Biological Assessment

Celanese Methanol Project

72388001.00

Document Information

Prepared for	Celanese Ltd.
Project Name	Celanese Methanol Project
Project Number	72388001.00
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Date	February 2013

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Acronyms

°F	Degrees Fahrenheit
ASI	Area of significant impact
BA	Biological Assessment
BACT	Best available control technology
BMP	Best management practice
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO2	Carbon dioxide
COE	US Army Corps of Engineers
CWA	Clean Water Act
dBA	A-weighted decibels
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
ESL	Effect screening level
FWS	US Fish and Wildlife Service
GCWDA	Gulf Coast Waste Disposal Authority
GHG	Greenhouse gas
GLC_{max}	Ground Level Concentration
GPD	Gallons per day
H2	Hydrogen
MGD	Million gallons per day
MMPA	Marin Mammal Protection Act

MOA	Memorandum of Agreement
MSS	Start-up and Shutdown
NAAQS	National Ambient Air Quality Standard
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
NO_x	Nitrogen oxides
NRCS	National Resources Conservation Service
OHWM	Ordinary high water mark
Pb	Lead
PFO	Palustrine forested wetlands
PM	Particulate matter
pph	Pounds per hour
PSD	Prevention of Significant Deterioration
Qb	Beaumont Formation
Qbc	Clay
SIL	Significant impact levels
SO_2	Sulfur dioxides
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
tpy	Tons per year
TSP	Total suspended particulate matter
TXNDD	Texas Natural Diversity Database
USC	United States Code
USGS	US Geological Survey
VOC	Volatile organic compound

Executive Summary

Celanese Ltd. (Celanese) owns and operates multiple manufacturing units at its chemical plant facility (Facility) in Pasadena, Harris County, Texas. Celanese proposes to expand the Facility to include a new methanol unit with associated support infrastructure (Project). The Project is composed of approximately 36.5 acres of undeveloped land that is currently owned by Celanese and immediately adjacent to its operating Facility and an oxygen pipeline that will be constructed and operated by a third-party (Project Area). Two options routes are currently being considered for the third-party oxygen pipeline, which are both include in the Project Area. The area evaluated consists of a 1.25-mile radius centered on the existing Facility (totaling approximately 3,141 acres), and Project Area wholly within Harris County, Texas (Action Area). The Action Area includes all resources within the Project Area and the 1.25-mile radius. Under the Clean Air Act, Celanese submitted an application to the US Environmental Protection Agency (EPA) Region 6 for authorization to emit greenhouse gases (GHG) associated with operation of the proposed Project.

Pursuant to 50 CFR Part 402.12 (Consultation Procedures, Biological Assessments), this Biological Assessment (BA) has been prepared by Cardno ENTRIX to analyze the potential impacts of the proposed Project on species listed as threatened or endangered (or candidate species and species proposed for listing) under the Endangered Species Act of 1973 (ESA), and designated critical habitat. Cardno ENTRIX's analysis is based on a literature review of the life histories and habitat requirements of the species considered and field reconnaissance of the Action Area and surrounding area.

The Action Area accounts for all potential direct and indirect impacts of the proposed Project on listed, proposed, and candidate species. Potential impacts include those from soil disturbance, vegetation removal, air emissions, noise, and water discharge associated with construction and operation of the proposed Project.

Modeling indicates air concentrations of criteria pollutants are at or below EPA significant impact levels (SILs) at the boundary of the Project Area and the Action Area.

Thirteen species are addressed in this BA, including twelve listed and one candidate species with the potential to occur in Harris County. No proposed species potentially occur in Harris County. A desktop review of data from the US Fish and Wildlife (FWS), Texas Parks and Wildlife Department, and other sources along with field reconnaissance were completed for the Action Area to assess potential Project impacts on these species. Several federally species listed as potentially occurring in Harris County are marine species; however, the Action Area assessed in this BA does not include marine or tidally influenced waters. Table ES-1 provides a list of the federally listed and candidate species that have the potential to occur in Harris County and the effects determination for each species.

Table ES-1 Federally Listed and Candidate Species Addressed in this BA

Species Common and Scientific Name	Federal Listing Status	Determination of Effect
Amphibians		
Houston toad (*Anaxyrus houstonensis*)	E	No effect
Birds		
Red-cockaded woodpecker (*Picoides borealis*)	E	No effect
Whooping crane (*Grus americana*)	E	No effect
Sprague's pipit (*Anthus spragueii*)	C	NA
Fishes		

Table ES-1 Federally Listed and Candidate Species Addressed in this BA

Species Common and Scientific Name	Federal Listing Status	Determination of Effect
Smalltooth sawfish (*Pristis pectinata*)	E	No effect
Mammals		
Louisiana black bear (*Ursus americanus luteolus*)	T	No effect
Red wolf (*Canis rufus*)	E	No effect
West Indian manatee (*Trichechus manatus*)	E	No effect
Plants		
Texas prairie dawn (*Hymenoxys texana*)	E	No effect
Reptiles		
Green sea turtle (*Chelonia mydas*)	T	No effect
Kemp's ridley sea turtle (*Lepidochelys kempii*)	E	No effect
Leatherback sea turtle (*Dermochelys coriacea*)	E	No effect
Loggerhead sea turtle (*Caretta caretta*)	T	No effect

C – Candidate, E – Endangered, T – Threatened

*Impact determinations for candidate species are not provided because these species are not protected under the ESA.

Source: TPWD 2012a, FWS 2012a

As discussed in more detail in this assessment, no habitat, suitable habitat, or occurrences for any species listed, proposed for listing, or that is a candidate for proposed listing exists within the Action Area. Accordingly, the proposed Project will have no effect on any such species.

1 Introduction

Cardno ENTRIX was contracted by Celanese to complete a BA in support of the EPA's decision to issue a GHG pre-construction air permit in connection with the proposed construction and operation of a new methanol unit at the Facility. The Facility is located at 9502 Bayport Boulevard in Pasadena, Harris County, Texas. The Project involves construction of a new methanol unit with associated support infrastructure and a stormwater retention pond. The Project is located approximately 1.25 miles northwest of the intersection of Bay Area Boulevard and Bayport Boulevard (29.6228 N latitude, 95.06606 W longitude) with surrounding areas composed of industrial and undeveloped forested areas (Figure 1).

Construction of the Project will be conducted within portions of the existing operating Facility boundaries on approximately 36.5 acres of undeveloped land that is currently owned by Celanese (Figure 2). The Action Area includes all areas directly and indirectly affected by the proposed Project, as defined in 50 CFR 402.2. The Action Area is defined as the 1.25-mile radius centered on the existing Facility and includes the entire 36.5-acre proposed Project Area and the two route options for the third-party oxygen pipeline (Figure 3). The Action Area totals approximately 3,141 acres and is wholly located within Harris County, Texas.

This BA is prepared pursuant to Section 7 under the ESA of 1973 (16 USC 1531 et seq.), as amended, to determine whether the EPA's issuance of a GHG pre-construction air permit for the proposed Project may affect listed species, proposed species or designated critical habitat. Species classified as candidate species for listing under ESA do not currently carry regulatory protection; however, because they may be federally listed in the future, they are also included in this analysis as a conservative measure. The BA also includes an assessment of federally listed species protected under both the ESA and the Marine Mammal Protection Act (MMPA). The outcome of this BA determines whether formal consultation or a conference with FWS, is necessary (50 CFR 402.02; 50 CFR 402.12).

1.1 Regulatory Setting

1.1.1 Clean Air Act

The Clean Air Act (CAA) of 1970 is the federal law regulating air emissions. The CAA authorizes EPA to regulate air emissions and to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. NAAQS are set for the following six criteria air pollutants: nitrogen oxides (NO_x), sulfur dioxide (SO_2), fine particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs) and lead (Pb).

The CAA also requires the EPA to establish thresholds of air quality and emissions to prevent deterioration of ambient air quality. The EPA regulates ambient air quality through Prevention of Significant Deterioration (PSD) permits (40 CFR § 51.166) for criteria air pollutants and non-criteria pollutants defined in EPA regulations. The PSD program defines the maximum allowable increase in emissions of pollutants (increment) to meet air quality thresholds relative to a specified baseline level. A SIL is the threshold applied to an individual facility for emissions that is used to determine whether proposed emissions may contribute to violation of NAAQS or defined PSD increments. Beginning January 2, 2011, GHGs from large stationary sources are covered by the PSD permit program.

The proposed Project is subject to PSD review for NOx, CO, VOC (Ozone pre-cursor), PM10/PM2.5, and GHGs. The Texas Commission on Environmental Quality (TCEQ) is responsible for issuance of the PSD permit for all pollutants except GHGs.

Celanese submitted an application to EPA Region 6 on August 8, 2012 for authorization to emit emissions of GHGs associated with construction and operation of the proposed Project. On June, 20, 2012,

Celanese submitted its initial PSD application to TCEQ for authorization to emit all other emissions associated with the Project.

1.1.2 Endangered Species Act

The ESA establishes measures for the protection of plant and animal species that are federally listed as threatened and endangered, and for the conservation of habitats that are critical to the continued existence of those species. It further prohibits unauthorized take, possession, sale, and transport of endangered or threatened species and provides protection for species and their habitats. 'Endangered' means a species is in danger of extinction throughout all or a significant portion of its range. 'Threatened' means a species is likely to become endangered within the foreseeable future.

Section 9 of the ESA prohibits the take of any federally listed endangered wildlife species (16 USC 1538(a)); FWS has extended prohibition to include threatened species by regulation. The ESA defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1532(19)). Section 10(a)(1)(B) of the ESA (16 USC 1539(a)(1)(B)) authorizes the FWS to issue a permit allowing take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Section 7 of the ESA requires federal agencies to ensure their actions are not likely to jeopardize the continued existence of an endangered or threatened species. Additionally, it requires federal agencies to ensure their actions are not likely to result in the destruction or adverse modification of designated critical habitat. Candidate species do not currently carry regulatory protection. However, because they may be federally listed in the future, they are included in this analysis as a conservative measure. The federal regulatory agencies responsible for enacting the ESA are FWS and National Oceanic Atmospheric Association, National Marine Fisheries Service (NOAA-NMFS).

2 Project Description

The Facility, an acetyl intermediates chemical plant owned and operated by Celanese, is located at 9502 Bayport Boulevard in Pasadena, Harris County, Texas. Celanese is a global technology and specialty materials company and is one of the world's largest producers of acetyl products, which are intermediate chemicals for nearly all major industries. These products go into a wide range of end-use applications: paints and coatings, textiles, adhesives, automobiles, electronics, and food and beverages. Celanese is the largest consumer of methanol in the world because methanol is one of the primary feedstocks for many acetyl products. The Project includes a proposed expansion of the Facility to include a new methanol unit.

2.1 Purpose and Need

Currently, methanol is imported to the Facility from off-shore, foreign suppliers. Celanese's current contract for methanol supplies expires in July 2015; therefore, a new source is required to continue operations. The proposed Project will allow Celanese to produce its own methanol onsite to support its acetyl operations, which will improve methanol supply reliability, reduce its independence on foreign sources, and reduce importation and transportation expenses.

2.2 Process Description

In general, methanol will be synthesized from a mixture of CO, carbon dioxide (CO2), and hydrogen (H2) (otherwise known as synthesis gas) over a catalyst at elevated pressures and temperatures. Methanol and water products will be separated out from any unreacted components. The water and methanol will then be separated and the final methanol product sent to storage.

The synthesis gas used in this process will be produced by steam reforming and oxygen reforming of natural gas. In this process, pipeline natural gas is compressed, preheated, treated to remove sulfur, saturated with process water, mixed with steam, and reheated. The natural gas/steam mixture will be fed to the primary reformer where a portion of the methane will be converted to synthesis gas by reaction with steam inside of externally-heated, catalyst-filled tubes. Heat input to the primary reformer will be provided by the combustion of natural gas and a purge stream taken from the converter loop to remove inerts (nitrogen, argon and methane) and excess H2. Heat will be recovered from the flue gases from the primary reformer prior to venting the flue gases to atmosphere by super-heating steam, reheating the natural gas/steam mixture fed to the primary reformer, preheating the natural gas feed to the sulfur removal system and preheating combustion air.

The partially reformed gas stream from the primary reformer will be sent to the secondary reformer where it will react with oxygen and the remaining methane converted to synthesis gas. The process synthesis gas leaving the secondary reformer will be cooled, compressed and sent to the converter loop where carbon monoxide, carbon dioxide, and hydrogen will react to produce crude methanol, a mixture of methanol and water. Process streams including the synthesis gas and converted methanol will be monitored using process analyzers. Most of the steam required to operate the methanol facilities will be produced by heat recovery from the synthesis gas leaving the secondary reformer; the remainder will be produced by heat recovery from the methanol converters.

The crude methanol will be sent to a three-column distillation train. Light ends will be taken overhead in the first column and combined with the purge stream from the converter loop. Approximately 60 percent of the finished methanol will be taken overhead in the second column. The residue from the second column will feed the third column. The remainder of the finished methanol will be taken overhead in the third

column. A side stream from the third column will be recycled to the saturation system. The process water stream from the bottom of the third column will also be recycled to the saturation system.

Finished methanol will be sent to the storage area. The storage area consists of five existing fixed-roof storage tanks and a proposed new internal floating roof storage tank. All of the tank vents will be routed to the tank farm vent scrubber. Finished methanol will be fed to the onsite acetic acid plant or shipped as a product from the methanol plant by existing truck, railcar, and/or pipeline facilities.

2.3 Project Facilities

The Project, as proposed, will be located wholly within property currently owned by Celanese. The Project includes the construction and installation of the following facilities:

- one methanol reformer unit, including:
  - a flare used for maintenance
  - process analyzers
  - one cooling tower;
- piping components for connection of 23 existing utilities and supply materials to the new methanol unit via 22 pipelines;
- one new power interrupter building;
- one new emergency generator
- connection to a new oxygen pipeline to be constructed and operated by a third-party;
- one new methanol rundown storage tank; and one tank vent scrubber
- one stormwater retention pond.

Existing utilities and supply materials include:

- four water lines;
- hydrogen;
- three steam;
- two natural gas;
- condensate;
- sulfuric acid;
- caustic;
- nitrogen;
- two compressed air;
- ammonia;
- three waste headers;
- sanitary sewer;
- electricity; and
- fire water.

2.3.1 Related Facilities

A new 10-inch-diameter oxygen pipeline will be constructed and operated by a third-party, which will start at a tie-in to the existing third-party oxygen pipeline within the existing corridor directly west of the Facility. The pipeline route has not been finalized and two route options are currently under consideration. The north route would connect the existing third-party oxygen pipeline to the proposed methanol unit by utilize an existing utility corridor north of the Facility (Figure 2). The south route would utilize an existing corridor south of the Facility. Either option would then be routed along Celanese existing utility corridors and connect to the proposed methanol unit. The third-party is responsible for receiving and complying with all applicable federal and state permits prior to construction and operation of the new oxygen pipeline. The route for new oxygen supply line will be located entirely within the Action Area (Figure 3).

3 Project Construction and Operation

3.1 Project Schedule

Construction of the methanol unit and supporting infrastructure is expected to begin with mobilization and site preparation in July 2013, with active construction being completed in July 2015. Commissioning and startup of the new methanol unit, as well as cleanup and demobilization of construction equipment, will continue through October 2015 for a total Project schedule of 27 months.

3.2 Construction Procedures and Equipment

The Project will be constructed on approximately 36.5 acres adjacent to the existing operating Facility boundaries, but wholly within property currently owned by Celanese. Standard construction techniques and equipment will be used during construction of the Project. Construction will begin with clearing and grading of the site to establish suitable grades for the methanol unit and associated facilities. Subsequent activities will include preparing foundations, installing underground piping, erecting and installing buildings, installing aboveground piping and equipment, testing the piping, testing the control equipment, and cleaning up the work area.

Typical equipment used during this type of construction includes: cranes, compactors, excavators, bulldozers, graders, rollers, frontend loaders, backhoes, dump trucks, pickup trucks, and flatbed trucks for construction activities; water trucks, concrete pump trucks, cranes, and concrete mixer trucks for materials handling; and equipment, such as pneumatic tools, generators, pumps, air compressors, and welding torches. A final list and count of equipment can be provided prior to construction if requested by EPA.

3.3 Stormwater Management and Permitting

The Project will include construction of an approximately 3.7-acre stormwater retention pond to manage stormwater from the 6.75-acre operational area of the methanol unit. Stormwater from the methanol unit area would either flow by gravity or be pumped to the new stormwater retention pond. Stormwater will be held in the pond to allow solids to settle and then discharged through currently permitted outfall #003 to Big Island Slough located along the west boundary of the Celanese property. Thus, no new outfalls will be required.

During construction of the Project, including this pond, Celanese will obtain Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit No.TXR150000 and adhere to and implement the pollution prevention measures in its construction Stormwater Pollution and Prevention Plan (SWPPP).

Prior to commissioning and operation of the methanol unit, Celanese will revise its operational SWPPP in accordance with its current TPDES Industrial Multi-Section General Permit No.TXR05V084.

Through use of the new stormwater retention pond and implementation of site-specific SWPPPs in accordance with TPDES permits, impacts on stormwater will be eliminated or reduced during construction and operation. There will be no pollutants present in stormwater runoff from the Project nor will stormwater be comingled with other wastewater streams. Therefore any associated impact from construction and operation of the Project on stormwater runoff is expected to be negligible. Any potential negligible stormwater impacts from the Project will not impact any listed and candidate species because there are no listed or candidate species or their habitats present within the action area. The potential for occurrence of listed and candidate species and their habitats are described in Section 7.0 of this BA.

3.4 Wastewater Management

The new methanol unit will generate process wastewater and clean stream wastewater from boiler blowdown. Celanese estimates process wastewater will be generated at a rate of 0.03 million gallons per day (MGD) on average, and estimates a total process and clean stream average flow of approximately 0.6 MGD.

For treatment and disposal of wastewater generated at its Facility, Celanese currently contracts with the Gulf Coast Waste Disposal Authority (GCWDA) Bayport Facility, located in Pasadena, Texas. The GCWDA Bayport Facility is authorized to manage, treat, and discharge wastewater generated under TPDES Industrial Wastewater Permit No. TX0005380. Treated and permitted effluent is discharged into the Bayport Ship Channel in accordance with the GCWDA permit. Currently, GCWDA is authorized to discharge up to a total of 30 MGD of water via the Bayport Ship Channel. However, the GCWDA Bayport Facility average daily discharge is only about 20 to 23 MGD.

Celanese contacted GCWDA Bayport Facility and verified the facility is currently permitted to and has the capacity to accept the estimated 0.6 MGD of wastewater that will be generated by the methanol unit. All wastewater associated with operation of the proposed Project will be managed and treated by GCWDA to meet allowable discharge effluent levels prior to discharge into the Bayport Ship Channel, thus impacts will be negligible.

Based on the estimated 0.6 MGD, the proposed Project is expected to raise GCWDA's average daily discharge by about 0.1 percent from process wastewater or 3 percent when combined with the clean stream from the currently reported 20 MGD. The 0.6 MGD estimated from the Project is within the daily variation of water discharged from the GCWDA Bayport Facility. Under these conditions, average daily discharge will remain within approximately 69 percent of the permitted maximum discharge of 30 MGD. In general, the wastewater generation process and effluent quality sent to GCWDA for treatment and discharge are expected to be the same as those generated from Celanese's current Facility processes. GCWDA confirmed it will not be required to apply for any wastewater permit modifications or amendments to accept, treat, and discharge the new wastewater generated by the Project. Therefore, there will be no change to GCWDA's currently authorized effluent limitations including pH limits for discharges into the Bayport Ship Channel.

Adherence to the permit limits and parameters established in TPDES Industrial Wastewater Permit No. TX0005380 will ensure impacts do not occur on aquatic species or species utilizing waterways where discharges extend. The proposed increase of process water produced by the Project will not require GCWDA to request modifications to TPDES Industrial Wastewater Permit No. TX0005380; therefore, no impacts on federally listed species will occur.

3.5 Noise

Noise levels during construction are expected to be similar to noise levels from operation and maintenance activities that are ongoing at the Facility. The operating equipment standard at the current Facility is 85 A-weighted decibels (dBA). Noise from construction or operation of the Project will not exceed this standard.

The existing Facility and Project Area are located in a developed, industrial area that does not include habitat for federally listed and candidate species. Therefore, no noise-related impacts to federally listed or candidate species are expected. Noise levels during construction are expected to be similar to noise levels from operation and maintenance activities that are ongoing at the Facility, thus impacts will be negligible. Additionally, sound waves from operation will dissipate by the time they reach the boundary of the Action Area; because no listed and candidate species or their habitat are present in the Action Area, there will be no impacts to listed species due to noise. The potential for occurrence of listed and candidate species and their habitats are described in Section 7.0 of this BA.

3.6 Dust

During dry weather conditions, dust may be generated by equipment during ground disturbance activities. Dust producing activities will be temporary and will occur primarily at the beginning of construction during grading. Once the work surfaces are leveled with gravel and concrete are laid, dust will likely not be produced.

Routine best management practices (BMPs) will be used during construction, as needed, to minimize noise and dust mobilization, such as:

- Use of modern, well-maintained machinery and vehicles meeting applicable emission performance standards to minimize equipment noise;
- Use of dust abatement techniques during construction, such as applying water prior to grading activities; and
- Covering or maintaining at least 2 feet of freeboard in the beds of trucks hauling dirt, sand, soil, or other loose materials to control dust.

During Project construction and operations, routine BMPs will be used to minimize dust mobilization. Dust associated with construction is expected to be negligible. As no listed and candidate species or their habitat are present in the Action Area, any dust associated with construction will not impact federally listed and candidate species. The potential for occurrence of listed and candidate species and their habitats are described in Section 7.0 of this BA.

3.7 Air Emissions

3.7.1 Potential exposure routes

There are several pathways for exposure of organisms to air pollutants. Plants may be exposed through:

- Absorption of gaseous or airborne particles directly; and
- Absorption of air pollutants following deposition via the root system.

Pathways for animal exposure to air pollutants include:

- Inhalation of airborne particles and gases;
- Contact with pollutants present in the air; and
- Ingestion (Smith and Levinson 1980).

Potential impacts to species and their habitats from air pollution vary depending upon the pollutant. Acidifying air pollutants (e.g., NO_x, SO_2) lead to acid precipitation which may harm plant tissue. While animals are able to withstand higher doses of acidifying pollutants than plants, SO_2 is a respiratory irritant and acidification of aquatic habitats reduces fish and amphibian reproductive success (Peterson 1982).

Atmospheric metals may be absorbed and accumulated by plants, and may accumulate in the body tissues of animals, with deleterious effects including reduction in photosynthesis (plants) and lung damage (animals; Peterson 1982). Any emissions of heavy metals from the proposed Project will be at trace levels and will not alter existing ambient levels enough to impact species.

Photochemical oxidants, air pollutants that may contribute to smog, including hydrocarbons and NO_x, contribute to ozone and smog production. These pollutants are linked with damage to foliage and other plant structures, as well as eye and respiratory irritation in animals (Peterson 1982).

Atmospheric sources of nitrogen, including NO_x and ammonia, contribute to increased nutrient levels in aquatic ecosystems that support algal blooms and create low-oxygen conditions that may result in mortality or exclusion of aquatic organisms (Spokes and Jickells 2005). In addition to direct species

effects, widespread ecosystem effects of air pollutants (e.g., modification of soil chemistry and nutrient cycling) may also impact listed species by altering habitat conditions and reducing habitat suitability (Peterson 1982).

Toxicity associated with air pollutant is a function of the exposure time and dosage (Peterson 1982). Because the proposed Project will comply with EPA and TCEQ *de minimus* emissions requirements, emissions from the Project will not significantly impact the ambient air quality. No listed and candidate species or their habitat are present within the Action Area. Therefore, air emissions from the proposed Project will not impact federally listed and candidate species that may be present in the Action Area. The potential for occurrence of listed and candidate species and their habitats are described in Section 7.0 of this BA.

3.7.2 Project Emissions Controls

Air quality analyses performed as part of the EPA and TCEQ permitting requirements included a best available control technology (BACT) analysis for each component in accordance with 30 Texas Administrative Code (TAC) § 116.111(a)(2)(c). The proposed Project will use BACT to avoid and minimize environmental impacts to the maximum extent practicable by controlling emissions. Project-specific BACTs are summarized in Table 3-1. The Celanese GHG Permit Application (filed under separate cover) provides a detailed discussion of Project-specific BACTs and the Lowest Achievable Emission Rate standards for GHG pollutants.

Table 3-1 Best Available Control Technologies

GHG Emissions Source	BACT
Emergency generator	Use a tier 3 clean burn engine; operating time will be restricted to less than 100 hours per year in non-emergencies
Flare	Good flare design with appropriate instrumentation and control
Fugitive Emissions	Appropriate monitoring instrumentation to detect leaks
General	Best operational practices will be used in the methanol production process
Reformer	Selection of the lowest carbon fuel; installation of energy efficient options

4 Methodology

4.1 Air Quality Analysis

Emissions rates were determined for criteria air pollutants expected to be emitted from the proposed Project. Emissions were calculated from the following sources: piping components, a flare used for maintenance, Start-up and Shutdown (MSS) and emergency events, process analyzers, a methanol reformer, one cooling tower, one emergency generator, one tank vent scrubber, and MSS events to atmosphere. Table 4-1 presents the results of the emission calculations for these sources.

Table 4-1 Total Annual and Hourly Emissions from Criteria Pollutants for the Proposed Project

Pollutant	Proposed Annual Emissions, tons per year (tpy)	Proposed Hourly Emissions, pounds per hour (pph)
Total VOC	47.23	258.85
Methanol	26.69	227.53
Propane	3.24	4.49
Butanes	1.88	2.69
Pentanes	0.70	1.00
Hexane	0.84	1.20
Methyl Formate	7.31	13.07
Dimethyl Ether	2.76	4.96
Ethanol	0.01	<0.01
IsoButanol	0.01	<0.01
NO_x	80.20	168.66
SO_2	8.39	2.30
CO	1158	2249
PM	36	9.11
PM10	34.63	8.64
PM2.5	33.13	8.30

Table Notes:

Speciation does not include emissions from the emergency generator or cooling tower. Each source is less than 5 tpy VOC emissions and therefore the VOCs are not speciated.

Trace quantities of miscellaneous air contaminants may be present and have not been represented

Per 30 TAC § 101.1(108), relating to definition of unauthorized emissions, emissions of ethane, methane, hydrogen, carbon dioxide, water, nitrogen, oxygen, and noble gases (including argon) are not represented.

PM represents PM10 and PM2.5

Air dispersion modeling was used to determine ambient air concentrations expected for emissions associated with operation of the proposed Project. By comparing air concentration results to the *de minimus* concentrations (the concentration at which impacts are trivial) associated with primary and secondary NAAQs for criteria pollutants, an Area of Significant Impact (ASI) could then be determined for each pollutant. An ASI is defined as the distance from the source for which the predicted concentration of

a given pollutant is greater than the *de minimus* emissions level. The *de minimus* level assigned for criteria pollutants is the SIL.

The guidance for performing PSD air quality analyses is set forth in Chapter C of EPA's "New Source Review Workshop Manual, Draft - October 1990", and in EPA's "Guideline on Air Quality Models", 40 CFR Part 51 Appendix W (referred to as the GAQM). These PSD modeling guidance documents address modeling for 1-hour and 8-hour CO, annual NO2, and 24-hour and annual PM10 averaging periods. Numerous changes in EPA requirements for PSD air quality analyses were promulgated in 2010 and were incorporated into the modeling protocol. Specific details of the modeling methodology used were submitted to TCEQ on November 30, 2012, and copied to EPA under separate cover on December 3, 2012.

For this Project, all criteria pollutants were reviewed by Sage Environmental (Sage) on behalf of Celanese. Sage then performed a significance analysis where the maximum modeled ground-level concentrations were compared to the corresponding SILs. The evaluation showed that all criteria pollutants are below each pollutant's SIL at ground level throughout the Project Area. Therefore, full impact analysis is not required per TCEQ modeling guidance and protocol. Furthermore, because the concentration of each criteria pollutant is below the SIL, none of the criteria pollutant concentrations are above *de minimus* levels. Therefore, no ASI will occur for any of the criteria pollutants. Figure 4 depicts the receptors used for air dispersion modeling. The receptors were located at the facility fence line and beyond. No criteria pollutants above the SIL were detected during modeling at any receptor depicted on Figure 4. Results of the modeling are provided in Table 4-2.

Table 4-2 Celanese Methanol Project Impacts from Criteria Air Pollutants

Pollutant	Averaging Period	Primary NAAQs	Secondary NAAQs	SIL	Maximum Ground Level Concentration (GLC_{max})	Below SIL? (yes or no)	% of "SIL"
NO_2	1-hour	Yes	-	7.5	4.31	Yes	57.5
	Annual	Yes	Yes	1	0.26	Yes	25.9
SO_2	1-hour	Yes	-	7.8	0.32	Yes	4.1
	3-hour	-	Yes	25	0.29	Yes	1.1
	24-hour	Yes	-	5	0.16	Yes	3.2
	Annual	-	-	1	0.02	Yes	2.1
CO	1-hour	Yes	-	2,000	142.12	Yes	7.1
	8-hour	Yes	-	500	48.52	Yes	9.7
PM10	24-hour	Yes	Yes	5	1.43	Yes	28.7
	Annual	Yes	Yes	1	0.22	Yes	22.1
PM2.5	24-hour	Yes	Yes	1.2	1.13	Yes	93.8
	Annual	Yes	Yes	0.3	0.18	Yes	60.6

4.2 Definition of the Action Area

The Action Area for the Project comprises all the areas potentially affected directly and/or indirectly by the Project, as defined in 50 CFR 402.2. The BA addresses impacts to federally listed and candidate species and designated critical habitat within the Action Area.

The Action Area includes the 36.5-acre footprint of the Project and related facilities (including the construction of the proposed new third-party oxygen supply pipeline), and a conservative 1.25-mile radius centered on the existing Facility (totaling approximately 3,141 acres). While dispersion modeling indicates that there will be no affect outside of the property line, a conservative 1.25-mile radius was used and includes a conservative buffer ranging between 0.97 and 1.53 miles from the Project Area as depicted in Figure 3. The Action Area includes all resources within the Project Area and the 1.25-mile radius. The 1.25-mile Action Area was developed in October 2012 assuming air quality impacts had the most potential to extend the farthest from the Project, and an air quality ASI of 0.9 mile with an additional 0.35-mile buffer was considered to be a reasonable preliminary estimate. However, the final air dispersion modeling indicates there will be no air quality impacts outside the facility as all receptors showed to be below the SIL for each criteria pollutant. Within the Action Area, Project construction is expected to directly impact 36.5 acres of undisturbed land. However, for purposes of this BA, we retained the conservative 1.25-mile radius encompassing the proposed 36.5-acre Project for the final Action Area to ensure that all potential impacts to natural resources near the Project are fully analyzed and disclosed.

4.3 Literature Review

Cardno ENTRIX biologists conducted a review of FWS and TPWD county species lists and TPWD Natural Diversity Database (TXNDD) element occurrence to determine which federally listed, proposed and candidate species potentially occur within the Action Area (TPWD 2012a; FWS 2012a; TXNDD 2012). Federally designated critical habitat locations were also researched to determine whether critical habitat is located within or near the Action Area (FWS 2012f).

The TXNDD maintains records of occurrences of tracked federally listed species in Texas. All 12 of the federally listed species that potentially occur in Harris County are tracked in the TXNDD; the one candidate species (Sprague's pipit) is not tracked in the TXNDD (TXNDD 2012). Data from the TXNDD were obtained and reviewed for an area within 50 miles of the Facility. This search area was chosen to document occurrences of listed species in the range of the Action Area, but does not represent the size of the Action Area, which is limited to a 1.25-mile radius.

4.4 Habitat Assessment

A review of available land use, soils, and imagery, in addition to ground verification of habitats in the Action Area, were used to characterize the Project setting and to identify habitats that may be used by federally listed and candidate species. Vegetative cover was initially determined through a review of existing aerial and infrared imagery and land use data. Field reconnaissance was then conducted to verify potential habitat identified by the imagery and land use data review.

4.4.1 Data Review

Cardno ENTRIX biologists reviewed infrared, color and black and white aerial photography, US Geological Survey (USGS) topographic maps, National Resources Conservation Service (NRCS) soil surveys and the National Land Cover Database to identify potential habitat for federally listed and candidate species within the Action Area.

4.4.2 Field Reconnaissance

Field reconnaissance was conducted by three Cardno ENTRIX biologists: Shannon Cass, Curtis Wilson, and Michael Franks to verify vegetation cover and habitats documented during the data review with accessible portions of the Action Area. The field reconnaissance consisted of a detailed pedestrian survey of the Action Area within Celanese's property and a windshield survey of the remainder of the Action Area to evaluate vegetation and landscape features considered important to the potential occurrence of species addressed in this BA. Data were collected to describe the vegetation communities in the Action Area and to assess the potential for occurrence of federally listed and candidate species. Photographic

documentation of field reconnaissance within the Action Area is available in Appendix A, as illustrated on Figure 8.

On August 13 through 16 of 2012, habitat surveys were conducted on a 183-acre tract owned by Celanese that includes the entire 36.5-acre Project Area; however, the proposed Project Area was not defined at that time. Five transects were surveyed within the 183-acre tract.

On October 11 and 12, 2012, and on January 31 and February 6, 2013, biologists conducted field reconnaissance throughout the Action Area and throughout the defined Project Area. Public rights-of-way and public roads were visited to assess the potential presence of habitat for listed and candidate species. Photographic documentation of field observations within the Action Area is available in Appendix A and on Figure 8.

4.5 Effects Assessment

The primary purpose of this BA is to determine the potential effects, if any, on any federally listed, proposed, or candidate species present in the defined Action Area. The effects analysis must address the direct, indirect, interrelated, interdependent, and cumulative effects of an action (50 CFR 402.02).

To determine whether the proposed Project would affect federally listed, proposed, and candidate species or designated critical habitat, Cardno ENTRIX biologists conducted a review of TPWD species occurrence reports, FWS species lists, and federally designated critical habitat as described in Section 6.0 of this BA. The assessment included a qualitative comparison of the habitat requirements of each species with vegetation communities and landscape features in the Action Area. Possible impacts to these species were evaluated based on reasonably foreseeable Project-related activities.

Potential direct, indirect, interrelated, interdependent, and cumulative effects of the proposed Project on each federally listed and candidate species were assessed to develop a Section 7 determination of effect. These effect determinations include:

- *No effect*: no positive or negative impacts to the listed species are expected as a result of the proposed Project.
- *May affect, but not likely to adversely affect:* while Project-related effects to the listed species may occur, all effects are discountable, insignificant, or beneficial.
- *May affect, and is likely to adversely affect:* listed species are likely to be negatively affected by exposure to the proposed Project.

5 Regional/Area Ecological Information

The Action Area is located in the West Gulf Coastal Plain, Prairie Parkland (Subtropical) Province of Texas (Baily 1995). The province is primarily composed of flat to gently rolling plains, with an elevation range between sea level and 1,300 feet. Vegetation includes various short and medium-to-tall grasses, woody vines and hardy tree species. This region also includes a high number of wetland areas along the coast. Vegetation in the region includes, but is not limited to, numerous oaks (*Quercus* spp.), hickories (*Carya* spp.), and bluestem (*Andropogon* spp.); American beauty berry (*Callicarpa americana*), yaupon holly (*Ilex vomitoria*), sawtooth blackberry (*Rubus argutus*), poison ivy (*Toxicodendron radicans*), and muscadine (*Vitis rotundifolia*) (Bailey 1995).

5.1 Land Use

Within the Action Area, Project construction is expected to directly impact 36.5 acres of undisturbed land, including impacts to approximately 6.13 acres of potential palustrine forested wetlands. Prior to construction, all potential wetland impacts will be authorized under an approved US Army Corps of Engineers (COE) Permit.

Land use and land cover data were obtained from the National Land Cover Database for the Action Area (Fry et al. 2011). The Project is located in a primarily industrial and developed area. Developed land comprises 52.42 percent of the Action Area. An additional 13.33 percent of the Action Area consists of barren land and pasture. Forested and herbaceous wetlands form a total of 27.26 percent of the Action Area, while open water comprises less than 1 percent of the Action Area. The open water within the Action Area consists of stormwater retention basins. The Action Area does not include marine or tidally influenced waters. Table 5-1 and Figure 5 detail land use and land cover within the Action Area.

Table 5-1 Land Use within the Action Area (1.25-mile radius of the Facility)

Land Use	Acres	Percent of Total (%)
Open Water	26.49	0.84
Developed, Open Space	382.30	12.17
Developed, Low Intensity	328.70	10.47
Developed, Medium Intensity	414.77	13.21
Developed, High Intensity	520.85	16.58
Open Land	11.79	0.38
Upland Deciduous Forest	42.70	1.36
Mixed Forest Upland	39.36	1.25
Shrub/Scrub	46.26	1.47
Herbaceous Upland	64.72	2.06
Hay/Pasture	406.98	12.96
Forested Wetlands	629.38	20.04
Herbaceous Wetlands	226.62	7.22
Total	**3140.92**	**100**

5.2 Climate

On average, rainfall in the region totals approximately 56 inches per year (NRCS 2012b). Temperatures in the region range from the low 50s degrees Fahrenheit (°F) during the winter (December to March) to the low-80s °F during the summer (June to September) (NCRS 201b2). The average daily minimum in the winter months is 46.7 °F and the average temperature is 56.4 °F. The average daily maximum in the summer months is 90.8 °F and the average temperature is 82.1 °F (NCRS 2012b).

5.3 Topography

The topography in Harris County ranges from sea level in the southeast (by Galveston Bay) to over 300 feet above sea level in the Northwest corner of the county (HCFCD 2012). The Action Area is in the Armand Bayou watershed which flows in a southward direction to Clear Lake (HCFCD 2012).

5.4 Geology

Geology in the Action Area consists of geologic units of the Beaumont Formation (Qb); clay (Qbc) (Bureau of Economic Geology 1992). Areas of the Qbc consist of loose, fine-grained sediment composed primarily of clay-sized particles (Bureau of Economic Geology 1992).

5.5 Soils

The NRCS soil units present within the Action Area are listed in Table 5-2 and illustrated in Figure 6. Soils in the Action Area are generally very deep, somewhat poorly drained, very slowly permeable clayey soils.

Table 5-2 Soils within the Action Area and Project Area (1.25-mile radius of the Facility)

NRCS Map Unit Name (Symbol)	Location		Soil Series Description	Drainage	Depth	Permeability	Landform	Hydric Soil
	Action Area	Project Area						
Vamont clay 0-1% slope (VaA)	X	X	Vamont fine, smectitic, thermic oxyaquic dystruderts	Somewhat poor	Very deep	Very slow	Coastal plains	No Data
Vamont clay 1-4% slope (VaB)	X		Vamont fine, smectitic, thermic oxyaquic dystruderts	Somewhat poor	Very deep	Very slow	Coastal plains	No Data
Beaumont clay (Ba)	X	X	Beaumont fine, smectitic, hyperthermic chromic dystraquerts	Poor	Very deep	Very slow	Depressions, Flats	Yes
Bernard clay loam (Bd)	X		Bernard fine, smectitic, thermic vertic argiaquolls	Somewhat poor	Very deep	Very slow	Depressions	Yes

Source: NRCS 2012a.

5.6 Water Resources

The Project is located in Harris County, Texas, which includes several prominent water features. The county is bordered by Galveston Bay, Cedar Bayou, Clear Creek and Spring Creek. Other major

waterways within Harris County include Buffalo Bayou and the Houston Ship Channel, Bray's Bayou, Hall's Bayou, Taylor's Bayou, Sims Bayou, and Armand Bayou.

The Project is located north of ecologically significant stream segments including Armand Bayou, Taylor's Bayou, and Clear Creek (Figure 7). Ecologically significant stream segments are recommended by regional water management boards to TPWD for designation in accordance with the criteria defined in 31 TAC § 357.8, Ecologically Unique River and Stream Segments. Armand Bayou is the closest designated stream and passes within about 0.6 mile of the Action Area. It is a tributary of Clear Lake and is located in the San Jacinto-Brazos Coastal Basin. Armand Bayou is designated as an ecologically significant stream segment due to its biological function (habitat value associated with the riparian zone and associated wetlands), its hydrologic function for flood attenuation, the presence of the Armand Bayou Coastal Preserve, and the waterway's value for outdoor recreation in an urban landscape (Norris and Linam, 1999; TPWD 2012l). Several federally species listed as potentially occurring in Harris County are marine species; however, the Action Area does not include marine or tidally influenced waters. According to the NOAA Essential Fish Habitat Mapper, the Action Area does not include essential fish habitat (NOAA, 2013).

Big Island Slough is a tributary of Armand Bayou and is located within the Action Area along the western boundary of the Celanese property boundary (Figure 7). It is approximately 60 feet wide and flows in a southward direction to Armand Bayou. Big Island Slough is not tidally influenced and no designations or ecological sensitivities are documented for this stream. All wastewater associated with operation of the proposed Project will be managed and treated by GCWDA and will meet allowable discharge effluent levels prior to discharge into the Bayport Ship Channel by GCWDA. Therefore, no additional impacts on waters of the Bayport Ship Channel will occur.

A wetland delineation survey was conducted by Cardno ENTRIX biologists within a 183-acre tract owned by Celanese that includes the entire 36.5-acre Project area. Wetland features within the 183-acre survey tract included 117.8 acres of potential palustrine forested wetlands, including approximately 6.1 acres within the Project area. Six small ephemeral streams (identified as drainage ditches) were also observed during this survey.

Approximately 755 acres of the Action Area are located within the 100-year floodplain and approximately 1,967 acres are located within the 500-year floodplain as established by the Federal Emergency Management Agency (Figure 7). Of this, approximately 9.6 acres of the Project Area are located within the 100-year floodplain and approximately 15.2 acres are located within the 500-year floodplain.

5.7 Vegetation

Vegetative cover was initially determined through a review of existing aerial and infrared imagery and land use data. Cardno ENTRIX conducted field reconnaissance to verify potential habitat identified by the imagery and land use data review (Section 3). Photographic documentation of field observations within the Action Area is available in Appendix A, as illustrated on Figure 8.

During field reconnaissance, habitats identified in undeveloped areas include mixed forested upland, herbaceous upland and potential palustrine forested (woody) wetlands.

5.7.1 Mixed Forested Upland

Mixed forested upland habitat observed within the Action Area is dominated by a mix of native and non-native tree species, saplings and woody vines. The canopy layer includes Chinese tallow (*Triadica sebifera)* and sweet gum (*Liquidamber styraciflua*). The dominant understory species observed in the forested upland habitat include American beautyberry (*Callicarpa americana)* and Yaupon holley (*Ilex vomitoria*). The dominant species layering the forest floor include sawtooth blackberry (*Rubus argutus)* and muscadine (*Vitis rotundifolia*).

5.7.2 Herbaceous Upland

In herbaceous upland habitat within the Action Area, dominant grasses include Bermuda grass (*Cynodon dactylon*), St. Augustine grass (*Stenotaphrum secondatum*) and dallisgrass (*Paspalum dilatatum)*. Other herbaceous species include Canadian horseweed (*Conyza canadensis),* common ragweed (*Ambrosia artemisiifolia).*

5.7.3 Potential Palustrine Forested (Woody) Wetlands

The physical footprint of the proposed Project will impact 6.13 acres of potential palustrine forested wetlands. Additional forested wetland areas are also present within the Action Area but will not be impacted by construction of the Project. Dominant tree species observed in the canopy layer include Chinese tallow, sweet gum, and water oak (*Quercus phellos*). Young Chinese tallow, young water oak and yaupon (*Ilex vomitoria*) dominate the understory of forested wetland areas. The dominant species overlaying the forest floor of the wetland areas are soft rush (*Juncus effusus*) and Cherokee sedge (*Carex cheerokeensis*).

5.8 Wildlife

The Christmas Bird Count for the Armand Bayou survey area, located near the Action Area, documented between 129 and 158 species of birds during annual surveys from 2006 through 2010. Species most frequently documented in the area include, but are not limited to white ibis (*Eudocimus albus*), yellow-crowned night-heron (*Nyctanassa violacea*), osprey (*Pandion haliaetus*), black-bellied whistling duck (*Dendrocygna autumnalis*), white-winged dove (*Zenaida asiatica*), American goldfinch (*Carduelis tristis*), and the Virginia rail (*Rallus limicola*) (Audubon Society 2012). Common terrestrial species in the West Gulf Coastal Plains region include, but are not limited to coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), nine-banded armadillo (*Dasypus novemcinctus*), javelina (*Pecari tajacu*), feral hog (*Sus scrofa*), swamp rabbit (*Sylvilagus aquaticus*), ringtail cat (*Bassariscus astutus*), nutria (*Myocastor coypus*), and American alligator (*Alligator mississipiensis*) (Wilken *et al.* 2011).

6 Federally Listed, Proposed and Candidate Species and Designated Critical Habitat

Species are federally listed under the ESA, and FWS and TPWD maintain status lists of threatened and endangered species designated in Texas by county. FWS designates critical habitat for federally listed and proposed species. TPWD frequently lists the status of a federally listed, proposed, and candidate species as potentially occurring in a county that is not documented as occurring on the FWS status list. Although FWS has authority over the status of species listed under the ESA, both the FWS and TPWD status lists were used in the analysis of this BA as provided in Table 6-1. Candidate species do not currently carry regulatory protection; however, because they may be federally listed in the future, they are also included in this analysis as a conservative measure.

The FWS lists two federally endangered species (Texas prairie dawn and West Indian manatee) as potentially occurring in Harris County (FWS 2012a). According to the current TPWD list, a total of twelve ESA listed species and one candidate species occur or potentially occur in Harris County, Texas (TPWD 2012a). Table 6-1 lists each species and provides the agency source for potential occurrence in Harris County. NOAA-NMFS manages sea turtles in marine waters; NOAA lists no additional species in their purview as potentially occurring in Harris County. As noted above, the Action Area does not include marine or tidally influenced waters. No proposed species are documented as potentially occurring in Harris County.

Table 6-1 Federally Listed and Candidate Species

Species Common and Scientific Name	Federal Listing Status	Source of Potential Occurrence
Amphibians		
Houston toad (*Anaxyrus houstonensis*)	E	TPWD
Birds		
Red-cockaded woodpecker (*Picoides borealis*)	E	TPWD
Whooping crane (*Grus americana*)	E	TPWD
Sprague's Pipit (*Anthus spragueii*)	C	TPWD
Fishes		
Smalltooth sawfish (*Pristis pectinata*)*	E	TPWD
Mammals		
Louisiana black bear (*Ursus americanus luteolus*)	T	TPWD
Red wolf (*Canis rufus*)	E	TPWD
West Indian manatee (*Trichechus manatus*)	E	FWS
Plants		
Texas prairie dawn (*Hymenoxys texana*)	E	FWS, TPWD
Reptiles		
Green sea turtle (*Chelonia mydas*)*	T	TPWD, NOAA NMFS
Kemp's ridley sea turtle (*Lepidochelys kempii*)*	E	TPWD, NOAA NMFS
Leatherback sea turtle (*Dermochelys coriacea*)*	E	TPWD, NOAA NMFS

Table 6-1 Federally Listed and Candidate Species

Species Common and Scientific Name	Federal Listing Status	Source of Potential Occurrence
Loggerhead sea turtle (*Caretta caretta*)*	T	TPWD, NOAA NMFS

C – Candidate, E – Endangered, T – Threatened

*NOAA NMFS has jurisdiction over this species in marine waters. No marine waters occur within the Action Area.

Source: TPWD 2012a, FWS 2012a

6.1 Federally Listed and Candidate Species

6.1.1 Amphibians

6.1.1.1 Houston Toad

The Houston toad (*Anaxyrus houstonensis*) is federally listed as endangered. The Houston toad primarily occurs in Bastrop County, Texas and in limited numbers in eight other Texas counties, including Austin, Burleson, Colorado, Lavaca, Lee, Leon, Milam, and Robertson. The Houston toad was extirpated from Fort Bend, Harris, and Liberty counties during the late 1950s (Price 1990). Houston toads are terrestrial amphibians that range in size from 2 to 3.5 inches long. Their coloration varies from light brown to gray, sometimes with green patches (TPWD 2012d). Their pale undersides have small, dark spots. Males have a dark throat, which appears blue when inflated. They inhabit areas with deep sandy soils within the Post Oak Savannah vegetation area of east central Texas. They are poor burrowers and, therefore, require loose soils to burrow into the sand to protect themselves against the cold in winter and hot, dry conditions in the summer. For breeding and juvenile development, slow-flowing bodies of water are required; this could include ephemeral ponds, flooded fields, wet areas associated with springs or seeps, or shallow permanent ponds (TPWD 2012d). The Houston toad is nocturnal and feeds on insects and small invertebrates.

The Houston toad generally breeds in February and March, but males can be heard calling from December through June. The toads can only breed when temperature and moisture conditions are suitable. The eggs are laid in the water and hatch within seven days; tadpoles metamorphose in 15 to100 days. After metamorphosis, the toadlets leave the water and become terrestrial to feed and winter. First-year toadlets and juvenile Houston toads are generally active year-round. Adult toads can also be active year-round if the temperature and moisture conditions are favorable (TPWD 2012d).

The primary threats to the Houston toad are habitat loss and degradation, particularly including the conversion of ephemeral wetlands to uplands or to open water. The former scenario eliminates water needed for breeding, but the latter scenario makes the toads more vulnerable to predators and increases competition with similar species. Drought, habitat fragmentation due to infrastructure, fire suppression, and the invasion of the red imported fire ant (*Solenopsis invicta*) are other existing threats to the Houston toad (TPWD 2012d).

6.1.2 Birds

6.1.2.1 Red-cockaded woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is federally listed as endangered. Red-cockaded woodpeckers are a small bird measuring about seven inches in length. They are identifiable by their white cheek patch and black and white barred back. Males have a few red feathers that usually remain hidden underneath black feathers between the black crown and white cheek patch (FWS 2002). They generally inhabit old-growth forest/savannah habitat (60 to 70+ years) of loblolly, shortleaf, slash, or longleaf pines. Longleaf pine savannahs are the most preferred, due to their resistance to fire that allows for shorter fire regimes and a more open forest (FWS 2002). Nesting and roosting cavities are made only

in living mature pine trees, usually over 80 years old. Red-cockaded woodpeckers also nest in clusters, which are groups of breeding pairs each nesting in separate cavities in a small stand of trees. Ideal cluster sites are located in stands of pines with little or no understory growth, maintained by fire. Longleaf pines are the nesting trees used by this species, as they produce more resin than other pine species when wounded. As the nest cavity is excavated, woodpeckers drill small holes around the nest cavity so resin flows down the trunk of the tree, protecting the nest cavity from predators, such as tree-climbing snakes (FWS 2002). Red-cockaded woodpeckers are primarily insectivores; they feed on egg, larvae, and adult forms of many insects that inhabit areas in and on pine trees. The birds will also eat fruits and berries as a supplement to insects (FWS 2002).

Known populations of red-cockaded woodpeckers exist in 17 eastern Texas counties (Angelina, Cherokee, Hardin, Houston, Jasper, Liberty, Montgomery, Nacogdoches, Newton, Polk, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Tyler, and Walker) and one county, McCurtain, in Oklahoma (FWS 2002). The red-cockaded woodpecker has been extirpated from Harris County since 1998 (Shackelford and Reid 2001).

The primary threats to red-cockaded woodpeckers include habitat loss and fragmentation. Timber harvesting of pine forests for various industries has resulted in a loss of mature pine forest habitat, which is required by the birds for food and shelter. Modern day forestry in Texas has focused on fiber production; these forests are managed on a short rotation age, making the trees too small for cavity excavation and the forests too dense for foraging (TPWD 2012i). Fire suppression over the past decades has also caused the open savannah habitat to be closed by denser canopy cover and herbaceous ground cover, hindering nesting and foraging (FWS 2002).

6.1.2.2 Sprague's pipit

Sprague's pipit (*Anthus spragueii*) is a candidate for federal listing under the ESA. Candidate species do not carry regulatory protection. However, because Sprague's pipit may be listed in the future, the species was included in this analysis as a conservative measure.

The Sprague's pipit is a ground nesting species with a plain buff colored face with a large eye-ring. during breeding season, migration, and on wintering grounds the diet of the Sprague's pipit consists primarily of arthropods. During late winter, seed are incorporated into their diet (FWS 2012e). They migrate a short distance from their breeding grounds in the northern prairies of southern Canada and the northern U.S. to wintering grounds in the southern US and northern Mexico. Breeding begins as early as late April and continues until mid to late August. In southern areas, Sprague's pipit distribution coincides with the occurrence of *Andropogon* spp. grasses (FWS 2012e). This species rarely occurs in cultivated lands, and is uncommon on non-native planted pasturelands (FWS 2012f).

Grazing, fire, and mowing are the most common management techniques used in grasslands to create or restore suitable habitat or to prevent further degradation for Sprague's pipit (FWS 2010). Habitat loss, degradation, fragmentation, energy development, and drought are threats that currently or potentially effect Sprague's pipits population throughout their range. Encroachment of woody vegetation resulting from fire suppression is also a threat to habitat on both breeding and wintering grounds (FWS 2010).

6.1.2.3 Whooping crane

The whooping crane (*Grus americana*) is federally listed as endangered. There are three populations of whooping cranes; an introduced non-migratory population of whooping cranes occurs in central Florida, an introduced eastern migratory population that migrates between Wisconsin and Florida, and the self-sustaining Aransas Wood Buffalo Population winters in Texas (FWS 2007). The Florida and eastern migratory populations are not addressed in this BA because birds from these populations do not occur in Texas. The whooping crane that occurs in Texas is the tallest bird found in North America, with males nearly five feet in height (Campbell 2003). Adult birds are white with some red and black coloring on the head. With a seven foot wing span, the whooping crane fly with their long necks and legs fully extended

(Campbell 2003). They winter on the Texas coast at Aransas National Wildlife Refuge near Rockport where the area is covered with swales and ponds. They summer and nest in poorly drained wetlands of Wood Buffalo National Park in northern Canada (Alsop 2001). They forage for blue crabs, clams, and the plant wolfberry in the brackish bays, marshes, and salt flats.

Whooping cranes migrate throughout the central portion of the state from the eastern panhandle to the Dallas-Fort Worth area and south through the Austin area to the central Texas coast during October-November and again in April (Campbell 2003). The potential whooping crane migration corridor is approximately 200 miles wide; Harris County is on the far eastern edge of this range and FWS has not listed whooping cranes as occurring in Harris County, Texas (FWS 2007, FWS 2012a). They begin their fall migration south towards Texas in mid-September and begin the spring migration north to Canada in late March or early April. This species has a high fidelity to the known migratory route; 95 percent of known whooping crane sightings are within the migration corridor, and the primary stopover on the migration route, located in Saskatchewan, is well known (FWS 2012i). Migration from this stopover to the wintering ground in Aransas National Wildlife Refuge is typically completed within a week; the flight speed of the whooping crane is between 30 and 45 miles per hour (FWS 2012i).

While the historical wintering range of whooping cranes may have included tall grass prairies along the Gulf Coast, the present wintering grounds are located at Aransas National Wildlife Refuge which is approximately 140 miles southwest of the Project Area (Alsop 2001). The nearest designated critical habitat for whooping cranes to the Project is located at Aransas National Wildlife Refuge. Threats to the whooping crane include habitat loss, severe weather and loss of genetic diversity (FWS 2012i).

6.1.3 Fishes

6.1.3.1 Smalltooth sawfish

The smalltooth sawfish (*Pristis pectinata*) is federally listed as endangered. Sawfish species belong to a group of fish called elasmobranchs, whose skeletons are made of cartilage. Smalltooth sawfish range from 18–27 feet in length. They have a shark-like body with a long, flat snout edged with pairs of teeth which are used to locate, stun, and kill prey (NOAA 2011). The diet of this species primarily consists of fish and also includes crustaceans (NOAA 2011). They inhabit shallow coastal waters of tropical seas and estuaries very close to shore over muddy and sandy bottoms. Historically, the US population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to Cape Hatteras (NOAA 2011). The current range of this species has contracted to peninsular Florida (NOAA 2011).

Smalltooth sawfish are extremely vulnerable to overexploitation because of their propensity for entanglement in nets, their restricted habitats, and low rate of population growth (NOAA 2011).

6.1.4 Mammals

6.1.4.1 Louisiana black bear

The Louisiana black bear (*Ursus americanus luteolus*) is federally listed as threatened. This bear is black in color and typically weighs 150–300 pounds as an adult (FWS 2008). The Louisiana black bear is a habitat generalist and often overwinters in hollow cypress trees either in or along sloughs, lakes or riverbanks in bottomland hardwoods (TPWD 2012h). These bears are mobile, opportunistic omnivores feeding on a variety of food resources including nuts such as acorns, soft fruits such as blackberries, herbaceous vegetation such as grasses and forbs, and animal matter such as ants and grubs (FWS 2008). Their breeding period occurs during the summer and females give birth in late January or early February often while in a hibernation-like state. Habitat loss and fragmentation of forested habitat are the greatest threats to these animals (TPWD 2012h). Human related mortality has also been a threat for Louisiana black bear.

According to the FWS there are currently no well-defined populations of black bears within eastern Texas. Although there is potential habitat in the eastern part of Texas, the Louisiana black bear are more often sighted in the Tensas River National Wildlife Refuge in Tallulah, Louisiana, or the White River National Wildlife Refuge in southeast Arkansas (FWS 2012c).

6.1.4.2 Red wolf

The red wolf (*Canis rufus*) is federally listed as endangered. Historically red wolves ranged throughout the southeastern US from Pennsylvania to Florida and as far west as Texas. However, by 1980 the species was considered extirpated from Texas (TPWD 2012b). The only wild population of red wolves was reintroduced to North Carolina, and includes approximately 100 individuals (FWS 2012d). Knowledge of red wolf habitat is limited; however, wetland soils, low human density and distance from roads may be important habitat components for this species (Kelly *et al.* 2004).

The red wolf is a small, long-legged wolf blackish in color. They weigh from 45–80 pounds and are about five feet long from nose to tail (FWS 2012d).The red wolf is known for the characteristic reddish color of their fur most apparent behind the ears and along their neck and legs (FWS 2012d). They are known to feed on cottontails and other rabbits, deer, native rats and mice, prairie chickens, as well as upon domestic livestock (FWS 2012d).Their mating season occurs in late winter with gestation lasting from 60 to 63 days (TPWD 2012b). The red wolf's diet consists primarily of small mammals such as rabbits and rodents.

Threats to the red wolf include habitat loss due to human development, severe weather, deaths by motor vehicle, and illegal killings (TPWD 2012b).

6.1.4.3 West Indian manatee

The West Indian manatee (*Trichechus manatus*) is federally listed as endangered=. West Indian manatees are large, gray aquatic mammals with seal-like bodies that taper to a flat, paddle-shaped tail. They have two forelimbs and their head and face is wrinkled with whiskers on the snout (FWS 2012h).They live in slow-moving rivers, estuaries, saltwater bays and coastal areas in tropical and sub-tropical regions. Within the United States, they are concentrated in Florida in the winter and can be found as far west as Texas in summer months. The West Indian manatee is mostly herbivorous feeding on a wide variety of marine, estuarine and freshwater plants such as cord grass, turtle grass, shoal grass and eel grass (FWS 2012h). Small fish and invertebrates can also sometimes be ingested with their normal diet.

Natural threats to the manatee include cold stress, gastrointestinal disease, pneumonia, and other diseases. Human related fatalities include watercraft collisions, impacts from canal locks and flood control structures, ingestion of fish hooks and litter and entanglement in trap lines.

6.1.5 Plants

6.1.5.1 Texas prairie dawn

The Texas prairie dawn (*Hymenoxys texana*) is federally listed as endangered. The Texas prairie dawn is a delicate annual flowering plant one to six inches tall that has yellow flower heads less than ½ inch in diameter (TPWDj). It grows in sparsely vegetated areas at the base of mima mounds (or pimple mounds) in slightly saline soils in coastal prairie grasslands (TPWD 2012j). Other bare spots where this species occurs include areas where mima mounds have been leveled but soil disturbance occurred long enough in the past that the land has returned to a cover of native vegetation (FWS 1989). The soil where the Texas prairie dawn grows is often covered with blue-green algae, and the species may grow in disturbed soils if the soil structure remains intact (FWS 2013, FWS 1989). It flowers in March through early April and is absent by mid-summer. Much of the Texas prairie dawn habitat is protected on public lands

administered by the COE. The Texas prairie dawn is well known within Addicks and Barker Reservoirs in western Harris County.

The main threat to the Texas prairie dawn is habitat destruction by urban development and invasion of brush and other woody species (TPWD 2012j; FWS 2013).

6.1.6 Reptiles

6.1.6.1 Green sea turtle

The green sea turtle (*Chelonia mydas*) is federally listed as threatened. The green sea turtle grows to a maximum size of about four feet and a weight of 440 pounds (FWS 2012b). It has a heart shaped shell, small head, and single-clawed flippers; color is variable. Identifying characteristics include four pairs of costal scutes, none of which border the nuchal scute, and only one pair of prefrontal scales between the eyes (FWS 2012b). This species nests in tropical and subtropical waters worldwide and inhabits shallow waters inside reefs, bays, and inlets, except during migration. Within the southeastern US, green turtles generally nest between June and September. Hatchlings eat a variety of plants and animals and forage in areas such as coral reefs, emergent rocky bottom, *Sargassum* mats, lagoons, and bays. The adults feed on seagrass and marine algae, including species of *Cymodocea*, *Thalassia*, and *Zostera*. Feeding grounds in the Gulf of Mexico include inshore south Texas waters, the upper west coast of Florida, and the northwestern coast of the Yucatan Peninsula in Mexico (TPWD 2012c). Nesting near the Action Area is highly unlikely, as green sea turtles prefer to nest on high energy beaches with deep sand and little organic content. No sandy beaches are located in the Action Area. Primary threats to the green turtle include incidental capture in fishing gear and, in some areas of the world, harvesting of eggs and adults for human consumption (FWS 2012b).

6.1.6.2 Kemp's ridley sea turtle

The Kemp's ridley sea turtle (*Lepidochelys kempii*) is federally listed as endangered. It is the smallest of all the marine turtles with adults reaching about two feet in length and weighing up to about 100 pounds. They are also considered the most endangered marine turtle (NOAA 2012a).Kemp's ridley sea turtles have an oval carapace that is olive in color and usually have five pairs of costal scutes. Their triangular shaped head has two pairs of prefrontal scales with a somewhat hooked beak (NOAAa). They occur mainly in the coastal areas of the Gulf of Mexico and northwestern Atlantic Ocean. Nesting occurs mainly in Mexico from May to July, but Kemp's ridley turtles also nest in small numbers along the Gulf coast. Juveniles and sub-adults occupy shallow, coastal regions and are commonly associated with crab-laden, sandy or muddy water bottoms; young turtles often float on mats of *Sargassum*. Kemp's ridley turtles feed mostly on swimming crabs, but their diet also includes fish, jellyfish, and mollusks. Between the eastern Gulf coast of Texas and the Mississippi River Delta, Kemp's ridley turtles can be found in nearshore waters, ocean sides of jetties, small boat passageways through jetties, and dredged and nondredged channels (NOAA 2012a; TPWD 2012e). They have been observed within Sabine Lake in the past; most likely sightings were post-pelagic sub-adults or juveniles (Metz 2004). Major threats to this species include over-exploitation of their nesting beaches; collection of eggs; drowning in fishing nets; and pollution, resulting of ingestion of floating trash (NOAA 2012a; TPWD 2012e).

6.1.6.3 Leatherback sea turtle

The leatherback sea turtle (*Dermochelys coriacea*) is federally listed as endangered. The leatherback is the largest, deepest diving, and most migratory and wide ranging of all sea turtles (NOAA 2012b). The adults can reach up to eight feet in length and 2,000 pounds in weight. Their shell is composed of small bones covered by firm, rubbery skin with seven longitudinal ridges (NOAA 2012b). The skin is predominantly black with varying degrees of pale spotting including a pink spot on the dorsal surface of the head in adults. It is primarily a pelagic species, although it will occasionally forage in coastal waters, and is distributed in temperate and tropical waters worldwide. It is the largest, deepest-diving, and widest-

ranging sea turtle. Leatherbacks undergo extensive migrations from feeding grounds to nesting beaches. Although southeast Florida only supports minor nesting colonies, the area represents the most significant nesting group within the continental United States, with the nesting period extending through the fall and winter. Rarely are leatherbacks seen along the Gulf Coast of Texas. Leatherback sea turtles feed primarily on jellyfish and other soft-bodied pelagic prey, but will also feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed. Significant threats to the species include disturbance of their nesting grounds; incidental capture in fishing gear; pollution, resulting in ingestion of floating trash; and harvest of adults and eggs (NOAA 2012b; TPWD 2012f).

6.1.6.4 Loggerhead sea turtle

The loggerhead sea turtle (*Caretta caretta*) is federally listed as threatened. They can grow to about three feet in length and weight up to 200 pounds on average. The loggerhead is characterized by their reddish-brown carapace and flippers; the plastron is yellow. The carapace has five pairs of costal scutes with the first touching the nuchal scute (NOAA 2012c). It is the most abundant sea turtle in the Gulf of Mexico and is a cosmopolitan species, inhabiting temperate and tropical waters in the estuaries and continental shelves of both hemispheres. In the southeastern US, females nest from late April through early September. Nesting occurs primarily on barrier islands adjacent to the mainland in warm-temperate and sub-tropical waters. Nest sites are typically located on open, sandy beaches above the mean high tide line and seaward of well-developed dunes. Adults occupy a variety of habitats, ranging from turbid bays to clear waters of reefs, whereas sub-adults occur mainly in nearshore and estuarine waters. Hatchlings move directly to sea after hatching and often float in masses of *Sargassum*. Loggerheads can be found throughout the Gulf of Mexico, but only occasionally venture to the Texas Gulf Coast. The loggerhead diet consists of a wide variety of benthic and pelagic food items, including conches, shellfish, horseshoe crabs, prawns and other crustaceans, squid, sponges, jellyfish, basket stars, fish, and hatchling loggerheads. The most significant threats to the loggerhead populations are commercial harvesting; incidental capture in fishing and shrimping nets; coastal development; and pollution, resulting in ingestion of floating trash (NOAA 2012c, TPWD 2012g).

6.2 Designated Critical Habitat

No federally designated critical habitat for any listed threatened and endangered species is present in Harris County (FWS 2012g). The nearest critical habitat to the Action Area is for the Houston toad, which is approximately 130 miles northwest of the Action Area. Critical habitat for the Whooping crane is more than 140 miles southwest of the Action Area.

7 Species Impact Determinations

7.1 Federally Listed and Candidate Species

7.1.1 Amphibians

7.1.1.1 Houston toad

Occurrence: The FWS does not list the Houston toad as potentially occurring in Harris County (FWS 2012a). The Houston toad was extirpated from Harris County in the late 1950s (Price 1990). There are no documented occurrences of the Houston toad in the Action Area, and the nearest occurrence was documented 11.5 miles from the Action Area in 1976 (TXNDD 2012). No documented occurrences of the Houston toad occur within 50 miles of the Action Area after 1976 (TXNDD 2012).

Habitat presence and potential for effect: Houston toads are found in areas with deep sandy soils within the Post Oak Savannah of east central Texas. They require loose soils to burrow into the sand for protection. The loose, sandy soils required for the Houston toad are not present within the Action Area. The nearest documented occurrence of the Houston toad was on sandy substrate and in ephemeral pools approximately 11.5 miles from the Action Area. The clay-y soils of the Action Area are not suitable for the Houston toad and are described in Section 5.1.There is no habitat for the Houston toad in the Action Area, and therefore the Houston toad will not to occur within the Action Area. The nearest designated critical habitat for the Houston toad is approximately 130 miles northwest of the Action Area.

Because the species is considered extirpated in Harris County, no occurrences have been documented since 1976 and habitat for this species is not located in the Action Area, the proposed action will have *no effect* on the Houston toad.

7.1.2 Birds

7.1.2.1 Red-cockaded woodpecker

Occurrence: The FWS does not list the red-cockaded woodpecker as potentially occurring in Harris County (FWS 2012a). Shackelford and Reid 2001 indicated that the species is considered extirpated in Harris County. Although TPWD does list the species in Harris County, there are no documented occurrences of the red-cockaded woodpecker within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The old-growth pine forest and savannah habitats used by the red-cockaded woodpecker are not present within the Action Area. The Action Area is composed of primarily developed land (Table 2-1) that is not suitable for the red-cockaded woodpecker. The mixed forested upland within the Action Area is not dominated by old-growth pines and but by early successional species such as Chinese tallow (*Triadica sebifera)*, sweet gum (*Liquidamber styraciflua*) (refer to Section 5.1).

Because the red-cockaded woodpecker is considered extirpated in Harris County and no habitat is present in the Action Area, the proposed action will have *no effect* on the red-cockaded woodpecker.

7.1.2.2 Sprague's pipit

Occurrence: The Sprague's pipit is a candidate species and is listed by TPWD as occurring in Harris County (TPWD 2012a). This candidate species is not tracked in the TXNDD; therefore, TPWD documented occurrence data are not available for this species. Candidate species do not currently carry regulatory protection; however, because they may be federally listed in the future, they are also included in this analysis as a conservative measure.

Habitat presence and potential for effect: The grassland habitat required by Sprague's pipit for both breeding and wintering is not present within the Action Area. The Action Area is composed of primarily developed (65.75 percent of land is developed, maintained as pasture, or is barren) land that is not suitable for Sprague's pipit. The remainder of the habitat in the Action Area is vegetated wetlands and uplands that do not include grasslands dominated by *Andropogon* species, as described in Section 5.1.

The FWS does not consider the Sprague's pipit to be present in Harris County (FWS 2012a) and no habitat for Sprague's pipit is documented in the Action Area.

7.1.2.3 Whooping crane

Occurrence: The whooping crane migration corridor is approximately 200 miles wide; Harris County is on the far eastern edge of this range. FWS does not consider the whooping crane to be present in Harris County (FWS 2007, FWS 2012a).There are no documented occurrences of the whopping crane within the Action Area, and no individuals of this species are documented within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The coastal prairies, salt flats, and marshes where the whooping crane winters are not found within the Action Area. The potential wetlands located in the Action Area are freshwater herbaceous and forested wetlands that are not consistent with the whooping crane wintering habitat of salt flats and coastal marshes. Furthermore, no Gulf coastal tall grass prairies are present in the Action Area, which are the historic wintering habitat of this species. The whooping crane is reported to summer and nest in poorly drained wetlands in Canada's Northwest Territories at Wood Buffalo National Park and is not present in Texas during the summer nesting season. According to TPWD, the whooping crane migrates from the Dallas-Fort Worth area south through the Austin area to the central coast to winter at Aransas National Wildlife Refuge which is approximately 140 miles away from the Action Area. The nearest designated critical habitat for the whooping crane is located in Aransas National Wildlife Refuge (FWS 2012f).

No occurrences or habitat of the whooping crane are documented in the Action Area. Furthermore, the Project is located outside of the migration corridor; therefore, the whooping crane will not be affected by the proposed Project. The proposed action will have *no effect* on the whooping crane.

7.1.3 Fishes

7.1.3.1 Smalltooth sawfish

Occurrence: The FWS does not consider the smalltooth sawfish present in Harris County (FWS 2012a).There are no documented occurrences of the smalltooth sawfish within the Action Area, and no individuals of this species are documented within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The shallow coastal waters and estuarine habitat required by the smalltooth sawfish are not found within the Action Area. The only named waterbody in the Action Area, Big Island Slough, is not tidally influenced and consists of fresh water within the Action Area. Designated critical habitat for the smalltooth sawfish is located in Florida (NOAA 2011).

No occurrences or habitat of the smalltooth sawfish are documented in the Action Area; therefore, the smalltooth sawfish will not be affected by the proposed Project. The proposed action will have *no effect* on the smalltooth sawfish.

7.1.4 Mammals

7.1.4.1 Louisiana black bear

Occurrence: The FWS does not consider the Louisiana black bear present in Harris County (FWS 2012a).There are no documented occurrences of the Louisiana black bear within the Action Area, and no individuals of this species are documented within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The hardwood forest habitat consisting of cypress trees in or along lakes and riverbanks inhabited by the Louisiana black bear is not found within the Action Area. The Action Area is within an industrial corridor and consists of primarily developed land; cypress-dominated forests are not present in the Action Area. The forested wetland and upland habitat within the Action Area is highly fragmented and is therefore not suitable for the Louisiana black bear. The nearest designated critical habitat for the Louisiana black bear is located 220 miles northeast of the Action Area in Louisiana.

No occurrences or habitat of the Louisiana black bear are documented in the Action Area; therefore, the Louisiana black bear will not be affected by the proposed Project. The proposed action will have *no effect* on the Louisiana black bear.

7.1.4.2 Red wolf

Occurrence: Red wolves have been extirpated from Texas.

Habitat presence and potential for effect: Wetland soils, low human density and distance from roads may be important habitat components for the red wolf (Kelly *et al.* 2004). The habitat within the Action Area is highly fragmented and is within an industrial corridor that experiences traffic and human activity; the habitat in the Action Area is therefore inconsistent with the documented habitat components important for the red wolf.

Because the red wolf has been extirpated from Texas, and because the Action Area is located within a fragmented industrial corridor this species will not be present in the Action Area. The proposed Project will have *no effect* on the red wolf.

7.1.4.3 West Indian manatee

Occurrence: There are no documented occurrences of the West Indian manatee within the Action Area, and the nearest documented of this species is greater than 30 miles from the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The slow-moving rivers, estuaries, and saltwater bay habitat the West Indian manatee inhabits are not found within the Action Area. The only named waterbody in the Action Area, Big Island Slough, is about 60-feet-wide and not tidally influenced within the Action Area and is not suitable for the West Indian manatee.

No occurrences or habitat of the West Indian manatee are documented in the Action Area; furthermore no marine or tidally influenced waters are located within the Action Area (TXNDD 2012). Therefore, the West Indian manatee will not be affected by the proposed Project. The proposed action will have *no effect* on the West Indian manatee.

7.1.5 Plants

7.1.5.1 Texas prairie dawn

Occurrence: There are no documented occurrences of the Texas prairie dawn within the Action Area, and the nearest occurrence is approximately 5 miles from the Action Area (TXNDD 2012). The last observation of Texas prairie dawn at that site was in 2002. No occurrences of Texas prairie dawn are documented within 50 miles of the Action Area after 2002.

Habitat presence and potential for effect: The nearest occurrence of Texas prairie dawn to the Action Area is located in an area of remnant prairie habitat in Addicks loam and Bernard clay loam soils approximately 5 miles from the Action Area. Bernard clay loam soils are documented in the eastern portion of the Action Area (Figure 6) but are mostly within developed industrial areas. Within the maintained existing corridors, the dominant plant species includes native big blue stem grass, non-native Bermuda grass, Chinese tallow and yaupon; these species are not listed as associated with Texas prairie dawn occurrences (TXNDD 2012, FWS 1989). Forested areas are present within the soil type but the Texas prairie dawn does not occur in habitats with brush or woody vegetation, such as Chinese tallow

and yaupon (FWS 2013). No mima mounds, barren areas adjacent to mima mounds, or soils covered in blue-green algae were observed along these rights-of-way (Figure 8, Appendix A). Therefore, the Action Area does not contain suitable habitat for the Texas prairie dawn.

Ground disturbance from the Project within Bernard clay loam soils will be limited to construction of the third-party oxygen pipeline within an existing pipeline corridor. The trenching required for pipeline construction, results in heavy soil disturbance during which soil structure does not remain intact. Ongoing construction along the southern proposed pipeline route occurred as recently as 2012 and has further impacted the soil structure (Figure 8, Appendix A). While the Texas prairie dawn may occur in disturbed soils, the soil structure of the disturbed soils must remain relatively intact. Therefore, the soils with the pipeline rights-of-way are not suitable for the Texas prairie dawn.

Suitable habitat for the Texas prairie dawn does not occur in the Action Area; therefore, the proposed action will have *no effect* on the Texas prairie dawn flower.

7.1.6 Reptiles

7.1.6.1 Green sea turtle

Occurrence: The FWS does not consider the Green sea turtle present in Harris County (FWS 2012a). There are no documented occurrences of the green sea turtle within the Action Area, and no individuals of this species are documented within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The Action Area does not include any marine waters or sandy beach habitat for sea turtles to occupy. The shallow waters found inside reefs, bays, and inlets used by the Green sea turtle are not found within the Action Area. The only named waterbody in the Action Area, Big Island Slough, is not tidally influenced and consists of fresh water that is not suitable for marine species. Also, the high energy beaches consisting of deep sand required for nesting are not found within the Action Area.

No occurrences or habitat of the Green sea turtle are documented in the Action Area; therefore, the Green sea turtle will not be affected by the proposed Project. The proposed action will have *no effect* on the Green sea turtle.

7.1.6.2 Kemp's ridley sea turtle

Occurrence: The FWS does not consider the Kemp's ridley sea turtle present in Harris County (FWS 2012a).There are no documented occurrences of the Kemp's ridley sea turtle within the Action Area, and the nearest documented occurrence is greater than 30 miles from the Action Area in 1994 (TXNDD 2012).

Habitat presence and potential for effect: The nearshore waters commonly associated with crab-laden, sandy or muddy water bottoms used by juvenile and sub-adult Kemp's ridley sea turtles are not found within the Action Area. The nearest documented occurrence of this species was on a beach in Galveston County in 1994; no sandy beaches are present in the Action Area. The only named waterbody in the Action Area, Big Island Slough, is not tidally influenced and consists of fresh water that is not suitable for marine species. The Action Area does not include any marine waters or sandy beach habitat for sea turtles to occupy.

No occurrences or habitat of the Kemp's ridley sea turtle are documented in the Action Area; therefore, the Kemp's ridley sea turtle will not be affected by the proposed Project. The proposed action will have *no effect* on the Kemp's ridley sea turtle.

7.1.6.3 Leatherback sea turtle

Occurrence: The FWS does not consider the Leatherback sea turtle present in Harris County (FWS 2012a). There are no documented occurrences of the Leatherback sea turtle within the Action Area, and no individuals of this species are documented within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The temperate and tropical waters used by the Leatherback sea turtle are not found within the Action Area. The only named waterbody in the Action Area, Big Island Slough, is not tidally influenced and consists of fresh water that is not suitable for marine species. The Action Area does not include any marine waters or sandy beach habitat for sea turtles to occupy.

No occurrences or habitat of the Leatherback sea turtle are documented in the Action Area; therefore, the Leatherback sea turtle will not be affected by the proposed Project. The proposed action will have *no effect* on the Leatherback sea turtle.

7.1.6.4 Loggerhead sea turtle

Occurrence: The FWS does not consider the Loggerhead sea turtle present in Harris County (FWS 2012a). There are no documented occurrences of the Loggerhead sea turtle within the Action Area, and no individuals of this species are documented within 50 miles of the Action Area (TXNDD 2012).

Habitat presence and potential for effect: The temperate and tropical estuarine waters used by the Loggerhead sea turtle are not found within the Action Area. The only named waterbody in the Action Area, Big Island Slough, is not tidally influenced and consists of fresh water that is not suitable for marine species. Also, the open sandy beaches required for nesting are not found within the Action Area.

No occurrences or habitat of the Loggerhead sea turtle are documented in the Action Area; therefore, the Loggerhead sea turtle will not be affected by the proposed Project. The proposed action will have *no effect* on the Loggerhead sea turtle.

7.2 Designated Critical Habitat

No federally designated critical habitat for any listed threatened and endangered species is present in Harris County (FWS 2012g). Therefore, the Project will not affect designated critical habitat.

8 Conclusions

Table 8-1 summarizes the recommended determination of effects for each federally listed species identified in Harris County as protected under the ESA, as well as for candidate species. Habitat for listed and candidate species is not present within the Action Area.

No occurrences for listed or candidate species are documented within the Action Area. Cardno ENTRIX biologists further determined the Action Area contains no potentially suitable habitat for any of the species listed in Table 8-1. Several federally species listed as potentially occurring in Harris County are marine species; the Action Area does not include marine or tidally influenced waters. Therefore no listed and candidate species are present in the Action Area, thus the proposed Project will not affect any listed or candidate species.

Table 8-1 Federally Listed and Candidate Species

Species Common and Scientific Name	Federal Listing Status	Determination of Effect
Amphibians		
Houston toad (*Anaxyrus houstonensis*)	E	No effect
Birds		
Red-cockaded woodpecker (*Picoides borealis*)	E	No effect
Whooping crane (*Grus americana*)	E	No effect
Sprague's pipit (*Anthus spragueii*)	C	NA*
Fishes		
Smalltooth sawfish (*Pristis pectinata*)	E	No effect
Mammals		
Louisiana black bear (*Ursus americanus luteolus*)	T	No effect
Red wolf (*Canis rufus*)	E	No effect
West Indian manatee (*Trichechus manatus*)	E	No effect
Plants		
Texas prairie dawn (*Hymenoxys texana*)	E	No effect
Reptiles		
Green sea turtle (*Chelonia mydas*)	T	No effect
Kemp's ridley sea turtle (*Lepidochelys kempii*)	E	No effect
Leatherback sea turtle (*Dermochelys coriacea*)	E	No effect
Loggerhead sea turtle (*Caretta caretta*)	T	No effect

C – Candidate, E – Endangered, T – Threatened

*Impact determinations for candidate species are not provided because these species are not protected under the ESA. Source: TPWD 2012a, FWS 2012a

9 References

Alsop, F.J. III. 2001. Birds of North America. New York, New York. 1008 pp.Audubon Society. 2012. Christmas Bird Count for Armand Bayou [TXAY] year 2006-2010. Available online at: http://audubon2.org/cbchist/count_table.html. Accessed December 2012.

Bailey, Robert G. Description of the ecoregions of the United States (2nd ed.). 1995. Misc. Pub. No. 1391, Map scale 1:7,500,000. USDA Forest Service.

Bureau of Economic Geology. 1992. Geologic Atlas of Texas. Austin, Texas: University of Texas at Austin.

Campbell, L. 2003. Endangered and Threatened Animals of Texas, Their Life History and Management. Texas Parks and Wildlife Resource Protection Division. Austin, Texas, USA.

FWS. 1989. Hymenoxys texana recovery plan. Albuquerque, New Mexico: U.S. Fish and Wildlife Service. p.53.

FWS. 2002. Red-cockaded Woodpecker. Available online at: http://library.fws.gov/Pubs4/redcockadedwp02.pdf. Accessed October 2012.

FWS. 2007. International Recovery Plan, Whooping Crane (*Grus Americana)*, Third Revision. Available online at: http://ecos.fws.gov/docs/recovery_plan/070604_v4.pdf. Accessed October 2012.

FWS. 2008. Louisiana Blck Bear Critical Habitat. Available online at: http://www.fws.gov/Lafayette/pdf/LA_Black_Bear_Critical_Habitat_Fact_Sheet.pdf. Accessed October 2012.

FWS. 2012a. Species by County Report. Available online at: http://www.fws.gov/endangered/. Accessed October 2012.

FWS. 2012b. Green Sea Turtle (*Chelonia mydas*) Fact Sheet. Available online at: http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/green-sea-turtle.htm. Accessed October 2012.

FWS. 2012c. Louisiana black bear (*Ursus americanus luteolus*). Available online at: http://www.fws.gov/southeast/pubs/LA_blackbear-fs.pdf. Accessed October 2012.

FWS. 2012d. Red Wolf Recovery Program. Available at: http://www.fws.gov/redwolf/index.html. Accessed December 2012.

FWS. 2012e. Sprague's pipit (*Anthus spragueii*) Conservation Plan. Available online at: http://www.fws.gov/mountain-prairie/species/birds/spraguespipit/SpraguesJS2010r4.pdf. Accessed October 2012.

FWS. 2012f. Sprague's pipit (*Anthus spragueii*) Species Profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0GD. Accessed October 2012.

FWS. 2012g. FWS Critical Habitat Portal. Available online at: http://criticalhabitat.fws.gov/crithab/. Accessed October 2012.

FWS. 2012h. West Indian manatee Species Profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A007#crithab. Accessed December 2012.

FWS. 2012i. Whooping crane (*Grus Americana*) Species Profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B003. Accessed October 2012.

FWS. 2013. Texas Prairie Dawn. Available online at http://www.fws.gov/southwest/clearlakees/PDF/TexasPrairieDawn.pdf.Accessed January 2013.

Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PE&RS, Vol. 77(9):858-864.Natural Resources Conservation Service (NRCS). 2012. MLRA Explorer. Website (http://www.cei.psu.edu/mlra/) accessed September, 2012.

Harris County Flood Control District (HCFCD). 2012. Armand Bayou Watershed. Available at: http://www.hcfcd.org/L_armandbayou.html. Accessed November 2012.

Kelly, B.T., A. Beyer and M.K. Phillips. 2004 Red Wolf. *in* International Union for Conservation of Nature. 2004. *Candids: Foxes, Wolves, Jackals and Dogs – 2004 Status Survey and Conservation Action Plan.* 342 pp. Available online at http://www.canids.org/cap/index.htm

Metz, Tasha Lynn. 2004. Factors Influencing Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) Distribution in Nearshore Waters and Implications for Management. Dissertation. Texas A&M University. Available online at: http://repository.tamu.edu/bitstream/handle/1969.1/1247/etd-tamu-2004B-2-WFSC-Metz-2.pdf?sequence=1.

NOAA. 2011. Smalltooth Sawfish (*Pristis pectinata*). Available online at: http://www.nmfs.noaa.gov/pr/species/fish/smalltoothsawfish.htm. Accessed October 2012.

NOAA. 2012a. Kemp's Ridley Turtle (*Lepidochelys kempii*). Available online at: http://www.nmfs.noaa.gov/pr/species/turtles/kempsridley.htm. Accessed October 2012.

NOAA. 2012b. Leatherback Turtle (*Dermochelys coriacea*). Available online at: http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm. Accessed October 2012.

NOAA. 2012c. Loggerhead Turtle (*Caretta caretta*). Available online at: http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm. Accessed October 2012.

NOAA. 2013. Essential Fish Habitat Mapper v3.0. Available online at: http://www.habitat.noaa.gov/protection/efh/habitatmapper.html. Accessed January 2013.

Norris, Chad W. and Fordon W. Linam. October 1999. Ecologically Significant River and Stream Segments – Region H. Available online at: http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_rp_t3200_1059c/index.phtml. Accessed October 2012.

NRCS. 2012a. Harris County Web Soil Survey. Available online at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed September 2012.

NRCS. 2012b. TAPS report for Baytown, Texas586 station. Available at: http://www.wcc.nrcs.usda.gov/ftpref/support/climate/taps/tx/48201.txt. Accessed November 2012.

Peterson, M.A. 1982. The effects of air pollution and acid rain on fish, wildlife and their habitats – urban ecosystems. U.S. Fish and Wildlife Service, Biological Services Program, Eastern Energy and Land Use Team, FWS/OBS-80/40.10. 89 pp.

Price, A.H. 1990. Status of Houston toad (*Bufo houstonensis*) along State Highway 21, Bastrop County, Texas. Submitted to the Texas Parks and Wildlife Department of Highways and Public Transportation in fulfillment of Interagency Contract (90-91) 0860 330-0568. Texas Parks and Wildlife Department. Austin, Texas.

Shackelford, C., and J. Reid. 2001. The Endangered Red-cockaded woodpecker and Modern Forestry in Texas: Living in Harmony. 2nd ed. PWD BK W7000-361 (11/01). Texas Partners in Flight, Texas Parks and Wildlife, US Fish and Wildlife Services, US Forest Service, and the Texas Forest Service. Available at: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_0361.pdf. Accessed November 2012.

Smith, A.E., and J.B. Levenson. 1980. *A Screening Procedure for the Impacts of Air Pollution on Plants, Soils and Animals*. (EPA-450/2-81-078). USEPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC.

Spokes, Lucinda J. and Tim D. Jickells. 2005. Is the atmosphere really an important source of reactive nitrogen to coastal waters? Continental Shelf Research. Volume 25(16). October 2005.

TPWD. 2012a. Rare, Threatened and Endangered Species of Texas, Annotated Harris County Lists of Rare Species. Available online at: http://www.tpwd.state.tx.us/gis/ris/es/ES_Reports.aspx?county=Harris. Accessed October 2012.

TPWD. 2012b. Background for Teachers: Red Wolf (*Canis rufus*). Available online at: http://www.tpwd.state.tx.us/outdoor-learning/resources/keep-texas-wild/the-wild-side-of-the-family/background-for-teachers. Accessed October 2012.

TPWD. 2012c. Green sea turtle (*Chelonia mydas*) . Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/greentur/. Accessed October 2012.

TPWD. 2012d. Houston toad (*Bufo houstonensis*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/htoad/. Accessed October 2012.

TPWD. 2012e. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/ridley/. Accessed October 2012.

TPWD. 2012f. Leatherback Sea Turtle (*Dermochelys coriacea*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/lethback/. Accessed October 2012.

TPWD. 2012g. Loggerhead Sea Turtle (*Caretta caretta*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/logghead/. Accessed October 2012.

TPWD. 2012h. Louisiana black bear (*Ursus americanus luteolus*). Available online at: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_0013_louisiana_black_bear.pdf. Accessed October 2012.

TPWD. 2012i. Red-cockaded Woodpecker (*Picoides borealis*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/rcw/. Accessed October 2012.

TPWD. 2012j. Texas prairie dawn (*Hymenoxys texana*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/txprdawn/. Accessed October 2012.

TPWD. 2012k. Whooping crane (*Grus Americana*). Available online at: http://www.tpwd.state.tx.us/huntwild/wild/species/whooper/. Accessed October 2012.

TPWD. 2012l. Water Planning Data for Region H. Available online at: http://www.tpwd.state.tx.us/landwater/water/environconcerns/water quality/sigsegs/regionh.phtml. Accessed October 2012.

TXNDD. 2012. Documented occurrences of rare species and sensitive features within the Action Area, requested September 2012.

Wiken, E., F. Jiménez Nava, and G. Griffith. 2011. North American Terrestrial Ecoregions—Level III. Montreal, Canada: Commission for Environmental Cooperation. Available online at: http://www.cec.org/Storage/133/15860_QA07.30-32_NP_NA_Terrestrial_Ecoregions_Level_3_Final-2june11.pdf. Accessed December 2012.

10 List of Preparers

Project Manager, Author:	Anne C. Allen, Senior Environmental Specialist, B.S., Business Administration
Author:	Louise L. Holley, Senior Staff Scientist, B.S., M.S. Biology
Author, Field Scientist:	Shannon D. Cass, Staff Scientist, B.S., Marine Biology; B.S., Environmental Science
Field Scientist:	Curtis Wilson, Staff Scientist, B.S, Environmental Science; Certificate, Environmental Management

Resumes for the authors of this BA are provided in Appendix B.

Celanese Methanol Project

Figure 1

SITE VICINITY MAP

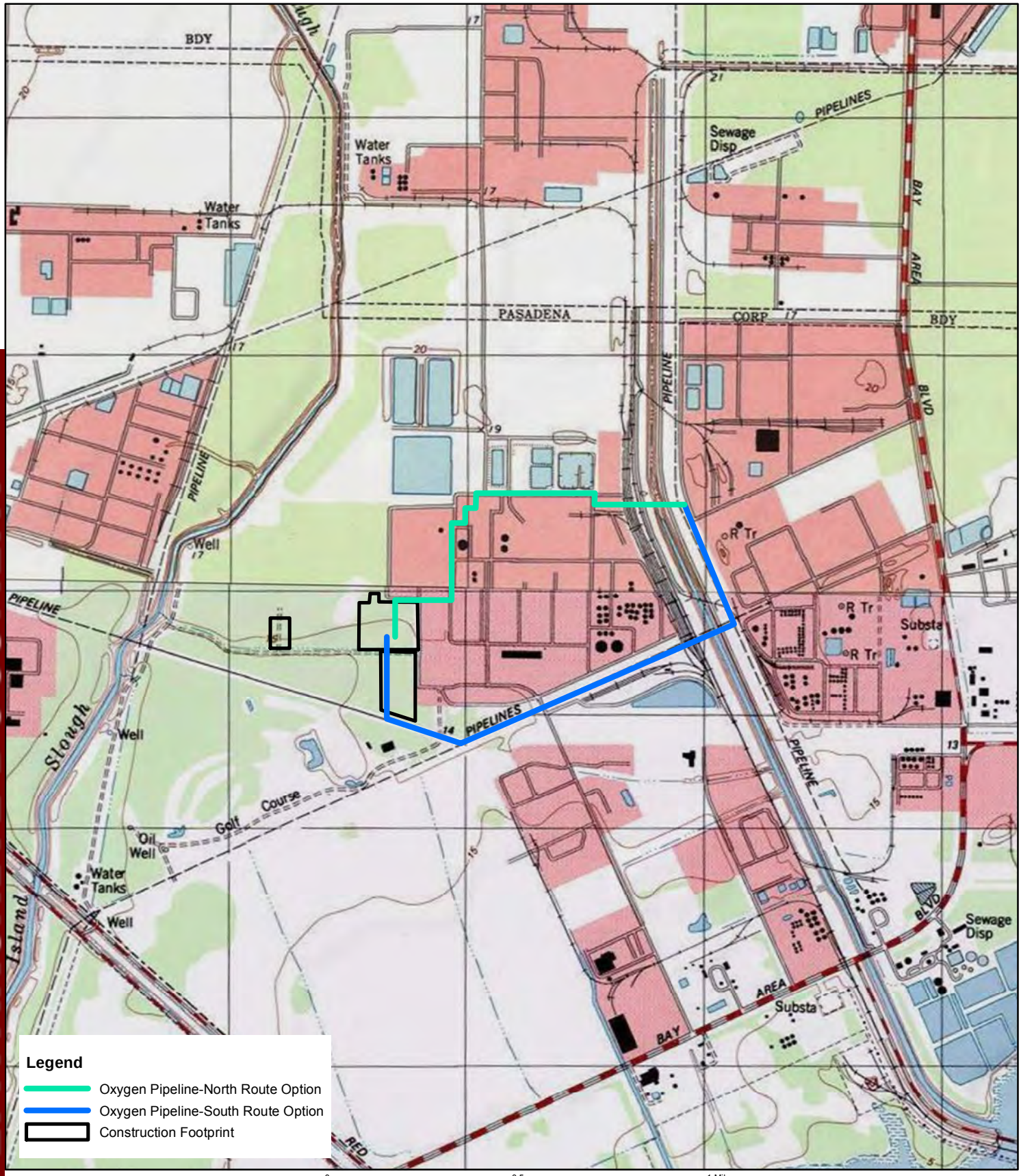


Figure 1
Site Vicinity Map
Celanese Methanol Project

Pasadena, Texas

N

Image: USA Topo from ArcGIS Online

Map date: 14 February 2013

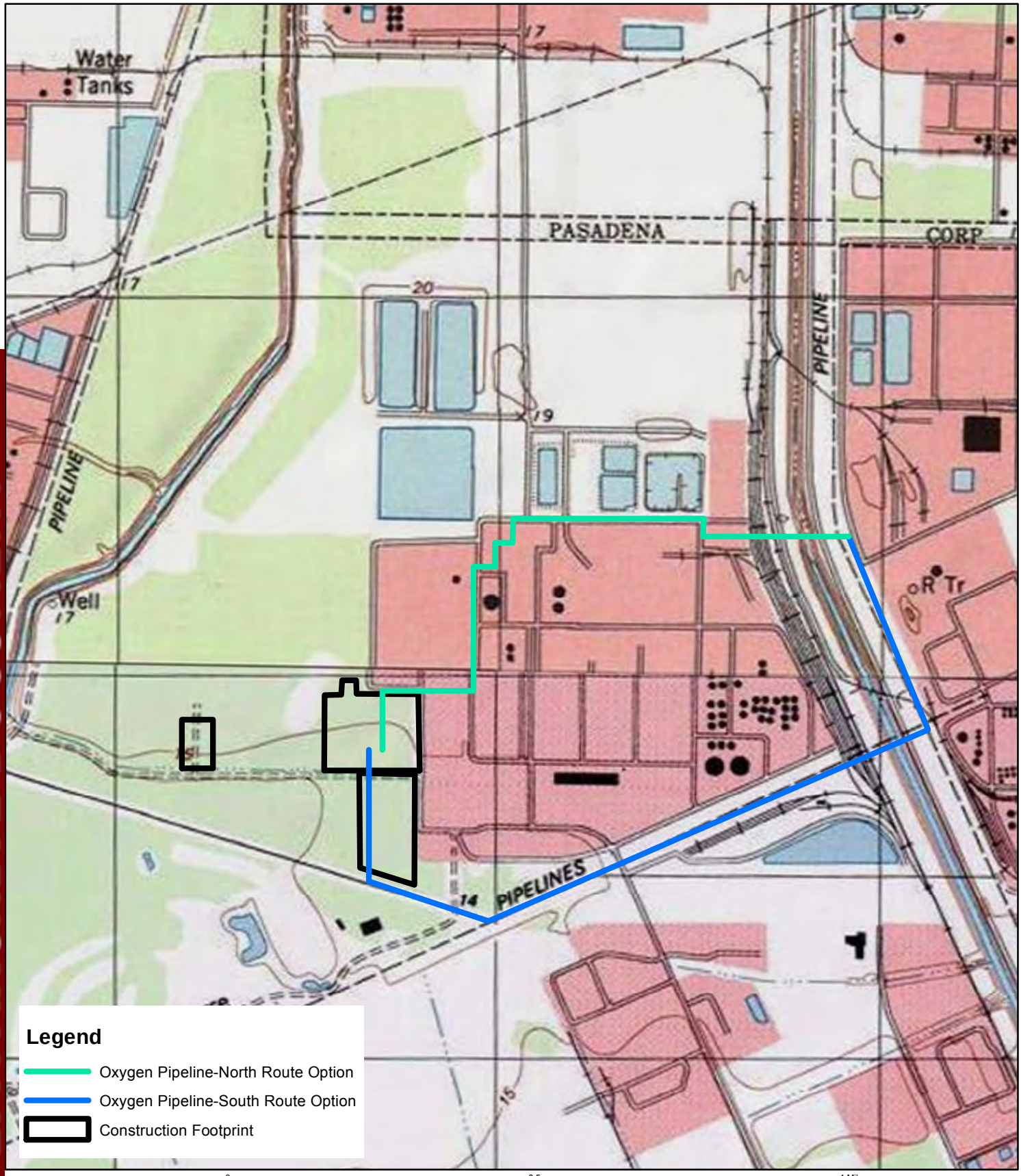
Cardno ENTRIX
5252 Westchester, Suite 250
Houston, TX 77005
ph (713) 666-6223
fx (713) 666-5227
www.cardnoentrix.com

Coordinate System: NAD 1983 UTM Zone 15N feet

Celanese Methanol Project

Figure 2

PROJECT AREA MAP



0 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Figure 2
Project Area Map
Celanese Chemical Plant

Pasadena, Texas

N

Image: USA Topo from ArcGIS Online

Map date: 14 February 2013

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Figure 3

ACTION AREA MAP

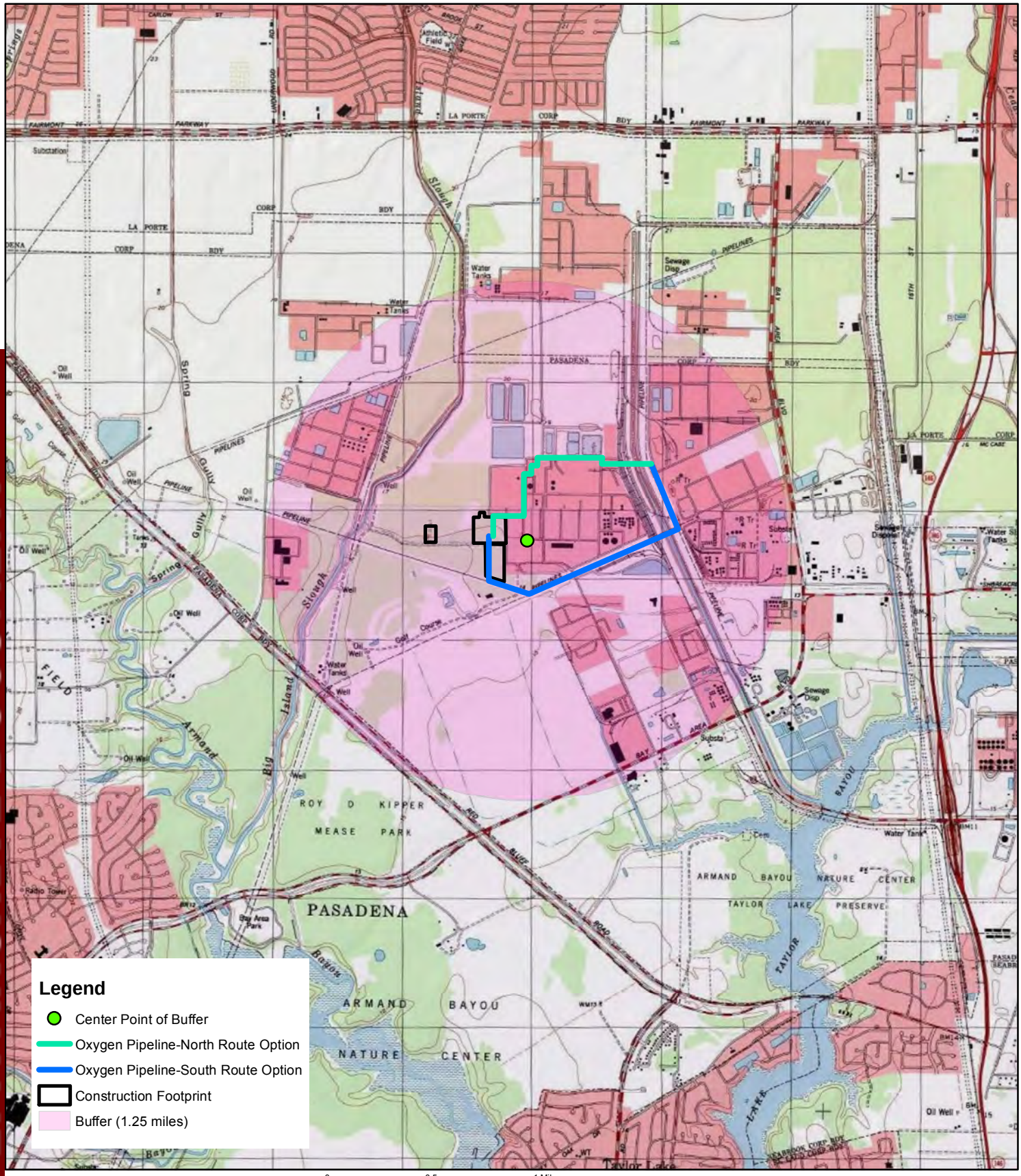

Figure 3
Action Area Map
Celanese Chemical Plant

Pasadena, Texas

N

Image: USA Topo from ArcGIS Online

Map date: 14 February 2013

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Coordinate System: NAD 1983 UTM Zone 15N feet

Celanese Methanol Project

Figure 4

RECEPTOR GRID MAP

SCALE
1"=3,000m

0 1,500 3,000 6,000
SCALE IN METERS

SAGE
ENVIRONMENTAL CONSULTING

RECEPTOR GRID
CELANESE LTD.
CLEAR LAKE PLANT
PASADENA, TX

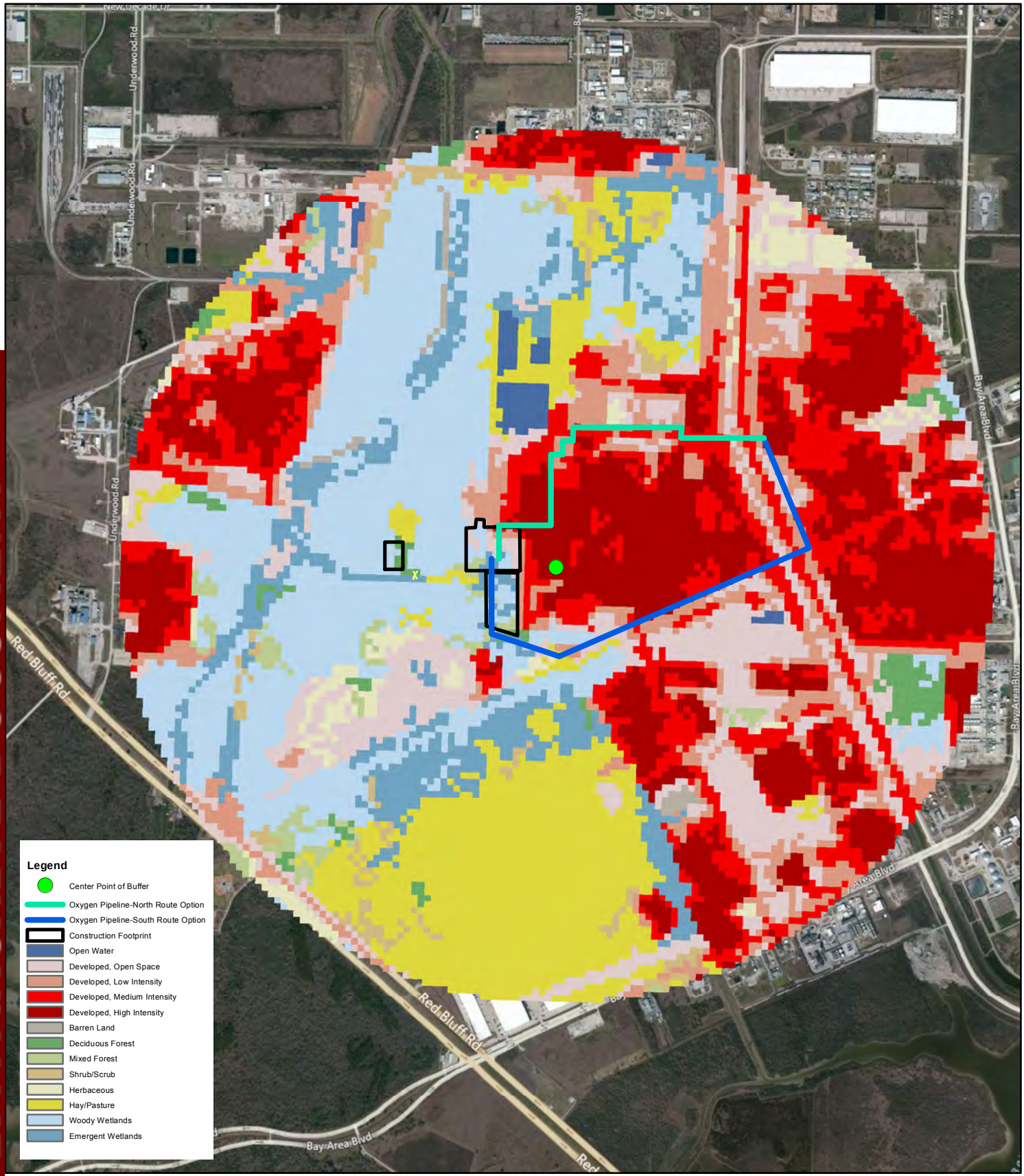
Sage Environmental Consulting, LP

Figure: 4
Revision # : 0
Date: Feb 2013

Celanese Methanol Project

Figure 5

LAND USE/LAND COVER MAP



0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Figure 5
Land Use/Land Cover Map
Celanese Chemical Plant

Pasadena, Texas

N

Image: Bing Hybrid from ArcGIS Online

Map date: 14 February 2013

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Coordinate System: NAD 1983 UTM Zone 15N feet

Celanese Methanol Project

Figure 6

SOILS MAP

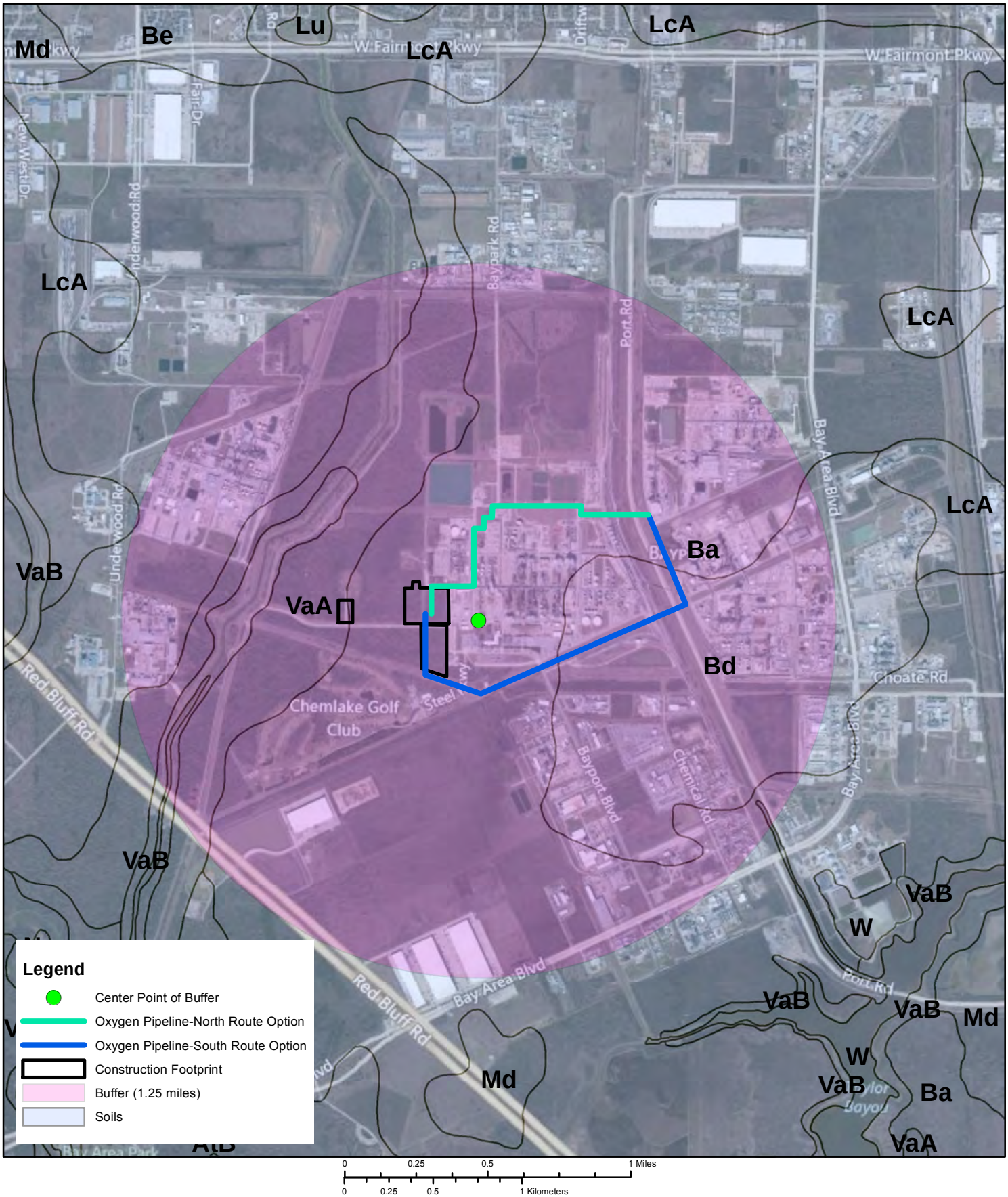

Figure 6
Soils Map
Celanese Chemical Plant

Pasadena, Texas

N

Image: Bing Hybrid from ArcGIS Online

Map date: 14 February 2013

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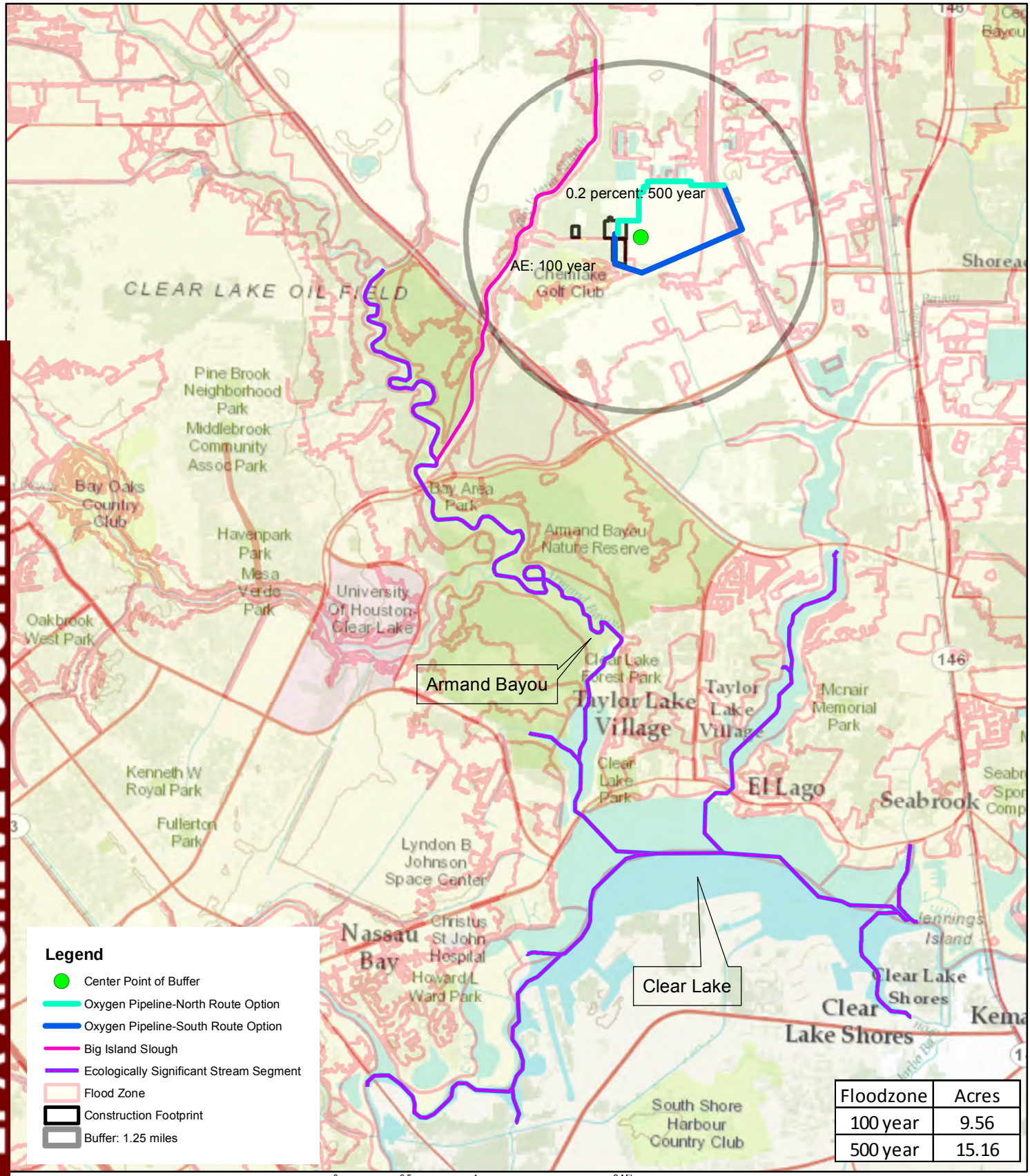
Coordinate System: NAD 1983 UTM Zone 15N feet

Celanese Methanol Project

Figure 7

FLOODPLAIN AND ECOLOGICALLY SIGNIFICANT STREAM SEGMENT MAP



Floodzone	Acres
100 year	9.56
500 year	15.16

Figure 7
Floodplain and Ecologically Significant Stream Segment Map
Celanese Chemical Plant

Pasadena, Texas

N

Image: Topo from ArcGIS Online

Map date: 14 February 2013

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Celanese Methanol Project

Figure 8

PHOTOGRAPH REFERENCE MAP

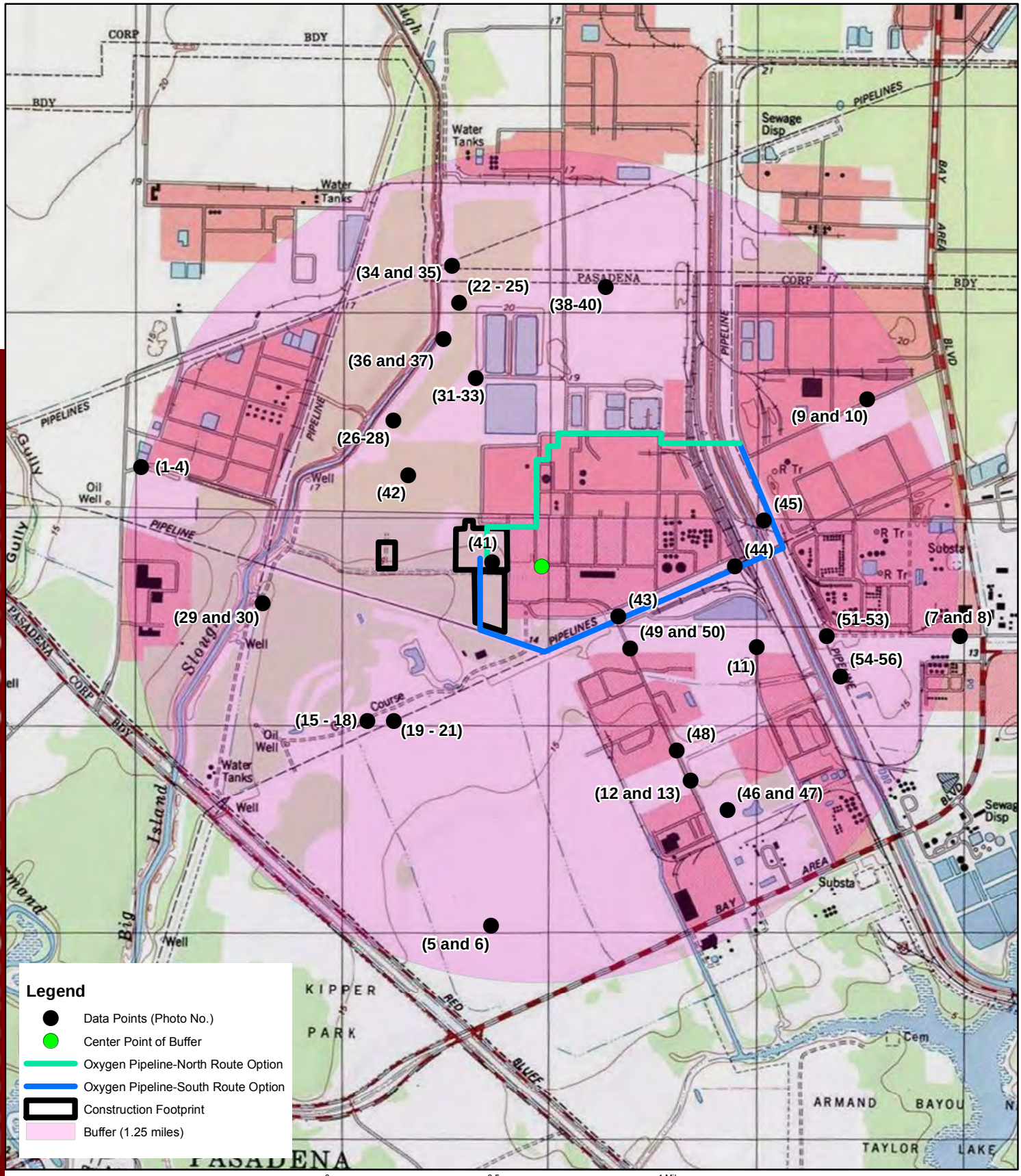

Figure 8
Photograph Reference
Celanese Chemical Plant

Pasadena, Texas

N

Image: USA Topo from ArcGIS Online

Map date: 14 February 2013

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Celanese Methanol Project

APPENDIX A

PHOTOGRAPHIC LOG

Photo 1 – Woody Wetlands

Photo 2 –Woody Wetlands

Photo 3 – Developed, High Intensity

Photo 4 – Developed, High Intensity

Photo 5 – Hay/Pasture

Photo 6 – Hay/Pasture

Photo 7 – Developed, High Intensity

Photo 8 – Developed, High Intensity

Photo 9 - Developed, High Intensity

Photo 10 - Developed, High Intensity

Photo 11 – Developed, Open Space

Photo 12 – Deciduous Forest in-between Developed, High Intensity

Photo 13 – Developed, High Intensity

Photo 14 - Developed, High Intensity

Photo 15 – Developed, Open Space

Photo 16 - Developed, Open Space

Photo 17 - Developed, Open Space

Photo 18 - Developed, Open Space

Photo 19 – Woody Wetlands and Open Space

Photo 20 - Woody Wetlands and Open Space

Photo 21 - Woody Wetlands

Photo 22 - Woody Wetlands

Photo 23 - Woody Wetlands

Photo 24 - Woody Wetlands

Photo 25 - Woody Wetlands

Photo 26 - Woody Wetlands

Photo 27 - Woody Wetlands

Photo 28 - Woody Wetlands

Photo 29 - Woody Wetlands

Photo 30- Woody Wetlands

Photo 31 – Hay/Pasture, Open Water

Photo 32 - Hay/Pasture, Open Water

Photo 33 - Hay/Pasture, Open Water

Photo 34 – Woody Wetlands and Open Space

Photo 35 - Woody Wetlands and Open Space

Photo 36 - Woody Wetlands and Big Island Slough

Photo 37 - Woody Wetlands and Big Island Slough

Photo 38 - Woody Wetlands

Photo 39 - Woody Wetlands

Photo 40 - Woody Wetlands

Photo 41- Woody Wetlands

Photo 42- Mixed Forest

Photo 43- Western portion of the proposed pipeline rights-of-way south corridor with recent disturbance and no vegetation.

Photo 44- Eastern portion of the proposed rights-of-way south corridor with no mima mounds or bare patches of sandy soil present.

Photo 45- Proposed pipeline rights-of-way east corridor with no mima mounds present.

Photo 46- Herbaceous area dominated by bermuda grass.

Photo 47- Herbaceous area with a small hill dominated by bermuda grass.

Photo 48- Forested area with no mima mounds present.

Photo 49- Forested area with no mima mounds present.

Photo 50- Forested area with no mima mounds present.

Photo 51- Forested area with no mima mounds present.

Photo 52- Forested area with no mima mounds present.

Photo 53- Herbaceous pipeline and power line easement in between two forested areas.

Photo 54- Forested area with no mima mounds present.

Photo 55- View south adjacent to the existing right-of-way.

Photo 56- View north adjacent to the existing right-of-way.

Celanese Methanol Project

APPENDIX B

AUTHOR RESUMES

Anne Christine Allen

Current Position
Senior Environmental Specialist

Discipline Areas
> Permitting & Compliance

> Environmental Audits

> Training/Education Programs

> NEPA Environmental Impact Statements and Environmental Assessments

> Third-Party Construction Compliance Monitoring

Years' Experience
9

Joined Cardno
2006

Education
> B.S. Business Administration University of Florida, 2001

Summary of Experience

Ms. Allen has 10 years' experience in consulting, nine of which are in environmental consulting. She has extensive technical experience in regulatory compliance and has managed compliance auditing, due diligence, facility permitting and compliance, and National Environmental Protection Act (NEPA) projects in 20 states. As part of a successful team completing NEPA projects, she prepared and reviewed all iterations of an Environmental Impact Statement (EIS) and conducted project scoping meetings, consulted with federal, state, and cooperating agencies, and participated in contentious public meetings. Ms. Allen also has extensive experience managing third-party construction compliance monitoring programs.

Compliance and permitting management skills include National Pollutant Discharge Elimination System (NPDES) storm water, NPDES industrial wastewater, multi-state annual and bi-annual waste summary reports, Resource Conservation Recovery Act (RCRA) compliance plans, Spill Prevention Control and Countermeasures (SPCC), and contingency plans.

Significant Projects

Environmental Permitting and Compliance

NPDES Industrial Storm Water Program – Texas and Louisiana

Prepared and submitted more than 30 NPDES storm water permits for chemical, commercial, industrial, bio fuel and power plant facilities. Prepared site-specific Storm Water Pollution Prevention Plans (SWPPPs). Performed compliance requirements and trained employees to performed SWPPP requirements and water quality sampling.

NPDES Industrial Wastewater Program – Texas and Louisiana

Prepared and submitted several wastewater permit and renewal applications for several types of commercial, industrial, and power plant facilities. Prepared completed administrative and technical reports. Performed facility assessment, permit analytical, mapping, discharge monitoring reports, and public notice.

SPCC Plan– Texas, Louisiana, Nevada

Prepared more than 20 SPCC Plans with secondary containment assessments for various chemical, construction, industrial, and power facilities.

Industrial and Hazardous Waste Permitting & Compliance – Texas, Louisiana, Oklahoma, Colorado, Tennessee, Alabama, South Carolina

Prepared solid waste registrations, waste determinations, and waste reduction plans for several types of commercial, industrial, and power plant facilities. Prepared and submitted annual, quarterly, and biennial reports for various companies. Prepared and submitted RCRA Compliance and Contingency Plans and coordinated compliance based on federal and state regulations. Performed waste management unit closures.

Construction Compliance Monitoring

Project Manager – Spring Valley Wind Farm Project– Nevada

Served as the project manager for the Bureau of Land Management (BLM) third-party monitoring program for construction of a 66-wind turbine farm. Primary responsibilities

involve: compliance guidance for all parties; managing field construction, biological, and cultural monitors; preparation of Construction, Operation, and Maintenance (COM) Plan, approving variance requests; performing on-site inspections during construction; and submitting daily, weekly, and monthly project reports.

Project Manager – Bison Pipeline Project – Wyoming, Montana, and North Dakota

Served as the project manager for the Federal Energy Regulatory Commission (FERC) third-party monitoring program for construction of a 302-mile natural gas pipeline project. Primary responsibilities involve: compliance guidance for all parties; managing field monitors; approving variance requests; performing on-site inspections during construction; and submitting daily, weekly, and monthly project reports.

Project Manager – Chevron Pipeline Company Replacement Project – Texas

Served as the project manager for the NPS third-party monitoring program for construction of a liquefied petroleum gas pipeline replacement project across the Big Thicket National Preserve. Primary responsibilities involved: managing field monitor; performing on-site inspections during construction; and submitting daily, weekly, and monthly project reports.

Project Manager - Gulf Crossing Pipeline Project– Texas, Oklahoma, Louisiana, and Mississippi

Served as the project manager for the FERC third-party monitoring program for construction of a 350-mile natural gas pipeline. Primary responsibilities involved: managing field monitors; approving variance requests; performing on-site inspections during construction; and submitting daily, weekly, and monthly project reports.

Environmental Auditing & Due Diligence

Project Manager – The Modern Group, Inc. (Dragon Products, Dragon Rigs, & Modern AG) – Texas

Performed multiple internal industrial environmental compliance audits for eleven Texas pipe metal fabrication and manufacturing facilities. Audit focus per activities included: storm water permitting and plans, waste generation and registrations, air permits, SPCC, and city specific wastewater permits. Completed voluntary disclosure of violations, corrective actions, and completion correspondence with the Texas Commission on Environmental Quality (TCEQ). Prepared all required permits and correspondence. Performed all required compliance initiatives and employee and management training.

Project Manager – Signal Hill Power Plant – Texas

Performed multiple internal industrial environmental compliance audits including an audit under the Texas Environmental, Health, and Safety Privilege Act. Audit focus per activities included: storm water permitting and plans, waste generation and registrations, air permits, EPCRA, SPCC, and local registrations. Prepared and completed all required permits and correspondence. Continue to perform all required permitting, compliance initiatives, and employee and management training.

Environmental Impact Statements and Environmental Assessments

Project Manager – Virginia Southside Expansion Project – Virginia

Currently serving as the Project Manager for the analysis and preparation of the FERC third-party Environmental EA (EA) for expansion of the existing Transco Virginia Southside Pipeline.

Deputy Project Manager – Cameron LNG Liquefaction Project and Cameron Interstate Expansion Project EIS – Louisiana

Serving as the Deputy Project Manager for the analysis and preparation of the FERC third-party EIS for expansion of the existing Cameron liquefied natural gas (LNG) receiving, storage, and regasification terminal (Cameron LNG Terminal), and additions to the Cameron Interstate Pipeline.

Section Author – Kern River Expansion Project – Nevada, Utah, Wyoming, and Montana

Served as a section author for the analysis and preparation of a FERC third-party EIS for a 28-mile natural gas pipeline and new and modified compressor station project. Primary responsibilities involve the research, evaluation, and impact analysis of local and regional water resources.

Project Manager – Chevron Pipeline Company Replacement Project – Texas

Served as the project manager for the analysis and preparation of a NPS EA for a liquefied petroleum gas pipeline replacement project across the Big Thicket National Preserve. Primary responsibilities include coordination of the NPS project team, participation in site surveys and agency meetings, and development of all sections of the EA.

Section Author – Bison Pipeline Project – Wyoming, Montana, and North Dakota

Served as a section author for the analysis and preparation of a FERC third-party EIS for a 302-mile natural gas pipeline project. Primary responsibilities involve the research, evaluation, and impact analysis of local and regional fishery and water resources.

Deputy Project Manager - TORP Terminal LNG Redesign Project – Federal Waters of Offshore Alabama

Served as the deputy project manager for the analysis and preparation of a Supplemental USCG DWP Application for the re-design of the TORP Terminal Project. Primary responsibilities include coordination of the project team and the research and development of impacts to multiple resources from LNG vaporization and terminal operations.

Physical Resources Task Lead – Gulf Crossing Project – Texas, Oklahoma, Louisiana, and Mississippi

Evaluated and analyzed impacts to physical and biological resources for the FERC third-party EIS of the 350-mile-long interstate pipeline and new compressor station project. Primary responsibilities involved the research, evaluation, and impact analysis of local and regional water, wetland, and vegetation resources. Further duties included attendance at open houses, public and agency scoping meetings, public hearings, and site surveys.

Certifications

> FERC Compliance and Regulation

> ISO 14001:2004 Certified Auditor

> 40-Hour OSHA — Training and annual refresher updates

> Standard CPR and First Aid

Shannon Cass

Current Position
Staff Scientist

Discipline Areas
> Environmental Permitting & Assessments
> Natural Resource Damage Assessment (NRDA)
> Ecological Risk Assessment
> Water Quality Analysis
> Field Methods

Years' Experience
2

Joined Cardno
2011

Education
> B.S., Environmental Science, UT/Brownsville, 2011
> State Board of Educators Certification, U of H-Victoria, 2007
> B.S., Marine Biology, TAMU/Galveston, 2005

Summary of Experience

Ms. Cass is a Staff Scientist with a broad background and training in biological and environmental sciences. She has experience performing biological research and field surveys, including wetland delineations and threatened and endangered species surveys. In addition to environmental surveys, she has assisted in marine animal research, stranding, and rescue/release. Ms. Cass' professional experience includes work supporting Natural Resource Damage Assessment, Ecological Risk Assessment, and pipeline and construction projects meeting requirements under the jurisdiction of the US Army Corps of Engineers.

Significant Projects

Wetland Delineations and Permitting

Staff Scientist- variety of projects

Performed wetland delineation and threatened and endangered species surveys on a variety of projects and prepared Section 404 Individual Permits.

Product Safety and Compliance

Staff Scientist- Baker Hughes Green Ranking System

Participated in the implementation of a "Green Ranking" system to assist the client in providing products with green attributes. Used the ranking system to score the associated risks and hazards of the client's chemical products.

Staff Scientist- variety of projects

Assisted Cardno staff in writing Spill Prevention, Control, and Countermeasure Plans (SPCC) and Storm Water Pollution Prevention Plans (SWPPP) for clients.

NRDA/Response

Staff Scientist- BP-MC252, Gulf of Mexico

Assisted the Cardno Fisheries team in compiling species specific reports for the purpose of analyzing data on effects of species indigenous to the Gulf of Mexico.

Research Technician – BP-MC252, Gulf of Mexico

Assisted the Cardno NRDA team responding to the Deep Water Horizon accident and oil spill in the Gulf of Mexico on behalf of BP. She is attached to the Birds and Wildlife technical working group, and participated in data analysis for NRDA studies. She is also attached to the Cardno ENTRIX Response team responding to the Deep Water Horizon accident and oil spill in the Gulf of Mexico on behalf of BP.

Technician

Laboratory Technician I- Various Projects, Padre Island and Boca Chica Beaches, Texas

Routinely monitored the levels of Enterococci spp. bacteria on the beaches of Padre Island and Boca Chica Beach through the Texas Beach Watch Program. She collected and analyzed water samples using the Quanti-Tray Seal Method and submitted results into the GLO database for comparison to the EPA's recommended criteria for accepted bacteria levels. She also assisted professors in ongoing research of seagrass bed

growth/deterioration rates and collection of sediment samples in the Laguna Madre Bay and assisted Sea Turtle Inc. in rescue, stranding, and release of sea turtles on South Padre Island.

Research

Research Assistant- Texas A&M University at Galveston Seafood Safety Lab

Routinely monitored the Vibrio spp. levels in oysters from designated oyster reefs on the Northwest side of Galveston Island. She collected and analyzed samples from the bay along with those delivered to the lab by the Texas Department of Health for processing. She also acquired hands on experience in bacteriological examination including DNA genes probes, and electrophoresis/molecular techniques.

Assistant Biologist- Moody Gardens Aquarium, Galveston, TX

Aided in the future development of animal behaviors in the Loggerhead sea turtle, Brown sharks, and Tiger sharks of the Caribbean Exhibit. She collected and recorded temperatures, salinities, and pH levels on all the other smaller tanks and acquired a diverse background in species identification and variation while performing education dives into the tanks for feeding purposes.

Certifications

> Open Water, Advanced, and Rescue SCUBA certification, PADI, 2004
> Enriched Air Nitrox Diver and Cavern Diver, NAUI, 2004
> 40-Hour OSHA HAZWOPER
> CPR/First Aid

Software Skills

> Microsoft Office: Outlook, Word, Excel and PowerPoint
> ArcGIS

Louise Lammons Holley

Current Position
Senior Staff Scientist

Discipline Areas
> NEPA, Environmental Impact Statements

> Oil Spill Response & NRDA

> Ecological Risk Assessments

> Environmental Permitting & Assessments

> Product Safety & Compliance

Years' Experience
4

Joined Cardno
2009

Education
> M.S., Biology, The College of William & Mary, 2009

> B.S, Biology, Wake Forest University, 2007

Summary of Experience

Ms. Louise Lammons Holley is a senior staff scientist with a broad background and training in ecology and environmental science. She has experience conducting biological research and field studies, including threatened and endangered species and wetland delineation surveys. Ms. Holley's professional experience includes work supporting Natural Resource Damage Assessments, Ecological Risk Assessments and multiple third-party EISs for offshore natural gas terminals and onshore pipeline projects to meet NEPA requirements under the jurisdiction of the USCG, FERC and FAA.

Significant Projects

National Environmental Policy Act (NEPA)

Senior Staff Scientist – SpaceX Texas Launch Site, Cameron County, Texas

Ms. Holley conducted the Federal consistency review with the Texas Coastal Management Program to support the FAA's third-party EIS for the SpaceX Texas Launch Site for issuance of launch licenses and/or experimental permits for vertical launch vehicles from a launch site in Cameron County, Texas. 2012 – present.

Staff Scientist – Kern River Gas Transmission Company Apex Expansion Project, Utah

Ms. Holley evaluated impacts to wetland resources, developed text for the FERC third-party EIS, and addressed agency comments for the 28-mile-long pipeline loop and new compressor station project. Assisted with pipeline construction monitoring, managed daily and weekly reports and assisted with processing variance requests. 2009-2011.

Assistant Staff Scientist – Calypso LNG DWP Project, Federal Waters of Florida

Ms. Holley participated in the analysis and preparation of the biological resources section of the USCG third-party EIS of the deepwater port Project. The proposed project was 8 to 10 miles off the eastern coast of Florida and included the FERC-permitted Calypso pipeline route. She conducted supporting research for the biological resources sections of the EIS, including essential fish habitat and threatened and endangered species. 2007.

Assistant Staff Scientist – Rockies Express Pipeline, East Project, Missouri, Illinois, Indiana and Ohio

Ms. Holley assisted in evaluating impacts to biological resources for the FERC third-party EIS of the 640-mile-long interstate pipeline and new compressor stations project. 2007.

Assistant Staff Scientist and Project Assistant – Gulf Crossing Pipeline Project, Texas, Oklahoma and Louisiana

Ms. Holley assisted in evaluating impacts to biological resources for the FERC third-party EIS of the 350-mile-long interstate pipeline and new compressor station project. Responsibilities included research of local fishery and wildlife resources and the coordination of communications for public and agency scoping meetings. 2006.

Assistant Staff Scientist – TORP Terminal LNG Project, Federal Waters of Alabama

Ms. Holley assisted with the evaluation and impact analysis of the biological resources for the TORP Terminal LP Resource Reports. Her primary responsibilities included assisting with ichthyoplankton assessments and the research of fisheries data, impacts to marine organisms from vessel discharges and spills, and environmental construction impacts for

offshore facilities. 2006-2007.

Project Assistant – Compass Port LNG Project, Alabama and Mississippi

Ms. Holley conducted supporting research for the preparation of the USCG third-party EIS for the Compass Port LNG Project and assembled and maintained the administrative record for the project. 2004.

Environmental Permitting, Monitoring and Assessments

Project Manager – Baker Hughes Incorporated, Texas

Ms. Holley managed and conducted wetland delineation surveys and surveys for state-and federally-listed species of conservation concern at a proposed construction site for new facilities. She also prepared and provided documentation summarizing findings. 2012 – present.

Project Manager – Chevron North America Exploration and Production, Midcontinent

Ms. Holley managed land use/land cover and natural resource mapping and GIS support for approximately 20 project sites within the geographic scope of the Midcontinent Business Unit. 2012 – present.

Project Manager – Eagle Rock Energy, Texas and Louisiana

Ms. Holley managed and conducted wetland delineation surveys and surveys for state-and federally-listed species of conservation concern along multiple proposed well pad and pipeline right-of-way locations. She also prepared and provided documentation summarizing findings. 2012 – present.

Staff Scientist - Chevron Pipe Line – Chambers and Harris Counties, Texas)

Ms. Holley conducted wetland delineation surveys and surveys for state-and federally-listed species of conservation concern along a proposed 20-mile pipeline installation and removal project crossing the Houston Ship Channel. She also prepared and submitted a Pre-Construction Notification for Nationwide Permit #12 and General Permit applications. 2011-2012.

Staff Scientist – Arrowhead Pipeline [Hilcorp Energy Company], Sweeny, Texas

Ms. Holley conducted groundwater sampling at an active gas processing plant in support of closure with the Texas Railroad Commission. The monitoring program includes an active recovery system for free-phase and dissolved phase hydrocarbons. 2010.

Staff Scientist – Chevron North America – Zapata and Webb Counties, Texas

Ms. Holley conducted field surveys for state- and federally-listed species of conservation concern along proposed well pad and pipeline right-of-way locations in the Eagle Ford shale play. Prepared and provided documentation summarizing findings. 2010.

Staff Scientist – TransCanada Pipeline Company, Franklin Parish, Louisiana

Ms. Holley performed a delineation of wetlands and waterbodies to be crossed by a proposed erosion-control project, and conducted field surveys for state- and federally-listed threatened and endangered species. She also developed supporting text to report findings to the client. 2009.

Oil Spill Response and Natural Resource Damage Assessments (NRDA)

Task Manager – NRDA, Gulf of Mexico

Ms. Holley is on the Cardno ENTRIX NRDA team responding to the Deepwater Horizon

accident and oil spill in the Gulf of Mexico. She has provided support to the *Birds and Wildlife* and *Marine Mammals and Turtles* technical working groups, participated in the implementation of several cooperative NRDA studies. 2010 – present.

Staff Scientist – Aramco Services Company, Texas

Ms. Holley participated in on-scene spill drill activities, working in the Environmental Unit within the Incident Command System. She also wrote and contributed to assessment and operational work plans. 2011 – 2012.

Project Assistant – Spill Response, Calcasieu Estuary, Louisiana

Ms. Holley conducted research supporting natural resource damage assessment for fish and benthic organisms. The area over which these damages occur is large, extending from the IH-210 Bridge to the mouth of Calcasieu Lake. 2006.

Ecological Risk Assessments

Staff Scientist – Chevron Environmental Management Company, Jefferson County, Texas

In support of a Remedial Investigation/Feasibility Study for a CERCLA site, Ms. Holley assisted with data management, performed data analyses, and contributed to the development of text for the Baseline Ecological Risk Assessment (BERA). 2009-2010.

Staff Scientist – Cypress Creek Town Center, Pasco County, Florida

Ms. Holley performed select analyses and refined and developed text, tables and risk exposure models in support of a revised Tier I Screening Level Ecological Risk Assessment (SLERA) for the wood stork. 2010.

Certifications

> CPR/First Aid
> 40 hour OSHA HAZWOPER

Presentations and Publications

> *Deepwater Horizon Ephemeral Data Collection* – Wakefield, J. P. Reilly, L. Holley, R. Klosowski. Carcass Stranding Data to be used in Estimating Acute Avian Mortality. 34th Annual Meeting of the Waterbird Society, March 2011.
> *Data for Estimating Acute Avian Mortality Associated with the Deepwater Horizon Oil Spill* – Wakefield, J., P. Reilly, L. Holley, L. Elmore, L. Noel, R. Klosowski, P. LaLancette, K. Gable. Society of Environmental Toxicology and Chemistry Gulf Oil Spill Focused Topic Meeting, April 2011.
> Selective feeding on nutrient-rich particles by gizzard shad *Dorosoma cepedianum* does not involve mechanical sorting. – Heidman, M.K., L.L. Holley, R.M. Chambers, S.L. Sanderson. Aquatic Biology. Vol 17: 129-139, 2012.
> *How do fish select more nutritious food particles?* – Mud and mucus: feeding selectivity in a suspension-feeding, detritivorous fish. William and Mary Graduate Research Symposium. Williamsburg, VA. March 2009. , William and Mary Graduate Research Symposium. Williamsburg, VA. March 2008.
> *Particle processing on the mantle of the freshwater mussel* – Utterbackia imbecillus. Association of Southeastern Biologists and Tri-Beta Biological Honors Society. Columbia, SC. April 2007

Continuing Education

> Summer Institute in Statistical Genetics, University of Washington, 2008
> Study Abroad: Universidad de Salamanca, Salamanca, Spain, 2005

Languages

> Fluent in Spanish

Awards

> Award for Excellence in Scholarship in the Natural and Computational Sciences. William and Mary Graduate Research Symposium. Williamsburg, VA. March 2009. Mud and mucus: feeding selectivity in a suspension-feeding, detritivorous fish.
> Frank G. Brooks award for excellence in undergraduate research, Tri-Beta Biological Honors Society. Particle processing on the mantle of the freshwater mussel Utterbackia imbecillis, April 2007.
> Graduate Student Teaching/Research Assistant Award, William and Mary, 2007-2009.
> Arts & Sciences Research Grant, William and Mary, 2008.
> Scholarship and Travel Grant, Summer Institute in Statistical Genetics, 2008