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Cultural Resources Assessment
The Dow Chemical Company
Light Hydrocarbon 9 (LHC-9) Unit Project
Freeport, Brazoria County, Texas

February, 2014

Supporting Documentation

HRA Gray and Pape, LLC

2013e - Cultural Resources Survey Within 79 Miles for the Proposed Dow 12-Inch MSR Ethane Pipeline Project in Brazoria, Galveston, Harris, and Chambers Counties, Texas

HRA Gray & Pape

DRAFT

CULTURAL RESOURCES SURVEY WITHIN 79 MILES FOR THE PROPOSED DOW 12-INCH MSR ETHANE PIPELINE PROJECT IN BRAZORIA, GALVESTON, HARRIS, AND CHAMBERS COUNTIES, TEXAS

Lead Federal Agency:
The United States Army Corps of Engineers, Galveston District

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OCTOBER 8, 2013

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HRA Gray & Pape Project # 739.01 October 8, 2013

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ABSTRACT

Wood Group Mustang, of Houston, Texas, on behalf of their client the DOW Hydrocarbon and Resources, LLC, requested that HRA Gray & Pape, LLC conduct intensive cultural resources surveys within 127 kilometers (79 miles) plus several alternate routes for a proposed ethane pipeline project (Project), in Brazoria, Galveston, Harris, and Chambers Counties, Texas. The Project's Area of Potential Effects consists of approximately 362.3 hectares (895.4 acres) of permanent and temporary easements plus an additional 384.3 hectares (949.6 acres) of survey area, totaling 748 hectares (1,845 acres). Nearly all of the proposed new alignment is to be collocated with existing pipelines. The Project is part of a Nationwide 12 permit for which the Lead Federal Agency is the United States Army Corps of Engineers. The procedures to be followed by the United States Army Corps of Engineers to fulfill the requirements set forth in the National Historic Preservation Act, other applicable historic preservation laws, and Presidential directives as they relate to the regulatory program of the United States Army Corps of Engineers (33 CFR Parts 320-334) are articulated in the Regulatory Program of the United States Army Corps of Engineers, Part 325 - Processing of Department of the Army Permits, Appendix C - Procedures for the Protection of Historic Properties.

Field efforts for the entire 127-kilometer (79-mile) Project were undertaken in 2 separate segments. The first segment consisted of 59.5 kilometers (37 miles) of proposed pipeline surveyed under Texas Antiquities Code permit number 6246. The second segment of field survey consisted of 67.6 kilometers (42 miles) of Project and was surveyed under Texas Antiquities Code permit number 6446. Field survey efforts were conducted between April of 2012, and October of 2013. A draft report detailing the results of survey on 59.5 kilometers (37 miles) of the Project was submitted to the Texas Historical Commission for review in September 2012. That report received concurrence in October 2012 (Appendix C) and is on file with the Texas Historical Commission (Scott 2012). Information contained in that report has been combined with information for the remaining 67.6 kilometers (42 miles) of Project length and presented in this document.

As a result of the investigations, a total of 748 hectares (1,833.7 acres) have been surveyed by a combination of systematic shovel testing, pedestrian walkover, windshield survey, and photo documentation. A total of 623 shovel tests were excavated. Numerous previous disturbances were noted including the presence of multiple pipelines, artificial canals, and levees. Survey resulted in the identification of 2 new prehistoric cultural sites (41BO239 and 41BO240), 1 new historic site (Field Site 739-387-01), 2 new prehistoric isolate finds, 2 historic-age structures, 1 historic to modern trash dump, and the confirmation of 3 previously recorded sites (41HR47, 41BO1036, and 41BO827). No evidence was identified during revisits of 6 previously recorded site locations. The results of field efforts suggest the sites have eroded or are now submerged due to subsidence.

None of the newly identified resources have been identified as possible candidates for nomination to the National Register of Historic Places and no further work regarding them is recommended for the current Project. The sites have been impacted by previous pipelines and planned directional drilling will avoid additional impacts to them. Planned directional drilling will avoid additional impacts to the mapped site locations and no further work is recommended regarding these previously recorded sites. HRA Gray & Pape, LLC collected

only diagnostic artifacts that may be used to help assign temporal affiliations to new sites and all artifacts will be returned to the land owners upon completion of the project. Based on the results of the cultural resources survey, HRA Gray & Pape, LLC recommends that no further investigation be necessary within the surveyed portions of the Project.

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1.0 INTRODUCTION

HRA Gray & Pape, LLC, (HRA Gray & Pape) on behalf of Wood Group Mustang (Mustang) and their client the DOW Hydrocarbon and Resources, LLC (DOW) conducted intensive pedestrian cultural resources survey and cultural resources review within 127 kilometers (79 miles) plus several alternate routes for a proposed ethane pipeline project (Project), in Brazoria, Galveston, Harris, and Chambers Counties, Texas.

For Nationwide 12 permitting requirements, the Lead Federal Agency for the Project has been identified as the United States Army Corps of Engineers (USACE), Galveston District. Therefore, the USACE's issuance of a permit for the Project is considered an undertaking subject to the provisions and review process provided in Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. A USACE permit number has not yet been assigned for this Project. The goals of the cultural resources survey were to determine if land altering activities required to complete this Project would affect any previously identified historic properties as defined by Section 106 of the NHPA of 1966, as amended (36 CFR 800), and to established whether or not previously unidentified cultural resources were located within the Project's Area of Potential Effects (APE). Fieldwork and reporting activities were completed with reference to state (the Council of Texas Archeologists [CTA]) and federal (NHPA) guidelines.

The Project is privately funded and entails a mix of public and privately-owned properties. Approximately 12.6 kilometers (7.8 miles) of Project centerline are located within the Brazoria National Wildlife Refuge. Due to the potential for surface impacts to properties owned by entities considered to be subdivisions of the state of Texas, the work was performed under Texas Antiquities Permit Numbers #6246 and 6446 which were acquired from the Texas Historical Commission (THC) Division of Archeology. All fieldwork and reporting activities were completed with reference to state (the Antiquities Code of Texas [1969, as amended 1997]) and federal (NHPA 1966; United States Department of the Interior [USDI], National Park Service [NPS] 1981, 1983) law and guidance for conducting cultural resources surveys pursuant to Section 106 of the NHPA (Advisory Council on Historic Preservation [ACHP] 2004).

1.1 Project Descriptions

The 127-kilometer (79-mile) pipeline field surveys were conducted in 2 segments between existing DOW facilities located in proximity of Clute and the Salt Dome Operations (SDO) at Stratton Ridge in Brazoria County to DOW facilities at Texas City in Galveston County, and to DOW facilities in Mont Belvieu in Chambers County (Figure 1). Each segment of the pipeline is discussed in more detail below.

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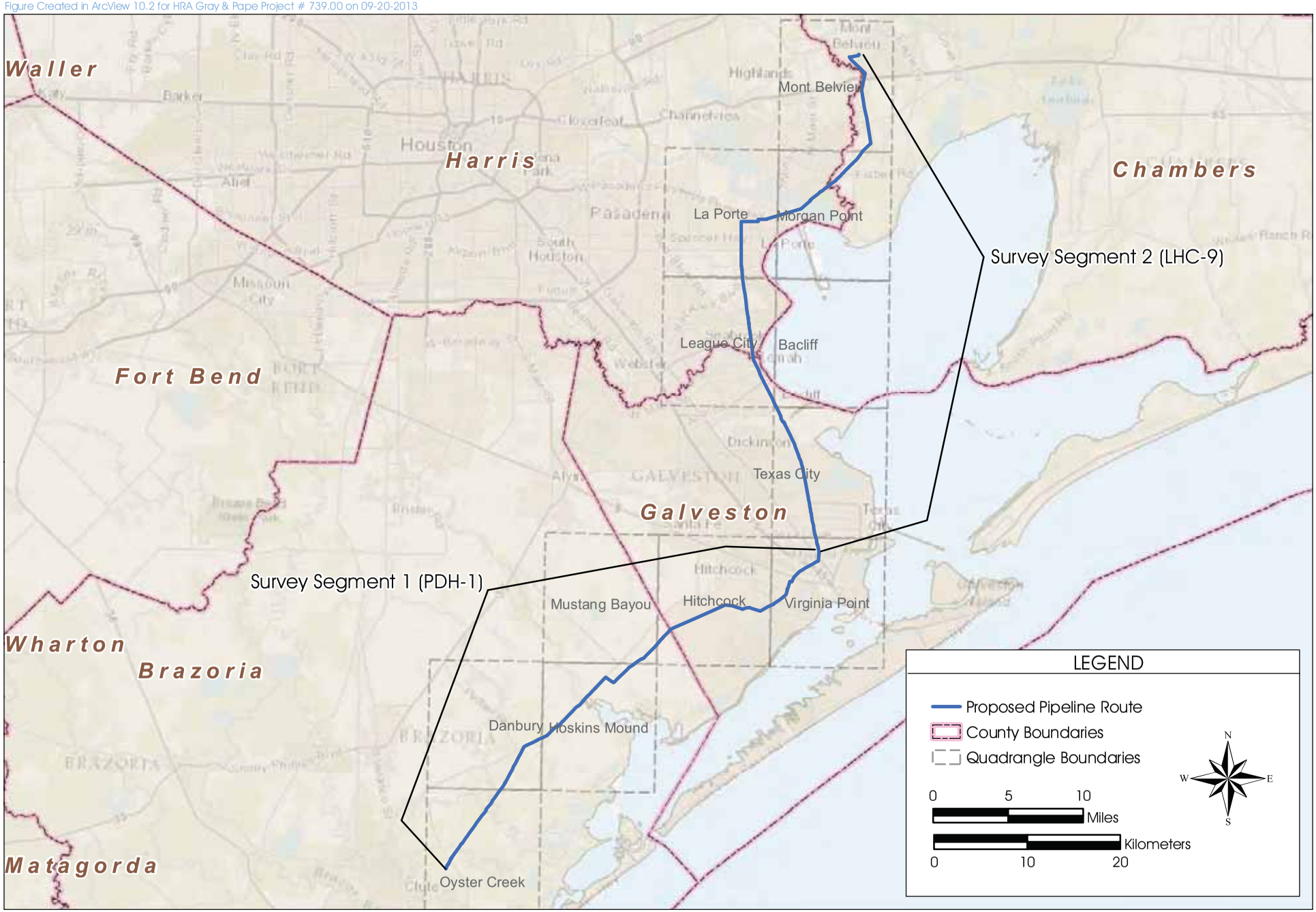

Project Area Map for the DOW 12-Inch MSR Ethane Pipeline Project Located in Brazoria, Galveston, Harris, and Chambers Counties, Texas

HRA Gray & Pape LLC.

Figure 1

1.1.1 Survey Segment 1 - SDO to Texas City (PDH-1 Pipeline)

In general, Survey Segment 1 of the Project alignment extends a total of approximately 59.5 kilometers (37 miles) from the DOW facility at the Stratton Ridge Oil Field in Brazoria County, Texas, to the DOW facility in Texas City in Galveston County, Texas (Figure 1). Of that length, approximately 36.7 kilometers (22.8 miles) is located in Brazoria County and 21 kilometers (13.2 miles) is located in Galveston County. Segment 1 of the Project is located on the *Oyster Creek*, *Danbury*, *Hoskins Mound*, *Mustang Bayou*, *Hitchcock*, and *Virginia Point*, United States Geological Survey (USGS) 7.5-minute topographic quadrangle maps. Approximately 12.6 kilometers (7.8 miles) of the proposed Project centerline are located within the Brazoria National Wildlife Refuge. Segment 1 of the pipeline crosses multiple waterways including Bastrop, Austin, Chocolate, Halls, and Basford Bayous. Although land use within Segment 1 is primarily pasture, the Project is to be located within or immediately adjacent to heavily used pipeline corridors. In addition, numerous pipelines intersect the route. Some clusters of recently plowed agricultural fields also comprise portions of Segment 1 of the Project. Portions of the Project located near Clute and Texas City were located on land that has been extensively modified for industrial use. Therefore, the majority of the surveyed area has encountered some amount of belowground disturbance due to previous construction activities associated with existing pipelines and industrialization. A draft report detailing the results of survey on Segment 1 was submitted to the THC for review in September 2012. That report received concurrence in October 2012 (Appendix C) and the final report is on file with the THC (Scott 2012).

1.1.2 Survey Segment 2 - Texas City to Mont Belvieu (LHC-9 Pipeline)

Survey Segment 2 extends a total of approximately 67.6 kilometers (42 miles) from the DOW facility in Texas City in Galveston County and will terminate at the proposed location of a new ethane pump station to be located in Mont Belvieu in Chambers County, Texas (Figure 1). Of that length, approximately 21.9 kilometers (13.6 miles) are located in Galveston County, 25.4 kilometers (15.8 miles) are located in Harris County, and 17.7 kilometers (11 miles) are located in Chambers County. Survey Segment 2 of the Project is located on the *Bacliff, La Porte, League City, Mont Belvieu, Morgan Point, Texas City, and Virginia Point, Texas*, USGS 7.5-minute topographic quadrangle maps. The proposed pipeline route extends from Texas City, Texas in Galveston County and heads northeast, crosses the Houston Ship Channel and Tabbs Bay, and then terminates in Mont Belvieu, Texas in Chambers County. The Project runs along existing pipeline and transmission corridors and parallels Highway 146 for its majority. Therefore, the majority of the surveyed area has encountered some amount of belowground disturbance due to previous construction activities associated with existing pipelines, development, and industrialization. The southern half of Segment 2 of the Project is nearly entirely developed while the north half is primarily composed of open prairie with mixed vegetation including cordgrasses and other low-to-ground grasses and shrubs. Segment 2 of the proposed pipeline route crosses multiple waterways, including Moses Bayou, Dickinson Bayou, Clear Lake, Taylor Bayou, Barbours Cut, the San Jacinto River, Cedar Bayou, and several other unnamed natural and channelized waterways and drainages.

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Together the segments comprise approximately 127 kilometers (79 miles) of new 12" diameter ethane pipeline. The USACE Permit Area for the Project is defined as a series of waterways and wetlands that are believed to be within USACE jurisdiction. These include a number of creeks, bayous, and smaller sloughs and sources of fresh water and aquatic resources. Because of the sensitive nature of these waterways and the potential for nearby resources, the preferred method of pipeline installation at waterways will be by horizontal directional drill (HDD). Drill entry and exit locations will be sited to provide a minimum of a 15.24-meter (50-foot) setback from most waterways. The depth below the channel(s) will be greater than the minimum clearance required by the USACE, normally 6 meters (20 feet) or 6 meters (20 feet) below the ultimate depth of channel. This allows for future dredging operations by the USACE.

1.2 Project APE

The Project will entail a 9-meter (30-foot) wide permanent easement with an additional 21 meters (70 feet) of temporary workspace resulting in a total Project corridor width of 30 meters (100 feet). Some locations of water and road crossings included an additional temporary workspace extending the survey area to another 30 meters (100 feet) wide. In total, the Project footprint including all permanent and temporary easements and additional workspaces subsumes approximately 362.3 hectares (895.4 acres). Approximately 12.6 kilometers (7.8 miles) of proposed Project centerline are located within the Brazoria National Wildlife Refuge. In addition, approximately 11.9 kilometers (7.4 miles) of the Project corridor is located on lands owned or controlled by political subdivisions of the state of Texas. These include the Cities of La Marque, Texas City, Seabrook, and La Porte, Galveston County, Port of Houston Authority, and county water authorities and drainage districts.

Areas that fall under USACE jurisdiction, land controlled by a political subdivision of the state, and areas considered to have a high probability for containing intact buried cultural resources define the Project APE. However, the entire alignment has been assessed for the potential to impact intact archaeological sites and historic structures. The archaeological APE for the Project consists of 362.3 hectares (895.4 acres) of permanent and temporary Project easements plus an additional 385.7 hectares (949.6 acres) of additional survey corridor totaling an area of 748 hectares (1,845 acres). Typically the visual APE for structures like meter and pump stations would be relative to the size of the proposed structure. For pipeline projects it is unlikely that the viewshed will be affected by below ground pipeline construction, but above ground markers or other pipeline infrastructure can result in viewshed-related concerns and vibration during pipeline construction could cause indirect impacts to structures located immediately adjacent to the workspace. Therefore, the APE for above ground resources included properties immediately adjacent to the archaeological APE.

1.3 Organization of the Report

This report is organized into 7 numbered chapters. Chapter 1.0 provides an overview of the surveyed area. Chapter 2.0 presents an overview of the environmental setting and geomorphology of the surveyed area. Chapter 3.0 presents a discussion of the cultural context associated with surveyed area. Chapter 4.0 presents the research design and methods

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developed for this investigation. The results of this investigation are presented in Chapter 5.0. Chapter 6.0 presents the investigation summary and provides recommendations based on the results of field survey. A list of literary references cited in the body of the report is provided in Chapter 7.0. Appendix A contains maps for the length of the Project and Appendix B contains zoomed in maps for identified resources. Records of previous agency consultations are in Appendix C.

1.4 Acknowledgements

Tony Scott served as the Principal Investigator. Jim Hughey served as Project Manager. Fieldwork was completed by Tony Scott, Field Director Elizabeth Spalding, and Field Technicians Craig Cosby, Luke Bahar, David Treichel, Rachel Perrine, Sarah Linden, and Charles William Fee. All of the content of this report was prepared Tony Scott with contributions by David Treichel and Rachel Perrine. Report graphics were prepared by Tony Scott and Julia Balakirova and the report was edited and produced by Jessica Bludau.

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2.0 ENVIRONMENTAL SETTING

The following section provides a discussion of general geomorphological and environmental characteristics found in Brazoria, Galveston, Harris, and Chambers Counties, Texas. This is followed by discussions of soil morphology, flora and fauna, and land use of the area.

2.1 Geomorphology

The Project lies within the Texas Coastal Prairie, a low, level to gently sloping flat prairie extending across the Texas Gulf Coast (University of Texas, Bureau of Economic Geology [UT-BEG] 1996). The basic geomorphological characteristics of the Texas coast and associated inland areas, which includes Brazoria and Galveston Counties, resulted from depositional conditions influenced by the combined action of sea level changes from glacial advance in the northern portions of the continent and subsequent downcutting and variations in the sediment load capacity of the region's rivers. Locally, Brazoria and Galveston Counties are represented by a geologic structure of nearly flat strata underlain by relatively recent deltaic sands and muds ranging in age from the Miocene to Holocene (Abbott 2001; UT-BEG 1996; Van Siclen 1991).

Although older geologic units have been identified in the region (Abbott 2001; Van Siclen 1991), units relevant to the study of long-term human occupation near the surveyed area include the Beaumont Formation, generally believed to predate human occupation in the region. The Beaumont Formation in the area is characterized by yellowish- to brownish-gray clay, and includes reddish orange intermixed and interbedded fine to fine quartz sand, silt, and minor fine gravel. Evidence of the formation can be found on stream channel, point-bar, cravasse-splay, and natural levee ridge deposits, and clayey fill in abandoned channels. Channel fill is generally dark brown to brownish dark gray, laminated organic-rich clay and silt. Other characteristics of the Beaumont formation include meander-belt ridges and pimple mounds 1 to 2 meters (3 to 6.5 feet) higher than the surrounding silt and clay (Moore and Wermund 1993a and b).

Overlaying Beaumont deposits may be relatively thick or thin Holocene-age alluvial deposits laid down in the area by alluvial or eolian factors or potentially marshy environments (UT-BEG 1992). The so-called "Deweyville" terraces may exist stratigraphically positioned between the Beaumont and Recent deposits. These terraces date to between 100,000 to 400,000 years ago, and are characterized as consisting "of up to 3 inset fluvial terraces…(distinguished by the presence of)…large looping meander scars…" indicative of watercourses capable of fluvial action and discharge markedly greater than that seen today (Abbott 2001:16).

2.2 Soils – Brazoria County

In Brazoria County, 12 soil map units have been identified within the Project corridor. These entail Asa silt loam; Asa silty clay loam; Bernard-Edna complex; Brazoria clay, 0 to 1% slopes; Edna fine sandy loam, 0 to 1% slopes; Edna-Aris complex; Ijam clay; Ijam-Urban land

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complex; Lake Charles clay, 0 to 1% slopes; Morey silt loam; Pledger clay; and Surfside clay (United States Department of Agriculture [USDA], Natural Resources Conservation Service [NRCS] 2008). Of the 12 listed soil series, Surfside comprises the greatest amount (approximately 33%) of the Project areas in Brazoria County. The next highest amount of mapped soil consists of Edna-Aris complex and Lake Charles soils, each found within 13% of the Project. These are closely followed by Pledger clay which is mapped within 11% of the Project. Of the 12 listed soils series Asa soils are considered to have a high potential for deeply buried intact cultural deposits (Abbott 2001) Asa soils are mapped within a combined 2.4 kilometers (1.5 miles) or approximately (7%) of the Project length. Brazoria and Pledger soils are considered to have a moderate to high potential for intact cultural deposits. These soils are mapped within a combined 4.8 kilometers (3 miles) or 14% of the Project length.

2.3 Soils – Galveston County

In Galveston County, 15 soil map units have been identified within the Project corridor. These entail Baicliff clay; Bernard clay loam; Edna fine sandy loam; Follet loam; Francitas clay; Francitas-Urban land complex; Kemah silt loam, 0 to 1% slopes; Kemah-Urban land complex; Lake Charles clay, 0 to 1% slopes; Mocarey-Algoa complex; Mocarey-Leton complex; Morey silt loam; Verland silty clay loam; and Veston loam, slightly saline-strongly saline complex (USDA-NRCS 2008). Of the 15 listed soil series, Bacliff soils comprises the greatest amount (approximately 23%) of the length of the Galveston County portion of the Project. The next highest amount of mapped soil consists of Verland soils at 14.6%. Of the 15 listed soils series none are considered to have a high or moderate to high potential for deeply buried intact cultural deposits (Abbott 2001).

2.4 Soils – Harris County

In Harris County, 13 soil map units have been identified within the Project corridor. These entail Bernard clay loam; Aldine very fine sandy loam; Aris fine sandy loam; Atasco fine sandy loam, 1 to 4% slopes; Beaumont clay; Beaumont-Urban land complex; Bernard-Edna complex; Edna fine sandy loam; Harris clay; Ijam soils; Lake Charles clay, 0 to 1% slopes; Verland silty clay loam; Verland-Urban land complex; and Vamont clay, 1 to 4% slopes (USDA-NRCS 2008). Of the 13 listed soil series, Bacliff soils comprise the greatest amount (approximately 20%) of the length of the Harris County portion of the Project. The next highest amount of mapped soil consists of Ijam soils at 14%. Of the 14 listed soils series none are considered to have a high or moderate to high potential for deeply buried intact cultural deposits (Abbott 2001).

2.5 Soils – Chambers County

In Chambers County, 5 soil map units have been identified within the Project corridor. These entail Anahuac silt loam; Beaumont clay; Lake Charles clay, 0 to 1% slopes; Morey silt loam, leveled; Oil waste; and Vamont clay, 1 to 5% slopes (USDA-NRCS 2008). Of the 5 listed soil series, Lake Charles soils comprise the greatest amount (approximately 72.7%) of the length of the Chambers County portion of the Project. The next highest amount of mapped soil

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consists of Morey soils at 15.5%. Of the 5 listed soils series none are considered to have a high or moderate to high potential for deeply buried intact cultural deposits (Abbott 2001).

2.6 Flora and Fauna

The surveyed area is located within a transitional area between the 2 ecological regions of the Gulf Coastal Marshes and Gulf Coastal Prairies (UT-BEG 2010; Blair 1950). Modern land alteration activities, especially those associated with rice farming, have resulted in the removal of native plant species from the area. Identified trees may include water oak, pecan, various elms, cedar, oaks, sweetgum, and mulberry, although the Chinese tallow has become the dominant species in many areas. Honeysuckle, dewberry, yaupon, and blackberry are common, as are indiangrass and bluegrasses (Gould 1973; UT-BEG 2000). Mammals in the area include deer, squirrels, raccoons, opossum, rabbits, skunks, and gophers. Riparian species include freshwater mussels and snails, alligators, and many different species of fish, turtles, and snakes (Jones 1982).

2.7 Land Use

Land within and adjacent to the Project consists of existing pipeline right-of-way (ROW). Areas outside of the existing pipeline ROW is classed as a mix of grassland, wetland, cultivated land, wooded, high intensity developed, open water, low intensity developed, bare/transitional land, and wooded wetland (Houston-Galveston Area Council [H-GAC] 2013). Much of Segment 1 of the Project area is used as cattle pasture and agricultural fields. In cultivated area crops include rice, grain sorghum, cotton, and soybeans (Crenwelge et al. 1981). The main problem that crop growers face is poor drainage. Nearly all soils in Segment 1 are somewhat poorly drained due to the flat to very gently sloping topography. Approximately 2/3 of Segment 2 of the Project is highly urbanized and modified from roadways, railways, and development. The northern 1/3 of Segment 2 occupies areas that have been less developed and is primarily used for pasture. Other uses include industrialization, particularly at either ends of the projects in the cities of Clute, Texas City, and Mont Belvieu.

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3.0 CULTURE HISTORY

Between the San Bernard River and Sabine Lake, most prehistoric sites near the coast consist of shell middens found in estuaries or exposed in cutbanks along streams (Aten 1983; Patterson 1985). Inland sites are more similar to generalized open campsites. In both areas, sites are found near stream channels. Historic sites tend to reflect farm or homesteads, generally dating to the mid-nineteenth century.

3.1 Prehistoric Period

The cultural context of the upper coastal region is described by Aten (1983) and Story (1990). This information is merged with the archaeological data here to give a complete picture of life on the Upper Texas Coast. Along the Upper Texas Coast, the Paleoindian period begins around 12,000 Before Present (B.P.) and ends near 9,000 B.P. (Aten 1983; Story 1990). The population during this stage was highly mobile in response to the movement of food sources. Isolated artifacts include Clovis, Angostura, Scottsbluff, Meserve, Plainview, and Golondrina point types (Aten 1983).

The Transitional Archaic period begins about 9,000 B.P. and ends around 7,500 B.P. (Aten 1983; Story 1990). The Archaic stage is thought to include a shift towards a diet more geared towards plant processing, but still included hunting (Story 1990). Beginning at 7,500 B.P. and spanning 2,500 years (Aten 1983), the Early Archaic period in this region has not been well documented. Points from this period include Bell, Carrollton, Trinity, Wells, and Early Stemmed.

The Middle Archaic period (5,000 to 3,000 B.P.) is represented by the earliest surviving shell middens (Aten 1983) in the area. These middens contain remains of shellfish, such as oysters and estuarine clams, faunal material from terrestrial and aquatic vertebrates, and the earliest known human burials in the region (Aten 1983). Characteristic projectile points include Bulverde, Williams, Lange, and Pedernales types.

The Late Archaic lasted from 3,000 to 2,000 B.P. and shows evidence for population increase (Aten 1983). Projectile points differ from earlier periods. Points associated with the Late Archaic are corner-notched or have expanding-stems, such as the Kent, Ellis, and Pontchartrain types. The transition from Late Archaic stage to Late Prehistoric is indicated by the introduction of ceramics into the assemblage (Aten 1983). The cultural tradition during the Late Prehistoric along the Upper Gulf Coast has been designated as Woodland. Story (1990) has suggested the use of the term Mossy Grove Tradition to define cultural patterns of the region. Story (1990) splits the Mossy Grove Tradition into 5 distinct time intervals on the coast, while noting that only 2 are found inland.

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3.2 Historic Period Brazoria County

Before European colonization of this region, it was occupied by the Karankawa Indians. Five different subgroups of Karankawa Indians, with the northern most tribe called the Cocos, lived in the area of modern day Brazoria County (Ricklis 2004).

In 1528, Alvar Nunez Cabeza de Vaca landed on San Luis Island and crossed the Brazos River in the area that would become Brazoria County. Many other Spanish explorers passed through the area, like Alonso De Leon in 1689 looking for the lost La Salle expedition and in 1727 Joaquin de Orobi y Basterra came through looking for French intruders in the Trinity River area.

Stephen F. Austin and 89 of Austin's Old Three Hundred settled the area in 1824. Some of the earliest communities were Velasco, Brazoria, and Columbia. It was in Velasco, soon after the Battle of San Jacinto, that General Santa Anna signed the Treaties of Velasco with the Republic of Texas on May 14, 1836. Under this newly formed provisional government came the formation of the first counties in Texas, among them Brazoria County, taking its name from the Brazos River (Kleiner 2012a). Between 1849 and 1859, the county of Brazoria flourished. The county became the wealthiest in Texas due in part to its largely southern society based on plantation life and slavery. Agriculture was the foundation for the county's economy based primarily on sugar and cotton (Kleiner 2012a).

Prior to the Civil War, the majority of white residents favored secession, which paved the way for new industries to be organized to help the Confederate Army, such as the Dance Brothers gun works manufacturing shop. Up until the time of the Great Depression, most Brazoria County residents made their living from agriculture with a maximum number of farms in 1940 reaching 3065. A major boom for the economy came from the greater production of rice. By 1940, the total acreage for rice had risen from 2,428 hectares (6,000 acres) to approximately 6,474 hectares (16,000 acres) and became the nation's number one rice producing area (Kleiner 2012a).

Brazoria County established its first school in 1827, followed by the Brazoria Academy in 1839. Academia became an integral part of the county around 1900 with the introduction of 8 independent school districts employing 200 teachers to educate the county's 6,000 students. The results of the county's educational efforts can be seen in the statistics of 1950 where only 23% of the population had completed high school, but in 1982 more than 65% percent had graduated from high school (Kleiner 2012a).

Now Brazoria County offers an assortment of recreational activities, everything from fishing, hunting, boating, skiing, and an array of other water sports. In conjunction, they also offer access to historic sites such as the Varner-Hogg Plantation State Historical Park. The county also contains Brazoria National Wildlife Refuge.

3.2.1 The Cities of Freeport, Stratton Ridge, and Clute, Texas

The City of Freeport, Texas was officially founded by the Freeport Sulphur Company in November 1912. The city is the location of a deepwater port at the mouth of the Brazos River

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and the largest sulphur mines in the world. The community was also the headquarters of the Houston and Brazos Valley Railway. The city has profited enormously from the development of chemical and petrochemical storage facilities and from commercial fishing (Kleiner 2012b). The introduction of Dow Chemical Company in the early 1940s provided support to the City's involvement with the Brazosport Industrial Complex, which was created during World War II. The industrial complex includes Freeport and the neighboring cities of Brazoria, Clute, Jones Creek, Lake Jackson, Oyster Creek, Quintana, Richwood, and Surfside Beach. The complex produces plastics, machinery, ships, and metal products (Encyclopedia Britannica, Inc. 2012). The port is home to one of the largest shrimp boat fleets in the entire Gulf of Mexico. In 1957, the City of Freeport integrated the historic Texas town of Velasco (Kleiner 2012b).

Stratton Ridge, Texas, which was originally known as Ranch Prairie or Phair, was a loose community dating to the mid nineteenth century. The community gained a modest population and even a post office, but lost residents after the Galveston hurricane of 1900. Sometime in the early twentieth century the community became known as Stratton Ridge, purportedly derived from a church built in 1933 in honor of an early settler by the name of J. T. Stratton. By 1936 state highway maps indicated Stratton Ridge and by 1979 the original townsite of Phair, plotted nearly a mile away, consisted of an abandoned railroad station and church (Kleiner 2012c).

The City of Clute is located on the site of Evergreen Plantation, one of the county's first plantations, dating to 1824. After 1839 the plantation later became the Herndon or Calvit-Herndon plantation when John H. Herndon married the daughter of original property owner Alexander Calvit. After the Civil War several relatives of the Clute family founded a community near the plantation and acquired additional land from Herndon and the property became known as Clute's Place from 1886 to 1889. The community remained small (only a population of 10 in 1933) until 1940 when it became part of the Brazosport industrial and port area. Fourteen years later the community had a population of 3,200 with several businesses. The townsite was incorporated in May 1952 under the name Clute City and in 1955 changed its name to Clute only to change its name to Clute City again in 1980. As recent as 2000 the City reached a population high of 10,424 and once again was known simply as Clute (Kleiner 2012d).

3.3 Historic Period Galveston County

Galveston County was formed with the help of Brazoria, Harrisburg (Harris), and Liberty Counties in 1838. The first Anglo occupation of the area began in 1815 when a few ships associated with Henry Perry and Waren D. C. Hall landed at Bolivar Point. Jean Laffite formed the first community recorded on the island of Galveston in 1817 known as Campeche. The small fort only survived until 1819 when it was destroyed by storm (Kleiner 2012e).

Before colonization started in the area, early Spanish explorers used to refer to the island as Isla de Malhado (Isle of Misfortune). This name is credited to Alvar Nunez Cabeza de Vaca, who was shipwrecked in the area in 1528. During the exploration of the area by Rene Robert Cavelier, Sieur de La Salle the island was designated San Louis to honor the king of France Louis XIV. The island finally achieved its current name in 1783 when the channel was

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surveyed and the bay was named Galvezton in honor of Viceroy Bernardo de Galvez. Although the land held its name of San Luis for a time, by 1820 it was being called Galveston Island (Kleiner 2012e).

In 1822, the ship Revenge brought a small group of Americans to settle a part of Galveston County and in 1827 the first American settlement was established near Offat's Bayou. Stephen F. Austin helped spark the flow of settlers to the area by convincing the government of Mexico to build a port and customhouse on the island. In 1830, a company called the Galveston Bay and Texas Land Company was formed by David G. Burnet and Lorenzo de Zavala to help settle the area under the Mexican colonization laws. By the time that the United States annexed Texas, Galveston was the largest city in Texas with a population of 3,500 (Kleiner 2012e).

The island of Galveston has had a tumultuous past including being taken over by Northern forces during the Civil War in 1862, having a yellow fever epidemic in 1864, which all but wiped out the population, and even surviving one of the worst hurricanes on record in 1900. Through all of this Galveston has remained strong and prosperous. It was still recorded as the largest city in Texas in 1880 with over 530 businesses, 10 hotels, and 127 saloons. The town continued to prosper up to 1930 with railway access being improved with the construction of a causeway and interurban railroad (Kleiner 2012e).

Today Galveston County is one of the most populated counties in Texas, with about half of the land being used for farming or ranching. The Galveston area still remains a focal point for medical services as well as aquatic research (Kleiner 2012e).

3.3.1 The City of Texas City, Texas

Texas City, on the southwestern shore of Galveston Bay was initially conceived in 1891, by 3 brothers from Duluth, Minnesota. The Myers brothers saw that the area had potential as a major port and they along with other shippers in Duluth, collectively known as the Texas City Improvement Company, bought 4,047 hectares (10,000 acres) of Galveston Bay frontage and named the area Texas City. The Gulf Channel leading into the port was authorized by the federal government in 1893 and the first shipment using the channel took place in September of 1894. The port was eventually supplemented by a rail line to the Texas City junction of the Galveston, Harrisburg and San Antonio and the Galveston, Houston and Henderson railroads. This network of rail connections allowed shippers to send freight by train to Houston, where it could join the national railway systems. After the channel had been deepened in 1905, along with the railroad connections and the expansion of warehouses and docks made Texas City an attractive port. Discovery of oil at the Spindletop oilfield in 1901 and the subsequent building of the Texas City Refining Company in 1910 only increased the use of the port. The next 20 years saw the location expand to include tank farms, pipelines, and 3 more refineries (Benham 2012a).

Perhaps most amazing is the city's ability to rebound after several natural, economic, and industrial disasters beginning with the hurricane of 1915, The Great Depression in the 1930s, The Texas City Disaster of 1947, Hurricane Carla in 1961, the BP explosion in 2005, and Hurricane Ike in 2008. The city's strong industrial ties to the oil, chemical, plastics, and

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petrochemical industries along with lessons learned from those disasters will likely allow Texas City to maintain its importance among Texas ports (Benham 2012a).

3.4 Historic Period Harris County

Harris County was formed as Harrisburg County on December 22, 1836. The county was renamed Harris in December 1839, to honor John Richardson Harris, an early pioneer who had established Harrisburgh in 1826, the first town site in the county. Harrisburgh was established at the confluence of Buffalo Bayou and Brays Bayou and by the 1830s had become the major port of entry for the region and a transportation hub. Roads ran northwest to the Brazos communities of San Felipe and Washington, east to the ferry landing that crossed the San Jacinto, and west paralleling Brays Bayou to the Oyster Creek Community near present day Stafford in Fort Bend County (Henson 2023).

Under Mexican rule the area surrounding Harrisburg (as it came to be spelled by 1832) was known as the San Jacinto District. The district stretched east from Lynchburg on the San Jacinto River west to the location of present day Richmond, and from Clear Creek in the south to Spring Creek in the north. Harrisburgh County encompassed this same territory with the addition of Galveston Island. The modern boundaries of Harris County were established in 1838 (Henson 2012).

The lands that would become Harris County comprised the southeastern border of Austin's Colony. In July of 1824, 29 titles were granted to lands in future Harris County, with an additional 23 grants made between 1828 and 1833. These original grants concentrated mainly on the watercourses of the region (Henson 2012). The early settlers in the region were mostly from the southern United States who brought with them their African slaves. In the 1840s, large numbers of German and French immigrants settled in Harris County. The Hispanic presence in the region was relatively sparse prior to an influx of immigrants following the Mexican Revolution reflecting the ephemeral nature of Spanish and Mexican colonization.

The founding of the city of Houston by Augustus and John Allen was announced in a newspaper advertisement of August 1836. The brothers managed to convince the delegates of the first Texas Congress to establish the yet to be built Houston as the first, albeit temporary (1837 to 1840), capital of Texas. In 1837, Houston also became the seat of Harrisburg County. The town was laid out on a grid plan with streets running parallel and perpendicular to Buffalo Bayou near the confluence of White Oak Bayou. The town grew rapidly from 12 inhabitants and 1 log cabin in January of 1837 to 1,500 people and 100 houses 4 months later (Henson 2012).

The immigrants that came to the area following the Civil War founded settlements along the rail lines that bisected the county. The Houston communities of Pasadena, Deer Park, Houston Heights, Bellaire, Webster, La Porte, South Houston, and Genoa developed in this manner and were eventually annexed into the city of Houston. By the 1930s Harris County was the largest county and Houston was the largest city in Texas.

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By the mid-nineteenth century Houston and Harris County had become a center of commerce. Products were imported into the Texas hinterland through Houston after being offloaded from ocean going ships in Galveston. Exports included agricultural products such as cotton, corn, and cow hides. The town became a railroad hub with 6 railways spreading from 80 to 161 kilometers (50 to 100 miles) to the northwest, east, west, south, and southeast. In 1873, Houston joined the national rail network when the Houston and Texas Central reached Denison (Henson 2012).

The discovery of oil at Spindletop made Houston an important center for the petroleum industry. The Ship Channel was safe from Gulf storms and refineries began lining the banks in 1918. By 1929, 40 oil companies had offices in Houston. The outbreak of World War II created an increased demand for products made of petrochemicals. The city would go on to become one of the 2 largest petrochemical concentrations in the United States (Henson 2012).

3.4.1 Evergreen Plantation

The Evergreen Plantation is situated on Galveston Bay, near Cedar Bayou. In 1839, Moseley Baker, one of the military leaders of the Texas Revolution, moved to a league of land near Goose Creek. Here he established the Evergreen Plantation (Cutrer 2013). Dr. Ashbel Smith was a leader and pioneer doctor in the development of Texas. Ranching was among his numerous valuable contributions to Texas. Smith moved to Texas in 1847 and became roommate and friend to Sam Houston (Silverthorne 2013). That same year, Mr. Smith bought the Evergreen plantation from Moseley Baker for $5,000. While some stock was raised on the plantation, its major crops were corn, potatoes, and sugarcane (The Handbook of Texas Online 2013. The Evergreen Plantation was his home until his death in 1886 (Cutrer 2013). A portion of this plantation was left to Smith's adopted daughter. Her portion later became a part of the Goose Creek Oilfield, an area in Texas where the first offshore drilling for oil occurred (The Handbook of Texas Online 2013, Cutrer 2013; Silverthorne 2013).

3.4.2 Hog Island

Hog Island was originally 90 hectares (223 acres). A steamboat landing operated on Hog Island in the 1800s. Dr. Ashbel Smith acquired Hog Island in the mid-1800s. Its name originated from Smith running hogs on it. This island was once a link between Morgan's Point and Baytown. John Gaillard bought the island from Smith in 1905 for $2,000 in order to run livestock on it. Gaillard was fishing off the island when he discovered natural gas. From 1917 to 1920, Mrs. Hettie Perry ran a boarding house on the island. It housed Goose Creek oil field workers. The first barge load of oil sailed from the Goose Creek oilfield from the island's landing. Crude oil was routed from the Goose Creek field via Hog Island to the ship channel. In 1918, the Humble Oil Company bought the island from Gaillard in 1918 for $300,000. In July 1933, the Morgan's Point ferry began operating between Hog Island and Morgan's Point. While Harris County operated the ferry in the beginning, the state took over its operation in 1939. This ferry's final voyage occurred in 1953 (Orton 2013a-b; Ourbaytown.com 2013).

Baytown community leaders envisioned this island becoming a second Sylvan Beach. During World War II, these development plans were halted. The island was both a ferry connection

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and a recreation spot. During the late 1950s, Hog Island was used as a land fill. Little is left of this island today (Orton 2013a).

3.5 Historic Period Chambers County

Chambers County was named for Thomas Jefferson Chambers and was formed in 1858 from portions of Jefferson and Liberty Counties. Prior to becoming a county, the land in this area was used by the French until they were driven from the area by the Spanish circa 1818. In 1821, Americans began settling the in the area (Kleiner 2012f).

The economy of Chambers County was depended on rice and cotton agriculture, although later a sawmill and shipyard were constructed. The county's first post office was at Anahuac, and this was established in 1844. Chambers County voted to secede during the Civil War and many in the county were members of the military. During the Reconstruction Era, farming began to be replaced by ranching. A meat packing plant was built in Wallisville during the 1870s. The railroad did not reach the interior of the county until the late 1890s (Kleiner 2012f).

Chambers County has suffered some hardships. A fire burned down the courthouse in 1875 and the county was hit by 2 hurricanes in 1875 and 1900. The county also suffered the smallpox epidemic in 1877. However, between 1880 and 1910 the population increased steadily. Around 1930, the oil boom hit Chambers County. The oil fields in the county provided jobs to the residents, which decreased the effects of the Great Depression on the county. In modern times, farming and oil still employ the majority of the county's residents (Kleiner 2012f).

3.5.1 The City of Mont Belvieu

Permanent historic period occupation of the Mont Belvieu area began with the settlement of Amos Barber in 1849. A community known as Barbers Hill eventually grew around the homestead. The name was later changed to Mont Belvieu and the population remained generally small (estimated at 20 in 1920) until the growth of oil related businesses in the mid-1930s. The town was incorporated in 1970 and population growth continued until the potential risk of the salt dome to explode caused many residents to relocate between the mid-1980s to 1990s to a location 3.2 kilometers (2 miles) to the east (Wooster 2012).

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4.0 METHODOLOGY

4.1 Site File Research and Literature Review

The site file research and literature review was performed in order to identify all previously recorded archaeological sites and previous investigations within 0.8 kilometers (0.5 miles) of linear Project areas and within 1.6 kilometers (1 mile) of block Project areas. This work was conducted by reviewing online data available on the Texas Online Archaeological Sites Atlas, an online resource maintained by the THC, as well as an online database of the National Register of Historic Places (NRHP) (2013). Historic maps from the collection of David Rumsey (2003) were also consulted in cooperation with Google Earth (Burr 1839; United States General Land Office [GLO] 1867) and researching maps maintained by the Texas GLO (2013).

As part of these investigations, HRA Gray & Pape created a series of tables to document previously identified cultural resources and previous investigations located within a background cultural review radius. This work was used to provide a historic context to the cultural resources survey, and additional documentary research was conducted in order to provide an understanding of the development and history of the surrounding area, and southeast Texas in general. This research then was used to prepare an overview history of the area and provided an understanding of the contextual framework of Brazoria and Galveston Counties' prehistory and history, and southeastern Texas in general.

4.2 Predictive Modeling using ArcView GIS

The locations of prehistoric and historic archaeological sites typically conform to a set of favorable environmental conditions including, but not limited to, choosing elevated areas protected from frequent episodic flooding, locales with well-drained soils, and close proximity to perennial freshwater streams where fish and other wildlife may have been found in abundance.

Several environmental factors were used to create a model for predicting the likelihood of encountering unidentified archaeological deposits within the surveyed area. These factors include:

- Known cultural resources;
- Historic maps;
- Topography;
- Soils and geomorphology;
- Natural waterway including major rivers, creeks, and intermittent streams;
- Wetlands; and
- Land use and land cover.

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Using ArcView Geographic Information Systems (GIS), geo-referenced layers of these environmental data were overlain on a shapefile of the proposed pipeline route and 60-meter (200-foot) wide survey corridor. Data used for GIS modeling include that available from the Texas Archeological Sites Atlas, the GLO (2013), the National resource Conservation Service (NRCS), the National Hydrography Dataset (NHD) (2013), the Texas Natural Resources Information System (TNRIS) (2013), the Environmental Systems Research Institute (ESRI) (2013), and H-GAC.

The resultant maps were evaluated for areas that could potentially contain favorable conditions for site occupation as outlined above. The identified areas are referred to as high potential areas (HPAs). HRA Gray & Pape selected several HPAs within the surveyed area at the desktop level. These HPAs possess one or more of the following characteristics:

- well-drained soils with high geoarchaeological potential as discussed in Chapter 2.0 including Asa, Brazoria and Pledger soils;
- pimple mounds or otherwise natural, elevated, flat, level terrain;
- land with intact natural ground surfaces composed of undeveloped grassland and woody land typically used for farming/ranching, as indicated by the H-GAC (2013); and
- close proximity to a natural waterway, this includes marshes and remnants of old channels.

Preliminary desktop analysis of the Project alignments identified 73 locations as possible HPAs. In addition to the environmental identifiers listed above, the Projects were also overlaid on historic aerial imagery and topographic maps to assess for the potential of historic standing structures.

4.3 Project Coordination

Approximately 11.9 kilometers (7.4 miles) of the Project corridor is located on lands owned or controlled by political subdivisions of the state of Texas. These include the Cities of La Marque, Texas City, Seabrook, and La Porte, Galveston County, Port of Houston Authority, and county water authorities and drainage districts. These properties are comprised of man-made drainage canals, levees, road crossings, dredge spoil placement areas, and even a golf course that are considered to be of a low potential for containing intact cultural resources. Available Project plans are for these properties to be drilled under. However, due to the potential for surface impacts to properties owned by entities considered to be subdivisions of the state of Texas, Texas Antiquities Permit Numbers 6246 and 6446 was acquired from the THC Division of Archeology. As advised by the THC, coordination also took place with Cody Denge, Park Manager of the Brazoria National Wildlife Refuge on April 18, 2012, to define suitable survey methods and rules of entry for the property. The Project was also discussed with numerous pipeline representatives in response to a One-Call Locate submitted on April 16, 2012, in order to ensure safety during subsurface testing.

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4.4 General Field Survey Methods

HRA Gray & Pape implemented a survey strategy focusing on areas that may contain previously recorded cultural resources, areas that fall under jurisdiction of the USACE, properties owned or controlled by political subdivisions of the state of Texas, and HPAs for containing buried cultural deposits. To select survey areas the proposed route was examined for: waterways and wetlands that are believed to be within USACE jurisdiction; recent and historic topographic maps and aerial images for areas that may have once contained waterways and wetlands; possible historic structures; and finally by determining property ownership. Water crossings selected for investigation did not include man-made canals and ditches except in cases where evidence showed a natural waterway predated the man-made structure. Highly modified/channelized banks of waterways were omitted from subsurface testing. Areas inside existing plants and refineries were not surveyed or visually inspected due to the previous impacts that have taken place within them. In general, the USACE jurisdictional waterways and wetlands would be subject to survey under the proposed work plan. The remainder of the Project was assessed for archaeological potential and field observations guided additional testing efforts along the Project's alignment.

Survey of Project areas consisted of windshield survey, pedestrian reconnaissance, photo-documentation, and shovel testing. A handheld Global Positioning System (GPS) receiver capable of sub-meter accuracy data recording was used to assist in survey. To facilitate record keeping and to measure survey progress, the Project length was overlaid onto property parcels and divided into segments and numbered accordingly based on the parcel tract numbers. Subsurface testing, photos, and field notes were all referenced to these tract numbers.

Two parallel linear transects spaced 30 meters (100 feet) apart were surveyed within the 60-meter (200-foot) wide survey corridor/APE. Within the surveyed areas, Transect A was always located 15 meters (49 feet) to the north/west side of the centerline and Transect B was always located 15 meters (49 feet) to the south/east side of the centerline. Additional transects were added to capture additional existing pipeline corridor that fell outside of the 60-meter (200-foot) pipeline survey corridor. Portions of the APEs were subjected to both systematic and judgmental excavation of shovel tests. Per THC guidelines, minimum standards for surface reconnaissance and subsurface testing on linear projects call for 16 shovel tests per 1.6 kilometers (1 mile), within a 30-meter (100-foot) wide study corridor. For non-linear areas between 4.45 and 40.47 hectares (11 and 100 acres) in size, the THC minimum survey standards call for the excavation of 1 shovel test every 0.81 hectares (2 acres). Shovel test interval ranged between 30 and 100 meters (100 and 300 feet) and was determined based on observed environmental conditions. In addition to systematic shovel testing, sampling of the survey corridor was conducted via the excavation of judgmentally-placed shovel tests and surface inspection as determined appropriate by the lead Field Archaeologist and Principal Investigator.

Landforms, mounds, or other areas of topography were subsurface tested on a judgmental basis. Shovel tests were not excavated in areas with 100% surface visibility, areas containing existing road, roadside ditches, standing water, areas directly above where underground utilities had been installed, or where previous disturbance was evident. Shovel testing

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consisted of 30 by 30-centimeter (11 by 11-inch) diameter tests excavated to a maximum depth of 100 centimeters (39.3 inches) into the underlying substratum. In areas containing an existing buried pipeline, shovel tests were limited to a depth of 40 centimeters (15 inches) per DOW safety regulations. Vertical control was maintained by excavating each shovel test in 10-centimeter (4-inch) levels. One wall of each shovel test was profiled and the walls and floor of each shovel test were inspected for color or texture change potentially associated with the presence of cultural features. Soils were screened through ¼-inch wire mesh and descriptions of soil texture and color followed standard terminology and the Munsell (2005) soil color charts. Additional information concerning soils encountered was recorded on standardized shovel test forms for each excavation.

The majority of the Project contains conditions considered to be of a low probability for containing intact buried resources and much of the areas are located adjacent to major highways and roads, thus a windshield reconnaissance was initiated prior to survey (Plate 1). Typically 1 transect was omitted from survey as existing pipelines occupied the majority of the survey corridor. Information regarding existing pipelines and the methods by which they were installed was available from representatives of DOW and Mustang who were always on hand during survey. Installation and maintenance of existing pipelines also left a good deal of the survey corridor clear of surface vegetation.

4.4.1 Site Definition

If new archaeological sites or loci were located preliminary assessments concerning resource integrity and preliminary recommendations for National Register eligibility status were made. For a site to be considered eligible for the NRHP under Criterion D, it must possess information bearing on an important scientific research question. Important research questions commonly involve testing new or former hypotheses regarding topics in the natural sciences and/or addressing aspects of the cultural chronology of a region. This information must be evaluated within the framework of an historic context, meaning, the researcher must be able to address how the information contained within the resource is likely to effect current understanding of a particular time period (USDI 1983: II-26, 1991:21). In order for an archaeological resource to be considered significant, it generally must retain integrity. While sites that have been disturbed through natural or cultural processes can still be eligible if their undisturbed portions contain significant information potential, sites that have lost their stratigraphic context are commonly considered to have lost integrity of location (USDI 1983:II-26, 1991:23, 49).

All newly identified sites were delineated within the Project area. All sites were photographed and mapped. With reference to THC guidelines, a minimum of 6 shovel tests must be excavated to delineate site boundaries. HRA Gray & Pape relies on the excavation of 2 consecutive negative shovel tests in each cardinal direction radiating from positive tests to delineate site boundaries, ensuring a clear definition of site boundaries. Radial shovel tests were excavated at 10-meter (30-foot) intervals within the Project area. HRA Gray & Pape collected only diagnostic artifacts that may be used to help assign temporal affiliations to new sites and that all other materials would be recorded in place. Upon survey completion, each cultural resource loci was assessed as to whether or not formal state recordation would be appropriate. In general, isolate non-diagnostic lithic finds and sites with extremely low-density

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Plate 1. Overview of a typical segment of the project area within a heavily developed corridor near roads and railroad tracts. View is to the south.

Plate 2. Bulkhead adjacent to the project corridor at the south side of Clear Lake. View is to the west.

Created in CorelDRAW X3, 02-01-2013

lithic scatters were plotted on Project maps and identified by field site or isolate number, but not formally recorded as archaeological sites. Site trinomials were obtained for all diagnostic isolates and for all sites for which some level of behavioral activity could be assessed. An official Texas site was completed and submitted to the Texas Archeological Research Laboratory (TARL), and a site trinomial was obtained from TARL for each newly recorded site. Artifacts will be returned to the land owners upon completion of the project. Data collected during shovel testing were used to assess the need for mechanical deep testing. If areas requiring deep testing were identified, backhoe trenching would be utilized to evaluate these areas to culturally sterile depths.

It was deemed unlikely that historic resources would be affected by below-ground pipeline construction, although above ground markers or other pipeline infrastructure can result in viewshed-related concerns. Therefore, had any standing structures located immediately adjacent to the survey corridor and appearing to be 50 years or older been identified they would have been photographed during the survey, and their locations plotted on field maps with Global GPS points collected.

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5.0 RESULTS OF INVESTIGATIONS

The primary purpose of this investigation was 3-fold; 1) determine if any previously identified cultural resources or National Register properties were located within a 0.8-kilometer (0.5-mile) study radius of the surveyed area; 2) to determine if any previous cultural resource investigations had been conducted in or near the surveyed area, and; 3) use these results to develop an appropriate field survey strategy to identify and record any previously unidentified cultural resources within the surveyed area.

5.1 Results of Site File Research and Literature Review

The Texas Online Archaeological Sites Atlas, an online resource maintained by the THC, identifies multiple cultural resources within the study radius of the surveyed area (Figures A2 to A27). Numerous survey projects, archaeological sites, historic markers and recorded cemeteries are located within the study radius. Lists of all previous investigations are provided in Table 1 and the results of the results of the site file research are provided in Table 2.

5.1.1 Previous Investigations

A total of approximately 44 area surveys (Table 1) and 32 linear surveys (Table 2) have been conducted within 0.8 kilometers (0.5 miles) of the Project (Figures A2 to A27). Many of these surveys were performed 30 or even 40 years ago and specific information relating to them is lacking. Such is the case with many surveys performed by agencies including the USACE, Federal Energy Regulatory Commission (FERC), Federal Highway Administration (FHWA), Environmental Protection Agency (EPA), and the Texas Department of Highways and Public Transportation (TDHPT). Tables 1 and 2 below provide a list of these linear and block area surveys, although only very limited information is available for most of them as these were conducted prior to 1980. Information regarding the field data collection methods utilized for older projects is not known.

Table 1. Previously conducted area surveys within 0.8 kilometers (0.5 miles) of the Project area.

Investigator	Project Date	Sponsor	Permit Number	Report Author
EPA	1975	EPA	-	-
USACE	1976	USACE	-	-
FHWA	1976	FHWA	-	-
TDHPT	1976		-	-
EPA	1979	EPA	-	-
USACE	1981	USACE	-	-
USACE	1981	USACE	-	Ferguson, John Steven Hall and Roger Moore
USACE	1981	USACE	-	-
USACE	1982	USACE	-	-
USACE	1984	USACE	-	-

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Investigator	Project Date	Sponsor	Permit Number	Report Author
USACE	1984	USACE	-	-
USACE	1984	USACE	-	-
USACE	1984	USACE	-	-
USACE	1984	USACE	-	-
USACE	1984	USACE	-	-
USACE	1984	USACE	-	-
Prewitt & Associates, Inc.	1985	USACE	-	Fields, R.
USACE	1985	USACE	-	-
USACE	1986	USACE	-	-
USACE	1988	USACE	-	-
FHWA	1988	FHWA	-	-
USACE	1989	USACE	-	-
FHWA	1991	FHWA	-	-
USACE	1992	USACE	-	-
Harris County	2003	Harris Co	3083	-
Prewitt & Associates, Inc.	2004	Port of Houston Authority	3308	Mehalchick, Gemma, and E. Frances Gadus
Moore Archaeological Consulting, Inc.	2004	City of La Porte	3533	Driver, David
Halff Associates	2005	-	3767	Voellinger, Leonard
Moore Archaeological Consulting, Inc.	2005	-	-	Mangum, Doug
Goodwin and Associates	2005	FERC	-	Sanders, Ashley, Brandi Carrier and others
Goodwin and Associates	2005	COE-VD	-	Sanders,Carrier,Smith,Hadly,Lackowicz,Athens
Moore Archaeological Consulting, Inc.	2005	City of League City	3801	Dogulas and Davi Driver
Michael Baker Associates	2006	TxDOT	-	Mooney, James P. and Ruth Mathews
HRA Gray & Pape	2007	HCPID	4339	Turner, Kristi
Moore Archaeological Consulting, Inc.	2008	-	-	-
SWCA	2008	-	-	-

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Investigator	Project Date	Sponsor	Permit Number	Report Author
TRC	2008	FERC	-	Laird, Price, et al.
PBS&J	2008	-	-	-
Gulf Coast Archaeology Group	2008	-	-	-
PBS&J	2009	USACE	5025	-
SWCA	2011	-	-	-
SWCA	2011	-	-	Crow, Michael, et. al.
HRA Gray & Pape	2007	-	-	Turner, Kristi
Unknown	-	-	-	-

- Indicates that no information is available

Table 2. Previously conducted linear surveys within 0.8 kilometers (0.5 miles) of the Project area.

Investigator	Project Date	Sponsor	Permit Number	Report Author
USACE	1972	USACE	-	-
TDHPT	1975	TDHPT	-	-
USACE	1975	USACE	-	-
USACE	1975	USACE	-	-
USACE	1975	USACE	-	-
USACE	1975	USACE	-	-
USACE	1979	USACE	-	-
USACE	1979	USACE	-	-
USACE	1979	USACE	-	-
USACE	1979	USACE	-	-
USACE	1979	USACE	-	-
EPA	1981	EPA	-	-
USACE	1982	USACE	-	-
USACE	1985	USACE	-	-
USACE	1986	USACE	-	-
FHWA	1986	FHWA	-	-
TDHPT	1988	TDHPT	-	-
FERC	1992	FERC	-	-
TxDOT	1996	TxDOT	-	-
USACE	1998	USACE	-	-
USACE	1998	USACE	-	-
USACE	1998	USACE	-	-
USACE	1998	USACE	-	-
USACE	1998	USACE	-	-

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Investigator	Project Date	Sponsor	Permit Number	Report Author
USACE	1998	USACE	-	-
USACE	1998	USACE	-	-
USACE	2000	USACE	-	-
USACE	2001	USACE	2667	-
Moore Archaeological Consulting, Inc.	2002	-	-	Mangum, Douglas, and Roger Moore
Michael Baker Jr. Inc.	2004	-	3303	-
Unknown	-	-		-
Unknown	-	-		-

- Indicates that no information is available

5.1.2 Previously Recorded Cultural Resources

A total of 34 previously recorded sites and 19 shipwrecks are located within 0.8 kilometers (0.5 miles) from the Project (Tables 3 and 4). Of those, 3 sites (41HR47, 41BO161, and 41GV67) have centroids or site boundaries mapped within or immediately adjacent to the Project easement. Another 6 sites (41HR162, 41HR682, 41HR683, 41HR687, 41HR827, and 41HR1036) have centroids mapped near survey corridors that are no longer in consideration for the Project. These sites are generally recorded as shell middens located adjacent to waterways and are often reported to contain prehistoric pottery, stone tools and flakes, and faunal bone. The sites were often noted to be subject to damage from erosion, subsidence, and pipeline construction.

Table 3. Known archaeological resources within 0.8 kilometers (0.5 miles) of the Project area.

Trinomial [Site Name]	Year Recorded	Site Type	Temporal Affiliation	Eligibility Statement When Recorded	Distance from Project Easement
41BO161	1986	Shell midden	Unknown Prehistoric	Not Eligible	Within
41BO162	1986	Open campsite, Rangia midden	Unknown Prehistoric	Has Potential	15 meters
41BO163	1986	Shell midden	Unknown Prehistoric	Not Eligible	0.1 miles
41BO194	1998	Shell midden	Unknown Prehistoric	Not Provided	0.25 miles
41BO224	2005	Cow dipping tank	Historic	Not Eligible	0.27 miles
41B047	1972	Shell midden	Unknown Prehistoric	Not Provided	0.4 miles
41GV2	Not Provided	Not Provided	Not Provided	Not Provided	0.2 miles

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Trinomial [Site Name]	Year Recorded	Site Type	Temporal Affiliation	Eligibility Statement When Recorded	Distance from Project Easement
41GV18	1983	Ceramics	Prehistoric, Ceramic	Not Eligible	0.3 miles
41GV20	1983	Shell Midden	Prehistoric, Ceramic	Not Eligible	0.3 miles
41GV37	1956	Shell Midden	Prehistoric, Ceramic	Not Provided	0.4 miles
41GV50	1972	Shell Midden	Prehistoric, Ceramic	Not Eligible	0.47 miles
41GV67	1976	Shell Scatter	Undetermined	Not Provided	Within
41GV75	1983	Lithic flake	Unknown Prehistoric	Not Eligible	0.3 miles
41GV83	1985	Shell Midden	Unknown Prehistoric	Not Eligible	0.3 miles
41GV84	1985	Shell Midden	Unknown Prehistoric	Has Potential	0.4 miles
41GV85	1985	Shell Midden	Unknown Prehistoric	Has Potential	0.45 miles
41HR418	1981	Shell Deposit	Unknown Prehistoric	Not Provided	0.4 miles
41HR91	1983	Shell Midden	Prehistoric, Ceramic	Not Eligible	0.1 miles
41HR90	1983	Shell Midden	Prehistoric, Ceramic	Not Eligible	0.25 miles
41HR565	1985	Homestead	Historic: Early 20th century	Not Eligible	94 meters
41HR1036	2008	Historic Road	Historic: 1930s	Not Provided	0.45 miles
41HR827	1998	Shell Midden	Unknown Prehistoric	Has Potential	0.3 miles
41HR683	1990	Shell Midden	Prehistoric, Ceramic	Not Eligible	0.32 miles
41HR682	1990	Shell Midden	Prehistoric, Ceramic	Not Eligible	126 meters
41HR681	1990	Shell Midden	Prehistoric, Ceramic / EuroAmerican	Has Potential	0.3 miles
41HR107	1956	Shell Midden	Unknown Prehistoric	Not Provided	0.3 miles
41HR408	1980	Homestead	Historic: 1830s to 1886	Not Provided	0.2 miles

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Trinomial [Site Name]	Year Recorded	Site Type	Temporal Affiliation	Eligibility Statement When Recorded	Distance from Project Easement
41HR47	1987	Shell Midden	Prehistoric, Ceramic	Has Potential	Within
41HR48	1950s	Not Provided	Not Provided	Not Provided	0.36 miles
41HR49	1950s	Not Provided	Not Provided	Not Provided	0.43 miles
41HR687	1990	Shell Midden	Prehistoric, Ceramic	Not Eligible	100 meters
41CH368	2001	Surface Scatter	Historic Post 1900	Not Provided	0.4 miles
41CH369	2001	Structure	Historic 1900-1950s	Not Provided	0.4 miles
41CH377	2008	Farmstead	Historic: mid-twentieth century	Not Provided	0.15 miles

Table 4. Known shipwrecks within 0.8 kilometers (0.5 miles) of the Project area.

THC Number	Name	Date	Vessel Type
1190	Unknown	1970	Unknown
1189	Unknown	1969	Unknown
1332	Unknown	1977	Unknown
1333	Unknown	1977	Unknown
1331	Unknown	1977	Unknown
1329	Unknown	1977	Unknown
1322	Unknown	1976	Unknown
1328	Unknown	1976	Unknown
1179	Unknown	1976	Unknown
1177	Unknown	1976	Unknown
2147	Unknown	Pre-1876	Unknown
1330	Unknown	1977	Unknown
1324	Unknown	Pre-1976	Unknown
1178	Unknown	1976	Unknown
1139	Unknown	1976	Unknown
No Data	No Data	No Data	No Data
1137	Unknown	1976	Unknown
1140	Unknown	1976	Unknown
116	A.B.L. 92	1943	Unknown

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In addition to the 34 previously recorded sites, 2 historic markers (Kemah and Paul's Union Church) and 3 cemeteries (Twilight, Busch-Morgan, and Paul's Union Church) are also recorded within 0.8 kilometers (0.5 miles) from the APE.

Historical Marker #7504 commemorates the townsite of Kemah and was erected in 1993 (Appendix A: Figure A17). The property on which the current town is located has its origins in Stephen F. Austin's Old Three hundred colony. In the 1890s, a townsite was established at the location after the Texas & New Orleans Railroad line was routed through the area. The original town, called Evergreen, did not survive the hurricane of 1900 but a new town was established in 1901 and named Kemah in 1907. The town's growth has been bolstered by gulf-related business and tourism ever since (THC 2012a).

Historical Marker #7542 commemorates Paul's Union Church. It and its associated cemetery (GV-C016) (also known as La Marque Cemetery) is located east of Highway 3 and west of 5th Avenue in La Marque and is approximately 0.8 kilometers (0.5 miles) from the Project APE (Appendix A: Figure A12). The cemetery dates to 1900. At that time the La Marque Union Protestant Church was destroyed by hurricane and many of the victims were interred in the cemetery. The church was later named Paul's Union Church in 1933 (THC 2012b). The cemetery contains approximately 706 interments dating to between 1900 to the present (THC 2013c; Find A Grave Online Database 2012a).

Twilight Cemetery (HR-C376) is located south of West Adams Street near the city of La Porte and is 680 meters (2,231 feet) east of the Project APE (Appendix A: Figure A21). The cemetery consists of approximately 126 interments with the majority dating between the 1970s to the present (THC 2012b; Find A Grave Online Database 2012b)

Busch Cemetery (CH-C016) is located off of Willow Oak Drive in a subdivision west of Highway 146 (Appendix A: Figure A26). The cemetery contains 4 marked and an unknown number of unmarked graves. The earliest marked grave dates to the 1890s (THC 2013e).

5.2 Results of Cultural Resources Survey

Field survey efforts were conducted between April 2012 and October 2013. Survey conducted with the 60-meter (200-foot) wide survey corridor resulted in the identification of 3 newly recorded archaeological sites, 2 isolated finds, and 2 newly identified historic-age structures. In addition, 1 historic-age trash scatter dating from the 1950s to present was identified. A total of 623 shovel tests were excavated across the Project length and within former Project alignments that are no longer in consideration for the Project. Total area visually inspected subsumed approximately 742 hectares (1,833.7 acres) of survey corridor, of which 47.5 hectares (117.4 acres) of property are no longer in consideration for the Project. Approximately 66.4 hectares (164 acres) of property were not pedestrian surveyed because the locations consisted of water bodies, man-made drainage canals, levees, road crossings, dredge spoil placement areas, heavily industrialized facilities, and a public golf course. This includes Spillman Island which is an active dredge spoil deposit location. Cultural resource review of those properties suggests a low probability for containing intact buried archaeological resources, an assessment supported by pedestrian survey efforts performed on adjacent

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properties. No field survey is recommended for these areas. Surveys were completed to either side of these properties and resulted in negative findings. Furthermore, available Project plans are for these locations to be drilled under.

5.2.1 General Descriptions of Surveyed Areas

Pedestrian survey confirmed a low and wet landscape devoid of natural landforms for much of the surveyed alignment. Some portions of Segment 1 of the Project retained pimple mounds that likely once covered the majority of the area but have since been leveled or silted over. Although shovel tests were often conducted in or near standing water, a presence of dense, massive, clayey deposits was identifiable in the majority of tests. Research and survey of locations adjacent to waterways have shown evidence of a high degree of disturbance. Many waterways have been channelized and widened and bulkheads are present along some shorelines, specifically in Segment 2 of the Project near Clear Lake (Plate 2). Areas adjacent to waterways have also been affected by subsidence and erosion; affects likely increased by impacts by previous pipeline installations.

Tests often included spoil overburden from adjacent previous pipeline installation. Shovel tests were excavated to a maximum depth of 100 centimeters (40 inches) below the ground surface where possible although restrictions in place due to the proximity of the Project to adjacent existing pipelines limited testing to no more than 40.6 centimeters (16 inches) within and immediately adjacent to the existing pipeline corridor. Shovel tests were terminated upon reaching the upper limits of the water table or at 100 centimeters (40 inches) due to the maximum reach of a shovel.

Shovel test profiles near waterways, drainages, and adjacent wetlands typically consisted of saturated to moist very dark gray (10YR 3/1) to dark gray (10YR 4/1) loam to clay loam. This was typically followed by dark gray (10YR 4/1) to gray (10YR 5/1) clay that continued to the final extent of the test (Munsell 2005). As expected, shovel tests conducted on pimple mounds were drier and contained more sand in the soil matrix. Those tests typically consisted of a profile that contained grayish brown (10YR 5/1) sandy loam followed by light brownish gray (10YR 6/2) sandy loam with strong brown (7.5YR 5/6 to 5/8) iron accumulations becoming more prevalent with depth (Munsell 2005).

5.2.2 Newly Identified Resources

A total of 3 new archaeological sites, 1 historic-age trash dump, 2 isolated finds, and 2 standing historic-age structures were identified during survey. These are discussed below in greater detail.

Isolate 739-045-ISO-01

Isolate 739-045-ISO-01, identified as a prehistoric isolate, was initially identified through a single positive shovel test containing a tan chert flake measuring roughly 1 centimeter (0.4 inch) in diameter. The isolate is located in Brazoria County and was discovered between the surface and approximately 10-centimeter (4-inch) depth within a grassy upland area approximately 73 meters (240 feet) northeast of the north bank of New Bayou and on the north

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edge of an existing pipeline corridor (Appendix A: Figure A8). The positive shovel test displayed a soil profile consisting of grayish brown (10YR 5/2) sandy loam to a depth of 30 centimeters (12 inches) followed by yellowish brown (10YR 5/4) clay. This site was delineated by the placement of shovel tests spaced at 10-meter (33-foot) intervals radiating in cardinal directions from the positive shovel test. A total of 7 additional shovel tests were dug during the delineation of this site. Delineation tests were not pursued into the existing pipeline corridor or outside of the Project's survey corridor. Tests extended to a maximum depth of 1 meter (3.3 feet), none of which were positive for cultural material. A state designated trinomial is not sought for this isolate.

Isolate 739-019-ISO-01

Isolate 739-019-ISO-01 was identified by a positive shovel test containing a single valve of the Tampico Pearly mussel (*Cyrtonaias tampicoensis*) or similar freshwater bivalve. The isolate is located in Brazoria County and is situated approximately 5 meters (17 feet) south of the south bank of Bastrop Bayou and immediately adjacent to the north bank of a small drainage that enters the bayou at the spot (Appendix A: Figures A3; Appendix B: Figure B1). The isolate was discovered approximately 50 centimeters (20 inches) below the surface. The shovel test profile consisted of highly mottled dark yellowish brown (10YR 3/4), yellowish brown (10YR 5/6), and yellowish red (5YR 4/6) clay from the surface to approximately 45 centimeters (18 inches) depth. This was followed by black (10YR 2/1) clay. The depth of the find and its proximity to nearby Prehistoric *Rangia* deposits suggest it could be associated with prehistoric use of the location; however this has not been verified. The location of the find places it outside of the Project APE in an area that will be avoided by directional drilling, thus no further testing was performed. A state designated trinomial is not sought for this isolate.

Site 41BO239

Site 41BO239 consists of a surface scatter of the eroded remnant of what was likely a Late Prehistoric occupation site or *Rangia* midden. The site is located in Brazoria County and lies on the south bank of Bastrop Bayou within an existing pipeline corridor (Appendix A: Figure A3; Appendix B: Figure B1). The site covers an area measuring approximately 30 meters (100 feet) along the bank and approximately 7 to 15 meters (50 feet) back from the water's edge. Based on pipeline markers visible in the field and GIS mapping by the Texas GLO, the site is underlain and bounded by existing pipelines to the south and west and by Bastrop Bayou to the north and east. The northwestern edge of the site is bounded by an inlet to a small drainage that extends inland from Bastrop Bayou and separates the site from Isolate 739-019-ISO-01. The surface scatter consists primarily of shell with small amounts of lithic cobbles, debitage, and faunal bone fragments. No diagnostic lithics and only 1 small ceramic fragment of an unclassified sandy paste temper were identified within the scatter. The overall extent of the scatter is likely the result of multiple erosion/redeposition events. DOW and Mustang personnel indicated the location had been dredged during installation of pipelines. Disturbance to the location is clearly visible on aerial imagery dating to 1944, 1977, 1987, 1995, and 2010. The surface scatter is likely the result of dredging activities associated with those pipelines. Those impacts left the area susceptible to erosional processes which have further scoured the area, resulting in a concave beach that extends from the water's edge inland approximately 40

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meters (130 feet). A shovel test placed just outside of the northwest boundary of the scatter produced no additional materials.

Site 41BO240

Site 41BO240 consists of what is likely a Late Prehistoric short-term occupation evidenced by a *Rangia* shell lens and eroded shell scatter. The site is located in Brazoria County and occupies approximately 10 meters (32 feet) of the south bank of Bastrop Bayou located approximately 40 meters (131 feet) northwest from Site 41BO239 (Appendix A: Figure A3; Appendix B: Figure B1). A portion of the site consists of a lens of *Rangia* shell deposited approximately 50 centimeters (20 inches) below the surface and is visible along approximately 5 meters (16 feet) of cutbank along the south bank of Bastrop Bayou. This deposit measures approximately 5 to 10 centimeters (2 to 4 inches) thick. Another portion of the site consists of shell that has eroded out of the cutbank and is visible along the bank in the shoreline extending north for another 5 meters (16 feet) past the buried shell lens. Examination of the buried shell lens produced a single Prehistoric pottery fragment of an unclassified sandy paste temper mingled with the shell in the wall of the cut bank. No other diagnostic materials were identified. The site is located well outside of the Project corridor and no subsurface testing was undertaken. The site may continue south and west from the bank and it is unknown how much of the site remains, but it appears that at least a portion of it has eroded into the bayou with no discernible continuation of the material located in the cutbank behind it.

Field Site 739-387-01

Field Site 739-387-01 measures approximately 0.1 hectares (0.3 acres) and consists of a buried historic to modern scatter (Appendix A: Figure A26; Appendix B: Figure B2). The site occupies a level terrace above a ravine sloping down into Cedar Bayou. A structure is visible in the location on the 1948 *Cedar Bayou, Texas* topographic quadrangle. Materials identified date to the 1950s or 1960s and consist of an exposed well pipe encased in cement and clay, 10+ brick and brick fragments, 2 round nails, 1 gate hinge, and 1 drill bit. Materials were identified to depths of 0 to 20 centimeters (0 to 8 inches) below surface. A total of 13 additional shovel tests were dug during the delineation of this site. The site is bounded to the east by a gravel road and an existing pipeline and transmission line corridor, to the north and west by slope to Cedar Bayou. Delineation tests pursued to the south were negative for additional materials. Because of the relatively recent date of the site and the materials identified within it, the site does not contain the potential to add to our understanding of the history of the area. A state-issued trinomial is currently in the process of being sought for this site.

Field Site 739-387-02

Field Site 739-387-02 consists of a surface scatter associated with a historic to modern trash dump and occupies a ravine leading west into Cedar Bayou (Appendix A: Figure A26). The site occupies an area of approximately 0.06 hectares (0.15 acres). The majority of materials within the dump consist of refrigerators, automotive and farm machinery parts, tires, and washers and dryers, a trampoline, and a chicken coop. Although some items appear to be older (potentially 1950s) it is clearly still in use as evidenced by the trampoline and other items. A

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state-issued trinomial is not being sought for this trash dump and no further work is recommended for it regarding the Project.

Resource 739-080-HSS-01

Resource 739-080-HSS-01 consists of a former cattle shelter. This structure is located approximately 428 meters (1,537 feet) south of Basford Bayou and 40 meters (131 feet) outside of the survey corridor in the Green Lakes Oil Field just south of Hitchcock, Galveston County, Texas (Appendix A: Figure A11). The oil field is a vast, treeless plain punctuated by the occasional cattle tank. Built ca.1960, the cattle shelter measures approximately 11 meters by 27 meters (35 feet by 90 feet) long. Built like a pole barn, the shelter consists of little more than a low, gable roof anchored to a series of heavy timber posts. There are 3 rows of posts, with 1 row for each side of the shelter and 1 to support the ridge of the roof. The posts are spaced at 3-meter (10-foot) intervals throughout the length of the building. The roof framing consists of long, 2.5-by-25-centimeter (1-by-10-inch) rafters, which extend from the ridge board to the pole plate along the sides of the shelter. The roofing material consisted of galvanized sheet metal. A few twisted fragments of this material are all that remain. The shelter has neither walls nor a foundation as it was designed simply to provide a low roof for the protection of livestock. Severely damaged by storms, much of the roof now lies on the ground. Resource 739-080-HSS-01 is located outside of the Project APE and is not in danger of direct impact by the Project. Research in local libraries and other repositories did not reveal the building to be associated with any significant events or persons. The building therefore is recommended not eligible for inclusion in the NRHP under Criterion A or B. Nor is the shelter representative of a distinctive type, period, or method of construction. As an undistinguished, vernacular structure, the cattle shelter is recommended not eligible under NRHP Criterion C. Consequently, this cattle shelter is recommended as not eligible for the NRHP.

Resource 739-189-HSS-01

Resource 739-189-HSS-01 is located on the north side of Dickinson Bayou (at the intersection of Avenue U and Hillman Drive within the survey corridor but outside of the existing pipeline ROW) (Appendix A: Figures A15). Structures are visible on topographic maps in this location as far back as 1929. The structure is an altered, cross-gabled roof, wood frame residential building. A western, rear addition has been attached to the original eastern building. The east building is on a concrete slab, while the west building is situated on concrete block. The entire house is covered in vertical wood siding. The placement of the windows and doors on the east building appear to be original as evidence of the simple, milled wood plank framing is still on the building. The windows and doors are all modern replacements. The east building has a stoop on the front façade with an overhang supported by simple-milled posts. The western addition of the house appears to have been constructed at a later date due to the concrete block foundation and doors and windows of modern design. Due to the extensive alterations of the original structure, and non-association with federal or local events, the building is not determined eligible for the NRHP.

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5.2.3 Revisit Efforts for Previously Identified Resources

Two and possibly 3 previously recorded resources were located within or adjacent to the Project APE based on the locations provided by the Texas Online Archaeological Sites Atlas. Efforts were made to confirm the locations of Sites 41HR47, 41BO161, and 41GV67. In addition, Sites 41BO162, 41HR682, 41HR683, 41HR687, 41HR827, and 41HR1036 were mapped within the survey corridor for Project alignments which are no longer in consideration. Attempts to revisit all 9 sites were made during the course of field efforts. Results for the revisits are discussed below.

Previously Recorded Site 41BO162

Site 41BO162 was recorded in 1986 and described as a thin deposit of shell adjacent to an exposed midden (Castille and Whelan 1986a). The datum point provided by the Texas Online Archaeological Sites Atlas shows it located approximately 36 meters (118 feet) north of Bastrop Bayou and within an additional temporary workspace for the current Project (Appendix A: Figure A3). Based on pipeline markers visible in the field and GIS mapping by the Texas GLO, the datum is underlain and bordered by existing pipelines. A medium-sized pond lies to the east and Bastrop Bayou lies to the south. The recorded site location was first walked over in an attempt to locate any exposed shell. None was observed. Next shovel tests were placed across the Project area in the site's reported vicinity, including 1 test placed as near to the datum location as possible. Three shovel tests spaced 30 meters (100 feet) apart were excavated across the Project corridor. Tests were excavated to maximum depth of 60 centimeters (23.6 inches) before encountering the water table. No shell or other evidence of a cultural site was observed.

A multitude of pipelines have altered the landscape significantly since that observed on the earliest aerial imagery for the area (ca.1944). Although the site was recommended for further testing at the time of its recordation, disturbance is visible in the mapped site location on aerials dating to 1987; roughly 1 year after the site was recorded. It is likely that those disturbances caused portions of the site to be destroyed or to be eroded away. It is equally plausible that the site was mis-plotted on topographic maps. Examination of the site's sketch map dating to 1986 and comparison to the surrounding topographic landmarks suggests the site is located further to the east, an area that visually appears undisturbed by pipelines. As this area was outside of the Project survey corridor this was not verified by current survey efforts.

Previously Recorded Site 41BO161

Site 41BO161 was recorded in 1986 and described as a thin deposit of shell (Castille and Whelan 1986b). The datum point mapped by the Texas Online Archaeological Sites Atlas is located approximately 24 meters (80 feet) northeast of Austin Bayou within existing pipeline corridor and within the survey corridor of the current Project (Appendix A: Figure A4). Based on pipeline markers visible in the field and GIS mapping by the Texas GLO the datum is underlain and bounded by existing pipelines. A small pond lies to the south and west and Austin Bayou lies to the south. The recorded site location was first walked over in an attempt to locate any exposed shell. None was observed. Next shovel tests were placed across the Project area in the site's reported vicinity, including one test placed as near to the datum

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location as possible. Three shovel tests spaced 30 meters (100 feet) apart were excavated over the Project corridor. Tests were excavated to maximum depth of 60 centimeters (23.6 inches) before encountering the water table. No shell or other evidence of a cultural site was observed. This site was not recommended for further work at the time it was identified. As with Site 41BO162, aerial imagery dating to 1987 shows a great deal of disturbance at the site's mapped location. This along with the negative survey results suggests the portion of it located within the current survey corridor has been destroyed or eroded away as a result of existing pipelines.

Previously Recorded Site 41GV67

Site 41GV67 was recorded in 1976 and described as low shell midden (Baxter 1976). The datum point provided by the Texas Online Archaeological Sites Atlas is located approximately 27 meters (90 feet) east of the north bank of Highland Bayou on the south edge of the Project survey corridor (Appendix A: Figure A12). The location is currently an artificial water channel which appears on aerial images between 1990 and 1995. The recorded site location was first walked over in an attempt to locate any exposed shell or presence of a landform. None was observed. Next shovel tests were placed across the Project area in the site's reported vicinity, including as close to the recorded datum point as possible. Two shovel tests spaced 30 meters (100 feet) apart were excavated in the site's reported location. Tests were excavated to maximum depth of 60 centimeters (23.6 inches) before encountering the water table. No shell or other evidence of a cultural site was observed. Although this site was recommended for further work at the time it was identified, it was also reported to have been impacted by cattle. It's location within an existing water channel suggests the site has been destroyed.

Previously Recorded Site 41HR827

Site 41HR827 was previously recorded in 1998 as a buried shell deposit composed of *Rangia* clam and oyster mapped within the north/central portion of Hog Island (Mahoney and Moore 1998) (Appendix A: Figure A22; Appendix B: Figure B4). The site was recorded within and adjacent to an existing pipeline corridor occupied by at least 4 and possibly as many as 8 existing pipelines based on data provided by Mustang and researching maps maintained by the Texas GLO (2013). This site was revisited during survey of a previous Project alignment that is no longer in consideration for the Project. A total of 20 shovel tests were positive for buried shell extending from within the existing pipeline corridor and into the tree line south of the corridor. Shovel test profiles generally contained a shallow surface layer of very dark grayish brown (10YR 3/2) clay to sandy clay between 5 to 10 centimeters (2 to 4 inches) depth. This was followed by gray to light brownish gray clay (10YR 6/1 to 6/2) sandy clay and clay nodules mottled with small amounts of yellowish brown (10YR 5/6) clay. The amount of shell consisted of 30 to 50% with the thickest concentrations between 10 and 40 centimeters (4 and 16 inches) depth below the surface. Previous pipeline installations have left some amount of shell visible on the surface. Surface survey and shovel testing within and around the site did not result in the discovery of cultural artifacts or features.

Site 41HR827 lacks the mottled soils indicative of redeposited material that were recorded elsewhere on the island, reducing the implication of the site having resulted from construction or dredge spoil. However, this area has been impacted by what appears to have been open cut trenching for several pipelines. Historic imagery does not show roads or other construction at

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the location; however an aerial image from 1957 suggests surface modification of some kind was taking place in the vicinity of the site on the north central portion of the island (Appendix B: Figure B4). Although buried shell extends into the existing pipeline corridor previous pipeline installations have resulted in scatters of shell on the surface and the subsequent subsidence has left the corridor generally lower and more prone to flooding and standing water. Of the 20 shovel tests that were positive for shell within Site 41HR827, none contained cultural artifacts. With the current level of investigation it is difficult to determine the site's provenance. Based on the lack of diagnostic artifacts, previous impacts, and the preponderance of redeposited sediments on the island, the portion of the site within the existing pipeline corridor is not recommended as eligible for listing on NRHP.

Previously Recorded Site 41HR1036

Site 41HR1036 was previously recorded in 2008 as a historic road which crossed the west side of Hog Island and continued along a timber causeway across Tabbs Bay (Maas 2008). This site was revisited during survey of a previous Project alignment that is no longer in consideration for the Project. Survey confirmed the site's location (Appendix A: Figure A22; Appendix B: Figure B4). The site consists of a concrete road bed visible at the north edge of an existing pipeline corridor and extends to the north. The road is still easily visible but appears to be sinking as a result of subsidence. The site is no longer within the proposed alignment of the Project.

Previously Recorded Site 41HR682

Site 41HR682 was previously recorded in 1990 as a shell midden composed of *Rangia* clam and oyster mapped along the north/east shoreline of the southern half of Hog Island (Ebersole 1990a) (Appendix A: Figure A22; Appendix B: Figure B4). This site location was revisited during survey of a previous Project alignment that is no longer in consideration for the Project. Field observation of the recorded site boundary showed a sand and clay beach that is very nearly submerged at low tide and impossible to explore on foot. A series of topographic maps dating to 1916, 1948, and 2011 shows a great deal of modification and erosion at the site's mapped location (Appendix B: Figure B5). It is possible that the site has eroded away or is buried under a sand and clay beach that extends from the current shoreline into Tabbs Bay.

Previously Recorded Site 41HR683

Site 41HR683 was previously recorded in 1990 as a shell midden composed of *Rangia* clam and oyster mapped along the north/east shoreline of the northern half of Hog Island (Ebersole 1990b) (Appendix A: Figure A22; Appendix B: Figure B4). This site was revisited during survey of a previous Project alignment that is no longer in consideration for the Project. Field observation of the recorded site boundary showed a sand and clay beach that is very nearly submerged at low tide and impossible to explore on foot. A series of topographic maps dating to 1916, 1948, and 2011 shows a great deal of modification and erosion at the site's mapped location (Appendix B: Figure B5). It is possible that the site has eroded away or is buried under a sand and clay beach that extends from the current shoreline into Tabbs Bay.

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Previously Recorded Site 41HR687

Site 41HR687 was previously recorded as buried shell midden located on the west bank of Cedar Bayou (Ebersole 1990c) (Appendix A: Figure A23). The site was originally recorded in 1990. At the time the site was recorded it was noted that possible future impacts could occur as a result from dredging and widening of the bayou as well as subsidence and erosion. This site location was revisited during survey of a previous Project alignment that is no longer in consideration for the Project. Survey efforts at the location failed to confirm the location. The location is composed of marsh with the water table at or near the surface. The existing pipeline corridor in this location is extremely eroded as a result of previous open cut dredging for pipeline installation. A total of 8 shovel tests were placed in the vicinity of the site's mapped location. Shovel tests recorded saturated mucky clay soils. It is possible that the site has completely eroded away or is now underwater within the bayou.

Previously Recorded Site 41HR47

Site 41HR47 was previously recorded as a *Rangia* shell midden along the north bank of the San Jacinto River (Tabbs Bay) (USACE 1987; Smith 2013). Current investigations at the site confirmed its location along the eroded north bank of the San Jacinto River at Tabbs Bay (Appendix A: Figure A23; Appendix B: Figure B3). The site measures approximately 1,571 square meters (16,911 square feet) and is bordered to the south by Tabbs Bay, to the west by 2 eroded ditches that appear to be remnants from previous land altering activities or transmission tower installations, and to the north by an animal pen. The site was identified by inspection of the cutbank and a shovel test (C1) placed above it approximately 2 meters (6.5 feet) north of the bank. The shell concentration consists of only *Rangia* species which were clearly visible in the cutbank extending from the surface to approximately 40 centimeters (16 inches) deep at its thickest and only a single layer of shell thick at its thinnest. Inspection of the cutbank produced 1 prehistoric pottery sherd that had eroded from the bank. The sherd is of a grog-tempered type consistent with the Baytown Plain style.

Seven shovel tests were performed in cardinal directions from test C1. Of those, six were positive for shell. Subsurface tests show that the amount of shell decreases moving away from the cutbank. Shell identified within the delineation tests was encountered within approximately 5 to 10 centimeters (2 to 4 inches) from the surface and ranged in depth from 5 to 20 centimeters (2 to 8 inches) in thickness. Shell within the delineation tests was found to be in a loose arrangement and typically consisted of approximately 20% or less of the matrix in each test. Besides shell these tests also produced a single prehistoric pottery sherd and a total of 13 glass fragments (1 brown, 2 aqua, and 10 clear), 3 round nails, 1 rifle cartridge, 3 small brick fragments, and 5 to 10 unidentifiable metals fragments. The pottery sherd is of a sandy paste temper consistent with the Goose Creek Plain style. All artifacts, historic/modern and prehistoric, were found within shell bearing layers and in all levels without any discernible stratigraphic context. The pottery sherd, the only prehistoric artifact identified through subsurface testing, was likewise found comingled with modern clear glass fragments.

A typical soil profile consisted of a surface layer of 7.5YR 3/1 loamy clay to a depth of 5 to 10 centimeters (2 to 4 inches) followed by a layer of 10YR 4/2 loamy clay and loose shell (10 to 20%) to a depth of 30 centimeters (12 inches). This was followed by a layer of 10YR 5/1 clay

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with 7.5YR 4/6 mottling to a depth of 50 centimeters (20 inches). Delineation tests showed a lack of a discernible shell lens away from the cutbank (Appendix B: Figure B3) for a representative photo of a typical soil profile. Shell and artifacts were typically not found below 30 centimeters (12 inches) in any of the delineation tests.

Cursory investigation at the edge of the survey corridor identified what appeared to be a former road continuing into the wooded area to the east. Because it is outside of the survey corridor for the current Project it was not pursued. But it lead to question regarding the formation of the site. A review of historic maps and aerial imagery show an unimproved road and several structures located along the shoreline in the site location beginning on the 1943 *Morgans Point* topographic map. The earliest aerial imagery (circa 1953) also clearly shows a road. By 1957, several of the structures have disappeared from the topographic map but the unimproved road remains until the 1982 topographic map. The road can be seen in aerial photos dating from 1953 to 1981 (see the 1962 aerial on Appendix B: Figure B6), but by 1989 the road appears to have fallen into disuse. By 2002, the shoreline can be seen to have eroded inland and reaches the former location of the road. This appears to be what is seen eroding out of the cutbank.

The result of subsurface testing and review of historic maps and aerials at the site presents a challenge for accurate assessment of the site. While the site contains prehistoric artifacts, these were found in questionable context and comingled with a great deal more modern materials than prehistoric. Further it is evident from topographic maps and aerials that a road was located at the location. Typically, the association of *Rangia* shell with prehistoric artifacts would suggest a prehistoric midden site. However the sparse amount of prehistoric material and this could suggest the shell had been imported to the location from elsewhere, where a prehistoric component had been inadvertently included. Conversely, existing middens at the location could have been used for and incorporated into an access road. Although it is unknown what structures had occupied the location, it is known that the shoreline was once used regularly for access to nearby oil-related industry (Ray Banda Personal Communication 2013). Thus the site could be recorded as a possible shell midden and/or former shell road.

Based on subsurface testing the densest portion of the site is located at and near the cutbank. The remainder of the site is largely composed of dispersed shell and historic/modern materials. Project plans for the location include pipeline installation by HDD under the shoreline to an exit point located at least approximately 90 meters (295 feet) from the shoreline. This places the HDD workspace approximately 74 meters (242 feet) from the delineated site boundary, thus avoiding any direct impacts to the site.

5.2.4 Newly Identified Non-Cultural Resources

Shell Concentration 1

Shell Concentration 1 is located north/east shoreline of the southern half of Hog Island (Appendix B: Figure B4). The site consists of an exposed shell berm that rises up to approximately 1 meter (inches) above the surrounding ground surface and a buried shell berm which was followed for 190 meters (624 feet) along the high tide mark along the shore of the island. The berm consists of several layers of shell aligned parallel to the shoreline. To the

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north and east is sand and clay beach which is likely inundated at times of high tide and to the south/west is marsh. Active colonies of clam and oyster are visible on and in the beach. Five shovel tests were excavated on the perimeter and within the shell berm. Surface survey and shovel tests around the perimeter of the berm and within it produced no cultural artifacts or features.

Shell Concentration 2

Shell Concentration 2 is located approximately 50 meters (164 feet) from the west shoreline in the northern half of Hog Island (Appendix B: Figure B4). The site consists of a buried deposit of *Rangia* clam and oyster. Shovel test profiles consisted of 15 to 20 centimeters (6 to 8 inches) of very dark grayish brown (10YR 3/2) clay underlain by heavily mottled pinkish gray (7.5YR 6/2) and strong brown (7.5YR 4/6) sandy clay. The amount of shell consisted of 30 to 50% of the matrix near the site center and approximately 5% near the site perimeter. Shell was generally present throughout the test profiles but in greater concentration near the surface. The site's location corresponds with a part of the island that was historically higher than the surrounding area and may represent a former natural berm or levee of the island's west shore. Historic aerial photographs also show a road in the location which is likely the source of at least some of the material. Surface inspection and shovel testing of the site produced no cultural artifacts or features.

The identification of shell concentrations on Hog Island is not surprising. Similar sites have been documented on barrier islands along the north Texas coast and the inclusion of mussels in the subsistence of native populations can be found in accounts by early European explorers. However, there are a number of possible explanations for the concentrations identified on Hog Island. Historic topographic maps dating as far back as 1916 (Appendix B: Figure B5) and aerial imagery dating as far back as 1953 display a great deal of changes to the island's shape; changes which likely occurred at least in part to the addition of dredge spoil to the island. Subsurface profiles on the island contained heavily mottled sands and clays indicative of dredge spoil, a finding supported by the identification of what appeared to be a dredge pipe extending from the shoreline on the island's southwest corner. Historic aerial imagery also shows surface modifications resulting from industrial use including pipelines and access roads. What appear to be roads or built-up shell concentrations are visible on a 1962 aerial of Hog Island correspond with the locations of Shell Concentrations 1 and 2 (Appendix B: Figure B6). Many surface modifications would likely have used shell or fill in their construction.

These 2 sites contained heavily mottled soils indicative of disturbance. Survey also recorded active colonies of clam and oyster along the shores of the island. Based on the historic research of the locations and the mottled composition of the soils it is believed that Shell Concentrations 1 and 2 are the result of a combination of natural processes and redeposited materials. A similar finding was documented by Takac et al. (2000).

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6.0 CONCLUSIONS AND RECOMMENDATIONS

This report presents the results of an intensive pedestrian cultural resources survey of 127 kilometers (79 miles) completed for a planned pipeline project in Brazoria, Galveston, Harris, Chambers Counties, Texas. All fieldwork and reporting activities were conducted with reference to state and federal guidelines. The Project is estimated to entail approximately 362.3 hectares (895.4 acres) of permanent and temporary easements. The survey corridor/archaeological APE for the Project entailed an additional 30 meters (100 feet) of corridor width bringing the total APE of the Project to 748 hectares (1,845 acres).

Prior to fieldwork, initial investigation consisted of a background literature and site files search to identify the presence of previously recorded sites in close proximity to the Project area. In addition, predictive modeling and a review of historic aerial imagery and topographic maps was performed along the entire length of the Project alignment in an effort to assess the potential of unrecorded intact buried cultural deposits or historic-age standing structures. As a result of these investigations, the Texas Online Archaeological Sites Atlas indicated that 34 previously recorded sites, 2 historic markers, and 3 cemeteries have been identified within 0.8 kilometers (0.5 miles) of the Project area. Of those resources, 2 archaeological site datums (41BO161 and 41GV67) are mapped within or adjacent to the Project survey corridor.

During this investigation, a total of 742 hectares (1,833.7 acres) were surveyed and 623 shovel tests were excavated. In general, pedestrian survey confirmed a low and wet landscape within which pimple mounds have survived on very few properties. This was particularly the case for the southern half of the Project, which is primarily depicted as marsh on historic topographic maps. Shovel tests confirmed a shallow water table for much of the proposed pipeline route with a presence of dense, massive, poorly drained clayey deposits. Survey resulted in the identification of 2 new prehistoric archaeological sites, 1 new historic archaeological site, 1 new multi-component site, 2 new prehistoric isolate finds, 2 historic-age structures, and 1 historic to modern age trash dump within and adjacent to the survey corridor. HRA Gray & Pape collected only diagnostic artifacts that may be used to help assign temporal affiliations to new sites and all artifacts will be returned to the land owners upon completion of the project.

Isolate 739-045-ISO-01 consists of a single non-diagnostic lithic flake. Further testing produced no additional materials. Newly identified archaeological sites 41BO239 and 41BO240 consist of the remnants of Late Prehistoric short-term occupations located on the south bank of Bastrop Bayou. Of the 2 sites only site 41BO240 retains cultural material in-situ. While isolate 739-019-ISO-01 may be associated with prehistoric use of the location this has not been verified. These sites may have been part of a larger Late Prehistoric site that could have occupied a bend of Bastrop Bayou and may have stretched all the way to site 41BO163. Disturbance and erosion has impacted the location to the extent that only smaller isolated cultural loci remain. Site 41BO240 is located outside of the Project APE and will not be in danger of direct impact as a result of the Project. Planned directional drilling under Bastrop Bayou will avoid additional impacts to the location of Site 41BO239, however due to past disturbances the site location is no longer intact. No further work is recommended for these sites and isolates. A draft report containing these recommendations was submitted to the

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THC for review in September 2012 (Scott 2012) and received concurrence in October 2012 (Appendix C).

Field Site 739-387-01 consists of a buried mid to late twentieth century scatter. The site does not contain materials or features that could add information to the history of the area. No further work is recommended for the site. A state-issued trinomial is currently being sought for this site.

Previously recorded Site 41HR47 is a multi-component site consisting of a possible shell midden and/or former shell road containing both prehistoric and historic to modern materials. Project plans will entail pipeline installation by HDD under the shoreline to an exit point located at least approximately 74 meters (242 feet) from the delineated site boundary thus avoiding direct impact to the site. No further work is recommended for this site in regard to the Project.

No evidence was identified for previously recorded sites 41BO162, 41BO161, 41GV67, 41HR682, 41HR683, and 41HR687. While it is possible that these sites were mis-plotted during their initial recordation, field efforts and a review of historic aerial imagery show their mapped locations to have been previously impacted by past pipeline activities, subsequent erosion, and likely subsidence. Further, Sites 41HR682, 41HR683, and 41HR687 are no longer within the Project alignment. No further work is recommended for these sites in regard to the current Project. The locations of Sites 41HR1036 and 41HR827 were confirmed by survey. These sites are no longer located within the proposed Project alignment and no further work is recommended for them in regard to the current Project.

Two historic-age structures were identified outside of the project corridor. Neither structure was determined to be eligible for listing on the NRHP. Further, neither structure will be directly impacted by the Project. Because the project is below ground, no visual impacts are anticipated. No further work is recommended for these structures and no state-issued trinomial is being sought.

Newly recorded Shell Concentrations 1 and 2 are considered the result of natural processes and redeposition on Hog Island and not recommended for further work. A reassessment by Takac et al. (2000) of several previously recorded archaeological sites consisting of similar deposits resulted in the same findings. State-issued trinomial numbers for these shell concentrations are not requested.

Project plans are for locations of major water crossings to be drilled under. This includes the Houston Ship Channel, Tabs Bay, and Cedar Bayou. This method of pipeline installation will avoid resources such as shipwrecks. Although no eligible resources were identified as a result of survey, installation of the Project by HDD at water crossing will also result in an avoidance of major impacts to shoreline areas, where prehistoric sites are most prevalent. The HDD entry and exit locations will be sited to provide a minimum of a 15.25-meter (50-foot) setback from any identified sensitive areas and a maximum design depth clearance to provide the greatest buffer between the sensitive area and the drilling activity/installed pipe.

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Based on the results of the cultural resources survey, HRA Gray & Pape recommends no further investigation within the Project and that the Project be allowed to proceed.

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APPENDIX A:

Research and Survey Results within the DOW 12-Inch MSR Ethane Pipeline Project

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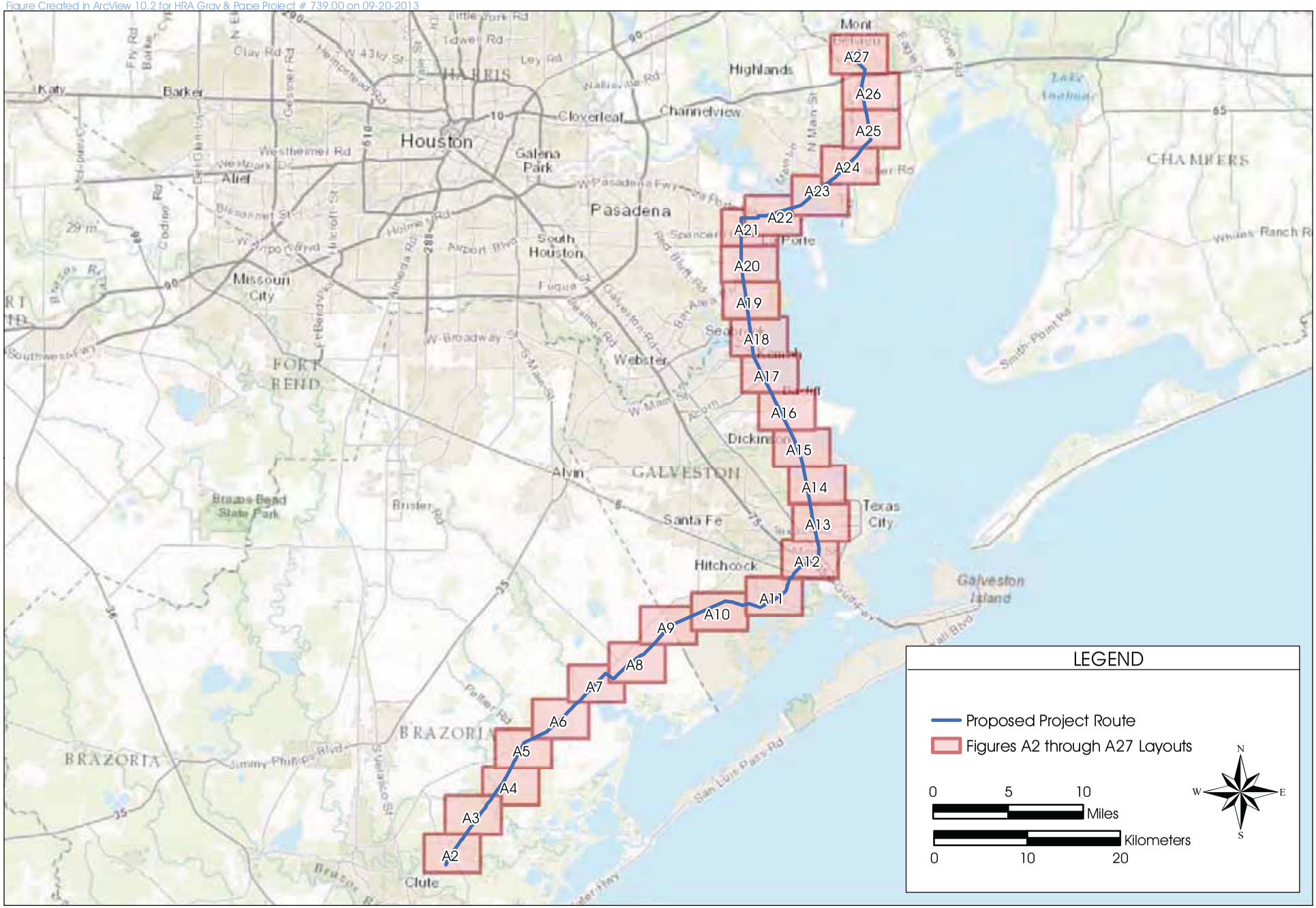
Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-20-2013



Research and Survey Results within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC.

Figure A1

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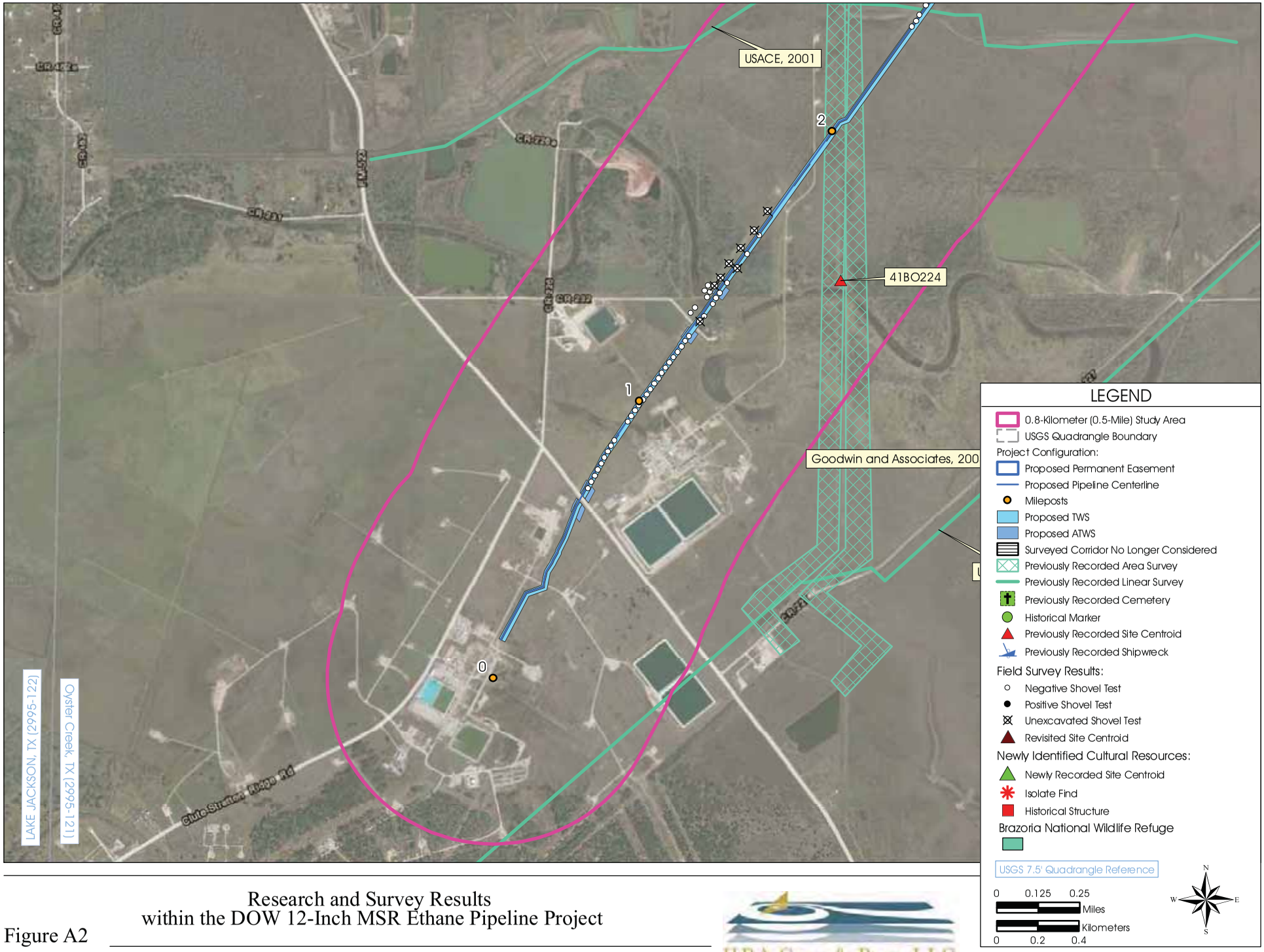

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A2

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

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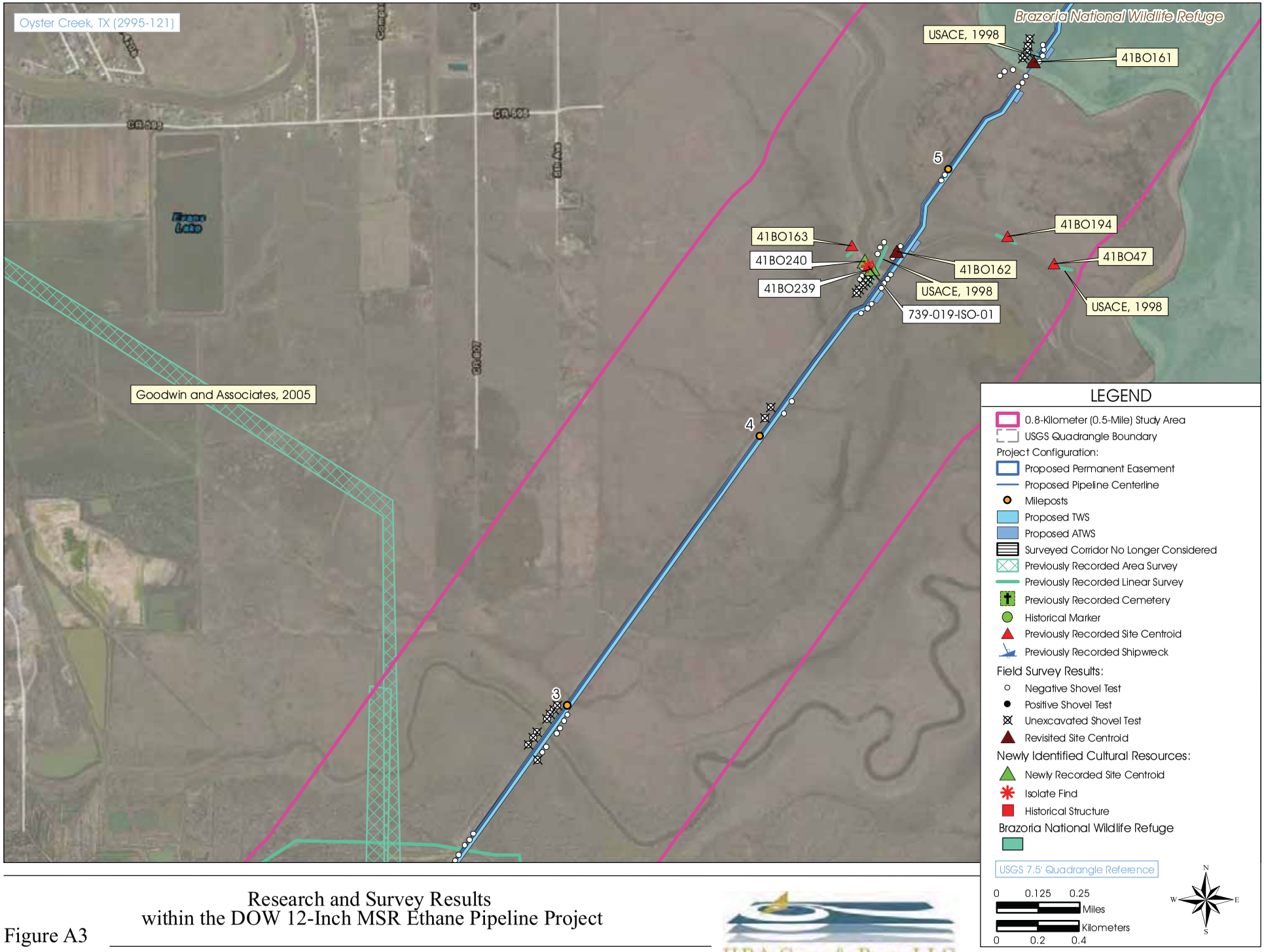

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A3

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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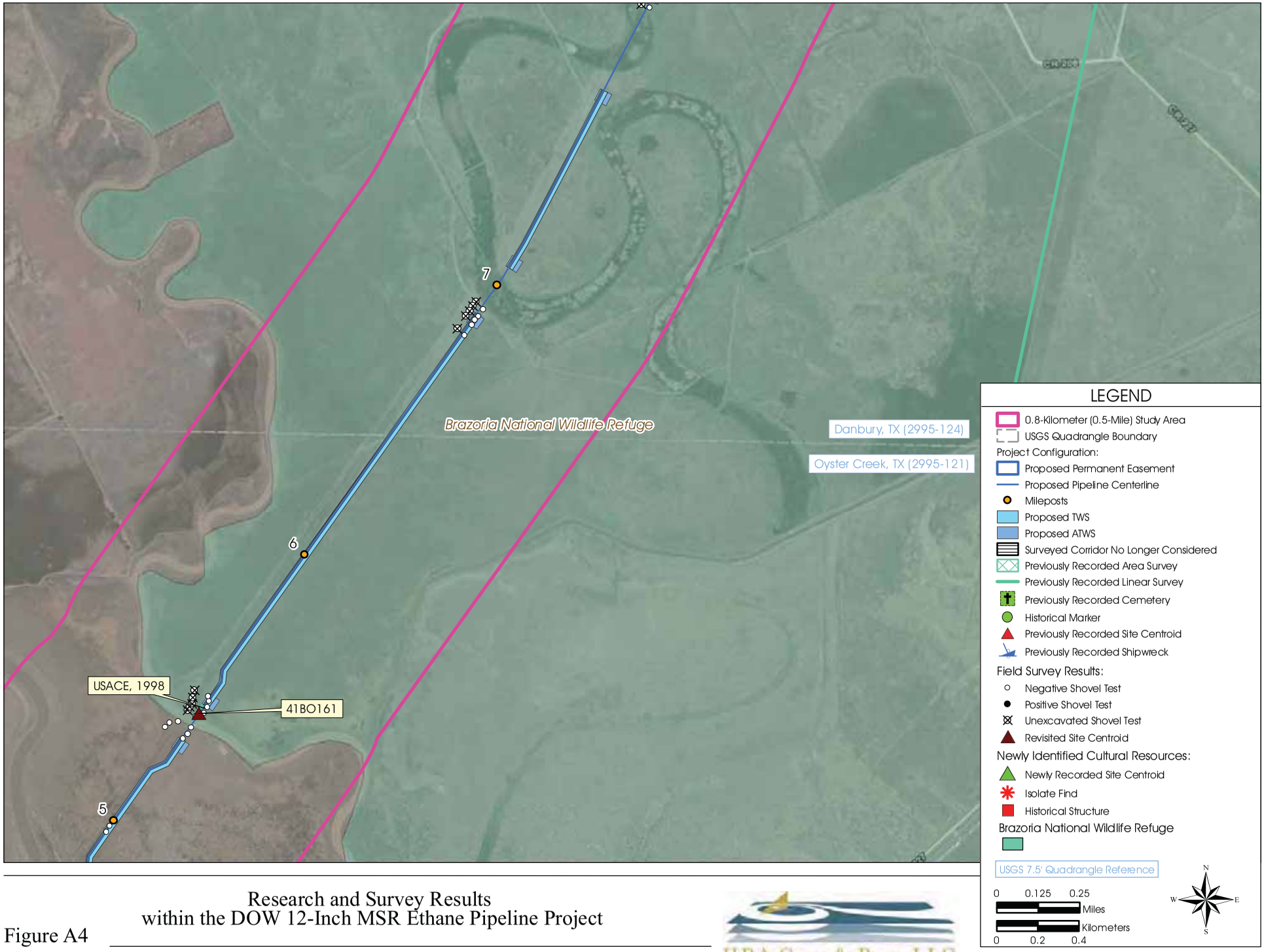

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A4

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

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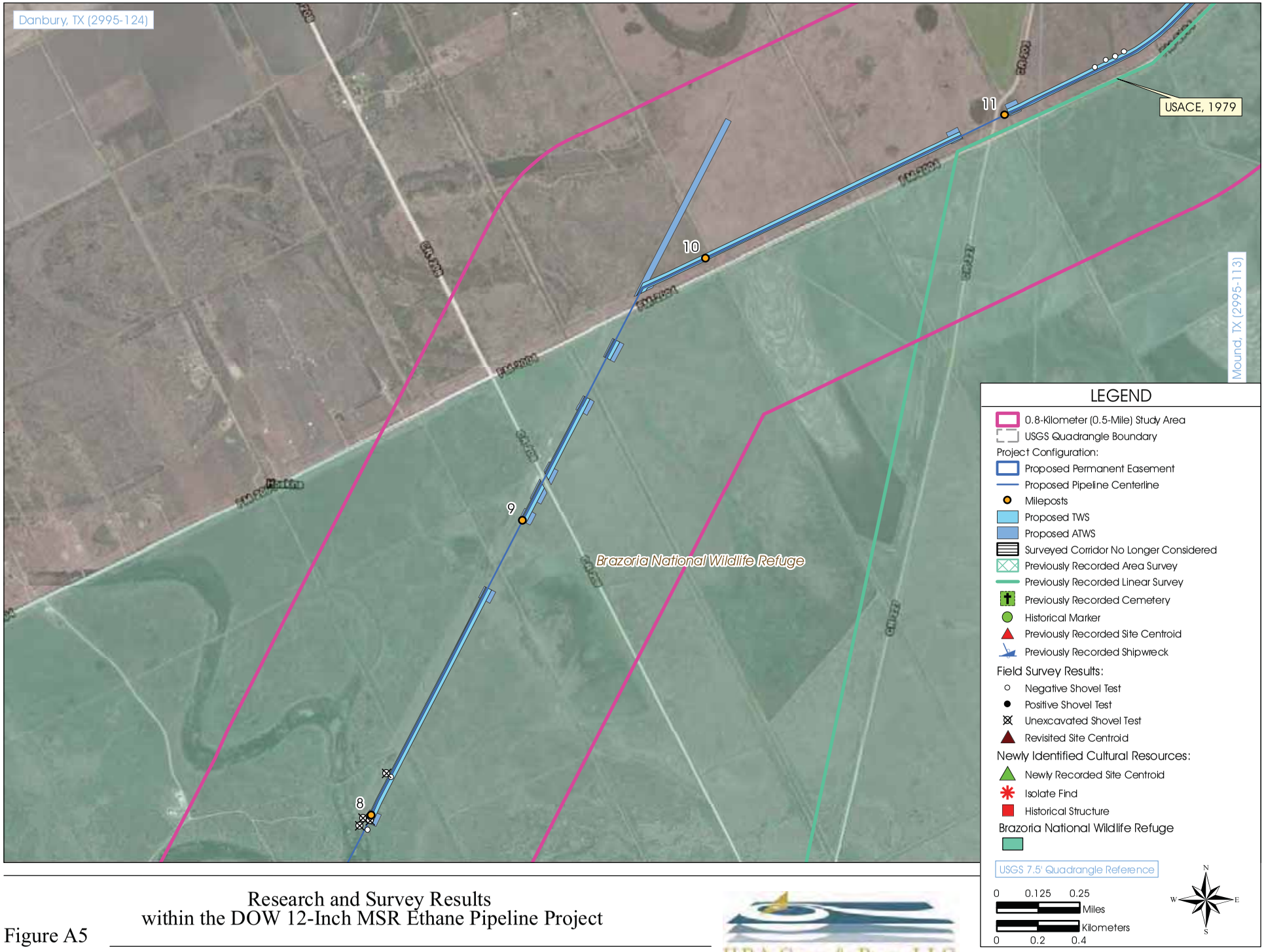

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A5

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

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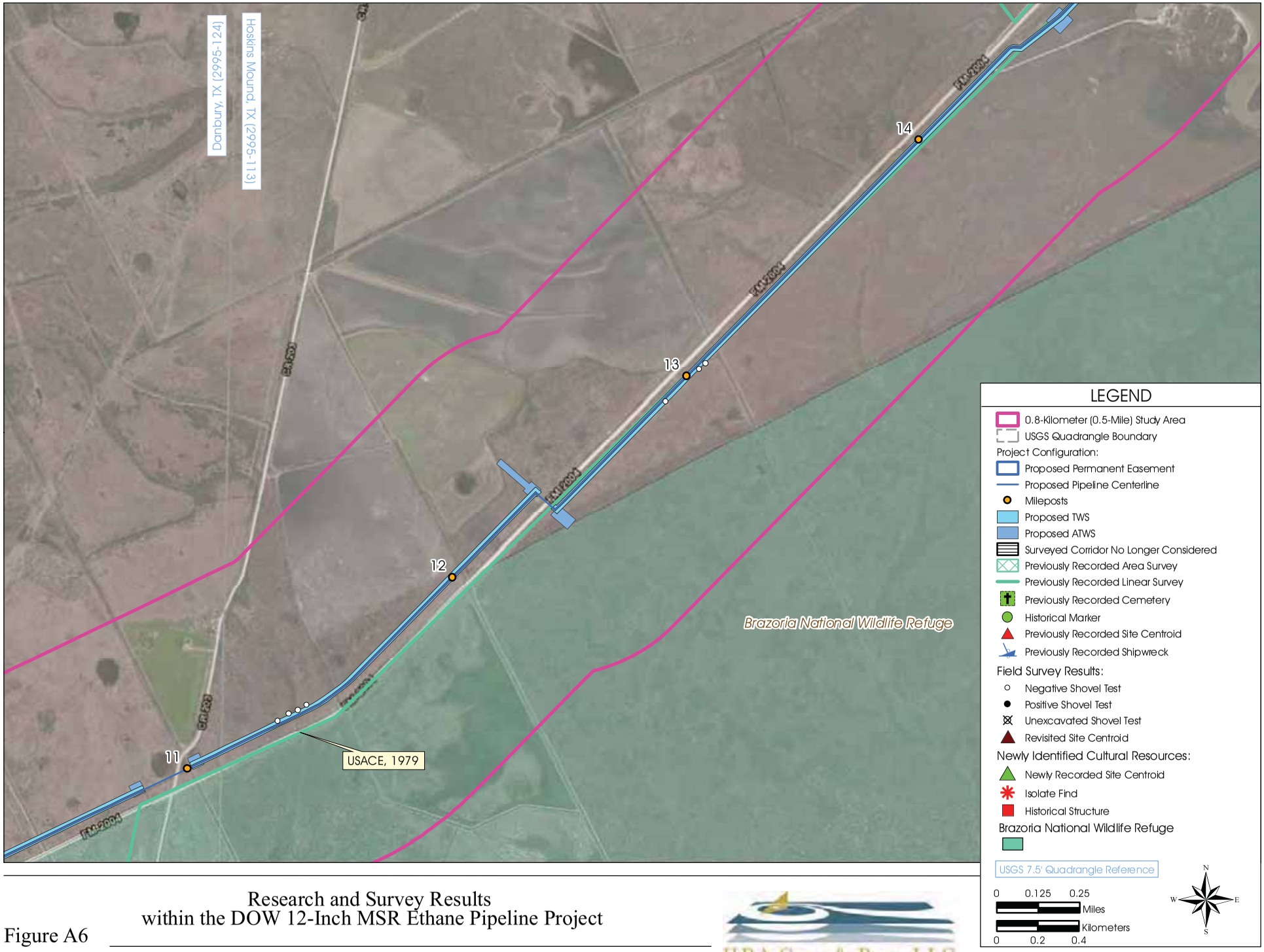

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A6

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

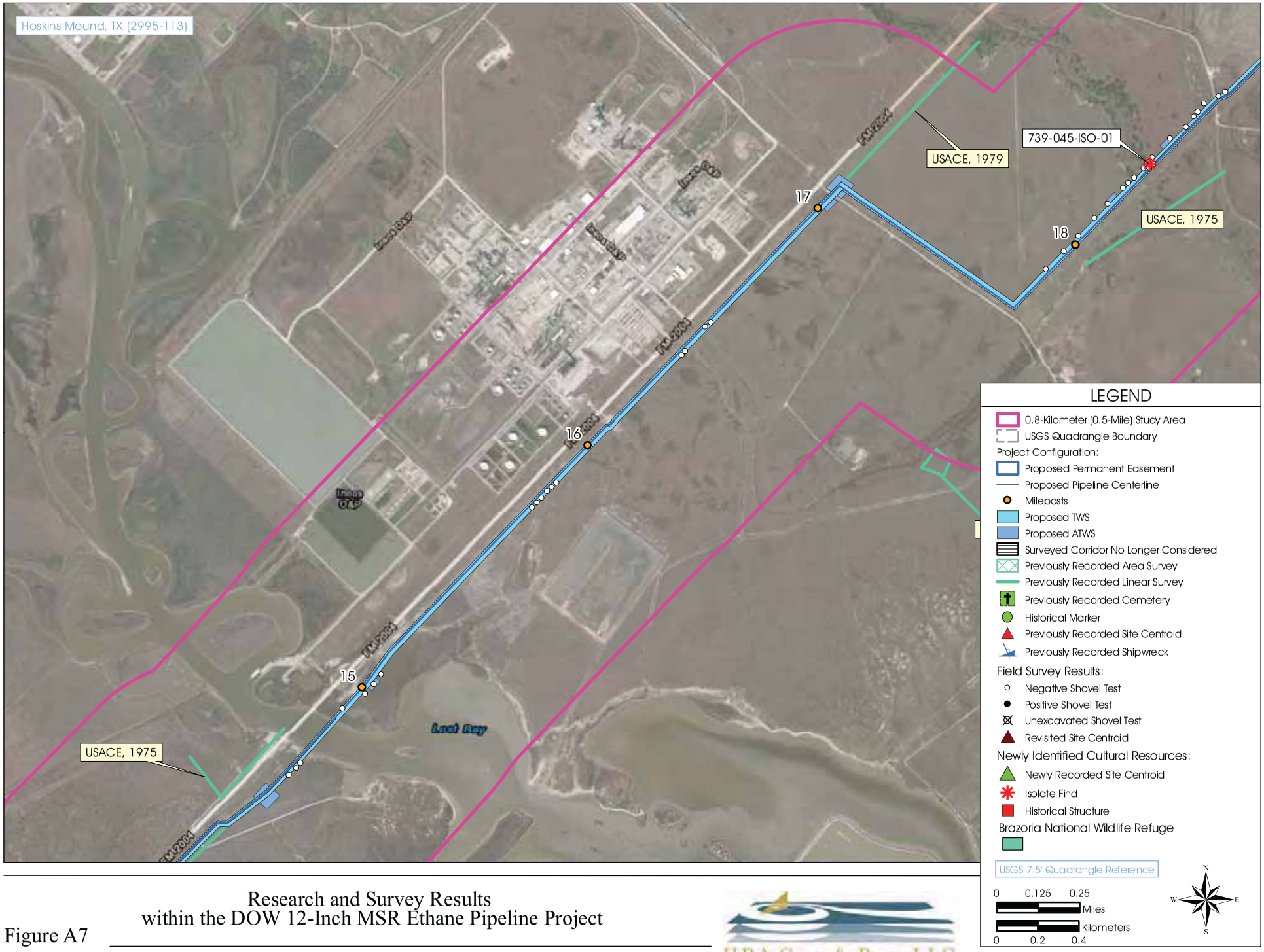

Figure A7

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

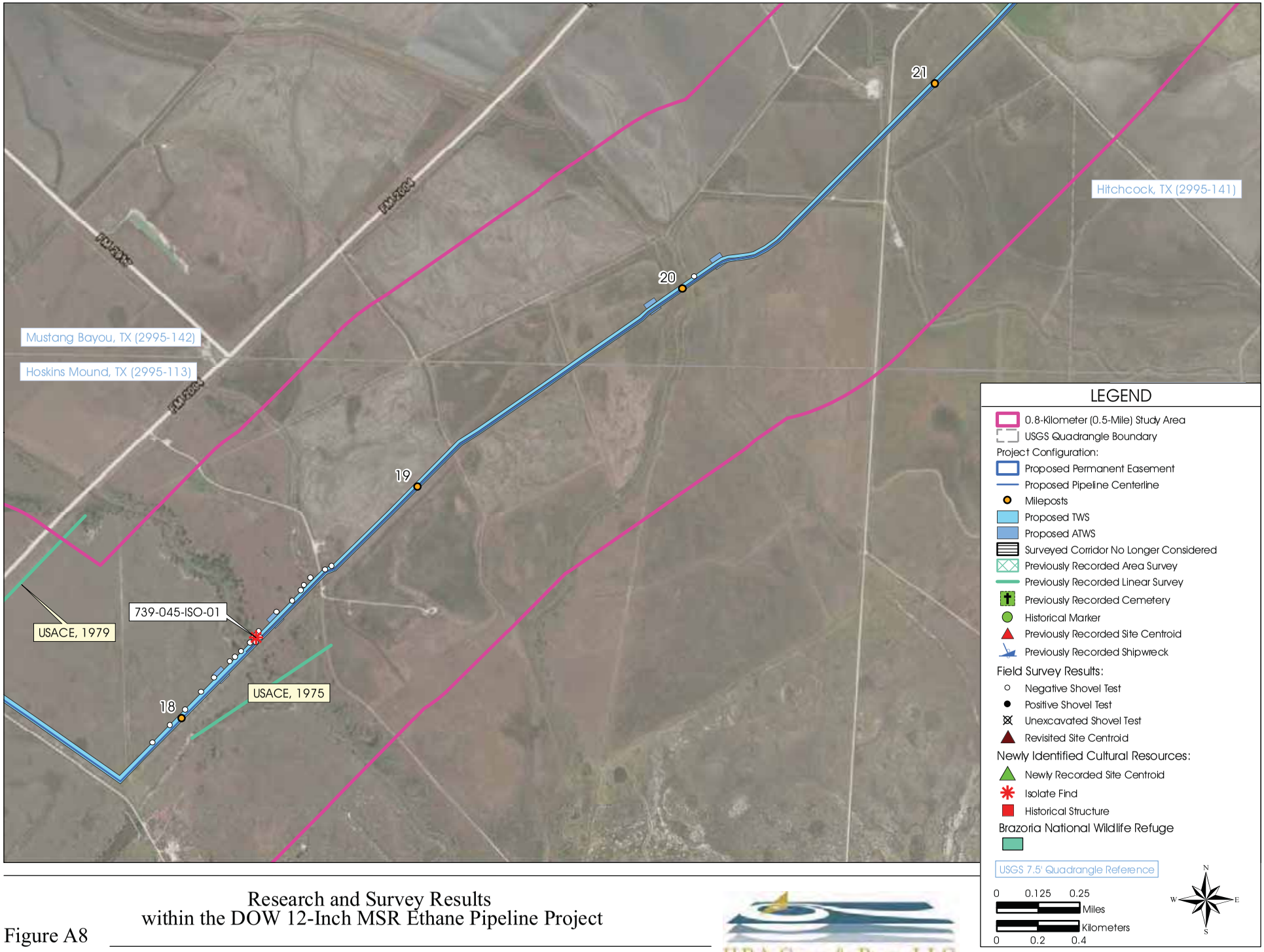

Figure A8

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

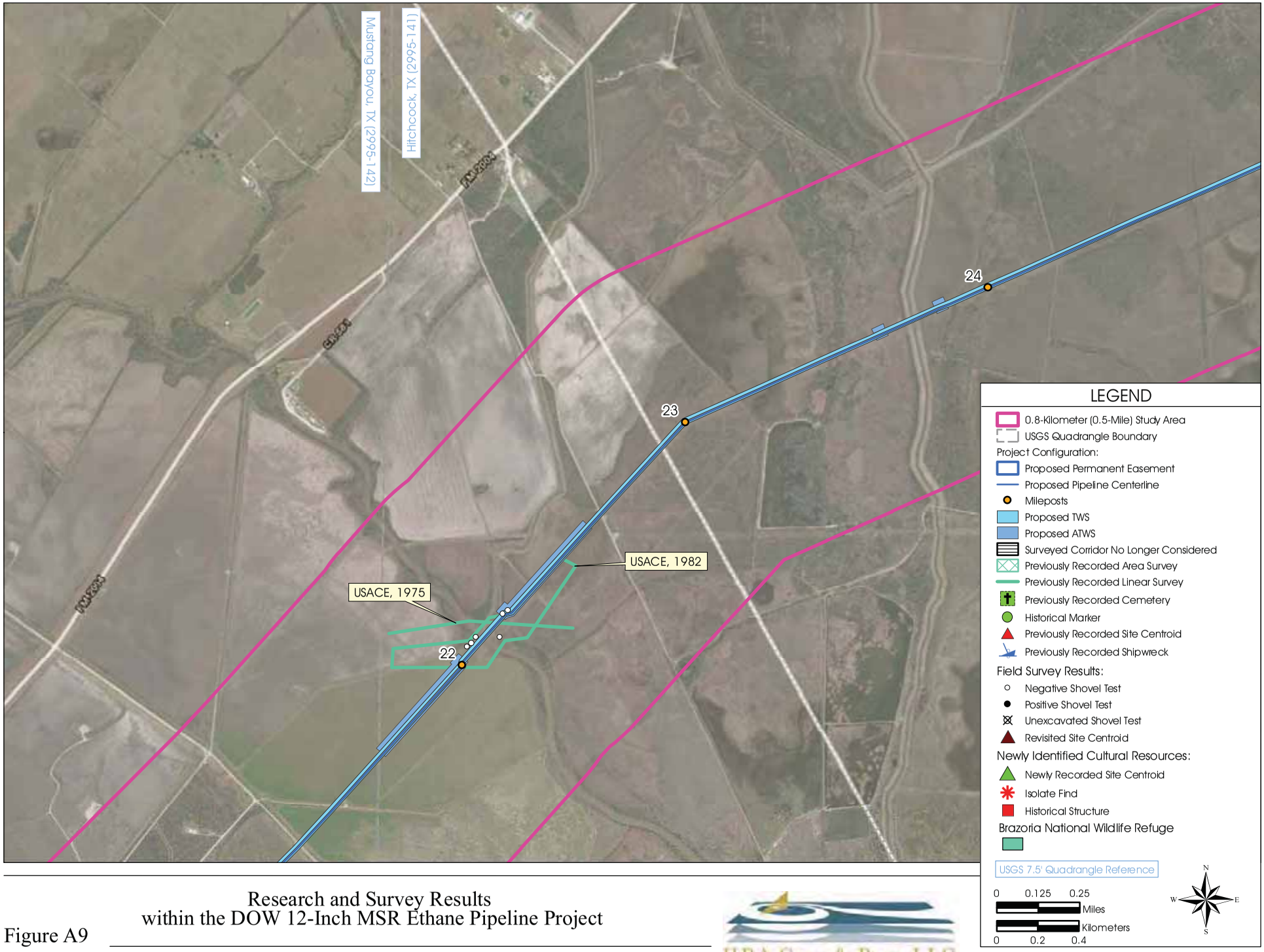

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A9

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

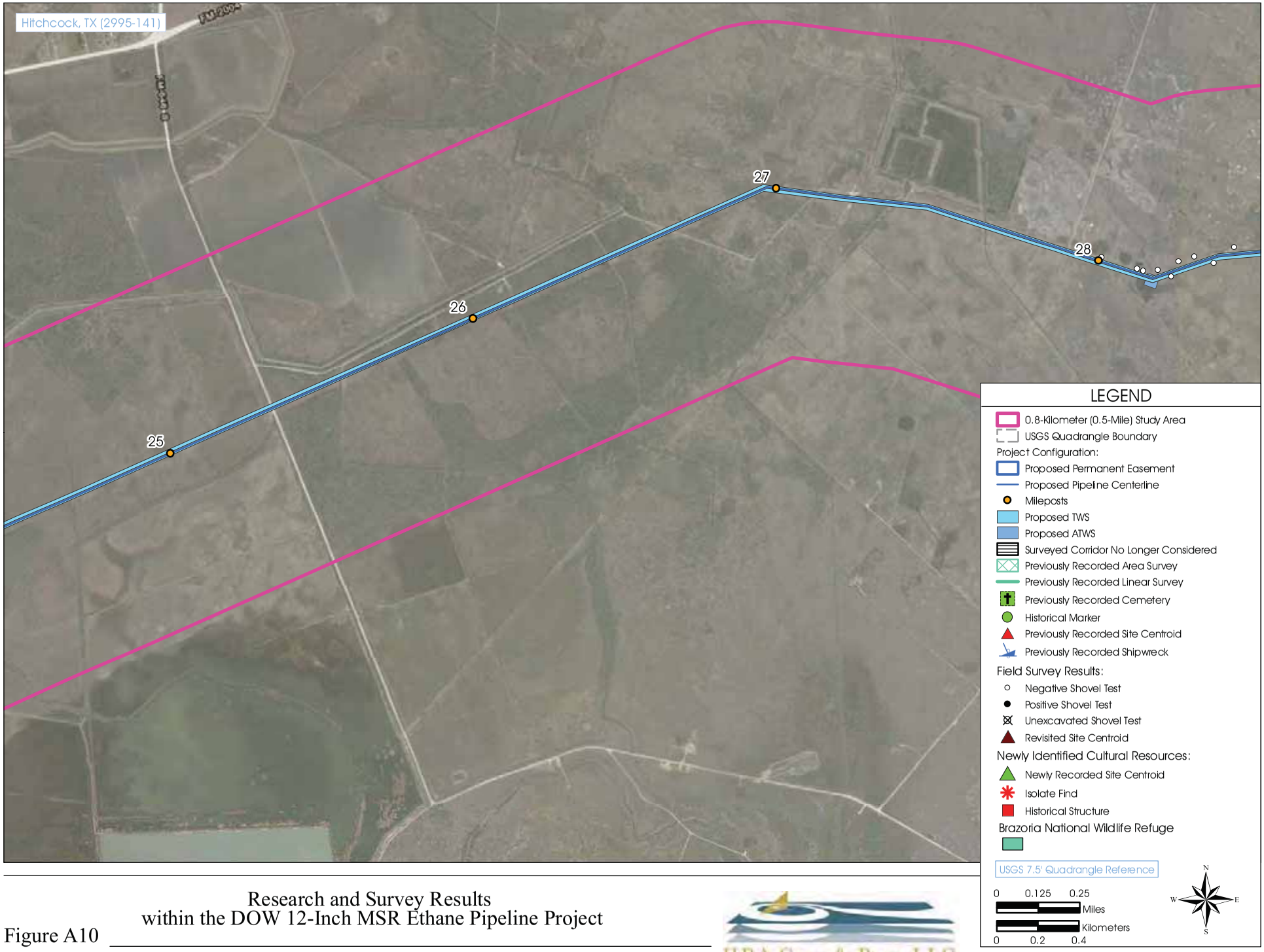

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A10

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

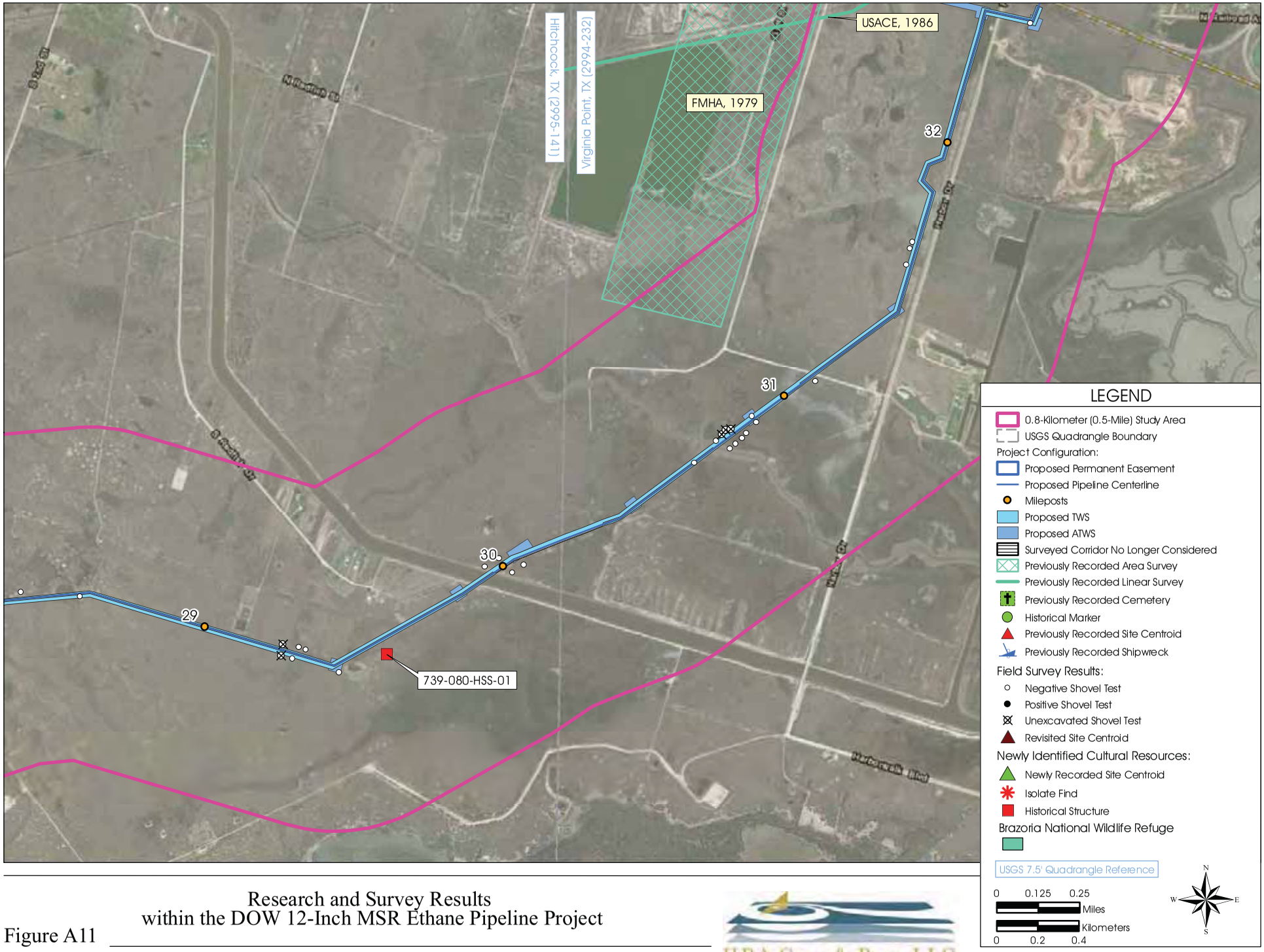

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A11

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

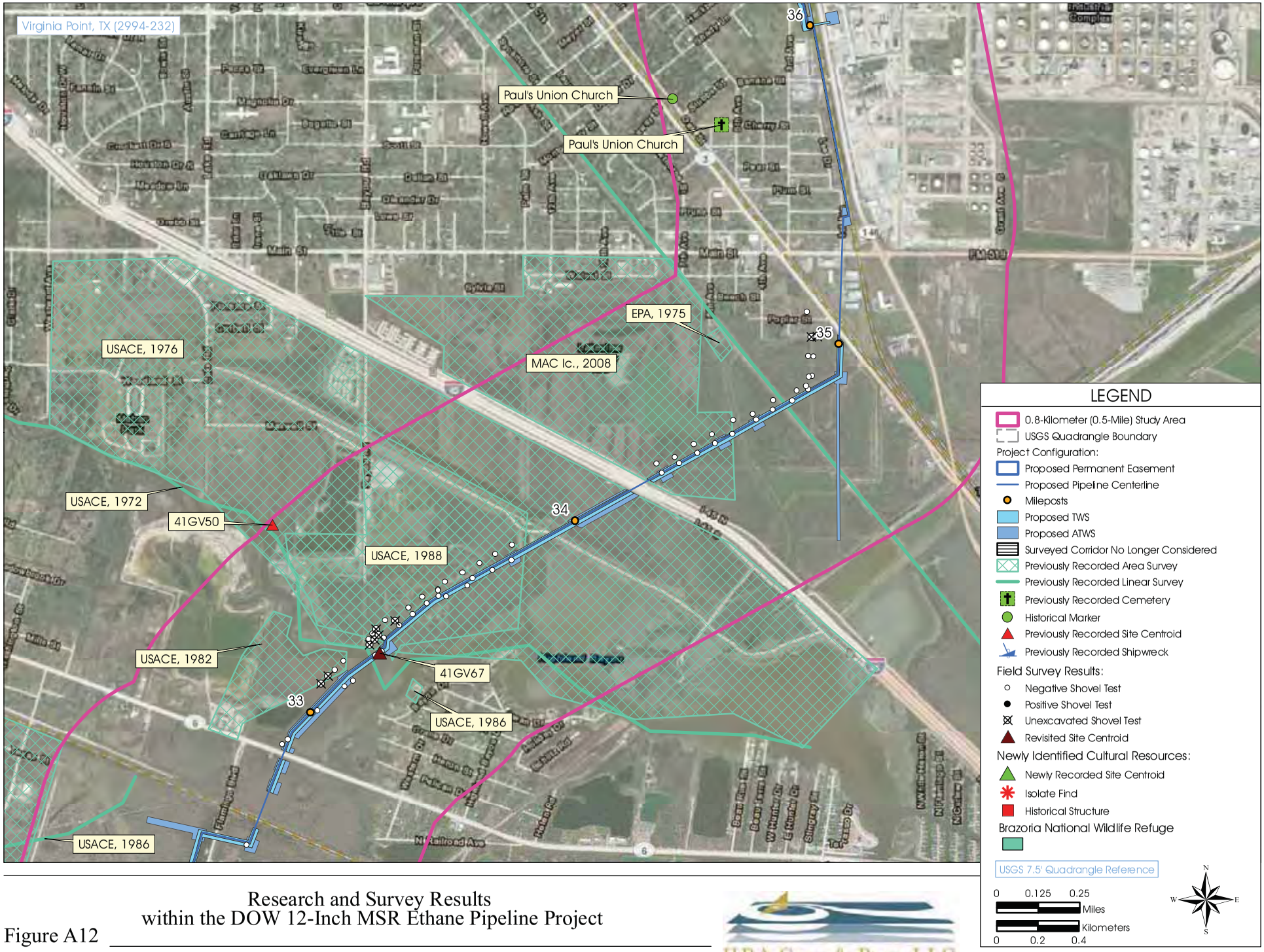

Figure A12

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

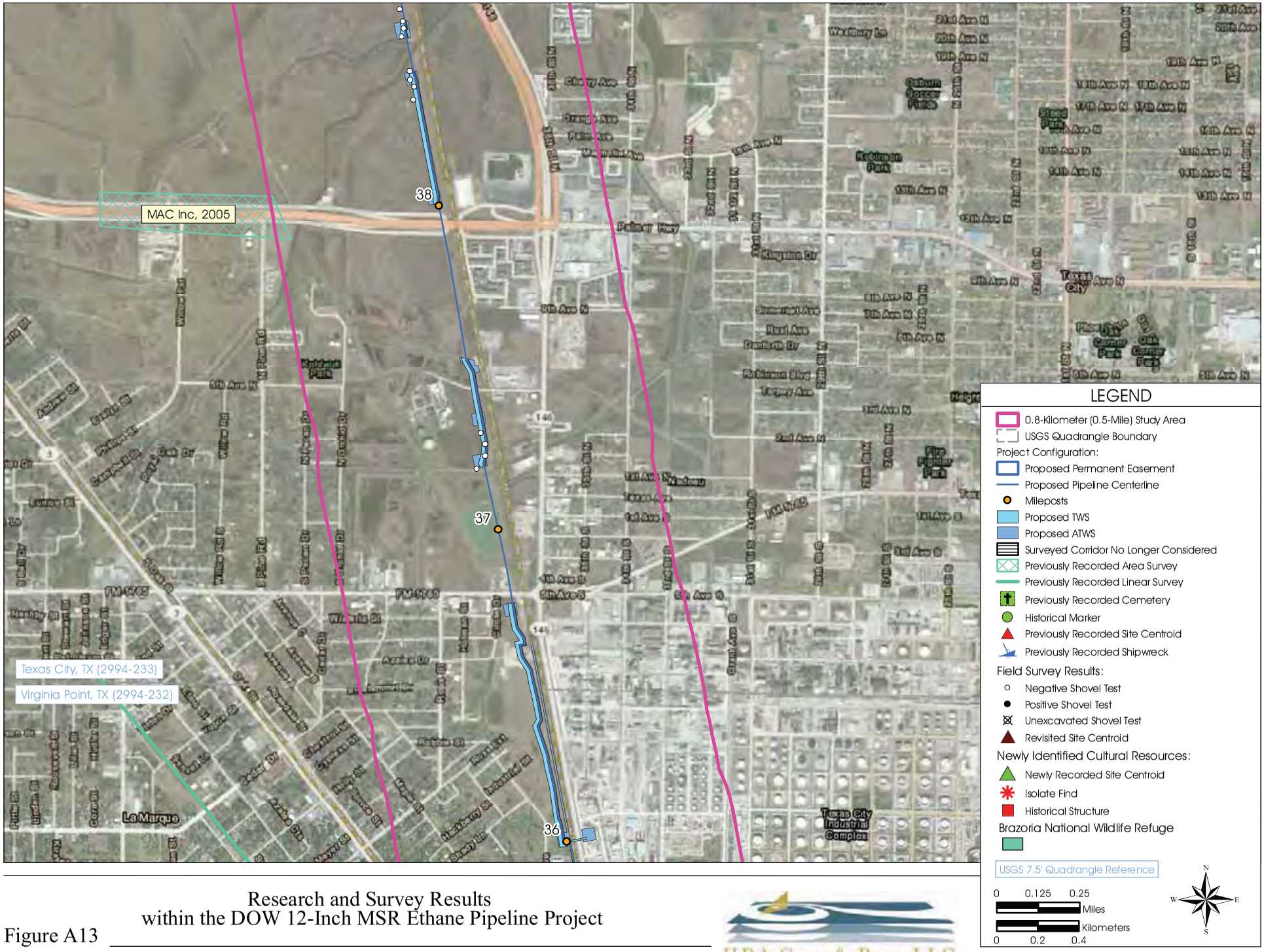

Figure A13

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

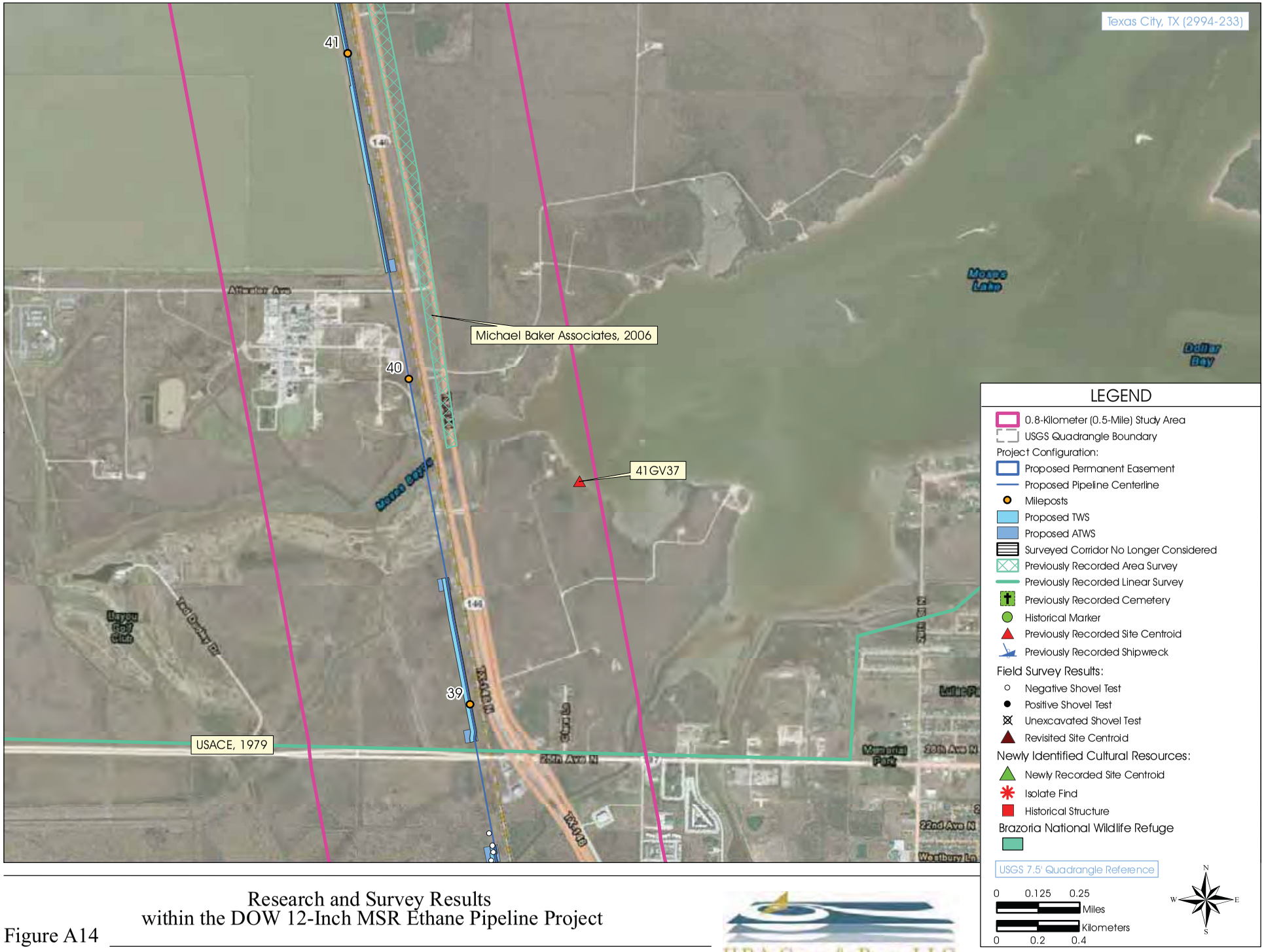

Figure A14

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

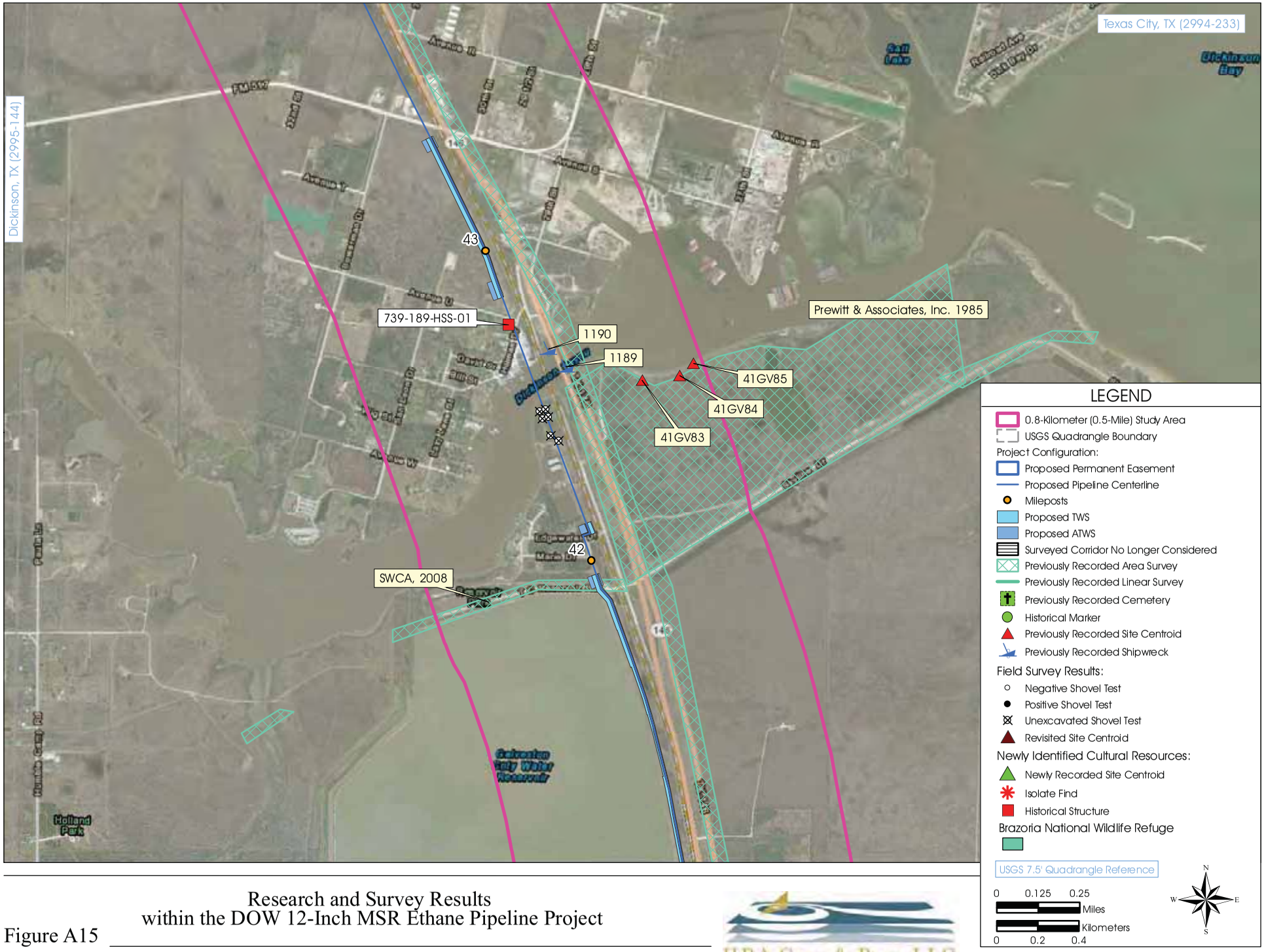

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A15

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A16

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A17

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

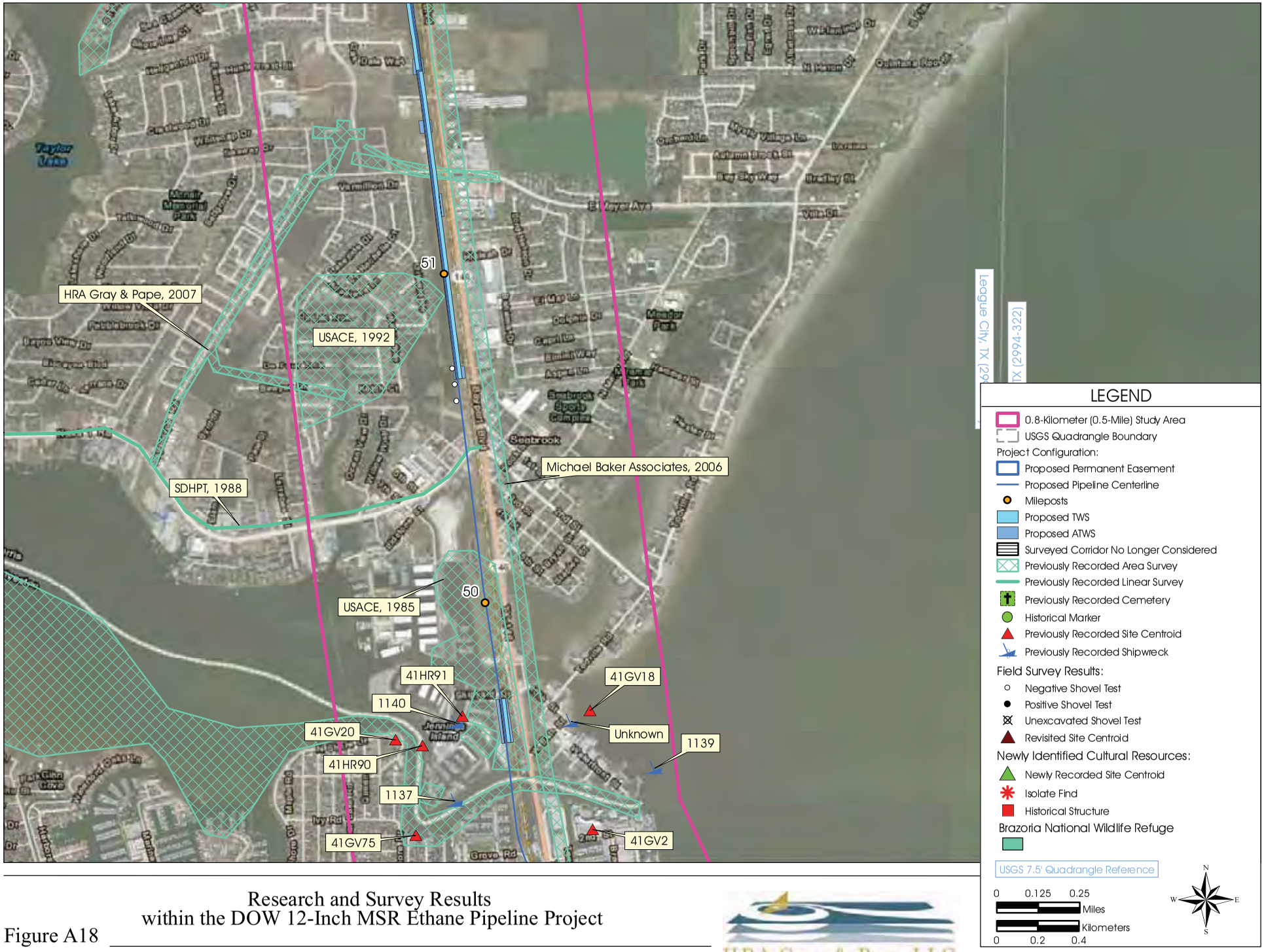

Figure A18

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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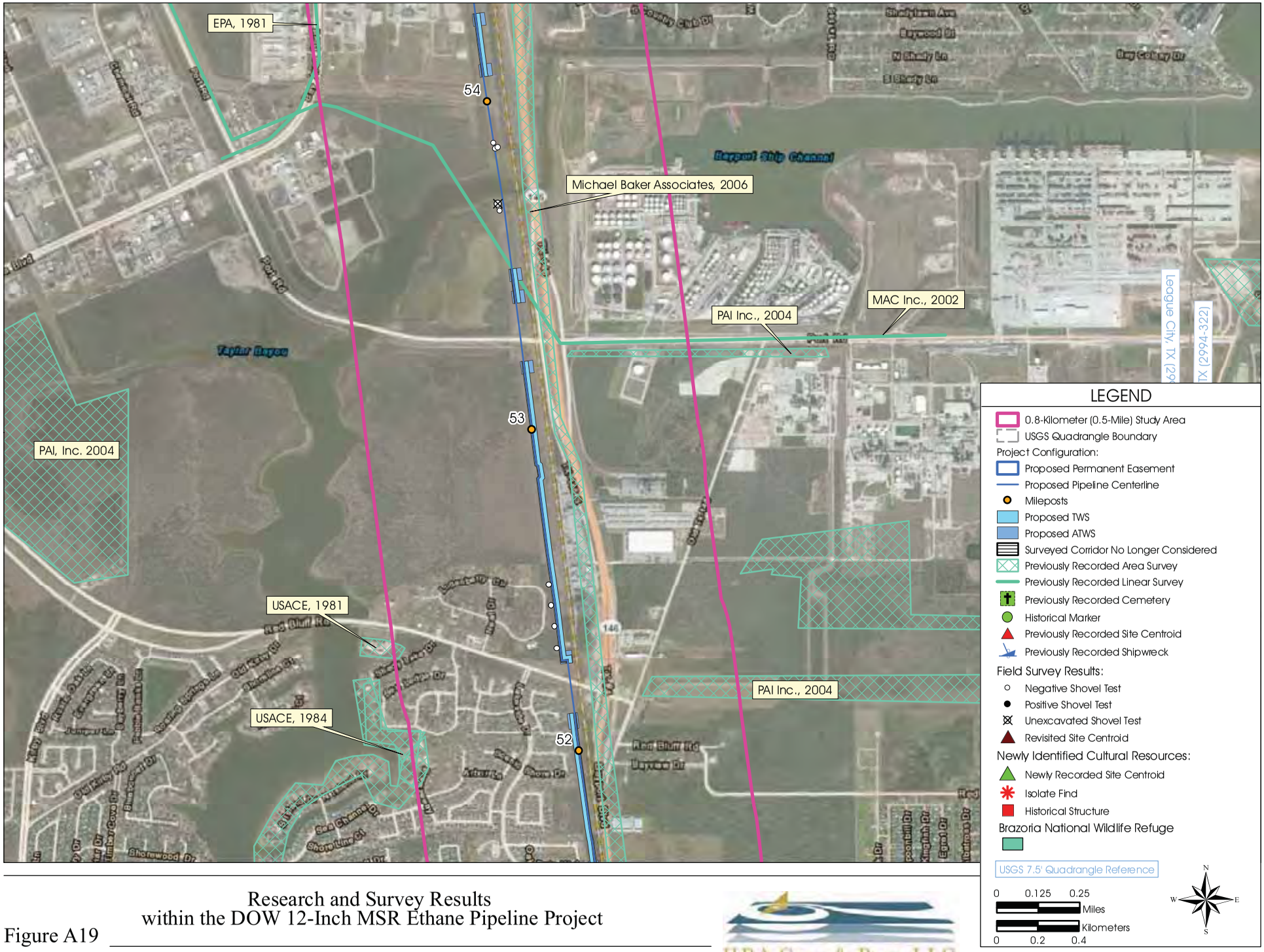
Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013



Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

Figure A19

HRA Gray & Pape LLC

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Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

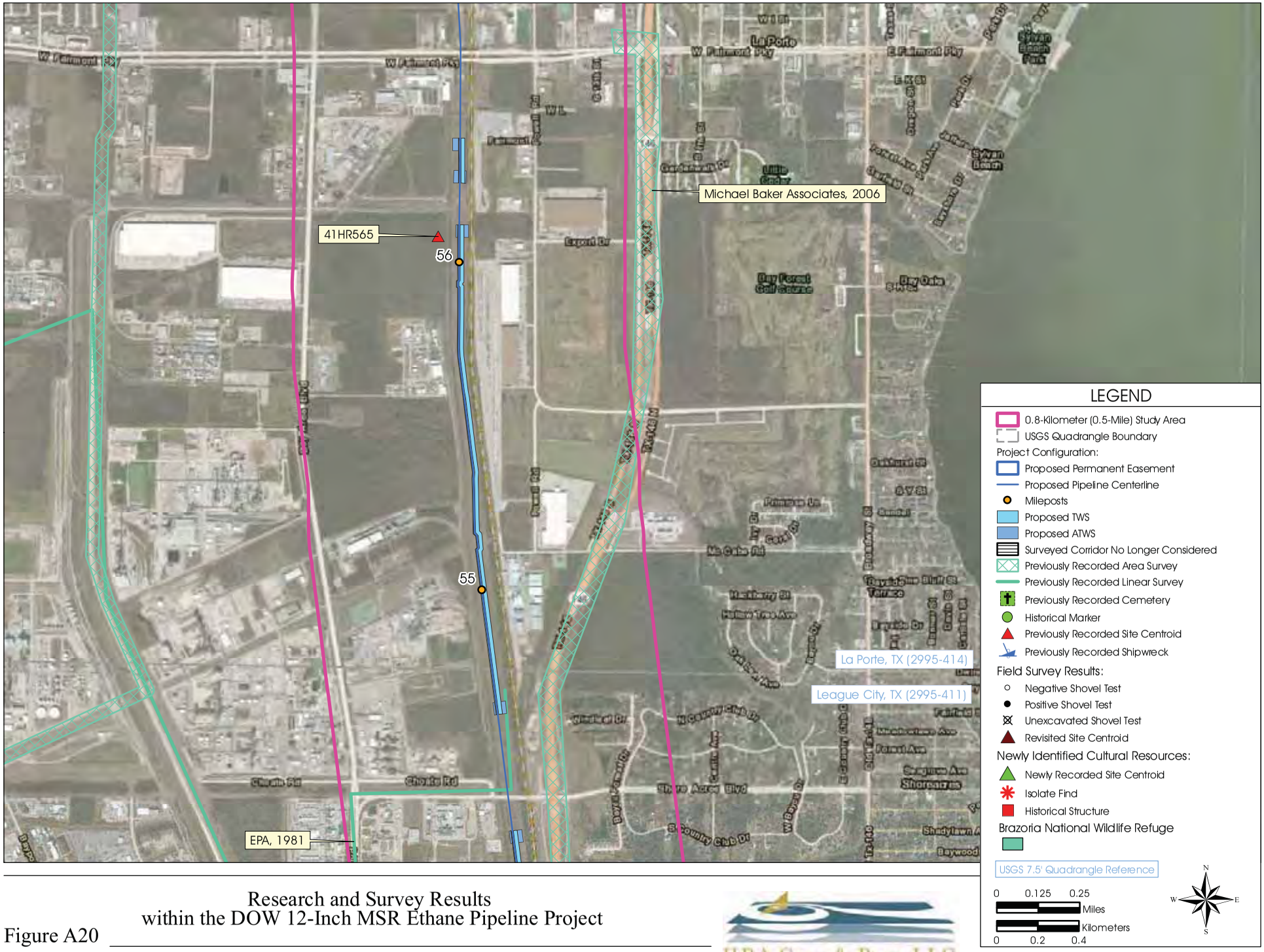

Figure A20

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

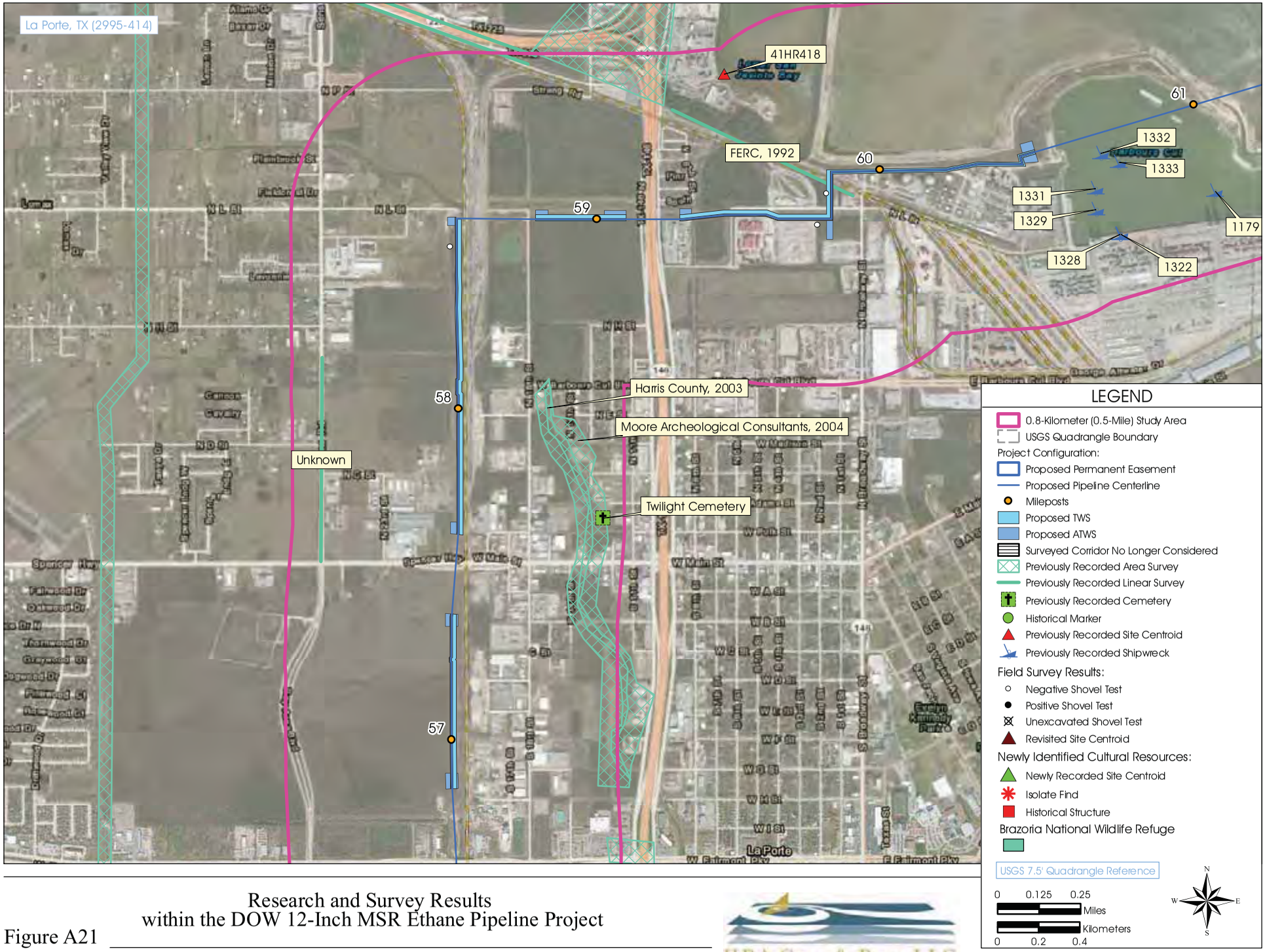

Figure A21

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

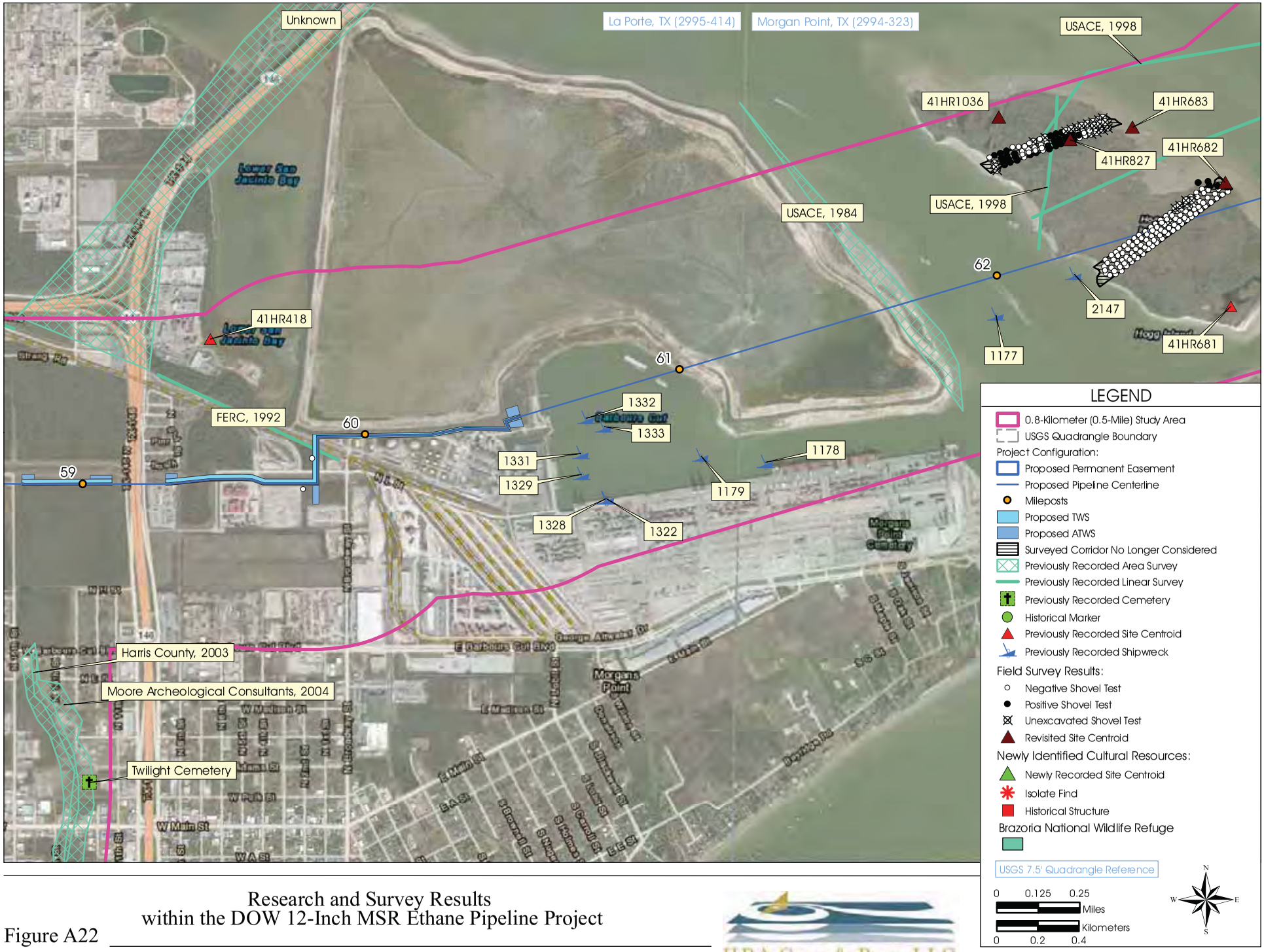

Figure A22

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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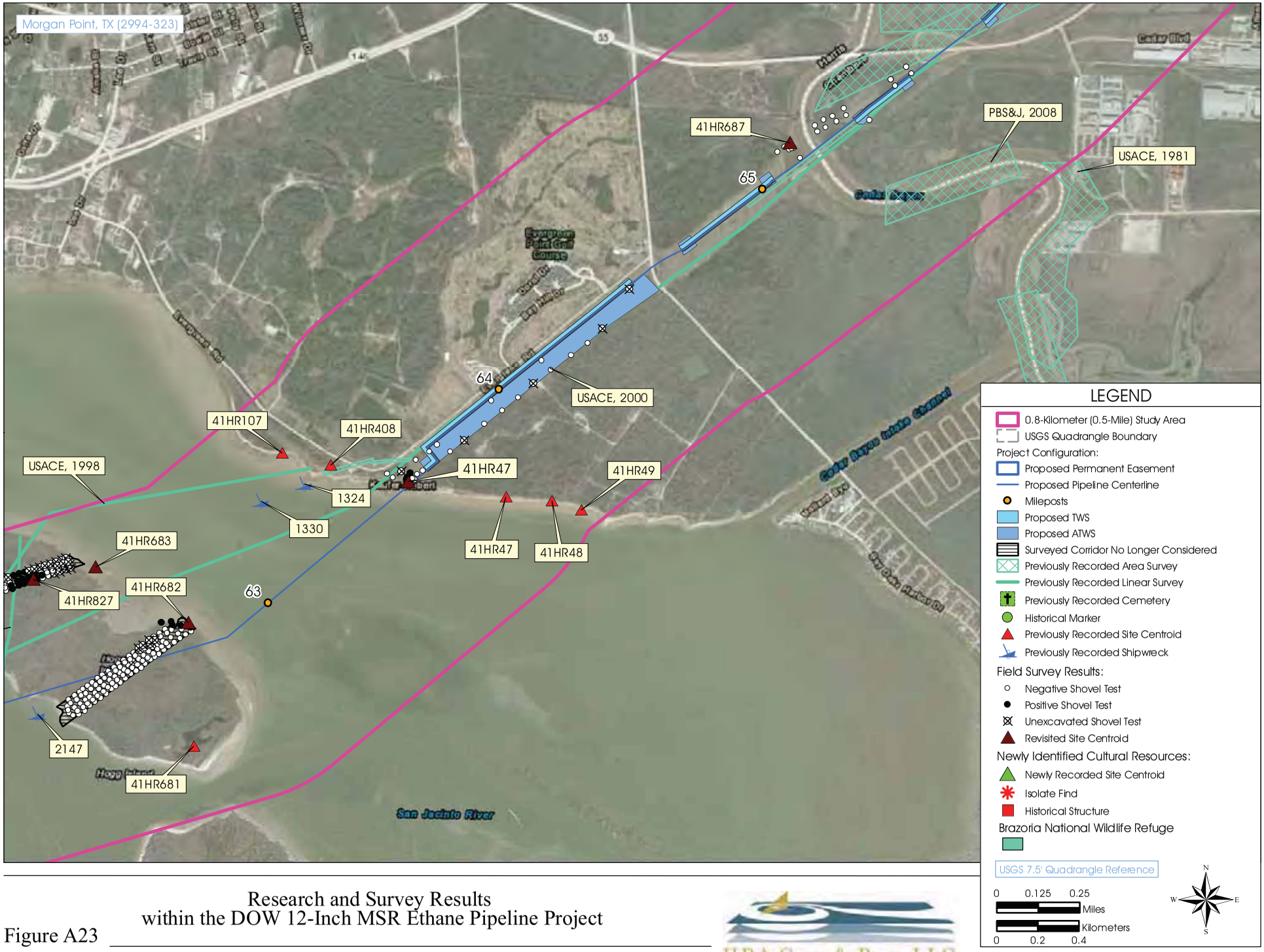

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

Figure A23

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

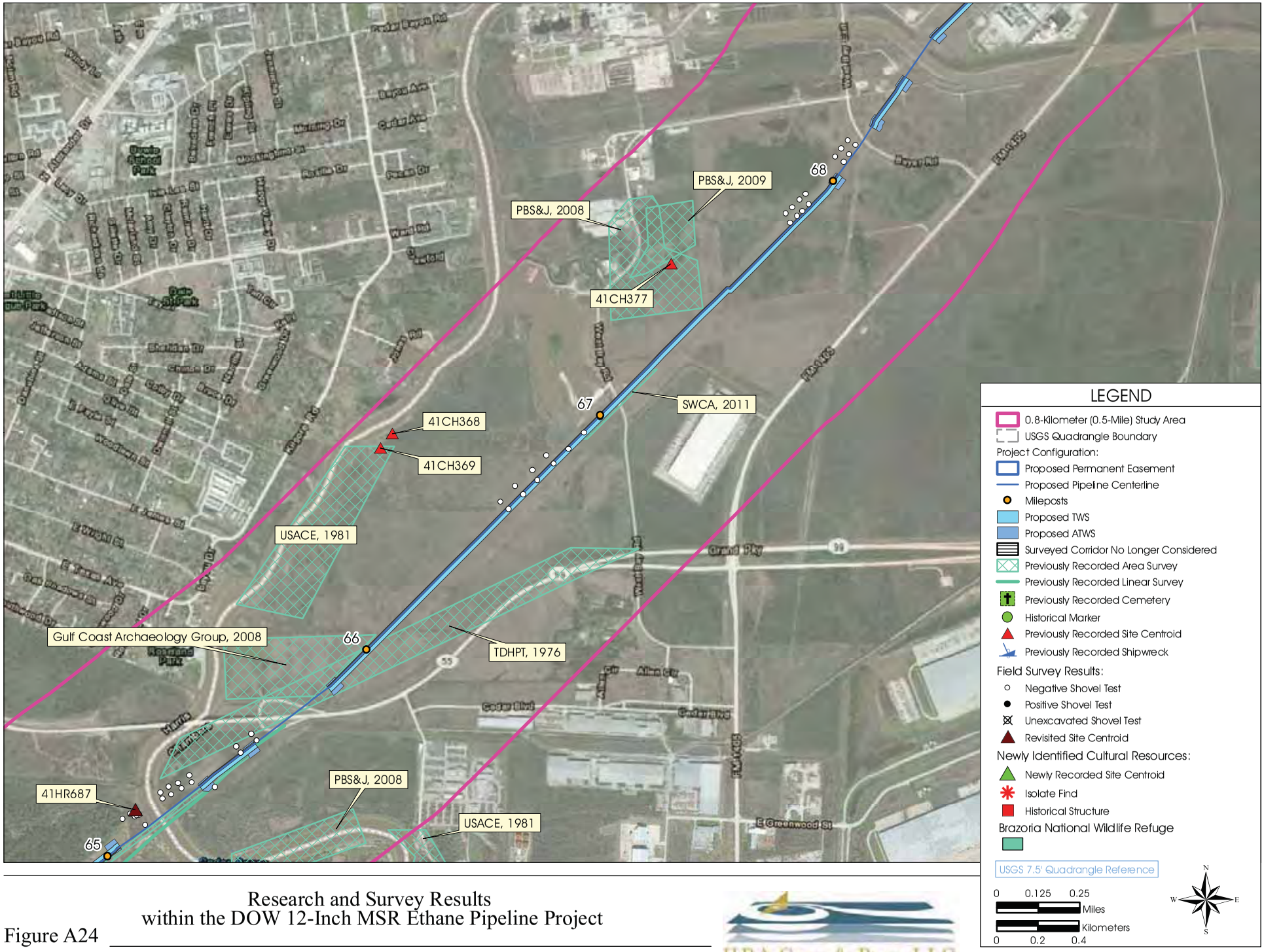

Figure A24

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

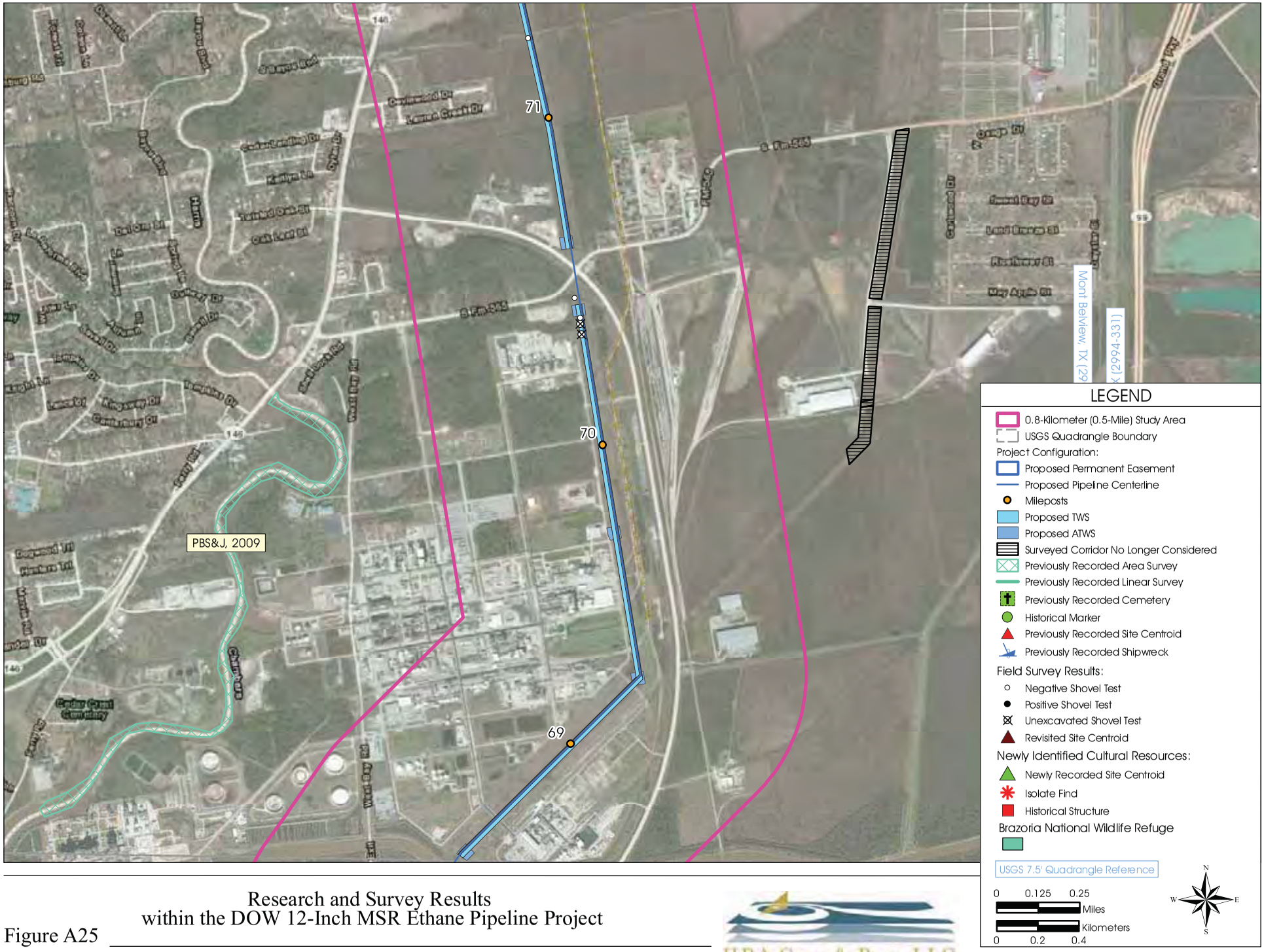

Figure A25

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

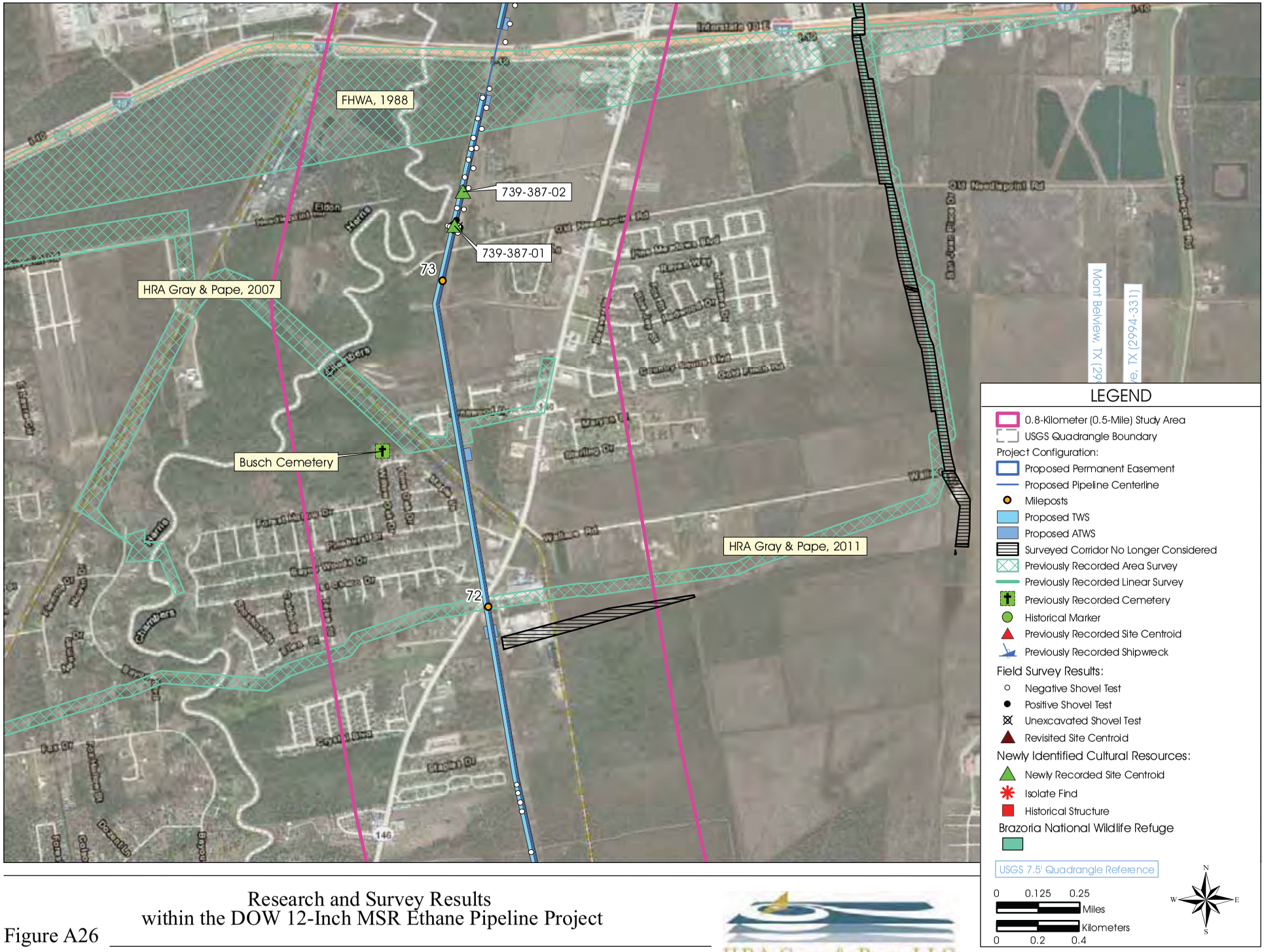

Figure A26

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739.00 on 09-10-2013

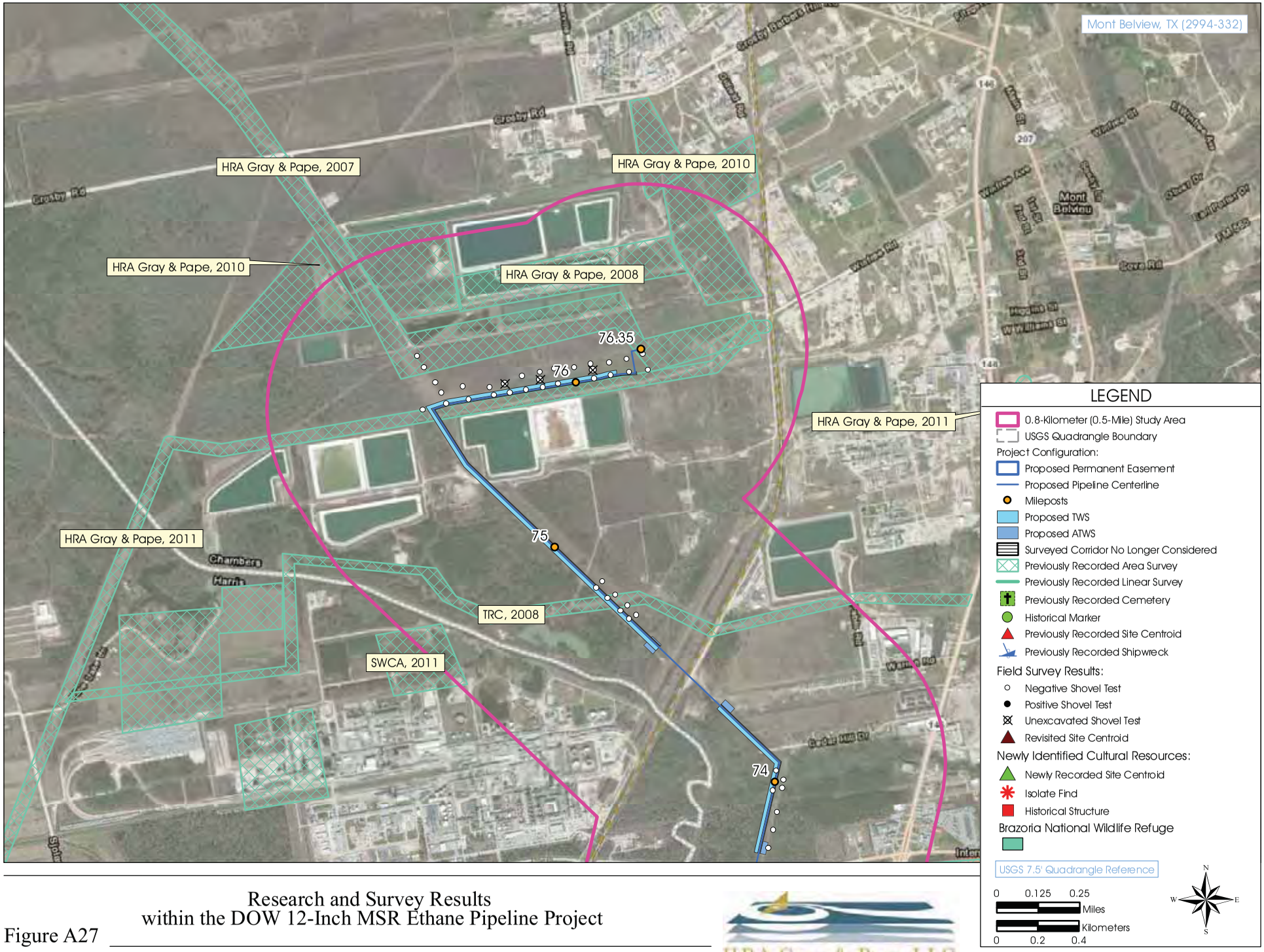

Figure A27

Research and Survey Results
within the DOW 12-Inch MSR Ethane Pipeline Project

HRA Gray & Pape LLC

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APPENDIX B:

Maps of Identified Resources

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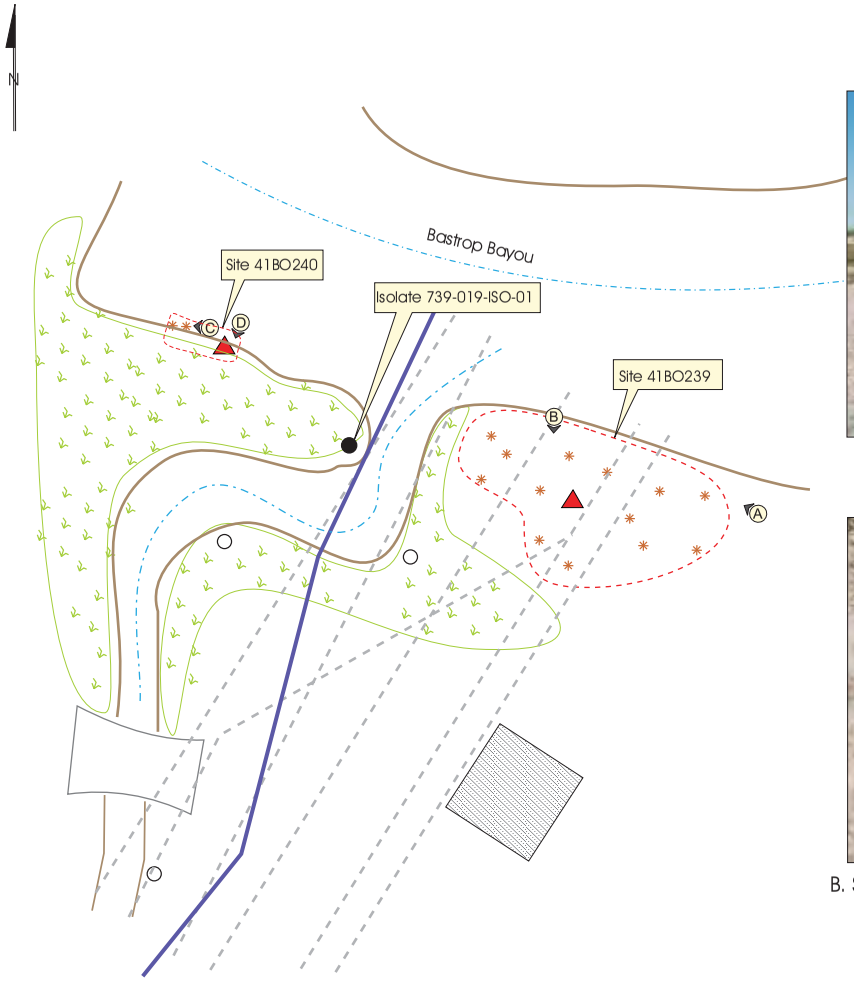
HRA Gray & Pape # 0739.00



A. Site 41BO239 as seen along the south bank of Bastop Bayou. View is to the northwest.

C. Shell eroded from bank within Site 41BO240. View is to the west.

B. Sample of non-diagnostic lithics and faunal bone from the surface of Site 41BO239. View is to the south.

D. Shell lens with pottery within Site 41BO240. View is to the southwest.

LEGEND

- Existing Pipelines
- Survey Corridor Limits
- Negative Shovel Test
- Positive Shovel Test
- Estimated Site Boundary
- Valve Station
- Gravel Covered Culvert
- Waterway
- Bank
- Low Surface Vegetation
- Photo Location and Bearing
- Surface Find

0 10 m
0 33 ft

Plan View of Sites 41BO239, 41BO240, and Isolate Find 739-019-ISO-01

HRA Gray & Pape, LLC.

Figure B1

Created in Illustrator CS4, 09-24-2013

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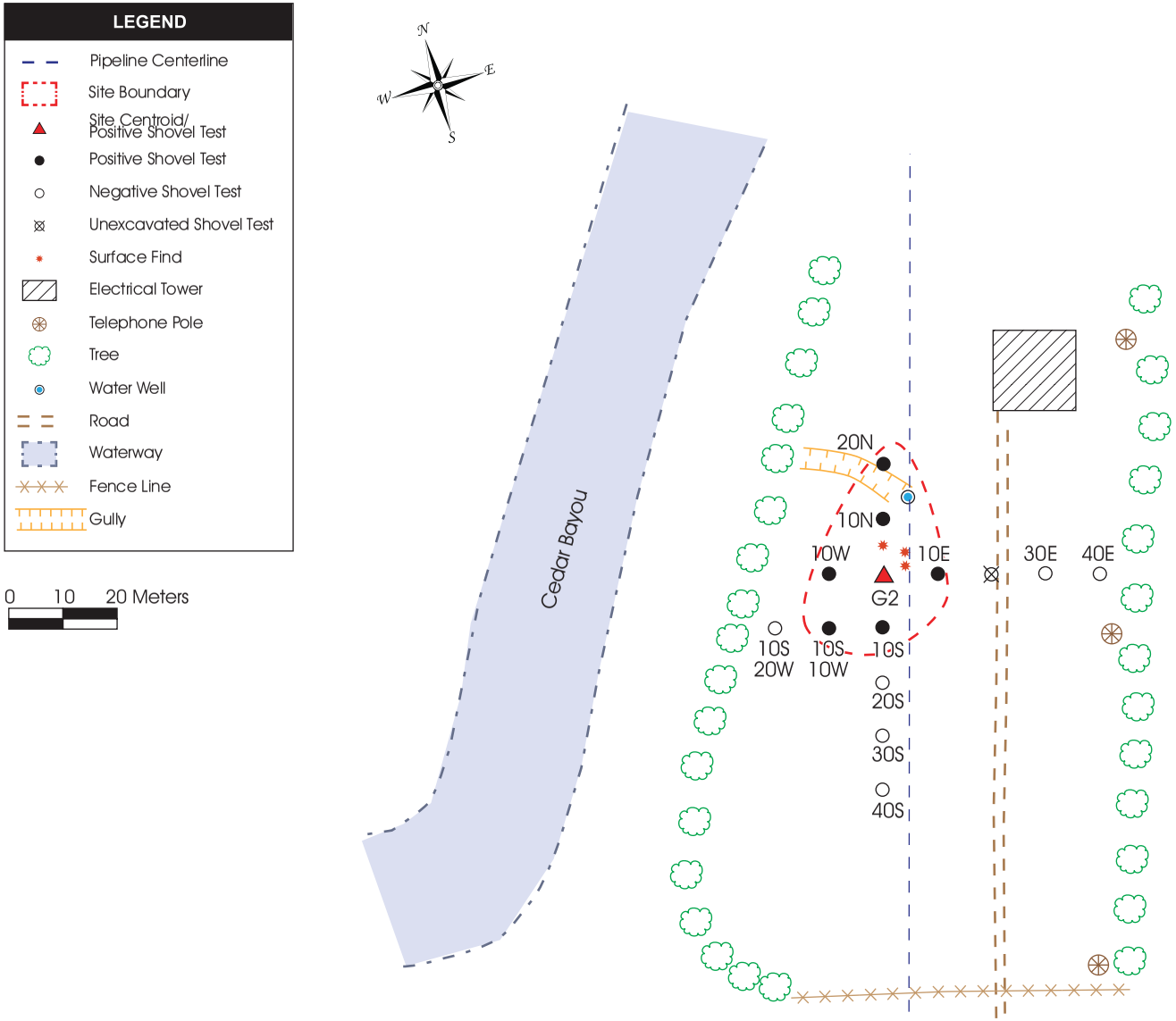
HRA Gray & Pape # 0739.00

Overview of Site 739-387-01.
View is to the north.

Exposed well pipe. View is to the north.

Overview of a possible brick pier.
View is to the east.



Overview of Site 739-387-01

HRA Gray & Pape, LLC.

Figure B2

Created in Illustrator CS4, 09-24-2013

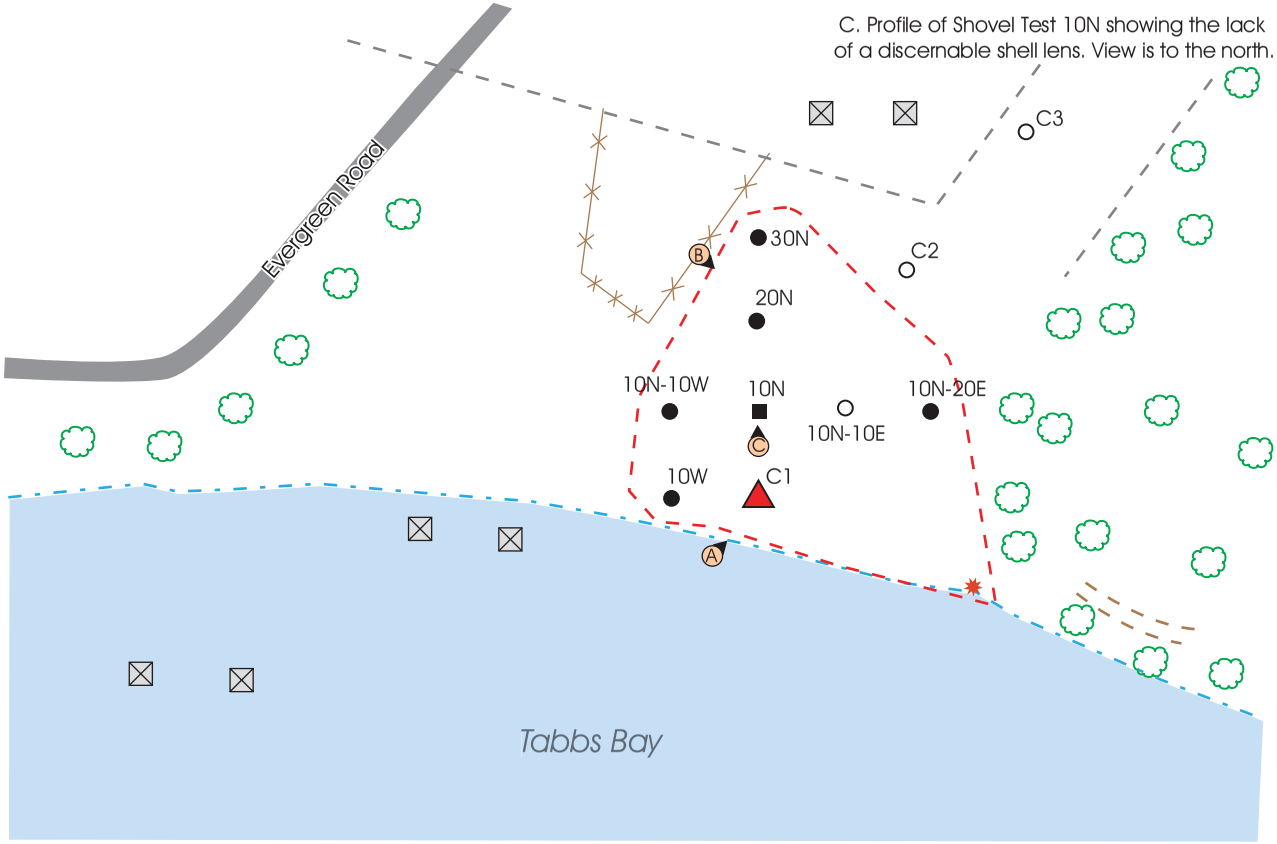
US EPA ARCHIVE DOCUMENT

HRA Gray & Pape # 0739.00

A. Overview of shell deposit at cut bank. View is to the northeast.

B. Overview of site. View is to the southeast

C. Profile of Shovel Test 10N showing the lack of a discernable shell lens. View is to the north.



LEGEND

- Existing Pipeline Centerline
- Site Boundary
- Site Centroid/ Positive Shovel Test (Shell)
- Positive Shovel Test (Shell and Modern Artifacts)
- Positive Shovel Test (Shell and Modern/Prehistoric Artifacts)
- Negative Shovel Test
- Surface Find (Prehistoric)
- Transmission Tower
- Tree
- Paved Road
- Shell Road Remnant
- Waterway
- Fence Line
- Photo Location and Camera Direction

HRA Gray & Pape, LLC.

Overview of Previously Recorded Site 41HR47

Figure B3

Created in Illustrator CS4, 09-24-2013

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 739-01 on 09-23-2013

A. Site 41HR1036 viewed from within the survey corridor. View is to the north.

B. General overview of field conditions viewed within the survey corridor. View is to the northeast.

C. Typical soil profile within Site 41HR827 showing a shell concentration between 10 and 25 centimeters depth.

D. Overview of the east side of the island in the general vicinity of the recorded locations of sites 41HR682 and 41HR683. View is to the southeast.

E. Shell concentration 1 berm. View is to the southeast.

LEGEND

- Pedestrian Surveyed Area
- Newly Recorded Resource Boundaries
- Previously Recorded Site Boundary
- Newly Recorded Shell Concentrations
- Photo Location and Bearing

0 100 200 Meters

0 300 600 Feet

N W E S

Pedestrian Survey Coverage on Hog Island and the Locations of Previously Recorded Resources

HRA Gray & Pape LLC

Figure B4

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 729-01 on 09-23-2013

LEGEND

Proposed Centerline

USGS Quadrangle Reference

0 0.25 0.5 Miles

0 0.25 0.5 Kilometers

N W E S

Timeline of Topographic Maps Showing Changes to Hog Island as the Result of Erosion and Dredge Spoil

HRA Gray & Pape LLC.

Figure B5

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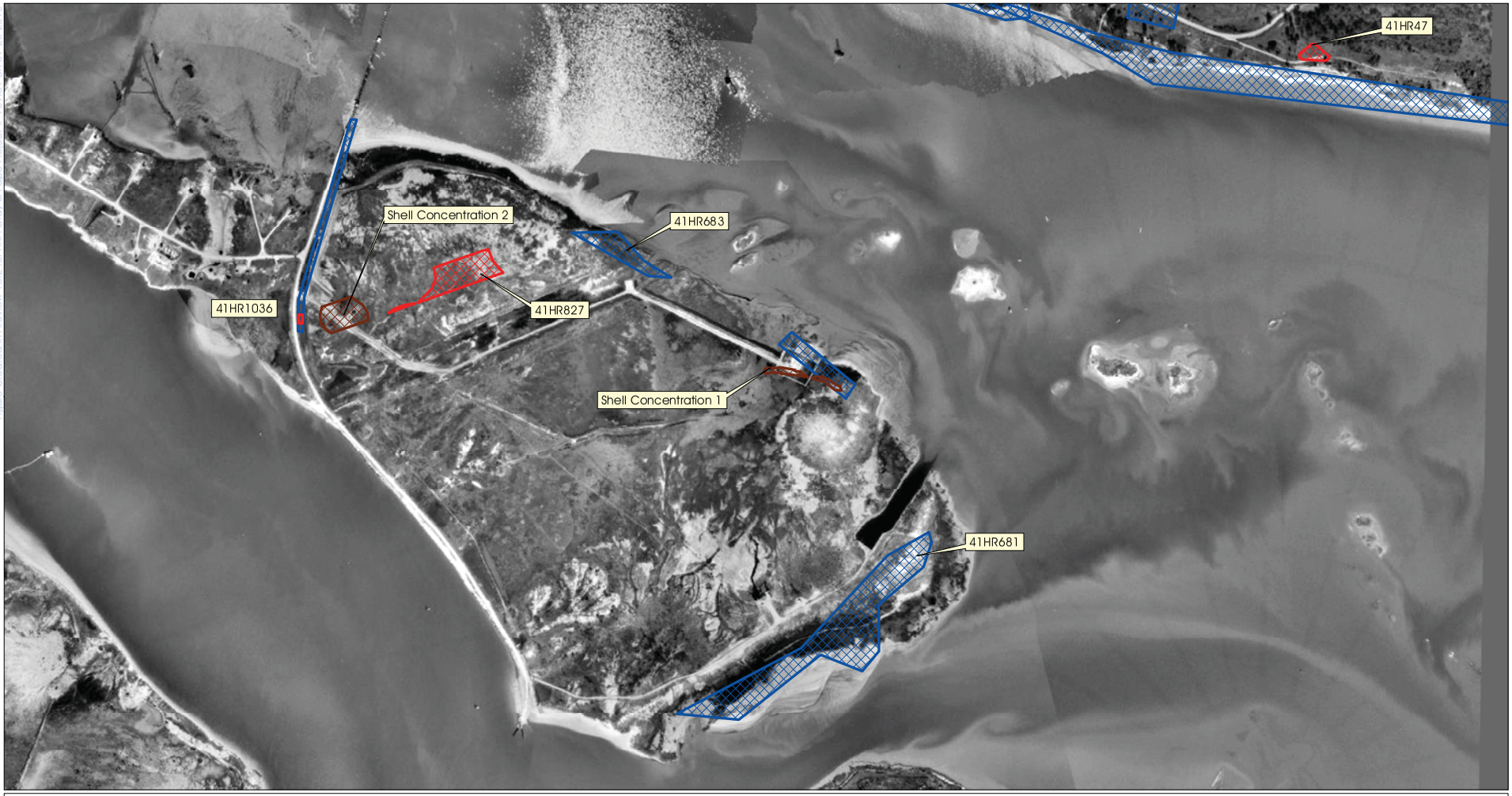
Figure Created in ArcView 10.2 for HRA Gray & Pape Project # 730-01 on 09-23-2013



LEGEND

- Previously Recorded Site Boundary
- Newly Recorded Resource Boundaries
- Newly Recorded Shell Concentrations

0 50 100 Meters

0 150 300 Feet

N W E S

Previously and Newly Recorded Resources Overlaid on a Circa 1962 Aerial Image

HRA Gray & Pape LLC

Figure B6

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APPENDIX C:

Agency Consultation Documents

TEXAS HISTORICAL COMMISSION
real places telling real stories

October 10, 2012

Tony Scott
HRA Gray & Pape, LLC
1428 West Alabama St.
Houston, Texas 77006

Re: Project review
Draft report: *Cultural Resources Survey of 37 miles for the Proposed DOW 12-Inch PDH-1 Freeport to Texas City Pipeline Project in Brazoria and Galveston Counties, Texas.*
Texas Antiquities Code Permit # 6246

Dear Mr. Scott:

Thank you for allowing us to review the report referenced above. This letter serves as comment on the proposed undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission.

The review staff, led by Jeff Durst, has completed its review. After reviewing the documentation, we concur that newly recorded sites 41BO239 and 41BO240 are ineligible for inclusion in the National Register of Historic Places (NRHP) based on the lack of buried deposits, cultural features, or temporally diagnostic materials. We also concur that previously recorded sites 41BO161, 41BO162, and GV67, are ineligible for inclusion in the NRHP based on the lack of buried deposits, cultural features, or temporally diagnostic materials.

The draft report that you have submitted is accepted and this project may proceed without further consultation with this office, provided that no significant archeological deposits are encountered during construction and development of the property.

Thank you for your cooperation in this review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If we may be of further assistance, please call Jeff Durst of our staff at 512/463-8884.**

Sincerely,

for
Mark Wolfe, State Historic Preservation Officer

MW/jjd

January 21, 2013

Tony Scott
HRA Gray and Pape, LLC
1428 West Alabama
Houston, TX 77006

Re: Project review under the Antiquities Code of Texas
Final Report: *Cultural Resources Survey of 37 Miles for the Proposed DOW 12-Inch PDH-1 Freeport to Texas City Pipeline Project in Brazoria and Galveston Counties, Texas*
Texas Antiquities Permit **#6246**
COMPLETED PERMIT

Dear Colleague:

Thank you for your correspondence describing the above referenced project. This letter presents the comments of the Executive Director of the Texas Historical Commission, the state agency responsible for administering the Antiquities Code of Texas.

The Archeology Division is in receipt of the final report, a completed *Abstracts in Texas Contract Archeology* form, and tagged PDF CD for the above referenced permit. The submission of the final report, abstract form, and CD demonstrates completion of your permit requirements under Permit #6246.

Thank you for your cooperation in this state review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Lillie Thompson at 512/463-1858.**

Sincerely,

for
Mark Wolfe
Executive Director

MW/lft

US EPA ARCHIVE DOCUMENT

Cultural Resources Assessment
The Dow Chemical Company
Light Hydrocarbon 9 (LHC-9) Unit Project
Freeport, Brazoria County, Texas

February, 2014

Supporting Documentation

HRA Gray and Pape, LLC

2013d - Results of Cultural Resources Review and Pedestrian Survey for the Locations of Proposed Dow Ethane Pipelines and Associated Components between Freeport and Stratton Ridge; Brazoria County, Texas (SOW Nos. 4 through 16)

US EPA ARCHIVE DOCUMENT

HRA Gray & Pape, LLC

Mr. Joe Franklin
Wood Group Mustang, Inc.
16001 Park Ten Place
Houston, TX 77084

February 14, 2013

Re: Results of Cultural Resources Review and Pedestrian Survey for the Locations of Proposed DOW Ethane Pipelines and Associated Components between Freeport and Stratton Ridge; Brazoria County, Texas (SOW Nos. 4 through 16)

Lead Federal Agency: United States Environmental Protection Agency

Dear Mr. Franklin,

HRA Gray & Pape, LLC (HRA Gray & Pape) has completed a cultural resources review and pedestrian survey for the proposed locations of the 13 scopes located in Brazoria County, Texas. The goal of this study was to assist Wood Group Mustang, Inc. (Mustang), their client, and the United States Environmental Protection Agency (USEPA) in determining whether or not intact cultural resources are potentially present within the project, and if so to provide management recommendations for these resources. As a result of research efforts, previously identified archaeological sites were recorded within or immediately adjacent to portions of the referenced scopes.

Project Area Descriptions

The project areas are located between existing facilities located in Clute and the DOW Salt Dome Operations (SDO) at Stratton Ridge in Brazoria County, Texas (Figure 1). The projects involve multiple scopes of work (SOW), each with specific components. These are listed in Table 1 below.

Cincinnati Ohio | Missoula Montana | Houston Texas | Richmond Virginia | Seattle Washington | Portland Oregon | Providence Rhode Island

Table 1. Reviewed project scopes and their associated components.

Scope	Component
SOW 4	Two new ethane pumps
SOW 5	Ethane Pipeline from DW6 to Stevens
SOW 6	New ethane meter station
SOW 7	New ethane meter station
SOW 8	Two metering facilities at the well and well head instrumentation
SOW 9	0.75-Mile Brine Pipeline for Ethane Storage Well
SOW 10	Ethane Pipeline SDO Area
SOW 11	Ethane Pipeline SDO to OCD
SOW 12	Ethane Pipeline SDO C-21 to DPL283
SOW 13	New ethane meter station for the pipeline connecting upstream of the 8" Ethylene pipeline connecting DPL-283 to wells at SDO
SOW 14	New ethane meter station located between SDO and the GCPL Ethylene compressor
SOW 15	New Ethylene Storage Well Drying and CO2 Removal facility
SOW 16	Ethylene Pipeline SDO to OCD

Scope Nos. 4,6,7,8,13,14, and 15 are all in relation to a proposed new facility (not part of this scope) to be located within the Stratton Ridge complex located south of County Road (CR) 226 (Clute-Stratton Ridge Road) and Highway 523. Scope 4 encompasses an estimated 0.6 hectares (1.5 acres) which defines the area of potential effect (APE) for two proposed pump stations. Scope Nos. 5,9,10,11,12, and 16 will consist of various pipelines to transport ethane and ethylene between facilities. Scope #5 involves the installation of approximately 1.9 kilometers (1.2 miles) of 12-inch diameter pipeline to be used for supplying ethane to an existing facility. Scope #9 involves the installation of approximately 1.2 kilometers (0.75 miles) of 16-inch pipe to be used for transportation of Brine. Scope #10 involves the installation of approximately 2.7 kilometers (1.7 miles) of 12-inch pipe to be used for transportation of Ethane. Scope #11 involves the installation of approximately 8.4 kilometers (5.2 miles) of 12-inch pipe to be used for transportation of ethane. This project will be co-located with Scope #16 which will transport ethylene through another 8.4 kilometers (5.2-miles) of 12-inch pipe. Scope #12 involves the installation of approximately 0.08 kilometers (0.05 miles) of 8-inch pipe to be used for the transportation of ethane. All proposed pipelines (Scope Nos. 5,9,10,11,12, and 16) will primarily follow existing pipeline corridors which are occupied by numerous pipelines. These individual scopes are part of a larger project. Scopes 1 through 3 are reported separately.

Scopes Nos. 5 and 10 are located in DOW corridor P will cross Oyster Creek near CR 226. Scope Nos. 11 and 16 are located in DOW corridor R and will also cross Oyster Creek although further south and along the way will pass near the locations of oxbow lakes including Chubb Lake, Stubblefield Lake, and Dutch Lake before crossing Flag Lake Drainage Canal. All canal and creek crossings are anticipated to be made by horizontal drilling. It is the understanding of HRA Gray & Pape that the pipeline projects will require a permanent right-of-way (ROW) of 6

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meters (20 feet) with an additional 24 meters (80 feet) of temporary workspace. For purposes of this cultural review an additional 30 meters (100 feet) were included in the review and survey to account for access roads, contractor yards, and other temporary workspaces, yielding a total width of 60 meters (200 feet). The combined APE for interconnecting pipelines totals approximately 64.3 hectares (159 acres).

Eight soil map units have been identified within the project APE. These consist of Asa silt loam and Asa silty clay loam; Brazoria clay, 0 to 1% slopes; Edna fine sandy loam, 0 to 1 % slopes; Edna-Aris complex; Lake Charles clay, 0 to 1% slopes; Pledger clay; and Surfside clay (USDA-NRCS 2009). Of those soils, Asa soils are considered to have a high potential for buried cultural resources and Brazoria clay is considered to have a moderate to high potential for buried cultural resources (Abbott 2001).

Cultural History

Most of the prehistoric cultural resources located near the Upper Texas Coast between the Brazos River and Sabine Lake consist of shell middens found in estuaries or exposed in cutbanks along streams (Aten 1983; Patterson 1985). These middens usually contain faunal material as well as cultural remains such as lithic tools and pottery. Inland sites are less likely to consist of middens and are more similar to generalized open campsites. Sites of this type consist of little to no stratification due to a short occupation time, erosion, and land clearing. Thus, subsurface features are rare (Patterson 1985). In both areas, sites are most often found near stream channels.

Methods

The cultural resources investigations included a site file research and literature review that was performed in order to identify all previously recorded archaeological sites and previous investigations within 1.6 kilometers (1 mile) of the project area. This work was conducted by reviewing online data available on the Texas Online Archaeological Sites Atlas, an online resource maintained by the Texas Historical Commission (THC), as well as an online database of the National Register of Historic Places (NRHP).

Given the alluvial nature of the location, available soils mapping suggests that a good deal of the overall area contains a moderate to high potential for containing archaeological sites (Abbott 2001); however, this potential diminishes with greater distance from Oyster Creek, the Brazos River, and nearby oxbow lakes. The proposed projects are located near and co-located with existing facilities and buried pipelines in areas showing signs of disturbance from industrial use and previous pipeline installation. Topographical maps and aerial photographs from the 1940s indicate that the proposed location of Scope Nos. 4,6,7,8,13,14, and 15 was at one time low and wet to the point of being drawn as marshy on the 1943 Oyster Creek topographic map. Salt wells appear by the 1960s and the area experienced more development in the 1970s. Transmission

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lines which parallel Scopes 11 and 16 are also visible on the 1943 map. The DOW Barge Canal and Flag Lake Drainage Canals are likewise visible on the 1943 topographic map.

Per THC guidelines, the minimum standards for surface reconnaissance in linear projects call for the excavation of 16 shovel tests every 1.6 linear kilometers (1 linear mile). Transects were spaced 30 meters (100 feet) apart within the APE. Shovel testing was performed in areas that either appeared undisturbed or to have a greater degree of potential for yielding intact buried cultural resources. The most extensive shovel test excavations occurred in the areas containing recorded archaeological sites. In disturbed areas with a low potential for containing resources, shovel tests were typically spaced at 100 meter (300 foot) intervals. At recorded sites and other areas determined to have a higher potential for yielding cultural resources the shovel test interval was reduced to 60 or 30 meters (180 or 90 feet) as deemed necessary by the archaeologist. Shovel tests were excavated to depths between 10 and 100 centimeters but were often restricted to a depth of no more than 40 centimeters (15 inches) per DOW safety regulations for areas containing buried pipelines and utilities. Deep testing was not performed due to the high number of existing pipelines within and adjacent to the project workspace and their potential to be at shallow depths.

Results

Through a site file review of a 1.6 kilometer (1 mile) radius around all proposed scopes it was determined that 17 previously recorded area surveys and 9 previously recorded linear surveys have taken place in the vicinity of the projects. Approximately 2 kilometers (1.2 miles) of Scope Nos. 11 and 16 were surveyed previously by HRA Gray & Pape in 2005 (Pickering and Hughey 2005) and again in 2007 (Turner & Mangum 2007) for unrelated projects (See Figure 2). No new sites were recorded as a result of those surveys. Other surveys were generally performed in the 1970s and 1980s by the United States Army Corps of Engineers (USACE) and USEPA. Little information is available regarding those surveys. A total of 15 previously recorded archaeological sites have been recorded within 1.6 kilometers (1 mile) of the project scopes. The majority of sites are located in the vicinity of Scope Nos. 11 and 16 near Oyster Creek and nearby oxbow lakes. Only 2 previously recorded sites (41BO159 and 41BO160) are located very near and potentially within any of the project corridors. The recorded locations of Sites 41BO159 and 41BO160 place them on the east side of DOW Corridor R, north of Oyster Creek. Sites 41BO159 and 41BO160 were both recorded in 1986 during a previous pipeline survey. The sites consist of prehistoric shell middens located along low ridges that once marked the waters edge. Besides shell, the sites were reported to contain prehistoric ceramics.

Scopes 4,6,7,8,9,12,13,14, and 15

Due to heavy industrial modification to locations within the existing SDO facility, project scopes 4,6,7,8,9,12,13,14, and 15 were only subjected to cultural resource review and not pedestrian surveyed. HRA Gray & Pape systematically excavated shovel tests within portions of Scope Nos. 5, 10, 11, and 16 along DOW Corridors P and R, where previously recorded archaeological

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sites were mapped and where the highest potential for the discovery of new sites exists. As a result, a total of 96 shovel tests have been excavated within the survey corridor. Shovel tests were excavated to a depth of 40 centimeters (15 inches) or less per DOW safety regulations in areas containing buried pipelines and utilities. All shovel tests were negative for buried archaeological materials. Soil profiles were typically composed of 1 strata of disturbed dense clay, although a handful of shovel tests excavated north of Oyster Creek in DOW Corridor R contained two strata of dense clay, each a different Munsell color.

Scopes 5 and 10

Sixteen shovel tests were excavated in DOW Corridor P, located east of Oyster Creek in the location of Scope Nos. 5 and 10 (Figure 3). No shovel tests were excavated west of Oyster Creek in Corridor P due to obvious evidence of heavy disturbance, including a parking lot and gravel roads. The 16 shovel tests were excavated in intervals of 30 to 60 meters (100 to 200 feet) because of their proximity to the Oyster Creek. They showed signs of previous disturbances and produced no evidence of cultural resources. The soil was primarily 10YR3/2 very dark grayish brown clay, with mottling of 10YR5/3 brown clay and 5YR5/6 strong brown clay in the heavily disturbed areas.

Scopes 11 and 16

Seventy nine shovel tests were excavated in DOW Corridor R in the location of Scope Nos. 11 and 16 (Figures 4 and 5). Of that total, 56 tests were excavated during the current field mobilization and 23 tests were performed in 2005 during field work for another project (Pickering and Hughey 2005). The shovel tests were typically excavated at intervals of 30 or 60 m (100 or 200 feet) near the creek and oxbow lakes. That interval was increased to 100 meters (300 feet) further away from waterways and lakes. Shovel test excavations revealed no evidence of cultural resources. The shovel tests were sterile and most frequently contained 10YR3/2 dark grayish brown clay or 10YR3/3 dark brown clay. Several showed signs of previous disturbances and were mottled with 5YR5/6 strong brown clay. Shovel tests excavated just north of Oyster Creek in Corridor R were located in a flagged wetland area and primarily consisted of 10YR3/3 dark brown clay, but contained no artifacts.

Recommendations

Scopes 4,6,7,8,9,12,13,14, and 15

Archival research produced no record of National Register listed properties within 1.6 kilometers (1 mile) of the proposed project scopes in the SDO location in Stratton Ridge (Scope Nos. 4,6,7,8,9,12,13,14, and 15). The location of Scopes 4,6,7,8,9,12,13,14, and 15 are not in close proximity to Oyster Creek, reducing the likelihood that archaeological sites exist in the location. Field survey is not recommended for these scopes. The SDO facility and immediate surrounding area is heavily industrialized and it is unlikely that National Register properties will be affected

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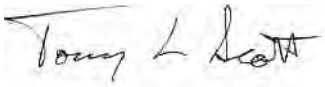
by visual impacts as the result of the construction of a new pipelines or pump stations. Previous impacts in the immediate vicinity of the existing SDO facility make it unlikely that archaeological fieldwork would be appropriate

Scopes 5,10,11, and 16

Intensive pedestrian fieldwork near Oyster Creek and adjacent oxbow lakes did not result in the discovery of prehistoric or historic cultural materials or features. It is determined that existing archaeological sites 41BO159 and 41BO160 are not located within the current project workspace.

Based on the lack of any cultural resources located within or immediately adjacent to the project workspace and the evidence of heavy disturbance within existing pipeline corridors, HRA Gray & Pape will be recommending to the agency reviewers that no further work be required at the reviewed and surveyed locations. Further discussion regarding cultural resources investigations for related project scopes 1 through 3 are provided in additional separate documents. A comprehensive report which will include all project-related components will be submitted to the agencies once the project is completed. Should project plans change, additional work may be necessary. If you have any questions or comments, or are in need of additional information, please do not hesitate to contact me at tscott@hragp.com or (713) 541-0473.

Sincerely,



Tony Scott
Principal Investigator
HRA Gray & Pape, LLC.

HRAGP # 739.04-16

Enc. Figures 1 through 5

Cc: David Marhofer, Wood Group Mustang, Inc.

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2007 *An Intensive Pedestrian Cultural Resources Survey of 50 Acres of Property Proposed for Freeport LNG's Stratton Ridge Well Pad in Brazoria County, Texas.* Report Produced by HRA Gray & Pape, LLC.

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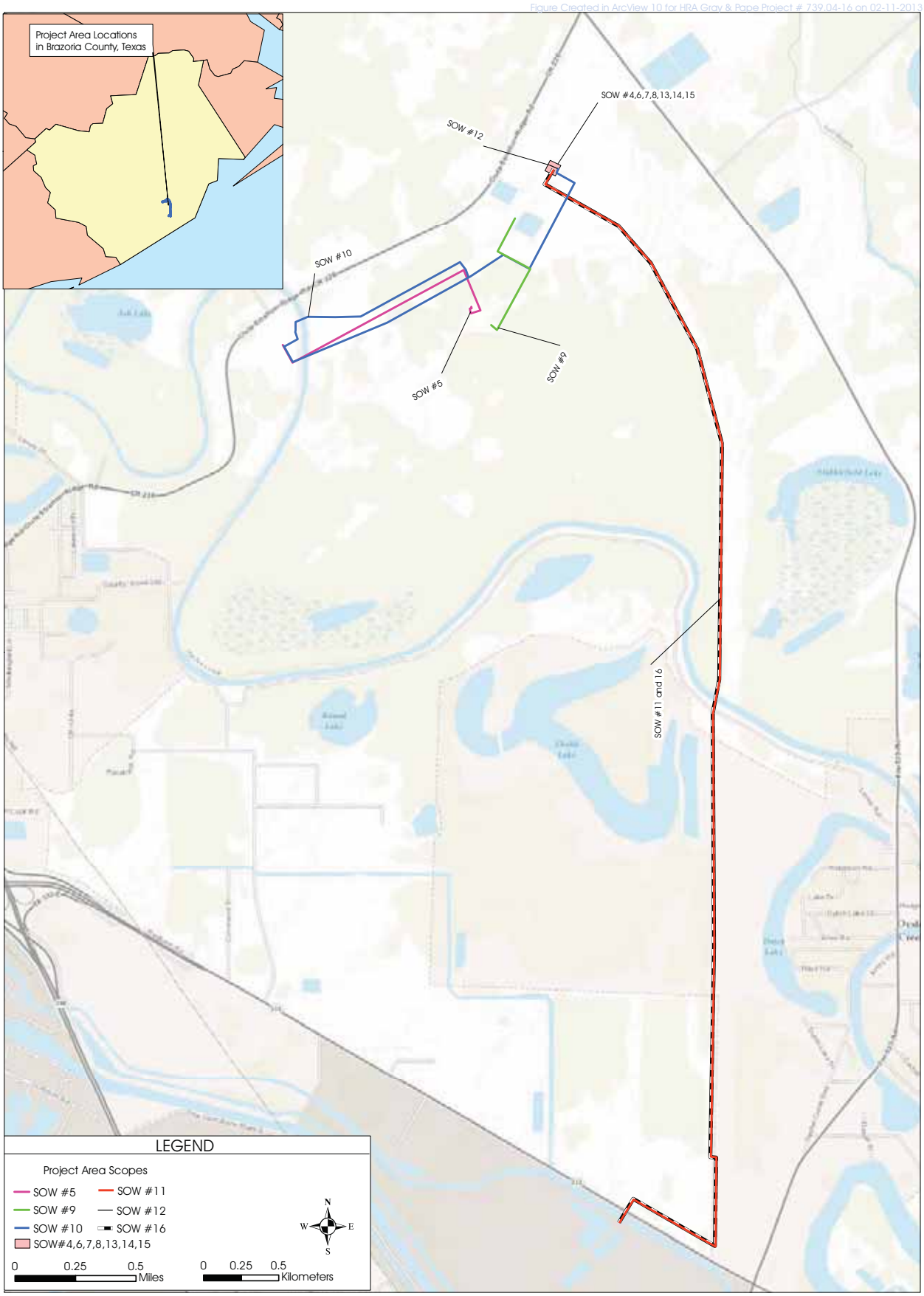

Overview Map of the Proposed Locations for Proposed Project
Scopes 4 Through 16 in Brazoria County, Texas

HRA Gray & Pape LLC

Figure 1

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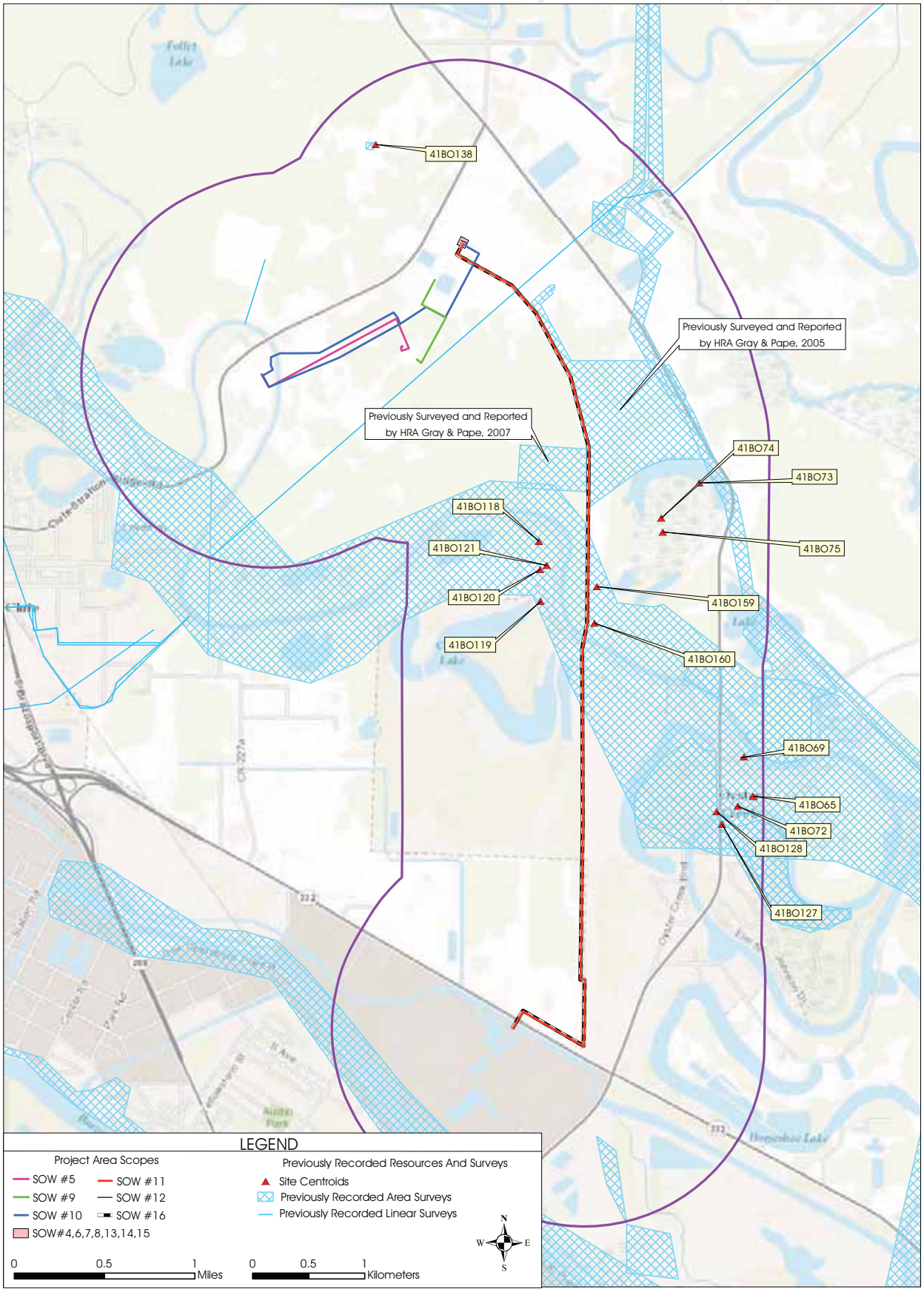
Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.04-16 on 02-11-2013



Map Showing Previously Identified Cultural Resources and Surveys Located within 1.6 Kilometers (1 Mile) of Project Scopes

HRA Gray & Pape LLC

Figure 2

CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE TO PUBLIC

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Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.04-16 on 02-12-2013

Cultural Resource Survey Results Within Scope Numbers 5 and 10, DOW Corridor P

HRA Gray & Pape LLC

Figure 3

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Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.04-16 on 02-12-2013

Cultural Resource Survey Results Within Scope Numbers 11 and 16, DOW Corridor R

HRA Gray & Pape LLC

Figure 4

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Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.04-16 on 02-12-2013

Cultural Resource Survey Results Within Scope Numbers 11 and 16, DOW Corridor R

HRA Gray & Pape LLC

Figure 5

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Cultural Resources Assessment
The Dow Chemical Company
Light Hydrocarbon 9 (LHC-9) Unit Project
Freeport, Brazoria County, Texas

February, 2014

Supporting Documentation

HRA Gray and Pape, LLC

2013c - Results of Cultural Resources Review for the Locations of 3 Proposed Dow Ethane Supply Pipelines in Mont Belvieu, Chambers County, Texas (SOW #3)

HRA Gray & Pape, LLC

Mr. Joe Franklin
Wood Group Mustang, Inc.
16001 Park Ten Place
Houston, TX 77084

January 14, 2013

Re: Results of Cultural Resources Review for the Locations of 3 Proposed DOW Ethane Supply Pipelines in Mont Belvieu, Chambers County, Texas (SOW #3)

Lead Federal Agency: United States Environmental Protection Agency

Dear Mr. Franklin,

HRA Gray & Pape, LLC has completed a cultural resources review for the proposed locations of the 3 new ethane supply pipelines in Chambers County, Texas. The goal of this study was to assist Wood Group Mustang, Inc. (Mustang), their client, and the United States Environmental Protection Agency (USEPA) in determining whether or not intact cultural resources are potentially present within the project, and if so to provide management recommendations for these resources. As a result of research efforts, no previously identified archaeological sites or historic structures were recorded within or immediately adjacent to the approximately 8 kilometers (5 miles) of pipeline length.

Project Area Description

The project area is located in Mont Belvieu, Texas, and will involve three (3) 10-inch pipelines, each approximately 2.4 kilometers (1.5 miles) in length (Figure 1). The pipelines, which will be used for supplying ethane to existing facilities, will require a permanent right-of-way (ROW) of 6 meters (20 feet) with an additional 24 meters (80 feet) of temporary workspace. For purposes of this cultural review an additional 30 meters (100 feet) were included in the review to account for access roads, contractor yards, and other temporary workspaces, yielding a total width of 60 meters (200 feet). This defines the project's area of potential effect (APE).

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Methods

The cultural resources review included a site file research and literature review was performed in order to identify all previously recorded archaeological sites and previous investigations within 1.6 kilometers (1 mile) of the project area. This work was conducted by reviewing online data available on the Texas Online Archaeological Sites Atlas, an online resource maintained by the Texas Historical Commission (THC), as well as an online database of the National Register of Historic Places (NRHP). Available mapping suggests that the majority of the project area contains a low probability for containing intact archaeological sites; most of the proposed project area appears to be co-located with existing buried pipelines, placed adjacent to road ROW, or is to be located in areas showing signs of disturbance from industrialization or agricultural use. Topographical maps and aerial photographs from the 1950s through the 2000s indicate that the areas associated with the proposed ethane pipeline in Mont Belvieu have been subject to agricultural and industrial development for at least 60 years. Aerials of Mont Belvieu from the 1950s and 1960s show primarily agricultural tracts, industrial development, and road ROW that are still in use in the proposed ethane pipeline locations and reveal no evidence of historic houses or other historic structures. Mont Belvieu aerials from 1981, 1973, and 2004 show a gradual increase in industrial development, particularly in the areas west of Highway 146. Topographical maps of Mont Belvieu between the 1960s and 1990s provide additional evidence of growing development, primarily associated with the oil and gas industries. The long-term agricultural and industrial development in Mont Belvieu makes the existence of intact, significant archaeological resources in the proposed pipeline locations highly unlikely.

Results

Site file review produced no records of previously recorded sites within a distance of 1.6 kilometers (1 mile) of the project. Several previous investigations have taken place in the general vicinity of the project including two performed by HRA Gray & Pape. No archaeological sites were recorded as part of investigations within 1.6 kilometers (1 mile) of the project areas. Two historical markers and 5 cemeteries are recorded within 1.6 kilometers (1 mile) of the project. Historic markers are associated with the First United Methodist Church and Barbers Hill Oil Field. Cemeteries in the area include the Barber and Williams, Fisher #2, First United Methodist, Lawrence, and Wilburn cemeteries.

Historical Marker #9122 commemorates the location of the First United Methodist Church. The spot was initially associated with Barber's Chapel, established circa 1877 when the Barber family donated land for a church and school. The school house served as the church until a church was constructed in 1897. The church was named Fisher's Chapel in honor of the principal donors for its construction. A cemetery was created around that same time. The current sanctuary dates to 1932 additional structures in 1945 and 1957.

Historical Marker #9081 commemorates the Barbers Hill Oil Field. The spot known as Barbers Hill refers to a salt dome on the property of Amos Barber, an early settler of the area. Natural gas

was discovered on the dome in 1889 and successful drilling of the location later caused periods of expansion of the community.

The Barber and Williams Cemetery is located on the west side of Spur 207 in Mont Belvieu. The cemetery contains headstones dating from the mid to late 1800s to the 2000s. The cemetery recorded as Fisher #2 by the THC is located west of Highway 146 in the Mont Belvieu oil complex. The cemetery contains approximately 12 burials with the earliest dating to circa 1890. The First United Methodist Cemetery is located on the east side of Spur 207 and. The cemetery dates to the time when Fisher's Chapel occupied the site and contains approximately 495 graves, the earliest dating to the late 1800s. Lawrence Cemetery is located north of Highway 565 at the edge of a pipeline ROW and consists of a single burial, that of Selina Lawrence, dated to 1882. Wilburn Cemetery is located south of Highway 565 and consists of a single burial, that of Sarah L. Wilburn, dated to 1888.

Portions of the proposed ethane lines were surveyed as part of cultural resources investigations for the proposed Winfree Pump Station (SOW #2), located west of Winfree Street (Figure 1). This area was covered by 5 survey transects, which were spaced 30 meters (100 feet) apart. Two of those transects were not excavated due to extensive disturbance from existing pipelines and the obstructions of wooden mats intended to allow heavy machinery to traverse the existing pipeline ROW. The remaining 3 transects were shovel tested at 100-meter (328-foot) intervals along the length of the property. The proposed location for the ethane pipelines was primarily composed of open prairie with mixed vegetation including cordgrasses and other low-to-ground grasses and shrubs. Shovel tests were excavated to a maximum of 40 centimeters (15 inches) below the ground surface in compliance with DOW's safety regulations for locations containing buried pipelines and utilities. Soil profiles were typically composed of 1 often disturbed strata composed of dense clay.

While surveying the proposed pump station, archaeologists also conducted visual inspection of the general surrounding area for the presence of historic structures. No structures were observed within or adjacent to the pipeline portion of the proposed Winfree Pump Station (SOW #2).

The systematic archaeological survey of lands west of Winfree Street confirmed the low probability of finding archaeological resources in the highly developed areas associated with the proposed ethane pipeline in Mont Belvieu. The shovel test excavations and pedestrian walkovers revealed no evidence of intact archaeological sites and, in general, the soil types identified in the survey have low geoarchaeological potential. Due to the negative survey results near Winfree Street, the low geoarchaeological potential of the local soils, and Mont Belvieu's history of long-term agricultural and industrial development, HRA Gray & Pape determined that no further archaeological surveys of the proposed ethane pipelines in Mont Belvieu were necessary.

Recommendations

No previously recorded sites, cemeteries, or historical markers are located within or immediately adjacent to the proposed pipeline routes. Based on the lack of any previously recorded cultural

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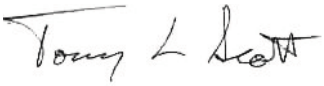
resources located within or immediately adjacent to the project areas, negative pedestrian survey results within the Winfree Pump Station (SOW #2) portion of the proposed pipelines, and the co-location of the proposed pipelines in existing utility and road corridors and other previously disturbed areas, HRA Gray & Pape will be recommending to the agency reviewers that no further work be required in the Mont Belvieu vicinity. Should project plans change, additional work may be necessary. If you have any questions or comments, or are in need of additional information, please do not hesitate to contact me at tscott@hragp.com or (713) 541-0473.

Sincerely,



Tony Scott
Principal Investigator
HRA Gray & Pape, LLC.

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Overview Map of the Proposed Locations for 3 DOW Ethane Supply Lines in Mont Belvieu, Texas

HRA Gray & Pape LLC

Figure 1

Cultural Resources Assessment
The Dow Chemical Company
Light Hydrocarbon 9 (LHC-9) Unit Project
Freeport, Brazoria County, Texas

February, 2014

Supporting Documentation

HRA Gray and Pape, LLC

2013b - Results of Cultural Resources Surveys Completed at the Location of the Proposed Dow Winfree Pump Station in Chambers County, Texas (SOW #2)

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HRA Gray & Pape, LLC

Mr. Joe Franklin
Wood Group Mustang, Inc.
16001 Park Ten Place
Houston, Texas 77084

January 14, 2013

Re: Results of Cultural Resources Surveys Completed at the Location of the Proposed DOW Winfree Pump Station in Chambers County, Texas (SOW #2)

Lead Federal Agency: United States Environmental Protection Agency

Dear Mr. Franklin,

HRA Gray & Pape, LLC has completed cultural resources surveys at the proposed location of a new ethane pump station west of Highway 146 in Mont Belvieu, Chambers County, Texas. The goal of this study was to assist Wood Group Mustang, Inc. (Mustang), their client, and the United States Environmental Protection Agency (USEPA) in determining whether or not intact cultural resources are present within the property, and if so to provide management recommendations for these resources. As a result of survey efforts, no new or previously identified archaeological sites or historic structures were recorded within or adjacent to the 54-hectare (133-acre) project area. Survey was completed on December 6, 2012. This letter documents the results of field surveys completed to date.

Project Area Description

The proposed project is to be located in Mont Belvieu in Chambers County, Texas, west of Winfree Street, north of Interstate 10, and east of Cedar Bayou. The project will involve the construction of a new pump station. The proposed location for the Winfree Pump Station was primarily composed of densely wooded and wetland environments. Cedar Bayou runs adjacent to the western edge of the project boundary. Though the bayou has been channelized, part of the waterway still exists just outside of the project area. An existing pipeline corridor approximately 20-meters (60 feet) wide exists within the southern boundary of the project area. The eastern end of the project area showed evidence of previous surface and subsurface disturbance due to

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Providence, RI 02909
401.273.0669
f 401.273.0644

pipeline activity. The survey area for the project measures approximately 2.8 kilometers (2 miles) long and 150 meters (500 feet) wide. This results in a project area measuring approximately 54 hectares (133 acres) which defines the project's area of potential effect (APE).

Methods

Prior to field efforts a cultural resources review was initiated which included a site file research and literature review performed in order to identify all previously recorded archaeological sites and previous investigations within 1.6 kilometers (1 mile) of the project area. This work was conducted by reviewing online data available on the Texas Online Archaeological Sites Atlas, an online resource maintained by the Texas Historical Commission (THC), as well as an online database of the National Register of Historic Places (NRHP).

Available mapping suggests that the majority of the project area contains a low probability for containing intact archaeological sites (Abbott 2001); most of the proposed project area appears to be co-located with existing buried pipelines, placed adjacent to road right-of-ways, or is to be located in areas showing signs of disturbance from industrialization or agricultural use. Topographical maps and aerial photographs from the 1950s through the 2000s indicate that the areas associated with the proposed ethane pipeline in Mont Belvieu have been subject to agricultural and industrial development for at least 60 years. Aerials of Mont Belvieu from the 1950s and 1960s show primarily agricultural tracts, industrial development, and road right-of-ways that are still in use in the proposed ethane pipeline locations and reveal no evidence of historic houses or other historic structures. Mont Belvieu aerials from 1981, 1973, and 2004 show a gradual increase in industrial development, particularly in the areas west of Highway 146. Topographical maps of Mont Belvieu between the 1960s and 1990s provide additional evidence of growing development, primarily associated with the oil and gas industries. The long-term agricultural and industrial development in Mont Belvieu makes the existence of intact, significant archaeological resources in the proposed pipeline locations highly unlikely.

Transects were spaced 30 meters (100 feet) apart within the APE. Shovel testing was performed in areas that either appeared undisturbed or to have a greater degree of potential for yielding intact buried cultural resources. Given the low potential for containing resources, shovel tests were typically spaced at 100 meter (300 foot) intervals. At water crossings and other areas determined to have a higher potential for yielding cultural resources the shovel test interval was reduced to 60 or 30 meters (180 or 90 feet) as deemed necessary by the archaeologist. Shovel tests were excavated to depths between 10 and 100 centimeters but were often restricted to a depth of no more than 40 centimeters (15 inches) per DOW safety regulations for areas containing buried pipelines and utilities.

Results

Site file review produced no records of previously recorded sites within a distance of 1.6 kilometers (1 mile) of the project. Several previous investigations have taken place in the general vicinity of the project including two performed by HRA Gray & Pape. No archaeological sites

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were recorded as part of investigations within 1.6 kilometers (1 mile) of the project areas. Two historical markers and 3 cemeteries are recorded within 1.6 kilometers (1 mile) of the project. Historic markers are associated with the First United Methodist Church and Barbers Hill Oil Field. Cemeteries in the area include the Barber and Williams, Fisher #2, and First United Methodist cemeteries.

Historical Marker #9122 commemorates the location of the First United Methodist Church. The spot was initially associated with Barber's Chapel, established circa 1877 when the Barber family donated land for a church and school. The school house served as the church until a church was constructed in 1897. The church was named Fisher's Chapel in honor of the principal donors for its construction. A cemetery was created around that same time. The current sanctuary dates to 1932 additional structures in 1945 and 1957.

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The Barber and Williams Cemetery is located on the west side of Spur 207 in Mont Belvieu. The cemetery contains headstones dating from the mid to late 1800s to the 2000s. The cemetery recorded as Fisher #2 by the THC is located west of Highway 146 in the Mont Belvieu oil complex. The cemetery contains approximately 12 burials with the earliest dating to circa 1890. The First United Methodist Cemetery is located on the east side of Spur 207 and. The cemetery dates to the time when Fisher's Chapel occupied the site and contains approximately 495 graves, the earliest dating to the late 1800s .

As planned, 5 survey transects were spaced 30 meters (100 feet) apart within the 170-meter (510-foot) wide survey corridor. Two of those transects were not excavated due to extensive disturbance from existing pipelines and the obstructions of wooden mats intended to allow heavy machinery to traverse the existing pipeline ROW. Because of extensive disturbance and active use by oil facilities the easternmost 12 hectares (30 acres) of the project area were also not shovel tested but subjected to visual reconnaissance only. The remaining 3 transects were shovel tested at 100-meter (328-foot) intervals along the length of the property. Shovel test intervals were decreased to 30 meters (100 feet) in areas near the old channel of Cedar Bayou. HRA Gray & Pape systematically excavated shovel tests primarily along the northern 3 survey transects, with judgmental shovel tests placed in areas that appeared to contain a high potential for yielding intact, buried cultural resources. As a result, a total of 57 shovel tests were excavated within the survey corridor. Shovel tests were excavated to a depth of 40 centimeters (15 inches) per DOW safety regulations in areas containing buried pipelines and utilities. All shovel tests were negative for buried archaeological materials. Soil profiles were typically composed of 1 strata of disturbed dense clay.

While systematically testing within the proposed Winfree Pump Station area, archaeologists also conducted visual inspection of the general surrounding area for the presence of historic

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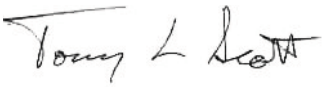
structures. One structure was photographed and recorded at the western edge of the project area, but was not determined to be of historic age or of historical significance. No other structures were observed within or adjacent to the project area, nor were any observed using historic aerial photographs.

Recommendations

Based on the lack of any cultural resources located within or immediately adjacent to the project area, HRA Gray & Pape will be recommending to the agency reviewers that no further work be required at the surveyed location. Should project plans change, additional work may be necessary. If you have any questions or comments, or are in need of additional information, please do not hesitate to contact me at tscott@hragp.com or (713) 541-0473.

Sincerely,



Tony Scott
Principal Investigator
HRA Gray & Pape, LLC

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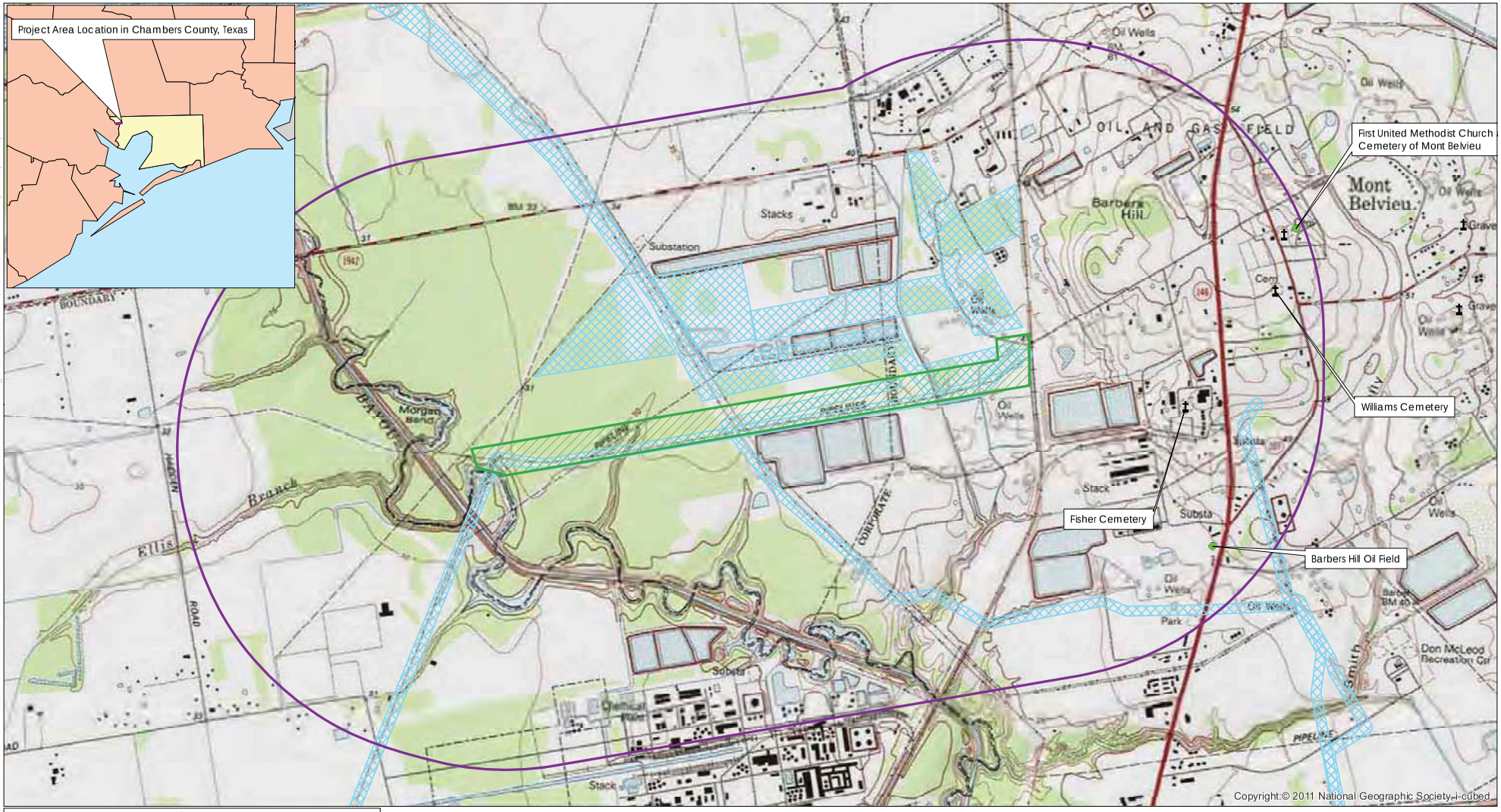

LEGEND

- Surveyed Area for the Proposed Winfree Pump Station
- 1.6-Kilometer (1-Mile) Cultural Review Area
- Historical Markers
- Cemeteries
- Areas Previously Investigated by HRAGP

N W E S

0 0.25 0.5 Miles 0 0.25 0.5 Kilometers

Overview Map of the Proposed Location for Proposed Winfree Pump Station in Mont Belvieu, Texas

HRA Gray & Pape LLC.

Figure 1

US EPA ARCHIVE DOCUMENT

Cultural Resources Assessment
The Dow Chemical Company
Light Hydrocarbon 9 (LHC-9) Unit Project
Freeport, Brazoria County, Texas

February, 2014

Supporting Documentation

HRA Gray and Pape, LLC

2013a - Results of Cultural Resources Survey and Review along Approximately 42 Miles for the Proposed Dow LHC-9, 12" Pipeline in Galveston, Harris, and Chambers County, Texas (SOW #1)

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HRA Gray & Pape, LLC

Mr. Joe Franklin
Wood Group Mustang, Inc.
16001 Park Ten Place
Houston, Texas 77084

January 14, 2013

Re: Results of Cultural Resources Survey and Review along Approximately 42 Miles for the Proposed DOW LHC-9, 12" Pipeline in Galveston, Harris, and Chambers County, Texas (SOW #1)

Lead Federal Agency: United States Environmental Protection Agency

Dear Mr. Franklin,

HRA Gray & Pape, LLC has completed cultural resources surveys along approximately 68 kilometers (42 miles) proposed for pipeline construction in Galveston, Harris, and Chambers Counties, Texas. The goal of this study was to assist Wood Group Mustang, Inc. (Mustang), their client, and the United States Environmental Protection Agency (USEPA) in determining whether or not intact cultural resources are present within the property, and if so to provide management recommendations for these resources. Field survey was performed between December 5, 2012, and January 3, 2013. As a result of survey efforts, previously identified archaeological sites or historic structures and potentially new historic structures were recorded within or adjacent to the APE. This letter documents the results of field surveys completed to date and a cultural resource review for remaining portions of the project.

Project Area Description

The proposed project consists of 68 kilometers (42 miles) of 12-inch diameter pipe to be used for transportation of Ethane. The proposed pipeline route extends from Mont Belvieu, Texas in Chambers County and heads southwest, crosses the Houston Ship Channel, and then terminates in Texas City, Texas in Galveston County. The project runs along an existing pipeline and transmission corridor for its entirety and was primarily composed of open prairie and wetland

Cincinnati Ohio | Missoula Montana | Houston Texas | Richmond Virginia | Seattle Washington | Portland Oregon | Providence Rhode Island

type areas with mixed vegetation including cordgrasses and other low-to-ground grasses and shrubs. In most instances the dense vegetation completely occluded surface visibility. Livestock were also present in many areas of the pipeline corridor. The proposed pipeline route crosses multiple waterways, including Cedar Bayou, the San Jacinto River, Barbours Cut, Taylor Bayou, Clear Lake, Dickinson Bayou, Moses Bayou, and several other unnamed natural and channelized waterways and drainages. Field survey took place along portions of the proposed 68 kilometer (42 mile) route within a 60-meter (200-foot) wide survey corridor. In areas where the existing pipeline corridor was wider than the survey corridor, survey was expanded to capture the entire existing corridor. In total this encompasses approximately 476 hectares (1176 acres). These dimensions define the project's Area of Potential Effect (APE).

Methods

Prior to field efforts a site file research and literature review was performed in order to identify all previously recorded archaeological sites and previous investigations within 0.8 kilometers (0.5 miles) of the Project area. This work was conducted by reviewing online data available on the Texas Online Archaeological Sites Atlas, an online resource maintained by the Texas Historical Commission (THC), as well as an online database of the National Register of Historic Places (NRHP). Historic topographic maps and aerials were also consulted. A total of 6 previously recorded sites (41HR408, 41HR682, 41HR683, 41HR687, 41HR827, and 41HR1036) are mapped within or immediately adjacent to the project corridor. To date, survey efforts have attempted to confirm 5 of those sites (sites 41HR682, 41HR683, 41HR687, 41HR827, and 41HR1036). These sites are generally recorded as shell middens located adjacent to waterways and are often reported to contain prehistoric pottery, stone tools and flakes, and faunal bone. The sites were often noted to be subject to damage from erosion, subsidence, and pipeline construction.

The majority of the project contains conditions considered to be of a low probability for containing intact buried resources and much of the project area is located adjacent to major highways and roads, thus a windshield reconnaissance of the project was initiated prior to survey. These areas were then sampled by pedestrian walkover and intensive pedestrian survey. Transects were spaced 30 meters (100 feet) apart within the APE. Shovel testing was performed in areas that either appeared undisturbed or to have a greater degree of potential for yielding intact buried cultural resources. Given the low potential for containing resources, shovel tests were typically spaced at 100 meter (300 foot) intervals. At water crossings and other areas determined to have a higher potential for yielding cultural resources the shovel test interval was reduced to 60 or 30 meters (180 or 90 feet) as deemed necessary by the archaeologist. Shovel tests were excavated to depths between 10 and 100 centimeters but were often restricted to a depth of no more than 40 centimeters (15 inches) per DOW safety regulations for areas containing buried pipelines and utilities.

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Results

Approximately 45 kilometers (28 miles) of the pipeline totaling 263 hectares (650 acres) have been surveyed by a combination of windshield reconnaissance and pedestrian survey. The remaining 22.5 kilometers (14 miles) were assessed by a cultural resource review. Areas that were reviewed but not surveyed include small parcels controlled or owned by cities, drainage districts, and other subdivisions of the State of Texas; a condition that would require the attainment of an antiquities permit prior to survey according to the Texas Antiquities Code. Cultural resource review of those properties suggests a low probability for containing intact buried archaeological resources, an assessment supported by pedestrian survey efforts performed on adjacent properties. Thus an antiquities permit has not been sought for the project. Research and survey of locations adjacent to waterways have shown evidence of a high degree of disturbance. Many waterways have been channelized and widened, and bulkheads are present along some shorelines, specifically near marinas at Clear Lake. Areas adjacent to waterways have also been affected by subsidence and erosion; affects likely increased by impacts by previous pipeline installations. Soil profiles were typically composed of clay and clayey loam, which are considered to contain low potential for intact buried cultural sites (Abbott 2001).

Survey efforts resulted in the confirmation of 2 previously recorded sites (41HR827 and 41HR1036) and the discovery of 2 new potentially cultural loci (Temporary Sites 1 and 2). All are located on Hog Island (Figure 2).

Site 41HR827 was previously recorded in 1998 as a buried shell deposit composed of *Rangia* clam and oyster mapped within the north/central portion of the island within and adjacent to an existing pipeline corridor. Recent observation of the location confirms the presence of buried shell. The material is thickest near the surface with the density decreasing with depth. A total of 20 shovel tests were positive for buried shell extending from within the existing pipeline corridor and into the tree line south of the corridor. Buried shell likely extends further to the south and possibly the north although shovel testing was not pursued further beyond the survey corridor/APE. Previous pipeline installations have left some amount of shell visible on the surface. Surface survey and shovel testing within and around the site did not result in the discovery of cultural artifacts.

Site 41HR1036 was previously recorded in 2008 as a historic road which crossed the west side of Hog Island and continued along a timber causeway across Tabbs Bay. Recent observation of the location confirms the existence of the site as a concrete road bed is visible at the north edge of an existing pipeline corridor and extends to the north. The road is easily identifiable but appears to be sinking as a result of subsidence.

Temporary Site 1 is located north/east shoreline of the southern half of the island. The site consists of a shell berm that rises up to approximately 1 meter (inches) above the surrounding ground surface and was followed for 190 meters (624 feet) along the high tide mark along the shore of the island. The berm consists of several layers of shell aligned parallel to the shoreline. To the north and east is sand and clay beach which is likely inundated at times of high tide and to

the south/west is marsh. Active colonies of clam and oyster are visible on and in the beach. Surface survey and shovel tests around the perimeter of the berm and within it produced no cultural artifacts.

Temporary Site 2 is located approximately 50 meters (164 feet) from the west shoreline in the northern half of the island. The site consists of a buried deposit of *Rangia* clam and oyster. The site's location corresponds with a part of the island that was historically higher than the surrounding area and may represent a former natural berm or levee of the island's west shore. Surface inspection and shovel testing of the site produced no cultural artifacts.

Site 41HR682 was previously recorded in 1990 as a shell midden composed of *Rangia* clam and oyster mapped along the north/east shoreline of the southern half of the island in the vicinity of Temporary Site 1. It is not clear if the site on record with the THC is associated with Temporary Site 1, however the southern portion of the recorded site polygon on file with the THC overlaps the eastern portion of Temporary Site 1. Field observation of the recorded site boundary showed a sand and clay beach that is very nearly submerged at low tide and impossible to explore on foot.

Site 41HR683 was previously recorded in 1990 as a shell midden composed of *Rangia* clam and oyster mapped along the north/east shoreline of the northern half of the island. Field observation of the recorded site boundary showed a sand and clay beach that is very nearly submerged at low tide and impossible to explore on foot. It is possible that the site has eroded away or is buried under a sand and clay beach that extends from the current shoreline into Tabbs Bay.

Site 41HR687 was previously recorded as buried shell midden located on the west bank of Cedar Bayou. The site was originally recorded in 1990. At the time the site was recorded the recorder noted possible future impacts from dredging and widening of the bayou as well as subsidence and erosion. Recent survey efforts at the location failed to confirm the location of the site within the APE. It is possible that the site has completely eroded away or is now underwater within the bayou.

Site 41HR408 was recorded in 1980 as a historic homestead located near the east bank of Tabbs Bay. The recorded location for this site was not revisited during recent field efforts and its location in relation to the proposed project has yet to be determined.

Cultural resource review of the remainder of the project suggests 3 locations that are considered to have a high probability for containing archaeological sites. These locations are the east bank of Tabbs Bay including the location of previously recorded site 41HR408, the east bank of Cedar Bayou, and a small natural drainage located approximately 1.5 kilometers (0.9 miles) east of Cedar Bayou.

While performing reconnaissance and pedestrian survey, archaeologists also conducted visual inspection of the general surrounding area for the presence of historic structures. Historic aerials and topographic maps of the project area were also used to assist in identifying potential standing

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historic structures. As a result of survey 2 potential historic standing structures were recorded and photographed. One of these on the north side of Dickinson Bayou (at the intersection of Avenue U and Hillman Drive) is located within the survey corridor but outside of the existing pipeline ROW. The other is near the south side of Dickinson Bayou on the north side Edgewater Drive.

Discussion

The identification of shell concentrations on Hog Island is not surprising. Similar sites have been documented on barrier islands along the north Texas coast and the inclusion of mussels in the subsistence of native populations can be found in accounts by early European explorers. However, there are a number of possible explanations for the concentrations identified on Hog Island. Historic topographic maps dating as far back as 1916 and aerial imagery dating as far back as 1953 display a great deal of changes to the island's shape; changes which likely occurred at least in part to the addition of dredge spoil to the island (Figure 3). Subsurface profiles on the island contained heavily mottled sands and clays indicative of dredge spoil, a finding supported by the identification of what appeared to be a dredge pipe extending from the shoreline on the island's southwest corner. Historic aerial imagery also shows surface modifications resulting from industrial use including pipelines and access roads. Many surface modifications would likely have used shell in their construction.

Structures visible on a 1962 aerial of Hog Island correspond with the locations of Temporary Sites 1 and 2 (Figure 4). Survey also recorded active colonies of clam and oyster along the shores of the island. Based on the historic aerials and the mottled composition of the soils it is believed that Temporary Sites 1 and 2 are the result of a combination of shell roads or other structures and natural processes. This may be the case for other previously recorded sites on the island (sites 41HR681-683) however this assumption can not be confirmed at this time. Unlike Temporary Sites 1 and 2, site 41HR827 lacks the mottled soils that were recorded elsewhere on the island, reducing the implication of the site having resulted from construction or dredge spoil. Historic imagery does not show roads or other construction at the location; however an aerial image from 1957 suggests surface modification of some kind was taking place in the vicinity of the site on the north central portion of the island (Figure 5). Although buried shell extends into the existing pipeline corridor previous pipeline installations have resulted in scatters of shell on the surface and the subsequent subsidence has left the corridor generally lower and more prone to flooding and standing water. Of the 20 shovel tests that were positive for shell within Site 41HR827, none contained cultural artifacts. With the current level of investigation it is difficult to determine the site's provenance. However it is possible to recommend that the portion of the site within the existing corridor is not eligible for listing on the National Register of Historic Places (NRHP).

Summary and Recommendations

Background cultural resources review of the entire project length combined with visual reconnaissance and pedestrian survey within portions of the proposed project have resulted in

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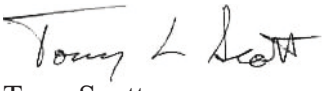
few areas of concern in regard to cultural resources within the proposed project's APE. The majority of the project area has been developed to a degree that the potential for intact buried cultural resources is minimal. Areas within the project that are generally considered high potential for cultural resources such as waterways and natural drainages show signs of erosion and subsidence, as well as previous impacts from channelization and the installation of bulkheads and pipelines.

The locations of sites 41HR1036 and 41HR827 were confirmed by survey. The portions of these sites located within the APE are not recommended as candidates for nomination to the NRHP and no further work regarding them is recommended for the current project. Newly recorded Temporary Sites 1 and 2 are considered the result of previous constructions on Hog Island and not recommended for further work. Three areas considered to retain a higher potential for intact resources, including the recorded location for Site 41HR408, have not been surveyed. These locations are recommended for avoidance by horizontal directional drilling.

Although project plans are not yet finalized it is the understanding of HRA Gray & Pape that all previously recorded site locations within the APE, both confirmed and unconfirmed, as well as unsurveyed high potential locations adjacent to waterways are planned to be avoided by horizontal directional drilling. Thus no recorded sites or potential site locations are planned for project impacts. Standing structures that have been identified as potentially historic are outside of areas planned for direct impacts. In addition, permanent project impacts will be underground and other than possible pipeline markers no visual impacts to potential historic structures will be created as a result of the project.

Based on planned avoidance of project impacts to the locations of cultural resources located within or immediately adjacent to the project area, HRA Gray & Pape will be recommending to the agency reviewers that no further work be required at the surveyed locations. Should project plans change, additional work may be necessary. If you have any questions or comments, or are in need of additional information, please do not hesitate to contact me at tscott@hragp.com or (713) 541-0473.

Sincerely,



Tony Scott
Principal Investigator
HRA Gray & Pape, LLC

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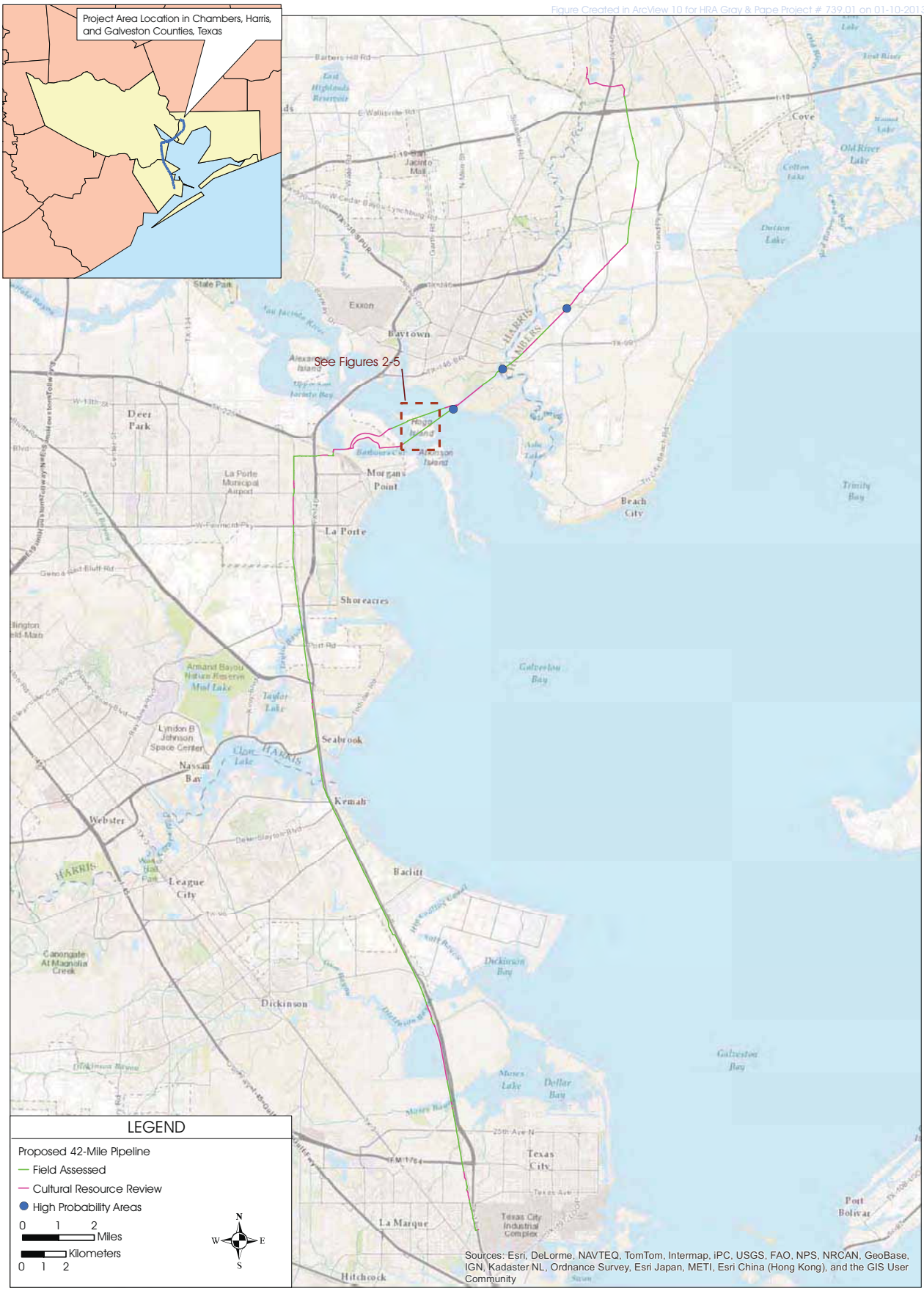

Overview Map of the Proposed DOW LHC-9 Pipeline Route

HRA Gray & Pape LLC.

Figure 1

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Figure Created in ArcView 10.1 for HRA Gray & Pape Project # 739.01 on 01/10/2013

LEGEND

- Pedestrian Survey Coverage
- Newly Recorded Resource Boundaries
- Previously Recorded Site Boundary

0 50 100 Meters

0 150 300 Feet

N W E S

Map of Pedestrian Survey Coverage on Hog Island and the Locations of Previously and Newly Recorded Resources

HRA Gray & Pape LLC

Figure 2

CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE TO PUBLIC

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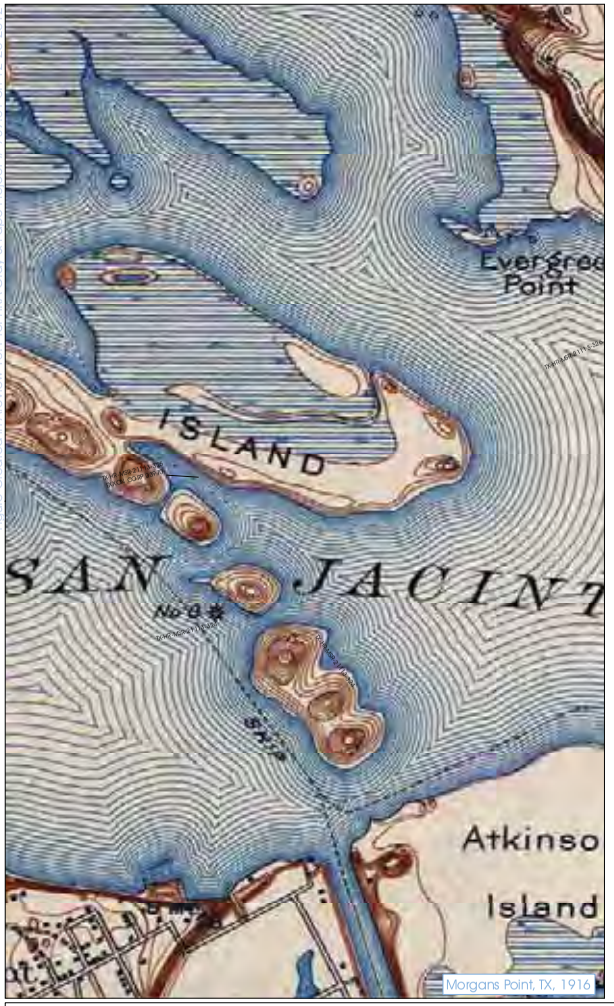
Figure Created in ArcView 10.1 for HRA Gray & Pape Project # 729-01 on 12-20-2012



LEGEND

Timeline of Topographic Maps Showing Changes to Hog Island as the Result of Erosion and Dredge Spoil

USGS Quadrangle Reference

0 0.25 0.5 Miles

0 0.25 0.5 Kilometers

N W E S

HRA Gray & Pape LLC

Figure 3

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Figure Created in ArcView 10.1 for HRA Gray & Pape Project # 739.01 on 01.15.2013

LEGEND

Newly Recorded Resource Boundaries

Previously Recorded Site Boundary

0 50 100 Meters

0 150 300 Feet

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Previously and Newly Recorded Resources Overlaid on a Circa 1962 Aerial Image of Hog Island

HRA Gray & Pape LLC

Figure 4

CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE TO PUBLIC

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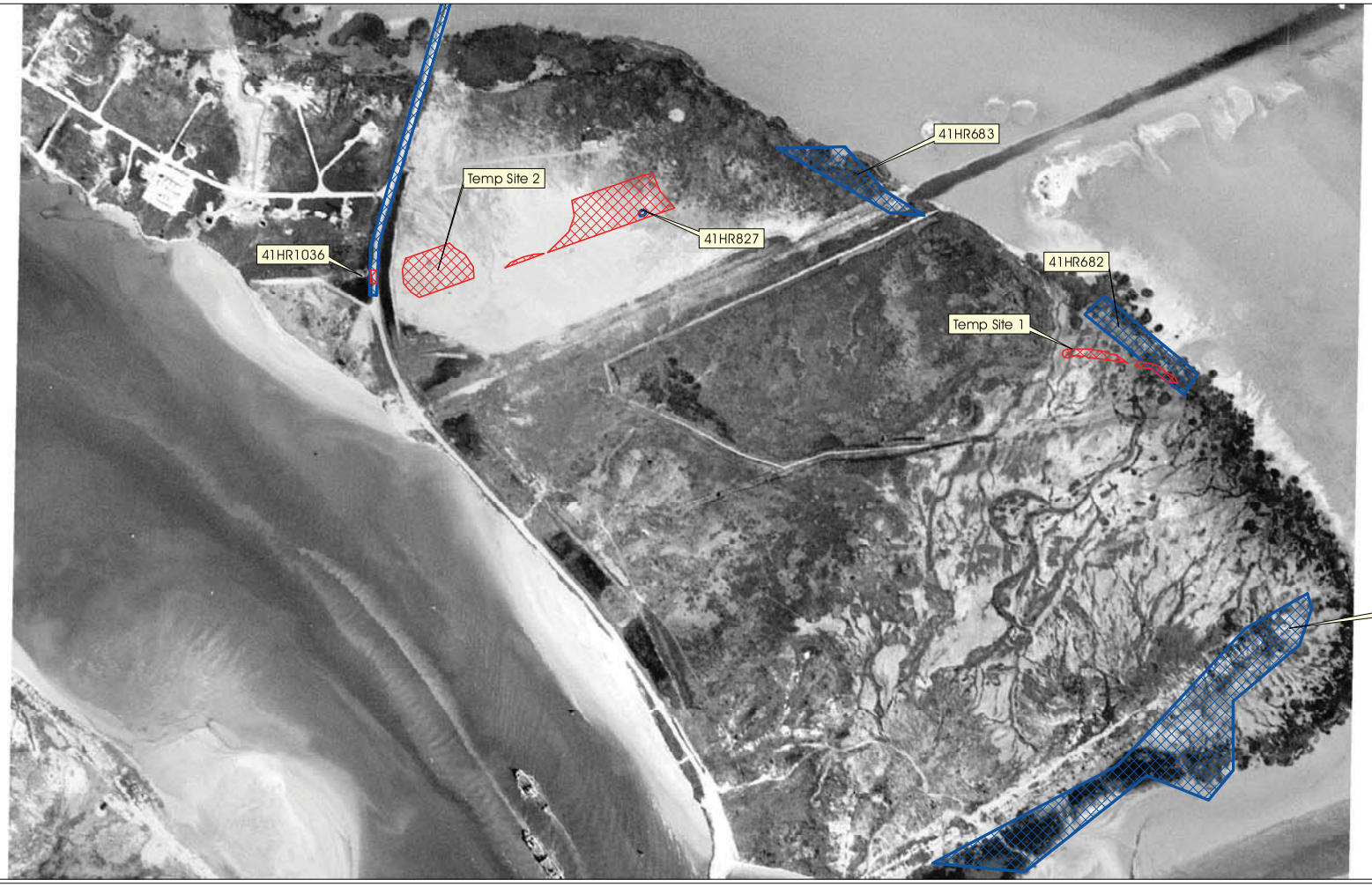
Figure Created in ArcView 10.1 for HRA Gray & Pape Project # 739.01 on 01-15-2013



LEGEND

Newly Recorded Resource Boundaries

Previously Recorded Site Boundary

0 50 100 Meters

0 150 300 Feet

N
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Previously and Newly Recorded Resources Overlaid on a Circa 1957 Aerial Image of Hog Island

HRA Gray & Pape LLC

Figure 5

CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE TO PUBLIC

Cultural Resources Assessment
The Dow Chemical Company
Light Hydrocarbon 9 (LHC-9) Unit Project
Freeport, Brazoria County, Texas

February, 2014

Supporting Documentation

HRA Gray and Pape, LLC

2012 - Cultural Resources Survey of 37 Miles for the Proposed Dow 12-Inch PDH-1 Freeport to Texas City Pipeline Project in Brazoria and Galveston Counties, Texas

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HRA Gray & Pape

DRAFT

CULTURAL RESOURCES SURVEY OF 37 MILES FOR THE PROPOSED DOW 12-INCH PDH-1 FREEPORT TO TEXAS CITY PIPELINE PROJECT IN BRAZORIA AND GALVESTON COUNTIES, TEXAS

Lead Federal Agency: United States Army Corps of Engineers, Galveston District

Texas Antiquities Code Permit # 6246

Prepared for:

Mustang Engineering, L.P.
900 Threadneedle, Suite 800
Houston, TX 77079

And

DOW Chemical Company

Prepared by:

HRA Gray & Pape, LLC.
1428 West Alabama Street
Houston, TX 77006

S E P T E M B E R 1 8 , 2 0 1 2

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HRA Gray & Pape Project # 739.00 Sept. 18, 2012

DRAFT

CULTURAL RESOURCES SURVEY OF 37 MILES FOR THE PROPOSED DOW 12-INCH PDH-1 FREEPORT TO TEXAS CITY PIPELINE PROJECT IN BRAZORIA AND GALVESTON COUNTIES, TEXAS

Lead Federal Agency: United States Army Corps of Engineers, Galveston District

Texas Antiquities Code Permit #6246

Prepared for:

Mustang Engineering, L.P.
900 Threadneedle, Suite 800
Houston, Texas 77079

Contact: Joe D. Franklin REM
Phone: (281) 206-6804

and

DOW Chemical Company

Prepared by:

Tony Scott, MA

Tony Scott, MA
Principal Investigator

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ABSTRACT

Mustang Engineering, L.P. of Houston, Texas, on behalf of their client the DOW Chemical Company, requested that HRA Gray & Pape, LLC conduct intensive cultural resources surveys within 59.5 kilometers (37 miles) for the PDH-1 Pipeline Project, in Brazoria and Galveston Counties. Nearly all of the proposed new alignment is to be collocated with existing pipelines. The Lead Federal Agency for the Project has been identified as the United States Army Corps of Engineers, Galveston District. The procedures to be followed by the United States Army Corps of Engineers to fulfill the requirements set forth in the National Historic Preservation Act, other applicable historic preservation laws, and Presidential directives as they relate to the regulatory program of the United States Army Corps of Engineers (33 CFR Parts 320-334) are articulated in the Regulatory Program of the United States Army Corps of Engineers, Part 325 - Processing of Department of the Army Permits, Appendix C - Procedures for the Protection of Historic Properties. In addition, portions of the project route are located on lands owned by the Brazoria National Wildlife Refuge, City of LaMarque and Galveston County. Therefore, this project is also subject to the requirements of the Texas Antiquities Code. Work on public property was conducted under Texas Antiquities Permit #6246.

Field survey efforts were conducted from April 14 to May 3, on May 9, and from August 14 to August 16, 2012. As a result of the investigation, a total of 391 hectares (966 acres) were surveyed by a combination of systematic shovel testing, pedestrian walkover, windshield survey, and photo documentation. A total of 234 shovel tests were excavated. Numerous previous disturbances were noted including the presence of multiple pipelines, artificial canals, and levees. Survey resulted in the identification of 2 new prehistoric archaeological sites, 41BO239 and 41BO240, and 2 new prehistoric isolate finds within and adjacent to the survey corridor. In addition, 1 historic structure was identified outside of the project corridor.

None of these newly identified sites, isolates, or structure were identified as possible candidates for nomination to the National Register of Historic Places and no further work regarding them is recommended for the current Project. The sites have been impacted by previous pipelines and planned directional drilling will avoid additional impacts to them. No evidence was identified for previously recorded sites 41BO162, 41BO161, and 41GV67. While it is possible that these sites were mis-plotted during their initial recordation, field efforts and a review of historic aerial imagery show their mapped locations to have been previously impacted. The recorded locations of sites 41BO162 and 41BO161 have been impacted by past pipeline activities and subsequent erosion. The recorded location of Site 41GV67 is now occupied by an artificial water channel which likely destroyed the site. Planned directional drilling will avoid additional impacts to the mapped site locations and no further work is recommended regarding these previously recorded sites.

Based on the results of the cultural resources survey, HRA Gray & Pape, LLC recommends that no further investigation be necessary within the project and that the project be allowed to proceed.

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1.0 INTRODUCTION

HRA Gray & Pape, LLC, (HRA Gray & Pape) on behalf of Mustang Engineering, L.P. (Mustang) and their client the DOW Chemical Company (DOW) conducted intensive pedestrian cultural resources survey within 59.5 kilometers (37 miles) for the proposed DOW 12-inch propane pipeline project (Project) in Brazoria and Galveston Counties, Texas.

For Nationwide 12 permitting requirements, the Lead Federal Agency for the Project has been identified as the United States Army Corps of Engineers (USACE), Galveston District. Therefore, the USACE's issuance of a permit for the Project is considered an undertaking subject to the provisions and review process provided in Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. A USACE permit number has not yet been assigned for this Project. The goals of the cultural resources survey were to determine if land altering activities required to complete this Project would affect any previously identified historic properties as defined by Section 106 of the NHPA of 1966, as amended (36 CFR 800), and to established whether or not previously unidentified cultural resources were located within the Project's Area of Potential Effect (APE). Fieldwork and reporting activities were completed with reference to state (the Council of Texas Archeologists [CTA]) and federal (NHPA) guidelines.

In addition, portions of the project route are located on lands owned by the City of LaMarque and Galveston County, political subdivisions of the state of Texas. Therefore, this project is also subject to the requirements of the Texas Antiquities Code. Work on property owned by the City of LaMarque and Galveston County was conducted under Texas Antiquities Code (TAC) Permit #6246. The goals of the cultural resources survey were to determine if land altering activities required to complete this project would affect any previously identified historic properties as defined by Section 106 of the NHPA of 1966, as amended (36 CFR 800), and to established whether or not previously unidentified cultural resources were located within the project's APE.

1.1 Surveyed Area and APE Description

In general, the Project's route extends a total of approximately 59.5 kilometers (37 miles) from the DOW facility at the Stratton Ridge Oil Field in Brazoria County, Texas, to the DOW facility in Texas City in Galveston County, Texas. Of that length approximately 36.7 kilometers (22.8 miles) is located in Brazoria County and 21 kilometers (13.2 miles) is located in Galveston County. The project is located on the *Oyster Creek*, *Danbury*, *Hoskins Mound*, *Mustang Bayou*, *Hitchcock*, and *Virginia Point*, United States Geological Survey (USGS) 7.5-minute topographic quadrangle maps (Figure 1). The permanent right-of-way (ROW) will be within a 30-meter (100-foot) corridor. Temporary construction ROW is expected to be within 30 meters (100 feet) to either side of the proposed centerline with some temporary workspaces at waterways and road crossings extending to 45.7 meters (150 feet) from the proposed centerline.

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US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 793.00 on 09-13-2012

LEGEND

- Project Location
- Extent of Figures A1 to A22
- Quadrangle Boundaries

USGS 7.5' Quadrangle Reference

0 2.5 5 Miles

0 2.5 5 Kilometers

N W E S

Topomap Overview of the DOW 12-Inch Pipeline Project in Brazoria and Galveston Counties, Texas

HRA Gray & Pape LLC

Figure 1

Based on current project plans, the USACE Permit Area for the pipeline portion of the project is defined as a series of waterways and wetlands that are believed to be within USACE jurisdiction. These include Bastrop, Austin, Chocolate, Halls, and Basford Bayous, and a number of smaller sloughs and sources of fresh water and aquatic resources. Approximately 12.6 kilometers (7.8 miles) of proposed Project centerline are located within the Brazoria National Wildlife Refuge. In addition, approximately 1.1-kilometer (0.7-mile) of the project corridor is located on lands owned or controlled by political subdivisions of the state of Texas. These include the City of La Marque and Galveston County.

The survey corridor for the project consists of a corridor measuring 61 meters (200 feet) wide for the length of the project with some locations of water and road crossings including an additional temporary workspace extending the survey area to 90 meters (300 feet) wide. Areas that fall under USACE jurisdiction, land controlled by a political subdivision of the state, and areas considered to have a high probability for containing intact buried cultural resources define the Project APE. However, the entire alignment has been assessed for the potential to impact intact archaeological sites and historic structures.

Although primarily used for pasture the Project is to be located within or immediately adjacent to heavily used pipeline corridors. In addition, numerous pipelines intersect the route. Some clusters of recently plowed agricultural fields also comprise portions of the Project. Portions of the Project located near Clute and Texas City were located on land that has been extensively modified for industrial use. Therefore, the majority of the surveyed area has encountered some amount of belowground disturbance due to previous construction activities associated with existing pipelines and industrialization.

1.2 Organization of the Report

This report is organized into 7 numbered chapters. Chapter 1.0 provides an overview of the surveyed area. Chapter 2.0 presents an overview of the environmental setting and geomorphology of the surveyed area. Chapter 3.0 presents a discussion of the cultural context associated with surveyed area. Chapter 4.0 presents the research design and methods developed for this investigation. The results of this investigation are presented in Chapter 5.0. Chapter 6.0 presents the investigation summary and provides recommendations based on the results of field survey. A list of literary references cited in the body of the report is provided in Chapter 7.0.

1.3 Acknowledgements

Tony Scott served as the Principal Investigator. Jim Hughey served as Project Manager. Fieldwork was completed by Tony Scott, Field Director Elizabeth Spalding, and Field Technicians Craig Cosby and Luke Bahar. All of the content of this report including graphics was prepared Tony Scott. The report was produced by Jessica Bludau.

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2.0 ENVIRONMENTAL SETTING

The following section provides a discussion of general geomorphological and environmental characteristics found in Brazoria and Galveston Counties, Texas. This is followed by discussions of soil morphology, flora and fauna, and land use of the area.

2.1 Geomorphology

The Project lies within the Texas Coastal Prairie, a low, level to gently sloping flat prairie extending across the Texas Gulf Coast (University of Texas, Bureau of Economic Geology [UT-BEG] 1996). The basic geomorphological characteristics of the Texas coast and associated inland areas, which includes Brazoria and Galveston Counties, resulted from depositional conditions influenced by the combined action of sea level changes from glacial advance in the northern portions of the continent and subsequent downcutting and variations in the sediment load capacity of the region's rivers. Locally, Brazoria and Galveston Counties are represented by a geologic structure of nearly flat strata underlain by relatively recent deltaic sands and muds ranging in age from the Miocene to Holocene (Abbott 2001; UT-BEG 1996; Van Siclen 1991).

Although older geologic units have been identified in the region (Abbott 2001; Van Siclen 1991), units relevant to the study of long-term human occupation near the surveyed area include the Beaumont Formation, generally believed to predate human occupation in the region. The Beaumont Formation in the area is characterized by yellowish- to brownish-gray clay, and includes reddish orange intermixed and interbedded fine to fine quartz sand, silt, and minor fine gravel. Evidence of the formation can be found on stream channel, point-bar, cravasse-splay, and natural levee ridge deposits, and clayey fill in abandoned channels. Channel fill is generally dark brown to brownish dark gray, laminated organic-rich clay and silt. Other characteristics of the Beaumont formation include meander-belt ridges and pimple mounds 1 to 2 meters (3 to 6.5 feet) higher than the surrounding silt and clay (Moore and Wermund 1993a and b).

Overlaying Beaumont deposits may be relatively thick or thin Holocene-age alluvial deposits laid down in the area by alluvial or eolian factors or potentially marshy environments (UT-BEG 1992). The so-called "Deweyville" terraces may exist stratigraphically positioned between the Beaumont and Recent deposits. These terraces date to between 100,000 to 400,000 years ago, and are characterized as consisting "of up to 3 inset fluvial terraces…(distinguished by the presence of)…large looping meander scars…" indicative of watercourses capable of fluvial action and discharge markedly greater than that seen today (Abbott 2001:16).

2.2 Soils – Brazoria County

In Brazoria County, 19 soil map units have been identified within the Project corridor. These entail Asa silt loam, Asa silty clay loam, Bacliff clay, 0 to 1% slopes, Bernard clay loam, Bernard-Edna complex, Edna fine sandy loam, 0 to 1% slopes, Edna fine sandy loam, 1 to 5% slopes, Edna-Aris complex, Follet clay loam, Francitas clay, Harris clay, Lake Charles clay, 0

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to 1% slopes, Leton loam, Leton-Aris complex, Morey silt loam, Narta fine sandy loam, Pledger clay, Surfside clay, and Veston silty clay loam (United States Department of Agriculture, Natural Resources Conservation Service [USDA-NRCS] 2007). Of those soils, the majority of Brazoria County portion of the pipeline is within Edna-Aris complex (19%), followed by Francitas clay (17.5%). Of the 19 listed soils series, Asa and Pledger are considered to have a high and moderate to high potential for deeply buried intact cultural deposits respectively (Abbott 2001). These soils comprise approximately 2% and 1% of the Brazoria County portion of the Project respectively. Asa soils are mapped on both sides of Big Slough and Pledger clay is mapped on 2 tracts of property south of Big Slough. Although it is possible for these soils to contain a high potential for intact buried cultural deposits they have been heavily modified by agriculture, previous pipeline installations, and dredging activities.

2.3 Soils – Galveston County

In Galveston County, 15 soil map units have been identified within the Project corridor. These entail Bernard clay loam, Bernard-Edna complex, Edna fine sandy loam, Follet loam, Francitas clay, Ijam clay, 0 to 2% slopes, Francitas-Urban land complex, Leton loam, Leton-Aris complex, Mocarey-Cieno complex, Mocarey-Leton complex, Morey-Leton complex, Narta fine sandy loam, and Tracosa mucky clay-clay, low complex (USDA-NRCS 2008). Of the 15 listed soil series, Narta fine sandy loam comprises the greatest amount (approximately 33%) of the Galveston County portion of the Project. The next highest amount of mapped soil consists of Mocarey-Cieno complex at 15.5%. Of the 15 listed soils series 4 are considered to have a low to moderate potential for deeply buried intact cultural deposits (Abbott 2001). These include Cieno, Follet, Narta, and Tracosa soils. Tracosa soils are located on both banks of Basford Bayou while Follet soils are located north and south of Highland Bayou. Mocarey-Cieno complex and Narta soils spread across wide swaths of the Project between major waterways. Although it is possible for these soils to contain a moderate potential for intact buried cultural deposits they have been heavily modified by agriculture, previous pipeline installations, and dredging to create artificial canals and drainages.

2.4 Flora and Fauna

The surveyed area is located within a transitional area between the 2 ecological regions of the Gulf Coastal Marshes and Gulf Coastal Prairies (UT-BEG 2010; Blair 1950). Modern land alteration activities, especially those associated with rice farming, have resulted in the removal of native plant species from the area. Identified trees may include water oak, pecan, various elms, cedar, oaks, sweetgum, and mulberry, although the Chinese tallow has become the dominant species in many areas. Honeysuckle, dewberry, yaupon, and blackberry are common, as are indiangrass and bluegrasses (Gould 1973; UT-BEG 2000). Mammals in the area include deer, squirrels, raccoons, opossum, rabbits, skunks, and gophers. Riparian species include freshwater mussels and snails, alligators, and many different species of fish, turtles, and snakes (Jones 1982).

2.5 Land Use

Land within and adjacent to the Project consists of existing pipeline ROW. Areas outside of the existing pipeline ROW is classed as follows: nearly half (46%) of the survey corridor is

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classed as grassland, 21% is classed as wetland, 14% cultivated land, 9.5% wooded, 3.4% high intensity developed, 3.2% open water, 1.5% low intensity developed, 0.1% bare/transitional land, and 0.1% wooded wetland (Houston-Galveston Area Council [H-GAC] 2012). Much of the Project area is used as cattle pasture. In cultivated area crops include rice, grain sorghum, cotton, and soybeans (Crenwelge et al. 1981). The main problem that crop growers face is poor drainage. Nearly all soils are somewhat poorly drained due to the flat to very gently sloping topography. Other uses include industrialization, particularly at either end of the project in the cities of Clute and Texas City.

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3.0 CULTURE HISTORY

Between the San Bernard River and Sabine Lake, most prehistoric sites near the coast consist of shell middens found in estuaries or exposed in cutbanks along streams (Aten 1983; Patterson 1985). Inland sites are more similar to generalized open campsites. In both areas, sites are found near stream channels. Historic sites tend to reflect farm or homesteads, generally dating to the mid-nineteenth century.

3.1 Prehistoric Period

The cultural context of the upper coastal region is described by Aten (1983) and Story (1990). This information is merged with the archaeological data here to give a complete picture of life on the Upper Texas Coast. Along the Upper Texas Coast, the Paleoindian period begins around 12,000 Before Present (B.P.) and ends near 9,000 B.P. (Aten 1983; Story 1990). The population during this stage was highly mobile in response to the movement of food sources. Isolated artifacts include Clovis, Angostura, Scottsbluff, Meserve, Plainview, and Golondrina point types (Aten 1983).

The Transitional Archaic period begins about 9000 B.P. and ends around 7500 B.P. (Aten 1983; Story 1990). The Archaic stage is thought to include a shift towards a diet more geared towards plant processing, but still included hunting (Story 1990). Beginning at 7500 B.P. and spanning 2500 years (Aten 1983), the Early Archaic period in this region has not been well documented. Points from this period include Bell, Carrollton, Trinity, Wells, and Early Stemmed.

The Middle Archaic period (5000 to 3000 B.P.) is represented by the earliest surviving shell middens (Aten 1983) in the area. These middens contain remains of shellfish, such as oysters and estuarine clams, faunal material from terrestrial and aquatic vertebrates, and the earliest known human burials in the region (Aten 1983). Characteristic projectile points include Bulverde, Williams, Lange, and Pedernales types.

The Late Archaic lasted from 3000 to 2000 B.P. and shows evidence for population increase (Aten 1983). Projectile points differ from earlier periods. Points associated with the Late Archaic are corner-notched or have expanding-stems, such as the Kent, Ellis, and Pontchartrain types. The transition from Late Archaic stage to Late Prehistoric is indicated by the introduction of ceramics into the assemblage (Aten 1983). The cultural tradition during the Late Prehistoric along the Upper Gulf Coast has been designated as Woodland. Story (1990) has suggested the use of the term Mossy Grove Tradition to define cultural patterns of the region. Story (1990) splits the Mossy Grove Tradition into 5 distinct time intervals on the coast, while noting that only 2 are found inland.

3.2 Historic Period Brazoria County

Before European colonization of this region, it was occupied by the Karankawa Indians. Five different subgroups of Karankawa Indians, with the northern most tribe called the Cocos, lived in the area of modern day Brazoria County (Ricklis 2004).

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In 1528, Alvar Nunez Cabeza de Vaca landed on San Luis Island and crossed the Brazos River in the area that would become Brazoria County. Many other Spanish explorers passed through the area, like Alonso De Leon in 1689 looking for the lost La Salle expedition and in 1727 Joaquin de Orobi y Basterra came through looking for French intruders in the Trinity River area.

Stephen F. Austin and 89 of Austin's Old Three Hundred settled the area in 1824. Some of the earliest communities were Velasco, Brazoria, and Columbia. It was in Velasco, soon after the Battle of San Jacinto, that General Santa Anna signed the Treaties of Velasco with the Republic of Texas on May 14, 1836. Under this newly formed provisional government came the formation of the first counties in Texas, among them Brazoria County, taking its name from the Brazos River (Kleiner 2012a). Between 1849 and 1859, the county of Brazoria flourished. The county became the wealthiest in Texas due in part to its largely southern society based on plantation life and slavery. Agriculture was the foundation for the county's economy based primarily on sugar and cotton (Kleiner 2012a).

Prior to the Civil War, the majority of white residents favored secession, which paved the way for new industries to be organized to help the Confederate Army, such as the Dance Brothers gun works manufacturing shop. Up until the time of the Great Depression, most Brazoria County residents made their living from agriculture with a maximum number of farms in 1940 reaching 3065. A major boom for the economy came from the greater production of rice. By 1940, the total acreage for rice had risen from 6000 acres to approximately 16,000 acres and became the nation's number one rice producing area (Kleiner 2012a).

Brazoria County established its first school in 1827, followed by the Brazoria Academy in 1839. Academia became an integral part of the county around 1900 with the introduction of 8 independent school districts employing 200 teachers to educate the county's 6000 students. The results of the county's educational efforts can be seen in the statistics of 1950 where only 23% of the population had completed high school, but in 1982 more than 65% percent had graduated from high school (Kleiner 2012a).

Now Brazoria County offers an assortment of recreational activities, everything from fishing, hunting, boating, skiing, and an array of other water sports. In conjunction, they also offer access to historic sites such as the Varner-Hogg Plantation State Historical Park. The county also contains Brazoria National Wildlife Refuge.

3.2.1 The Brazoria National Wildlife Refuge

Approximately 12.6 kilometers (7.8 miles) of the current Project passes through the Brazoria National Wildlife Refuge. The refuge, established in 1966, is administered by the United States Fish and Wildlife Service, Department of the Interior and is located 8 kilometers (5 miles) east of the City of Freeport, Texas. The refuge includes the banks of Austin Bayou and contains several small lakes, providing habitat for more than 425 species of wildlife of which 270 are species of birds. The refuge provides essential winter habitat for birds on the Central Flyway, one of 4 major migratory routes over the continental United States. Today the refuge encompasses a total of 16,530 hectares (40,854 acres) (Jenkins 2012).

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3.2.2 The Cities of Freeport, Stratton Ridge, and Clute, Texas

The City of Freeport, Texas was officially founded by the Freeport Sulphur Company in November 1912. The city is the location of a deepwater port at the mouth of the Brazos River and the largest sulphur mines in the world. The community was also the headquarters of the Houston and Brazos Valley Railway. The city has profited enormously from the development of chemical and petrochemical storage facilities and from commercial fishing (Kleiner 2012b). The introduction of Dow Chemical Company in the early 1940s provided support to the City's involvement with the Brazosport Industrial Complex, which was created during World War II. The industrial complex includes Freeport and the neighboring cities of Brazoria, Clute, Jones Creek, Lake Jackson, Oyster Creek, Quintana, Richwood, and Surfside Beach. The complex produces plastics, machinery, ships, and metal products (Encyclopedia Britannica, Inc. 2012). The port is home to one of the largest shrimp boat fleets in the entire Gulf of Mexico. In 1957, the City of Freeport integrated the historic Texas town of Velasco (Kleiner 2012b).

Stratton Ridge, Texas, which was originally known as Ranch Prairie or Phair, was a loose community dating to the mid nineteenth century. The community gained a modest population and even a post office, but lost residents after the Galveston hurricane of 1900. Sometime in the early twentieth century the community became known as Stratton Ridge, purportedly derived from a church built in 1933 in honor of an early settler by the name of J. T. Stratton. By 1936 state highway maps indicated Stratton Ridge and by 1979 the original townsite of Phair, plotted nearly a mile away, consisted of an abandoned railroad station and church (Kleiner 2012c).

The City of Clute is located on the site of Evergreen Plantation, one of the county's first plantations, dating to 1824. After 1839 the plantation later became the Herndon or Calvit-Herndon plantation when John H. Herndon married the daughter of original property owner Alexander Calvit. After the Civil War several relatives of the Clute family founded a community near the plantation and acquired additional land from Herndon and the property became known as Clute's Place from 1886 to 1889. The community remained small (only a population of 10 in 1933) until 1940 when it became part of the Brazosport industrial and port area. Fourteen years later the community had a population of 3,200 with several businesses. The townsite was incorporated in May 1952 under the name Clute City and in 1955 changed its name to Clute only to change its name to Clute City again in 1980. As recent as 2000 the City reached a population high of 10,424 and once again was known simply as Clute (Kleiner 2012d).

3.3 Historic Period Galveston County

Galveston County was formed with the help of Brazoria, Harrisburg (Harris), and Liberty Counties in 1838. The first Anglo occupation of the area began in 1815 when a few ships associated with Henry Perry and Waren D. C. Hall landed at Bolivar Point. Jean Laffite formed the first community recorded on the island of Galveston in 1817 known as Campeche. The small fort only survived until 1819 when it was destroyed by storm (Kleiner 2012e).

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Before colonization started in the area, early Spanish explorers used to refer to the island as Isla de Malhado (Isle of Misfortune). This name is credited to Alvar Nunez Cabeza de Vaca, who was shipwrecked in the area in 1528. During the exploration of the area by Rene Robert Cavelier, Sieur de La Salle the island was designated San Louis to honor the king of France Louis XIV. The island finally achieved its current name in 1783 when the channel was surveyed and the bay was named Galvezton in honor of Viceroy Bernardo de Galvez. Although the land held its name of San Luis for a time, by 1820 it was being called Galveston Island (Kleiner 2012e).

In 1822, the ship Revenge brought a small group of Americans to settle a part of Galveston County and in 1827 the first American settlement was established near Offat's Bayou. Stephen F. Austin helped spark the flow of settlers to the area by convincing the government of Mexico to build a port and customhouse on the island. In 1830, a company called the Galveston Bay and Texas Land Company was formed by David G. Burnet and Lorenzo de Zavala to help settle the area under the Mexican colonization laws. By the time that the United States annexed Texas, Galveston was the largest city in Texas with a population of 3,500 (Kleiner 2012e).

The island of Galveston has had a tumultuous past including being taken over by Northern forces during the Civil War in 1862, having a yellow fever epidemic in 1864, which all but wiped out the population, and even surviving one of the worst hurricanes on record in 1900. Through all of this Galveston has remained strong and prosperous. It was still recorded as the largest city in Texas in 1880 with over 530 businesses, 10 hotels, and 127 saloons. The town continued to prosper up to 1930 with railway access being improved with the construction of a causeway and interurban railroad (Kleiner 2012e).

Today Galveston County is one of the most populated counties in Texas, with about half of the land being used for farming or ranching. The Galveston area still remains a focal point for medical services as well as aquatic research (Kleiner 2012e).

3.3.1 The City of Texas City, Texas

Texas City, on the southwestern shore of Galveston Bay was initially conceived in 1891, by 3 brothers from Duluth, Minnesota. The Myers brothers saw that the area had potential as a major port and they along with other shippers in Duluth, collectively known as the Texas City Improvement Company, bought 4,047 hectares (10,000 acres) of Galveston Bay frontage and named the area Texas City. The Gulf Channel leading into the port was authorized by the federal government in 1893 and the first shipment using the channel took place in September of 1894. The port was eventually supplemented by a rail line to the Texas City junction of the Galveston, Harrisburg and San Antonio and the Galveston, Houston and Henderson railroads. This network of rail connections allowed shippers to send freight by train to Houston, where it could join the national railway systems. After the channel had been deepened in 1905, along with the railroad connections and the expansion of warehouses and docks made Texas City an attractive port. Discovery of oil at the Spindletop oilfield in 1901 and the subsequent building of the Texas City Refining Company in 1910 only increased the use of the port. The next 20 years saw the location expand to include tank farms, pipelines, and 3 more refineries (Benham 2012).

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Perhaps most amazing is the city's ability to rebound after several natural, economic, and industrial disasters beginning with the hurricane of 1915, The Great Depression in the 1930s, The Texas City Disaster of 1947, Hurricane Carla in 1961, the BP explosion in 2005, and Hurricane Ike in 2008. The city's strong industrial ties to the oil, chemical, plastics, and petrochemical industries along with lessons learned from those disasters will likely allow Texas City to maintain its importance among Texas ports (Benham 2012).

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4.0 METHODOLOGY

4.1 Site File Research and Literature Review

The site file research and literature review was performed in order to identify all previously recorded archaeological sites and previous investigations within 0.8 kilometers (0.5 miles) of the Project area. This work was conducted by reviewing online data available on the Texas Online Archaeological Sites Atlas, an online resource maintained by the Texas Historical Commission (THC), as well as an online database of the National Register of Historic Places (NRHP) (2012). Historic maps from the collection of David Rumsey (2003) were also consulted in cooperation with Google Earth (Burr 1839; United States General Land Office [GLO] 1867) and researching maps maintained by the Texas GLO (2012).

As part of these investigations, HRA Gray & Pape created a series of tables to document previously identified cultural resources and previous investigations located within a 0.8-kilometer (0.5-mile) study radius. This work was used to provide a historic context to the cultural resources survey, and additional documentary research was conducted in order to provide an understanding of the development and history of the surrounding area, and southeast Texas in general. This research then was used to prepare an overview history of the area and provided an understanding of the contextual framework of Brazoria and Galveston Counties' prehistory and history, and southeastern Texas in general.

4.2 Predictive Modeling using ArcView GIS

The locations of prehistoric and historic archaeological sites typically conform to a set of favorable environmental conditions including, but not limited to, choosing elevated areas protected from frequent episodic flooding, locales with well-drained soils, and close proximity to perennial freshwater streams where fish and other wildlife may have been found in abundance.

Several environmental factors were used to create a model for predicting the likelihood of encountering unidentified archaeological deposits within the surveyed area. These factors include:

- Known archaeological resources;
- Historic maps
- Topography;
- Soils and geomorphology;
- Natural waterway including major rivers, creeks, and intermittent streams;
- Wetlands; and
- Land use and land cover.

Using ArcView Geographic Information Systems (GIS), geo-referenced layers of these environmental data were overlain on a shapefile of the proposed pipeline route and 60-meter (200-foot) wide survey corridor. Data used for GIS modeling include that available from the

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Texas Archeological Sites Atlas, the GLO (2012), the National resource Conservation Service (NRCS), the National Hydrography Dataset (NHD) (2012), the Texas Natural Resources Information System (TNRIS) (2012), the Environmental Systems Research Institute (ESRI) (2012), and H-GAC.

The resultant maps were evaluated for areas that could potentially contain favorable conditions for site occupation as outlined above. The identified areas are referred to as high potential areas (HPAs). HRA Gray & Pape selected several HPAs within the surveyed area at the desktop level. These HPAs possess one or more of the following characteristics:

- well-drained soils with high geoarchaeological potential as discussed in Chapter 2.0 including Pledger and Asa soils;
- pimple mounds or otherwise natural, elevated, flat, level terrain;
- land with intact natural ground surfaces composed of undeveloped grassland and woody land typically used for farming/ranching, as indicated by the H-GAC (2012); and
- close proximity to a natural waterway, this includes marshes and remnants of old channels.

Preliminary desktop analysis of the Project alignment identified 73 locations as possible HPAs. In addition to the environmental identifiers listed above the project alignment was also overlaid on historic aerial imagery and topographic maps to assess for the potential of historic structures.

4.3 Project Coordination

Project coordination with William Martin of the THC took place on April 18 and 26 of 2012. Texas Antiquities Code Permit #6246 was provided by Jeff Durst of the THC on May 1 of 2012. As advised by the THC, coordination also took place with Cody Denge, Park Manager of the Brazoria National Wildlife Refuge on April 18 to define suitable survey methods and rules of entry for the property. The Project was also discussed with numerous pipeline representatives in response to a One-Call Locate submitted on April 16, 2012 in order to ensure safety during subsurface testing.

4.4 General Field Survey Methods

HRA Gray & Pape implemented a survey strategy focusing on areas that fall under jurisdiction of the USACE, Galveston District, on properties owned or controlled by political subdivisions of the state of Texas, and HPAs for containing buried cultural deposits. To select survey areas the proposed route was examined for: waterways and wetlands that are believed to be within USACE jurisdiction; recent and historic topographic maps and aerial images for areas that may have once contained waterways and wetlands; possible historic structures; and finally by determining property ownership. Water crossings selected for investigation did not include man-made canals and ditches except in cases where evidence showed a natural waterway predated the man-made structure. Highly modified/channelized banks of waterways were omitted from subsurface testing. Areas inside existing refineries were not surveyed or visually

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inspected due to the previous impacts that have taken place within them. In general, the USACE jurisdictional waterways and wetlands would be subject to survey under the proposed work plan. The remainder of the Project was assessed for archaeological potential and field observations guided additional testing efforts along the Project's alignment.

Survey of the Project area consisted of pedestrian reconnaissance, photo-documentation, and limited shovel testing. A handheld Global Positioning System (GPS) receiver capable of sub-meter accuracy data recording was used to assist in survey. To facilitate record keeping and to measure survey progress, the Project length was overlaid onto property parcels and divided into segments and numbered accordingly based on the parcel tract numbers. Subsurface testing, photos, and field notes were all referenced to these tract numbers.

Two parallel linear transects spaced 30 meters (100 feet) apart were surveyed within the 60-meter (200-foot) wide survey corridor. Within the surveyed areas, Transect A was always located 15 meters (49 feet) to the north/west side of the centerline and Transect B was always located 15 meters (49 feet) to the south/east side of the centerline. Additional transects were added to capture workspaces that fell outside of the pipeline survey corridor. The HPAs were subjected to the systematic excavation of shovel tests. Per THC guidelines, minimum standards for surface reconnaissance and subsurface testing on linear projects call for 16 shovel tests per 1.6 kilometers (1 mile), within a 30-meter (100-foot) wide study corridor. For non-linear areas between 4.45 and 40.47 hectares (11 and 100 acres) in size, the THC minimum survey standards call for the excavation of 1 shovel test every 0.81 hectares (2 acres). The shovel test interval within HPAs ranged between 30 and 100 meters (100 and 300 feet) and was determined based on observed environmental conditions. In addition to systematic shovel testing, sampling of the survey corridor was conducted via the excavation of judgmentally-placed shovel tests and surface inspection as determined appropriate by the lead Field Archaeologist and Principal Investigator.

Landforms, mounds, or other areas of topography were subsurface tested on a judgmental basis. Shovel tests were not excavated in areas with 100% surface visibility, areas containing existing road, roadside ditches, standing water, areas directly above where underground utilities had been installed, or where previous disturbance was evident. Shovel testing consisted of 30 by 30-centimeter (11 by 11-inch) diameter tests excavated to a maximum depth of 100 centimeters (39.3 inches) into the underlying substratum. Vertical control was maintained by excavating each shovel test in 10-centimeter (4-inch) levels. One wall of each shovel test was profiled and the walls and floor of each shovel test were inspected for color or texture change potentially associated with the presence of cultural features. Soils were screened through ¼-inch wire mesh and descriptions of soil texture and color followed standard terminology and the Munsell (2005) soil color charts. Additional information concerning soils encountered was recorded on standardized shovel test forms for each excavation.

Heavy rains precipitated the initial field mobilization. Combined with the low-lying and nearly level topography and poorly drained soils this left the project area largely inundated with standing water during the month of April. Typically 1 transect was omitted from survey as existing pipelines occupied the majority of the survey corridor. Information regarding existing pipelines and the methods by which they were installed was available from representatives of

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DOW and Mustang who were always on hand during survey. Installation and maintenance of existing pipelines also left a good deal of the survey corridor clear of surface vegetation. This as well as recently plowed agricultural fields allowed a visual inspection of long swaths of the Project. Survey and testing occasionally strayed outside of the Project corridor due to field conditions and discrepancies between Project GIS files and staking in the field.

4.4.1 Site Definition

If new archaeological sites or loci were located preliminary assessments concerning resource integrity and preliminary recommendations for National Register eligibility status were made. All newly identified sites were delineated within the Project area. All sites were photographed and mapped. With reference to THC guidelines, a minimum of 6 shovel tests must be excavated to delineate site boundaries. HRA Gray & Pape relies on the excavation of 2 consecutive negative shovel tests in each cardinal direction radiating from positive tests to delineate site boundaries, ensuring a clear definition of site boundaries. Radial shovel tests were excavated at 10-meter (30-foot) intervals within the Project area. HRA Gray & Pape collected only diagnostic artifacts that may be used to help assign temporal affiliations to new sites and that all other materials would be recorded in place. Upon survey completion, each cultural resource loci was assessed as to whether or not formal state recordation would be appropriate. In general, isolate non-diagnostic lithic finds and sites with extremely low-density lithic scatters were plotted on project maps and identified by field site or isolate number, but not formally recorded as archaeological sites. Site trinomials were obtained for all diagnostic isolates and for all sites for which some level of behavioral activity could be assessed. An official Texas site was completed and submitted to the Texas Archeological Research Laboratory (TARL), and a site trinomial was obtained from TARL for each newly recorded site. Data collected during shovel testing were used to assess the need for mechanical deep testing. If areas requiring deep testing were identified, backhoe trenching would be utilized to evaluate these areas to culturally sterile depths.

It was deemed unlikely that historic resources would be affected by below-ground pipeline construction, although above ground markers or other pipeline infrastructure can result in viewshed-related concerns. Therefore, had any standing structures appearing to be 50 years or older be identified located immediately adjacent to the survey corridor they would have been photographed during the survey, and their locations plotted on field maps with Global GPS points collected.

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5.0 RESULTS OF INVESTIGATIONS

The primary purpose of this investigation was 3-fold; 1) determine if any previously identified cultural resources or National Register properties were located within a 0.8-kilometer (0.5-mile) study radius of the surveyed area; 2) to determine if any previous cultural resource investigations had been conducted in or near the surveyed area, and; 3) use these results to develop an appropriate field survey strategy to identify and record any previously unidentified cultural resources within the surveyed area.

5.1 Results of Site File Research and Literature Review

The Texas Online Archaeological Sites Atlas, an online resource maintained by the THC, identifies multiple cultural resources within the study radius of the surveyed area (see Figures A1 to A22). Seven archaeological sites, 1 historic marker, and 1 recorded cemetery are located within 0.8 kilometers (0.5 mile) of the Project. Two previously recorded site centroids (41BO161 and 41BO162) are mapped within the survey corridor (Table 1). Lists of all previous investigations are provided in Tables 2 and 3.

Table 1. Known Archaeological Resources within 0.8 kilometers (0.5 mile) of the Project area.

Trinomial [Site Name]	Site Type and Temporal Affiliation	Site Size	Depth of Deposits	Environmental Setting	NRHP Status
41BO224	Historic; Cow dipping tank	10 x 45 meters	2 meters below surface	Mixed forest and shrub	Not eligible
41BO162	Prehistoric; Open campsite, Rangia midden	15 x 60 meters	8-18 cm below surface, deposit 6+/- cm thick	Coastal plain	Potentially eligible
41BO163	Prehistoric shell midden	30 x 60 meters	Surface deposit, 5 cm thick	Coastal plain, bayou bank	Not eligible
41BO194	Prehistoric shell midden	5 x 32 meters	Surface deposit, 10-20cm thick	Spartina Marsh	unknown
41B047	Prehistoric shell midden	unknown	Surface deposit, 7-10 cm thick	Coastal plain, bayou bank	unknown
41BO161	Prehistoric shell midden	10 x 45 meters	20-25 cmbs	Spartina Marsh	Not eligible

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Trinomial [Site Name]	Site Type and Temporal Affiliation	Site Size	Depth of Deposits	Environmental Setting	NRHP Status
41GV67	Shell midden (Potentially prehistoric)	3 meter diameter	20 cmbs	Bayou bank	unknown

-centimeters below the surface (cmbs)

5.1.1 Known Archaeological Resources

Two previously defined resources, 41BO161 and 41BO162, fall within the surveyed project area. Both of these sites are Rangia shell middens. Both sites were described as prehistoric shell middens. Another site, 41GV67, is mapped very near the Project survey corridor. It was also described as a potentially prehistoric shell midden. The remainder of the sites are also shell middens, with the exception of 41BO224, a concrete-lined cattle dipping tank.

Archaeological Site 41BO224 is a surface-visible cattle-dipping tank that can potentially date to the late-nineteenth century, though likely relates to the early-twentieth century (Sanders 1985). Due to the ubiquitous nature of these features in this region, this site was not recommended for NRHP eligibility.

Site 41BO162 is a prehistoric shell midden. Its mapped location places it along the southern edge of the Project's proposed temporary workspace near the east bank of Bastrop Bayou. No other artifact types beyond the Rangia shell were recorded. The site was recommended as having the potential for listing on the NRHP. Further testing was recommended to conclusively determine the site's eligibility (Castille and Whelan 1986a.).

Site 41BO163 is a prehistoric shell midden located northwest of the surveyed area along the west bank of Bastrop Bayou. In addition to Rangia shell, artifacts recorded included chert cobble and a diagnostic ceramic sherd (ca. AD 1250). This site was not recommended for NRHP eligibility (Turpin and Middleton 1997).

Site 41BO194 is a prehistoric shell midden located southeast of the surveyed area along the east bank of Bastrop Bayou. No other artifact types beyond the Rangia shell were recorded. A NRHP evaluation of the site has not been conducted to date (d'Aigle 1998).

Site 41BO47 is a prehistoric shell midden located southeast of the surveyed area along the east bank of Bastrop Bayou. In addition to the midden, a hearth and ceramic sherds (not described) were recorded for the site. A NRHP evaluation of the site has not been conducted to date (Aten 1972).

Site 41BO161 is a prehistoric shell midden. Its mapped location places it within the southern edge of the Project's pipeline survey corridor. No other artifact types beyond the Rangia shell were recorded. This site was not recommended for NRHP eligibility (Castille and Whelan 1986b.).

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Site 41GV67 is a potentially prehistoric shell midden. Its mapped location places it along the southern edge of the Project's pipeline corridor near the east bank of Highland Bayou. The recorders noted that the site had been disturbed by cattle passage. No other artifact types beyond the Rangia shell were recorded. Further testing was recommended on the site and its NRHP eligibility potential is currently unknown (Baxter 1976).

In addition to the archaeological sites listed above, 1 historic marker and 1 cemetery is located within 0.8 kilometers (0.5 miles) of the Project area. The marker commemorates Paul's Union Church which was established in 1895 as an interdenominational congregation. The original church building was destroyed by the 1900 storm. Many victims of the storm are buried in Paul's Union Cemetery, which adjoins the location of the church (THC 2003, 2012). Neither the historical marker nor the cemetery are located near the project APE. No National Register Historic districts fall within 0.8 kilometers (0.5 miles) of the surveyed Project area.

5.1.2 Previous Investigations

Several previously conducted cultural resources investigations have been conducted within 0.8 kilometers (0.5 miles) of the surveyed area. Tables 2 and 3 below provide a list of these linear and block area surveys, although only very limited information is available for most of them as these were conducted prior to 1980. Information regarding the field data collection methods utilized in these past projects is not known.

Table 2. Previously conducted block area surveys within 0.8 kilometers (0.5 miles) of the Project area.

Date	Agency	Permit	Investigating Firm	Report Author	Principal Investigator	Report Date
09/79	Farmers Home Administration (FMHA)	-	-	-	-	-
03/82	Corps of Engineers (COE-VD)	-	-	-	-	-
03/86	COE-VD	-	-	-	-	-
1976	COE-VD	-	-	-	-	-
05/08	Economic Development Administration (EDA)	4909	Moore Archaeological Consulting (MAC)	Douglas Mangum and R. Moore	Roger Moore	07/28/2008
1964	EPA	-	-	-	-	-

- Indicates that no information is available

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Table 3. Previously conducted linear surveys within 0.8 kilometers (0.5 mile) of the Project area.

Date	Agency	Permit	Investigating Firm	Report Author	Principal Investigator	Report Date
01/79	GAL CE	-	-	-	-	-
06/75	GAL CE	-	-	-	-	-
03/82	GAL CE	-	-	-	-	-
02/86	GAL CE	-	-	-	-	-
1972	GAL CE	-	-	-	-	-

- Indicates that no information is available

Many of these surveys were performed 30 or even 40 years ago and specific information relating to them is lacking. Such is the case with a linear surveys performed by the Galveston Core of Engineers (GAL CE) and the area surveys performed by the Core of Engineers – Galveston District.

5.2 Results of Cultural Resources Survey

Field survey efforts were conducted from April 14 to May 3, on May 9, and from August 14 to August 16, 2012. Survey conducted with the 60-meter (200-foot) wide survey corridor resulted in the identification of newly recorded archaeological sites, isolated finds, and historic structures. A total of 234 shovel tests were excavated across the project area. Total area visually inspected subsumed approximately 348 hectares (860 acres) of survey corridor and another 43 hectares (106 acres) of temporary workspace across 56.9 kilometers (35.4 miles) of pipeline centerline (Figure A1 to A22). An additional 2.6 kilometers (1.6 miles) of proposed pipeline to be located within existing facilities was not surveyed.

In general, subsurface testing along the survey transects adjacent to an existing pipeline corridor produced similar soil profiles as described below with some observed disturbances from past pipeline construction. Observed disturbances included mixing of sediments and the presence of gravel inclusions.

5.2.1 General Descriptions of Surveyed Areas

Pedestrian survey confirmed a low and wet landscape devoid of natural landforms for much of the surveyed alignment. Some portions of the Project retained pimple mounds that likely once covered the majority of the area but have since been leveled or silted over. Although shovel tests were often conducted in or near standing water, a presence of dense, massive, clayey deposits was identifiable in the majority of tests. Removed soils conformed to the official soil series descriptions for the vicinity.

Tests often included spoil overburden from adjacent previous pipeline installation. Shovel tests were excavated to a maximum depth of 100 centimeters (40 inches) below the ground surface where possible although restrictions in place due to the proximity of the Project to

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adjacent existing pipelines limited testing to no more than 40.6 centimeters (16 inches) within and immediately adjacent to the existing pipeline corridor. Shovel tests were terminated upon reaching the upper limits of the water table or at 100 centimeters (40 inches) due to the maximum reach of a shovel.

Shovel test profiles near waterways, drainages, and adjacent wetlands typically consisted of saturated to moist very dark gray (10YR 3/1) to dark gray (10YR 4/1) loam to clay loam. This was typically followed by dark gray (10YR 4/1) to gray (10YR 5/1) clay that continued to the final extent of the test (Munsell 2005). As expected, shovel tests conducted on pimple mounds were drier and contained more sand in the soil matrix. Those tests typically consisted of a profile that contained grayish brown (10YR 5/1) sandy loam followed by light brownish gray (10YR 6/2) sandy loam with strong brown (7.5YR 5/6 to 5/8) iron accumulations becoming more prevalent with depth (Munsell 2005).

5.2.2 Newly Identified Resources

A total of 2 new archaeological sites, 2 isolated finds, and 1 standing historic structure were identified during survey. These are discussed below in greater detail.

Isolate 739-045-ISO-01, identified as a prehistoric isolate, was initially identified through a single positive shovel test containing a tan chert flake measuring roughly 1-centimeter (0.4-inch) diameter. The isolate is located in Brazoria County and was discovered between the surface and approximately 10 centimeters (4 inches) depth within a grassy upland area approximately 73 meters (240 feet) northeast of the north bank of New Bayou and on the north edge of an existing pipeline corridor (Figure A12). The positive shovel test displayed a soil profile consisting of grayish brown (10YR 5/2) sandy loam to a depth of 30 centimeters (12 inches) followed by yellowish brown (10YR 5/4) clay. This site was delineated by the placement of shovel tests spaced at 10-meter (33-foot) intervals radiating in cardinal directions from the positive shovel test. A total of 7 additional shovel tests were dug during the delineation of this site. Delineation tests were not pursued into the existing pipeline corridor or outside of the Project's survey corridor. Tests extended to a maximum depth of 1 meter (3.3 feet), none of which were positive for cultural material. A state designated trinomial is not sought for this isolate.

Isolate 739-019-ISO-01 was identified by a positive shovel test containing a single valve of the Tampico Pearly mussel (*Cyrtonaias tampicoensis*) or similar freshwater bivalve. The isolate is located in Brazoria County and is situated approximately 5 meters (17 feet) south of the south bank of Bastrop Bayou and immediately adjacent to the north bank of a small drainage that enters the bayou at the spot (Figure A4). The isolate was discovered approximately 50 centimeters (20 inches) below the surface. The shovel test profile consisted of highly mottled dark yellowish brown (10YR 3/4), yellowish brown (10YR 5/6), and yellowish red (5YR 4/6) clay from the surface to approximately 45 centimeters (18 inches) depth. This was followed by black (10YR 2/1) clay. The depth of the find and its proximity to nearby Prehistoric *Rangia* deposits suggest it could be associated with prehistoric use of the location; however this has not been verified. The location of the find places it outside of the Project APE in an area that will be avoided by directional drilling, thus no further testing was performed. A state designated trinomial is not sought for this isolate.

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Site 41BO239 consists of a surface scatter of the eroded remnant of what was likely a Late Prehistoric occupation site or *Rangia* midden. The site is located in Brazoria County and lies on the south bank of Bastrop Bayou within an existing pipeline corridor (Figure A4). The site covers an area measuring approximately 30 meters (100 feet) along the bank and approximately 7 to 15 meters (50 feet) back from the water's edge. Based on pipeline markers visible in the field and GIS mapping by the Texas GLO, the site is underlain and bounded by existing pipelines to the south and west and by Bastrop Bayou to the north and east. The northwestern edge of the site is bounded by an inlet to a small drainage that extends inland from Bastrop Bayou and separates the site from Isolate 739-019-ISO-01. The surface scatter consists primarily of shell with small amounts of lithic cobbles, debitage, and faunal bone fragments. No diagnostic lithics and only one small ceramic fragment of an unclassified sandy paste temper were identified within the scatter. The overall extent of the scatter is likely the result of multiple erosion/redeposition events. Dow and Mustang personnel indicated the location had been dredged during installation of pipelines. Disturbance to the location is clearly visible on aerial imagery dating to 1944, 1977, 1987, 1995, and 2010. The surface scatter is likely the result of dredging activities associated with those pipelines. Those impacts left the area susceptible to erosional processes which have further scoured the area, resulting in a concave beach that extends from the water's edge inland approximately 40 meters (130 feet). A shovel test placed just outside of the northwest boundary of the scatter produced no additional materials.

Site 41BO240 consists of what is likely a Late Prehistoric short-term occupation evidenced by a *Rangia* shell lens and eroded shell scatter. The site is located in Brazoria County and occupies approximately 10 meters (32 feet) of the south bank of Bastrop Bayou located approximately 40 meters (131 feet) northwest from Site 41BO239 (Figure A4). A portion of the site consists of a lens of *Rangia* shell deposited approximately 50 centimeters (20 inches) below the surface and is visible along approximately 5 meters (16 feet) of cutbank along the south bank of Bastrop Bayou. This deposit measures approximately 5 to 10 centimeters (2 to 4 inches) thick. Another portion of the site consists of shell that has eroded out of the cutbank and is visible along the bank in the shoreline extending north for another 5 meters (16 feet) past the buried shell lens. Examination of the buried shell lens produced a single Prehistoric pottery fragment of an unclassified sandy paste temper mingled with the shell in the wall of the cut bank. No other diagnostic materials were identified. The site is located well outside of the Project corridor and no subsurface testing was undertaken. The site may continue south and west from the bank and it is unknown how much of the site remains but it appears that at least a portion of it has eroded into the bayou with no discernable continuation of the material located in the cutbank behind it.

Resource 739-080-HSS-01 consists of a former cattle shelter. This structure is located approximately 428 meters (1,537 feet) south of Basford Bayou and 40 meters (131 feet) outside of the survey corridor in the Green Lakes Oil Field just south of Hitchcock, Galveston County, Texas (Figure A18). The oil field is a vast, treeless plain punctuated by the occasional cattle tank. Built ca.1960, the cattle shelter measures approximately 11 meters by 27 meters (35 feet by 90 feet) long. Built like a pole barn, the shelter consists of little more than a low, gable roof anchored to a series of heavy timber posts. There are 3 rows of posts, with 1 row

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for each side of the shelter and 1 to support the ridge of the roof. The posts are spaced at 3-meter (10-foot) intervals throughout the length of the building. The roof framing consists of long, 2.5-by-25-centimeter (1-by-10-inch) rafters, which extend from the ridge board to the pole plate along the sides of the shelter. The roofing material consisted of galvanized sheet metal. A few twisted fragments of this material are all that remain. The shelter has neither walls nor a foundation as it was designed simply to provide a low roof for the protection of livestock. Severely damaged by storms, much of the roof now lies on the ground.

5.2.3 Confirmation Efforts for Previously Identified Resources

Two and possibly 3 previously recorded resources were located within or adjacent to the Project APE based on the locations provided by the Texas Online Archaeological Sites Atlas. Efforts were made to confirm the locations of Sites 41BO161, 41BO162, and 41GV67.

Site 41BO162 was recorded in 1986 and described as a thin deposit of shell adjacent to an exposed midden. The datum point provided by the Texas Online Archaeological Sites Atlas shows it located approximately 36 meters (118 feet) north of Bastrop Bayou and within an additional temporary workspace for the current Project (Figure A4). Based on pipeline markers visible in the field and GIS mapping by the Texas GLO the datum is underlain and bordered by existing pipelines. A medium sized pond lies to the east and Bastrop Bayou lies to the south. The recorded site location was first walked over in an attempt to locate any exposed shell. None was observed. Next shovel tests were placed across the Project area in the site's reported vicinity, including one test placed as near to the datum location as possible. Three shovel tests spaced 30 meters (100 feet) apart were excavated across the Project corridor. Tests were excavated to maximum depth of 60 centimeters (23.6 inches) before encountering the water table. No shell or other evidence of a cultural site was observed.

A multitude of pipelines have altered the landscape significantly since that observed on the earliest aerial imagery for the area (ca.1944). Although the site was recommended for further testing at the time of its recordation, disturbance is visible in the mapped site location on aerials dating to 1987; roughly 1 year after the site was recorded. It is likely that those disturbances caused portions of the site to be destroyed or to be eroded away. It is equally plausible that the site was mis-plotted on topographic maps. Examination of the site's sketch map dating to 1986 and comparison to the surrounding topographic landmarks suggests the site is located further to the east, an area that visually appears undisturbed by pipelines. As this area was outside of the project survey corridor this was not verified by current survey efforts.

Site 41BO161 was recorded in 1986 and described as a thin deposit of shell. The datum point mapped by the Texas Online Archaeological Sites Atlas is located approximately 24 meters (80 feet) northeast of Austin Bayou within existing pipeline corridor and within the survey corridor of the current Project (Figure A5). Based on pipeline markers visible in the field and GIS mapping by the Texas GLO the datum is underlain and bounded by existing pipelines. A small pond lies to the south and west and Austin Bayou lies to the south. The recorded site location was first walked over in an attempt to locate any exposed shell. None was observed. Next shovel tests were placed across the Project area in the site's reported vicinity, including one test placed as near to the datum location as possible. Three shovel tests spaced 30 meters

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(100 feet) apart were excavated over the Project corridor. Tests were excavated to maximum depth of 60 centimeters (23.6 inches) before encountering the water table. No shell or other evidence of a cultural site was observed. This site was not recommended for further work at the time it was identified. As with Site 41BO162, aerial imagery dating to 1987 shows a great deal of disturbance at the site's mapped location. This along with the negative survey results suggests the portion of it located within the current survey corridor has been destroyed or eroded away as a result of existing pipelines.

Site 41GV67 was recorded in 1976 and described as low shell midden. The datum point provided by the Texas Online Archaeological Sites Atlas is located approximately 27 meters (90 feet) east of the north bank of Highland Bayou on the south edge of the Project survey corridor (Figure A20). The location is currently an artificial water channel which appears on aerial images between 1990 and 1995. The recorded site location was first walked over in an attempt to locate any exposed shell or presence of a landform. None was observed. Next shovel tests were placed across the Project area in the site's reported vicinity, including as close to the recorded datum point as possible. Two shovel tests spaced 30 meters (100 feet) apart were excavated in the site's reported location. Tests were excavated to maximum depth of 60 centimeters (23.6 inches) before encountering the water table. No shell or other evidence of a cultural site was observed. Although this site was recommended for further work at the time it was identified, it was also reported to have been impacted by cattle. It's location within an existing water channel suggests the site has been destroyed.

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6.0 CONCLUSIONS AND RECOMMENDATIONS

This report presents the results of an intensive pedestrian cultural resources survey of 56.9 kilometers (35.4 miles) completed for a planned pipeline project in Brazoria and Galveston Counties, Texas. Portions of the survey were conducted under TAC Permit #6246 issued by the THC in April of 2012. All fieldwork and reporting activities were conducted with reference to state and federal guidelines. The APE is estimated to entail approximately 397 hectares (980 acres).

Prior to fieldwork, initial investigation consisted of a background literature and site files search to identify the presence of previously recorded sites in close proximity to the Project area. In addition, predictive modeling and a review of historic aerial imagery and topographic maps was performed along the entire length of the Project alignment in an effort to assess the potential of unrecorded intact buried cultural deposits or historic standing structures. As a result of these investigations, the Texas Online Archaeological Sites Atlas indicated that 7 previously recorded archaeological resources, 1 historic marker, and 1 cemetery have been identified within 0.8 kilometers (0.5 miles) of the Project area. Of those resources, 3 archaeological site datums (41BO162, 41BO161, and 41GV67) are mapped within or adjacent to the Project survey corridor.

During this investigation, a total of 391 hectares (966 acres) were surveyed and 234 shovel tests were excavated. In general pedestrian survey confirmed a low and wet landscape within which pimple mounds have survived on very few properties. This was particularly the case for the southern half of the Project, which is primarily depicted as marsh on historic topographic maps. Shovel tests confirmed a shallow water table for much of the proposed pipeline route with a presence of dense, massive, poorly drained clayey deposits. Survey resulted in the identification of 2 new prehistoric archaeological sites and 2 new prehistoric isolate finds within and adjacent to the survey corridor.

Isolate 739-045-ISO-01 consists of a single non-diagnostic lithic flake. Further testing produced no additional materials. Newly identified archaeological sites 41BO239 and 41BO240 consist of the remnants of Late Prehistoric short-term occupations located on the south bank of Bastrop Bayou. Of the 2 sites only site 41BO240 retains cultural material in-situ. While isolate 739-019-ISO-01 may be associated with prehistoric use of the location this has not been verified. These sites may have been part of a larger Late Prehistoric site that could have occupied a bend of Bastrop Bayou and may have stretched all the way to site 41BO163. Disturbance and erosion has impacted the location to the extent that only smaller isolated cultural loci remain. Site 41BO240 is located outside of the Project APE and will not be in danger of direct impact as a result of the Project. Planned directional drilling under Bastrop Bayou will avoid additional impacts to the location of Site 41BO239, however due to past disturbances the site location is no longer intact.

HRA Gray & Pape recommends that the data collected on these newly identified cultural loci during the current field effort be considered sufficient and no further work regarding these is required. These sites are not recommended as eligible for listing on the NRHP. For a site to be

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considered eligible for the NRHP under Criterion D, it must possess information bearing on an important scientific research question. Important research questions commonly involve testing new or former hypotheses regarding topics in the natural sciences and/or addressing aspects of the cultural chronology of a region. This information must be evaluated within the framework of an historic context, meaning, the researcher must be able to address how the information contained within the resource is likely to effect current understanding of a particular time period (USDI 1983:II-26, 1991:21). In order for an archaeological resource to be considered significant, it generally must retain integrity. While sites that have been disturbed through natural or cultural processes can still be eligible if their undisturbed portions contain significant information potential, sites that have lost their stratigraphic context are commonly considered to have lost integrity of location (USDI 1983:II-26, 1991:23, 49).

No evidence was identified for previously recorded sites 41BO162, 41BO161, and 41GV67. While it is possible that these sites were mis-plotted during their initial recordation, field efforts and a review of historic aerial imagery show their mapped locations to have been previously impacted. The recorded locations of sites 41BO162 and 41BO161 have been impacted by past pipeline activities and subsequent erosion. The recorded location of site 41GV67 is now occupied by an artificial water channel which likely destroyed the site. Regardless, planned directional drilling will avoid additional impacts to the mapped site locations and no further work is recommended regarding these previously recorded sites.

In addition, 1 historic structure was identified outside of the project corridor. The historic cattle shelter, 739-080-HSS-01, is located outside of the Project APE and is not in danger of direct impact by the Project. Research in local libraries and other repositories did not reveal the building to be associated with any significant events or persons. The building therefore is recommended not eligible for inclusion in the NRHP under Criterion A or B. Nor is the shelter representative of a distinctive type, period, or method of construction. As an undistinguished, vernacular structure, the cattle shelter is recommended not eligible under NRHP Criterion C. Consequently, this cattle shelter is recommended as not eligible for the NRHP. No further work is recommended for this structure and no state-issued trinomial is being sought.

Based on the results of the cultural resources survey, HRA Gray & Pape recommends no further investigation within the Project and that the Project be allowed to proceed.

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APPENDIX A:

DOW 12-Inch Pipeline Project Research and Survey Results Maps

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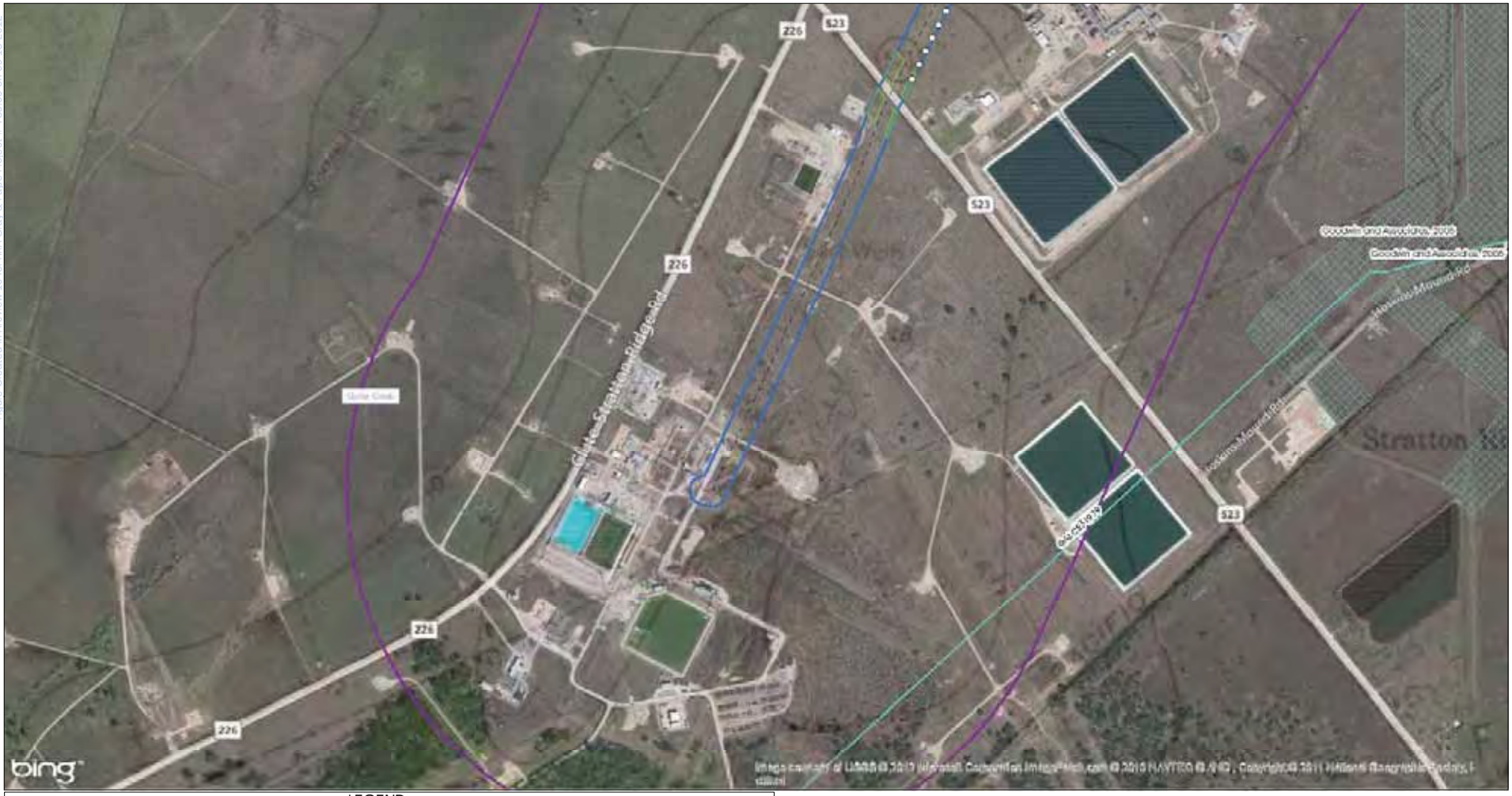
Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012



LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

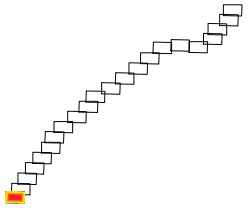
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



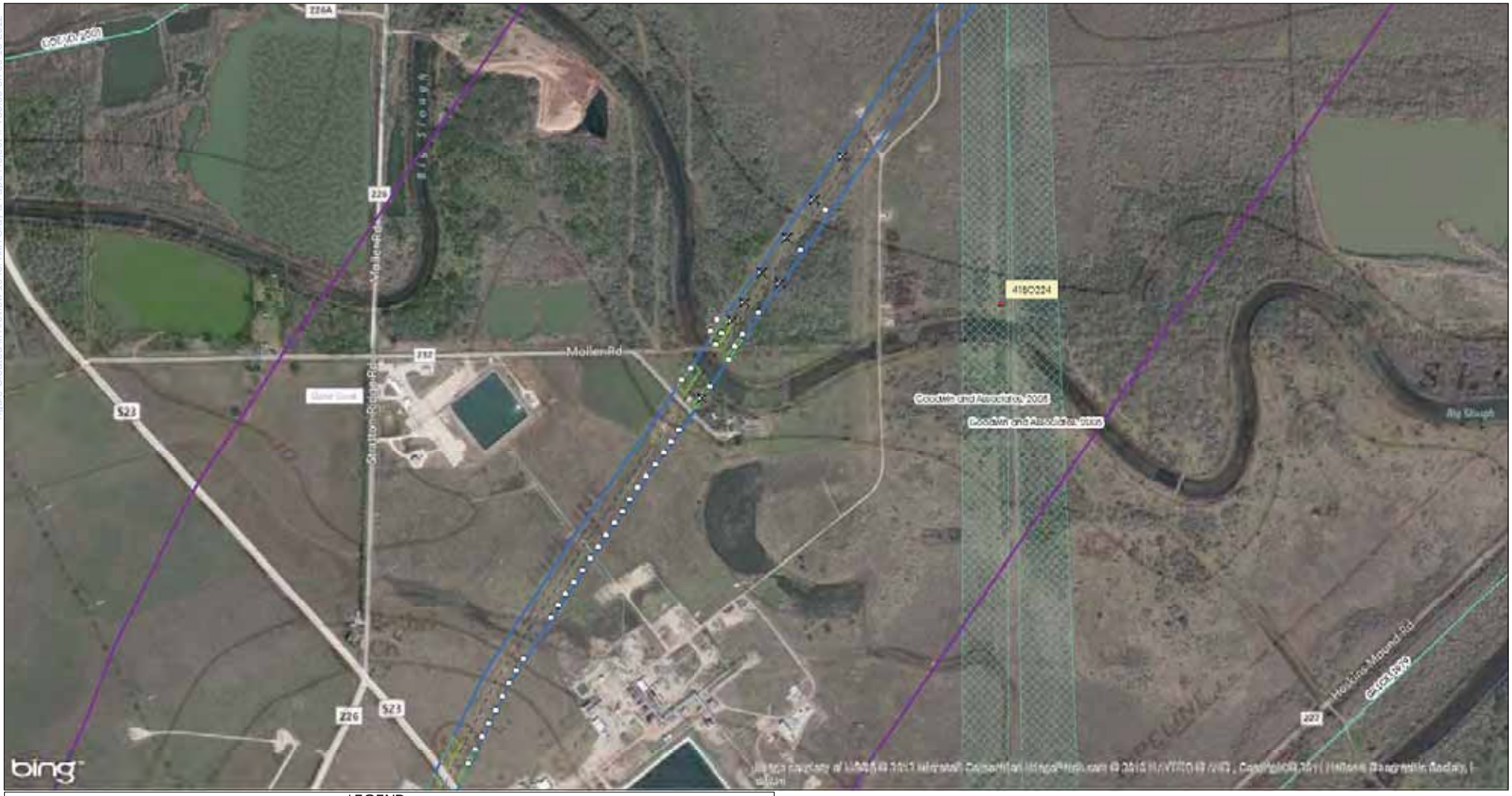
DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 1 of 22

HRA Gray & Pape LLC

Figure A1

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012



LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

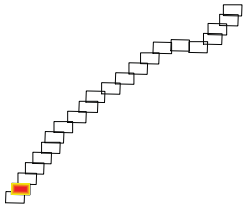
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 2 of 22

HRA Gray & Pape LLC

Figure A2

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

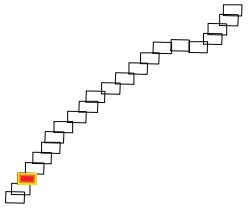
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 3 of 22

HRA Gray & Pape LLC

Figure A3

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

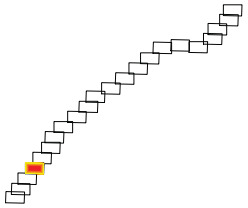
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 4 of 22

HRA Gray & Pape LLC

Figure A4

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

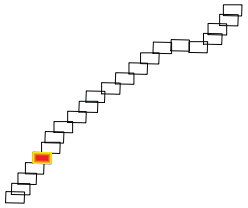
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 5 of 22

HRA Gray & Pape LLC

Figure A5

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

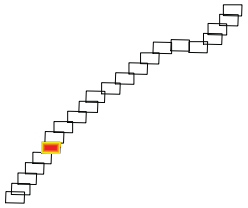
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 6 of 22

HRA Gray & Pape LLC

Figure A6

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

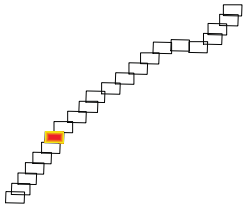
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 7 of 22

HRA Gray & Pape LLC

Figure A7

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

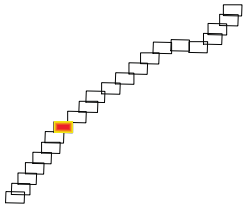
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 8 of 22

HRA Gray & Pape LLC

Figure A8

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

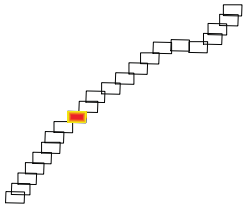
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 9 of 22

HRA Gray & Pape LLC

Figure A9

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

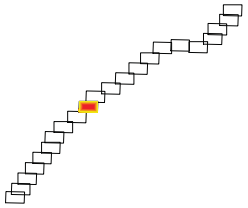
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 10 of 22

HRA Gray & Pape LLC

Figure A10

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

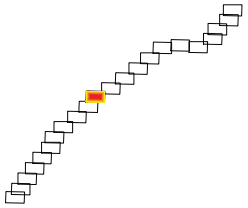
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 11 of 22

HRA Gray & Pape LLC

Figure A11

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

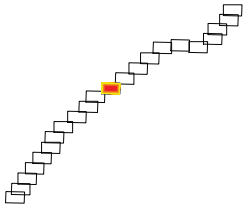
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 12 of 22

HRA Gray & Pape LLC

Figure A12

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

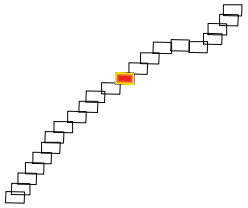
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 13 of 22

HRA Gray & Pape LLC

Figure A13

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

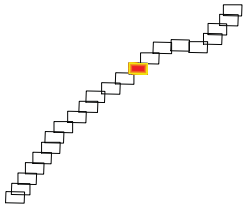
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 14 of 22

HRA Gray & Pape LLC

Figure A14

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

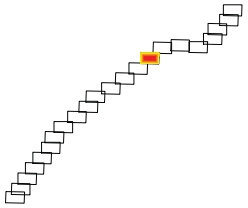
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 15 of 22

HRA Gray & Pape LLC

Figure A15

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

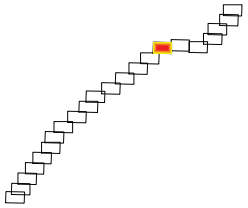
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 16 of 22

HRA Gray & Pape LLC

Figure A16

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

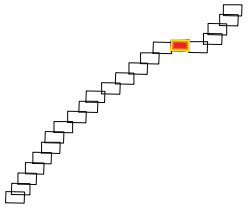
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 17 of 22

HRA Gray & Pape LLC

Figure A17

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

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- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

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- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

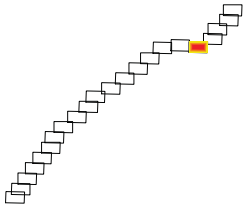
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 18 of 22

HRA Gray & Pape LLC

Figure A18

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

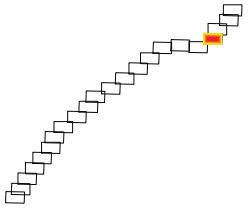
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



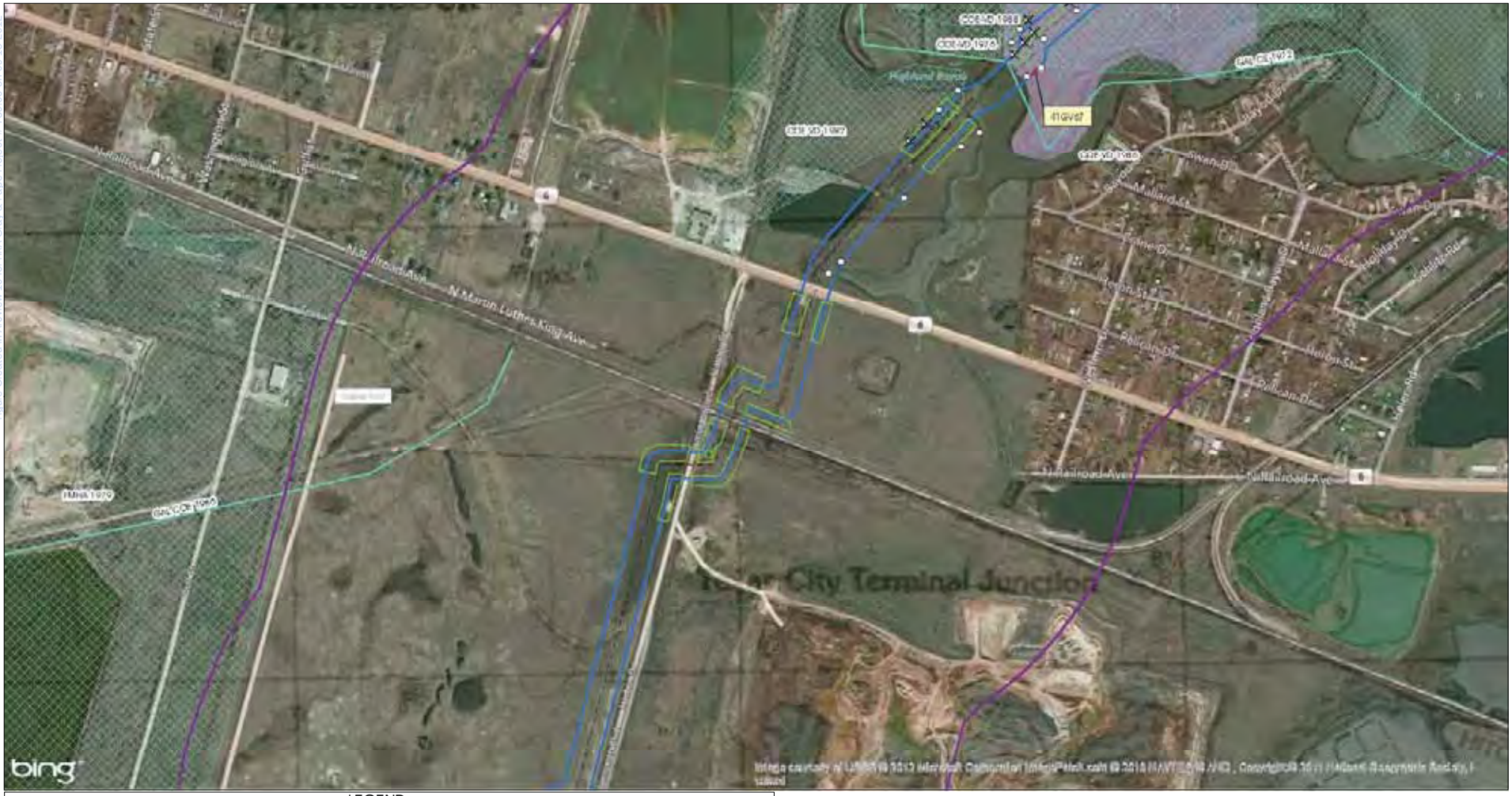
DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 19 of 22

HRA Gray & Pape LLC

Figure A19

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 793.00 on 09-13-2012



LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

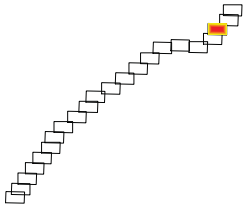
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



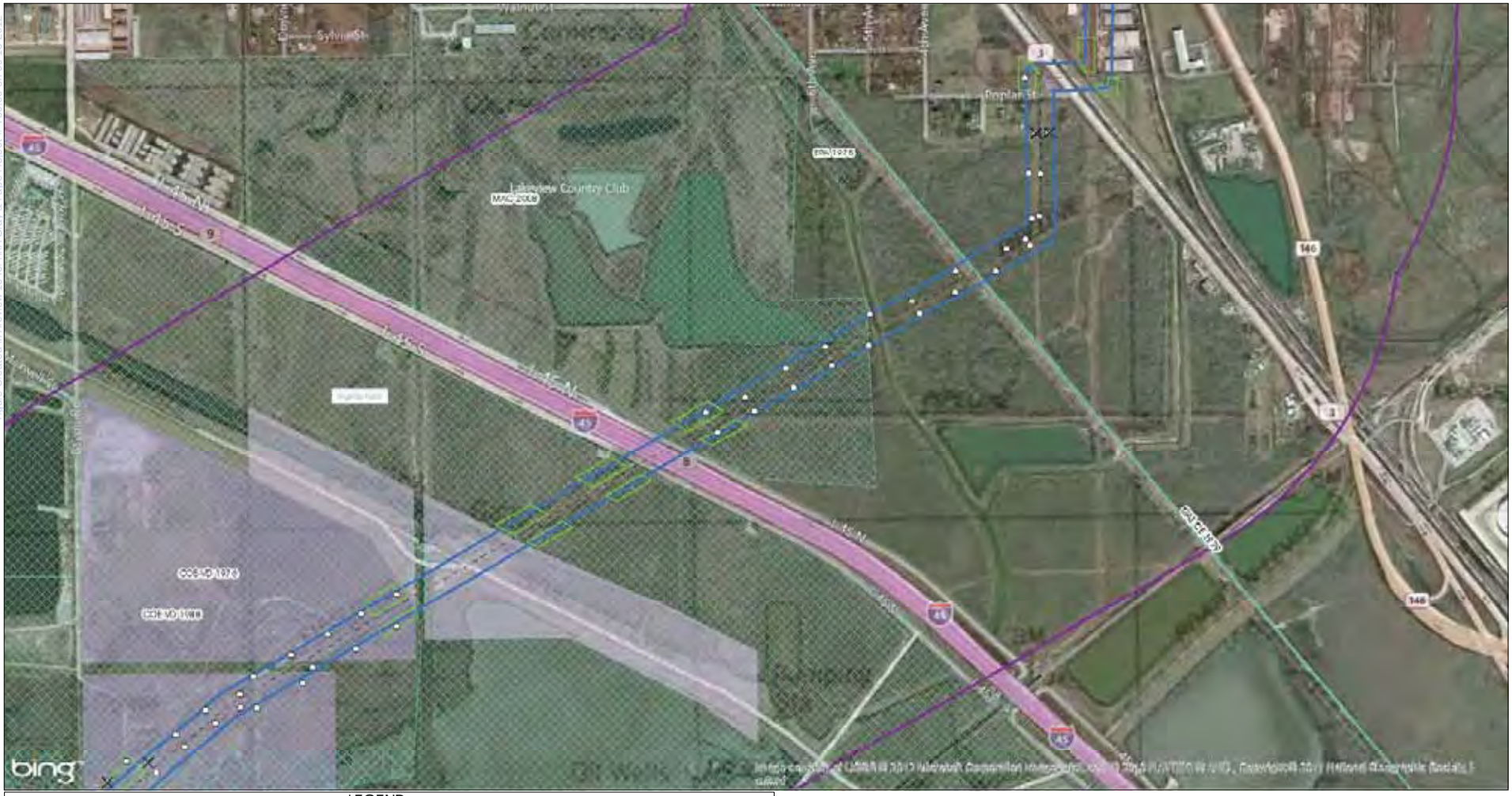
DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 20 of 22

HRA Gray & Pape LLC

Figure A20

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 799.00 on 09-13-2012



LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

Public or Government Owned Properties

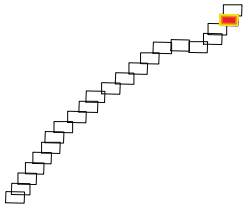
- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles

N W E S



DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 21 of 22

HRA Gray & Pape LLC

Figure A21

US EPA ARCHIVE DOCUMENT

Figure Created in ArcView 10 for HRA Gray & Pape Project # 739.00 on 09-13-2012

LEGEND

- Proposed Centerline
- 200-Foot Survey Corridor
- Additional Temporary Workspace
- Newly Identified Cultural Resources

Subsurface Testing Results

- Negative Shovel Test
- Positive Shovel Test
- Unexcavated Shovel Test

Previously Recorded Cultural Data

- 0.8-Kilometer (0.5-Mile) Study Radius
- Site Centroids
- Historical Marker
- Cemetery Boundary
- Linear Survey
- Block Area Survey

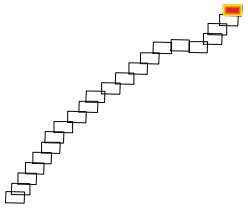
Public or Government Owned Properties

- Brazoria National Wildlife Refuge
- Galveston County
- City of La Marque

USGS 7.5' Quadrangle Reference

0 50 100 Meters

0 0.05 0.1 Miles



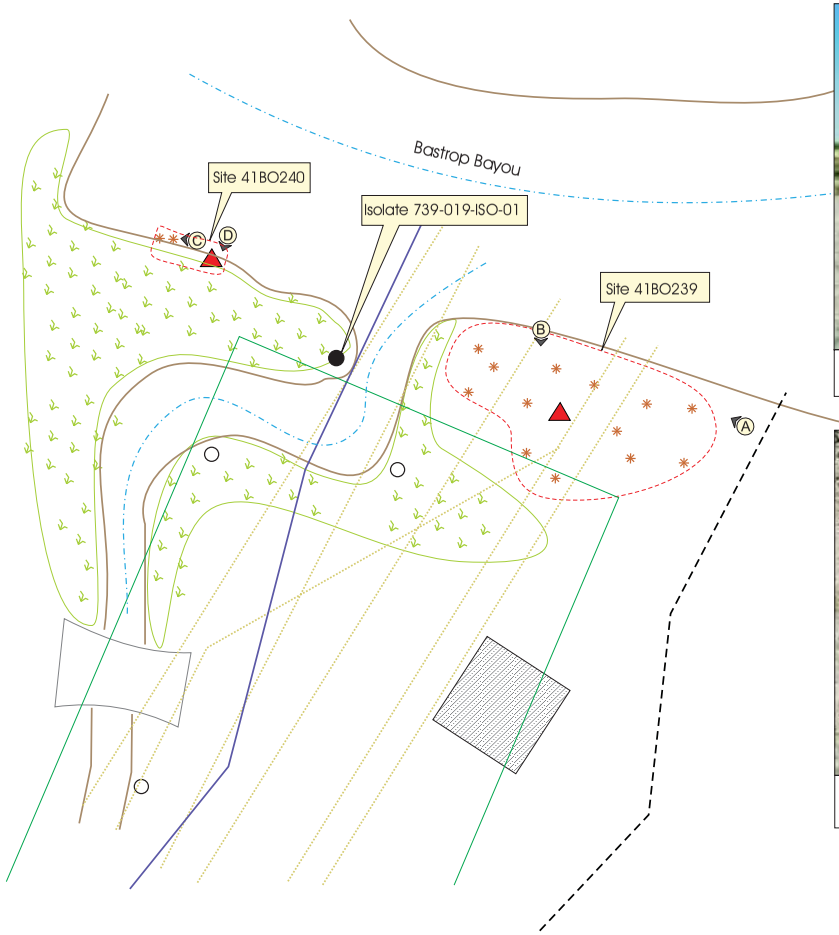
DOW 12-Inch Pipeline Project Research and Survey Results
Sheet 22 of 22

HRA Gray & Pape LLC

Figure A22

US EPA ARCHIVE DOCUMENT

HRAGray & Pape #739.00



A. Site 41BO239 as seen along the south bank of Bastop Bayou. View is to the northwest.

C. Shell eroded from bank within Site 41BO240. View is to the west.

B. Sample of non-diagnostic lithics and faunal bone from the surface of Site 41BO239. View is to the south.

D. Shell lens with pottery within Site 41BO240. View is to the southwest.

LEGEND

- Proposed Centerline
- Existing Pipelines
- Survey Corridor Limits
- Temporary Workspace
- Negative Shovel Test
- Positive Shovel Test
- Estimated Site Boundary
- Valve Station
- Gravel Covered Culvert
- Waterway
- Bank
- Low Surface Vegetation
- Photo Location and Bearing

0 10 m
0 33 ft
N

Plan View of Sites 41BO239, 41BO240, and Isolate Find 739-019-ISO-01

HRA Gray & Pape LLC

Figure A23

Created in CorelDRAW X3, 09-13-2012