DOE/EA-1769

FINAL ENVIRONMENTAL ASSESSMENT

BATTLEGROUND ENERGY RECOVERY PROJECT

HARRIS COUNTY, TEXAS

U.S. DEPARTMENT OF ENERGY
National Energy Technology Laboratory

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Title: Final Environmental Assessment for the Battleground Energy Recovery Project (DOE/EA-1769)

Location: Deer Park, Harris County, Texas

Contact:

William J. Gwilliam, Document Manager
National Energy Technology Laboratory
U.S. Department of Energy
P.O. Box 880
3610 Collins Ferry Road
Morgantown, WV 26505
Email: william.gwilliam@netl.doe.gov
Fax: 304-285-4403

Abstract:

The United States Department of Energy's (DOE's) National Energy Technology Laboratory (NETL) prepared this Environmental Assessment (EA) to analyze the potential environmental impacts of providing funding for the proposed Battleground Energy Recovery Project in Deer Park, Harris County, Texas.

The proposed action is for DOE to provide $1.94 million in cost-shared funding to the Houston Advanced Research Center (HARC) for the Battleground Energy Recovery Project. The proposed project was selected by the DOE Office of Energy Efficiency and Renewable Energy (EERE) to advance research and demonstration of energy efficiency and renewable energy technologies. The proposed project would produce 8 megawatts (MWs) of electricity from high pressure steam generated by capturing heat that is currently lost at the Clean Harbors Deer Park (CHDP) facility. The proposed project is consistent with DOE's goal of increased use of energy efficiency and renewable energy generation projects.

The proposed project involves installation of a specifically designed waste heat recovery boiler on the existing kiln afterburner of an incineration unit at the CHDP facility. This boiler would use heat from the incinerator flue gases to generate high-pressure superheated steam. The adjacent Dow Chemical plant would periodically consume part of the steam for process needs, replacing natural gas firing of existing boilers. The majority of the steam, however, would be piped to a new turbine generator (TG). The TG would be installed in a new building adjacent to the existing CHDP facility. Additional waste heat steam from the

neighboring Dow Chemical plant would be routed to the TG when available. A cooling tower would be installed adjacent to the new building in the northwest corner of the facility.

The 8 MWs of electricity generated by the TG would be used by the CHDP facility to offset purchased power; any excess power generated would be transmitted to the electric grid. Construction and installation activities associated with the proposed project would occur entirely within private industrial property. The project would require **a construction permit and a minor amendment to the facility's air emissions operating** permit. Additionally, modification to the facility's hazardous waste processing and disposal permit would be necessary. However, no significant adverse impacts are anticipated to result from implementation of this proposed project.

Public Participation:

DOE invited comments on the Draft EA for this project for a period of 30 days following publication of the public notice in two local newspapers; The *Houston Press* and the *Deer Park Broadcaster*. The public notice was published for 3 consecutive days on Wednesday, February 2; Thursday, February 3; and Friday, February 4, 2011. Copies of the Draft EA were made available through the DOE NEPA website, the Harris County Public Library System, and at the Clean Harbors facility in Deer Park. The public was encouraged to submit written comments regarding the proposed project at the above address to William Gwilliam, DOE NEPA document manager.

By the close of the comment period on March 4, 2011, a total of six (6) comments on this project were received. The comments came from the Kickapoo Traditional Tribe of Texas, the Texas Parks and Wildlife Department, the Bureau of Indian Affairs – Southern Plains Region, the U.S. Fish and Wildlife Service (USFWS) in Houston, Texas, the State Historic Preservation Officer (SHPO) representing the Texas Historical Commission, and the SHPO on behalf of the Alabama-Coushatta Tribe. These comments have been included in Appendix C of this document. The Kickapoo Traditional Tribe of Texas, the Bureau of Indian Affairs, the USFWS, the Texas Parks and Wildlife Department, and the Alabama-Coushatta Tribe had no further comment on this project. The Texas Historical Commission concluded that since the project area had never been surveyed by a professional archaeologist, the proposed steam and condensate lines running between Clean Harbors and the Dow Chemical Plant could disturb intact archaeological deposits. In response to the concerns identified in this letter, the area was surveyed by Moore Archaeological Consulting, Inc. on behalf of the DOE. The survey, included in Appendix D, found no artifacts of either historic or prehistoric origin in the proposed project area. The Texas Historical Commission reviewed and concurred with this determination.

Availability:

This EA is available on DOE's National Energy Technology website at: http://www.netl.doe.gov/publications/others/nepa/index.html.

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ACRONYMS AND ABBREVIATIONS

ABC	Afterburner Chamber
ANSI	American National Standard
AQCR	Air-Quality Control Region
BMP	Best Management Practice
Btu	British thermal units
CAA	Clean Air Act
CoDP	City of Deer Park
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, Liability Act
CFR	Code of Federal Regulations
CHDP	Clean Harbors Deer Park, L.L.C.
CHP	Combined Heat and Power
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	Decibels
dBA	A-weighted Decibel
DNL	Day-night Average Sound Level
DOE	Department of Energy
EA	Environmental Assessment
EERE	Office of Energy Efficiency and Renewable Energy
EPACT	Energy Policy Act
EO	Executive Order
ESA	Endangered Species Act
^oF	Degree in Fahrenheit
FAA	Federal Aviation Administration
ft	foot
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutant
HARC	Houston Advanced Research Center
HRSG	Heat Recovery Steam Generator
IPCC	Intergovernmental Panel on Climate Change
L_{eq}	Equivalent Sound Level
MACT	Maximum Achievable Control Technology
MM Btu/hr	million British thermal units per hour
msl	mean sea level
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_x	Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System

NSPS	New Source Performance Standards
NSR	New Source Review
O_3	Ozone
OSHA	Occupational Safety and Health
PCB	Polychlorinated biphenyl
PL	Public Law
PM_{10}	Particulate Matter less than 10 microns in diameter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
ppm	parts per million
PSD	Prevention of Significant Deterioration
psig	pound-force per square inch gauge
RCRA	Resource Conservation Recovery Act
sf	square foot
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TG	Turbine Generator
THC	Texas Historical Commission
TPDES	Texas Pollutant Discharge Elimination System
tpy	tons per year
TSCA	Toxic Substances Control Act
$\mu g/m^3$	micrograms per cubic meter
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compound
VPP	Voluntary Protection Program
WESP	Wet Electrostatic Precipitator

1.0 INTRODUCTION

The United States Department of Energy's (DOE) National Energy Technology Laboratory (NETL) prepared this Environmental Assessment (EA) to analyze the potential environmental impacts of providing cost-shared funding for the proposed Battleground Energy Recovery Project in Deer Park, Texas. This project was selected by the DOE's Office of Energy Efficiency and Renewable Energy (EERE) to advance research and demonstrate energy efficiency and renewable energy technologies.

The proposed project considered in this EA was one of the four projects DOE selected for funding. The proposed project would incorporate commercial scale state-of-the-art waste heat recovery technology at a large hazardous waste incinerator site owned and operated by Clean Harbors, Inc. Waste heat produced by this system would be used onsite and by an adjacent chemical manufacturing facility owned by Dow Chemical Company. The proposed project would make combined heat and power more readily available in the 5 to 20 Megawatt (MW) range, replacing natural gas with waste energy streams.

1.1 BACKGROUND

Combined heat and power (CHP) involves recovery of waste heat to generate useful energy such as steam or electricity. In general, CHP represents the most cost effective application for distributed generation, which is the production of electricity at or close to the point of use.

The widely recognized benefits of CHP include energy savings, cost savings, and reductions of carbon dioxide (CO_2) and other pollutants. CHP is a realistic, near-term option for large energy efficiency improvements and significant CO_2 reductions. CHP can provide thermal energy for buildings and industrial processes, while simultaneously generating part of the electricity needed at the site – at a higher combined efficiency. CHP supports EERE's mission to strengthen America's energy security, environmental quality, and economic vitality in public-private partnerships.

Industrial applications of CHP have been around for decades, producing electricity and thermal energy, and converting eighty percent (80%) or more of the fuel into useable energy. Typically, CHP systems operate by generating hot water or steam from the recovered waste heat and using it for process heating, but it also can be used with an absorption chiller to provide cooling. However, while CHP is a well-established practice in large industrial processes with sizable electricity and thermal loads, analyses indicate that there is still a largely untapped potential in applications of less than 20 MW in electrical demand.

Industrial demand accounts for approximately one-third of U.S. energy and represents significant opportunities for energy savings. Relative to the separate generation of electricity and heat, CHP is one of the most effective commercially-available alternatives for accomplishing sizable near-term energy savings and corresponding GHG reductions. A fully developed CHP market can lower energy consumption, offset imported oil, create

jobs and improve the overall economic competitiveness of the nation.

The proposed Battleground Energy Recovery Project would assist in developing the CHP market for industrial applications of less than 20 MW by producing 8 MWs of electricity from high pressure steam generated at the Clean Harbors Deer Park (CHDP) facility (**see Figure 1-1**). Additional high pressure steam from the neighboring Dow Chemical plant would also be used, when available.

The CHDP facility is a fully permitted hazardous waste facility, which manages a wide variety of regulated materials, including solids, liquids, sludge and gas that are delivered to the site via drums, tankers and rail (Clean Harbors, 2008). The facility began operations in 1971.

Figure 1-1. CHDP Facility Incineration Train I

The CHDP property contains two incineration units (Trains I and II). The proposed project would include installation of a specifically designed waste heat recovery boiler on the existing kiln afterburner of Incineration Train 1 at the CHDP facility. This boiler would remove heat from the incinerator flue gases, generating high pressure superheated steam. The adjacent Dow Chemical plant would periodically use part of the steam to serve process needs, replacing natural gas firing of existing boilers. The majority of the steam, however, would be piped to a new TG in order to produce electricity. Additional waste steam from the neighboring Dow Chemical plant would be routed to the TG when it is available.

The 8 MW of electricity generated by the TG would be used by the CHDP facility to offset purchased power; any excess power generated would be transmitted to the electrical grid by Center Point Energy.

DOE's proposed action is to provide $1,938,410 in cost-shared funding to Houston Advanced Research Center (HARC) for the Battleground Energy Recovery Project. Private industry partners would provide the remaining funding. The project would have a minimum 30-year operating life and would be considered a permanent installation. However, the period of performance for DOE's proposed action is much shorter.

1.2 PURPOSE OF AND NEED FOR DOE'S PROPOSED ACTION

The overall purpose of the proposed action is to advance research on and demonstration of energy efficiency and renewable energy technologies. On a national level, there is a need for projects to demonstrate energy generation through more efficient and environmentally preferable means. These projects support innovative technologies that provide fuel flexibility for manufacturers and consumers and reduce fossil fuel requirements. The proposed project would use waste heat, which is considered a green energy fuel.

Sharing in the funding of this proposed project also furthers the objectives set forth in the Energy Independence and Security Act of 2007 by increasing national energy security through improving industrial energy efficiency (Title IV, Subtitle D). The increase of industrial energy efficiency will result in a variety of benefits to the nation, including: improved national energy security, increased economic growth, and broad-based environmental benefits (DOE, 2010).

1.2.1 PURPOSE AND NEED OF HARC'S PROJECT

DOE's NETL manages the research and development portfolio of the Industrial Technologies Program for the EERE. The mission of the Industrial Technologies Program is to establish U.S. industry as a world leader in energy efficiency and productivity. The program leads the national effort to reduce industrial energy intensity and carbon emissions, and strives to transform the way U.S. industry uses energy by supporting cost-shared research and development that addresses the top energy challenges facing industry. In addition, the Industrial Technologies Program fosters the adoption of advanced technologies and energy management best practices to produce meaningful progress in reducing industrial energy intensity.

DOE solicited applications for ITP funding by issuing a competitive Funding Opportunity Announcement (DE-PS26-08NT0004312-00), *Fuel/Feedstock Flexibility and Combined Heat and Power*, in May 2008. The announcement invited applications in three areas of interest:

- Area of Interest 1: Fuel Flexibility - Cost shared applications were sought for application-specific replacement of natural gas as a heating or prime mover power source. This can be accomplished through the utilization of industrial waste streams, organic waste, or post-industrial/commercial waste such as municipal solid waste and tire-derived fuel.
- Area of Interest 2: Feedstock Flexibility in the Chemical Industry - Applications in this Area of Interest were sought to perform Research and Development (R&D) for the utilization of non-traditional feedstocks for chemical and related industries. Research emphasis was placed on waste or other under-utilized abundant and low cost streams.
- Area of Interest 3: Clean Distributed Generation - Cost shared applications were sought in this Area of Interest to increase Combined Heat and Power (CHP)

utilization for industrial and commercial applications, with an emphasis on projects that have the flexibility to utilize renewable and opportunity fuels.

DOE selected nine projects for funding based on the evaluation criteria in the funding opportunity announcement and gave special consideration to cost-shared R&D projects to develop innovative technologies that when deployed commercially, would enable the U.S. industry to reduce natural gas requirements for chemical feedstocks, increase utilization of opportunity fuels, and expand the use of CHP applications.

Upon initial review, it was determined that the proposed project could be excluded from further NEPA review under a DOE Categorical Exclusion. However, upon further assessment, it was determined that an Environmental Assessment would be prepared for the project due to uncertainty regarding environmental impacts.

1.3 LOCATION AND GENERAL DESCRIPTION OF THE AFFECTED AREA

The proposed project would be located within the boundaries of the existing Clean Harbors Environmental Services Resource Conservation Recovery Act (RCRA) hazardous waste facility in Deer Park, Harris County, Texas, approximately 15 miles southeast of downtown Houston (**see Figure 1-2**).

The Clean Harbors Deer Park (CHDP) property is 145 acres, with 8 acres of buffer. The site is located on the west side of Independence Parkway (formerly Battleground Road), which is a highly industrial corridor along the Houston Ship Channel. The plant is surrounded by the Dow Chemical Plant to the north and west, and the Total Petrochemicals facility directly across Independence Parkway to the east. The Clean Harbors plant site also includes a landfill located on the property to the south.

Pipelines for vent steam and condensate return may be installed to connect the project to the adjacent Dow Chemical Plant, which lies immediately west of the CHDP.

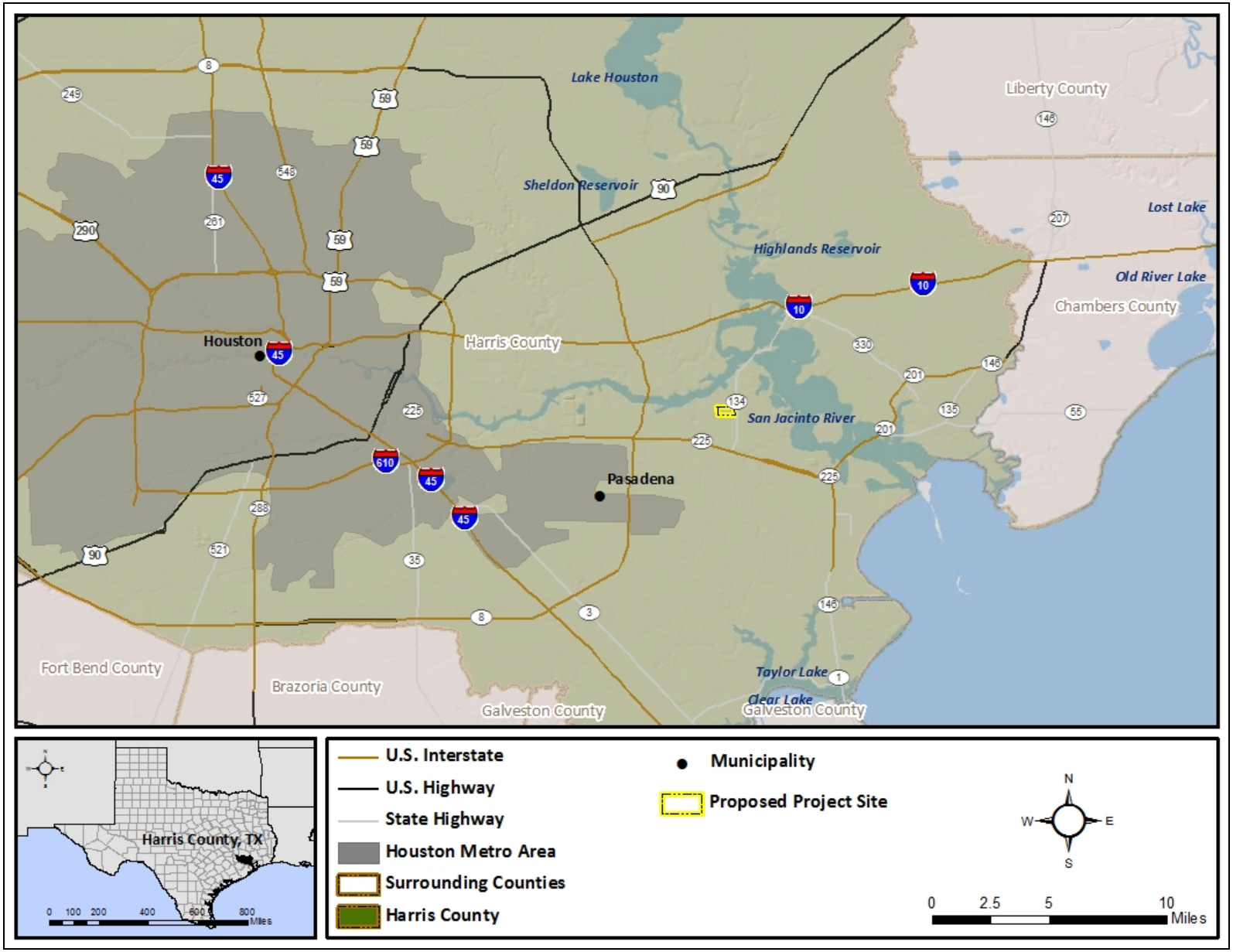


Figure 1-2. Project Vicinity Map

1.4 SCOPE OF THE EA

This EA analyzes the potential environmental impacts that would result from DOE's Proposed Action, which would assist HARC to implement the proposed project, and its alternative, the No Action alternative. This EA was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (PL 91-190), the Council of Environmental Quality (CEQ) Regulations dated 28 November 1978 (40 CFR Parts 1500-1508), and the DOE NEPA Implementing Procedures (10 CFR Part 1021).

The purpose of NEPA is to help federal agency officials make informed decisions about agency actions and to provide a role for the general public in the decision-making process. The study and documentation mechanisms associated with NEPA seek to provide decision-makers with knowledge of the comparative environmental consequences of the courses of action available to them. NEPA studies, and the documents recording their results, such as this EA, focus on providing input to the particular decisions faced by the relevant agency officials.

This EA identifies, describes, and evaluates the potential environmental impacts that would result from the implementation of the proposed project and the no action alternative, and takes into consideration possible cumulative impacts from other actions. As appropriate, the affected environment and environmental consequences of the action will be described in both site-specific and regional contexts. In instances where mitigation measures may lessen any potentially adverse impacts, this EA identifies such measures that could be implemented to further minimize environmental impacts.

The following resource areas have been identified for study within this EA: soil and land use, water resources (including surface water, wetlands, and floodplains), air quality, noise, biological resources (including threatened and endangered species), cultural resources, infrastructure, and socioeconomic resources. Resource areas considered but dismissed for further analysis are discussed below.

1.4.1 Resource Topics Dismissed from Further Analysis

Several resource topics and issues were raised during internal DOE scoping for this project that were not considered to warrant detailed analysis in this EA because they were: 1) outside the scope of the proposed project; 2) already decided by law, regulation, or other higher level decisions; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The rationale for eliminating these issues is provided in the descriptions below.

Wild and Scenic Rivers

The National Wild and Scenic Rivers Act is administered by four federal agencies; the Bureau of Land Management, the National Park Service, the U.S. Fish and Wildlife Service (USFWS), and the U.S. Forest Service. The Act protects selected rivers, and

their immediate environments, which possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. In Texas, there is only one National Wild and Scenic River, the Rio Grande River, which is designated for its reach within Big Bend National Park. Big Bend National Park is located well over 400 miles west of the proposed project area, and the Rio Grande River is not located within the same watershed as the proposed project. The Rio Grande River will not be affected by the proposed project. Therefore, this topic is dismissed from further analysis.

Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations,* requires all federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs and policies on minorities (e.g. those persons who identify themselves as something other than White, not Hispanic or Latino, in the U.S. Census) and low-income populations and communities.

Compared to the U.S. percentage of individuals below the poverty line in 2008 (13.2%), the City of Deer Park has a small percentage of residents in poverty at 6%. Both Harris County and the State of Texas have 16% of residents below the poverty line (Census, No date[a]). Relevant racial demographics are included in **Table 1-1** from the 2006-2008 American Community Survey for the city, county, state, and nation for comparison. As illustrated in the table, the City of Deer Park generally has a higher percentage of white non-Hispanics and lower percentages of minorities compared to the county, state, and nation.

Table 1-1. Area Racial Demographics in 2006-2008

	City of Deer Park	Harris County	Texas	United States
White	87.7%	59.7%	71.4%	74.3%
Black	1.5%	18.4%	11.5%	12.3%
American Indian and Alaska Native	0.4%	0.4%	0.5%	0.8%
Asian	2.2%	5.5%	3.4%	4.4%
Native Hawaiian and Other Pacific Islander	0.2%	0.1%	0.1%	0.1%
Some Other Race	5.7%	14.4%	11.3%	5.8%
Two or More Races	2.2%	1.5%	1.9%	2.2%
Hispanic or Latino	21.9%	38.4%	35.9%	15.1%

Source: (Census, No date[a]). Note: the percentages do not add up to 100% due to Hispanics identifying themselves as multiple races.

Recent census data at the neighborhood level is not available because the 2010 Census data will not be available until after 2011. However, the nearest neighborhoods to the project are approximately 1.8 miles to the south across a freeway. The neighborhoods

have been near industrial activities for at least 40 years given the CHDP history. This history means that the residents have likely become acclimated to the existing industrial operations. The impacts from the proposed action should not be disproportionate given the relatively low percentages of both low-income and minority populations in the area, the distance between residential areas and the site, the long history of the industrial activities in the immediate project vicinity, the general lack of significant impacts from the proposed project as well as the fact that impacts should be felt equally among the populations, and the private, industrial nature of the proposed site that excludes use by other people. Therefore, this topic is dismissed from further analysis.

Human Health and Safety

It is assumed that the contractors responsible for site development and construction activities will also be responsible for compliance with the applicable Occupational Safety and Health Act (OSHA) regulations and all CHDP site-specific safety measures that concern occupational hazards and specify appropriate protective measures for all employees and site visitors. The CHDP facility has been approved into OSHA's Voluntary Protection Programs (VPP), which promotes effective worksite-based safety and health. In the VPP, management, labor, and OSHA establish cooperative relationships at workplaces that have implemented a comprehensive safety and health management system. Approval into VPP is OSHA's official recognition of the outstanding efforts of employers and employees who have achieved exemplary occupational safety and health (OSHA, 2009).

Health and safety impacts generated from air emissions, noise, or hazardous waste associated with the proposed project, are evaluated under those respective resource sections within this EA. Therefore, this resource area is dismissed from further analysis as an independent resource area.

Recreation

The project area is contained entirely within private industrial property; public access and use of the property is strictly limited, as are natural resources at or near the property. The proposed project is not anticipated to impact any public or recreational uses of the land. Furthermore, the offsite impacts of the proposed project (e.g. air emissions from facility operations) are not anticipated to have any impact on recreation activities offsite of the proposed project area. Because the proposed project would not appreciably diminish recreation opportunities or the quality of recreation activities in the vicinity of the project area, this topic is dismissed from further analysis.

1.4.2 Compliance with Laws and Executive Orders

This EA complies with the NEPA, CEQ regulations (40 CFR Parts 1500-1508), and DOE regulations for compliance with NEPA (10 CFR Part 1021). The EA also addresses all applicable laws and regulations, including but not limited to the following:

- Energy Policy Act (EPACT),
- National Historic Preservation Act (NHPA),
- Archeological Resources Protection Act (ARPA),
- The Noise Control Act of 1972, as amended,
- Addressing Environmental Justice (EO 12898),
- Clean Air Act (CAA),
- Clean Water Act (CWA),
- Coastal Zone Management Act,
- Protection of Wetlands (EO 11990),
- Floodplain Management (EO 11988),
- Endangered Species Act (ESA),
- Pollution Prevention Act (PPA),
- Resource Conservation and Recovery Act (RCRA), and
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

The proposed project will meet the new emission standards promulgated under 40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants (NESHAP) and all applicable New Source Performance Standards. Implementation of the Proposed Action will also help carry out EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, by promoting energy efficiency and the reduction of fossil fuel consumption. Finally, the Proposed Action will help DOE meet the provisions set forth in the Energy Independence and Security Act of 2007.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 DOE'S PROPOSED ACTION

DOE's proposed action is to provide cost-shared funding to the Houston Advanced Research Center (HARC) for the Battleground Energy Recovery Project in Deer Park, Harris County, Texas. The Proposed Action would advance waste heat recovery in the hazardous waste incineration market, an area that has seen little adoption of heat recovery in the U.S., and would further DOE's goal of increasing energy efficiency projects. The proposed project would have a minimum 30 year operating life and would be considered a permanent installation.

The DOE's Office of Energy Efficiency and Renewable Energy (EERE) would provide approximately $1.94 million in cost-shared funding. Private industry partners would provide the remaining project funding and be responsible for project implementation.

2.2 PROPOSED PROJECT – BATTLEGROUND ENERGY RECOVERY PROJECT

The proposed Battleground Energy Recovery Project would produce 8 MW of electricity from high pressure steam generated from waste heat that is currently lost at the Clean Harbors Deer Park (CHDP) facility.

The project would incorporate commercial scale state-of-the-art waste heat recovery technology at a large hazardous waste incinerator site owned and operated by Clean Harbors, Inc. Steam produced by this system would be utilized onsite and occasionally by an adjacent chemical manufacturing facility owned by Dow Chemical Company (**see Figure 2-1**). The proposed project would be hosted and managed by a special entity created for that purpose – Battleground Green Energy LLC. The proposed project would make combined heat and power more readily available in the 5 to 20 Megawatt (MW) range to replace natural gas usage with underutilized waste energy streams.

The project would include installation of a specifically designed waste heat recovery boiler on the existing kiln afterburner of Incineration Train 1 at the CHDP facility. This boiler would remove heat from the incinerator flue gases, generating high pressure superheated steam. The adjacent Dow Chemical plant would periodically use part of the steam to serve process needs, replacing natural gas firing of existing boilers. The majority of the steam, however, would be piped to a new TG. The TG would be installed in a new building adjacent to the existing CHDP facility to produce electric power. Additional waste steam from the neighboring Dow Chemical plant would be routed to the TG when it is available. A cooling tower would be installed adjacent to the new TG building in the northwest corner of the facility **(see Figure 2-1)**.

Output from the proposed TG would produce 8 MWs of electricity. The electricity would be used by the CHDP facility to offset purchased power; any excess power generated would be transmitted to the electrical grid by Center Point Energy.

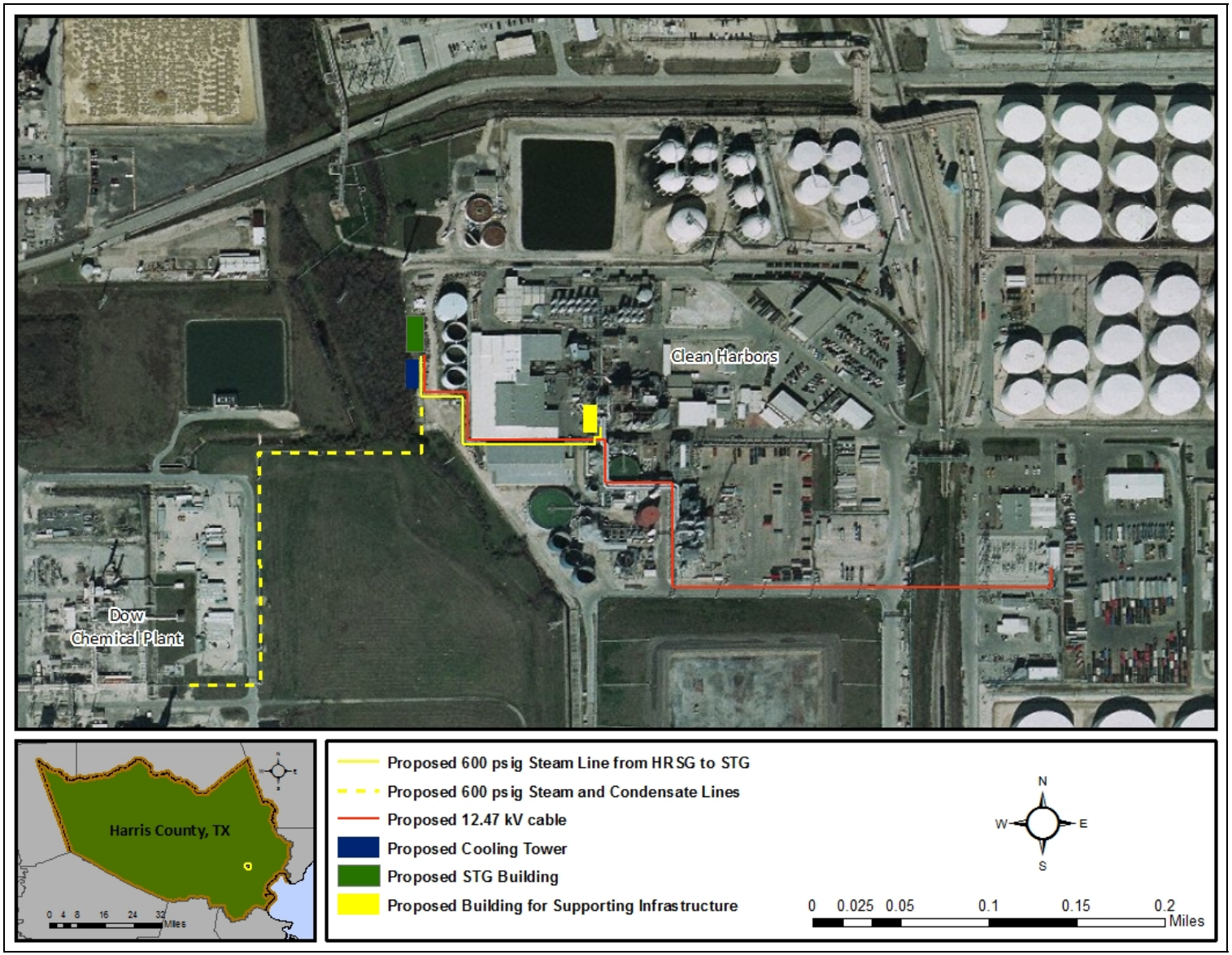


Figure 2-1. Proposed Project Layout

Clean Harbors Deer Park Facility

The CHDP facility is a fully permitted hazardous waste facility, which manages a wide variety of regulated materials, including solids, liquids, sludge and gas that are delivered to the site via drums, tankers and rail (Clean Harbors, 2008). The facility began operations in 1971.

The CHDP property contains ample storage areas for waste, two incineration units (Trains I and II), an onsite landfill for incineration residues, and an onsite wastewater treatment system (Clean Harbors, 2008). Wastes accepted by the facility include RCRA regulated hazardous wastes, Polychlorinated biphenyls (PCBs), contaminated wastewaters and soils, oils, solvents, laboratory chemicals, debris from toxic or reactive chemical cleanups, labpacks, and non-regulated waste materials. A full-time staff of approximately 275 personnel is currently employed by the facility (Clean Harbors, 2008).

The two incineration units at the CHDP facility have a combined output of 333.5 million British thermal units per hour (MM Btu/hr) (Clean Harbors, 2008). The Texas Commission on Environmental Quality (TCEQ) permit that authorizes the operation of the incineration units establishes operating conditions to ensure that the permitted emission limits for the facility (including particulate matter, chlorine, and certain metals) are achieved. The incinerators are subject to the Hazardous Waste Combustor Maximum Achievable Control Technology (MACT) rule contained in *40 CFR Part 63, Subpart EEE,* which regulates additional emission parameters. The facility is also regulated under several air permits issued by the TCEQ, and Train I is authorized to incinerate PCB materials under the Toxic Substances Control Act (TSCA) regulated by USEPA Region 6 (CHDP, 2010).

Compliance with the MACT final standards was demonstrated in 2006 for Trains I and II, with a subsequent additional demonstration for Train II in 2008. These data served as the basis for the current operating parameter limits under the MACT regulations as specified in the Notice of Compliance for each unit (CHDP, 2010).

The proposed heat recovery boiler would be installed only in Train I. Train I includes a rotary kiln, which is equipped with a solid feed chute, a combination liquid/gas burner, a sludge feed port, and a gas vent port. Inert solids exit the kiln in the form of slag, dropping into a water bath "deslagger." Hot gases exit the drop-out chamber through refractory lined duct, to the afterburner chamber (ABC) (CHDP, 2010).

A horizontal liquid waste burner is the primary heat source for the ABC. Combined hot gases exit the ABC through a vertical duct that turns down to enter the rapid quench or saturator. Under the proposed project, these gases would be intercepted and routed to the heat recovery boiler. The saturator presently cools the flue gases from incinerator temperatures as high as 2200 degree in Fahrenheit (^{o}F) to typically less than 190^{o}F. The saturator would continue to function under the proposal, but at a greatly reduced capacity.

Quenched gases generated during the incineration process enter a series of condensers, which use recirculating cooling water to remove heat from the gases. These begin the scrubbing process for all contaminants. The scrubbing water is cooled and neutralized before it is recirculated. Gases pass through a scrubber system prior to being treated in two wet electrostatic precipitators (WESPs). The WESPs remove fine particulate and metals from the flue gases. An induced draft fan pulls the flue gas flow through all of these unit operations. The gases then flow through the selective catalytic reduction control system, and out the stack where they are sampled and analyzed by the continuous emissions monitoring system (CHDP, 2010).

The scrubbing waters for both incineration units flow through a water treatment system where they are neutralized with lime and sodium hydroxide, clarified to remove solids, and cooled. These waters are comingled amongst the unit operations, and also between the two incineration trains. Blowdown water from the common system is treated further in the metals removal system before being discharged under the facility's Texas Pollution Discharge Elimination System (TPDES) wastewater permit (CHDP, 2010).

Project Components

The proposed Battleground Energy Recovery Project would produce 8 MW of electricity from high pressure steam generated by capturing waste heat that is currently lost at the CHDP facility.

The project would include installation of a waste heat recovery boiler (also referred to as a heat recovery steam generator or HRSG) designed specifically to address the challenges of hazardous waste incineration flue gas, including substantial fouling potential from slagging particulate and corrosive gas constituents. The waste heat recovery boiler would be installed in a small open space on the existing kiln afterburner of Incineration Train I at the CHDP facility. The boiler would remove heat from the incinerator flue gases, generating high pressure superheated steam. The location of the proposed boiler would minimize the ductwork associated with the installation. The proposed boiler would have a maximum height of 90 feet (ft).

The proposed boiler would incorporate superheater, evaporator, and economizer sections that would generate high pressure steam from the 2200°F flue gas at a maximum of 675 pound-force per square inch gauge (psig) and a temperature of 765^{o}F. Boiler outlet temperature; feedwater, steam, and superheater/ attemperator temperatures; steam and feedwater pressures; steam drum levels; and, chemical feeds, would all be monitored at various points in the proposed boiler system in order to maintain optimal operating conditions (CHDP, 2010).

Particulate matter would tend to drop out in the boiler. Ash hoppers would be installed along the bottom of the casing, which would allow those solids to be removed by rotary airlock valves, into a roll-off bin. These solids, which would otherwise have been collected in the scrubbing equipment, would be landfilled onsite along with incinerator slag and scrubber sludge. The proposed boiler would be equipped with an array of

sootblowers using steam to blow collected solids off the tubes for removal in the scrubber and ash hoppers. The sootblowers would be operated on demand to keep the boiler tubes clean and maximize heat removal. The installation of the boiler would reduce operating loads on the gas cleaning train. The dramatically reduced heat load would improve scrubbing capabilities and reduce evaporation out of the direct circulation cooling towers used in the system (CHDP, 2010).

The high pressure steam generated from the proposed boiler (or HRSG) would periodically be consumed by the adjacent Dow Chemical Plant to serve process needs by backing out natural gas firing of existing boilers. The majority of the steam, however, would be piped to a new TG. The TG would be installed in a new building adjacent to the existing CHDP facility to produce electric power. The steam in the TG would drive a turbine and generate electric power in proportion to its flow. The proposed TG building would be approximately 60 ft tall and have a surface area of approximately 6,000 square feet (sf). Additional waste heat steam from the neighboring Dow Chemical plant would be routed to the TG when it is available.

Boiler feed water and steam piping would be routed between the proposed boiler and the proposed TG location. A 24 ft tall cooling tower for the TG system would be installed adjacent to the new building in the northwest corner of the facility. The cooling tower would have a surface area of approximately 2,000 sf.

Existing CHDP facility roads would be used to access the proposed project sites whenever possible. A gravel spur would be required to tie the existing facility roads to the proposed TG building area. This gravel spur would be approximately 60 ft long and cover 2,000 sf.

A total of 1-2 acres of land would be disturbed at the existing CHDP facility and the adjacent Dow Chemical plant during construction and installation activities. A total of approximately 10,000 sf (0.2 acres) of new impervious surface area would be added in primarily the northwest corner of the CHDP facility (**see Figure 2-2**). This area is currently unused, and drops off to facilitate site drainage. The area would need to be reclaimed with fill and graded in order to accommodate the proposed project elements.

Figure 2-2. Proposed TG Project Site

The 8 MW of electricity generated by the TG would be used by the CHDP facility to offset purchased power; any excess power generated would be transmitted to the electrical grid by Center Point Energy.

Pipelines for vent steam and condensate return may be installed to connect the project to the adjacent Dow Chemical Plant, which lies immediately west of the CHDP. These facilities sit back-to-back, minimizing the length of new pipelines needed to connect the facilities. The new steam pipeline would be approximately 2,400 ft long, eliminating the need for public road right-of way access. The proposed project would need utility easements from Clean Harbors and Dow, which are under negotiation. The CHDP facility would need to obtain a RCRA Class 3 Solid Waste Permit Modification to accommodate this proposed project. Operating agreements between Battleground Green Energy LLC, Clean Harbors, Inc. and Dow Chemical Company are currently under negotiation.

Assuming the power production generated by the proposed project would otherwise by produced by a natural-gas fired turbine, approximately 60,000 tons of carbon dioxide (CO_2) emissions per year and 29 tons of nitrogen oxide (NO_x) emissions per year would be eliminated from generation sites elsewhere.

If the proposed project is implemented, construction and installation activities related to the proposed project would be anticipated to begin in the 2nd or 3rd quarter of 2011. Construction and installation activities would take approximately 18 months and would employ an average of 50 construction workers, and a peak of no more than 100 construction workers. Construction equipment used during construction and installation activities would include heavy haul trucks, fork trucks, large cranes, and a hydraulic work platform known as a cherry picker.

Current operations of the CHDP facility would remain largely unchanged if the proposed project were to be constructed and brought online. The proposed project equipment would have an expected life of a minimum of 30 years. Routine operation of the proposed project equipment would require 4 additional full-time staff.

2.3 NO ACTION ALTERNATIVE

Pursuant to 40 CFR 1502.14(d), DOE must analyze the No Action alternative. "No Action" means an action would not take place. The No Action alternative provides a benchmark for decision makers to compare the magnitude of potential environmental effects of the proposed project or alternatives with the conditions that would occur if the action does not take place. Under the No Action alternative, DOE would not provide funding for the proposed project (which includes a waste heat recovery boiler and a steam turbine generator) at the CHDP facility. No other alternatives were determined to be feasible.

In reality, construction and operation of the project elements could proceed as described under the proposed project in Section 2.2, without any federal monetary

contribution. However, for the purposes of providing a baseline for describing and quantifying the impacts associated with the proposed project, a hypothetical "No Action" alternative, which assumes that the project elements would not be constructed, is analyzed in this EA. Under the No Action alternative scenario, the CHDP facility would continue to operate under existing conditions and would undergo no additional expansion or energy efficiency modifications.

Natural-gas would continue to be purchased and consumed as a required energy source by both the CDHP facility and the adjacent Dow Chemical plant.

2.4 DOE ALTERNATIVE ACTIONS

The Department's alternatives to its Proposed Action for the Industrial Technologies Program consist of the other technically acceptable applications received in response to Funding Opportunity Announcement DE-PS26-08NT0004312-00, *Fuel/Feedstock Flexibility and Combined Heat and Power.* Prior to selection, DOE made preliminary determinations regarding the level of review required by NEPA based on potentially significant impacts identified during reviews of the technically acceptable applications. DOE conducted these preliminary environmental reviews pursuant to 10 CFR 1021.216. These preliminary NEPA determinations and environmental reviews were provided to the selecting official for consideration during the selection process.

Because DOE's Proposed Action under the Industrial Technologies Program is limited to providing financial assistance in cost-sharing arrangements to projects submitted by applicants in response to a competitive funding opportunity, DOE's decision is limited to either accepting or rejecting the project as proposed by the proponent, including its proposed technology and selected site. DOE's consideration of reasonable alternatives is therefore limited to the technically acceptable applications and the No Action Alternative for each selected project.

2.5 ALTERNATIVES CONSIDERED BUT DISMISSED

CEQ regulations for implementing NEPA require that federal agencies explore and objectively evaluate all reasonable alternatives to a proposed project and to briefly discuss the rationale for eliminating any alternatives that are not considered in detail. For this project, no other alternatives are currently being considered because the agency decision is to fund or not to fund the proposed project. Alternate locations for the proposed project elements were not considered, as the project elements will be located in as close proximity as possible to the existing facility structures, and in order to minimize new construction requirements for both logistical and economic reasons.

3.0 AFFECTED ENVIRONMENT

3.1 LAND USE AND SOILS

The CHDP facility is located in Deer Park, Harris County, Texas, approximately 15 miles southeast of downtown Houston. The CHDP property is located on the west side of Independence Parkway (formerly Battleground Road), which is a highly industrial corridor along the Houston Ship Channel. The plant is surrounded by the Dow Chemical Plant to the north and west, and the Total Petrochemicals facility directly across Independence Pkwy to the east. The CHDP site also includes a landfill located on the property to the south.

The City of Deer Park has adopted numerous ordinances which enforce the City's zoning and land use regulations. The CHDP facility and Dow Chemical plant properties are located within the City of Deer Park's Industrial District, which is an extra-territorial jurisdiction of the City. Within this Industrial District, the City has established tax incentives to encourage economic growth and expansion of existing facilities (CoDP, 2010).

Staff at the CHDP facility manage and maintain numerous buildings, support structures, and the infrastructure at the facility site. Facility staff also actively maintain the grounds on the site by mowing and brush clearing. Existing tanks and warehouse buildings adjacent to the proposed TG building location range up to 75-ft tall, while two process stacks located in the main operating area of the CHDP facility are 100-ft tall. The proposed project area is located entirely within private, industrial property boundaries.

The proposed project area is located in the Coastal Prairie subdivision of the Gulf Coastal Plains physiographic province. This province is characterized by topography that ranges from sea level to 300 ft above mean sea level (msl). The proposed project area, however, lies below 30 ft above msl. Soils underlying the majority of the CHDP facility site consist of Beaumont clay soils, however, soils underlying the western area of the site where the proposed TG building and cooling tower would be constructed are Lake Charles clay soils.

Beaumont soils consist of very deep, poorly drained, and very slowly permeable soils. They are nearly level soils formed in clayey sediments of the Pleistocene Age. Runoff from these soils is low (USDA, 1997a). The Lake Charles soils consist of very deep, moderately well drained, very slowly permeable soils that formed in clayey sediments. Water enters the soil rapidly when cracked, but very slow when wet and cracks are closed. Runoff from these soils is also generally low (USDA, 1997b).

3.2 WATER RESOURCES

The CHDP facility lies within the San Jacinto River Basin. The San Jacinto River flows from its headwaters near Huntsville, through Lake Conroe and Lake Houston. The San Jacinto River's drainage area is approximately 4,500 square miles. The San Jacinto River joins with the Houston Ship Channel before flowing into Galveston Bay along the southeastern edge of Harris County.

The Houston Ship Channel is a conduit for ocean going vessels between the Houston-area shipyards and the Gulf of Mexico. The Houston Ship Channel follows the original alignment of the last sixteen miles of Buffalo Bayou to the San Jacinto River (TSHA, 2010). The Houston Ship Channel/Buffalo Bayou waterway is located approximately 1 mile north of the proposed project site. Northeast of the site, the Houston Ship Channel is located approximately 2 miles from the CHDP facility (see **Figure 3-1**).

Section 303 of the Clean Water Act (CWA) has established water quality standards and designated uses of all regulated surface waterbodies in the U.S., which are then enforced by each State. When a State deems a water body impaired, it is placed on the 303(d) List of Impaired Waters. The Houston Ship Channel is on the 2010 CWA Section 303(d) List in the vicinity of the project area as being impaired due to elevated concentrations of PCBs and dioxin in fish tissue and elevated bacteria concentrations in the water (TCEQ, 2010).

No surface waterbodies or federally classified or other known wetlands are located on the proposed project site itself (NWI, 2009). Several retention basins are in the vicinity of the project site, but no high quality aquatic habitat exists near the site. Additionally, no designated 100-year floodplains are located either within the proposed project site or in the immediate vicinity of the area. The closest 100-year floodplain is associated with the Houston Ship Channel over 1 mile west of the proposed project area.

Harris County, and therefore the CHDP facility and the proposed project area, are located within Texas' Coastal Zone. The Coastal Zone Management Act (CZMA) authorizes the State to review federal permits and licenses, federal projects, and federally funded projects that could potentially impact the coastal area. In Texas, the State's Coastal Zone is managed under the Coastal Management Program by the Coastal Coordination Council. The Coastal Management Program seeks to ensure the long-term environmental and economic health of the Texas coast through management of the state's coastal natural resource areas (CCC, 2010). DOE has entered into consultation with the Coastal Coordination Council and will ensure that its actions are consistent to the maximum extent practicable with the state Coastal Management Plan.

All make-up water required for industrial operations at the CHDP facility is supplied from the Coastal Water Authority. Process water is treated in the facility's onsite waste water treatment plant before being discharged. The National Pollutant Discharge Elimination System (NPDES) under the CWA prohibits the discharge of any pollutant, including sediments, to waters of the United States. Industrial sites require coverage under the NPDES program. The NPDES program is regulated by the U.S. Environmental

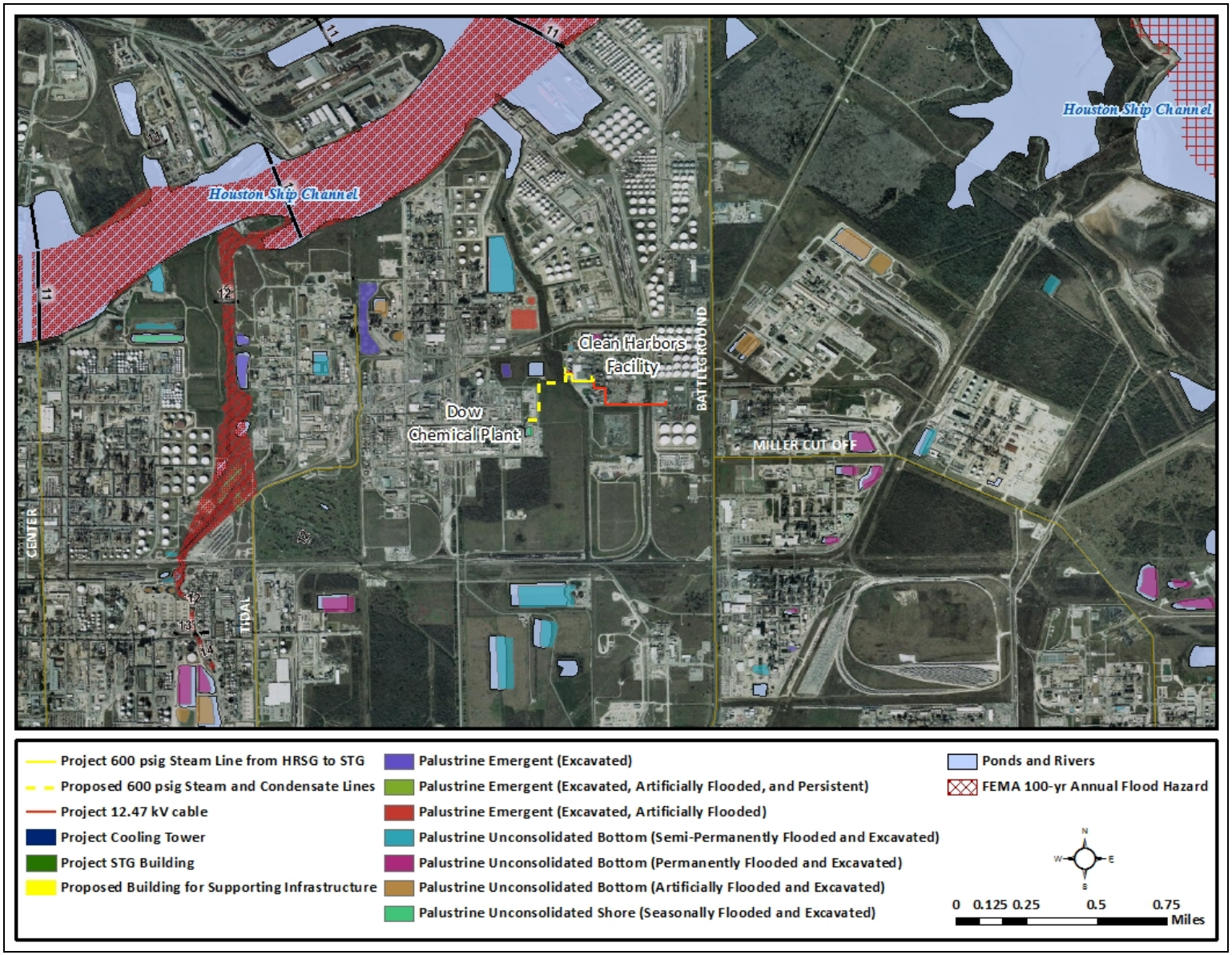


Figure 3-1. Water Resources in Project Vicinity

Protection Agency (USEPA), and within Texas, the program is administered by the TCEQ. The CHDP facility holds Individual Permit TX0005941 for discharge from its treatment plant. Treated process wastewater and site stormwater is discharged via pipe into Tucker Bayou/Houston Ship Channel.

Groundwater below the CHDP facility has been contaminated from past industrial site activities. In 1999, the CHDP began participation in a Corrective Action Program under the provisions of RCRA for groundwater recovery operations onsite whereby contaminated groundwater is pumped-and-treated and an inward gradient for groundwater flow is maintained so that no contaminated groundwater moves away from the facility (USEPA, 1999). Key groundwater contaminants included chlorobenzene, chloroform, trichloroethene, and tetrachloroethene (USEPA, 1999). The migration of contaminated groundwater has stabilized at the site (USEPA, 1999).

3.3 AIR QUALITY

This is a description of regional climate, ambient air quality with respect to attainment of National Ambient Air Quality Standards (NAAQS), and identification of applicable air quality regulations.

3.3.1 NAAQS and Attainment Status

The U.S. Environmental Protection Agency (USEPA) Region 6 and the Texas Commission on Environmental Quality (TCEQ), regulate air quality in Texas. The Clean Air Act (CAA) (42 USC 7401-7671q), as amended, gives USEPA the responsibility to establish the primary and secondary NAAQS (40 CFR Part 50) that set acceptable concentration levels for six criteria pollutants: fine particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_x), ozone (O_3), and lead. Short-term standards (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term standards (annual averages) have been established for pollutants contributing to chronic health effects. Each state has the authority to adopt standards stricter than those established under the federal program; however, the State of Texas accepts the federal standards.

Federal regulations designate Air-Quality Control Regions (AQCRs) which are in violation of the NAAQS as nonattainment areas and those in accordance with the NAAQS as attainment areas. Harris County, and therefore the proposed project area, is within the Metropolitan Houston-Galveston Interstate AQCR (AQCR 216) (40 CFR 81.38). USEPA has designated Harris County as severe nonattainment for the 8-hour O_3 and PM_{10} NAAQS and attainment for all other criteria pollutants. Because the Proposed Action is nonattainment region, the air conformity regulations apply, and the Proposed Action's emissions and the *de minimis* thresholds were carried forward to determine the applicability of the general conformity rule and level of impact under NEPA.

3.3.2 Local Ambient Air Quality

Worst-case ambient air quality conditions can be estimated from measurements conducted at vicinity air-quality monitoring stations (**Table 3.1**). With the exception of the 8-hour O_3 and the PM_{10} standards, air-quality measurements are below the NAAQS for the area (USEPA, 2010a). Neither the 3-year average of the weighted annual mean, nor the 3-year average 98th percentile of 24-hour PM_{10} concentration exceeded the NAAQS ; hence, the attainment status. The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations exceeds 0.08 ppm; hence, the nonattainment status for the area.

Table 3-1.
NAAQS and Monitored Levels of Criteria Pollutants

Pollutant and Averaging Time	Primary NAAQS[a]	Secondary NAAQS[a]	Monitored Data[b]	Location
CO				
8-hour maximum[c] (ppm)	9	(None)	5.9	Houston
1-hour maximum[c] (ppm)	35	(None)	8.9	
NO_X				
Annual arithmetic mean (ppm)	0.053	0.053	0.01	Houston
O_3				
8-hour maximum[d] (ppm)	0.08	0.08	0.106	Harris Co.
$PM_{2.5}$				
Annual arithmetic mean[e] ($\mu g/m^3$)	15	15	14.26	Houston
24-hour maximum[f] ($\mu g/m^3$)	65	65	32.4	
PM_{10}				
Annual arithmetic mean[g] ($\mu g/m^3$)	50	50	55	Houston
24-hour maximum[c] ($\mu g/m^3$)	150	150	150	
SO_2				
Annual arithmetic mean (ppm)	0.03	(None)	0.002	Houston
24-hour maximum[c] (ppm)	0.14	(None)	0.016	
3-hour maximum[c] (ppm)		0.5	0.055	

ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

Notes:

[a] Source: 40 CFR 50.1-50.12.

[b] Source: USEPA, 2010a.

[c] Not to be exceeded more than once per year.

[d] The 3-year average of the fourth highest daily maximum 8-hour average ozone concentrations over each year must not exceed 0.08 ppm.

[e] The 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from must not exceed 15.0 $\mu g/m^3$.

[f] The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor must not exceed 65 $\mu g/m^3$.

[g] The 3-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 $\mu g/m^3$.

3.3.3 Climate, Greenhouse Gases, and Global Warming

The proposed project would be located in Deer Park, Texas. The climate is characterized by hot summers and cool winters. Precipitation is evenly distributed throughout the year, the wettest month being June with 6.7 inches of precipitation, and the driest month being February with approximately 3.1 inches of precipitation. January, historically the coldest month, has an average regional temperature range of 45.2°F. In July, historically the warmest month, temperatures reach approximately 93.6 °F and can fluctuate by cooling 18 °F from day to evening (Idcide, 2010).

Greenhouse gases (GHGs) are components of the atmosphere that trap heat relatively near the surface of the earth, and therefore, contribute to the greenhouse effect and global warming. Most GHGs occur naturally in the atmosphere, but increases in their concentration result from human activities such as the burning of fossil fuels. Global temperatures are expected to continue to rise as human activities continue to add carbon dioxide, methane, nitrous oxide, and other greenhouse (or heat-trapping) gases to the atmosphere. Since 1900, the Earth's average surface air temperature has increased by about 1.2 to 1.4 ºF. The warmest global average temperatures on record have all occurred within the past 10 years, with the warmest year being 2005 (USEPA, 2007). Most of the U.S. is expected to experience an increase in average temperature. Precipitation changes, which are also very important to consider when assessing climate change effects, are more difficult to predict. Whether or not rainfall will increase or decrease remains difficult to project for specific regions (USEPA, 2010b; IPCC, 2007).

The extent of climate change effects and whether these effects prove harmful or beneficial will vary by region, over time, and with the ability of different societal and environmental systems to adapt or cope with the change. Human health, agriculture, natural ecosystems, coastal areas, and heating and cooling requirements are examples of climate-sensitive systems. Rising average temperatures are already affecting the environment. Some observed changes include shrinking of glaciers, thawing of permafrost, later freezing and earlier break-up of ice on rivers and lakes, lengthening of growing seasons, shifts in plant and animal ranges and earlier flowering of trees (USEPA, 2010a; IPCC, 2007).

3.4 NOISE

Sound is a physical phenomenon consisting of vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor,

receptor sensitivity, and time of day. Noise is often generated by activities essential to a community's quality of life, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. "A-weighing", measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. Sounds encountered in daily life and their dBA levels are provided in **Table 3-2.**

Table 3-2.
Common Sounds and Their Levels

Outdoor	Sound level (dBA)	Indoor
Snowmobile	100	Subway train
Tractor	90	Garbage disposal
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: Harris, 1998.

The dBA noise metric describes steady noise levels, although very few noises are, in fact, constant. Therefore, Day-night Sound Level has been developed. Day-night Sound Level (DNL) is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). DNL is a useful descriptor for noise because: (1) it averages ongoing yet intermittent noise, and (2) it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB.

The Noise Control Act of 1972 (PL 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. In 1974, the USEPA provided information suggesting continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. The State of Texas does not regulate noise at the state level, and Harris County does not have a noise ordinance.

Existing sources of noise near the proposed project site include heavy train and shipyard traffic, industrial plant noise, local road traffic, and high-altitude aircraft over flights. The areas surrounding these locations can be categorized as moderate industrial and heavy commercial. The noise environment may have increased traffic noise and production plant operational noise during business hours. Existing noise levels (DNL and L_{eq}) were estimated for the proposed project site and surrounding areas using the techniques specified in the "American National Standard Quantities and Procedures for

Description and Measurement of Environmental Sound Part 3: Short-term measurements with an observer present" (**Table 3-3**) (ANSI, 2003).

Table 3.3.
Estimated Existing Noise Levels In the Project Area

Land Use Category	DNL	L_{eq} (Daytime)	L_{eq} (Nighttime)
Moderate Industrial/ Heavy Commercial	65	64	57

Source: ANSI, 2003.

3.5 BIOLOGICAL RESOURCES

3.5.1 Vegetation

Harris County, Texas lies within the coastal prairie ecosystem that borders the Gulf Coast in Texas and Louisiana (Grafe et al. 2000). The coastal prairie is a grassland ecosystem that is intermixed with wildflowers and other small herbaceous plants. However, the proposed project site is within an industrial zone that has previously been disturbed and developed. Weeds and opportunistic plants such as thistles, mustard, and dandelions generally emerge on disturbed areas. Grasses and herbaceous vegetation comprise the majority of vegetative species occurring in disturbed areas of the industrial community where the CHDP facility is located. These developed areas provide poor to moderate quality habitat relative to the higher quality coastal prairie and marsh areas by the San Jacinto River and outside of the industrial zone. The proposed project area has been previously disturbed and mostly lacks vegetation, especially native terrestrial vegetation. Federally protected species with potential for occurrence within the project area are discussed in section 3.5.3.

No wetland or aquatic habitat is located within the proposed project area. Small ponds, streams, and wetlands nearby may support similar vegetation species as the above mentioned habitats, but they would also provide habitat for species that are dependent upon abundant sources of water. Wetlands are discussed more in sections 3.2 and 4.2.

Executive Order 13112 Invasive Species directs federal agencies to make efforts to prevent the introduction and spread of invasive plant species. Invasive species are usually destructive, difficult to control or eradicate, and generally cause ecological and economic harm. A noxious weed is any plant designated by a federal, state, or county government as injurious to public health, agriculture, recreation, wildlife, or property. Chapter 78 of the Texas agriculture code also designates certain weed species that must be controlled on both public and private lands within the state. The Texas Department of Agriculture and the Texas Parks and Wildlife Department (TPWD) are the authorizing entities but the laws are enforced by district boards.

3.5.2 Wildlife

The coastal prairie habitat described in section 3.5.1 once supported a large variety of animal species including bison (*Bison bison*) and the red wolf (*Canis rufus*) (Grafe et al. 2000). However much of this habitat has been degraded from development and overgrazing. The herbaceous vegetation within undeveloped land areas in the vicinity of the project area does provide habitat for small and large mammals, birds, and other species. Mammal species that could typically be found in an industrial zone similar to the project area in Texas include white-tailed deer (*Odocoileus hemionus*), fox (*Vulpes spp*), rabbit (*Silvilagus sp*), chipmunk (*Tamius sp*), grey squirrel (*Sciurus griseus*), ground squirrel (*Spermophilus beechii*) striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale putorius*) and different species of mice (*Mus spp. Peromyscus sp.*) moles (*Scapanus spp*), shrews (*Sorex spp.*), and bats (Sub-Order Microchiroptera). Common reptiles and amphibians that have potential to occur within the project area include spiny lizards (*Sceloporus spp.*) the southern black racer (*Coluber constrictor priapus*), rat snakes (*Scotophis spp*.), king snakes (*Lampropeltis spp*.), rattlesnakes (*Crotalus spp.*), box turtles (*Terrapene spp*.), toads (*Bufo spp.* or *Anaxyrus spp.*) and treefrogs (*Acris spp.* or *Hyla spp.*) (Grafe, 2008; NatureServe, 2010).

Most species of migratory birds are protected by the Migratory Bird Treaty Act, which prohibits the destruction of active nesting habitat. The industrial area of the project site does not contain suitable nesting or foraging habitat for migratory bird species found in the area. Common birds that may have potential, however, to occur within the project area, as either residents or migrants, include the American crow (*Corvus brachyrhynchos*), brown thrasher (*Toxostoma rufum*), gray catbird (*Dumetella carolinensis*), northern mockingbird (*Mimus polyglottos*), common grackle (*Quiscalus quiscula*), boat-tailed grackle (*Quiscalus major*), blackbirds (*Euphagus spp*.), vireos (*Vireo spp*.), red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), and numerous other passerines and raptors (Grafe, 2008; NatureServe, 2010).

Federally protected species with potential for occurrence within the project area are discussed in section 3.5.3.

3.5.3 Threatened and Endangered Species

A species listed under the Endangered Species Act (ESA) is so designated because of danger of its extinction without adequate conservation due to economic growth and development. Animal species in danger of extinction throughout all or a part of their range are listed as "endangered." Species that are likely to become endangered within the foreseeable future throughout all or a significant part of their range are listed as "threatened." Federally endangered and threatened species and their habitats are protected by the ESA. Section 7 of the ESA provides that no federal action should jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species.

There are 27 animal species and 2 plant species found in Harris County, TX that are listed as protected under the ESA or by the State of Texas. Of these 29 species, 10 are fully aquatic and therefore do not use the project area as habitat (NatureServe, 2010). The brown pelican (*Pelecanus occidentalis*), mountain plover (*Charadrius montanus*), White-faced Ibis (*Plegadis chihi*), and the wood stork (*Mycteria americana*) are all shore birds who live in ponds or streams and the wetlands and uplands immediately adjacent to aquatic habitats. These aquatic or wetland species are not described in detail because the project area does not include any aquatic habitats, nor are there any wetlands or coastal areas within the vicinity of the project. Wetlands and water resources are discussed further in sections 3.2 and 4.2. No critical habitat exists in the project area.

Table 3-4 includes al list of all protected species that could be found in the vicinity of the project site.

Although the bald eagle was officially removed from the federal list of threatened and endangered species in 2007, it continues to be protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Bald eagles nest from December through mid-May in mature trees near marshes or open water.

Red-cockaded woodpeckers (*Picoides borealis*) inhabit mature (greater than 9.1 inches, or 23 centimeters DBH) longleaf pine forests and mixed pine upland hardwood forests with little to no hardwood mid-story vegetation (NatureServe, 2010). Primary threats to the species include the loss of pine stands due to development, the management of pine forests in short rotation, and fire suppression, which promotes the growth of hardwood mid-story vegetation, which is unsuitable as red-cockaded woodpecker habitat (NatureServe, 2010). The Louisiana black bear (*Trichechus manatus*), Rafinesque's big eared bat (*Corynorhinus rafinesquii*), timber or canebrake rattlesnake (*Crotalus horridus*) and the red wolf (*Canis rufus*) also inhabit forested areas and is unlikely to be found in the Project vicinity but all have the potential for large home-ranges. The primary threats to these species include habitat loss and fragmentation.

The whooping crane (*Grus Americana*), Houston toad (*Anaxyrus houstinensis*) and the smooth green snake (*Liochlorophis vernalis*) inhabit areas with soft, sandy soil in forested or coastal prairie vegetation, often near water or wetlands (NatureServe, 2010). Slender rush-pea (*Hoffmannseggia tenella*) and Texas prairie dawn (*Hymenoxys texana*) are found in the coastal plains of southern Texas and are sensitive to habitat destruction and development and competition with invasive species (NatureServe, 2010).

Texas horned lizards (*Phrynosoma cornutum*) prefer sandy loose disturbed soils in open areas, and depend on harvester ants for a large part of their diet (NatureServe, 2010). In Texas the spread of fire ants and their competition with harvester ants have decreased the preferred food source of the Texas horned lizard.

The peregrine falcon and subspecies (*Falco peregrinus*) have been delisted federally in Texas but are still considered threatened by the State of Texas. These falcons nest in cliffs or rocky outcroppings in mountains or canyons. This species occurs near open

areas or wetlands where prey is abundant but has also adapted to cities with ample nesting areas on tall buildings.

Table 3-4.
Protected Species Potentially Occurring in Project Vicinity

Species Common Name	Latin Name	Status	
		Federal	Texas
Amphibians			
Houston Toad	*Anaxyrus houstinensis*	LE	E
Mammals			
Louisiana Black Bear	*Trichechus manatus*	LT	T
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	--	T
Red Wolf	*Canis rufus*	LE	E
Reptiles			
Smooth Green Snake	*Liochlorophis vernalis*	--	T
Texas Horned Lizard	*Phrynosoma cornutum*	--	T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	--	T
Birds			
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	--
Bald Eagle	*Haliaeetus leucocephalus*	DL	T
Peregrine Falcon	*Falco pereginus*	DL	T
Red-cockaded Woodpecker	*Picoides borealis*	LE	E
Whooping Crane	*Grus americana*	LE	E
Plants			
Slender rush-pea	*Hoffmannseggia tenella*	E	--
Texas Prairie Dawn	*Hymenoxys texana*	LE	E

Sources: TPWD, 2010; USFWS, 2010; NatureServe, 2010

LE, LT	Federally listed endangered/threatened
E, T	State listed endangered/threatened
DL	Federally delisted

3.6 CULTURAL RESOURCES

Cultural and historic resources are protected by a variety of laws and regulations, including the National Historic Preservation Act, as amended, and the Archaeological Resources Protection Act. Section 106 of the National Historic Preservation Act and implementing regulations (36 CFR 800) outline the procedures to be followed in the documentation, evaluation, and mitigation of impacts to cultural resources. The Section 106 process applies to any federal undertaking that has the potential to affect cultural resources. The Texas Historical Commission is the SHPO for Texas (THC, No date).

There are no federally recognized Tribes with land claims in Texas (NPS, 2008; HUD, 2008). The closest Tribal reservation, the Alabama-Coushatta Indian Reservation, is over 70 miles northeast of the proposed project site. However, consultation letters have been sent to the federally recognized Tribes in Texas and SHPO. The closest site listed on the publically available National Register of Historic Places (NRHP) is San Jacinto Battlefield, approximately 1.6 miles to the north from the project boundary. The closest cemetery is DeZavalla Cemetery, which is 2.03 miles to the northeast.

Regarding the potential for fossils in the area, fossils are formed in sedimentary rock. Most of the soils in the area are clay, so there is little opportunity for accessible fossils in the project area. Further, the proposed project site has likely been disturbed due to the nature of the site and vicinity development, which would reduce the chances of previously unknown archaeological resources being present.

As required by the Texas Historical Commission, the project area was surveyed by a professional archaeologist. The survey was requested due to the potential presence of intact archaeological deposits in the area that would be disturbed by the installation of the proposed steam and condensate lines running between Clean Harbors and the Dow Chemical plant. The survey found no artifacts of either historic or prehistoric origin in the proposed project area (Mangum, 2011). A report of this investigation was produced in conformance with the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation and is included in Appendix D.

3.7 INFRASTRUCTURE

3.7.1 Hazardous Materials and Waste Management

Hazardous wastes are regulated by the Resource Conservation and Recovery Act (RCRA) as those wastes that pose substantial or potential threats to public health or the environment, based on the four factors of ignitability (flammable), reactivity, corrosivity, and toxicity. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes. The USEPA regulates all aspects of hazardous waste under RCRA. TCEQ administers the provisions of RCRA in the State of Texas.

The CHDP facility is a hazardous waste processing, storage, and disposal facility which holds numerous federal and state permits including: TCEQ Hazardous Waste Permit No.

50089, TCEQ Compliance Plan CP-50089, USEPA ID No. TXD055141378, USEPA TSCA Authorization for Commercial PCB Storage and Incineration, and, several operating permits for air emissions and water usage. The CHDP facility is fully permitted to manage a wide variety of regulated materials, including solids, liquids, sludge and gas which are delivered to the site via drums, tankers and rail (Clean Harbors, 2008).

The CHDP property contains ample storage areas for waste, two incineration units (Trains I and II), an onsite landfill for incineration residues that has an estimated life expectancy of 14 years remaining, and an onsite wastewater treatment system (Clean Harbors, 2010). Wastes accepted by the facility include RCRA regulated hazardous wastes, PCBs, contaminated wastewaters and soils, oils, solvents, laboratory chemicals, debris from toxic or reactive chemical cleanups, labpacks, and non-regulated waste materials (Clean Harbors, 2008).

Incineration Train I at the CHDP facility has an output of 180 MM Btu/hr and Incineration Train II has an output of 153.5 MM Btu/hr (Clean Harbors, 2008). Tank storage capacity at the facility is 830,000 gallons, drum storage capacity is 1,490,000 gallons (25,000 drums), tanker storage capacity is 132,000 gallons (24 tankers), and bin storage capacity is 6,120 cubic yards (200 bins)

In addition to treatment of hazardous materials, the CHDP facility uses and stores hazardous materials such as diesel fuel and oil in quantities necessary to maintain and operate equipment. All hazardous materials are properly stored and handled by staff trained in hazardous materials and waste handling and RCRA procedures.

3.7.2 Traffic and Transportation

Several service roads are near the proposed project area. The two closest named roads are Old Battleground Road to the north and Independence Parkway (formerly Battleground Road) to the east. Other major roads in the vicinity are Pasadena Freeway (Texas Highway 225) to the south, Interstate 10 to the north, and East Sam Houston Parkway to the west. The Pasadena Highway has approximately 110,000 vehicles on it per day in segments close to Houston. The closest and most recent traffic count near the project area is 4,130 vehicles for a 24 hour period on Independence Parkway /Battleground Road from Old Battleground Road to the ferry in 2008 (Harris County, 2009). None of these streets is on the list of 100 most congested roadway segments in Texas list, and no transportation improvement projects are currently underway near the proposed project area (TDOT, No date[a]; TDOT, 2010). The nearby railroad is owned by Port Terminal Railroad Association and is not a passenger train system (PTRA, No date).

The Houston Airport System operates three airports in the greater Houston region: George Bush Intercontinental Airport, which is located approximately 25 miles northwest of the proposed project vicinity; the William P. Hobby Airport and Ellington Field, which is located approximately 12 miles southwest; and, the Ellington Field (home also to Ellington Air Force Base), which is located approximately 10 miles south. Additionally,

the La Porte Municipal Airport is located approximately 5 miles southeast of the project vicinity and the Baytown Airport is located approximately 10 miles northeast.

3.7.3 Utilities

The water utilities come from the Coastal Water Authority. Coastal Water Authority has several projects, such as the Luce Bayou Interbasin Transfer Project, to meet the expected increase in demand in the City of Houston, Harris County, and Montgomery County area (TWDB, No date; CWA, No date). As far as power, the Dow Chemical Plant currently uses natural gas for its steam needs when its own waste heat generated steam is inadequate, which historically has been about a third of the time. The natural gas comes from Centerpoint Energy. Various pipelines and power lines exist in the project area for the industrial activities.

3.8 SOCIOECONOMICS

The 2009 estimated population for the City of Deer Park was 30,938, which was about an 8.5% increase from the 2000 population. This rate of growth is approximately half of what Harris County and Texas experienced over the same time period (Census, No date[b]). The 2006-2008 civilian unemployment rate was 4.7% for the City of Deer Park, which is less than Harris County (6.3%), Texas (6.0%), and national average (6.4%) (Census, No date[c]). The 2008 total personal income (income of residents from all sources) of Harris County was $190,226,395,000 (BEA, 2010).

Management, professional, and related occupations is the largest occupation for the City of Deer Park at 36.4% of the civilian workforce over 16 years of age followed by sales and office occupations at 27.4%, which were the same top two occupations for Harris County. The manufacturing industry of City of Deer Park employs over 3,000 or 19.1% of the population, which is the most of any industry in the city. The second largest industry is educational services, and health care and social assistance industry at 17.6%. Construction employs almost 2,000 people or 11.1%. For comparison, Harris County's top industry is educational services, and health care and social assistance followed by professional, scientific, and management, and administrative and waste management service (Census, No date[c]).

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of implementing the applicant's proposed project compared with those of the No Action alternative. Potential impacts are described in terms of type (beneficial or adverse), severity, geographic extent, and duration. This EA was prepared to determine whether the proposed project could cause significant impacts, which would require the preparation of an Environmental Impact Statement (40 CFR 1508.9), or, whether a Finding of No Significant Impact can be issued for the Proposed Action. **Table 4.1** provides the thresholds used to assess the significance of the potential impacts for each topic and resource evaluated.

Table 4-1: Impact Significance Thresholds

Resource Area	Impact Significance Thresholds An impact would be significant if it EXCEEDS the following conditions
Land use	The proposed project would not contribute to a conversion of large amounts of vicinity land use. Any conflicts with state, regional, or local land use plans are readily resolved with the appropriate agency.
Soil	Any changes in soil stability, permeability, or productivity would be limited in extent. Full recovery would occur in a reasonable time*, considering the size of the project. Mitigation, if needed, would be simple to implement and proven to be effective in previous applications.
Water Resources	Any changes to surface water quality or hydrology would be confined to the immediate project area. Full recovery would occur in a reasonable time*, considering the size of the project and the affected area's natural state; any impacts to wetlands or floodplains would be confined to the immediate project area, would not cause any regional impacts, and would be fully mitigated.
Air Quality	The proposed project would not produce emissions that would exceed applicability thresholds, be *regionally significant* as defined under the general conformity rule, or contribute to a violation of any federal, state, or local air regulation.
Noise	Noise from the proposed project would not create substantial areas of incompatible land use or contribute to a violation of any federal, state, or local noise regulation.
Vegetation	Any changes to native vegetation would be limited to a small area and would not affect the viability of the resources. Full recovery would occur in a reasonable time*, considering the size of the project and the affected resource's natural state. Mitigation, if needed, would be proven to be effective in previous applications.

Resource Area	Impact Significance Thresholds An impact would be significant if it EXCEEDS the following conditions
Wildlife	Any changes to wildlife would be limited to a small portion of the population and would not affect the viability of the resource. Full recovery would occur in a reasonable time*, considering the size of the project and the affected species' natural state.
Threatened or Endangered Species	Any effect to a federally listed species or its critical habitat would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. This negligible effect would equate to a "no effect" determination in USFWS terms.
Cultural and Historic Resources	The action would not affect the context or integrity features (including visual features) of any properties listed or eligible for listing on the National Register of Historic Places or of other cultural significance. Following correspondence with the SHPO/THPO and correspondence with any other potentially affected groups including Indian Tribes, local governments, and the NPS, the determination of effect under Section 106 of the NHPA would be "not expected to have any adverse effect".
Hazardous Materials	The proposed project, along with planned mitigation measures, would not cause air, water, or soil to be contaminated with any waste materials that pose a threat to human or ecological health and safety.
Utilities	The proposed project would not noticeably affect or disrupt the normal or routine functions of public institutions, electricity and other public utilities and services in the project area.
Traffic and Transportation	The proposed project would not contribute to an appreciable increase in vehicle trips or miles traveled within the region, or contribute appreciably to the deterioration in the Level of Serve (LOS) of any roadway segment or intersection.
Socioeconomic Resources	Changes to the normal or routine functions of the affected community are short-term or do not alter existing social or economic conditions in a way that is disruptive or costly to the community.

* Recovery in a reasonable time: Constant, sustainable improvement is apparent and measurable when the site is routinely observed, and full recovery is achieved over a period of no more than five years.

4.1 LAND USE AND SOILS

4.1.1 Proposed Project

The proposed project would involve the construction and installation of a waste heat recovery boiler on Incineration Train I at the CHDP facility, along with a TG, a cooling tower, water and steam piping, a gravel road spur, and a building for supporting infrastructure. A total of 1-2 acres of land would be disturbed at the existing CHDP

facility and the adjacent Dow Chemical plant during construction and installation activities. A total of approximately 10,000 sf (0.2 acres) of new impervious surface area would be added in primarily the northwest corner of the CHDP facility. This area is currently unused, and drops off to facilitate site drainage. The area would need to be reclaimed with fill and graded in order to accommodate the proposed project elements.

The proposed project is located within the City of Deer Park's Industrial District and is compatible with the zoning and land use regulations of this district. In fact, the City has numerous incentives programs in place to encourage expansion of existing facilities (CoDP, 2010). Potential conflicts between the project and the surrounding land uses are not anticipated.

The area proposed for development is relatively small and is adjacent to several other industrial buildings, in particular Incineration Train I. The area is contained completely within existing private industry boundaries. No onsite land use changes would result from implementation of the proposed project. Additionally, no changes to vicinity land use or land use designations would occur. A very limited amount of soils, however, could be disturbed during the construction/development phase of the proposed project. The site these soils underlay has likely been previously disturbed during construction of the existing facility, and any of the soil or fill disturbed during the construction phase may not be native to the original site.

Construction equipment used during the proposed project construction and installation activities would include heavy haul trucks, fork trucks, large cranes, and a hydraulic work platform known as a cherry picker. As with almost any construction project involving the use of heavy equipment, there is some risk of an accidental fuel or chemical spill, and the potential contamination of site soils. Fuel products (petroleum, oils, lubricant) would be needed to operate and fuel equipment. To reduce the potential for soil contamination, fuels would be stored and maintained in a designated equipment staging area. A person(s) designated as being responsible for equipment fueling would closely monitor the fueling operation, and an emergency spill kit containing absorption pads, absorbent material, a shovel or rake, and other cleanup items, would readily be available on site in the event of an accidental spill. Following these precautions, the potential for an accidental chemical or fuel spill to occur and result in adverse impacts on soils would be negligible.

The use of heavy equipment would result in soil compaction in unpaved areas adjacent to the area of construction. Compaction reduces the porosity and conductivity of the soil, and is likely to slightly increase the amount of surface runoff in the immediate area. Stabilization of the soils will be required to prevent sediment runoff impacts to the onsite stormwater collection system. Protection of water resources from potential surface runoff is discussed in detail in the Water Resources section, **Section 4.2.1**, below. Soils tracked from the construction site by motor vehicles and equipment will be cleaned from paved surfaces throughout the duration of construction.

Beaumont and Lake Charles clay soils which underlay the area of proposed development are relatively flat and characterized by poor to moderate drainage and low rates of surface runoff. Soils with higher rates of runoff than the subject soils would be more likely to be displaced and result in sediment erosion and transport into surface waters. The impacts to land use and soils at the proposed project area from both construction and operation activities are expected to be negligible. Overall impacts to both land use and soils from implementation of the proposed project would be below the level of significance.

4.1.2 No Action

Under the No Action alternative, the proposed project would not be constructed or installed and therefore, no impacts to land use or soils are expected to occur. No operational changes at either the CHDP facility or the Dow Chemical plant would occur that would impact land use or soils.

4.2 WATER RESOURCES

4.2.1 Proposed Project

Construction

The proposed project would involve the construction and installation of a waste heat recovery boiler and associated infrastructure on either already paved or highly disturbed unpaved surfaces. It is unlikely that construction impacts associated with the proposed project would generate a measurable increase of stormwater runoff from the site. However, if site soils are disturbed and compacted during construction activities, some additional stormwater could be generated which could carry sediment and contamination loads into the site drainage system during times of precipitation. Additionally, contamination from construction activities could affect water resources by infiltrating area soils and percolating down into the groundwater. Typically, sediment erosion rates from construction sites are 10 to 20 times greater than those from agricultural lands due to removal of vegetation. The first flush of rains after a long dry period carries silt from exposed soils, and pollutants deposited on pavement, into surface waterbodies, posing a risk of contaminating water and harming aquatic life.

The NPDES program regulates stormwater discharge from construction activities. Generally, construction sites of less than one acre do not need NPDES permit approval from TCEQ in order to proceed. The proposed project is not anticipated to warrant any special water quality considerations, and thus, the project would not require coverage under an NPDES construction permit.

Standard construction erosion and sediment controls, including vegetative stabilization practices, structural practices, stormwater management, and other controls as necessary, would be employed and maintained throughout the construction phase of the project. Vigorous use of appropriate Best Management Practices (BMPs) would minimize erosion

at the construction site and sediment runoff to all water resources in the vicinity of the proposed construction area. During the design phase of the project, special care should be taken to address mitigation measures that may be needed to prevent a localized shift in groundwater flow during construction activities. If construction of the proposed project has any potential to affect the flow of contaminated groundwater, measures would need to be in place to ensure that no plume migration were to occur offsite.

No project development activities under this alternative are proposed in the vicinity of floodplains or wetlands, or, are anticipated to directly impact surface waterbodies. Indirect impacts, from erosion and siltation, would be mitigated from impacting vicinity surface drainages and waterbodies as a result of incorporating and maintaining erosion and sediment control BMPs during the construction phase of the project.

Although implementation of this alternative would result in a very minor increase of impervious surface area onsite (0.2 acres), this alternative is not likely to have more than a negligible impact on water quality due to the small area of development. The implementation and adherence to BMPs is expected to minimize any impacts to water quality, and subsequently to aquatic species. Therefore, the proposed project would have negligible long-term impacts anticipated to area surface waterbodies, wetlands, and floodplains.

The CHDP facility and the adjacent Dow Chemical plant are located within Texas' Coastal Zone, and a federal consistency determination, as per the requirements of the Texas Coastal Management Program, is required prior to implementation of the Proposed Action. This involves mailing a formal consultation letter to the Coastal Coordination Council to initiate the review process. The consistency review process is in place to ensure that project impacts are analyzed and mitigated against in a holistic way to promote coastal ecosystem health and prevent degradation. A large aspect of complying with coastal zone regulations involves implementing mitigation measures before, during and after a project to ensure that any potential environmental impacts are avoided, minimized and compensated for to the extent possible. No direct or indirect impacts from this alternative are anticipated to occur to area waterbodies, wetlands, or floodplains. Overall impacts to the coastal zone, following implementation of all mitigation measures, are anticipated to be negligible. The activities associated with this alternative are considered consistent with the Coastal Management Program.

Implementation of this alternative is not likely to have more than a minimal impact on water quality in the immediate project area. The implementation and adherence to BMPs is expected to minimize any potential impacts to groundwater flows and contamination migration. Overall impacts to water quality and water resources from site development and construction activities are anticipated to be temporary and minor.

Operation

Once project construction and installation is complete, runoff from the new impervious surface areas at the CHDP facility would be managed through the existing stormwater collection system. The new project elements would be incorporated into CHDP's

existing NPDES permit for the site's discharges. The Stormwater Pollution Prevention Plan from the existing NPDES permit would require modification in order to address and include the new project elements. However, since only 0.2 acres of new impervious surface area would be added at the CHDP facility from implementation of the proposed project, there would only be a negligible net increase in stormwater runoff at the facility.

During operation, the proposed project would require boiler and cooling tower make-up water and would also generate boiler and cooling tower blowdown streams, routing them as make-up water to the existing plant wet scrubbing system. All make-up water would continue to be supplied by the Coastal Water Authority. However, since the proposed heat recovery boiler and cooling tower would be displacing the existing gas cooling system which requires a higher amount of make-up water, the net effect of the proposed project would be reduced water consumption by the CHDP facility, estimated at 20 million gallons of water per year.

The Houston Ship Channel including, including Tucker Bayou where the CHDP facility wastewater discharge is located, is on the 2010 CWA Section 303(d) list of impaired waterbodies due to elevated concentrations of PCBs and dioxin in fish tissue and elevated bacteria concentrations in the water (TCEQ, 2010). The NPDES permit regulating CHDP facility discharge has set limits for all water quality parameters, including PCBs and dioxin. Nonetheless, special precaution should be taken to the extent possible to limit both PCBs and dioxin in the facility's discharge. That said, the proposed project would not contribute any new contaminants or parameters to the wastewater stream at the CHDP facility and would thus have no impact on wastewater discharges or water quality at the facility's outfall location.

No additional impacts to groundwater, surface water, wetlands, floodplains, or any coastal resources, are expected during the operations of the proposed project. Operational impacts to water resources from the implementation of the proposed project can be expected to be negligible. Overall impacts to water resources from implementation of the proposed project would be below the level of significance.

4.2.2 No Action

Under the No Action alternative, the proposed project elements would not be installed at the CHDP facility. Operations at the facility would remain the same as under current conditions. No additional impacts to surface water, groundwater, wetlands, or floodplains would occur.

4.3 AIR QUALITY

4.3.1 Proposed Project

Short-term minor impacts to air quality would be expected with the implementation of the proposed project. Direct and indirect air emissions would not exceed *de minimis* thresholds, be "regionally significant", or contribute to a violation of any federal, state, or

local air regulation. Air emissions would be limited to temporary mobile and non-road source emissions from construction equipment, and evaporative emissions from the proposed cooling tower.

Estimated Emissions and General Conformity

The general conformity rules require federal agencies to determine whether their action(s) would increase emissions of criteria pollutants above preset threshold levels (40 CFR 93.153(b)). These *de minimis* (of minimal importance) rates vary depending on the severity of the non-attainment and geographic location. Because the proposed project is located in a severe non-attainment area, all direct and indirect emissions of criteria pollutants were estimated and compared to applicability threshold levels of 25 tons per year (tpy) for NO_x and VOC, and 100 tpy for other criteria pollutants, determine the applicability of the general conformity rule and level of effects under NEPA. The total direct and indirect emissions associated with the following activities were accounted for:

- Installation of boiler and cooling tower,
- Construction of the supporting buildings and infrastructure,
- Site preparation & construction of steam turbine generator and steam lines, and
- Operation and maintenance of boiler and generator.

The total direct and indirect emissions associated with the proposed project would not exceed d*e minimis* threshold levels (**Table 4.2**). Construction and line installation emissions would primarily be due to the use of heavy equipment, worker commutes, deliveries to the sites, and fugitive dust. Actual construction and installation is expected to take approximately 18 month. For the purposes of calculating emissions, it was conservatively assumed all installation and construction activities would take place within a single calendar year. Therefore, regardless of the ultimate construction schedule these emissions estimates can be considered a reasonable upper bound.

Table 4.2.
Project Emissions Compared to Applicability Thresholds

	Annual emissions (tpy)						***De minimis* threshold (tpy)** [a]	**Would emissions exceed applicability thresholds? [Yes/No]**
Activity	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**		
Installation and Construction	10.3	9.1	1.8	0.0	0.8	0.5	100 (25)	No
Operational Emissions (i.e. cooling tower)	0.0	0.0	0.0	0.0	1.3	0.0		

Notes: VOC is volatile organic compounds, and SO_x is sulfur oxides.
[a] *De minimis* thresholds for NO_x and VOC are 25 tpy. Although the region is in attainment for all other criteria pollutants, the *de minimis* threshold of 100 tpy was carried forward to determine the level of effects under NEPA.

The only permanent source of air emission associated with the proposed project would be the cooling tower. The airflow from the tower would entrain droplets from the water flow, which contain dissolved solids that cycle up in the tower due to evaporation losses. These droplets, called drift, would evaporate to dryness in the atmosphere, leaving behind fine particles. A detailed breakdown of emissions is located in **Appendix A**.

Regulatory Review

The CAA, as amended in 1990, mandates that state agencies adopt State Implementation Plans (SIPs) that target the elimination or reduction of the severity and number of violations of the NAAQS. SIPs set forth policies to expeditiously achieve and maintain attainment of the NAAQS. Texas has developed a core of air quality regulations that USEPA approved. These approvals signified the development of the general requirements of the SIP. The Texas program for regulating air emissions affects industrial sources, commercial facilities, and residential development activities. Regulation occurs primarily through a process of reviewing engineering documents and other technical information, applying emission standards and regulations in the issuance of permits, performing field inspections, and assisting industries in determining their compliance status with applicable requirements.

As part of these requirements, TCEQ oversees programs for permitting the construction and operation of new or modified stationary source air emissions in Texas. TCEQ air permitting is required for many industries and facilities that emit regulated pollutants. These requirements include Title V permitting of major sources, New Source Review, Prevention of Significant Deterioration, New Source Performance Standards for selected categories of industrial sources, and the National Emission Standards for Hazardous Air Pollutants. TCEQ air permitting regulations do not apply to mobile sources, such as trucks. An overview of these regulations applicability to the proposed project is outlined in **Table 4.3**.

Table 4.3.
Air Quality Regulatory Review

Regulation	Project Status
New Source Review (NSR)	A minor modification to existing NSR permit (5064-Nool) would be required.
Prevention of Significant Deterioration (PSD)	Potential emissions would not exceed the 250-tons-per-year PSD threshold. Therefore, the proposed project would not be subject to PSD review.
Title V Permitting Requirements	A minor modification to existing Title V permit (015566) would be required.
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Potential HAP emissions would not exceed NESHAP thresholds.
New Source Performance Standards (NSPS)	All new equipment would meet New Source Performance Standards where applicable.

Other non-permitting requirements may be applied through the use of compliant practices or products. These regulations are outlined in TAC Regulation (30 TAC 115, A-J). They include the following:

- General Air Quality Rules (Chapter 115 TAC A)
- Air pollution from Visible Emissions and Particulate Matter (Chapter 115 TAC H)
- Air pollution from Open Burning (Chapter 115 TAC H)
- Air pollution from Volatile Organic Compounds (Chapter 115 TAC C)

In addition to those outlined above, no person may handle, transport, or store any material in a manner that could allow unnecessary amounts of air contaminants to become airborne. During construction, reasonable measures may be required to prevent unnecessary amounts of particulate matter from becoming airborne (30 TAC 116 B). Such precautions might include the following:

- Using water to control dust during construction operations, road grading, or land clearing
- Paving roadways and maintaining them in a clean condition
- Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne
- Promptly removing spilled or tracked dirt or other materials from paved streets

Climate, Greenhouse Gasses, and Global Warming

The proposed project would constitute a short-term minor increase in the use of fossil fuel and associated GHG emissions during installation of steam lines, towers, steam generator and boiler, and construction of warehouse buildings. GHG emissions would be ephemeral to the construction and installation process, in the short-term, and the proposed project would increase the amount of CO_2 released by 1,262 tpy. This is equivalent to annual GHG emissions from 219 passenger vehicles, or the consumption of 2,662 barrels of oil (USEPA, 2010b). In addition, CEQ recently released draft guidance on when and how federal agencies should consider GHG emissions and climate change in NEPA. The draft guidance includes a presumptive effects threshold of 25,000 metric tons of CO_2 equivalent emissions from an action (CEQ, 2010). The GHG emissions associated with the proposed project are well below the CEQ threshold. Therefore, GHG emissions from the proposed project would not contribute appreciably to climate change or global warming.

4.3.2 No Action

Selecting the No Action Alternative would have no impacts to air quality. No installation or construction would take place and air quality would remain consistent with that of current conditions. However, under this scenario, the facility would not benefit from using a green energy source to meet some of its required energy needs, and would not

benefit from a reduction of CO_2 and NO_x emissions. Natural gas would continue to be consumed to generate the power required by the CHDP facility.

4.4 NOISE

4.4.1 Proposed Project

Implementation of the proposed project would have short-term minor adverse effects on the noise environment. The effects would be primarily due to equipment noise during installation and construction activities. No long-term effects to noise from operational activities are anticipated to occur.

The proposed project would involve moderate to heavy construction at the CHDP facility and some light construction for pipeline installation between the CHDP facility and the Dow Chemical plant. Individual pieces of heavy equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet. **Table 4.4** presents typical noise levels (dBA at 50 feet) estimated for outdoor construction.

Table 4-4.
Noise Levels Associated with Construction

Construction Phase	dBA L_{eq} at 50 feet from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Source: USEPA, 1974.

With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of active construction sites. The zone of relatively high noise levels typically extends to distances of 400 to 800 ft from the site of heavy equipment operations. Locations within 800 ft would experience substantial levels (greater than 62 dBA) of construction noise. However, there are no sensitive noise receptors (residences, schools, hospitals) within 1,000 ft of the proposed project location. It is likely that the proposed construction and installation activities would introduce some amounts of noise into the ambient environment, but this noise would be consistent with current heavy industrial levels in the vicinity and would likely go unnoticed. These effects would be temporary and minor, given the distance to the nearest sensitive receptors.

Noise effects on construction personnel and facility operators would be limited by ensuring that all personnel wear adequate personal hearing protection to limit exposure and ensure compliance with federal health and safety regulations. The overall effects of noise from the proposed project would be minor.

4.4.2 No Action

Selecting the No Action Alternative would result in no impact to the ambient noise environment. No construction or changes in facility operations would be expected. Ambient noise conditions would remain as described in **Section 3.4**.

4.5 BIOLOGICAL RESOURCES

4.5.1 Proposed Project

Vegetation

Noxious weeds and invasive plant species are generally found in disturbed soil conditions. Surface disturbance and construction activities could facilitate the establishment and spread of noxious weeds. Aggressive non-native species could become established in the vicinity of the proposed project if ground disturbance during construction is extensive and lengthy. However, the limited size of disturbance for the proposed facilities and the short length of time before the ground surface is stabilized would minimize the risk of noxious weeds becoming established and therefore any potential impacts would be negligible. Preventive measures such as monitoring and eradication would be implemented, as necessary, to reduce weeds from emerging after ground disturbance occurs.

Impacts to herbaceous and previously undeveloped land during project construction would occur; however, the land at the proposed project site has been disturbed from decades of adjacent industrial activities and any impacts to native vegetation would be minimal. Overall, any changes to native vegetation would be limited to a small area and would not affect the viability of the resources. Full recovery would occur in a reasonable time, considering the size of the project and the affected resource's natural state. Therefore, impacts on terrestrial vegetation would be expected to be minimal and would not exceed the significance threshold.

Wildlife

Any impacts on wildlife from the proposed project would be limited to a small portion of the population and would not affect the viability of the resource. Mobile species would disperse to adjacent habitat. Small, less mobile species may suffer mortality during workspace clearing, grading and construction. Mobile species are expected to re-colonize open land habitats after the completion of project construction activities. These impacts would be localized and limited to the immediate area of the project site. Any species inhabiting the project site or nearby areas would be accustomed to the noise and disturbance of an industrial area. Full recovery would occur in a reasonable time, considering the size of the project and the affected species' natural state. Therefore, impacts on wildlife would be minimal and would not exceed the significance threshold.

Threatened and Endangered Species

The project area does not include and would not affect any suitable habitat for protected species found in Harris County, TX. Construction and normal operating activities for the proposed project would most likely not affect any threatened or endangered species. Consultations with state and federal natural resource agencies have been initiated to ensure that any possible impacts that the proposed project may have on ecologically sensitive species would be identified and properly mitigated. As there are no known state or federal threatened or endangered species that exist at the proposed project site, it can be assumed that the proposed project would not have more than a negligible impact on threatened and endangered species. Unless a discovery of previously unknown threatened and endangered species occurs or USFWS consultation finds otherwise, impacts from implementing this alternative would be expected to be negligible and less than the significance threshold.

4.5.2 No Action

The No Action alternative will not result in any impacts to wildlife or vegetation, as no construction activities or CHDP facility changes would occur. Additionally, the No Action Alternative is not anticipated to result in any impacts to threatened or endangered species which may be found in the vicinity of the area.

4.6 CULTURAL RESOURCES

4.6.1 Proposed Project

An archaeological investigation of the project area was completed in August 2011 (See Appendix D). There are no identified cultural sites within or adjacent to the project area, and consultation with SHPO and relevant Tribes was conducted to ensure that no undisclosed cultural or historic resources would be impacted. Due to the lack of Tribal land claims in the county and the distance of over a mile to the nearest NRHP site, the additional buildings and related infrastructure within an industrial complex proposed under this project would not likely cause deterioration of the historic characteristics of the NRHP sites or to any Tribal lands, especially as the complex has been in operation for almost 40 years. Accessible fossils are not anticipated due to the lack of sedimentary rock and previously disturbed nature of the site.

Activities associated with this alternative that could potentially affect any unknown archaeological resources include grading, transporting equipment, creating the gravel spur, and the construction of the TG, cooling tower, support building, and related infrastructure. These activities could potentially cause an adverse impact to any cultural resources present by damaging or destroying the resources with heavy equipment. If cultural resources were discovered during construction activities, the construction would be stopped, and the SHPO, any relevant Tribes, and/or other agencies would be consulted. If the cultural resources were found to be historic properties or human remains, then the construction component would need to be relocated elsewhere or other

acceptable mitigation performed as per consultation with the SHPO and any relevant Tribes or agencies. With the exception of unearthing any previously unknown archaeological resources, this alternative would have a negligible impact on archaeological and other cultural resources.

4.6.2 No Action

Under the No Action alternative, the proposed project, including the earthmoving activities and heavy machinery, would not occur. This would remove any risk of damage to cultural resources and any change in the visual landscape. This alternative would represent no change from the current situation. Therefore, this alternative would have no impacts.

4.7 INFRASTRUCTURE

4.7.1 Proposed Project

The proposed project would include installation of a waste heat recovery boiler on the existing kiln afterburner of Incineration Train I at the CHDP facility. The high pressure steam generated from the proposed boiler would periodically be consumed by the adjacent Dow Chemical Plant to serve process needs by backing out natural gas firing of existing boilers. The majority of the steam, however, would be piped to a new TG. The TG would be installed in a new building adjacent to the existing CHDP facility to produce electric power. Additional waste heat steam from the neighboring Dow Chemical plant would be routed to the TG when it is available.

Boiler feed water and steam piping would be routed between the proposed boiler and the proposed TG location. A cooling tower for the TG system would be installed adjacent to the new building in the northwest corner of the facility. Output from the proposed TG would produce 8 MW of electricity. The energy produced would be used by the CHDP facility to offset their utility purchased power; any excess power generated would be transported to the electrical grid by Center Point Energy.

Hazardous Materials and Waste Management

The construction and operation activities associated with the proposed project would generate debris and waste, which would require proper management at the CHDP facility. Recycling and/or reuse of all discarded materials would occur whenever possible.

The project would require a modification to Incineration Train I's RCRA permit (TCEQ HW-50089-1) known as a RCRA Class 3 Solid Waste Permit Modification, as the project would involve modification within that unit's hazardous waste incineration system.

Ash generated when flue gases are cooled would be collected and landfilled onsite along with incinerator slag and scrubber sludge. These solids would otherwise have been collected in the scrubbing equipment, and thus, the installation of the boiler would reduce

operating loads on the gas cleaning train. The dramatically reduced heat load would improve scrubbing capabilities and reduce evaporation out of the direct circulation cooling towers used in the system (CHDP, 2010). The onsite landfill for ash has an estimated life expectancy of 14 years remaining (Clean Harbors, 2010). Because the minimum operating life of the proposed project is 30 years, the CHDP facility will have to expand current landfill capacity or access a new landfill during the project's lifetime. Both landfill expansion and landfill construction are regulated by RCRA and strictly enforced by TCEQ. Increasing landfill capacity, however, is not within the scope of this analysis.

In addition to processing and disposing of hazardous wastes, the CHDP facility uses a limited amount of hazardous materials such as diesel fuel and oil in quantities necessary to maintain and operate equipment. Boiler treatment chemicals would be required to be used and properly stored under this alternative. No new storage tanks are proposed as part of this project.

Provided all personnel follow applicable guidelines, impacts from storage or handling of waste materials would be negligible. The overall impact of implementing the proposed project on hazardous materials and waste management would be below the threshold of significance.

Traffic and Transportation

Implementation of the proposed project would slightly increase the volume of traffic in the project area in the short term due to on-road use by construction equipment, construction workforce vehicles, and vehicles delivering construction materials. The amount of construction related traffic would be likely be a negligible increase in context of the over 4,000 vehicles daily on the adjacent segment of Battleground Road. Construction and worker vehicles are expected to have sufficient parking space, which would help avoid disturbance to main roads. Although no significant impacts to traffic are expected during the construction phase, minor short-term delays could occur during delivery of larger construction equipment and materials.

Existing CHDP facility roads would be used to access the proposed project sites whenever possible. The 60-ft long, 2,000 sf new gravel spur required to access the new TG and cooling tower area would be a minimal addition of road surface in the area, given the size and the extensive internal road system present at the CHDP facility. Employee, operation, and maintenance vehicles would minimally increase at the CHDP facility each day once the proposed project is operational, however, the impacts from this small increase is anticipated to be negligible. Thus, as long as BMPS are followed, such as avoiding blocking roads and creating guided detours, impacts to traffic and transportation corridors should be minor, short-term, local, and adverse, which would be less than the significance threshold.

Under Federal Aviation Regulations Part 77.15, the Federal Aviation Administration (FAA) requires submission and approval of a 7640 Form when building any structure

over 20 feet in height near an airport which could cause an aviation hazard. The proposed TG building would be approximately 60 ft tall and the proposed boiler would have a maximum height of 90 ft. However, the existing tanks and warehouse buildings adjacent to the proposed TG building location range up to 75-ft tall, while two process stacks located in the main operating area of the CHDP facility are 100-ft tall. The closest airport to the facility, the La Porte Municipal Airport, is located approximately 5 miles southeast of the project vicinity. Due to the distance to the closest airport and the fact that none of the proposed project elements will exceed existing facility structures in height, submission of the FAA 7640 Form is not required for this project. Overall impacts from implementation of the proposed project on traffic and transportation systems in the region would be short-term only, and would be less than significant.

Utilities

It is not anticipated that any disruptions of utilities to either the CHDP facility or the Dow Chemical plant would occur during construction activities. Should any utility disruptions occur, however, they would be temporary and affect only a small population. The project is not expected to require any more make-up water or additional discharge with the project due to the circulation of the streams from the boiler and cooling tower blowdown (Integral Power, LLC, 2010).

The project's purpose is to utilize the waste heat at CDHP to offset the natural gas consumption at the CHDP facility and the Dow Chemical plant. This reduction of natural gas consumption would not likely cause an impact to the natural gas provider or affect the local natural gas market. Any excess power generated by the TG would be transported to the electrical grid by Center Point Energy, but the excess amount of an 8 MW facility would likely be minimal to the electrical demand of the area. However, any excess green power provided to the grid would supplement the capacity of the electrical system and reduce consumption of the equivalent quantity of fossil fuels.

The new 10-inch steam pipe needed to connect the CHDP and Dow Chemical facilities would be approximately 2,400 ft. long, eliminating the need for public road right-of way access. The proposed project would require utility easements from Clean Harbors and Dow, which are under negotiation. Operating agreements between Battleground Green Energy LLC, Clean Harbors, Inc. and Dow Chemical Company are also currently under negotiation.

The new pipelines and utility connections proposed under this project and other required infrastructure would be a negligible increase in development within the region's industrial complex. BMPs would be implemented to make sure that these infrastructure improvements do not interfere with other industrial activities and to ensure safety. Therefore, the impacts to utilities would likely be minor, local, long-term, and beneficial due to the reduction of natural gas consumption and the potential for creating electrical power from heat that is currently generated and lost. These impacts would be below the threshold of significance.

4.7.2 No Action

Under the No Action alternative, the proposed project, including the reduction of natural gas consumption, would not occur. This would represent a lost opportunity to reduce the utility demands and fossil fuel consumption of both the CHDP facility and the Dow Chemical plant, but this would represent a no change from the current situation. Therefore, this alternative would have negligible, local, long-term, and adverse impacts, which would be less than the significance threshold.

4.8 SOCIOECONOMICS

4.8.1 Proposed Project

The proposed project would employ an average of 50 construction workers over 18 months with a peak of 100 construction workers. The local pool of construction workers of almost 2,000 could handle this demand. Even if the entire construction workforce were not local, the increase in population would be temporary and represent about a 0.3% population increase in the City of Deer Park, even with the peak estimate of 100 workers. Such a small population increase should be able to be accommodated without disruption. With regards to the injection of federal money with the project, the less than two million would be less than 0.001% of Harris County's total personal income even if it were spent in a single year. Consequently, the increased expenditures from the supplies and the workers would be negligible in the area. Thus, the construction impacts from implementing the proposed project would be short-term, local, negligible, and beneficial.

As far as facility operations, only four more full-time employees would be added under the proposal to the current 275 personnel at the CHDP facility. This would represent about a 1.5% increase in facility employees and would be a negligible increase in the City of Deer Park's workforce population. This would not be disruptive to the neighboring community, especially with the low unemployment in the area compared to county, state average, and national average (Census, No date[c]). The entire project would occur within the current industrial boundaries of the two facilities, which means tax revenue from landownership would not change. The proposed project would keep with the industrial character existing in the project area and would not introduce any new or incompatible uses. Accordingly, no substantial impact would be associated with the potential to change the community character and setting, demographic composition, or housing availability beyond that already existing under the Dow Chemical's and CDHP's current operations.

The green energy generated by the proposed project would represent a long-term reduction in natural gas purchasing requirements and consumption by the CHDP facility. Thus, the impacts from the operation of the proposed project would be beneficial, minor, local, and long-term. The implementation of the proposed project on socioeconomics would be below the significance threshold.

4.8.2 No Action

Under the No Action alternative, the proposed project, including the planned increase in employment and injection of federal dollars, and the subsequent decrease in natural gas consumption at the CHDP facility, would not occur. This alternative would be a no change from the current situation. Therefore, this alternative would have no impacts.

4.9 CUMULATIVE IMPACTS

CEQ regulations (40 CFR 1508.7) require an analysis of the cumulative impacts resulting from the incremental impact of a proposed project when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these other actions. Cumulative impacts can result from individually minor, but collectively significant, actions. This cumulative impacts section of the EA addresses only the cumulative effects arising from considering the proposed project in combination with other ongoing actions in the vicinity of the CHDP facility in Harris County.

The heat recovery boiler is only proposed to be installed in Train I at the CHDP facility at this time. Success with the Train I boiler, however, could lead to a second installation on Train II at some time in the future, which would involve roughly the same amounts of impact and development at the CHDP facility as discussed in this EA. Regionally, the area surrounding the CHDP facility and the greater City of Deer Park area are experiencing substantial growth and are becoming more developed. Any future CHDP facility expansion would contribute cumulatively beneficial impacts to the area's economy. Facility expansion would also, however, contribute minor adverse cumulative impacts to biological resources and stormwater runoff impacts associated with the increase of impervious surface area.

On an airshed level, the State of Texas takes into account the effects of all past, present, and reasonably foreseeable emissions during the development of the SIP. The State of Texas accounts for all significant stationary, area, and mobile emission sources in the development of this plan. Air pollutants from heavy equipment would be temporary and limited to the immediate vicinity of the project. Estimated emissions generated by the proposed project would be *de minimis* and would not be regionally significant. Therefore, the proposed project would contribute negligible cumulative effects to air quality.

The cumulative beneficial impacts of the proposed project include the replacement and reduction of a relatively small annual quantity of fossil fuels with green energy. Although small, the advancement of research and the development and demonstration of energy efficiency technologies can cumulatively have a substantial impact on the national level for the implementation of energy generation projects that increase industrial efficiency, lower operating costs, and reduce fossil fuel requirements. Overall, the cumulative impacts of the proposed project, when considered with other ongoing actions in the vicinity of the facility, would have minor beneficial impacts. These impacts would not be significant.

5.0 COORDINATION AND PUBLIC REVIEW

5.1 COORDINATION

Federal, State, and local agencies were consulted during the data collection processes which occurred in September, 2010 and again in February, 2011. Agencies were contacted by letter, electronic mail or by telephone during the course of the study. The agencies and people contacted are listed below. **Appendix C** includes a compilation of all the response letters that were received from the agencies contacted during the scoping process and any follow-ups for this EA.

Federal Agencies
United States Environmental Protection Agency, Region 6
U.S. Fish & Wildlife Service, Clear Lake Ecological Services Field Office

Tribal
Bureau of Indian Affairs, Southern Plains Regional Office
Alabama-Coushatta Tribes of Texas
Kickapoo Traditional Tribe of Texas
Ysleta del Sur Pueblo

State Agencies
Texas Coastal Coordination Council
Texas Parks and Wildlife, Wildlife Region 4
Texas Commission on Environmental Quality, Region 12
Texas Historical Commission

Regional/Local Contacts
Harris County Commissioner, Precinct Three
Deer Park Chamber of Commerce
City of Deer Park Mayor & Secretary
City of Deer Park Public Works
City of Deer Park Parks & Recreation

5.2 PUBLIC REVIEW

DOE invited comments on the Draft EA for this project for a period of 30 days following publication of the public notice in two local newspapers; The *Houston Press* and the *Deer Park Broadcaster*. The public notice was published for 3 consecutive days on Wednesday, February 2; Thursday, February 3; and Friday, February 4. Copies of the Draft EA were made available through the DOE NEPA website, the Harris County Public Library System, and at the Clean Harbors facility in Deer Park. The public was encouraged to submit written comments regarding the proposed project at the above address to William Gwilliam, DOE NEPA document manager.

By the close of the comment period on March 4, 2011, a total of six (6) comments on this project were received. The comments came from the Kickapoo Traditional Tribe of Texas, the Texas Parks and Wildlife Department, the Bureau of Indian Affairs – Southern Plains Region, the U.S. Fish and Wildlife Service (USFWS) in Houston, Texas, the State Historic Preservation Officer (SHPO) representing the Texas Historical Commission, and the SHPO on behalf of the Alabama-Coushatta Tribe. These comments have been included in Appendix C of this document. The Kickapoo Traditional Tribe of Texas, the Bureau of Indian Affairs, the USFWS, the Texas Parks and Wildlife Department, and the Alabama-Coushatta Tribe had no further comment on this project. The Texas Historical Commission concluded that since the project area had never been surveyed by a professional archaeologist, the proposed steam and condensate lines running between Clean Harbors and the Dow Chemical Plant could disturb intact archaeological deposits. In response to the concerns identified in this letter, the area was surveyed by Moore Archaeological Consulting, Inc. on behalf of the DOE. The survey, included in **Appendix D**, found no artifacts of either historic or prehistoric origin in the proposed project area. The complete EA distribution list is included in **Appendix B**.

6.0 REFERENCES CITED

(ANSI, 2003) American National Standards Institute. 2003. American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound. Part 3: Short-term measurements with an observer present.

(BEA, 2010). Bureau of Economic Analysis. 2010. Bearfacts: Harris, Texas. Accessed September 2010 at: http://www.bea.gov/regional/bearfacts/action.cfm?fips=48201&areatype=48201.

(CARB, 2007a). California Air Resources Board. 2007. *EMFAC 2007 (v2.3) Emission Factors (On-Road).* California Air Resources Board, Sacramento, CA.

(CARB, 2007b). California Air Resources Board. 2007. *EMFAC 2007 (v2.3) Emission Factors (Off-Road).* California Air Resources Board, Sacramento, CA.

(CCC, 2010). Coastal Coordination Council. Texas Coastal Management Program. May, 2010. Accessed at: http://www.glo.state.tx.us/coastal/cmp.html

(CoDP, 2010). City of Deer Park. Economic Development: Industrial District Information. 2010. Accessed at: http://www.deerparktx.gov/department/?fDD=36-0

(Census, No date[a]). U.S. Census Bureau. No date provided. 2006-2008 American Community Survey 3-Year Estimates: Data Profile Highlights. Accessed September 2010 at: http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=16000US4819624&_geoContext=&_street=&_county=Deer+Park&_cityTown=Deer+Park&_state=&_zip=&_lang=en&_sse=on&ActiveGeoDiv=&_useEV=&pctxt=fph&pgsl=010&_submenuId=factsheet_1&ds_name=ACS_2008_3YR_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=

(Census, No date[b]). U.S. Census Bureau. No date provided. Population Finder [multiple pages used]. Accessed September 2010 at: ((http://factfinder.census.gov/servlet/SAFFPopulation?_event=Search&geo_id=16000US4872392&_geoContext=01000US%7C04000US48%7C16000US4872392&_street=&_county=&_cityTown=&_state=04000US48&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=160&_submenuId=population_0&ds_name=null&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=

(Census, No date[c]). 2006-2008 American Community Survey 3-Year Estimates: Selected Economic Characteristics: 2006-2008 [multiple pages used]. Accessed September 2010 at: http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US4819624&-qr_name=ACS_2008_3YR_G00_DP3YR3&-ds_name=ACS_2008_3YR_G00_&-_lang=en&-_sse=on

(CEQ, 2010). Council on Environmental Quality. 2010. Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions. Accessed August 3, 2010 at http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf

(CHDP, 2010). Clean Harbors Deer Park, LP. Technical Report and Supporting Data for Class 3 Permit Modification: Waste Heat Boiler Addition to Incinerator Train I for Heat Recovery, Steam and Electric Power Generation. Clean Harbors Deer Park. June, 2010.

(Clean Harbors, 2010). Clean Harbors Environmental Services, Inc. Form 10-K. SEC Commission File 001-34223. Accessed August 2010 at: http://www.faqs.org/sec-filings/100301/CLEAN-HARBORS-INC_10-K/a2196913zex-23.htm

(Clean Harbors, 2008). Clean Harbors Environmental Services, Inc. 2008. Deer Park, Texas Facility Facts. Accessed August 2010 at: http://clark.cleanharbors.com/ttServerRoot/Download/13603_FINAL_Deer_Park_TX_Facility_FS_120408.pdf

(CWA, No date). Coastal Water Authority. No date provided. Luce Bayou Interbasin Transfer Project. Accessed September 2010 at: http://www.lucebayou.com/

(DOE, 2010). United States Department of Energy, Federal Energy Management Program. Energy Efficiency and Renewable Energy. Industrial Technologies Program. A Clean, Secure Energy Future via Industrial Energy Efficiency. May 2010. Accessed August 2010 at: http://www1.eere.energy.gov/library/pdfs/48094_industrialtechnology_fs_r2.pdf

(Espey, 2009). Espey Consultants, Inc. San Jacinto River Basin SB3 Ecological Overlay. Final Report. September 21, 2009. Project No. 8069.01. Accessed August 2010 at: http://www.twdb.state.tx.us/RWPG/rpgm_rpts/0900010980_San%20JacintoEcoOverlay.pdf

(Grafe et al. 2000) Grafe, V., L. Allain, M. Vidrine, C. Allen, and S. Johnson. 2000. *Paradise Lost? the coastal prairie of Louisiania and Texas*. U.S. Fish and Wildlife Service Pamphlet, Arlington, Virginia, USA. Access online September 2010 at http://library.fws.gov/pubs/paradise_lost.pdf

(Harris, 1998). Harris, Cecil M. 1998. Handbook of Acoustical Measurement and Noise Control.

(Harris County, 2009). Harris County Public Infrastructure Department, Architecture and Engineering Division. January 2009. Traffic Volumes, Update 2009. Accessed September 2009 at: http://www.eng.hctx.net/traffic/hc_counts.PDF

(HUD, 2008). U.S. Department of Housing and Urban Development. 2008. Tribal Directory Assessment Tool: Office of Community Planning and Development—Environmental Planning Division Tribal Directory Summary with County of Interest: Texas. Accessed September 2010 at: http://www.hud.gov/offices/cpd/environment/tribal/tx/County_TX.pdf

(Idcide, 2010) Weather Data for Deer Park, TX. 2010. Accessed on August 2, 2010 at http://www.idcide.com/weather/al/lynchburg.htm and http://www.idcide.com/weather/tx/deer-park.htm

(Integral Power, LLC, 2010). Integral Power, LLC. July 2010. Environmental Questionnaire: Battleground Energy Recovery Project. 12 pp.

(IPCC, 2007). Intergovernmental Panel on Climate Change. 2007. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom, 1000 pp.

(Mangum, 2011). Moore Archaeological Consulting, Inc. An Archaeological Investigation of the Battleground Energy Recovery Project on the Clean Harbors Property, Harris County, Texas. 42 pages.

(Nature Serve, 2010). Nature Serve Online Encyclopedia of Life. 2010. *Species Reports*. Accessed September 2010 at http://www.natureserve.org/explorer

(NPS, 2008). National Park Service. 2008. Native American Consultation Database Query Results, Full Data Report: County=Mobile. Accessed September 2010 at: http://www.nps.gov/nacd/

(NWI, 2009). United States Fish and Wildlife Service, National Wetlands Inventory. Geospatial Wetlands Data. 2009. Accessed at: http://www.fws.gov/wetlands/Data/Mapper.html

(OSHA, 2009). United States Department of Labor, Occupational Safety, and Health Administration. Voluntary Protection Programs. Page Updated 09/01/2009. Accessed at: http://www.osha.gov/dcsp/vpp/index.html

(PTRA, No date). Port Terminal Railroad Association. No date provided. Port Terminal Railroad Association. Accessed September 2010 at: http://www.ptra.com/

(TAC, 2010) Texas Administrative Code. Texas Commission on Environmental Quality, Control of Air Pollution from Volatile Organic Compounds. Accessed August 2, 2010 http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=115

(TCEQ, 2010). Texas Commission on Environmental Quality. Draft 2010 Texas 303(d) List. February 5, 2010. Accessed at:

http://www.tceq.state.tx.us/assets/public/compliance/monops/water/10twqi/2010_303d.pdf

(TDOT, 2010). Texas Department of Transportation. 2010. Current TxDOT Projects: Harris County. Accessed September 2010 at: http://apps.dot.state.tx.us/apps/project_tracker/projects.htm?view=cnty&dist=Houston&cnty=Harris

(TDOT, No date[a]). Texas Department of Transportation. No date provided. 100 Most Congested Roadway Segments in Texas. Accessed September 2010 at: http://apps.dot.state.tx.us/apps/rider56/map.htm

(THC, No date). Texas Historical Commission. No date provided. The National Historic Preservation Act. Accessed September 2010 at: http://www.thc.state.tx.us/crm/crmnhpa.shtml.

(TPWD, 2010) Texas Parks and Wildlife Department TPWD). 2010. *Rare, Threatened, and Endangered Species of Texas County Search*. Last updated July 2010. Accessed September 2010 at http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/

(TSHA, 2010). Texas State Historical Association. Handbook of Texas Online; Harris County. Updated May, 2010. Accessed August 2010 at: http://www.tshaonline.org/handbook/online/articles/HH/hch7.html

(TWDB, No date). Texas Water Development Board. No date provided. Summary of Region H. Accessed September 2010 at: http://www.twdb.state.tx.us/publications/reports/State_Water_Plan/2007/2007StateWaterPlan/CHAPTER%202_REGIONAL%20H_FINAL%20112706.pdf

(USDA, 1997a). United States Department of Agriculture, Natural Resources Conservation Service. February 1997. Official Soil Series Description: Beaumont Series. Accessed at: http://www2.ftw.nrcs.usda.gov/osd/dat/B/BEAUMONT.html

(USDA, 1997b). United States Department of Agriculture, Natural Resources Conservation Service. February 1997. Official Soil Series Description: Lake Charles Series. Accessed at: http://www2.ftw.nrcs.usda.gov/osd/dat/L/LAKE_CHARLES.html

(USEPA, 2010a). U.S. Environmental Protection Agency. 2010. Monitor Values Report, Criteria Pollutants. Accessed August 2, 2010 at http://www.epa.gov/air/data/monvals.html?st~TX~Texas

(USEPA, 2010b). U.S. Environmental Protection Agency. 2010. Climate Change - Health and Environmental Effects. Accessed April 22 at http://www.epa.gov/climatechange/effects/index.html.

(USEPA, 2010c). U.S. Environmental Protection Agency. 2010. USEPA Currently Designated Nonattainment Areas for Criteria Pollutants. Accessed August 2, 2010 at http://www.epa.gov/air/oaqps/greenbk/ancl.html#
(USEPA, 2007). U.S. Environmental Protection Agency. 2007. Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2005. EPA 430-R-07-002. April 15, 2007. U.S. Environmental Protection Agency. Washington, D.C.

(USEPA, 2005). United States Environmental Protection Agency. 2005. Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses. Washington, D.C.

(USEPA, 2003). United States Environmental Protection Agency. User's Guide to MOBILE6.2: Mobile Source Emission Factor Model. EPA420-R-02-028. August 2003.

(USEPA, 1999). United States Environmental Protection Agency. Documentation of Environmental Indicator Determination, RCRA Corrective Action; Clean Harbors Deer Park LP. Interim Final February 5, 1999. Accessed at: http://www.epa.gov/Region6//6pd/rcra_c/pd-a/eiforms/tx1378ca725.pdf

(USEPA, 1995). United States Environmental Protection Agency. 1995. Compilation of Air Pollutant Emission Factors, AP-42, 5th edition, Vol. I: Stationary Point and Area Sources.

(USEPA, 1974). U.S. Environmental Protection Agency. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Accessed May 18, 2010 at http://www.nonoise.org/library/levels74/levels74.htm#table%20of%20contents.

(USFWS, 2010). U.S. Fish and Wildlife Services. 2010. *Threatened and Endangered Species Report for Harris County*. Last updated September 2010 Accessed September 2010 at: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=48201

7.0 DOCUMENT PREPARERS

The contractor responsible for preparing this EA:

Mangi Environmental Group
7927 Jones Branch Drive, Suite 150
McLean, VA 22102
703-760-4801

The following Mangi Environmental Group personnel were principal contributors to this EA:

Name and Document Contribution	**Associated Professional Expertise**
Marissa Staples, **MS Environmental Science & Policy** Project Management, Water, Soils, Infrastructure, HHS	8 years experience: Watershed analyses, Phase I/II environmental site assessments, Environmental Baseline Surveys, EAs/EISs
Meghan Morse **MS Natural Resources (in progress)** Socioeconomics, Utilities, and Cultural Resources	5 years of experience: CATEXs/EAs/EISs, editing and socioeconomic research.
Chelsie Romulo **MS Natural Resources (in progress)** GIS, Biological Resources	8 years of experience: research in wildlife biology and ecology.
Jim Mangi, Ph.D., Ecology Project Oversight	35 years experience: recognized as a NEPA expert; has assisted the DoD and five other Federal and State agencies in the development of their NEPA regulations and guidance.
Timothy Lavallee, P.E. **LPES, Inc. Engineering and Plannin** Air Quality, Noise	18 years of experience M.S., Environmental Health, Tufts University, Medford, Massachusetts. B.S., Mechanical Engineering, Northeastern University, Boston, Massachusetts.

APPENDIX A

AIR EMISSIONS CALCULATIONS

Construction Emissions

Table A-1 Construction Equipment Use

Equipment Type	Number of Units	Days on Site	Hours Per Day	Operating Hours
Excavators Composite	1	230	4	920
Rollers Composite	1	173	8	1384
Rubber Tired Dozers Composite	1	230	8	1840
Plate Compactors Composite	1	115	4	460
Trenchers Composite	2	230	8	3680
Air Compressors	1	115	4	460
Cement & Mortar Mixers	2	115	6	1380
Tractors/Loaders/Backhoes	2	230	7	3220
Pavers Composite	1	58	8	464
Paving Equipment	1	58	8	464

Table A-2 Construction Equipment Emission Factors (lbs/hour)

Equipment	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2
Excavators Composite	0.5828	1.3249	0.1695	0.0013	0.0727	0.0727	119.6
Rollers Composite	0.4341	0.8607	0.1328	0.0008	0.0601	0.0601	67.1
Rubber Tired Dozers Composite	1.5961	3.2672	0.3644	0.0025	0.1409	0.1409	239.1
Plate Compactors Composite	0.0263	0.0328	0.0052	0.0001	0.0021	0.0021	4.3
Trenchers Composite	0.5080	0.8237	0.1851	0.0007	0.0688	0.0688	58.7
Air Compressors	0.3782	0.7980	0.1232	0.0007	0.0563	0.0563	63.6
Cement and Mortar Mixers	0.0447	0.0658	0.0113	0.0001	0.0044	0.0044	7.2
Tractors/Loaders/Backhoes	0.4063	0.7746	0.1204	0.0008	0.0599	0.0599	66.8
Pavers Composite	0.5874	1.0796	0.1963	0.0009	0.0769	0.0769	77.9
Paving Equipment	0.0532	0.1061	0.0166	0.0002	0.0063	0.0063	12.6

Source: CARB 2007

Table A-3 Construction Equipment Emissions (tons)

Equipment	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2
Excavators Composite	0.2681	0.6095	0.0780	0.0006	0.0335	0.0335	55.0074
Rollers Composite	0.3004	0.5956	0.0919	0.0005	0.0416	0.0416	46.4006
Rubber Tired Dozers Composite	1.4684	3.0058	0.3353	0.0023	0.1296	0.1296	219.9772
Plate Compactors Composite	0.0061	0.0076	0.0012	0.0000	0.0005	0.0005	0.9922
Trenchers Composite	0.9347	1.5156	0.3405	0.0013	0.1267	0.1267	108.0472
Air Compressors	0.0870	0.1835	0.0283	0.0002	0.0130	0.0130	14.6297
Cement and Mortar Mixers	0.0309	0.0454	0.0078	0.0001	0.0031	0.0031	5.0012
Tractors/Loaders/Backhoes	0.6542	1.2470	0.1939	0.0012	0.0964	0.0964	107.5583
Pavers Composite	0.1363	0.2505	0.0455	0.0002	0.0178	0.0178	18.0811
Paving Equipment	0.0123	0.0246	0.0038	0.0000	0.0015	0.0015	2.9297
Total	**3.90**	**7.49**	**1.13**	**0.0064**	**0.46**	**0.46**	**578.62**

***Table A-4* Heavy Truck Emissions**

Delivery of Concrete							
Volume of Concrete (cubic yards)	231						
Number of Concrete Trucks	***23***						
Delivery of Equipment and Supplies							
Number of Deliveries Per Site Per Day	2						
Days of Construction	230						
Total Number of Deliveries	***460***						
Delivery of Fill							
Number of Deliveries Per Site Per Day	4						
Days of Construction	230						
Total Number of Fill Trucks	***920***						
Grand Total Number of Trucks	**1403**						
Number of Trips	2						
Miles Per Trip Within AQCR	30						
Total Miles	84189						
Pollutant	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**
Emission Factor (lbs/mile)	0.0219	0.0237	0.0030	0.0000	0.0009	0.0007	2.7
Total Emissions (lbs)	1847.87	1996.34	251.95	2.16	72.07	62.24	228946
Total Emissions (tons)	**0.92**	**1.00**	**0.13**	**0.0011**	**0.04**	**0.03**	**114.5**

Source: USEPA 2003

Table A-5 Surface Disturbance

TSP Emissions	80	lb/acre				
PM10/TSP	0.45					
PM2.5/PM10	0.15					
Period of Disturbance	30	days				
Capture Fraction	0.5					
Building/Facility	**Area [acres]**	**TSP[lbs]**	**PM_{10}[lbs]**	**PM_{10}[tons]**	**$PM_{2.5}$[lbs]**	**$PM_{2.5}$[tons]**
All Facilities	0.4	1035	466	0.23	35	0.02
Total	**0.4**	**1035**	**466**	**0.23**	**35**	**0.02**

Sources: USEPA 1995; USEPA 2005.

Table A-6 Worker Commutes

Number of Workers	75						
Number of Trips	2						
Miles Per Trip	30						
Days of Construction	230						
Total Miles	1035000						
Pollutant	**CO**	**NO_x**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**
Emission Factor (lbs/mile)	0.0105	0.0011	0.0011	0.0000	0.0001	0.0001	1.1
Total Emissions (lbs)	10917.63	1141.48	1116.96	11.12	88.03	54.78	1138015.9
Total Emissions (tons)	**5.46**	**0.57**	**0.56**	**0.0056**	**0.04**	**0.03**	**569.01**

Source: CARB 2007

Table A-7 Total Construction Emissions (tons)

Activity/Source	CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2
Construction Equipment	3.90	7.49	1.13	0.0064	0.46	0.46	578.62
Delivery of Equipment and Supplies	0.92	1.00	0.13	0.0011	0.04	0.03	114.47
Paving Off Gasses	0.00	0.00	0.00	0.0000	0.00	0.00	0.00
Surface Disturbance	0.00	0.00	0.00	0.0000	0.23	0.02	0.00
Worker Commutes	5.46	0.57	0.56	0.0056	0.04	0.03	569.01
Total Construction Emissions	**10.3**	**9.1**	**1.8**	**0.0**	**0.8**	**0.5**	**1262.1**

Air Emissions - Cooling Tower

The air flow from the tower will entrain droplets from the water flow, which contain dissolved solids that concentrate (cycle up) in the tower due to evaporation losses. These droplets, called drift, will themselves evaporate to dryness in the atmosphere, leaving behind PM-10. Drift losses are generally guaranteed (to be below a maximum) by the cooling tower vendor. The resulting PM-10 emissions are calculated thusly:

Cooling tower circulation: 14,900 gpm

Maximum TDS in the recirculating water: 2,000 ppmw

Maximum drift (per vendor): 0.002% of total flow

Emissions are calculated from the above data, assuming 8760 hours per year operation, to be 1.3 tons per year.

APPENDIX B

DISTRIBUTION LIST

Battleground Energy Recovery Project, Harris County, TX
EA Distribution List

Federal Agencies:

Steve Parris
Field Supervisor
U.S. Fish & Wildlife Service
Clear Lake Ecological Services Field Office
17629 El Camino Real, Ste. 211
Houston, TX 77058

Cathy Gilmore
Office of Planning and Coordination
United States Environmental Protection Agency, Region 6
1445 Ross Avenue
Suite 1200
Mail Code: 6EN
Dallas, TX 75202-2733

Tribal:

Dan Deerinwater, Regional Director
Southern Plains Regional Office
Bureau of Indian Affairs
WCD Office Complex
P.O. Box 368
Anadarko, OK 73005

Bryant Celestine, THPO
Alabama-Coushatta Tribes of Texas
571 State Park Rd. 56
Livingston, TX 77351

Don Spaulding, Tribal Administrator
Kickapoo Traditional Tribe of Texas
HCR 1, Box 9700
Eagle Pass, TX 78852

Governor Frank Paiz
Ysleta del Sur Pueblo
P.O. Box 17579
El Paso, TX 79917

Stratford Williams, President
Wichita and Affiliated Tribes
PO Box 729
1 1/4 Miles North on Hwy 281
Anadarko, OK 73005

Brenda Edwards, Chairman
Caddo Nation
PO Box 487
Binger, OK 73009

State Agencies:

Tammy Brooks, Team Leader
CMP/Federal Consistency
Texas Coastal Coordination Council
P.O. Box 12873
Austin, Texas 78711-2873

David Mabie
Wildlife Region 4, Regional Director
Texas Parks and Wildlife
715 S. Hwy. 35
Rockport, TX 78382

Linda K. Vasse, P.G.
Region 12 Director
Texas Commission on Environmental Quality
5425 Polk Ave., Ste. H
Houston, TX 77023-1452

Bill Martin
Department of Energy 106 Review Specialist
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Local Governments and Entities

Paul Wilson, Director
City of Deer Park, Parks & Recreation
610 E. San Augustine
Deer Park, TX 77536

Bill Pedersen, Director
City of Deer Park, Public Works
710 E. San Augustine
Deer Park, TX 77536

Wayne Riddle
City of Deer Park, Mayor
710 E. San Augustine
Deer Park, TX 77536

Sandra Watkins
City of Deer Park, City Secretary
710 E San Augustine
Deer Park, TX

Mike Mills
Chairman of the Board
Deer Park Chamber of Commerce
110 Center Street
Deer Park, TX 77536

Steve Radack
Commissioner of Precinct Three
Harris County
Administration Building
1001 Preston, 9th floor
Houston, Texas 77002
(713) 755-6306

Robert E. Leach
Clean Harbors Environmental Services, Inc.
2027 Battleground Road
LaPorte, TX 77571

APPENDIX C

AGENCY CORRESPONDENCE

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF INDIAN AFFAIRS
SOUTHERN PLAINS REGION
BRANCH OF NATURAL RESOURCES
1 MILE NORTH OF CITY, HWY 281 & RIVERSIDE DRIVE
P.O. BOX 368
ANADARKO, OKLAHOMA 73005

IN REPLY REFER TO: NATURAL RESOURCES (405) 247-6673

George Pukanic
NEPA Document Coordinator
National Energy Technology Laboratory
P.O. Box 10940, MA 922-342C
Pittsburgh, PA 15236

OCT 2 1 2010

Dear Mr. Pukanic:

Thank you for the opportunity to comment on the DOE/NETL proposed Battleground Energy Recovery Project in Deer Park, Harris County, Texas. From your description the proposed improvements will be entirely on privately owned property with a total of 2 acres disturbed.

A review of Bureau of Indian Affairs (BIA) maps of the project location indicates that there are no tribal or Individual Indian trust lands within the project area. The BIA has no jurisdiction within the project area and there are no concerns that the proposed improvements will impact Indian trust lands within the Southern Plains Region jurisdiction.

It is recommended that you contact the Wichita and Affiliated Tribes of Oklahoma, and the Caddo Nation of Oklahoma as they have historic ties to the area and should be consulted to determine if they have some concern that the project has a potential to impact sites of importance in their respective histories or cultural traditions.

If any additional information is required, please contact John A. Worthington, Regional Archeologist, at 405.247.1565.

Sincerely,

Constance M. Fox

Acting Regional Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real #211
Houston, Texas 77058-3051

June 2010

Thank you for your request for threatened and endangered species information in the Clear Lake Ecological Services Field Office's area of responsibility. According to Section 7(a)(2) of the Endangered Species Act and the implementing regulations, it is the responsibility of each Federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally listed species.

Please note that while a Federal agency may designate a non-Federal representative to conduct informal consultation or prepare a biological assessment, the Federal agency must notify the U.S. Fish and Wildlife Service (Service) in writing of such designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

A county by county listing of federally listed threatened and endangered species that occur within this office's work area can be found at http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm. You should use the county by county listing and other current species information to determine whether suitable habitat for a listed species is present at your project site. If suitable habitat is present, a qualified individual should conduct surveys to determine whether a listed species is present.

After completing a habitat evaluation and/or any necessary surveys, you should evaluate the project for potential effects to listed species and make one of the following determinations:

- **No effect** – the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

- **Is not likely to adversely affect** – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

TAKE PRIDE IN AMERICA

TEXAS HISTORICAL COMMISSION
real places telling real stories

October 15, 2010

Mr. George Pukanic
NEPA Document Manager
National Energy Technology Laboratory
P.O. Box 10940, MS 922-342C
Pittsburgh, PA 15236

Re: Project review under Section 106 of the National Historic Preservation Act
Battleground Energy Recovery Project, Harris County, Texas (DOE)

Dear Mr. Pukanic:

Thank you for allowing us to comment on the project referenced above. This letter serves as comment from the Executive Director of the Texas Historical Commission, the state agency responsible for administering the Antiquities Code of Texas.

The review staff, led by Bill Martin, has completed its review. The proposed project area has never been surveyed by a professional archeologist. The proposed steam and condensate lines running between Clean Harbors and the Dow Chemical Plant could disturb intact archeological deposits. Therefore, we cannot concur with your determination that this project will not have an adverse effect on historic properties.

We believe a professional archeologist should survey these lines, and all portions of the other lines that will be placed anywhere other than beneath the pavement. The work should meet the minimum archeological survey standards posted on-line at www.thc.state.tx.us. A report of investigations should be produced in conformance with the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation, and submitted to this office for review. In addition, any buildings 45 years old or older that are located on or adjacent to the tract should be documented with photographs and included in the report. You may obtain lists of archeologists in Texas on-line at: www.counciloftexasarcheologists.org or www.rpanet.org. Please note that other potentially qualified archeologists not included on these lists may be used.

Thank you for your cooperation in this federal 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 Bill Martin at 512/463-5867.**

Sincerely,

for
Mark Wolfe, State Historic Preservation Officer

MW/wam

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

January 26, 2011

Dear Reader:

Enclosed for your review and comment is the U.S. Department of Energy's (DOE's) *Draft Environmental Assessment for the Battleground Energy Recovery Project in Deer Park, Harris County, Texas (DOE/EA-1769)* (Draft EA). DOE's proposed action is to provide $1.94 million in cost-shared funding to Houston Advanced Research Center (HARC) for the Battleground Energy Recovery Project. The proposed project has been selected by DOE's Office of Energy Efficiency and Renewable Energy (EERE) to advance research and demonstrate energy efficiency and renewable energy technologies. The proposed project would involve the production of 8 megawatt (MW) of electricity from high pressure steam generated by capturing heat that is currently lost at the Clean Harbors Deer Park facility.

DOE prepared this Draft EA to evaluate the potential environmental consequences of providing cost-sharing funding to HARC to install a specifically-designed heat recovery boiler on the existing kiln afterburner of an incineration unit at the CDHP facility. This boiler would use heat from the incinerator flue gases to generate high pressure superheated steam. The majority of the steam, however, would be piped to a new steam turbine-generator (STG). The STG would be installed in a new building adjacent to the CHDP facility to produce electric power. A cooling tower would be installed adjacent to the new building in the northwest corner of the facility. The 8 MW of electricity generated by the STG would be used by the CHDP facility to offset purchased power; any excess power generated would be transmitted to the electrical grid.

This Draft EA evaluates eight resource areas and identifies no significant adverse impacts from the proposed project. Construction and installation activities associated with the project would occur entirely within private industrial property. The project would require a construction permit and a minor amendment to the facility's air emissions operating permit. Additionally, modification to the facility's existing hazardous waste permit would be necessary.

DOE invites interested parties to comment on this Draft EA during a 30-day public comment period that begins on Date February 3 and ends March 4, 2011. Submit comments to:

Mr. William Gwilliam
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
M/S: B07
P.O. Box 880
Morgantown, West Virginia 26507-0880
E-mail: william.gwilliam@netl.doe.gov
Fax: (304) 285-4216

Envelopes and the subject line of e-mails and faxes should be labeled "Draft Battleground Energy Recovery EA Comments." Comments received after close of the comment period will be considered to the extent practicable.

Individual names and addresses, including e-mail addresses, received as part of the comment documents normally are considered part of the public record. Persons wishing to withhold their name, address, or other identifying information from the public record must state this request prominently at the beginning of the comment document; DOE will honor this request to the extent allowed by law. All submissions from organizations, businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses will be included in the public record and open to public inspection in their entirety.

Thank you for your interest in this Draft EA. For further information on the Draft EA or to request additional copies, please contact me as noted above. The Draft EA is also available on DOE's National Energy Technology Laboratory web site at http://www.netl.doe.gov/publications/others/nepa/ea.html.

Sincerely,

W. L. Gwilliam

William Gwilliam
NEPA Document Manager

TEXAS PARKS & WILDLIFE

Based on the project description, the Wildlife Habitat Assessment Program does not anticipate significant adverse impacts to rare, threatened or endangered species, or other fish and wildlife resources.

Signed: Amy Turner

Date: 2/25/2011

KICKAPOO
TRADITIONAL
TRIBE OF TEXAS

HCR 1 Box 9700
Eagle Pass, Texas 78852

Traditional Council

February 17, 2011

Mr. William Gwilliam
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
M/S: B07
P.O. Box 880
Morgantown, West Virginia 26507-0880

Re: Draft Environmental Assessment for the Battleground Energy Recovery Project in Deer Park, Harris County, Texas (DOE/EA-1769) (Draft EA).

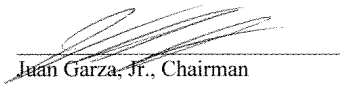
Dear Sir:

Thank you for your letter dated on January 26, 2011, regarding: Draft Environmental Assessment for the Battleground Energy Recovery Project in Deer Park, Harris County, Texas (DOE/EA-1769) (Draft EA).

Thank you for advising us about the proposed action. The Kickapoo Nation values its traditions and customs so we appreciate your taking the time to ask for our input in this matter. By keeping the lines of communication open we can peacefully co-exist yet attend to our respective businesses.

We do not have any questions or concerns regarding the information within your transmittal, as we are unaware of any tribal sites in this area, therefore it does not affect our interests in any way. Furthermore, the Kickapoo Traditional Tribe of Texas wishes you success in your endeavor.

Should you have any further questions please do not hesitate to contact us.



Juan Garza, Jr., Chairman

>>> "Bryant J. Celestine" <celestine.bryant@actribe.org> 3/3/2011 5:51 PM >>>

Dear Mr. Gwilliam:

On behalf of Mikko Oscola Clayton Sylestine and the Alabama-Coushatta Tribe, our appreciation is expressed on your efforts to consult us regarding the draft Environmental Assessment for the Battleground Energy Recovery Project in Deer Park, Harris County, Texas.

Our Tribe maintains ancestral associations throughout the state of Texas despite the absence of written documentation to completely identify Tribal activities, villages, trails, or burial sites. However, it is our objective to ensure significances of Native American ancestry, especially of the Alabama-Coushatta Tribe, are administered with the utmost considerations.

Upon review of your January 26, 2011 submission, no known impacts to religious, cultural, or historical assets of the Alabama-Coushatta Tribe of Texas are anticipated in conjunction with this proposal. In the event of inadvertent discovery of human remains and/or archaeological artifacts, activity in proximity to the location must cease and appropriate authorities, including our office, notified without delay for additional consultation.

Should you require further assistance, please do not hesitate to contact us.

Sincerely,

Bryant J. Celestine
Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, Texas 77351
936 - 563 - 1181
celestine.bryant@actribe.org

APPENDIX D

ARCHAEOLOGICAL SURVEY REPORT

AN ARCHEOLOGICAL INVESTIGATION OF THE BATTLEGROUND ENERGY RECOVERY PROJECT ON THE CLEAN HARBORS PROPERTY, HARRIS COUNTY, TEXAS

By
Douglas G. Mangum
Principal Investigator

For
The Houston Advanced Research Center
and
the National Energy Technology Laboratory, U.S. Department of Energy

Moore Archeological Consulting, Inc.
Report of Investigations Number 591
August 2011

ABSTRACT

In June of 2011, a crew from Moore Archeological Consulting, Inc. conducted an intensive pedestrian survey and a metal detecting pedestrian survey investigation of the proposed Battleground Energy Recovery Project in Harris County, Texas. The investigation was for the Houston Advanced Research Center and the National Energy Technology Laboratory, U.S. Department of Energy (the Clients) as a result of a letter issued by the Texas Historical Commission (THC). This letter indicated the need for a Section 106 compliance survey. Further consultation with the THC determined the need for a metal detecting survey to determine if any artifacts related to the nearby San Jacinto Battleground were present within the Project Area.

The proposed Project Area is in eastern Harris County and can be found on the La Porte (299524) USGS quadrangle. It covers an area roughly one acre in size. The proposed project will involve construction of a pad, installation of a waste heat recovery boiler, a steam turbine-generator, and pipelines.

The survey found no artifacts of either historic or prehistoric origin, including anything related to the Battle of San Jacinto. A total of seven shovel tests were dug and a minimum of 800 linear meters of survey lane were metal detected. Deposits of artificial fill of recent origin (based on debris within the soil) were noted across all of the Project Area. It is recommended that no further archeological investigations, including those involving metal detecting, are necessary on the Clean Harbors property before the onset of construction.

CONTENTS

LIST OF FIGURES

INTRODUCTION

In June of 2011, a crew from Moore Archeological Consulting, Inc. (MAC) conducted an archeological investigation of the proposed Battleground Energy Recovery Project (BERP) in Harris County, Texas (Figures 1-4). The investigation was conducted in response to a request, issued by the Houston Advanced Research Center and the National Energy Technology Laboratory, U.S. Department of Energy (the Clients). The request was the result of a letter dated October 15, 2010 issued by Mr. Bill Martin (for Mark Wolfe) of the Texas Historical Commission (THC). In the letter Mr. Martin specifically stated that an archeological survey of the proposed Project Area was needed. Further consultation with Mr. Martin determined the need for a mixture of traditional intensive pedestrian survey and a metal detecting pedestrian survey as discussed in the METHODS section of this report. The latter methodology was necessary due to the proximity of the San Jacinto Battleground State Historic Site nearby. All work was consistent with the guidelines set out under 36CFR800 for Section 106 compliance. The project will be subject to review by the THC and the Clients.

The proposed Project Area is in eastern Harris County and can be found on the La Porte (299524) USGS quadrangle. It covers an area roughly one acre in size. The proposed construction will take place principally on the Clean Harbors Deer Park (CDHP) facility with some steam conduits traversing portions of the neighboring Dow Chemical plant. The proposed project will involve construction of a pad, installation of a waste heat recovery boiler, a steam turbine-generator, and pipelines. A total of one acre of land will be disturbed at the existing CHDP facility and the adjacent Dow Chemical plant during

project construction and installation activities. It is expected that impacts will be deep, though much of the Project Area will simply have ballast placed atop it to create a stable surface for the boiler and turbine-generator to be built upon.

The primary objective of the investigation is to determine the presence or absence of cultural materials within the locations where the proposed construction will occur. This objective is further broken into two portions. First; to examine the tract to see if it contained artifacts related to the Battle of San Jacinto. Recent investigations in and around the San Jacinto Battleground State Historic Site have indicated that such artifacts are more widespread than originally believed and have developed a potential model for possible locations of artifact concentrations (Mangum and Moore, 2006 and 2010a; Mangum, Moore, and Butler, 2011; Karbula, et al. 2004). Second; to see if the site contained other historic or prehistoric artifacts. The differing needs of these two aspects of the objective resulted in a twofold methodology which will be discussed further in the METHODS section of this report. Finally this investigation will provide a report of the results of the survey to the Client and the THC.

Principal Investigator Douglas G. Mangum, Staff Archeologists David Driver, Randy Ferguson, and technicians Rachel Goings, Abidemi "Tunde" Babalola, Stephanie McKernan, and Nick Bell conducted this investigation. The entire project was conducted under the overall supervision of the MAC President Roger G. Moore Ph.D.

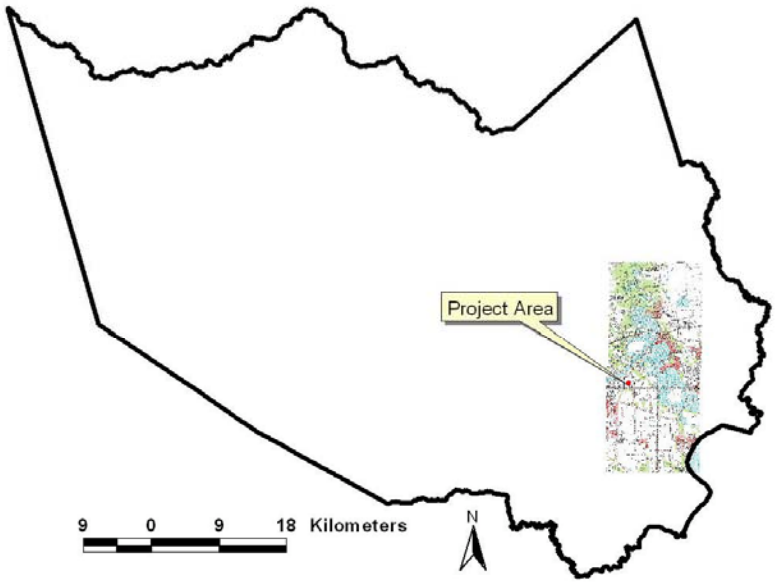


Figure 1: Project Area in Harris County

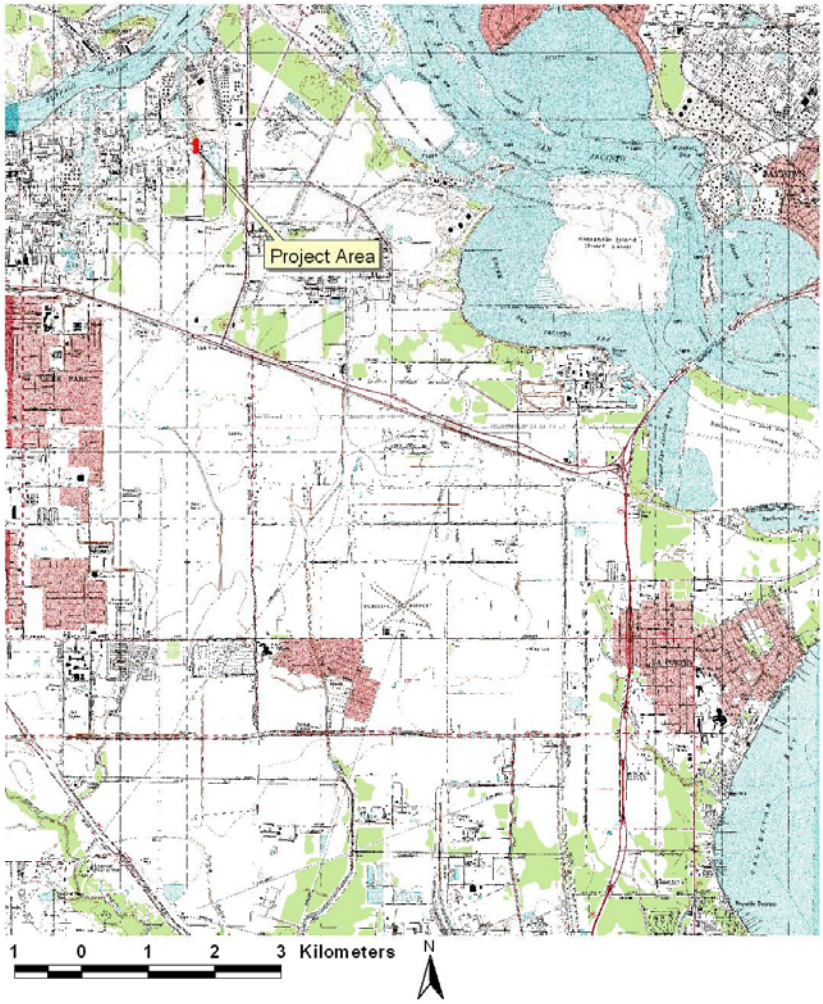


Figure 2: Project Areas on the La Porte and Highlands USGS Quadrangle Maps

Figure 3: Detail of Project Areas on La Porte and Highlands Maps

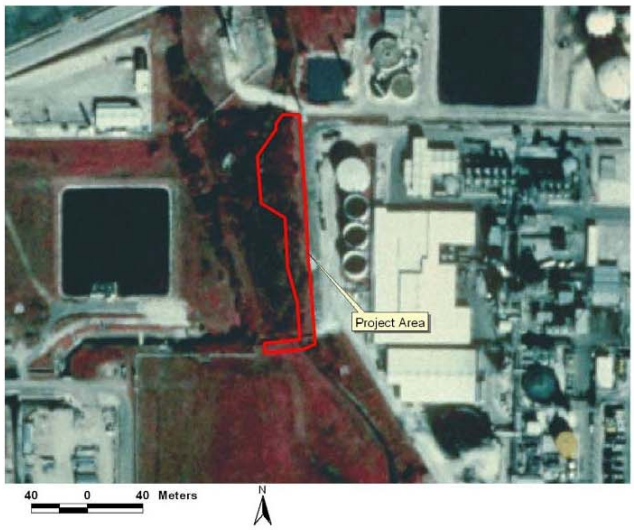


Figure 4: Project Area overlaying a 1995 aerial photograph.

ENVIRONMENTAL SETTINGS

Modern Climate

The modern climate of the Project Area can aptly be characterized as hot and wet for most of the year. The mean annual temperature for the region is about 20 degrees Centigrade, with mean rainfall of 117 centimeters. Summer temperatures average about 34 degrees Centigrade, with temperatures above 38 degrees common during July and August (Carr 1967; St. Clair *et al.* 1975). The average winter temperature is a mild 18 degrees Centigrade. Freezes are infrequent and of short duration, with an average of 271 frost-free days per year. Snow, sleet, and freezing rain are uncommon.

Rainfall varies from 7 centimeters in March to 11 centimeters in December, with July to December rainfall often supplemented by tropical fronts and storms. The rainfall records range from a low of 45 centimeters to a high of 185 centimeters. Prevailing winds are usually from the southeast except during the winter months when 'Northers' sweep into the area.

Modern Flora and Fauna

Southeast Texas is within the Austroriparian biotic province, near its western boundary with the Texan province (Blair 1950:98-101). Pine-hardwood forests on the eastern Gulf coastal plain mark this boundary, which is set by available moisture levels. The Project Area is situated within the pine-oak forest subdivision of the Austroriparian province and includes portions of the coastal prairie within its western limits (Tharp 1939).

Grasses within the coastal prairies and marsh vegetation area are described from a range-management perspective in Hoffman et al. (nd: 45). This 10,000,000-acre area consists of 9,500,000 acres of gulf prairies and 500,000 acres of gulf marshes. The regional vegetation of the coastal prairies is characterized as follows:

> The principal grasses of the prairies are tall bunchgrass, including big bluestem *(Andropon gerardi)*, little bluestem, seacoast bluestem *(Schizachyrium scoparium*, var. *littorus)*, Indiangrass, eastern gamagrass *(Tripascum dactyloides)*, switchgrass, and gulf cordgrass. Seashore saltgrass is common on moist saline sites. Grazing pressures have changed the composition of the range vegetation so that the grasses now existing are broomsedge bluestem, smutgrass, threeawns, tumblegrass and many other inferior grasses. The other plants that have invaded the productive grasslands are oak underbrush, mcartney rose, huisache, mesquite, pricklypear, ragweed, bitter sneezeweed, broomweed, and many other unpalatable annual weeds [Hoffman et al. nd: 45].

The dominant floral species of the pine-oak forest subdivision of the Austroriparian biotic province include loblolly pine *(Pinus taeda)*, yellow pine *(Pinus echinata)*, red oak *(Quercus rubra)*, post oak *(Quercus stellata)*, and blackjack oak *(Quercus marilandica)*. Hardwood forests are found on lowlands within the Austroriparian and are characterized by such trees as sweetgum *(Liquidambar styraciflua)*, magnolia *(Magnolia grandiflora)*, tupelo *(Nyssa sylvatica)*, water oak *(Quercus nigra)* and other species of oaks, elms, and

ashes, as well as the highly diagnostic Spanish moss *(Tillandsia usneiodes)* and palmetto *(Sabal glabra)*. Swamps are common in the region.

Blair (1950) and Gadus and Howard (1990:12-15) define the following mammals as common within the Austroriparian province: white-tailed deer *(Odocoileus virginianus)*, muskrat *(Ondatra zibethicus)*, raccoon *(Procyon lotor)*, coyote *(Canis latrans)*, opossum *(Didelphis virginiana), Scalopus aquaticus, Pipistrellus subflavus, Lasiurus borealis, Sciurus niger, Sciurus carolinensis, Glaucomys volans, Geomys breviceps, Reithrodonomys fulvescens, Peromyscus leucopus, Oryzomys palustris,* cotton rat *(Sigmodon hispidus,),* packrat *(Neotoma floridana),* eastern cottontail *(Sylvilagus floridanus),* and swamp rabbit *(Sylvilagus aquaticus.).* Bison *(Bison bison)* may have been present on nearby grasslands at various times in the past (Gadus and Howard 1990:15).

Common land turtles include eastern box turtle *(Terrapene carolina)* and *Terrapene ornata*, while snapping turtle *(Chelydra serpentinia)*, mud turtle *(Kinosteron* spp.), river cooter *(Chrysemys concinna)* and diamondback terrapin *(Malaclemys terrapin)* comprise common water turtles. Common lizards include *Anolis carolinensis*, *Sceloporus undulatus, Leiolopisma laterale, Eumeces laticeps, Cnemidophorus sexlineatus*, and *Ophiosaurus ventralis*. Snakes and amphibians are also present in considerable numbers and diversity.

The resources provided by river-influenced estuarine and marsh environments were undoubtedly of great importance to the littoral residents of southeast Texas. These resources are summarized by Gadus and Howard (1990:12-15). Estuarine fish resources cited by Gadus and Howard include sand trout *(Cynoscion arenarius)*, spotted sea trout *(Cynoscion nebulosus)*, Atlantic croaker *(Micropogon undulatus)*, striped mullet *(Mugil cephalus)*, southern flounder *(Paralichthysis lethostigma)*, shortnose gar *(Lepisosteus platostomus)*, channel catfish *(Ictalurus punctatus)*, freshwater drum *(Aplodinotus grunniens)*, red drum *(Sciaenops ocellata)*, and bluegill *(Lepomis macrochirus)* and other sunfishes. Common shellfish include Rangia *(Rangia cuneata)*, *Macoma* spp., dwarf surf clam *(Mulinia lateralis)*, oyster *(Crassostrea virginica)*, *Vioscalba louisianae*, and olive nerite *(Neritina [Vitta] reclivata)*. Arthropods, such as shrimp and crab, are also numerous and highly productive.

Area marshes replete with plants such as cordgrasses *(Spartina* spp.), reeds *(Phragmites* spp.), giant millet *(Setaria magna)*, and bullrushes *(Scirpus* spp.) would have formed a highly attractive and bountiful magnet for waterfowl (Gadus and Howard 1990).

Until recently the Project Area was a small but densely wooded area that appeared to be the natural riparian zone of Tucker Bayou (as seen in a 1930 Tobin aerial, Figure 5). This wooded area was most likely a mix of Chinese tallow and native species hardwoods. A review of older topographical maps and aerial photographs confirms that in its natural state this area is wooded. In preparation for the archeological metal detecting survey the Clients had the Project Area cleared using a machine called a wood gator. This was

necessary to allow for metal detecting of the entirety of the tract. As a result of this clearing there is currently no vegetation within the tract.

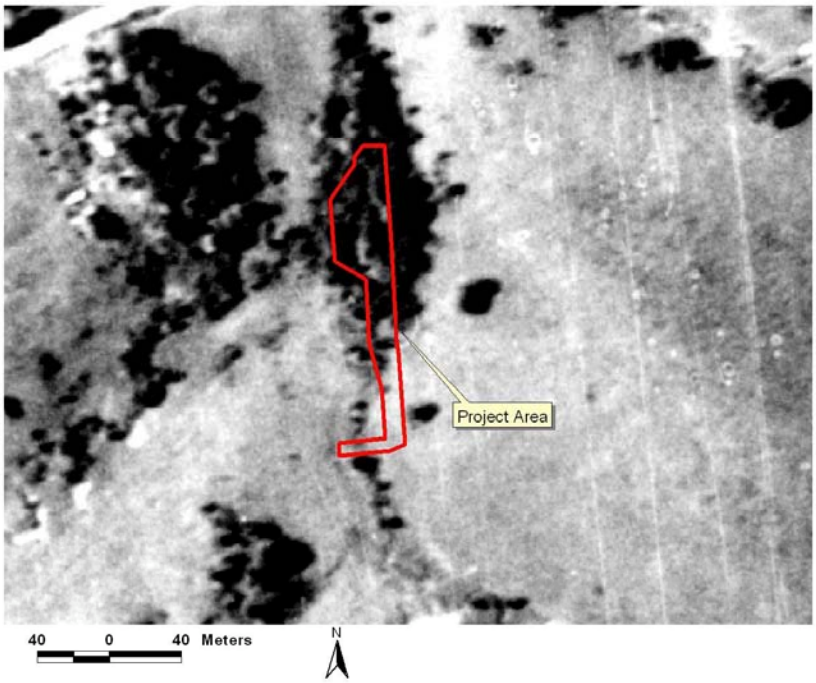


Figure 5: Project Area over 1930 Tobin aerial photograph.

Soils and Geology

Geologic formations of the Upper Texas Coastal region are Pleistocene in age. The Gulf Coastal Plain is the result of a series of sediment wedges, both marine and continental, created over the last 65 million years (Spearing 1991). Their presence is the result of the rise and fall of sea level and the fluvial and deltaic deposits of Texas rivers. Combinations of these activities have contributed to the advancement of the Gulf Coast shoreline and the Gulf of Mexico. The geological activity that created the Texas coastal

floodplain over the last 65 million years has added 250 miles of land to the United States (Spearing 1991).

The surface geology of the Gulf Coastal Plain is referred to as the Lissie Formation of the Houston Group. The Lissie Formation is a series of Pleistocene-age deposits located stratigraphically above Pliocene-age sands and gravels. Extending from the Sabine River to the Rio Grande, the Formation fans out into a 20-mile wide belt north of the Beaumont Plain (Fields et al. 1983). It retains deltaic and fluvial characteristics from its composition of river materials and of materials deposited from continental deterioration carried by streams across the coastal plain (Wheeler 1976).

The Project Area is depicted on sheet 107 of the *Soil Survey of Harris County, Texas* (Wheeler 1976). There is only one soil type evident within the Project Area. This is Lake Charles clay. Lake Charles soils are nearly level and are known to incorporate small pockets of Beaumont clay, Bernard clay loam, Midland silty clay loam, Addicks loam, and Vamont clay. Lake Charles clays are somewhat poorly drained, or poorly drained, and have a low geoarcheological potential (Abbott 2001). Where natural appearing soils were encountered during the fieldwork they largely matched descriptions of the Lake Charles soil type. However, much of the tract was covered with layers of artificial fill soils. This was evident in both the formal shovel tests and in the excavations for the metal detecting hits. From this evidence it appears that artificial fill soils were brought in and deposited on the tract some time in recent history. It was not possible to determine either the origin of these fill soils or a date of when it was deposited. However, the fill soil

contained significant amounts of recent modern debris suggesting that the soil was deposited within the last 50 years.

Hydrology

The major water source impacting the tract is Tucker Bayou. The bayou makes up the western boundary of the Project Area except where the pipeline crosses it to meet with the main line. Tucker Bayou is an intermittent stream running south to north. It merges with Buffalo Bayou roughly 1.5 kilometers north of the Project Area. An examination of topographical maps dating back to 1920 suggests that the general contours and alignment of Tucker Bayou have remained unaltered by human activity. There is some suggestion of normal stream channel drift over time, but no indication that this particular portion of the bayou has ever been intentionally modified.

A small, unnamed drainage flows out from within the Clean Harbor plant, cuts the Project Area in half, and flows directly into Tucker Bayou. This appears to be directly associated with storm water runoff from the plant and is not a natural stream. This drainage acted as the separation between the second and third segments of sampling lanes.

The presence of Tucker Bayou within the Project Area was part of why this work was undertaken. Historical accounts suggest that some small amount of battle related activity may have occurred somewhere along the bayou. Furthermore, the bayou and its riparian zone have similar aspects to a battle related site found east of the battleground. It was

thought possible that a riparian zone and stream channel could have acted to impede the progress of Mexican soldiers fleeing the battlefield and potentially acted to provide a temporary haven to those men. However, the negative results of this investigation indicate that, if any such occurrence took place on or around Tucker Bayou, they happened on some other portion of the stream.

HISTORICAL BACKGROUND

The Project Area is within the Southeast Texas Archeological Region, which has been recently summarized by Patterson (1995). Other recent prehistoric summaries equally pertinent to the prehistory of the Brazoria-Fort Bend County area include Ensor (1991), and Moore and Moore (1991). The reader is referred to these works for detailed data on the prehistory of this region.

Previous investigations in Southeast Texas have demonstrated that prehistoric people occupied this area as early as 12,000 years ago. All through prehistory the inhabitants were nomadic hunter-gatherers. Ensor (1990) has proposed a prehistoric cultural sequence of periods for Southeast Texas which are as follows: Paleo-Indian (10,000-8,000 BC), Early Archaic (8,000-5,000 BC), Middle Archaic (5,000-1,000 BC), Late Archaic (1,000 BC – AD 400), Early Ceramic (AD 400-AD 800), and Late Ceramic (AD 800-AD 1750).

Evidence for prehistoric occupation of Southeast Texas is scarce in the Paleo-Indian period, and indeed, is rather ambiguous through the Middle Archaic period (Patterson 1983; Aten 1983:156-157). However, although most previously recorded sites date to the Late Archaic and Ceramic periods, it is probable that earlier dating sites have been lost to erosion, channel cutting, and, particularly in the case of very early sites, to rising sea level. In cases where early-dating artifacts have been found, such as Wheat's (1953) finds of projectile points dating from the Paleo-Indian through Middle Archaic periods at Addicks Reservoir in western Harris County, the materials occur in deposits with poor

contextual integrity.

Sites dating from the Late Archaic through the Ceramic periods are much more commonly found in the project vicinity. During the late Archaic period, modern climatic conditions evolved, sea level rose and stabilized, and coastal woodlands expanded. Aten (1983) hypothesizes that an increase in population and the establishment of seasonal rounds, including regular movement from littoral to inland areas occurred during the Late Archaic period. Particularly relevant to the prehistory of the Project Area are Hall's (1981) data from the Allens Creek project in nearby Austin County, Texas. Excavations of a large cemetery there suggest a Late Archaic trade system that linked Southeast Texas to Central Texas and areas eastward into Arkansas. The excavation of other, smaller cemeteries in this section of the Brazos River drainage, including some in Fort Bend County, has yielded similar evidence.

Lawrence Aten (1983) has proposed that ceramics were introduced in the aboriginal artifact assemblage on the Upper Texas Coast at AD 100. Ensor places the beginnings of the Early Ceramic period at AD 400, which may be more applicable for areas inland from the coastline. The Early Ceramic period is characterized by a continued growth in population levels. Ensor (1991) places the beginning of the Late Ceramic at AD 800, which coincides with the introduction of the bow and arrow. A plain sand-tempered pottery dominates throughout both parts of the Ceramic era. Story et al. (1990) has defined the Mossy Grove Cultural Tradition for Late Prehistoric cultures in Southeast Texas with sandy paste pottery being the principle diagnostic artifact type.

European settlement did not begin to seriously disrupt aboriginal habitation in the areas inland from the Upper Texas Coast until after AD 1700 (Patterson 1995; 249). European diseases, probably introduced by explorers and early traders, did begin to have impacts as early as AD 1528. At least seven epidemics were recorded among the tribes of the study area between that date and AD 1890 (Ewers, 1974).

The Project Area falls within or closely adjacent to the original land grant of Arthur McCormick (map provided by Texas General Land Office dated 1824). He was one of Stephen F. Austin's "Old Three Hundred" colonists. Arthur drowned while attempting to cross Buffalo Bayou in 1824 or 1825 and his land was held by his wife Margaret (Peggy) McCormick and their sons. The family raised cattle on the land (Henson, Handbook of Texas Online). This was the ownership status of the land at the time of the Battle of San Jacinto.

Summary of the Battle of San Jacinto

This summary of the battle will be intentionally brief and basic. Many of the aspects of the battle are subject to widely divergent interpretation. The results of prior MAC investigations have already indicated that some elements of the battle occurred somewhere other than commonly accepted. They have also discredited some generally believed notions. Those wishing more extensive discussions of the battle can refer to such books as "Eighteen Minutes" (Stephen L. Moore, 2004), "The Day of San Jacinto" (Frank X. Tolbert, 1959), or any of numerous other sources.

On April 20th, 1836 the Mexican forces under Santa Anna met those of General Sam Houston at the confluence of the San Jacinto River and Buffalo Bayou. On that first day the Mexican forces made an initial foray towards the line of trees in which the Texans were camped only to be driven away by cannon and rifle fire. There followed a dual between the one Mexican cannon and the two Texan cannons which lasted some time. An effort by the Texas cavalry to capture the Mexican cannon as it was being moved led to a brief skirmish between the cavalry of both sides. A covering force of Texan infantry allowed their cavalry to withdraw to the camp. Meanwhile the Mexican forces had removed some distance across the prairie and set up a camp and defensive breastworks made up mostly of luggage, saddles, and brush. This was the status at the end of the first day.

Early in the morning of April 21st, reinforcements under the command of Mexican general Martin Perfecto de Cos reached Santa Anna's camp after an exhausting forced march and were detailed to the right of the Mexican lines. After the Texans did not make an expected dawn attack, Santa Anna determined that no further hostilities need be expected, allowed his men to stack arms and rest, and planned for an attack on April 22nd. However, Sam Houston and his men determined to make an afternoon attack and at around 3 pm began to form up. A piece of low ground (commonly referred to as the swale) allowed the Texas forces to arrange themselves out of sight of pickets and begin the march upslope towards the Mexican defenses. Regiments under the commands of Sherman, Burleson, and Millard made up the left, center, and right wings of the Texan

forces respectively. Cavalry under Lamar took the extreme right and the artillery advanced in the middle. The Texan forces caught the Mexican army largely unprepared for attack and after approximately 20 minutes of combat they largely broke and ran. In the ensuing chaos roughly half of Santa Anna's force was killed and most of the other half was captured. Santa Anna himself was captured on April 22nd.

Proposed Project Area in Relation to Battlefield Occurrences

The Project Area falls close to the original location of the Harrisburg Road. This road provided accessibility into and out of the battlefield as well as being a much frequented route before and for long after the battle. An examination of a 1905 map of Galveston Bay and a 1930 Tobin aerial photograph suggest that this road crossed Tucker Bayou less than 200 meters downstream (north) of the current Project Area. This is almost the same locale as the modern day crossing of Tidal Road.

An account of the burning of the bridge over Vince's Bayou written by Y. P Alsbury in 1858 indicates that some portion of the battle may have occurred in/around this locale. Specifically Alsbury and the others in the detachment delegated with that task passed an area that appears to have been the crossing of Tucker Bayou. No other battle related events are documented to have occurred in or around Tucker Bayou but it is probably that some occurrences did occur there. The proximity of Tucker Bayou (and its associated wooded riparian zone) as the first major stream south-southwest of the battlefield suggests the possibility that any Mexican fleeing the battle in a southerly direction might have sought out this stream as cover. This possibility corresponds to what has been seen

in the behavior of Mexican soldiers who fled east away from the battlefield, as seen in the Peggy Lake and NRG reports (Mangum and Moore, 2006, 2010). This potential for battle related artifacts was the rationale behind metal detecting the proposed Project Area.

PREVIOUS ARCHEOLOGICAL INVESTIGATIONS

No previous archeological surveys have ever occurred within the current Project Area. The nearest prior investigation was a linear investigation which crossed Tucker Bayou roughly 200 meters north of the current Project Area. This project was performed as a Section 106 compliance survey by Laird Price of TRC Companies, Inc. for the Federal Energy Regulatory Commission in 2008. No specifics are available regarding the project though no sites were recorded along the project corridor. It is unlikely that this investigation included metal detecting.

The next nearest Project Area is another linear project which occurred approximately 750 meters east of the current Project Area. This was a project conducted for the Texas Parks and Wildlife Department by Russell K. Brownlow for Horizon Environmental Services in 2010 under TAC permit number 5316. Again, the details of this survey are not available at present. However, this author discussed the results with Brownlow, the Principal Investigator, at the time and observed portions of the work while it was in progress. Metal detectors were utilized and no battle related cultural resources were found.

Another project was conducted by JKW in 2010 roughly 700 meters east of the current Project Area. This was conducted for the Texas Parks and Wildlife Department under TAC permit number 5478 and was specifically oriented towards the recovery of battle related artifacts. This project is still ongoing and as a result the specifics are not available. However, a site form submitted to the Texas Archeological Sites Atlas indicates that numerous battle related artifacts have been recovered in the course of the work.

An archeological reconnaissance of the 13 acre Coastal Water Authority property was conducted in 2009 by Moore Archeological Consulting (Mangum and Moore, 2010b). This property is roughly 2 kilometers north of the current Project Area. It was conducted under TAC permit number 5233 and had the intent of determining if the Texan camp extended from within the State Historic Site onto private land. The property had been heavily impacted by industrial activity and had also been largely mantled by fill soils. As a result, though no artifacts related to the battle were recovered, no definitive determination of presence or absence of cultural resources related to the Battle of San Jacinto could be made.

Though there are no sites within close proximity to the current Project Area there are numerous cultural resource sites (both historic and prehistoric) within kilometers of the tract. This is based on a review of the Texas Archeological Sites Atlas. Examples of these include the battlefields itself (41HR115), three historic scatters (41HR316, 41HR317, and 41HR865) and the mixed prehistoric/historic scatter (41HR488). There is also an extant cemetery (the Habermehl Cemetery recorded as C201). However, none of these fall within the boundaries of the current investigation limits.

METHODS

The traditional pedestrian cultural resources survey covered 100% of the proposed Project Area. The Principal Investigator and/or the Project Archeologist and two field assistants conducted the survey. All areas of exposed soil were examined for surface exposure of cultural remains and features. Particular attention was paid to any landforms or features that have been determined of high archeological probability.

Small (40 cm by 40 cm) shovel tests were excavated within the blocks where construction of the boiler and generator will occur as well as along a transect following the alignment of the proposed pipeline where new racks will need to be built. Shovel tests were excavated in 10-cm arbitrary levels and were excavated to at least 50 centimeters or until intact basal clay was reached. Each test was documented, including information on location (utilizing the Total Station set up for the metal detecting survey), soil profile and cultural yield. Soil fill from tests was screened (when possible) through ¼-inch hardware cloth, examined for cultural materials, and the units were backfilled immediately. Allowances were made in the shovel test placement to allow for the sampling of landforms or features of interest. The location of each shovel test was then plotted on a map of the Project Area (Figure 6).

Based on the soils described for the Project Area (mostly Beaumont clay and Lake Charles clay) it was expected that deep reconnaissance (in the form of backhoe trenching) would not be necessary. The results in the field confirmed this determination as the soils largely conformed to those described in the county soil manual.

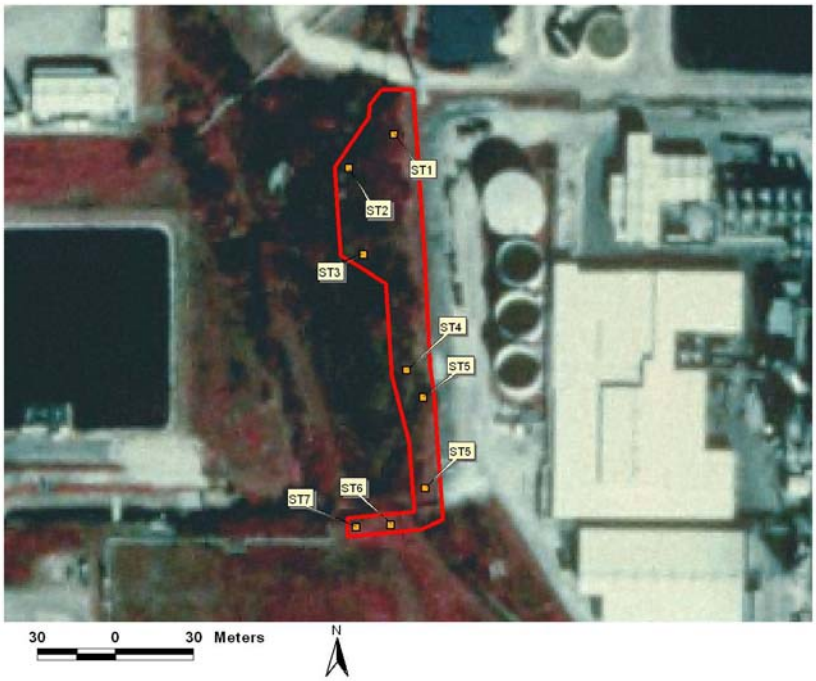


Figure 6: Project Area showing location of shovel tests

For the purpose of the metal detecting survey a series of two meter wide lanes running roughly north to south were established within the Project Area (Figure 7). These were split up into three segments (Numbers 1, 2, and 3) for the sake of limiting long runs and also to address the break at the unnamed storm water drainage. The lanes were shot in utilizing a total station. All metal detecting survey was conducted by a team consisting of a metal detector technician, using a Minelab Explorer SE Professional, and two field archeologists (technician, crew leader, or project archeologist).[1] These teams examined 50% of the Project Area as per consultation with the THC. This sampling method

[1] This particular Minelab machine has show a capacity for finding items as deep as a meter in sandy soils and 65 centimeters of depth in the soils at the San Jacinto battlefield.

resulted in the examination of every other lane within the Project Area. Any hits identified by the metal detector technicians were dug immediately. If any hits had been determined to be one of several categories of battle related, potentially battle related, or otherwise potentially historically significant, then the artifact was to be collected, documented on a Metal Detector Survey Location form, and placed in an appropriately labeled bag. Its location would have been shot in with a Total Station. A unique "Location Number" would have been assigned to each Hit location producing one or more artifacts selected for collection and full recording under the criteria defined. This "Location Number" would have been the basic unit of artifact provenience (and identifying its total station mapped coordinate point in the real world). However, no battle related, potentially battle related, or otherwise potentially historically significant artifacts were recovered.

Figure 7: Sampling lanes (segment 1 light blue, segment 2 light green, segment 3 purple)

The metal detector hit excavations differed from that of standard archeological shovel tests in several particulars: (1) the collection treatment and level of documentation depended upon the on-the-spot assessment of the significance of the item(s) unearthed: litter went into a lane general collection bag with no further documentation, but meaningful artifacts would be formally collected and fully recorded; (2) the diameter of the excavation was kept to the absolute minimum in order not to disturb the surrounding strata and any associated non-metallic artifacts therein; (3) the excavations were not carried out in traditional, arbitrary 10-cm levels; rather, the approximate, absolute depth of a target metallic artifact meeting the collection criteria as a Metal Detector "Location" was to be measured (by tape in cmbs) and recorded on the accompanying form; and, (4) at the same time,[2] a single Total Station shot would have been made at the base of the excavation for this Metal Detector Location. Thus, this single Total Station shot would simultaneously record for the electronic spatial record both the horizontal location and the vertical elevation of the artifact in a single measurement. Also differing from most – but certainly not all - of our conventional shovel tests, the excavated soils were manually broken up to look for artifacts, since the plastic, clayey nature of the soils in the region precludes dry screening.

Based on the soils described in the county soil manual it was not anticipated that deep reconnaissance (in the form of backhoe trenching) would be necessary for this project. As a result no backhoe trenching was proposed for the investigation.

[2] i.e., while the collection-worthy artifact is still *in situ* or, more probably, immediately after the item has been found in the last back-dirt lump out of the hole and identified.

Any locality that produced either prehistoric or historic cultural remains would be recorded on State of Texas archeological site forms for submission to Texas Historical Commission. In addition to form information, photographs, plan and stratigraphic sketches and measured drawings and crewmembers' daily field notes documented sites and features.

Investigations at any identified site or feature sought to determine site boundaries, depth, nature of the archeological deposits, and the site's state of preservation as far as was possible with shovel testing. Archeological sites and cultural features were photographed, mapped in plan view and plotted with accuracy on USGS quadrangle maps and project maps. If possible, a recommendation for State Archeological Landmark and National Register of Historic Places eligibility was made.

For buried or obscure sites, boundaries were delineated through shovel test excavation. Where necessary, shovel tests were dug at 5 or 10-meter (16.5' or 33') intervals radially, generally in the cardinal directions from the presumed center of each site until no further artifacts were encountered in two successive units (or until the boundary of the Project Area was reached). The site boundaries on each radius were presumed to lie between the last artifact-producing test and the first sterile unit. Information on the depth and nature of the deposits was derived from shovel test results, as well as available surface observations. No prehistoric resources were found during this investigation.

The collection policy for this survey was that (1) we would retain any prehistoric or potentially pre-1870 historic materials recovered from shovel tests or other subsurface investigations that did not prove, after extensive site delineation tests, to be isolated artifacts[3], and (2) for surface materials: only diagnostic cultural materials from the above periods would be collected and retained.

Photographs were taken of the Project Area and general landforms within the tract. Photographs were also taken of any feature that stood out (i.e. mounds, structure remnants, etc.) and of localities that could not be dug for various reasons. Photograph direction, subject, photographer name, and dates were recorded on a standard Moore Archeological Consulting photographic log.

[3] These isolated artifacts, such as a single flake surrounded by multiple, negative shovel tests, will be reburied and the isolate will not be recorded as an archeological site.

RESULTS

The intensive pedestrian survey resulted in the excavation of a series of seven (7) shovel tests (Figure 6, Appendix B). All shovel tests were negative for cultural resources. It was determined that virtually all of the Project Area is layered in artificial fill soils. This fill deposit ranged from 23 cmbs to 86 cmbs in depth (based on the profiles of the shovel tests), with three of the shovel tests not reaching intact soil at all. These fill soils were mostly dense, dry clay or clay loam soils with numerous inclusions of modern debris. All were excavated to a minimum depth of 50 cmbs with most reaching 70-90 cmbs before being terminated. It was determined in the field that all of the debris recovered from the shovel tests dated to the middle to late twentieth century and none fell within the collections policy of this survey.

During the metal detecting pedestrian survey, no battle related, potentially battle related, or historical metal artifacts were recovered within the Project Area. Metal detecting resulted in the recovery of numerous items of modern metal debris from within the artificial fill layers previously discussed. It should be noted that the presence of fill soils reduced the effectiveness of metal detecting. In the case of the very deep deposits of fill soil it is likely that the metal detector could not effectively detect any natural soils. And in the locales with less deep deposits of fill soil, each centimeter of fill reduced the potential depth the machine could reach by an equal amount (i.e. metal detecting across a locale with 25 cmbs of fill reduces the depth the machine can reach into the natural deposits by 25 cm). It could not be determined by the transition from fill soil to natural soil whether truncation of the original surface had occurred prior to the deposit of

artificial fill. It should be noted that in the case of battle related artifacts, most of which have been found at depths of 30 cmbs or less, it would not take much removal of the natural soil surface for such items to be lost.

Because it was difficult or impossible to penetrate these fill soils with the metal detector it was also not possible to definitively determine whether or not battle related artifacts might remain below the artificial fill soils. The only possibility for overcoming this problem would be stripping these artificial soils away to allow the metal detector free access to the natural soils below, and such work was beyond the scope of this investigation.

RECOMMENDATIONS

It is the recommendation of Moore Archeological Consulting, Inc. that no further archeological investigations, including those involving metal detecting, are necessary on the Clean Harbors property before the onset of construction. It is felt that this investigation, combining traditional intensive pedestrian archeological survey with metal detecting pedestrian survey, has sufficiently examined the tract and found no definite evidence that any significant prehistoric or historic cultural resource are present within the boundaries of the Project Area. This includes any potential for historic artifacts related to the Battle of San Jacinto.

There is a very small potential that cultural resources, either prehistoric or historic, could exist at depths deeper than the ability of the metal detector used during this investigation to reach, particularly because of the type of soil expected in the area (Lake Charles clay) and the deep nature of the fill soils observed during the field work. Should archeological deposits or features be encountered during construction, it is advised that construction cease in the immediate area of the finds and the Archeology Division of the Texas Historical Commission should be contacted for further consultation.

REFERENCES CITED

Abbott, James T.

2001 *Houston Area Geoarcheology; A Framework for Archeological Investigation, Interpretation, and Cultural Resource Management in the Houston Highway District.* Texas Department of Transportation, Environmental Affairs Division, Archeological Studies Program, Report 27.

Aten, Lawrence E.

1983 *Indians of the Upper Texas Coast.* National Parks Service, United States Department of the Interior. Washington, D.C.

Blair, Frank W.

1950 The Biotic Provinces of Texas. *The Texas Journal of Science* 2 (1): 93-117

Ensor, H. Blaine

1991 Comments on Prehistoric Chronology Building in Southeast Texas. *Houston Archeological Society Journal*, 98:1-11

Ewers, John C.

1974 The Influence of Epidemics on the Indian Populations and Cultures of Texas. *Plains Anthropologist*, Volume 8: 104-115. Lincoln Nebraska

Fields, R., M. D. Freeman and S. M. Kotter

1983 *Inventory and Assessment of Cultural Resources at Addicks Reservoir, Harris County, Texas.* Prewitt and Associates, Inc., Reports of Investigations 22. Austin.

Gadus, Eloise F., and Margaret Ann Howard

1990 *Hunter-Fisher-Gatherers on the Upper Texas Coast: Archeological Investigations at the Peggy Lake Disposal Area, Harris County, Texas* (Volume 1). Prewitt and Associates, Inc., Report of Investigations Number 74. Austin

Hall, Grant D.

1981 *Allens Creek: A Study in the Cultural Prehistory of the Lower Brazos River Valley, Texas.* Texas Archeological Survey Research Report 61. Austin

Handbook of Texas Online

Entry for McCormick, Margaret by Margaret Swett Henson. http://www.tsha.utexas.edu/handbook/online/articles/MM/fmcbs.html

Hoffman, G. O., B. J. Ragsdale and J. Daniel Rogers

N.d. *Know Your Grasses.* Texas Agricultural Extension Service. The Texas A & M University System. College Station, Texas

Karbula, James W., Jonathan Jarvis and Rachel Feit

2004 *Metal Detecting Along the Path of the Mexican Retreat at San Jacinto.* Hicks and Company Archeological Series No. 124

Mangum, Douglas G, and Roger G. Moore

2002 *Archeological Investigation of the Phillips Ditch Rectification Project in the San Jacinto State Historical Park, Harris County, Texas.* Moore Archeological Consulting, Report of Investigations Number 328

2006 Intensive Metal Detecting on Peggy Lake, Harris County, Texas. Moore Archeological Consulting, Report of Investigations Number 457.

2010a Archeological Investigations at the NRG Property, Harris County, Texas. Moore Archeological Consulting, Report of Investigations Number 547.

2010b Archeological Investigations of the 13 Acre Coastal Water Authority Property on Buffalo Bayou, Harris County, Texas. Moore Archeological Consulting, Report of Investigations Number 561.

Mangum, Douglas G., Roger G. Moore, and Scott Butler

2011 Archeological Investigation of Three Alternative Locations for a Proposed Visitor's Center at the San Jacinto Battleground State Historic Site, Harris County, Texas. Moore Archeological Consulting, Report of Investigations Number 560

Moore, Roger G., and William E. Moore

1991 *A Cultural Resources Survey of the Proposed 750 Acre Joseph S. and Lucie H. Cullinan Park, Fort Bend County, Texas*. Moore Archeological Consulting, Report of Investigations Number 50.

Moore, Stephen L.

2004 *Eighteen Minutes: The Battle of San Jacinto and the Texas Independence Campaign.* Republic of Texas Press. Dallas, Texas.

Spearing, Darwin

1991 *Roadside Geology of Texas*. Mountain Press Publishing. Colorado

Story, D. A., Janice A. Guy, Barbara A. Burnett, Martha D. Freeman, Jerome C. Rose, D. Gentry Steele, Ben W. Olive, and Karl J. Reinhard

1990 *The Archeology and Bioarcheology of the Gulf Coastal Plain: Volume 1.* Arkansas Archeological Survey Research Series. No. 38

Tharp, B. C.

1939 *The Vegetation of Texas*. Texas Academy of Sciences, Non-Technical Series 1 (I-vi): 1-74

Tolbert, Frank X.

1959 The Day of San Jacinto. Jenkins Publishing, Company.

Wheat, Joe Ben

1953 An Archeological Survey of the Addicks Dam Basin, Southeast Texas. *Bureau of American Ethnology Bulletin* 154: 143-252. Washington, D.C.

Wheeler, Frankie F.

1976 *Soil Survey of Harris County, Texas.* United States Department of Agriculture, Soil Conservation Service and Forest Service. In cooperation with Texas Agricultural Experiment Station.

Yoakum, Henderson King

1856 *History of Texas: From its First Settlement in 1685 to its Annexation to the United States in 1846.* Redfield. New York.

APPENDIX A: Photographs

Photograph 1: The Project Area as seen from within the Clean Harbors plant.

Photograph 2: The unnamed drainage on west edge of the Project Area

Photograph 3: Metal detecting within the sampling lanes.

Photograph 4: Sampling lane ends along the unnamed drainage.

Photograph 5: Excavating shovel tests (ST 6&7) along the proposed pipeline route.

APPENDIX B: Shovel Test Log

ST No.	Depth	Description	Comments
1	0-25	Fill	Modern debris
	25-46	Yellowish clay	Hard
	46-76	Dark brown clay loam	
	76-92	Lt brown clay loam	
2	0-60	Fill	Modern debris
3	0-58	Fill	Modern debris
4	0-44	Fill	Modern debris
	44-80	Multiple levels of flood deposits, dark gray and light tan clay with some modern debris	
	80-86	Dark gray and brown mottled clay	Intact soils
5	0-55	Fill	Modern debris
	65-73	Dark gray and yellow brown clay,	Hard
6	0-78	Fill	Modern debris
7	0-50	Fill	Modern debris
	50-70	Medium to dark brown loamy clay	
	70	Orangey brown clay	