSH Project) in Big Spring, Howard County, Texas (Figures 1 and 2). The proposed project consists of a 50-foot-wide corridor for four pipeline components: Hannathon Zilbert 6-43 to Flanagan Pipeline Route (Zilbert), Hannathon Allar 19A-30 to NGL Crude Oil Line (Allar), Hannathon Morgan Ranch 27-34 to Allar 19A-30 Pipeline Route (Morgan Ranch 27-34), and Hannathon Morgan Ranch 38-47 to Allar 19A-30 Pipeline Route (Morgan Ranch 38-47). Investigations were conducted in support of Delek's acquisition of a U.S. Army Corps of Engineers (USACE) Section 404 permit in accordance with 33 Code of Federal Regulations (CFR) Part 325, Appendix C and Section 106 of the National Historic Preservation Act (NHPA) (54 United States Code [USC] 306108) and its implementing regulations (36 CFR 800). All investigations were conducted in accordance with the standards and guidelines of the Secretary of Interior (SOI), Texas Historical Commission (THC), and the Council of Texas Archeologists (CTA).

Rather than surveying the entire 11.4-mile-long alignment, the cultural survey targeted anticipated USACE permit review areas (PRAs) within the area of potential effect (APE). Specifically, this approach identified areas of U.S.-regulated waterways or nearby previously identified cultural resources. Using these criteria, SWCA identified and surveyed 10 individual PRAs within the proposed pipeline alignments; this represented 1.74 miles (22.83 acres) of alignment at the 10 delineated PRAs. Investigations included a cultural resources background review and an intensive pedestrian survey augmented by shovel testing to systematically identify, record, delineate, and, if possible, determine the significance of any cultural resources located within the above APE.

Martin Handly served as Principal Investigator. Fieldwork was completed April 23–26, 2018, by crew chief Jay King and archaeologists Robert Brush, Stefan Barker, and Benjamin K Morton. A secondary field effort to address alignment reroutes was conducted by Jay King on May 16, 2018. The report was prepared by Benjamin K. Morton and Martin Handly. Jayme Fontenot and Carole Carpenter provided geographic information system (GIS) support from fieldwork through report production.

## **Project Description**

The proposed BSH Project will consist of 11.4 miles of new 16-inch-diameter crude oil gathering pipeline. The proposed pipeline system will be constructed primarily by conventional trenching methods. Horizontal directional drilling will be employed at existing infrastructure (e.g., highways). Horizontal bores will be employed to cross smaller infrastructure, such as county roads and railroads. Construction will occur within a typical right-of-way (ROW) width of 100 feet, which will consist of a 50-foot-wide permanent easement and a 50-foot-wide temporary construction ROW.

Construction of the proposed pipeline will employ best management practices for clearing vegetation, excavating the pipeline trench, welding and laying the pipe, backfilling the pipeline trench, re-establishing pre-construction contours, and restoring permanent vegetation.

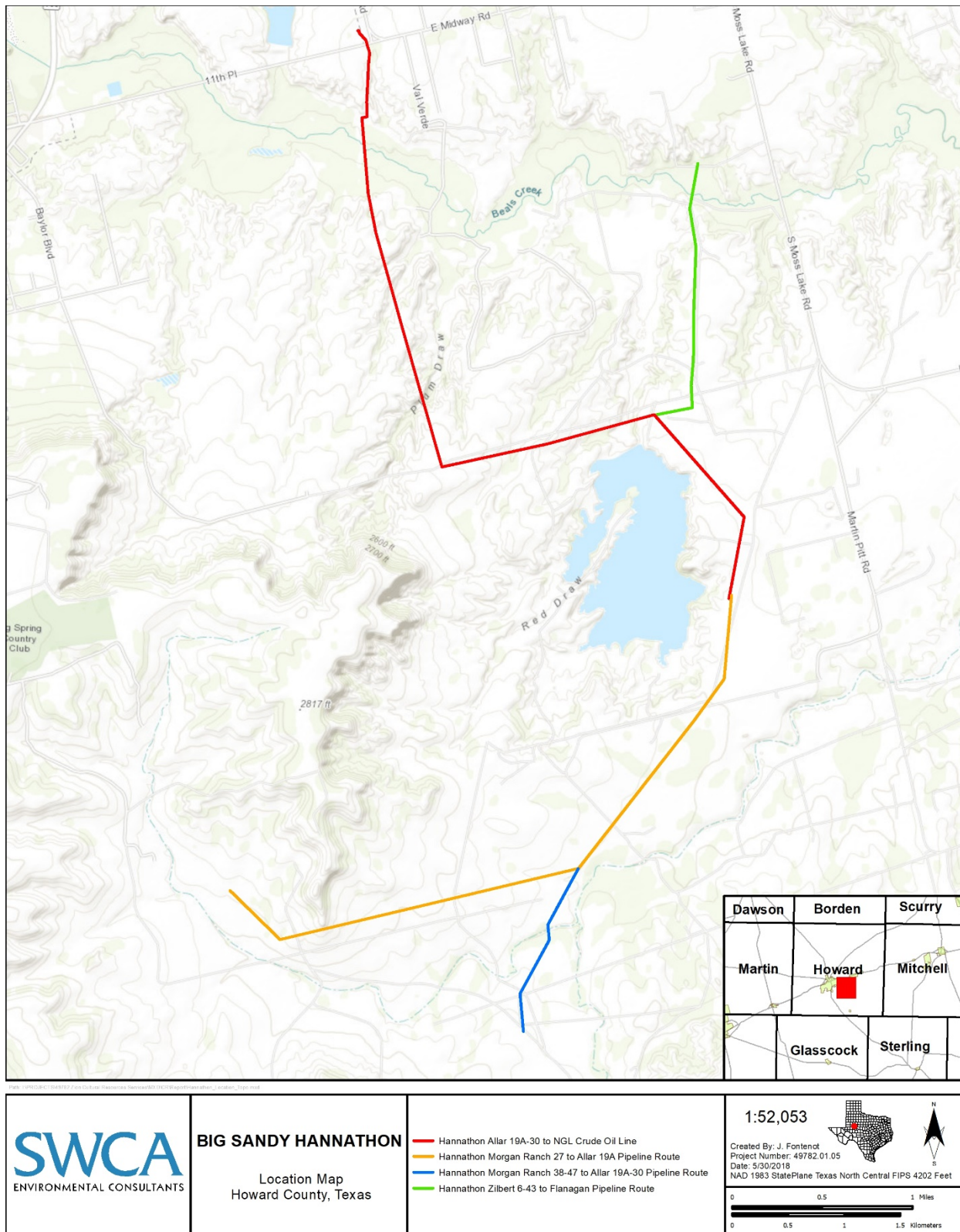


Figure 1. BSH Project location – topographic map.

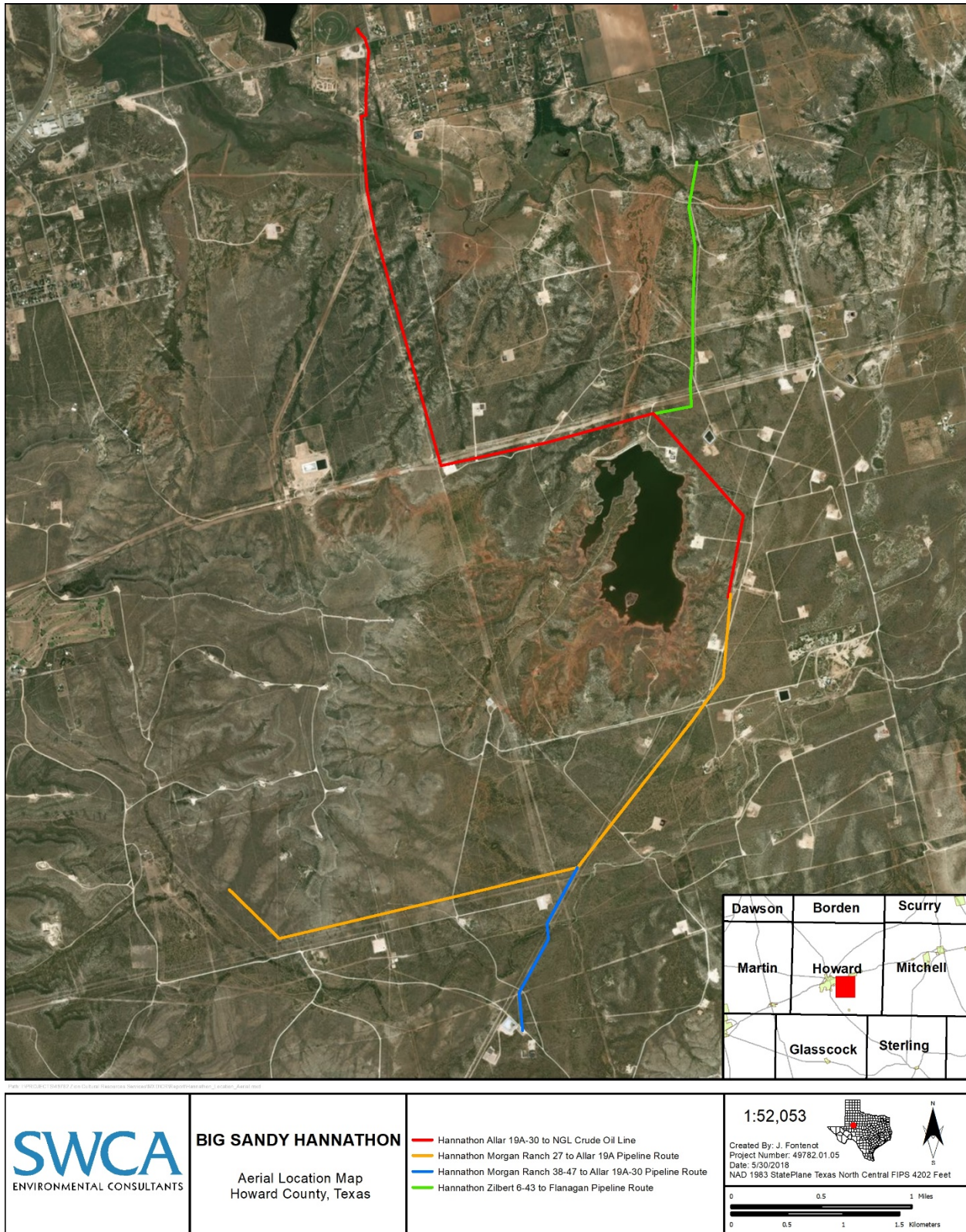


Figure 2. BSH Project location – aerial.

## ENVIRONMENTAL BACKGROUND

### Geology

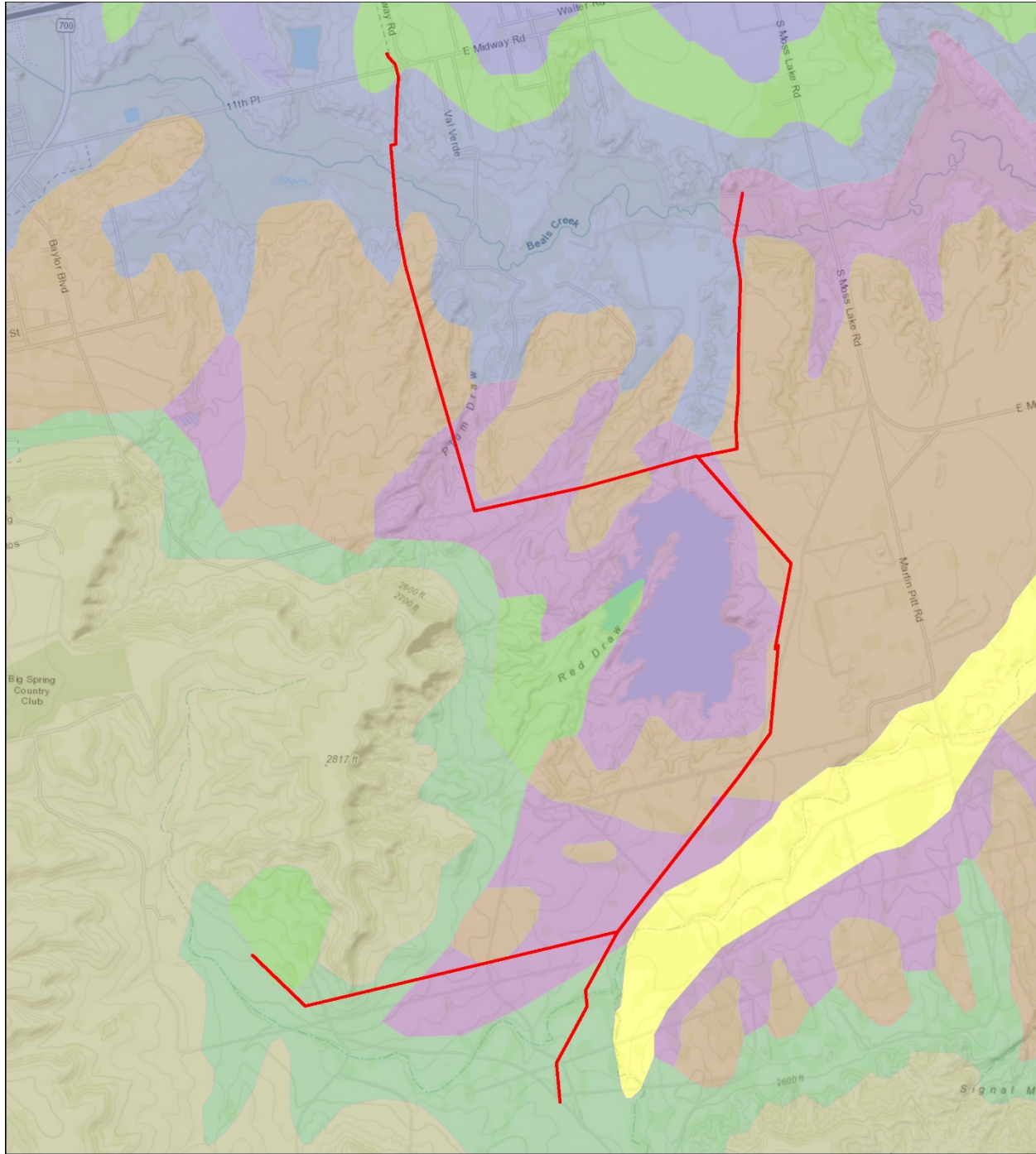
Approximately one third (34 percent) of the proposed BSH Project lies within the Late Triassic-age Dockum group, undivided geological formation (Table 1; Figure 3) (Barnes 1994). A smaller portion (22 percent) is situated within the Middle Pleistocene to recent-age Lingos geological formation. In addition, approximately 13 percent of the proposed Project corridor lies within the Early Cretaceous-age Antler Sands geological formation. Recent Holocene deposits comprise 31 percent of the alignment and are located along various large drainages throughout the BSH Project area including Moss Creek, Beals Creek, Plum Draw, and Red Draw.

**Table 1. Prominent Geological Formations Traversed by the BSH Project**

Map Code	Formation	Age	Description
TRd	Dockum group, undivided	Late Triassic	Fine-grain mixed clastic, limestone, and conglomerate: Continental redbed sequence deposited unconformably on Upper Permian. Mostly shale, micaceous, thin-bedded; thickness up to 300–400 feet.
Qli	Lingos	Middle Pleistocene to recent	Primarily sand and gravel. Lower parts 3–40 m thick sand and gravel with Ogallala calcrete clasts; middle parts 1–12 m thick, chiefly clay; upper part 3–30 m thick eolian and fluvial sand, sandy silt, and paleosols locally.
Ka	Antler Sands	Early Cretaceous	Sand, clay, and conglomerate. Lower and upper parts mostly sand; middle part chiefly clay; grades northward to interbedded sand and clay; thickness 500–650 feet.

### Soils

Soil survey data obtained from the Natural Resources Conservation Service (NRCS) provides an inventory of the various soil series intersected by the BSH Project. The most prominent soil series in Howard County are the Potter-Mansker and Acuff-Olton. The Potter-Mansker soil series, with 0 to 30 percent slopes, consists of gently sloping to steep soils that are shallow over caliche. The Acuff-Olton soil series, with 0 to 3 percent slopes, consists of deep, dark-colored loamy soils. These soils formed in sandy and clayey residuum from claystone and sandstone and can be found on gently undulating plains (NRCS 2018). According to the NRCS (2018), the BSH Project crosses 20 soil map units, with the most abundant units comprising Potter soils, 3 to 20 percent slopes (51 percent); Mansker loam, 1 to 3 percent slopes (12 percent); and Portales loam (7 percent). Most of the surveyed BSH Project area occurs on the Potter soil, which is characterized by moderately sloping, loamy soil over sandstone and calcareous earth.



	<b>BIG SANDY HANNATHON</b> Geology Map Howard County, Texas	Proposed Alignment	Qal	1:53,284 Created By: J. Fontenot Project Number: 49782.01.05 Date: 5/24/2018 NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
		<b>Geologic Unit</b> Ka Ked PoMo	Qli Qs Qu TRd	

Figure 3. BSH Project location – geological setting.

## Topography and Hydrology

The BSH Project is situated at the intersection of the Southern High Plains and North Central Plains physiographic regions. The topography throughout the Southern High Plains is characterized by large expanses of generally flat plateau, playa lakes, and caprock formations (Wermund 2018). The transition into the North Central Plains is characterized by stretches of rolling plains and steep hills eroded by meandering drainages. Agricultural landscape modification and oil field construction have impacted the topography across portions of the proposed pipeline.

Hydrologically, the proposed BSH Project area is encompassed by the Colorado River basin. The Pecos River and the Canadian River captured the headwater streams of rivers that once ran across the Southern High Plains from the Rocky Mountains, isolating the region and truncating the drainage areas of the Red, Brazos, and Colorado Rivers of Texas. As a result, the dry plain, cut off from a mountain surface water source and with little slope to induce runoff, has a very low drainage density. There are very few spring-fed creeks, and shallow draws carry water only after heavy rains. The smooth surface of the plains holds seasonal rainfall in myriads of small intermittent ponds or playas (Griffith et al. 2007).

The mapped waterways within the BSH Project area include Moss Creek, Beals Creek, Plum Draw, Red Draw, and a tributary of Wildhorse Creek, all of which flow southeast into the Colorado River. Moss Creek, Beals Creek, and Wildhorse Creek are the most prominent waterways within the study area. Most of the stream crossings investigated at the 10 PRAs exhibited minimal channel development and were impacted by landscape modification from agricultural irrigation or oil field construction practices.

## Fauna

The BSH Project area sits at the junction of two biotic provinces: the Balconian and Kansan. These provinces are transitional zones from the mesic forests of eastern North America to the xeric grasslands of the central United States. These provinces have a high faunal diversity, with Blair (1950) identifying at least 57 species of mammal, over 42 species of reptile, and 15 species of amphibian native to the Balconian biotic province. None of the fauna for the Balconian is restricted solely to this province (Blair 1950). For the Kansan biotic province, Blair (1950) recorded 59 mammalian species, 45 reptilian species (snakes and lizards), and 16 amphibian species.

Some mammals common to the Balconian province include: opossum (*Didelphis virginiana*), eastern pipistrelle (*Pipistrellus subflavus*), eastern fox squirrel (*Sciurus niger*), eastern cottontail rabbit (*Sylvilagus floridanus*), pocket gopher (*Geomys breviceps*), pallid bat (*Antrozous pallidus*), valley pocket gopher (*Thomomys bottae*), badger (*Taxidea taxus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), mink (*Mustela vison*), muskrat (*Ondatra zibethica*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and white-tailed deer (*Odocoileus virginianus*). Historically, red wolf, bison and black bear ranged into or near this region (Burt and Grossenheider 1976; Davis and Schmidly 1994; Schmidly 1983).

The general reptilian assemblage for the Balconian province include the Great Plains rat snake (*Elaphe guttata emoryi*), eastern yellowbelly racer (*Coluber constrictor flaviventris*), Yellow mud turtle (*Kinosternon flavescens flavescens*), bullfrog (*Rana catesbiana*), southern leopard frog (*Rana utricularia*), and the Gulf Coast toad (*Bufo valliceps*) (Blair 1950; Conant and Collins 1998; Kutac and Caran 1994; Werler and Dixon 2004).

Comparatively, the mammalian fauna encountered within the Kansan province in the northern portion of the BSH Project area include: Ord's kangaroo rat (*Dipodomys ordii*), deer mouse (*Peromyscus maniculatus*), eastern mole (*Scalopus aquaticus*), swift fox (*Vulpes velox*), plains pocket mouse



(*Perognathus flavescens*), black-footed ferret (*Mustela nigripes*), striped skunk, badger, coyote, spotted ground squirrel (*Citellus spilosoma*), blacktail prairie dog (*Cynomys ludovicianus*), yellow-faced pocket gopher (*Cratogeomys castanops*), hispid pocket mouse (*Perognathus hispidus*), Merriam pocket mouse (*Perognathus merriami*), northern grasshopper mouse (*Onychomys leucogaster*), white-footed mouse (*Peromyscus leucopus*), whitethroat woodrat (*Neotoma albigula*), southern plains woodrat (*Neotoma micropus*), blacktail jackrabbit (*Lepus californicus*). Three mammalian species within this province, eastern cottontail, eastern mole (*Scalopus aquaticus*) and eastern fox squirrel, are at their western limit. Bison once existed in this area but no longer remain in this area (Blair 1950; Burt and Grossenheider 1976; Davis and Schmidly 1994).

Reptilian species encountered within the Kansan province consist of 14 lizard species and 31 snake species. Some of the lizard species include: eastern collared lizard (*Crotaphytus collaris*), Great Plains skink (*Eumeces obsoletus*), and prairie lizard (*Sceloporus undulatus*), of which none are limited to this province. Some of the snake species include: eastern glossy snake (*Arizona elegans*), western diamond-backed rattlesnake (*Crotalus atrox*), western rattlesnake (*Crotalus viridis*), plains blind snake (*Leptotyphlops dulcis*), gopher snake (*Pituophis catenifer*), long-nosed snake (*Rhinocheilus lecontei*), plains black-headed snake (*Tantilla nigriceps*), checkered garter snake (*Thamnophis marcianus*), and common garter snake (*Thamnophis sirtalis*) (Blair 1950; Conant and Collins 1998; Werler and Dixon 2004).

Amphibian species encountered within the Kansan biotic province includes only one land turtle species, the ornate box turtle (*Terrapene ornate*). Additionally, only one urodele, the eastern tiger salamander (*Ambystoma tigrinum*), is observed within this province. Some of the anuran species encountered within the Kansan biotic province include: southern cricket frog (*Acris gryllus*), Great Plains toad (*Bufo cognatus*), eastern green toad (*Bufo debilis*), red-spotted toad (*Bufo punctatus*), and Woodhouse's toad (*Bufo woodhousii*) (Blair 1950; Conant and Collins 1998).

## Vegetation

Broadly defined, the BSH Project area extends from the floral communities of the Edwards Plateau/Balconian biotic province into the southern extent of the Kansan biotic province (Wermund 2014). Herbaceous upland communities throughout the BSH Project area consist of non-wetland areas dominated by non-woody vegetation such as grasses and forbs and having less than 30 percent trees and shrubs. Most herbaceous uplands comprise an herbaceous layer dominated by species such as prairie broomweed (*Amphiachyris dracunculoides*), purple threeawn (*Aristida purpurea*), yellow bluestem (*Bothriochloa ischaemum*), sideoats grama (*Bouteloua curtipendula*), curly-mesquite (*Hilaria belangeri*), Texas croton (*Croton texensis*), Texas pricklypear (*Opuntia engelmannii*), hairy grama (*Bouteloua hirsuta*), Bermudagrass (*Cynodon dactylon*), and Jame's galleta (*Pleuraphis jamesii*). A few shrubs such as lotebush (*Ziziphus obtusifolia*), honey mesquite (*Prosopis glandulosa*), roundflower catclaw (*Acacia roemeriana*), and creosote bush (*Larrea tridentata*) are also present in the herbaceous communities as scattered individuals.

Scrub-shrub upland communities throughout the BSH Project area consist of non-wetland areas with at least 30 percent shrubs or saplings and less than 30 percent trees. Most of the scrub-shrub uplands consist of a sapling/shrub layer populated by whitebrush (*Aloysia gratissima*), agarita (*Mahonia trifoliolata*), Texas persimmon (*Diospyros texana*), Ashe's juniper (*Juniperus ashei*), Pinchot's juniper (*Juniperus pinchotii*), border pricklypear (*Opuntia atrispina*), Christmas cactus (*Opuntia leptocaulis*), longleaf joinfir (*Ephedra trifurca*), Texas sotol (*Dasyilirion texanum*), knifeleaf condalia (*Condalia spathulata*), honey mesquite, creosote bush, Texas pricklypear, and lotebush. Dominant herbaceous layer species include Texas wintergrass (*Nassella leucotricha*), buffalograss (*Bouteloua dactyloides*), sideoats grama, purple threeawn, Jame's galleta, yellow bluestem, curly-mesquite, and prairie broomweed.

## **METHODS**

Archaeological investigations for the proposed BSH Project were designed to accurately determine the nature, extent, and, if possible, significance of any cultural resources located within the 100-foot-wide survey corridor at the identified PRAs. SWCA generally defined PRAs as areas of anticipated impacts to jurisdictional waterways of the United States, which typically includes drainages and adjacent terraces or floodplains, or previously identified cultural resources. All investigations were conducted in accordance with the standards and guidelines of the NHPA, THC minimum archaeological survey standards, and the CTA Guidelines for Performance, Curation, and Reports.

## **Background Review**

Prior to field investigations, SWCA performed a cultural resources file records review to determine if the BSH Project area has been previously surveyed for cultural resources or if any archaeological sites have been recorded within a 1-mile radius of the BSH Project. For the background research, an SWCA archaeologist reviewed the corresponding U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle maps, site files, and records on the THC's Texas Archeological Sites Atlas (Atlas) online database. As part of the review, an SWCA archaeologist also examined the Texas Historic Overlay (THO) maps, a mapping/GIS database with historic maps and resource information covering most portions of the state (Foster et al. 2006). These sources provide the locations and nature of previously recorded cultural resources surveys, previously recorded prehistoric and/or historic archaeological sites, cemeteries, National Register of Historic Places (NRHP) districts/properties, State Antiquities Landmarks (SALs), Official Texas Historical Markers, Registered Texas Historic Landmarks, and local neighborhood surveys.

## **Archaeological Survey**

Cultural resources investigations were intended to satisfy regulatory obligations related to the acquisition of a USACE Section 404 permit in accordance with 33 CFR 325, Appendix C, and the NHPA. Based on regulatory requirements and a review of the Project area geology, topographic maps, previously conducted surveys, and the anticipated requirements of the USACE, only a portion of the proposed pipeline route and workspaces would require cultural resources investigations. Based on the above regulatory conditions and the overall landforms and geographical and geological settings crossed by the Project, SWCA conducted a targeted survey of anticipated PRAs.

## **Permit Review Areas (PRAs)**

During the background review, SWCA accessed readily available information regarding known water bodies within the BSH Project area. Reviewed data sets included the National Wetlands Inventory (NWI), the National Hydrography Datasets (NHD), and historical topographic maps and aerial photography. Anticipated PRAs were defined upon review of the BSH Project in relation to these sources. Specifically, this approach identified areas of anticipated impacts to potential USACE-regulated waterways. Additionally, PRAs were either extended or added to include areas in which previously identified cultural resources were recorded within or adjacent to the Project alignment.

The PRA designations are intrinsically flexible, resulting in adjustments in PRA lengths, widths, and/or locations, as needed. PRAs along the length of the line were individually fine-tuned, based on the data gathered from the background and historical records research, as well as recent aerial imagery. Survey intensity within any PRA was adjusted when archaeologists encountered a heavily disturbed setting or additional drainages not depicted on topographic and aerial maps. In such cases, the field director or team

lead would have modified the shovel testing regime accordingly. During transit along the proposed survey corridor between PRAs, if survey crews encountered cultural resources on the ground surface (e.g., eroding lithic scatter site in a two-track road or a historic standing structure), the survey crews would have identified these locations as PRAs in the field and recorded those cultural resources in accordance with the methods described below.

Prior to fieldwork, SWCA identified 10 PRAs along the proposed Project alignment. Survey of the PRAs consisted of a systematic visual inspection of the surface, shovel testing on either side of the crossing within the PRA, and shovel testing in those areas adjacent to the previously identified cultural resources.

### ***Pedestrian Survey/Shovel Testing***

The field survey consisted of a single team of two SWCA archaeologists surveying the predefined segments along the 100-foot-wide corridor within the previously identified 10 PRAs associated with the BSH Project. The investigation included both pedestrian survey and shovel testing within the designated PRAs. The ground surface and exposed soil profiles were examined for evidence of cultural resources. The surface survey was conducted in a single transect along the proposed centerline with shovel testing conducted at 100-meter (m) intervals.

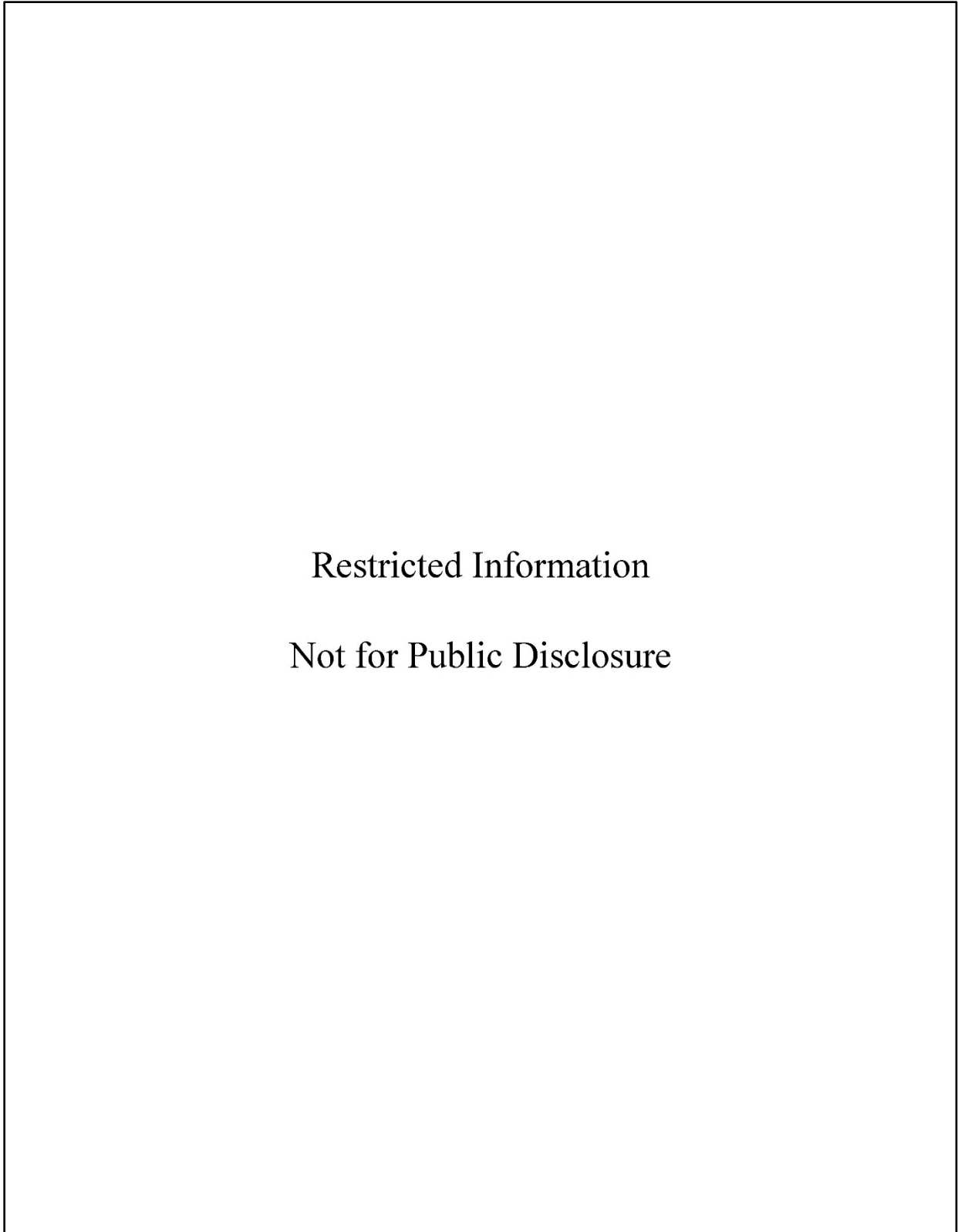
Shovel testing was primarily used when the Project alignment crossed topography with a potential for shallowly buried sites and where ground surface visibility was poor. Where performed, shovel tests were systematically excavated within each PRA. Shovel tests were 30 centimeters (cm) in diameter and excavated in 20-cm arbitrary levels to a depth of 1 m or to culturally sterile deposits, whichever came first. All excavated soil was screened through ¼-inch mesh hardware cloth to retrieve any cultural materials that might be present. The location of each shovel test was recorded using sub-meter accurate, handheld global positioning system (GPS) receivers. Archaeologists recorded data for each shovel test on appropriate field forms using tablets. Soils were described utilizing standard terminology and colors were identified with a Munsell Soil Color Chart. Shovel tests were backfilled immediately upon completion.

## **RESULTS OF BACKGROUND REVIEW**

Prior to the field investigation, SWCA archaeologists conducted a background review and literature search to determine the locations and content of any previously recorded cultural resources or cultural resources surveys within a 1-mile radius of the currently proposed Project alignment. The background review provided site data and geographic information critical to the discovery and interpretation of cultural resources within the BSH Project area and allowed SWCA to refine the proposed survey scope and methods accordingly. The following information describes all previously documented cultural resources identified within the BSH Project area.

### **Previous Cultural Resources Investigations**

The Atlas review revealed that six previously conducted cultural resources survey areas are within the Project area (Figure 4). Two of the previously conducted surveys were for a transmission line and were conducted by ACI Consultants in August 2011 and again in August 2012 on behalf of the KP Environmental/WETT. The THC Atlas has very little data on the third previous cultural resources survey, other than it was conducted in 1976 on behalf of Texas Department of Transportation's (TxDOT). Three previous linear cultural surveys are recorded within the study area; however, Atlas only has spatial data available for the surveys. A total of 17 archaeological sites were recorded within the study area during these previous surveys (THC 2018).



**Figure 4. BSH Project location – previous cultural resources investigations, site locations, and PRA locations.**

## Previously Recorded Archaeological Sites

Thirty-eight (38) previously recorded archaeological sites are located within 1 mile of the BSH Project (Table 2; see Figure 4) (THC 2018). The majority of the sites (n=33) are clustered around Beals and Moss Creeks along the southern pipeline routes. Of the 38 sites, five previously recorded sites (i.e., 41HW77, 41HW49, 41HW50, 41HW51, and 41HW133) are located within 300 feet of the project alignment and these adjacent areas were identified as PRAs. Of these five sites, three are previously recommended as ineligible for the NRHP (i.e., 41HW49, 41HW50, and 41HW133) and two have not been assessed or remain undetermined for the NRHP (i.e., 41HW51 and 41HW77). These five sites are discussed in more detail below. No NRHP properties, SALs, or historic markers were identified during this study.

**Table 2. Previously Recorded Archaeological Sites within 1 Mile of the APE**

Trinomial	Site Type	NRHP Recommendation	Distance to Project (feet)
41HW4	Prehistoric Campsite	Not Assessed	422
41HW9	Prehistoric Campsite	Not Assessed	3,696
41HW10	Prehistoric Campsite	Not Assessed	3,960
41HW16	Prehistoric Campsite	Not Assessed	3,696
41HW17	Paleoindian Kill Site	Not Assessed	2,112
41HW36	Prehistoric Campsite	Not Assessed	5,280
41HW41	Prehistoric Campsite	Not Assessed	3,696
41HW42	Prehistoric Campsite	Not Assessed	1,056
<b>41HW49</b>	<b>Prehistoric Lithic Procurement</b>	<b>Not Eligible</b>	<b>159</b>
<b>41HW50</b>	<b>Prehistoric Lithic Procurement</b>	<b>Not Eligible</b>	<b>106</b>
<b>41HW51</b>	<b>Prehistoric Campsite</b>	<b>Undetermined</b>	<b>106</b>
41HW53	Prehistoric Lithic Procurement	Not Eligible	3,168
41HW54	Prehistoric Lithic Procurement	Undetermined	4,224
41HW55	Prehistoric Campsite	Undetermined	4,752
41HW56	Prehistoric Campsite	Not Eligible	4,224
41HW57	Prehistoric Campsite	Not Eligible	5,280
41HW58	Prehistoric Campsite	Not Eligible	4,224
41HW59	Prehistoric Campsite	Undetermined	2,112
41HW63	Prehistoric Lithic scatter	Not Assessed	3,168
41HW64	Prehistoric Lithic scatter	Not Assessed	1,056
41HW65	Prehistoric Lithic scatter	Not Assessed	3,168
41HW68	Prehistoric Lithic scatter	Not Assessed	792
41HW69	Prehistoric Lithic Procurement	Not Assessed	3,696
41HW70	Prehistoric Lithic scatter	Not Assessed	528
41HW72	Prehistoric Lithic Procurement	Not Assessed	4,752
41HW73	Prehistoric Campsite	Potentially Eligible	5,122
41HW75	Prehistoric Campsite	Potentially Eligible	2,112
41HW76	Prehistoric Campsite	Potentially Eligible	4,752
<b>41HW77</b>	<b>Prehistoric Lithic scatter</b>	<b>Not Assessed</b>	<b>264</b>

Trinomial	Site Type	NRHP Recommendation	Distance to Project (feet)
41HW96	Historic House	Not Eligible within ROW	5,175
41HW97	Historic House	Not Eligible	3,960
41HW98	Prehistoric Lithic scatter	Not Eligible within ROW	1,320
41HW99	Prehistoric Lithic scatter	Not Eligible within ROW	2,376
41HW100	Prehistoric Lithic scatter	Not Eligible	3,696
41HW101	Prehistoric Campsite	Not Eligible	2,112
41HW102	Prehistoric Lithic Procurement	Not Eligible within ROW	2,112
<b>41HW133</b>	<b>Prehistoric Lithic Procurement</b>	<b>Not Eligible</b>	<b>264</b>
41HW135	Multicomponent Artifact Scatter	Not Eligible within ROW	4,752

Note: Bolded sites are within 300 feet of the project alignment.

Site 41HW49 was recorded by Mariah Associates, Inc., in 1993 during investigations associated with the Cap Rock Electric Cooperatives Transmission Line. The site was identified as a low-density lithic scatter and open campsite. The site measured approximately 344×302 feet (105×92 m) in extent and was positioned on a slightly sloping, limestone- and caliche-covered ridgetop. Ground surface exposure was greater than 80 percent and three shovel tests were excavated within the site boundary. No temporally diagnostic artifacts were recovered and the site was assessed as not eligible for the NRHP (THC 2018).

Site 41HW50 was initially recorded by Mariah Associates, Inc., in 1993 during investigations associated with the Cap Rock Electric Cooperatives Transmission Line. The site was identified as a prehistoric lithic quarry, with a low density of primary flakes, cores, and cobbles noted across the site. The site measured approximately 820×318 feet (250×97 m) in extent and was positioned on a rocky, southwest-facing slope overlooking the Moss Creek Valley. Ground surface exposure was greater than 70 percent and three shovel tests were excavated within the site boundary. In 1997, the site was revisited for the York Windpower Farm by TRC Mariah Associates, Inc. Additional shovel testing was undertaken at that time and a possible deflated hearth was observed. No temporally diagnostic artifacts were recovered and the site was assessed as not eligible for the NRHP (THC 2018).

Site 41HW51 was recorded by Mariah Associates, Inc., in 1993 during investigations associated with the Cap Rock Electric Cooperatives Transmission Line. The site was identified as a prehistoric open campsite, with a low density of primary and secondary flakes, cores, and fire-cracked rock noted across the site. The site measured approximately 328×289 feet (100×88 m) in extent and was positioned on a level ridge covered with limestone pebbles. Ground surface exposure was greater than 80 percent and two shovel tests were excavated within the site boundary; both shovel tests contained single flakes between 5 and 10 cm below surface (cmbs). No temporally diagnostic artifacts were recovered; however, since the site did display limited subsurface cultural materials, it was assessed as undetermined for the NRHP (THC 2018).

Site 41HW77 was recorded by TRC Mariah Associates, Inc., in 1997 for the York Windpower Farm. The site was identified as a low-density prehistoric lithic scatter. The site measured approximately 131×79 feet (40×24 m) in extent and was positioned on a level terrace. Ground surface exposure was greater than 50–60 percent and two shovel tests were excavated within the site boundary. No temporally diagnostic artifacts were recovered and the site was assessed as not eligible for the NRHP (THC 2018).

Site 41HW133 was recorded by TAS Inc. in 2015 for the Lone Star Express 24 Project. The site was identified as a low-density prehistoric lithic scatter with an associated deflated fire-cracked rock hearth feature. The site measured approximately 262×492 feet (80×150 m) in extent and was positioned on a flat

landform. Ground surface exposure was approximately 60 percent and no shovel tests appear to have been excavated within the site boundary. No temporally diagnostic artifacts were recovered and the site was assessed as not eligible for the NRHP (THC 2018).

## **Other Previously Identified Cultural Resources**

In addition to previously recorded archaeological sites, the background review assessed whether other cultural resources including possible structures, cemeteries, historic linear features, and NRHP properties, were present within the BSH Project area. SWCA reviewed additional resources, such as NRHP listings, USGS maps, and THO maps; however, no NRHP properties, SALs, historic markers, or cemeteries were identified during this study.

### ***Historic Structures***

As part of the review of the TxDOT THO and historical USGS topographic maps, archaeologists reviewed historic maps dating from 1769 to 1971 to determine if any historic-age resources are within the 1-mile BSH Project review area (Foster et al. 2006; USGS 2018). The review identified 190 potentially historic-age structures within the 1-mile BSH Project review area (Figure 5). None of these 190 structures are located within 300 feet of the proposed APE. Many of these potential historic-age structures are located around Big Spring and historic-age oil fields, with a scattering of agricultural and residential properties throughout the BSH Project corridor. Most of the historic structures appear to be historic-age wells or related structures, as well as homesteads and farmsteads with associated outbuildings and structures (e.g., barns, corrals, windmills, and wells), which would be expected in a rural setting. It should be noted that the historic map overlay review may not accurately reflect the total number of standing historic-age structures currently within the 1-mile BSH Project review area because many of the 190 structures have likely been extensively modified or removed completely from their original context.

### ***Unmarked Burials***

As recently as the early to mid-twentieth century, it was a common practice in much of frontier/rural America to bury deceased family members near their homes, often with little or no marking. SWCA has come across no archival or physical evidence of cemeteries or burials within the BSH Project. As such, it is SWCA's opinion that the probability for burials is extremely low; however, please see Appendix A for an Unanticipated Human Remains Discovery Plan in case evidence of human remains are encountered during construction and/or maintenance activities.

## **RESULTS OF ARCHAEOLOGICAL SURVEY**

During April 23–26 and May 16, 2018, SWCA conducted archaeological investigations along portions of the proposed BSH Project in Big Spring, Howard County, Texas (Appendix B). This section presents the results of archaeological investigations for 10 PRAs along the 11.4-mile proposed alignment. During the investigation, SWCA surveyed approximately 1.74 miles (22.83 acres) within the survey corridor along the pipeline alignment. Most of the BSH Project traverses undeveloped agricultural/ranch land, though portions parallel existing pipeline or transmission line corridors and traverse active oil and gas exploration areas, other existing pipeline and utility corridors, residential areas, and existing roadways. Due to the proximity of the proposed BSH Project to these types of ground-disturbing activities, with their associated construction and continued usage, portions of the proposed Project area have been previously disturbed (see Figure 4). These modern disturbances have minimized the potential for intact buried cultural deposits throughout the proposed BSH Project corridor.

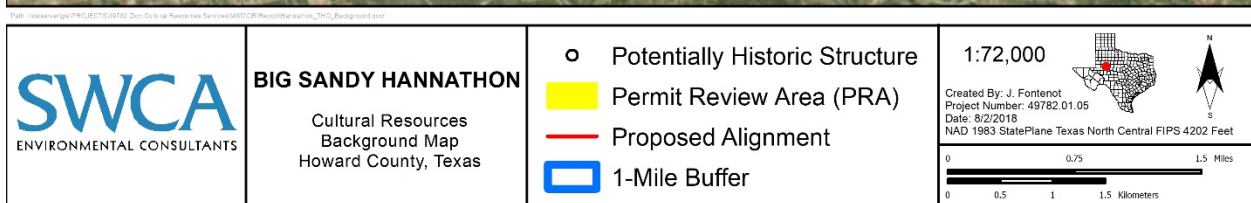
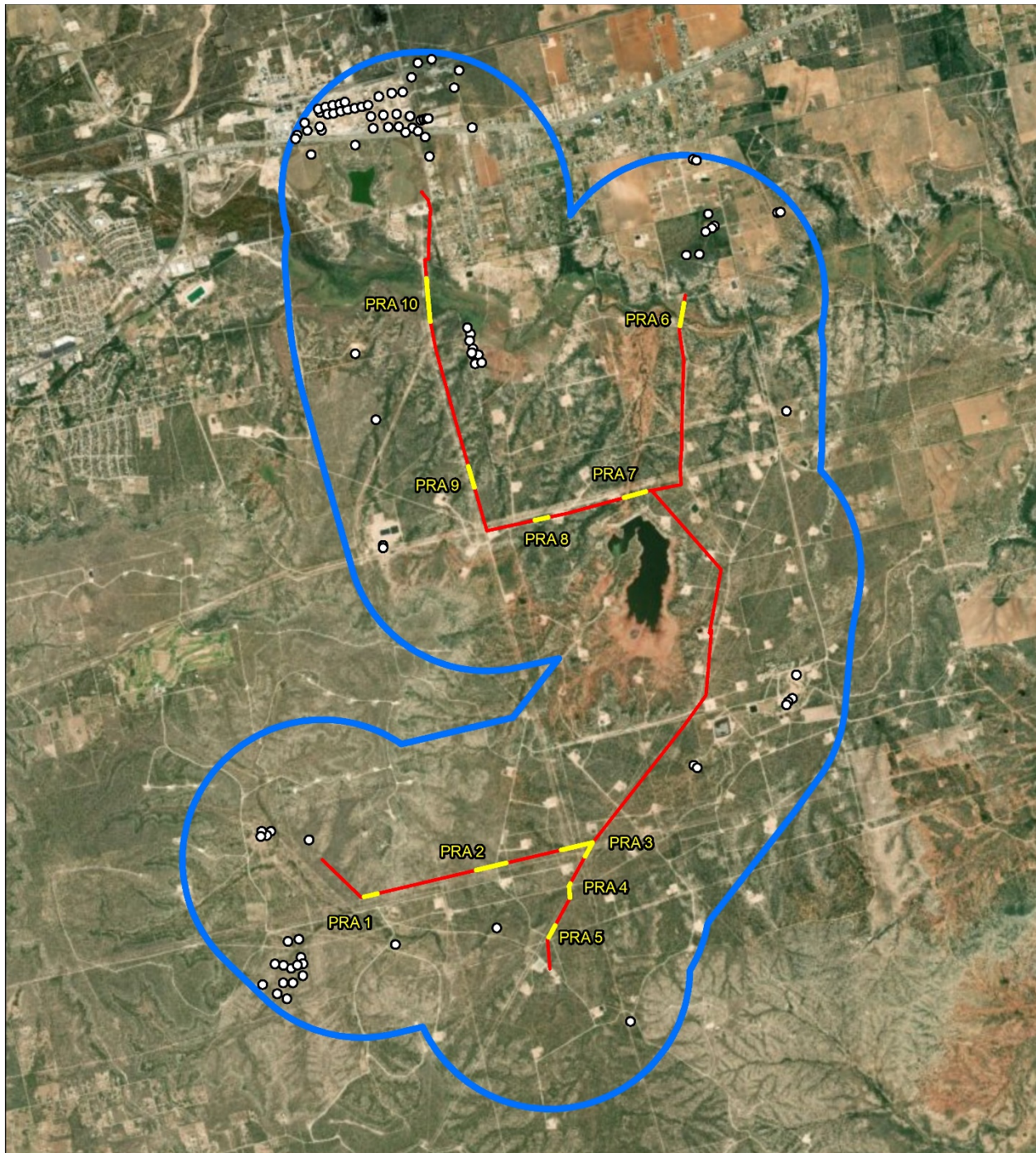


Figure 5. BSH Project location – potentially historic structure locations.



Topographically, the landscape crossed by the proposed BSH Project is diverse, primarily consisting of gently rolling upland plains, prairies, and terraces with their respective floodplains in association with the Colorado River basin. Vegetation in the Project area is characterized by patches of oak, juniper, mesquite, and prickly pear cactus dispersed throughout short grass scrubland and open fields. The varied landscape and vegetation throughout the proposed Project area resulted in highly variable surface visibility ranging from 0 to 100 percent, with an average of approximately 40 percent (see Figure 4). Secondary and tertiary drainages crossed by the proposed pipeline include Moss Creek, Beals Creek, Plum Draw, and Red Draw.

Surface examination of the 10 PRAs revealed extensive surface and subsurface disturbances from agricultural practices, ongoing oil and gas extraction activities, and existing two-track and gravel roads that comprise parts of the oil and gas extraction infrastructure (Figure 6). Surface examination of the APE at the 10 PRAs found no cultural materials, only recent trash and debris.



**Figure 6. BSH Project location – examples of typical ground surface disturbance.**

SWCA augmented the pedestrian survey investigations with the excavation of 71 shovel tests at the 10 PRAs (Table 3; Appendix C). Shovel tests were excavated along a single transect following the BSH Project centerline within the 100-foot-wide survey corridor. Depths of shovel tests varied from 5 to 70 cmbs and were terminated due to compact soils, basal clay, or bedrock. Soils encountered during the survey ranged from sandy loams to sandy clay loams and clay loams, and silt loams to silty clay and silt (Appendix C).

**Table 3. Assessed PRAs, BSH Project**

PRA	Online/ Offline	Stream	County	Length (feet)	Acres	No. of Shovel Tests	Cultural Materials
1	Online	Tributary of Moss Creek	Howard	513.68	1.4	7	No
2	Online	Tributary of Moss Creek	Howard	1,161.52	2.8	15	No
3	Online	Tributary of Moss Creek	Howard	1,806.71	4.3	6	No
4	Online	Moss Creek	Howard	541.42	1.4	7	No
5	Online	Tributary of Moss Creek	Howard	498.67	1.3	7	No
6	Online	Beals Creek	Howard	856.12	2.1	6	No
7	Online	Red Draw	Howard	855.30	2.1	4	No
8	Online	Tributary of Red Draw	Howard	502.04	1.3	4	No
9	Online	Plum Draw	Howard	823.40	2.1	4	No
10	Online	Beals Creek	Howard	1,625.79	3.9	11	No
<b>TOTAL</b>				<b>9,184.65</b>	<b>22.7</b>	<b>71</b>	

As a result of the recent survey effort, SWCA archaeologists identified no cultural resources at the 10 PRAs (see Table 2); however, one isolated find (IF), consisting of two gray lithic flakes (tertiary), was observed on the ground surface during pedestrian survey transit between PRAs 9 and 10 (Figure 7; Appendix B:page 14). Despite an intensive ground surface inspection of this exposed bedrock-controlled ridge, no additional cultural materials were observed within the BSH Project corridor.



**Figure 7. Isolated Find identified between PRAs 9 and 10.**

## PRA Overview

### PRA 1

PRA 1 measured approximately 513 feet (156 m) in length and was situated where the proposed pipeline corridor intersects a tributary of Moss Creek. Survey investigations observed a minor drainage with little to no channel development at the defined PRA. The area was in moderately open prairie land consisting of dispersed tall grasses with riparian woods around the drainages. SWCA excavated seven shovel tests

(i.e., RB001-002, RB030, JK001-002, BM05, and SB04) within the PRA, which typically revealed a pale brown (10YR 6/3) silt or brown (7.5YR 5/3) sandy clay from the surface to an average depth of 20 cmbs (ranging from 10 to 30 cmbs). Shovel tests were terminated at bedrock or compact subsoil. Previously recorded site 41HW50, located south of the defined PRA, was investigated by pedestrian survey and additional shovel tests; however, no evidence of the site was observed within the BSH Project corridor; in addition, the PRA and surrounding area were impacted by modern disturbances including access roads, a transmission line, and pipeline corridors (Figure 8). No cultural materials were encountered on the surface or within any of the shovel tests (Appendix B:page 1).



**Figure 8. PRA 1 – BSH Project, facing west.**

## **PRA 2**

PRA 2 measured approximately 1,161 feet (353 m) in length and was situated where the proposed pipeline corridor intersects a tributary of Moss Creek. Survey investigations observed a minor drainage with little to no channel development at the defined PRA (Figure 9). The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages. SWCA excavated 15 shovel tests (i.e., BM03-04, JK003-005, JK025-026, RB003-006, RB028-029, and SB03-04) within the PRA, which typically revealed a pale brown (10YR 6/3) silt or reddish yellow (7.5YR 6/8) sandy clay from the surface to an average depth of 30 cmbs (ranging from 10 to 70 cmbs). Shovel tests were terminated at bedrock or compact subsoil. Previously recorded sites 41HW51 and 41HW49 are located just to the south of PRA 2; although the area immediately adjacent to these two sites were investigated by close interval pedestrian survey and additional shovel tests, no evidence of the sites was observed. The PRA and surrounding area were impacted by modern disturbances including access roads, and transmission line and pipeline corridors; no cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:pages 2–3).



**Figure 9. PRA 2 – BSH Project, facing east.**

### ***PRA 3***

PRA 3 measured approximately 1,806 feet (550 m) in length and was situated where the proposed pipeline corridor intersects a tributary of Moss Creek. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages. Survey investigations observed a minor drainage with little to no channel development at the defined PRA. SWCA excavated six shovel tests (i.e., JK010-012 and RB011-013) within the PRA, which typically revealed a pale brown (10YR 6/3) silt or strong brown (7.5YR 5/8) sandy clay loam from the surface to an average depth of approximately 35 cmbs (ranging from 30 to 45 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was impacted by modern disturbances including several pipeline corridors (Figure 10); no cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:page 4).



**Figure 10. PRA 3 – BSH Project, facing east.**

## **PRA 4**

PRA 4 measured approximately 541 feet (165 m) in length and was situated where the proposed pipeline corridor intersects Moss Creek. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages. SWCA excavated seven shovel tests (i.e., BM06, SB06, JK008-009, RB009-010, and RB031) within the PRA, which typically revealed a brown (7.5YR 5/4) silt or reddish yellow (7.5YR 6/8) sandy clay from the surface to an average depth of 20 cmbs (ranging from 10 to 30 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was impacted by modern disturbances including a pipeline corridor (Figure 11). No cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:page 5).



**Figure 11. PRA 4 – BSH Project, facing south.**

## **PRA 5**

PRA 5 measured approximately 498 feet (152 m) in length and was situated where the proposed pipeline corridor intersects a tributary of Moss Creek. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages. Survey investigations observed a minor drainage with little to no channel development at the defined PRA. SWCA excavated seven shovel tests (i.e., BM02, SB02, RB007-008, RB027, and JK006-007) within the PRA, which typically revealed a pale brown (10YR 6/3) silt or reddish yellow (7.5YR 6/8) sandy clay from the surface to an average depth of 20 cmbs (ranging from 10 to 30 cmbs). Shovel tests were terminated at bedrock or compact subsoil.

Previously recorded site 41HW77, located west of the defined PRA was investigated by close interval pedestrian survey and additional shovel tests; however, no evidence of the site was observed within the BSH Project corridor. The PRA and surrounding area were impacted by modern disturbances, including an access road, pipeline corridors, and transmission line (Figure 12). No cultural materials were encountered on the surface or within any of the shovel tests (Appendix B:page 5).



**Figure 12. PRA 5 – BSH Project, facing southwest.**

## **PRA 6**

PRA 6 measured approximately 856 feet (260 m) in length and was situated where the proposed pipeline corridor intersects Beals Creek. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages (Figure 13). SWCA excavated six shovel tests (i.e., JK018-020 and RB019-021) within the PRA, which typically revealed a pale brown (10YR 6/3) silt or brown (7.5YR 5/3) sandy clay from the surface to an average depth of 35 cmbs (ranging from 30 to 45 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was impacted by modern disturbances including three access roads. No cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:page 11).



**Figure 13. PRA 6 – BSH Project, facing east.**

## **PRA 7**

PRA 7 measured approximately 855 feet (260 m) in length and was situated where the proposed pipeline corridor intersects Red Draw. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages (Figure 14). SWCA excavated four shovel tests (i.e., JK013-014 and RB014-015) within the PRA, which typically revealed a light reddish brown (2.5YR 7/4) silty clay or brown (7.5YR 5/3) sandy clay from the surface to an average depth of approximately 30 cmbs (ranging from 10 to 45 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was impacted by modern disturbances including access roads, and transmission line and pipeline corridors. No cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:page 9).



**Figure 14. PRA 7 – BSH Project, facing northwest.**

## **PRA 8**

PRA 8 measured approximately 502 feet (153 m) in length and was situated where the proposed pipeline corridor intersects a tributary of Red Draw. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages (Figure 15). Survey investigations observed a minor drainage with little to no channel development at the defined PRA. SWCA excavated four shovel tests (i.e., JK015-016 and RB016-017) within the PRA, which typically revealed a brown (10YR 4/3) silty clay loam or reddish yellow (7.5YR 6/8) sandy clay from the surface to an average depth of approximately 25 cmbs (ranging from 5 to 40 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was impacted by modern disturbances including access road and pipeline construction. No cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:pages 12–13).



**Figure 15. PRA 8 – BSH Project, facing west.**

## **PRA 9**

PRA 9 measured approximately 823 feet (250 m) in length and was situated where the proposed pipeline corridor intersects Plum Draw. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages (Figure 16). SWCA excavated four shovel tests (i.e., JK050-051, JK017, and RB018) within the PRA, which typically revealed a very pale brown (10YR 7/3) silt or reddish yellow (7.5YR 6/8) sandy clay from the surface to an average depth of approximately 25 cmbs (ranging from 5 to 40 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was slightly impacted by modern disturbances including a transmission line corridor. No cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B:page 13).



**Figure 16. PRA 9 – BSH Project, facing north.**



## **PRA 10**

PRA 10 measured approximately 1,625 feet (495 m) in length and was situated where the proposed pipeline corridor intersects Beals Creek. The area was in moderately open prairie land consisting of dispersed tall grasses and riparian woods around the drainages (Figure 17). SWCA excavated 11 shovel tests (i.e., BM01, SB01, JK021-024, and RB022-026) within the PRA, which typically revealed a pale brown (10YR 6/3) sandy loam or a reddish yellow (7.5YR 6/8) sandy clay from the surface to an average depth of approximately 40 cmbs (ranging from 30 to 60 cmbs). Shovel tests were terminated at bedrock or compact subsoil. The area was impacted by modern disturbances including access roads and a pipeline corridor. No cultural materials were encountered on the surface or within any of the excavated shovel tests (Appendix B: pages 15–16).



**Figure 17. PRA 10 – BSH Project, facing north.**

## **SUMMARY AND RECOMMENDATIONS**

At the request of Olsson, and on behalf of Delek, SWCA conducted an intensive cultural resources survey on a portion of the proposed approximately 11.4-mile-long BSH Project in Big Spring, Howard County, Texas. Investigations were conducted in support of Delek’s acquisition of a USACE Section 404 permit in accordance with 33 CFR 325, Appendix C (Processing Department of Army Permits: procedures for the Protection of Historic Properties; Final Rule 1990; with current Interim Guidance Documents dated April 25, 2005, and January 31, 2007) and Section 106 of the NHPA (54 USC 306108) and its implementing regulations (36 CFR 800). All investigations were conducted in accordance with the standards and guidelines of the SOI, THC, and the CTA.

Investigations included a cultural resources background review and an intensive pedestrian survey augmented by shovel testing to systematically identify, record, delineate, and, if possible, determine the significance of any cultural resources located within the APE. Rather than surveying the entire 11.4-mile-long alignment, the cultural survey targeted anticipated USACE jurisdictional crossings. Specifically, this approach identified areas of anticipated impacts to U.S.-regulated waterways or nearby previously identified cultural resources. Using these criteria, SWCA identified and surveyed 10 individual PRAs within the proposed pipeline alignments. During the investigations, SWCA surveyed 1.74 miles of proposed pipeline alignment at the 10 delineated PRAs (22.83 acres).

Surface examination of the 10 PRAs revealed extensive surface and subsurface disturbances from ongoing oil and gas extraction activities, and existing two-track and gravel roads that comprise parts of the oil and gas extraction infrastructure. Survey investigations observed only minor drainage crossings with little to no channel development at the defined PRAs. Surface examination of the APE at the 10 PRAs found no cultural materials, only recent trash and debris. SWCA augmented the pedestrian survey investigations with the excavation of 71 shovel tests at the 10 PRAs. Shovel testing revealed variable matrices (i.e., sandy loams, sandy clay loams, clay loams, silt loams, and silt) to a typical depth of 40 cmbs; tests were terminated due to bedrock or compact subsoils. No cultural resources were identified by SWCA archaeologists at the 10 PRAs. One IF, consisting of two gray lithic flakes (tertiary), was observed on the surface during pedestrian transit between PRAs 9 and 10. Despite an intensive ground surface inspection of this exposed bedrock-controlled ridge, no additional cultural materials were observed within the BSH Project corridor.

In accordance with 33 CFR 325, Appendix C, Section 106 of the NHPA, and 36 CFR 800.4 (b)(1), SWCA has made a reasonable and good faith effort to identify historic properties within the anticipated PRAs. Based on the negative results of the survey, it is the opinion of SWCA that the proposed Project will have NO EFFECT (per 36 CFR 800.5[b]) on any archaeological historic properties listed on, or otherwise eligible for, the NRHP at PRAs 1 through 10 associated with the BSH Project.

## REFERENCES CITED

- Barnes, V. E.  
1994 *Geologic Atlas of Texas, Big Spring Sheet*. The University of Texas at Austin, Bureau of Economic Geology.
- Blair, W. F.  
1950 The Biotic Provinces of Texas. *Texas Journal of Science*.
- Burt, W. H., and R. P. Grossenheider  
1976 Peterson Field Guides: Mammals. *Houghton Mifflin Company, Boston and New York*.
- Conant, R., and J. T. Collins  
1998 Peterson Field Guides: Reptiles and Amphibians Eastern and Central North America. *Third Edition*. *Houghton Mifflin Company, Boston and New York*.
- Davis, W. B., and Schmidly, D. J.  
1994 The Mammals of Texas. *Texas Parks and Wildlife Press, Austin*.
- Foster, T. R., T. Summerville, and T. Brown  
2006 The Texas Historic Overlay: A Geographic Information System of Historic Map Images for Planning Transportation Projects in Texas. Prepared for the Texas Department of Transportation by PBS&J, Austin.
- Griffith, Glenn E., Sandy A. Bryce, James M. Omernik, and Ann C. Rogers  
2007 *Ecoregions of Texas*. Texas Commission on Environmental Quality Surface Water Quality Monitoring Program, Austin, Texas.
- Kutac, E. A., and S. C. Caran  
1994 *Birds and Other Wildlife of South Central Texas*. University of Texas, Austin.
- Natural Resources Conservation Service (NRCS)  
2018 *Web Soil Survey*. U.S. Department of Agriculture. Available at: <http://websoilsurvey.nrcs.usda.gov>. Accessed February 2018.
- Schmidly, D. J.  
1983 *Texas Mammals East of the Balcones Fault Zone*. Texas A&M Press, College Station.
- Texas Historical Commission (THC)  
2018 Texas Archeological Sites Atlas online restricted database, Texas Historical Commission. <http://pedernales.thc.state.tx.us/>. Accessed February 2018.
- Werler, J. E., and J. R. Dixon  
2004 Texas Snakes: Identification, Distribution, and Natural History. *Fourth edition*. *University of Texas Press, Austin*.
- Wermund, E. G.  
2018 "Physiography of Texas," Bureau of Economic Geology <http://www.beg.utexas.edu/UTopia/images/pagessizemap/physiography>. Accessed February 2018.



## **APPENDIX A**

### **UNANTICIPATED HUMAN REMAINS DISCOVERY PLAN**



In the event that an unmarked grave, grave goods or human remains are discovered during construction, the following procedures will occur in accordance with Nation Wide Permit (NWP) General Condition 21, the Native American Graves Protection and Repatriation Act (NAGPRA), the Texas Health and Safety Code Section 711 General Provisions Relating to Cemeteries (herein referred to as Section 711), and the Texas Administrative Code (TAC) Title 13, Texas Historical Commission, Chapter 22 Cemeteries (13 TAC §§22.1–22.6):

1. All work within 100 feet (30.5 meters) of the discovery will cease.
  - a. Upon cessation of work, Delek or its designated representative shall immediately take steps to preserve the remains from further disturbance which may include, but are not limited to, covering with impermeable plastic sheeting, marking it with lathing stakes, or fencing off the area.
  - b. The representative will carefully inspect and document (e.g., map, photograph, and describe) the discovery and immediately adjacent areas for additional traces of grave goods, grave shaft, or human remains. This will include a brief sketch map of the location of the discovery in relation to the project area.
2. Delek or its designated representative will immediately notify both local law enforcement / county coroner, and the Texas Historical Commission (THC) / State Historic Preservation Officer (SHPO).
3. If human skeletal remains appear to be from an unregistered grave or associated with a crime scene, the county coroner shall notify the SHPO within 24 hours.
4. If the human remains are determined to be Native American, they will be handled in accordance with NAGPRA.
5. Under Section 711 and the Texas Antiquities Code (13 TAC §§ 22.1–22.6), the county clerk shall be notified within 10 days of the discovery of the grave or graves in Texas.
6. Work in the affected area may resume following THC / SHPO authorization.





**APPENDIX B**  
**RESULTS MAPS**



Restricted Information

Not for Public Disclosure



**APPENDIX C**  
**SHOVEL TEST RESULTS**



PRA No.	ST No.	Level No.	Depth (cmbs)	Munsell	Soil Color	Soil Texture	Inclusions	Cultural Material (Y/N)	Comments / Reason for Termination
1	BM05	1	0-10	7.5YR 5/4	brown	Silt	5-10% Gravels, Pebbles	N	Terminated at bedrock.
1	JK001	1	0-10	10YR 6/3	pale brown	Silt	>20% Calcium Carbonate	N	Terminated at compact soil.
1	JK002	1	0-10	10YR 6/3	pale brown	Silt	>20% Cobbles	N	Terminated at bedrock.
1	RB001	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
1	RB002	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
1	RB030	1	0-40	7.5YR 5/8	strong brown	Sandy Clay Loam		N	Terminated at compact soil.
1	SB05	1	0-30	10YR 5/4	yellowish brown	Silt Loam		N	Terminated at compact soil.
2	BM03	1	0-30	7.5YR 4/3	brown	Silt Loam	1-5% Gravels, Pebbles	N	Terminated at compact soil.
2	BM04	1	0-30	7.5YR 4/3	brown	Silt Loam	1-5% Gravels, Pebbles	N	Terminated at compact soil.
2	JK003	1	0-15	10YR 6/3	pale brown	Silt	>20% Cobbles	N	Terminated at bedrock.
2	JK004	1	0-70	10YR 6/3	pale brown	Silt	10-20% Gravels	N	Terminated at bedrock.
2	JK005	1	0-50	10YR 6/3	pale brown	Silt	10-20% Gravels	N	Terminated at bedrock.
2	JK025	1	0-10	10YR 6/3	pale brown	Silt	5-10% Gravels	N	Terminated at bedrock.
2	JK026	1	0-10	10YR 6/3	pale brown	Silt	5-10% Gravels	N	Terminated at bedrock.
2	RB003	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
2	RB004	1	0-10	7.5YR 8/6	reddish yellow	Sand	>20% Cobbles, Gravels, Large Rock Frags	N	Terminated at bedrock.
2	RB005	1	0-10	7.5YR 8/6	reddish yellow	Sand	>20% Cobbles, Gravels, Large Rock Frags	N	Terminated at bedrock.
2	RB006	1	0-50	7.5YR 4/3	brown	Sandy Clay Loam	–	N	Terminated at compact soil.
2	RB026	1	0-30	7.5YR 5/8	strong brown	Sandy Clay Loam	5-10% Gravels	N	–
		2	30-40	10YR 4/1	dark gray	Clay Loam	–	N	Terminated at compact soil.
2	RB028	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.

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2	RB029	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
2	SB03	1	0-30	10YR 5/4	yellowish brown	Sandy Loam	5-10% Cobbles	N	Terminated at compact soil.
2	SB04	1	0-40	10YR 5/4	yellowish brown	Silt Loam	–	N	Terminated at compact soil.
3	JK010	1	0-20	10YR 6/3	pale brown	Silt	–	N	–
		2	20-30	10YR 6/1	gray	Silt	5-10% Gravels	N	Terminated at compact soil.
3	JK011	1	0-30	10YR 6/3	pale brown	Silt	–	N	Terminated at bedrock.
3	JK012	1	0-30	10YR 6/3	pale brown	Silt	–	N	Terminated at compact soil.
3	RB011	1	0-45	7.5YR 5/8	strong brown	Sandy Clay Loam	–	N	Terminated at compact soil.
3	RB012	1	0-45	7.5YR 5/8	strong brown	Sandy Clay Loam	–	N	Terminated at compact soil.
3	RB013	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
4	BM06	1	0-10	7.5YR 5/4	brown	Silt	5-10% Gravels, Pebbles	N	Terminated at bedrock.
4	JK008	1	0-25	10YR 4/3	brown	Silt Loam	–	N	–
		2	25-30	10YR 4/2	dark grayish brown	Silt Loam	10-20% Gravels	N	Terminated at bedrock.
4	JK009	1	0-30	10YR 6/3	pale brown	Silt	–	N	–
		2	30-40	7.5YR 5/6	strong brown	Silty Clay	–	N	Terminated at basal clay.
4	RB009	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
4	RB010	1	0-45	7.5YR 5/8	strong brown	Sandy Clay Loam	–	N	Terminated at compact soil.
4	RB031	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
4	SB06	1	0-30	10YR 5/4	yellowish brown	Silt Loam		N	Terminated at compact soil.
5	BM02	1	0-40	7.5YR 4/3	brown	Sandy Loam	1-5% Pebbles	N	Terminated at compact soil.
5	JK006	1	0-10	10YR 6/3	pale brown	Silt	10-20% Gravels	N	Terminated at compact soil.



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5	JK007	1	0-30	10YR 4/3	brown	Silt Loam	–	N	–
		2	30-40	10YR 3/2	very dark grayish brown	Silty Clay	–	N	Terminated at basal clay.
5	RB007	1	0-30	7.5YR 4/3	brown	Sandy Clay	–	N	Terminated at compact soil.
5	RB008	1	0-40	7.5YR 6/3	light brown	Sandy Clay	10-20% Cobbles, Gravels, Large Rock Frags	N	Terminated at bedrock.
5	RB027	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
5	SB02	1	0-40	10YR 5/3	brown	Silt Loam	–	N	Terminated at compact soil.
6	JK018	1	0-30	7.5YR 4/3	brown	Silt Loam	5-10% Gravels	N	–
		2	30-40	10YR 6/3	pale brown	Silt	5-10% Cobbles	N	Terminated at bedrock.
6	JK019	1	0-30	5YR 5/6	yellowish red	Silty Clay Loam	–	N	–
		2	30-40	5YR 4/6	yellowish red	Silty Clay	–	N	Terminated at basal clay.
6	JK020	1	0-40	5YR 5/6	yellowish red	Silty Clay	>20% Cobbles	N	Terminated at compact soil.
6	RB020	1	0-30	7.5YR 5/8	strong brown	Sand	>20% Gravels, Large Rock Frags	N	Terminated at bedrock.
6	RB021	1	0-30	7.5YR 8/4	reddish yellow	Sand	>20% Gravels, Large Rock Frags	N	Terminated at bedrock.
7	JK013	1	0-10	10YR 6/2	light brownish gray	Silt	>20% Gravels	N	Terminated at bedrock.
7	JK014	1	0-20	2.5YR 7/4	light reddish brown	Silty Clay	–	N	–
		2	20-30	10YR 4/2	dark grayish brown	Silt Loam	–	N	–
		3	30-40	2.5YR 6/4	light reddish gray	Silty Clay	–	N	Terminated at compact soil.
7	RB014	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
7	RB015	1	0-30	7.5YR 5/3	brown	Sandy Clay	5-10% Calcium Carbonate, Gravels, Large Rock Frags	N	Terminated at bedrock.
7	RB019	1	0-45	7.5YR 5/8	strong brown	Clay Loam	–	N	Terminated at compact soil.
8	JK015	1	0-5	10YR 6/3	pale brown	Silt	>20% Cobbles, Gravels	N	Terminated at bedrock.

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8	JK016	1	0-20	10YR 4/3	brown	Silty Clay Loam	–	N	–
		2	20-40	10YR 5/3	brown	Silty Clay	5-10% Calcium Carbonate	N	Terminated at compact soil.
8	RB016	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
8	RB017	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
9	JK017	1	0-5	10YR 6/3	pale brown	Silt	>20% Cobbles, Gravels	N	Terminated at bedrock.
9	JK050	1	0-5	10YR 7/3	very pale brown	Silt	>20% Gravels	N	Terminated at bedrock.
9	JK051	1	0-10	10YR 7/3	very pale brown	Silt	>20% Gravels	N	Terminated at bedrock.
9	RB018	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
10	BM01	1	0-50	7.5YR 4/3	brown	Sandy Loam	–	N	Terminated at compact soil.
10	JK021	1	0-10	10YR 4/3	brown	Sandy Clay Loam	–	N	–
		2	10-50	10YR 6/3	pale brown	Sandy Loam	–	N	–
		3	50-60	10YR 5/1	gray	Sandy Clay	5-10% Pebbles, FeO2	N	Terminated at basal clay.
10	JK022	1	0-10	10YR 5/3	brown	Sandy Clay Loam	5-10% FeO2	N	–
		2	10-30	10YR 3/2	very dark grayish brown	Sandy Clay	–	N	Terminated at basal clay.
10	JK023	1	0-30	10YR 6/1	gray	Silty Clay	10-20% Calcium Carbonate	N	Terminated at compact soil.
10	JK024	1	0-10	10YR 4/3	brown	Sandy Clay Loam	–	N	–
		2	10-30	10YR 4/1	dark gray	Sandy Clay	5-10% FeO2	N	Terminated at basal clay.
10	RB022	1	0-30	7.5YR 5/8	strong brown	Sandy Clay Loam	5-10% Gravels	N	–
		2	30-40	10YR 4/1	dark gray	Clay Loam	–	N	Terminated at compact soil.
10	RB023	1	0-30	7.5YR 5/8	strong brown	Sandy Clay Loam	5-10% Gravels	N	–
		2	30-40	10YR 4/1	dark gray	Clay Loam	–	N	Terminated at compact soil.

<b>PRA No.</b>	<b>ST No.</b>	<b>Level No.</b>	<b>Depth (cmbs)</b>	<b>Munsell</b>	<b>Soil Color</b>	<b>Soil Texture</b>	<b>Inclusions</b>	<b>Cultural Material (Y/N)</b>	<b>Comments / Reason for Termination</b>
10	RB024	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
10	RB025	1	0-30	7.5YR 6/8	reddish yellow	Sandy Clay	10-20% Gravels, Large Rock Frags	N	Terminated at bedrock.
10	SB01	1	0-40	10YR 5/4	yellowish brown	Silt Loam	–	N	Terminated at compact soil.