Archeological Report

Chocolate Bayou Cracking Furnace Project

Alvin, Brazoria County, Texas

June 2012

Prepared For
INEOS USA LLC

Prepared By
J. Michael Quigg, Senior Archeologist

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Table of Contents

List of Tables

List of Appendices

Acronyms

Atlas	Texas Archeological Sites Atlas
BNWR	Brazoria National Wildlife Refuge
CAA	Clean Air Act
EPA	Environmental Protection Agency
GHG	Green House Gas
INEOS	INEOS USA LLC
LRRT	Outer Coastal Plain Land Resource Region
PSD	Prevention of Significant Deterioration
SCR	Selective Catalytic Reduction
THC	Texas Historical Commission
USACE	United States Army Corps of Engineers
TRC	TRC Environmental Corporation

Section 1
Introduction

INEOS USA LLC (INEOS) operates a chemical manufacturing facility that is located adjacent to the left descending bank of Chocolate Bayou, a tidally influenced tributary to Galveston Bay. The INEOS facility is located on the northwest side of Texas Highway Number FM 2004, approximately 2 miles southwest from the intersection of FM 2004 and FM 2917 (Alvin, Brazoria County, Texas). Figure 1 (Appendix A) is an area map that depicts the approximate boundary of the INEOS site and the surrounding environs.

1.1 Project location Information

USGS Quad	Latitude/ Longitude
Hoskins Mound	29 13' 50.39" N / -95 11' 25.57" W

INEOS is proposing to add one (1) olefins furnace at the Chocolate Bayou facility (the Project). The purpose of the Project is to manufacture olefins, a group of chemicals that is used as a raw material in the production of many useful industrial products. The new furnace will receive feedstock (ethane, propane, and/or liquids such as refinery raffinate or debutanized natural gasoline) via existing pipelines and thermally "crack" them at high temperatures. This creates various olefin products, ranging from hydrogen to pyrolysis gasoline. These various products will be separated by distillation in the existing No. 2 Olefins unit. The furnace will be equipped with a Selective Catalytic Reduction (SCR) unit to reduce NO_x emissions. The furnace will require periodic decoking to remove coke buildup along its tube length. Decoking is conducted by substituting the furnace feed with steam and air to combust the coke to carbon dioxide. The decoke vent is routed through a cyclone to remove any solids before venting to the atmosphere. Solid waste from the decoke operation will be landfilled. There will be only a minimal increase in the volume of this coke material. It is estimated that 22 tpy of coke (increase of 5% for the facility) will break off during the decoking process.

Maintenance, Startup, and Shutdown emissions will be generated from cleaning piping, vessels, exchangers, and pumps/compressors for maintenance. The new furnace and associated equipment will be connected to the existing No. 2 Olefins flare (EPN DDM-3101, Permit No. 95).

The additional furnace will be constructed within the already developed portion of the INEOS facility. The size of the Project will consist of only a 60 -foot by 100 -foot area (actual area of direct construction impact). Construction activities will include site preparation, steel erection, equipment installation; tying-in to existing plant utilities, and commissioning/start-up.

Pursuant to the federal Clean Air Act (CAA), INEOS is seeking a permit under the U.S. Environmental Protection Agency's (EPA) Greenhouse Gas (GHG) Prevention of Significant Deterioration (PSD) Program to authorize construction of the Project. This Cultural Resource report is based on the best available information from publically available databases and archeological experts.

Additional information on the Project can be found in greater detail in the Biological Assessment and Essential Fish Habitat reports produced under separate cover.

1.2 Construction Information

Construction of the proposed expansion, associated infrastructure, and auxiliary equipment will take place within the existing facility in an area approximately 60 feet by 100 feet (construction area). No additional earth disturbance will be required outside of this 60-foot by 100-foot area, which is currently a graveled area. The existing graveled area will be scraped and graded to allow installation of auger cast concrete piles and a new mat and pier foundation for the furnace. The proposed construction activities include the installation within a 60 -foot by 100 -foot area of approximately 92 steel-reinforced concrete piles 18-inches in diameter to a depth of 93 feet; plus 40 additional 18-inch diameter piles installed to a depth of 25 feet to support the pipe rack running from the new furnace across the existing plant road to the west and into the existing process area of the plant. Construction laydown area adjacent to the construction area will be utilized as a materials laydown and storage area during construction. This area will be in previously disturbed land (gravel or concrete) and will involve impacting vegetated areas. The construction area is shown on Figure 2. The projected construction start date is 01 October 2012. The projected operation start date is November 2013. No areas of previously undisturbed land will be impacted by the construction of this Project.

Section 2
Background Information

2.1 History of the INEOS Chocolate Bayou Facility

The INEOS Chocolate Bayou site was acquired by Amoco for petrochemical manufacturing in 1967. Following the purchase of the property, the initial facility was constructed over the next few years, and a number of major additions were constructed and added throughout the 1970s.

2.2 Regional Environmental Background

The facility is within the Texas Gulf Coastal Plain, which is within the Outer Coastal Plain Land Resource Region (LRRT). Undeveloped areas are composed of grasslands and riparian bayous with topography gently sloping to the coast. Historic elevations within the project area range from sea level at Chocolate Bayou to five feet above sea level on the north side of the project area. The project area has been altered due to past rice cultivation and the construction of the facility itself.

2.3 Water Resources

Brazoria County is located on the Upper Texas Coast. The watershed of Brazoria County is composed of the Brazos River and the San Bernard River along with numerous smaller creek and bayous that either drain into the aforementioned rivers or go directly into coastal bays. Brazoria County encompasses a portion of West Galveston Bay and all of Christmas and Drum Bays. All waters are part of the larger Galveston Bay complex.

The Brazos River splits the county into east and west halves. The San Bernard River flows southeasterly through the western part of the county. These two rivers make up the majority of the watershed in the county. Other minor drainages such as Halls Bayou, Oyster Bayou, Persimmon Bayou, Chocolate Bayou, and Jones Creek flow directly into the bay.

The proposed addition of a new furnace is within the existing INEOS facility, on the left descending bank of Chocolate Bayou. Chocolate Bayou empties into Chocolate Bay, part of the Galveston Bay system. The Brazos River is approximately 21 miles to the west. The San Bernard River is even farther away at 30 miles west. In Brazoria County, numerous stock tanks, irrigation canals, farm ponds, and emergent wetlands exist. Two National Wildlife Refuges are within Brazoria County. San Bernard National Wildlife Refuge is in the southwestern portion of the county, approximately 30 miles away. The extreme northeastern corner of the Brazoria

National Wildlife Refuge (BNWR) is 1.6 miles from the construction zone. No water resources will be directly impacted as a result of this proposed additional furnace.

2.4 Geological Background

The existing INEOS Chocolate Bayou facility lies on the Beaumont Formation along the Gulf of Mexico. The Beaumont Formation is broadly described as a barrier island and beach deposits. The surface is almost featureless, characterized by relict river channels shown by meander patterns and pimple mounds on a meander belt ridge, separated by areas of low, relatively smooth, featureless back swamp deposits without pimple mounds. The Beaumont Formation consists mostly of clayey sand and silt of moderate permeability and drainage, low to moderate compressibility and shrink swell potential, level relief with local mounds and ridges, and high shear strength. This includes mainly stream channel, point bar, natural levee, backswamp, and to a lesser extent, coastal marsh and mud flats deposits (Barnes 1982). Concretions of calcium carbonate, iron oxide, and iron manganese oxides are present in zones of weathering. The thickness of the Beaumont deposits is roughly 100 feet.

2.5 Soils

Soils in the county are mostly alluvial loams and clays. They are highly productive. Approximately 70 percent of the county was considered prime farm land (Kleiner, 2012). There are ten soil types mapped within the fenceline represented in table 1 (NRCS, 1981) and Figure 3.

Table 1
Soils Found Within The Action Area

NRCS Map Unit Symbol	NRCS Map Unit Name	NRCS Map Unit Characteristics	USDA Classification				NRCS Hydric Soil
			Depth	Drainage	Permeability	Landform	
6	Bacliff Clay	0-1% slopes rarely flooded	Deep & Very Deep	Poorly Drained	Low	Flats on Coastal Plains	Yes
7	Bernard Clay Loam	0-1% slopes, not flooded	Moderately Deep to Very Deep	Somewhat Poorly Drained	Low	Meander Scrolls on Coastal Plains	No
8	Bernard-Edna Complex	0-1% slopes, not flooded	Moderately Deep to Very Deep	Somewhat Poorly Drained	Low	Meander Scrolls on Coastal Plains	No

Table 1
Soils Found Within The Action Area

NRCS Map Unit Symbol	NRCS Map Unit Name	NRCS Map Unit Characteristics	USDA Classification				NRCS Hydric Soil
			Depth	Drainage	Permeability	Landform	
13	Edna Fine Sandy Loam	0-1% slopes, not flooded	Deep & Very Deep	Somewhat Poorly Drained	Low	Flats on Coastal Plains	No
15	Edna-Aris Complex	0-1% slopes, not flooded	Deep & Very Deep	Somewhat Poorly Drained	Low	Flats on Coastal Plains	No
21	Ijam Clay	0-1% slopes, rarely flooded	Moderately Deep	Poorly Drained	Low	Dredge Spoil Banks on Lagoons	Yes
22	Ijam-Urban Land Complex	0-1% slopes, rarely flooded	Moderately Deep	Poorly Drained	Low	Dredge Spoil Banks on Lagoons	Yes
25	Lake Charles Clay	1-8% slopes, not flooded	Deep & Very Deep	Moderately well Drained	Low	Flats on Coastal Plains	No
27	Leton Loam	0-1% slopes, occasionally flooded	Deep & Very Deep	Poorly Drained	Moderately Low	Flats on Coastal Plains	Yes
28	Leton-Aris Complex	0-1% slopes, occasionally flooded	Deep & Very Deep	Poorly Drained	Moderately Low	Flats on Coastal Plains	Yes
W	Water	N/A	N/A	N/A	N/A	N/A	No

Section 3
Archeological Site File Search

An archeological site file search was performed by TRC archeologists on June 14, 2012 using the Texas Archeological Sites Atlas (Atlas) maintained by the Texas Historical Commission (THC). The file search found no cultural resources (archeological sites, cemeteries, historical landmarks, National Register of Historic Places, structures, historic districts) previously documented in the INEOS facility or within a one mile search radius.

One previously conducted archeological survey has been performed within the one-mile search radius. The United States Army Corps of Engineers, Galveston District (USACE) funded a cultural resources survey in 1979 for a deepwater port and crude oil distribution system. A portion of the 1979 project corridor is situated along Chocolate Bayou adjacent to the Project. No archeological sites were recorded within a one-mile radius of the Project.
The THC Atlas documents no other cultural resources recorded within a one-mile radius of the Project.

In addition to the Atlas search, historic topographic maps of 1959 and 1966, and an aerial photograph of 2004 were consulted to determine if historic structures or features were present within the INEOS facility (Nationwide Environmental Title Research 2009). No historic structures or buildings were present within the INEOS facility on the 1966 topographic map (Figure 4).

The THC atlas search found no documented cultural resources including archeological sites, National Register properties, cemeteries or historic landmarks documented within one-mile of the Project.

3.1 Native American Tribes

Prior to European settlement, Brazoria County was inhabited by the Karankawa Indians (Carol A. Lipscomb, "KARANKAWA INDIANS," *Handbook of Texas Online* (http://www.tshaonline.org/handbook/online/articles/bmk05), accessed September 29, 2011; Published by the Texas State Historical Association). The Karankawa Indians inhabited a narrow strip of coastal Texas that extended from the southwest side of Galveston Bay south and west to Corpus Christi Bay and inland approximately 70 miles. Several accounts of the Karankawa were made by Spanish and French explorers who visited this region. According to these accounts, the Karankawa were a semi-nomadic people that lived in bands consisting of several family groups. Typically, these bands migrated seasonally between inland foraging

grounds, which were inhabited during the warm season, and coastal encampments, which were utilized during the cool season. Encampments moved frequently to take advantage of food resources. The Karankawa Indians have been considered extinct since 1858. The INEOS facility is situated within the territory that the Karankawa's were known to inhabit, however there is no evidence that Karanawa's actually utilized the area of the Project. As this Native American tribe is considered to be extinct, consultation with this tribe is not possible nor warranted based on the Project location being inside an existing facility. There are no other known Native American tribes that inhabited the Project area.

3.2 Brazoria County Historical Museum

Jamie Murray, Collections Manager for the Brazoria County Historical Museum was contacted to identify known cultural or historical resources within the INEOS facility. In a telephone conversation, she was aware of no significant resources in the vicinity of the INEOS facility. She contacted Sandra Pollan, Chair of the Brazoria County Historical Commission. On October 2, 2011, Ms. Pollan replied via e-mail that she knew of no significant cultural or historical resources in the vicinity of the proposed project.

Mr. Neil McLain, a volunteer at the Brazoria County Historical Museum, also replied that to the best of his knowledge, there are no known significant cultural resources in the vicinity of the INEOS facility.

Copies of a telephone communication record with Ms. Murray and the e-mail communications from Ms. Pollan and Mr. McLain are included in Appendix B to this supplement.

Section 4
Conclusion

The geoarcheological potential for this area, which reflects archeological sites with a high degree of preservation and integrity, is minimal for prehistoric sites located in the Beaumont Formation clays. A Texas Department of Transportation model concerning prehistoric sites, referred to as the Houston-PALM, rates this area as low potential for intact prehistoric sites (Abbott 2001).

The lack of buildings depicted on the 1966 topographic map (Figure 4) indicates no building(s) of historical significance are present in the INEOS Chocolate Bayou facility. The fact that the proposed new furnace will be constructed within the boundaries of an existing facility, which has likely undergone extensive surface modifications over time, indicates that there is no potential for intact archeological deposits in this setting and therefore no further cultural resource investigation or mitigation is warranted.

Section 5
References

Abbott, James T. 2001. Houston Area Geoarcheology: A Framework for Archeological Investigation, and Cultural Resource Management in the Houston Highway District. Texas Department of Transportation, Environmental Affairs Division, Archeological Studies Program, Report 27, Austin.

Barnes Virgil, E. 1982. Geologic Atlas of Texas, Houston Sheet, Paul Weaver Memorial Edition, Bureau of Economic Geology, The University of Texas at Austin.

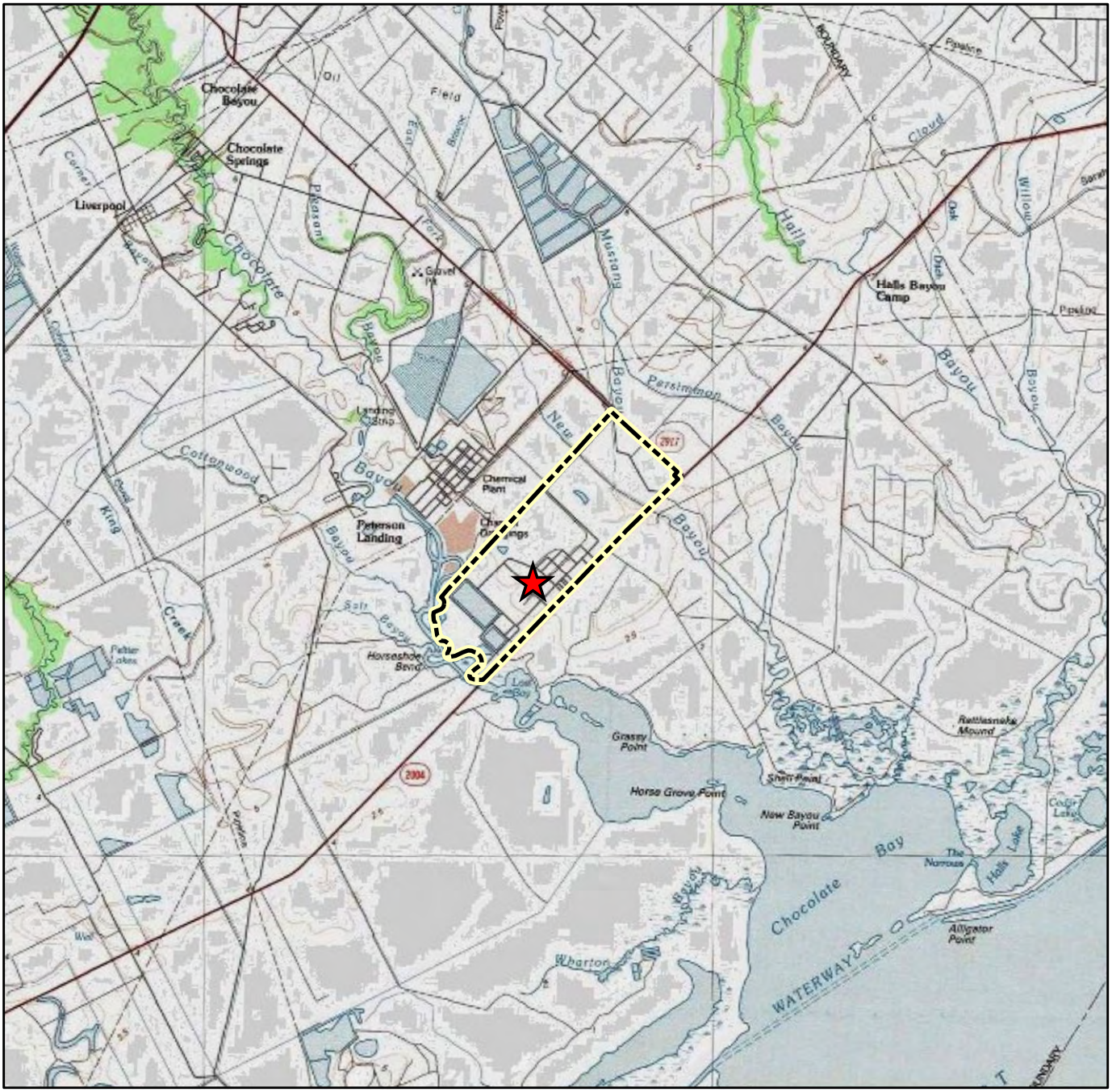
Diana J. Kleiner. 2012. Brazoria County, Handbook to Texas Online. Found on March 23, 2012. http://www.tshaonline.org/handbook/online/articles/hcb12

Lipscomb, Carol A. 2011. Karankawa Indians. In *The Handbook of Texas Online* (http://www.tshaonline.org/handbook/online/articles/bmk05), accessed June 1, 2012.

NRCS. 1981. Soil Survey of Brazoria County, Texas.

Appendix A
Figures

TRC - GIS



BASE MAP: USGS 100k TOPOGRAPHIC QUADRANGLE SERIES: ANGLETON, TX. (1984)

PROJECT LOCATION

INEOS PROPERTY LINE

N

0 10,000 20,000 Feet

TRC
10011 Meadowglen Lane
Suite 100
Houston, TX 77042
713.244.1000

INEOS USA LLC
CHOCOLATE BAYOU PLANT

PROJECT LOCATION
CULTURAL RESOURCE REPORT
ALVIN, BRAZORIA COUNTY, TEXAS

DRAWN BY:	RREDMAN
APPROVED BY:	MROBBINS
PROJECT NO:	192202.0000.0000
FILE NO.	192202.000.01.Cul.mxd
DATE:	JUNE 2012

Z:\Clients_Projects\INEOS\2012_192202\192202.000.01.Cul.mxd

FIGURE 1

TRC - GIS

BASE MAP:ESRI ONLINE DATA
BING HYBRID (2011)

CONSTRUCTION AREA
60' X 100'

N

0 300 600
Feet

TRC
10011 Meadowglen Lane
Suite 100
Houston, TX 77042
713.244.1000

INEOS USA LLC
CHOCOLATE BAYOU PLANT

CONSTRUCTION AREA - 2001 AERIAL PHOTOGRAPH
CULTURAL RESOURCE REPORT
ALVIN, BRAZORIA COUNTY, TEXAS

DRAWN BY:	RREDMAN
APPROVED BY:	MROBBINS
PROJECT NO:	192202.0000.0000
FILE NO.	192202.000.02.Cul.mxd
DATE:	JUNE 2012

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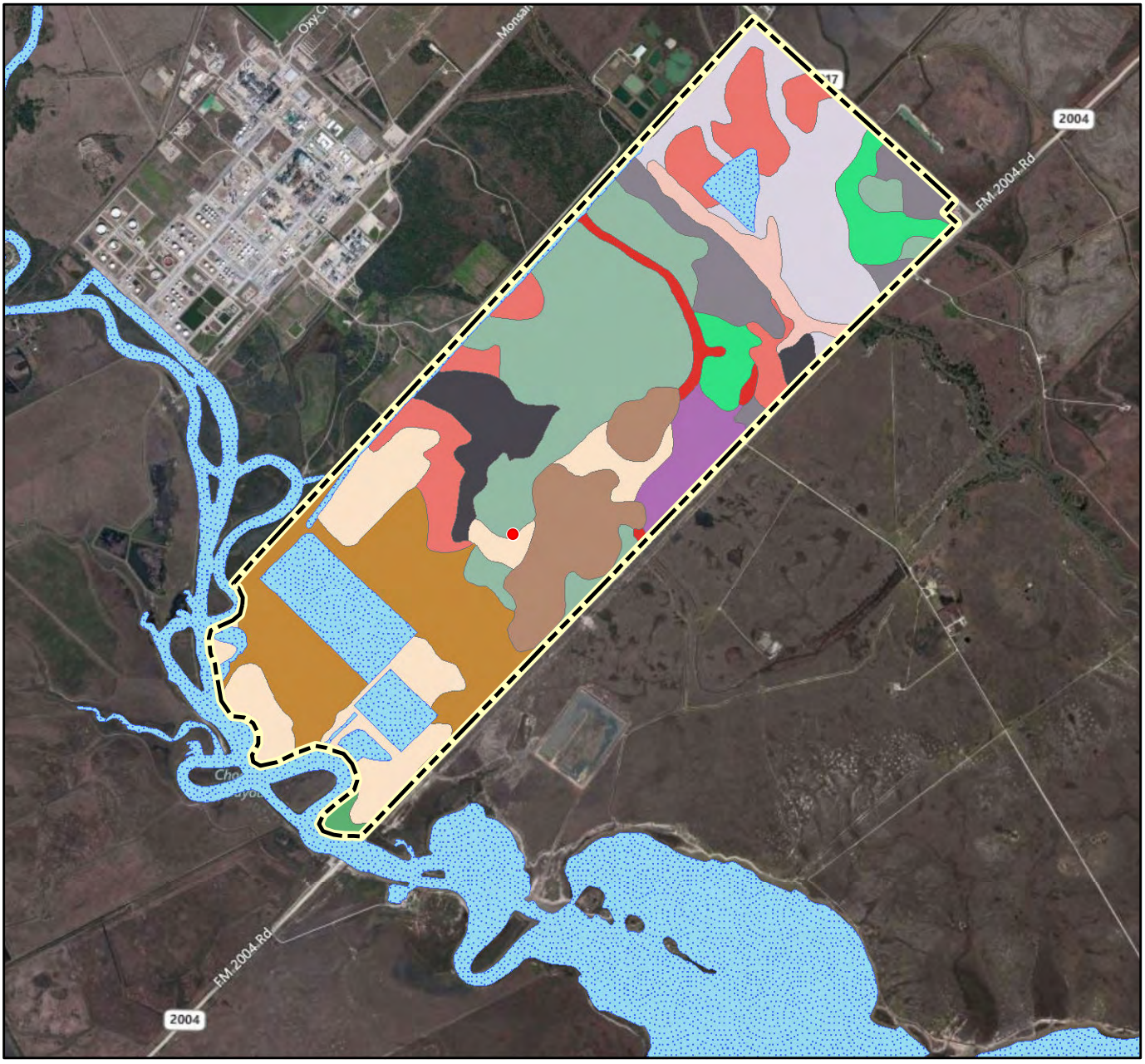
FIGURE 2

TRC - GIS



- CENTROID OF CONSTRUCTION AREA 60' X 100' (N.T.S.)
- INEOS PROPERTY LINE
- Water
- Bacliff clay, 0 to 1 percent slopes
- Bernard clay loam
- Bernard-Edna complex
- Edna fine sandy loam, 0 to 1 percent slopes
- Edna-Aris complex
- Follet clay loam
- Francitas clay
- Ijam clay
- Ijam-Urban land complex
- Lake Charles clay, 0 to 1 percent slopes
- Lake Charles clay, 1 to 8 percent slopes
- Leton loam
- Leton-Aris complex

N

1"=3,373'
1:40,477

0 3,000 6,000 Feet

SOURCE: USDA SOIL SURVEY, BRAZORIA COUNTY (2009)
BASE MAP:ESRI ONLINE DATA
BING HYBRID (2011)

TRC
10011 Meadowglen Lane
Suite 100
Houston, TX 77042
713.244.1000

INEOS USA LLC
CHOCOLATE BAYOU PLANT

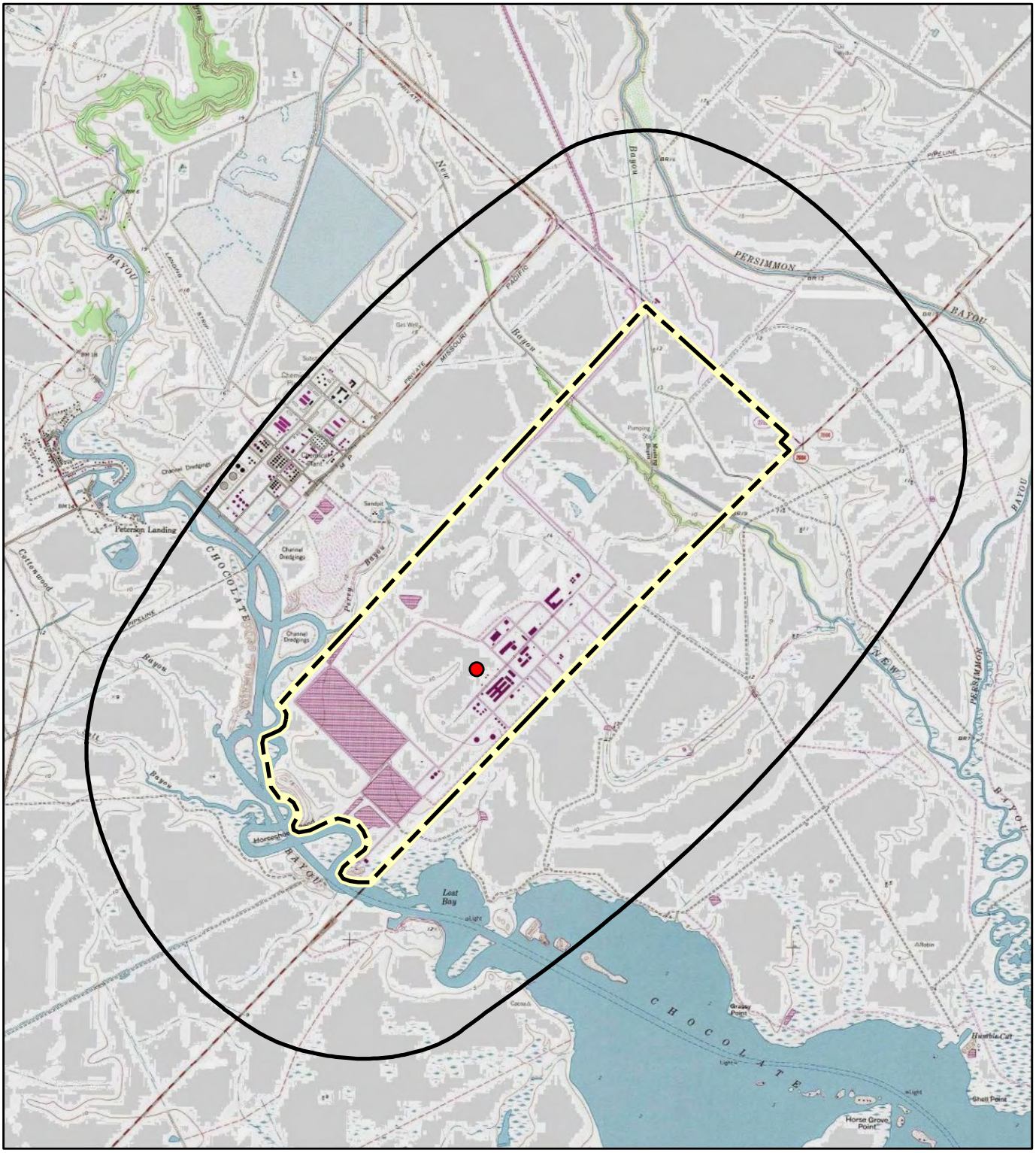
SOIL SURVEY MAP
CULTURAL RESOURCE REPORT
ALVIN, BRAZORIA COUNTY, TEXAS

DRAWN BY:	RREDMAN
APPROVED BY:	RHANLEY
PROJECT NO:	185864.0000.0000
FILE NO.	192202.000.03.CUL.mxd
DATE:	JUNE 2012

Z:\Clients_Projects\INEOS\2012_192202\192202.000.03.CUL.mxd

FIGURE 3

TRC - GIS



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES:
HOSKINS MOUND AND MUSTANG BAYOU, TX.

N

1"= approx. 4,300'
1:52,000

0 4,000 8,000
Feet

- *CENTROID OF CONSTRUCTION AREA 60' X 100' (N.T.S.)*
- INEOS PROPERTY LINE
- 1-MILE SEARCH RADIUS

TRC
10011 Meadowglen Lane
Suite 100
Houston, TX 77042
713.244.1000

INEOS USA LLC
CHOCOLATE BAYOU PLANT

1-MILE RADIUS SEARCH OF
TEXAS ARCHEOLOGICAL SITES ATLAS
ALVIN, BRAZORIA COUNTY, TEXAS

DRAWN BY:	RREDMAN
APPROVED BY:	MROBBINS
PROJECT NO:	192202.0000.0000
FILE NO.	192202.000.04.Cul.mxd
DATE:	JUNE 2012

Z:\Clients_Projects\INEOS\2012_192202\192202.000.04.Cul.mxd

FIGURE 4

Appendix B
Brazoria County Museum Correspondence

TRC Environmental Corporation
30 Patewood Drive, Suite 100
Patewood Plaza One
Greenville, SC 29615

Main 864.281.0030
Fax 864.281.0288

Communication Record

Participant(s)	Company Name	Telephone No.
Jamie Murray	Brazoria County Historical Museum	979.864.1208

Project No: 185864.0000.0000 **Date/Time:** 29 September 2011

Project Name: Ineos USA LLC, NEPA Resources Review

Meeting/Conversation (explain): Telephone Call

Prepared by: Robert Hanley **Title:** Senior Environmental Scientist

Signature:

Subject/Purpose: Cultural/Historical Review

TRC contacted the Brazoria County Historical Museum to inquire about cultural or historical resources in the vicinity of the Chocolate Bayou facility. TRC e-mailed a location map of the facility.

Ms. Murray was not aware of any significant cultural or historical resources in the vicinity of the Chocolate Bayou facility. She said that she would pass the information on to representatives of the Brazoria County Historical Commission.

Powell, Amanda

From: Johnney Pollan <pollanone@sbcglobal.net>
Sent: Sunday, October 02, 2011 5:03 PM
To: Hanley, Robert
Subject: Site Location of INEOS USA, LLC Facility

Dear Sir,

I have reviewed your project map forwarded me by Jamie Murray of the Brazoria County Historical Museum and can find no evidence of either cultural or historical importance within the parameter of your project, specifically any that may not have already been impacted by existing development. I understand that Mrs Murray is researching the archival records for any such and will contact you separately should she find anything in the records that may affect your permit application.

Thank you for making contact. This process not only helps to protect our irreplaceable history, but keeps us current with the ongoing developments in the area. We appreciate your diligence.

Sincerely,

Sandra D. Pollan, Chair
Brazoria County Historical Commission
Texas Archeological Stewards Network

Powell, Amanda

From: Neal McLain <nmclain@annsgarden.com>
Sent: Friday, September 30, 2011 9:00 PM
To: Hanley, Robert
Cc: Barbara Burkhardt; Dave Brandes; Ed Barrios; Fred Lewis; Cody Dingee; Jamie Murray; Jennifer Sanchez; Netta Shingler; Tom Schneider; Neal McLain
Subject: Re: Site Location of INEOS USA, LLC Facility

Mr. Hanley:

This is in reference to the Site Location of INEOS USA, LLC Facility.
Jamie Murray, of Brazoria County Historical Museum, forwarded your two messages to me. I am a volunteer at BCHM, with responsibility for cataloging maps. I also volunteer for the following organizations:
- Friends of Brazoria Wildlife Refuges (FOBWR)
  http://refugefriends.org
- Texas Master Naturalist Cradle of Texas Chapter (TMN-COT)
  http://tmn-cot.org
- U.S. Fish & Wildlife Service, Texas Mid-coast NWR Complex (USFWS)
  http://1.usa.gov/TMC-NWRC

After studying the map you sent, I am not aware of any "known, significant cultural or historical sites and/or resources within a one-mile radius of the INEOS site" or within the INEOS property as shown by a blue line on your map.

I forwarded your request to representatives from USFWS, FOBWR, and TMN-COT to solicit their opinions. As of 5:00 pm September 30, 2011, I had not heard from anyone who disagrees with this opinion.

When studying the map you sent, I paid particular attention to two features:

- The Chocolate Bayou Wildlife Conservation Center, located on INEOS-owned land south of highway FM2004.
Volunteers from TMC-COT conduct environmental education (EE) classes for local elementary school students at this facility. Inasmuch as INEOS sponsors this program, I assume they're aware of it. A Google map showing the location of this property is at:
http://bit.ly/INEOS-map.
This facility appears to be outside of the areas of interest shown on your map.

- Brazoria National Wildlife Refuge, located south of Chocolate Bayou.
A map of the refuge is posted at:
http://refugefriends.org/maps/BNWR_2009.pdf
The entire refuge appears to be outside of the areas of interest as shown on your map.

Please be aware that I am not a surveyor, a lawyer, or a professional engineer. The opinion I expressed above is based solely on my experience as a volunteer for organizations mentioned above.

Neal McLain
416 County Road 912A
Brazoria, TX 77422-7695
979-798-2284 home
979-824-3586 cell

cc: Barbara Burkhardt, President, TMN-COT
cc: Dave Brandes, Past President, TMN-COT
cc: Ed Barrios, President, FOBWR
cc: Fred Lewis, INEOS EE Program Coordinator, TMN-COT
cc: J. Cody Dingee, Refuge Manager, Brazoria NWR, USFWS
cc: Jamie Murray, Brazoria County Historical Museum
cc: Jennifer Sanchez, Project Leader, USFWS
cc: Netta Shingler, SHE Administrative Assistant, INEOS
cc: Tom Schneider, Outdoor Recreation, USFWS