Biological Assessment

Equistar Chemicals La Porte Complex

QE-1 Olefins Unit Expansion

La Porte, Harris County, Texas

Prepared for:

Equistar Chemical Company
1515 Miller Cut Off Road, La Porte, TX 77571

AND

U.S. Environmental Protection Agency - Region 6
1445 Ross Avenue, Dallas, TX 75202

Prepared by:

URS
URS Corporation
10550 Richmond Avenue, Suite 155
Houston, TX 77042
(713) 914-6699

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E.S. Executive Summary

Equistar Chemical Company (Equistar) owns and operates a chemical manufacturing complex (La Porte Complex) located in La Porte, Harris County, Texas. Equistar proposes to expand the plant and increase the production capacity with the construction of two additional cracking furnaces and associated process equipment within the existing plant footprint, immediately adjacent to nine existing cracking furnaces in the plant's QE-1 Olefins Unit. Equistar has determined that the proposed project will require a Prevention of Significant Deterioration (PSD) permit issued by the U.S. Environmental Protection Agency (USEPA) for Greenhouse Gas (GHG) emissions.

Equistar has retained the services of URS Corporation (URS) to prepare a Biological Assessment (BA) to evaluate the proposed project site for federally-protected threatened and endangered (T&E) species and/or their potential habitat and to provide an evaluation of the project's likelihood to jeopardize the continued existence of listed species.

Construction for the proposed expansion, associated infrastructure, and auxiliary equipment will take place within the existing Equistar La Porte Complex, in a previous disturbed area approximately 170 feet by 250 feet. No additional ground disturbance will be required outside of this 170-foot by 250-foot area, which is currently a caliche parking lot. The project will include two new furnaces, two new selective catalytic reduction systems, a new decoking drum, new fugitive components, a new group of analyzer vents, additional cells added to the cooling tower, and new ammonia storage and ammonia loading scrubber. Several additional areas of the La Porte Complex will be used temporarily during construction of the proposed project, including a furnace contractor laydown area, new equipment laydown, vendor trailers, and a fabrication area.

Federally-protected species considered in this BA include: Texas prairie dawn, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, Houston toad, red-cockaded woodpecker, whooping crane, smalltooth sawfish, Louisiana black bear, red wolf, and marine mammals. This BA includes a pedestrian protected species habitat evaluation of the La Porte Complex and an evaluation of potential environmental impacts based on ground disturbing activities associated with the construction and operational phases of the project, air quality dispersion modeling results, and proposed changes in the complex's wastewater effluent discharge into the San Jacinto Bay.

Trinity Consultants completed detailed pollutant emission calculations for the project in accordance with the Air Permit Amendment Application requirements. Trinity Consultants also performed dispersion modeling of air pollutants that will be emitted by the proposed project in accordance with the Prevention of Significant Deterioration (PSD) Permit requirements. Dispersion models indicate that no off-property impacts above the significant impact levels to air quality would occur as a result of the proposed project and that impacts within the La Porte Complex will be limited to particulate matter (PM) within an area near the cooling towers.

An Action Area of potential impact has been defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involve in the action" according to federal regulation (50 CFR 402.2). For the basis of this BA, the project's Action Area was defined by the following parameters: 1) areas where construction activities would occur within the La Porte Complex; 2) areas where criteria air pollutants exceed significant impact levels (SIL); and 3) the wastewater effluent drainage channel and dilution area within the receiving water body, a portion of the San Jacinto Bay.

Land use and plant community types within the La Porte Complex include marshland, maintained grasses, mixed woodland, open water, and riverine. A significant portion of these habitats have historically been constructed, manipulated, or otherwise impacted by industrial activities. As such, the majority of the La Porte Complex is concrete, caliche, or asphalt. Construction is proposed in industrial process areas and other developed areas of the complex. The existing process areas do not possess habitat with the potential to support any federally-protected species and were not evaluated.

The proposed construction of the QE-1 Olefins Expansion Project will have no effect on federally-protected species because there is no suitable habitat within the construction site. Similarly, air emissions and wastewater effluent resulting from the operation of the proposed expansion will have no effect on federally-protected species; available data and site visits do not indicate the presence of federally-protected species or their preferred habitat within the Action Area. Based on the information gathered for this BA, URS biologists recommend the following determinations:

Protected Species	**Classification- Reason for Evaluation**	**Determination of Effect**
Federal List of T&E Species (Harris County)		
Texas Prairie Dawn	Listed by United States Fish and Wildlife Service (USFWS) as Endangered in Harris County	No effect
Green Sea Turtle	Listed by USFWS and National Marine Fisheries Service (NMFS) as Threatened, possibly occurring in San Jacinto Bay.	No effect
Hawksbill Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Kemp's Ridley Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Leatherback Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Loggerhead Sea Turtle	Listed by USFWS and NMFS as Threatened, possibly occurring in San Jacinto Bay.	No effect
State-recognized List of Federal T&E Species (Harris County)		
Houston Toad	Listed by the Texas Parks and Wildlife Department (TPWD) as Endangered in Harris County	No effect
Red-cockaded Woodpecker	Listed by the TPWD as Endangered in Harris County	No effect
Whooping Crane	Listed by the TPWD as Endangered in Harris County	No effect

Protected Species	Classification- Reason for Evaluation	Determination of Effect
Smalltooth Sawfish	Listed by the TPWD as Endangered in Harris County	No effect
Louisiana Black Bear	Listed by the TPWD as Threatened in Harris County	No effect
Red Wolf	Listed by the TPWD as Endangered in Harris County	No effect
Bottlenose Dolphin	Listed as depleted by Marine Mammal Protection Act	No take anticipated

1.0 Introduction

Equistar Chemical Company (Equistar) owns and operates a chemical manufacturing complex (La Porte Complex) located in La Porte, Harris County, Texas (Figure 1). Equistar proposes to expand the plant and increase the production capacity with the construction of two additional cracking furnaces and associated process equipment within the existing plant footprint, immediately adjacent to nine existing cracking furnaces in the plant's QE-1 Olefins Unit (Figure 2). Equistar has determined that the proposed project will require a Prevention of Significant Deterioration (PSD) permit issued by the U.S. Environmental Protection Agency (USEPA) for Greenhouse Gas (GHG) emissions.

Equistar has retained the services of URS Corporation (URS) to prepare a Biological Assessment (BA) to evaluate the proposed project site for federally-protected threatened and endangered (T&E) species and/or their potential habitat and to provide an evaluation of the project's likelihood to jeopardize the continued existence of listed species.

1.1 Project Description

1.1.1 Facility Location and Description

The proposed project is located at the Equistar La Porte Complex, approximately 2.3 miles west-northwest (300°) of the intersection of Texas State Highways 225 and 146N (Figure 1). The site is located on the La Porte United States Geological Survey (USGS) Quad, at 29.708° north latitude and 95.061° west longitude. The La Porte Complex is approximately 639 acres and is broken up into two operating areas and each area operates under a unique Texas Commission on Environmental Quality (TCEQ) Regulated Entity Number (RN) and Customer Number (CN):

- Equistar Facility: Olefins Unit and Polymers Units operated by Equistar Chemicals, LP (RN: 100210319, CN: 600124705), and
- Acetyls Facility: Glacial Acetic Acid and Vinyl Acetate Monomer Units operated by LyondellBasell Acetyls, LLC (RN: 100224450, CN: 603674862).

1.1.2 Project Purpose

The purpose of the project is to expand the existing Equistar QE-1 Olefins Unit by adding two cracking furnaces immediately adjacent to the nine existing cracking furnaces currently in operation at the La Porte Complex (Figure 2). The following additions to the QE-1 Olefins Unit are proposed:

- Two new ethylene cracking furnaces (EPNs: QE1010B and QE1011B);
- Two new selective catalytic reduction (SCR) systems, one for each of the new cracking furnaces;
- A new decoking drum (EPN: QE1416FB);
- New fugitive components in both VOC and ammonia service (added to EPN: QEFUG);
- A new group of analyzer vents (EPN: QEANALYZ4);
- Two additional cells added to the cooling tower (EPN: QE7801U);
- Additional maintenance, startup, and shutdown (MSS) emissions associated with the periodic clean-out of the new and modified process equipment; and

- A new ammonia storage and ammonia loading scrubber, (EPN: QENH3SC).

1.1.3 Construction Information

New construction of the proposed ethylene cracking furnaces (Furnace 10 and 11), associated infrastructure, and auxiliary equipment will take place within the boundaries of the La Porte Complex in an area approximately 170 feet by 250 feet, which is currently a caliche parking lot. This area is labeled as the Furnace Area (furnace site) on Figure 2.

Although the proposed project will require the erection of new project equipment and modification to existing process units, physical ground disturbance will be limited to the construction of the proposed furnace site. Equistar has also identified several areas of the La Porte Complex that will be used temporarily during construction of the proposed project, such as: a furnace contractor laydown and fabrication area, new equipment laydown, vendor trailers, and a fabrication area. These areas are also labeled on Figure 2.

The projected construction schedule is:

- Furnace Erection 3/1/13 to 5/7/14
- Compressor Rebuild 3/1/14 to 6/30/14
- Equipment Replacements 3/1/14 to 6/30/14
- Cooling Tower Cell Erection 3/1/13 to 9/30/13

Construction Equipment Required

Equipment required to complete the furnace construction activities is roughly estimated to include the following for the listed time periods.

- 2 - Large Cranes (200 tons) - 45 weeks
- 5 - Large Cranes (200 tons) - 12 weeks
- 6 - Small Cranes (30-40 tons) – 45 weeks
- 6 – Carry Deck Cranes – 45 weeks
- 24 - Welding Machines and Generators – 45 weeks
- 2 - Heat Exchanger Bundle Extractors – 12 weeks
- 4 - Fork Trucks -45 weeks
- 8 – Man Lifts – 45 weeks
- 6 – Air compressors – 45 weeks
- 15 - Light Towers – 12 weeks
- 2 - Excavators – 15 weeks
- 6 - Back Hoes – 15 weeks
- 3- Water Trucks – 15 weeks
- 2 - Cement Pump Trucks – 12 weeks
- 8 - Pick Up Trucks - 45 weeks
- 6 - Gator Personnel Vehicles – 45 weeks

1.1.4 Operation

The two ethylene cracking furnaces (Furnace 10 and Furnace 11) will be added onto the existing hydrocarbon cracking train consisting of nine furnaces, also referred to as heaters. The role of the cracking system is to convert less valuable saturated hydrocarbons into the highly desirable basic building blocks of the petrochemical industry (ethylene, propylene, and butenes, and butadiene). The conversion takes place in the presence of dilution steam by rapidly raising the hydrocarbon/dilution steam temperature to cracking temperatures. The extreme temperature acts to destabilize the structure of the hydrocarbon molecule and initiate the rearrangement of the hydrocarbon molecular bonds.

Decoking of the new furnaces will be done through new equipment installed as part of this expansion project. Coke forms inside process tubing and must be removed due to the restriction it creates and its insulating properties. Decoking emissions result from the steam/air decoking process. This causes both erosion of the coke and combustion of the coke. Emissions include carbon dioxide (CO_2), carbon monoxide (CO), and particulate matter (PM).

Water Use

Raw water is supplied by the Coastal Industrial Water Authority (CIWA) to the Equistar La Porte Complex, including the QE-1 ethylene manufacturing unit. CIWA takes water from the Trinity River. Equistar estimates an approximately 1.0 million gallons per day (MGD) increase in fresh water intake (from 4.0 MGD to 5.0 MGD) to make up for losses and the increase in blowdowns associated with the new equipment.

Noise Levels

Equistar project engineers estimate that the project will not produce increased noise levels during construction compared to noise levels from maintenance activities that currently take place at the plant.

Equistar's Process Change Authorization program ensures that additional equipment added as part of the proposed project will not produce noise levels greater than 90 decibels. Any equipment greater than 90 decibels will be evaluated on a case-by-case basis. The new equipment should not alter the pre-existing noise exposure at the site.

1.2 Regulation of Air Quality and Emission Controls

1.2.1 Regulation of Air Quality

The Clean Air Act requires air quality standards be maintained to protect public health and the environment. These standards are the National Ambient Air Quality Standards, NAAQS, and are regulated by the US EPA. Ambient air is the air to which the general public has access, as opposed to air within the boundaries of an industrial facility. The NAAQS are concentration limits of pollutants in ambient air within specific averaging time. The averaging time is the time period over which the air pollutant concentrations must be met to comply with the standard. The NAAQS are classified into two categories: primary and secondary standards. Primary standards are set to protect public health, including "sensitive" populations. Secondary standards are set to protect public welfare, including the environment.

The EPA sets NAAQS for six principal air pollutants, also referred to as criteria air pollutants. These six criteria air pollutants are nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), PM, CO, and lead (Pb). A geographic area whose ambient air concentration for a criteria pollutant is equal to or less than the primary standard is an attainment area. A geographic area with an ambient air concentration greater than the primary standard is a nonattainment area. A geographic area will have a separate designation for each criteria pollutant.

The Clean Air Act also requires the EPA to establish regulations to prevent significant deterioration of air quality in attainment areas. The EPA established PSD Increments to satisfy this requirement. A PSD Increment is a measure of the maximum allowable increase in ambient air concentrations of a criteria pollutant from a baseline concentration after a specified baseline date. A significant impact level (SIL) is a concentration that represents a *de minimis*, or insignificant, threshold applied to PSD permit applicants. The SIL is a measurable limit above which a source may cause or contribute to a violation of a PSD Increment for a criteria pollutant. Before a PSD permit can be issued, the applicant must demonstrate that the proposed emissions from a project will not cause or contribute to a violation of a NAAQS or to an increase above a PSD Increment for each pollutant emitted in significant amounts by the project.

1.2.2 Emission Controls

Per 30 TAC §116.111(a)(2)(c), new or modified facilities must utilize Best Available Control Technology (BACT), with consideration given to the technical practicability and economic reasonableness of reducing or eliminating the emissions from the facility. The project will include two new furnaces, two new selective catalytic reduction systems, a new decoking drum, new fugitive components, a new group of analyzer vents, additional cells added to the cooling tower, and a new ammonia loading scrubber. The La Porte Complex is in a nonattainment area for ozone and the expansion project will trigger Nonattainment New Source Review (NNSR) for nitrogen oxide (NO_x). NNSR will not be triggered for volatile organic compounds (VOC). In addition, the estimated CO, NO_2, PM less than 10 microns in diameter (PM_{10}), and PM less than 2.5 microns in diameter ($PM_{2.5}$) emission increases associated with the proposed expansion will trigger PSD review. PSD will not be triggered for the remaining criteria pollutant, SO_2 and Pb. There will be negligible SO_2 emissions from the facility. There are no potential Pb emissions from the facility, and therefore Pb will not be addressed elsewhere in this document.

Equistar will utilize BACT to control emissions from the project and thus minimize impacts to the surrounding environment to the maximum extent practicable. Equistar has selected TCEQ BACT guidance for each of the criteria pollutants. Details of the selection can be found in the TCEQ and EPA permit applications for this project. The following control technologies were selected for the listed pollutants:

FURNACE EMISSIONS:

- NOx Selective catalytic reduction
- NO_2 Low-NOx burners
- CO Good combustion practices

- PM Good combustion practices
- VOC Good combustion practices

DECOKE EMISSIONS:

- PM Dual cyclone
- CO Minimize coke formation and follow decoking procedures

COOLING TOWER EMISSIONS:

- PM Drift eliminators

1.2.3 Wastewater

Equistar is authorized to treat and discharge wastes from the La Porte Complex under Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0004013000. According to the TPDES permit the existing wastewater Outfall #004 discharges to an unnamed ditch, thence to an unnamed tidal ditch which empties into San Jacinto Bay in Segment No. 2427 of the Bays and Estuaries. The unnamed ditch is expected to have no significant aquatic life use, and the unnamed tidal ditch is expected to be utilized by aquatic life. The San Jacinto Bay is expected to be utilized by aquatic life and contact recreation. The La Porte Complex is currently subject to effluent limitations, monitoring requirements, and other conditions described in the permit. The La Porte Complex process wastewaters undergo primary and secondary treatment and disinfection prior to discharge from Outfall #004. The proposed expansion project would increase the treated effluent flow from 0.5 to 0.6 MGD and increase the cooling tower blowdown from 0.3 to 0.4 MGD. Water quality at the outfall is currently maintained within all permit limits. The proposed water discharge will be subject to the current permit limitations and is expected to remain unchanged.

If ancillary areas are disturbed in support of the construction project, structural controls may be used to protect surrounding areas from impacted surface runoff. Runoff from within the site is directed through a series of onsite ditches and weirs before discharge through permitted outfalls. Additional erosion control measures (silt fence, sandbags) may be used if excess erosion and/or sedimentation are observed during the construction phases. Re-vegetation is not a concern since the site is a heavy industrial site consisting of gravel or concrete-paved surfaces.

The Equistar facility currently has an Oil and Hazardous Materials Spill Prevention, Control, and Countermeasure Plan and Storm Water Pollution Prevention Plans (SWPPP) in place and the facility employees are trained to implement these plans. These plans will be utilized during construction, operations, and maintenance of the proposed additional furnaces. Best Management Practices will be utilized in accordance with Section 401 of the Clean Water Act Chapter 279 of the Texas Water Code and as prescribed in the Equistar SWPPP.

1.3 Purpose of the BA

The purpose of this BA is to research, evaluate, analyze, and document the potential for direct and indirect effects, interdependent and interrelated actions, and cumulative effects on federally-protected species as a result of the proposed expansion project. Specifically, the BA considers potential temporary impacts from construction activities and permanent impacts from the additional emissions and water discharges that will result from facility expansion. An Action Area of potential impact has been defined and is shown in Figure 3. This BA includes a pedestrian protected species habitat evaluation of the proposed construction area, and areas of potential habitat within the La Porte Complex property, and an evaluation of potential environmental impacts based on the total emissions and dispersion modeling data provided by Trinity Consultants, dilution modeling, field survey and background review data collected by URS, and literature review and research of potential effects of known pollutants on flora and fauna.

The conclusion of this BA will include a recommended determination of effect on federally-protected species and their habitat. Three possible determinations offered by the US Fish and Wildlife Service (USFWS) for the purpose of Biological Assessments and Evaluations are described below .

1. No effect – A “no effect” determination means that there are absolutely no effects from the proposed action, positive or negative, to listed species. A “no effect” determination does not include effects that are insignificant (small in size), discountable (extremely unlikely to occur), or beneficial.

2. May affect, not likely to adversely affect – A “may affect, not likely to adversely affect” determination may be reached for a proposed action where all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat (i.e., there cannot be a “balancing,” where the benefits of the proposed action would be expected to outweigh the adverse effects – see below). Insignificant effects relate to the size of the effects and should not reach the scale where take occurs. Discountable effects are those that are extremely unlikely to occur.

3. May affect, likely to adversely affect - A “may affect, likely to adversely affect” determination means that all adverse effects cannot be avoided. A combination of beneficial and adverse effects is still “likely to adversely affect” even if the net effect is neutral or positive.

1.4 Action Area

The Action Area of potential effect has been defined as “all areas to be affected directly or indirectly by the federal action and not merely the immediate area involve in the action” according to federal regulation (50 CFR 402.2). For the basis of this BA, the project’s Action Area was defined by the following parameters: 1) areas where construction activities would occur within the La Porte Complex; 2) areas where criteria air pollutants exceed significant impact levels (SIL); and 3) the wastewater effluent drainage channel and dilution area within the receiving water body, a portion of the San Jacinto Bay immediately adjacent to the La Porte Complex boundary (Figure 3).

Although the proposed project will require the erection of new process equipment and modification to existing process units, physical ground disturbance will be limited to the construction of the proposed furnace site. Equistar has also identified several areas of the La Porte Complex that will be used temporarily during construction of the proposed project, such as: a furnace contractor laydown and fabrication area, new equipment laydown, vendor trailers, and a fabrication area. As these areas would be utilized during the construction phase of the project, they are included in the project's Action Area.

The analysis of protected species likely to be affected by the proposed expansion project focused on impacts within the Project Site's Action Area. The Action Area is approximately 99-acres of land within the La Porte Complex and 3-acres of the San Jacinto Bay adjacent to the La Porte Complex property boundary. Land use and plant community types within the Action Area include process areas (fill or concrete), marshland, maintained grasses, mixed woodland, riverine, and open water. A significant portion of these habitats have historically been constructed, manipulated, or otherwise impacted by industrial activities.

2.0 Existing Conditions

2.1 General Environmental Information

This section provides applicable environmental characteristics for the general region in which the project is located.

2.1.1 General Region Information

According to the United States Department of Agriculture (USDA) Major Land Resource Area nomenclature, the proposed Project site is located within the Gulf Coast Prairies and Marshes eco-region of Texas which is in the Gulf Coastal Plain physiographic province of North America (USDA 2012). Because the majority of the river basins of Texas drain towards the Gulf of Mexico and this Major Land Resource Area (MLRA) receive more rainfall, there are multiple dynamic ecosystems within this MLRA including bays, estuaries, salt marshes, freshwater wetlands, tidal flats, marshes, and swamps as well as hardwood bottomlands, prairies, and oak mottes are common throughout this region. These ecosystems are home to an abundance and variety of wildlife including mammals, birds, reptiles, amphibians, fish, and invertebrates and are important breeding grounds and fish hatcheries.

2.1.2 Air Quality

La Porte, Texas is located within the Houston-Galveston-Brazoria Nonattainment Area for ozone and the proposed expansion project will trigger Nonattainment New Source Review (NNSR) for NO_x. NNSR will not be triggered for VOC. In addition, the estimated CO, NO_2, PM less than 10 microns in diameter (PM_{10}), and PM less than 2.5 microns in diameter ($PM_{2.5}$) emission increases associated with the proposed expansion will trigger PSD review. PSD will not be triggered for the remaining criteria pollutant, SO_2.

2.1.3 Land Use

Because of the abundant water resources, the rich soils, and the proximity to the coast, most of the native coastal prairie has been developed for commercial, industrial, or residential use; or is now planted pastureland for beef cattle grazing or cropland for rice, sugarcane, forage, and grain crops. Much of Harris County is part of the developed Houston metropolitan area. These land uses have reduced and fragmented habitat throughout the region. The proximity and access to the Gulf of Mexico through the Houston-Galveston Navigation Channel make Harris County one of the nation’s most important locations for deepwater transport and industrial development, particularly in the petrochemical industry.

The land use within the proposed project area is currently industrial development. Land use types within the surrounding areas are dominated by industrial development, with few remaining small areas of woodland and pastureland (Fry et al. 2006; Figure 4).

2.1.4 Climate

According to the Natural Resource Conservation Service (NRCS), the mean annual precipitation in the region is 59.88 inches (NRCS 2012). The mean annual growing season is 250 days. In winter, the average temperature is 54°F and average daily minimum temperature is 44°F. In summer, the average temperature is 82°F and the average daily maximum temperature is 91°F. Prevailing winds are from the south with an average speed of 11.8 miles per hour. Average humidity is 72 percent with a higher average humidity at night of 91 percent.

2.1.5 Topography

Harris County has generally low and flat terrain. The topography of the project area is flat, but is located near the Upper San Jacinto Bay which has a steep shoreline. The elevation of the project area is approximately 25 feet above sea level (Figure 5). Drainage is generally to the east into San Jacinto Bay via a system of onsite ditches.

According to the Federal Emergency Management Agency (FEMA) flood insurance rate map, the proposed construction site is located outside of the designated 100-year floodplain according to the FEMA Flood Insurance Rate Map (FIRM) Community Panel No. 48201C0935L, Revised June 18, 2007 (FEMA 2012). An area of the northeastern portion of the La Porte Complex is within the 100-year floodplain, near the barge dock and the stream that flows out to the Upper San Jacinto Bay; and in the extreme northeastern corner of the property. FEMA floodplain designation is demonstrated in Figure 6.

2.1.6 Geology

The specific geologic formation found in the area is the Beaumont Formation from the Cenozoic Era. The geologic units found within and surrounding the proposed project area are Beaumont Formation, areas predominantly clay (Qbc) and Beaumont Formation, areas predominantly sand (Qbs). The following are the descriptions of the geologic units provided by the USGS (USGS 2012):

> Beaumont Formation, areas predominantly clay is described as light- to dark-gray and bluish- to greenish-gray clay and silt, intermixed and interbedded; contains beds and lenses of fine sand, decayed organic matter, and many buried organic-rich, oxidized soil zones that contain calcareous and ferruginous nodules. Very light gray to very light yellow-gray sediment cemented by calcium carbonate present in varied forms, veins, laminar zones, burrows, root casts, and nodules. Locally, small gypsum crystals present. Includes plastic and compressible clay and mud deposited in flood basins, coastal lakes, and former stream channels on a deltaic plain. Disconformably overlies Lissie Formation. Thickness 5-10 meters (m) along north edge of outcrop; thickens southward in subsurface to more than 100 m.

> Beaumont Formation, areas predominantly sand is described as yellowish- to brownish-gray, locally reddish orange, very fine to fine quartz sand, silt, and minor fine gravel, intermixed and interbedded. Includes stream channel, point-bar, cravasse-splay, and natural levee ridge deposits, and clayey fill in abandoned channels. Forms poorly defined meander-belt ridges and pimple mounds aligned approximately normal to coast and 1-2 m higher than surround interdistributary silt and clay. Channel fill is dark brown to brownish-dark-gray, laminated clay and silt, organic -rich. Includes marine delta-front sand, lagoonal clay, and near-shore marine sand beneath and landward of bays along the coast. Interfingers with the interdistributary facies of Beaumont Formation and rests disconformably on Lissie Formation. Thickness 3-10 m on outcrop; thickens in southeastward in subsurface to more than 100 m.

2.1.7 Soils

The USDA Natural Resources Conservation Service (USDA-NRCS) soil units mapped within and surrounding the proposed project area are listed and described below in Table 1 (USDA-NRCS 2004).

Table 1- USDA NRCS Soil Units

NRCS Map Unit Symbol	NRCS Map Unit Name	USDA Classification				NRCS Hydric Soil
		Depth	Drainage	Permeability	Landform	
Ad	Addicks loam	Deep	Poorly drained	Moderate	Coastal prairies	Partially hydric
Am	Aldine very fine sandy loam	Deep	Somewhat poorly drained	Very slow	Coastal plains	Not hydric
AtB	Atasco fine sandy loam – 1 to 4 percent slopes	Deep	Moderately well drained	Very slow	Coastal plains	Not hydric
Be	Bernard-Edna complex	Deep	Somewhat poorly drained	Very slow	Upland prairies	Partially hydric
Md	Verland silty clay loam	Very deep	Somewhat poorly drained	Very slow	Coastal uplands	Partially hydric

2.1.8 Water Resources

The project area is immediately west of Upper San Jacinto Bay, which is part of the San Jacinto River. The San Jacinto River flows into Galveston Bay approximately 6 miles southeast of the project area; Galveston Bay is a large estuary connected to the Gulf of Mexico.

The La Porte Complex is located within the Buffalo-San Jacinto Watershed (Hydrologic Unit Code 12040104), near its boundary with the West Galveston Bay watershed and the North Galveston Bay Watershed (USEPA 2012).

The National Wetlands Inventory (NWI) indicates the presence of a freshwater emergent wetland in the north-central portion of the La Porte Complex, as well as several man-made freshwater ponds within the property. The feature identified by the NWI as a freshwater emergent wetland is outside of the Action Area (as described in Section 3.1 and shown in Figure 7) and the features identified by the NWI as freshwater ponds within the Action Area are wastewater treatment ponds. The Upper San Jacinto Bay is identified as an estuarine and marine deepwater feature. Outfall #004 discharges into an unnamed tidal ditch that flows into the Bay, which is identified as an estuarine and marine wetland feature (USFWS 2012a; Figure 7).

The proposed expansion will include a discharge to the San Jacinto Bay (Segment ID: 2427), which is on the Section 303(d) state list of impaired streams. It does not have a defined total maximum daily load (TMDL) limitation as of the 2010 Texas Integrated Report. The water body is listed as impaired because it does not meet applicable water quality standards for dioxin and polychlorinated biphenyl (PCB) in edible tissues. These constituents of concern are not handled at the facility and will not contribute to the proposed water discharge. TPWD does not identify any designated Ecologically Unique River and Stream Segments in the vicinity of the project (TPWD 2012).

2.1.9 Vegetation

Historically, the native plant community of the region was Coastal Prairie, which is a tallgrass prairie with scattered trees. Most of the native coastal prairie has been converted to pastureland, cropland, or residential, urban, commercial, and industrial development. The project area has been heavily developed. The National Land Cover Database (NLCD) classifies the project area as primarily Developed High Intensity, Developed Medium Intensity, Developed Low Intensity, and Developed Open Space. Small areas of undeveloped land in the northwest and southwest portions of the project area are classified as mixed forest and pasture/hay (Multi-Resolution Land Characteristics Consortium 2012).

2.2 Protected Species

2.2.1 Threatened or Endangered Species List

The USFWS and the National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NMFS) regulate the Endangered Species Act (ESA) of 1973. “The purpose of the ESA is to protect and recover imperiled species and the ecosystems on which they depend.” Imperiled species specifically includes those listed by the USFWS as threatened or endangered. Candidate species are those “the [US]FWS has enough information to warrant proposing them for listing but is precluded from doing so by higher listing priorities.” Candidate species are not specifically protected by the ESA, but will be included for the purposes of this BA.

Section 9 of the ESA prohibits the “take” of threatened and endangered species. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." “Harm” is defined as “an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”

The USFWS lists only one threatened or endangered species within Harris County (USFWS 2012b), the Texas prairie dawn (*Hymenoxys texana*). The Texas Parks and Wildlife (TPWD) lists an additional six species with federal threatened or endangered species status in Harris County (TPWD 2009): Houston toad (*Bufo houstonensis*), red-cockaded woodpecker (*Picoides borealis*), whooping crane (*Grus americana*), smalltooth sawfish (*Pristis pectinata*), Louisiana black bear (*Ursus americanus luteolus*), and red wolf (*Canis rufus*). Preliminary consultation with NMFS indicated the potential for sea turtles to occur within the Upper San Jacinto Bay. Therefore, the following five additional species will be evaluated: green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricate*), Kemp’s ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), and loggerhead sea turtle (*Caretta caretta*).

2.2.2 Threatened or Endangered Species Descriptions

Texas Prairie Dawn (Hymenoxys texana)

The Texas prairie dawn is federally listed as an endangered species. It is a small, tap-rooted, annual plant with extant populations known only from western Harris County and extreme eastern Fort Bend County, west of the city of Houston, Texas (USFWS 1989, Poole et al. 2007). The Texas prairie dawn is found in small, sparsely vegetated areas, described a slick spots, on the lower sloping portion of pimple (mima) mounds or on the level land around the mound's base. The soils that comprise the pimple mounds are sandier than the soils of the surrounding flat areas and are sticky when wet, and powdery when dry. The Texas prairie dawn flowers from late February to early April, and may be the dominant plant in its microhabitat in late winter and early spring. Plants may be senescent during the summer. According to the USFWS recovery plan, the primary threat to the Texas prairie dawn is habitat destruction owing to housing development and roadway construction in western and northwestern Harris County.

Green Sea Turtle (Chelonia mydas)

The green sea turtle can grow to 4 feet in length and reported weights vary from 350-850 pounds. The carapace is smooth and keelless, and the color varies with shades of black, gray, green, brown, and yellow. Adults are herbivorous. Hatchlings are omnivorous.

Green sea turtles occupy three ecosystems according to lifestage: terrestrial zone, neritic zone, and oceanic zone. The terrestrial zone is occupied briefly during nesting and hatching activities. Hatchlings move out to the oceanic zone until their carapace reaches approximately 20-25 centimeters in length. Juveniles and adults primarily occupy benthic feeding grounds in shallow, protected waters. Preferred feeding grounds include pastures of seagrasses and/or algae.

Green sea turtles have a worldwide distribution in tropical and subtropical waters. The nesting season in the southeastern US is June through September. Nesting is nocturnal and occurs in 2, 3, or 4-year intervals. Females nest an average of 5 times per season at 14 day intervals. Hatchlings typically emerge at night. Approximately 200 to 1,100 females are estimated to nest on US beaches. Nesting occurs on high energy oceanic beaches, primarily on islands with minimal disturbance. Green turtles return to the same nesting site and are known to travel long distances between foraging areas and nesting beaches.

Breeding populations of green sea turtles in Florida and on the Pacific coast of Mexico are federally listed as endangered; all other populations, including those on the Texas coast, are listed as threatened (NMFS-USFWS 1991). Green sea turtles have been observed within Galveston Bay, which is approximately 28 miles south of the project site, as recent as 2012. These sea turtle species utilize the area for seasonal foraging (Galveston Bay Estuary Program [GBEP] 2004a).

Hawksbill Sea Turtle (Eretmochelys imbricate)

The USFWS describes the hawksbill sea turtle as a small to medium-sized marine turtle with a reddish-brown carapace. The head is relatively small with a distinctive hawk-like beak. The adult hawksbill is commonly 2.5 feet in length and weighs between 95 to 165 pounds.

Hawksbill hatchlings live in a pelagic environment, specifically in the weedlines that accumulate at convergence zones. Juveniles will return to a coastal environment when their carapace reaches approximately 20-25 centimeters in length. Juveniles and adults will spend most of their time in their primary foraging habitat, coral reefs. The hawksbill feeds primarily on sponges.

Hawksbill turtle nesting occurs sometime between April and November. Nesting is nocturnal and occurs every 2 to 3 years, 4 to 5 times per season, approximately every 14 days. Preferred nesting habitat includes low and high energy beaches in tropical oceans. Nesting habitat is often shared with green sea turtles. Hawksbills can traverse beaches limited to other species of sea turtles with their ability to traverse fringe reefs. Hawksbills have a tolerance for a variety of nesting substrates and often build their nests under vegetation.

The hawksbill is found in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. Hawksbills are typically associated with rocky areas and coral reefs in water less than 65 feet. Mexico is now considered the most important region for hawksbills in the Caribbean yielding 3,000 to 4,500 nests/year. The Hawksbill is an occasional visitor to the Texas coast (NMFS-USFWS 1993). Hawksbill sea turtles' favored habitat is coral reefs and they are not known to occur within Galveston Bay (GBEP 2004a).

Kemp's Ridley Sea Turtle (Lepidochelys kempii)

The Kemp's ridley sea turtle is considered the smallest sea turtle with an olive-gray carapace and a triangular shaped head and a hooked beak. Adults can grow to about 2 feet in length and weigh up to 100 pounds. This turtle is a shallow water benthic feeder with a diet consisting primarily of shrimp, jellyfish, snails, sea stars, and swimming crabs.

Kemp's ridleys, similar to loggerhead sea turtles, occupy three ecosystems according to lifestage: terrestrial zone, neritic zone, and oceanic zone. The terrestrial zone is occupied briefly during nesting and hatching activities. Hatchlings move out to the oceanic zone for an average of 2 years. Juveniles and adults primarily occupy the neritic zone (nearshore marine environment).

Most nesting occurs on the eastern coast of Mexico, however a small number consistently nest at Padre Island National Seashore in Texas and various other locations along the Gulf and lower Atlantic coasts. Nesting occurs from May to July during daylight hours. Large numbers of females emerge for a synchronized nesting event referred to as "arribada". Arribadas are thought to be caused by female pheromone release, offshore winds, and/or lunar cycles. Females nest up to 4 times per season at intervals of 10 to 28 days. The preferred nesting beaches are adjacent to extensive swamps or large bodies of open water.

The Kemp's ridley turtles range includes the Gulf coasts of Mexico and the US, and the Atlantic coast of North America as far north as Nova Scotia and Newfoundland (NMFS 2010). Kemp's ridley sea turtles have been observed within Galveston Bay , which is approximately 28 miles south of the project site, as recent as 2012; they are known to utilize the area for seasonal foraging (GBEP 2004a).

Leatherback Sea Turtle (Dermochelys coriacea)

The leatherback sea turtle is the largest sea turtle. The adult leatherback can get up to 8 feet in length and up to 2000 pounds. The turtle lacks a "normal" turtle shell and is covered by firm, rubbery skin that is approximately 4 inches thick. Coloration is predominantly black with varying degrees of pale spotting; including a notable pink spot on the dorsal surface of the head in adults. Their diet is primarily jellyfish and salp, but it is also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed.

Leatherbacks are highly migratory and the most pelagic of all sea turtles. Females prefer high energy, sandy beaches with vegetation immediately upslope and a beach sloped sufficiently so the crawl to dry sand is not too far. Preferred beaches have deep, unobstructed oceanic access on continental shorelines.

In the United States, nesting occurs from March to July. Females nest on average 6 times per season at 10 day intervals. Most leatherbacks return to their nesting beaches at 2 to 3- year intervals.

Distribution is worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. The leatherback is also found in small numbers as far north as British Columbia, Newfoundland, and the British Isles and as far south as Australia and Argentina. The leatherback has a small presence in the US with most nesting occurring on the Florida east coast, Sandy Point, US Virgin Islands, and Puerto Rico (NMFS 1992).

Leatherback sea turtles are most commonly found in deep water habitats and are not known to nest in Galveston Bay (USFWS 2012c). Leatherback sea turtles would not be expected to utilize habitat in the vicinity of the project.

Loggerhead Sea Turtle (Caretta caretta)

The loggerhead sea turtle is a reddish-brown marine turtle characterized by a large head with blunt jaws. Adults can be up to 500 pounds and 4 feet in length. Adult loggerheads feed on jellyfish, floating egg clusters, flying fishes, mollusks, crustaceans, and other marine animals.

Loggerheads occupy three ecosystems according to lifestage: terrestrial zone, neritic zone, and oceanic zone. The terrestrial zone is occupied briefly during nesting and hatching activities. Hatchlings move out to the oceanic zone until their carapace reaches approximately 40-60 centimeters in length. Juveniles and adults primarily occupy the neritic zone (nearshore marine environment).

The nesting season in the US is May through August. Nesting occurs every 2 to 3 years and is mostly nocturnal. Females can nest up to 5 times per season at intervals of approximately 14 days. Hatchling emergence is mostly nocturnal. Loggerheads nest on oceanic beaches between the high tide line and dune fronts and occasionally on estuarine shorelines with suitable sand. Females prefer narrow, steeply sloped, coarse-grained beaches.

Distribution of the loggerhead includes the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Although the majority (~80%) of the US nesting activity occurs in south Florida, loggerheads nest along the Gulf and Atlantic coastlines from Texas to Virginia. Loggerheads are considered an occasional visitor to Texas (NMFS 2008). Loggerhead sea turtles have been observed within Galveston Bay, which is approximately 28 miles south of the project site, as recent as 2012. These sea turtles utilize the area for seasonal foraging (GBEP 2004a).

Houston Toad (Bufo houstonensis)

Houston toad adults can reach 3.5 inches in length. Their coloration can vary from light brown to gray and tend to show small dark spots on the ventral side. Males are identified by a darkened throat patch that can appear blue when inflated. Adults and juveniles are insectivorous.

Houston toad adults burrow in deep sandy soils that support loblolly pine (*Pinus taeda*), yaupon (*Ilex vomitoria*), post oak (*Quercus stellata*), blue jack or sandjack oak (*Quercus incana*), and little bluestem (*Schizachyrium scoparium*) during winter and summer seasons. Temporary pools of water must be available for breeding.

Houston Toads breed from January to June. Males reach sexual maturity after 1 year, and females become sexually mature after 2 years. Females can lay several thousand eggs that are fertilized externally by males. Eggs hatch within 7 days. Toadlets are approximately 0.5 inch long and metamorphose within 15-100 days. Timing depends on the magnitude of predatory threat, water temperature and pond desiccation rates.

Houston toads are federally listed as endangered and have been extirpated across the Houston area (Harris, Fort Bend, and Liberty Counties) since the 1960s after undergoing severe drought and massive habitat loss/ conversion (USFWS 2012d). According to TXNDD, the last known sighting was in 1976 approximately 11 miles southwest from the project site. Bastrop and Burleson Counties have been designated critical habitat, 42 FR 27009 27011, since 1978.

Red-cockaded Woodpecker (Picoides borealis)

Red-cockaded woodpeckers can grow to 7 inches in length with a wingspan of about 15 inches. Typical coloration consists of a distinguished black cap and nape with large white cheek patches. Black barring with white horizontal stripes can be readily identified on the back. They are primarily insectivorous with the occasional consumption of fruits.

Red-cockaded woodpeckers occupy mature, old-growth pine forests with preference for longleaf pines (*Pinus palustris*). It takes approximately 1–3 years to fully excavate a cavity. A typical group territory ranges from 125–200 acres, which is related to habitat suitability and population density.

Red-cockaded woodpeckers are territorial, cooperative breeders. Only one pair will breed each year from a group of 3–9 members. They nest from April through June. Females generally lay 3–4 eggs which incubate for 10–12 days. Nestlings will remain in the cavity for approximately 26 days.

Red-cockaded woodpeckers are federally listed as endangered. There are approximately 6,000 groups left. They can be found in eleven states extending from Florida to Virginia and west to southeast Oklahoma and eastern Texas (USFWS 2012d). This is representative of approximately 1% of their historical range in the United States due to the replacement of old-growth forests and the suppression of periodic fires.

Whooping Crane (Grus americana)

The whooping crane can approach 5 feet in height with a wingspan of 8 feet. Adults are snowy white with black primary feathers and a bare red face and crown. The bill is typically a dark olive-gray that becomes lighter during breeding season. Immature cranes have a reddish coloration that appears mottled by the growing white feather bases. Whooping cranes are insectivorous, carnivorous, and frugivorous.

Whooping cranes occupy saltmarshes during the winter and poorly drained wetlands in the summer. Whooping cranes migrate in September and reach wintering grounds by October or November (USFWS 2012d).

Whooping cranes are monogamous and return to the same breeding territory. Adults reach sexual maturity at 4-5 years of age. Nests are constructed from sedges, bulrushes, and cattails. Females lay 1-3 eggs in April and May. Eggs incubate for 30 days. Typically, only one chick survives.

Whooping cranes are federally listed as endangered as a consequence of hunting, low genetic diversity, human disturbance and loss of critical wetland habitat. Colorado, Idaho, Kansas, Nebraska, New Mexico, Oklahoma, and Texas have been designated critical habitat. The historic range extended from the Arctic coast to south-central Mexico. Currently there are two distinct migratory populations (USFWS 2012d). One population winters along the southeastern United States and summers in central Wisconsin. The other group winters along the Gulf Coast of Texas at Aransas National Wildlife Refuge and summers in northwestern Canada. Small, non-migratory populations are located in central Florida and coastal Louisiana. According to TXNDD, there are no recorded sightings within an approximate 11 mile radius from the project site.

Smalltooth sawfish (Pristis pectinata)

The smalltooth sawfish can grow to 20 feet in length. The long, flat snout lined with pairs of teeth is a defining characteristic. Smalltooth sawfish feed primarily on fish and occasionally on crustaceans.

The smalltooth sawfish typically inhabit sheltered bays and shallow banks of estuaries (National Oceanographic and Atmospheric Administrations (NOAA) 2011). Lagoons, bays, mangroves, and shallow reefs are suitable habitat types. Habitat can include a wide range of salinity, temperature, and depth. The smalltooth sawfish reaches maturity after approximately 10 years. Females are ovoviviparous and produce litters of 17 pups.

The smalltooth sawfish is federally listed as endangered due to habitat conversion and bycatch. It is extirpated from large areas of its range. The historical distribution in the United States extended along the shores from Texas to New York (NOAA 2012). Charlotte Harbor Estuary Unit and the Ten Thousand Islands/ Everglades Unit are designated critical habitat, 74 FR 45353.

Louisiana Black Bear (Ursus americanus luteolus)

The Louisiana black bear can reach 7 feet in height. Typically, males can weigh up to 400 pounds, and females weigh up to 200 pounds. They have long black hair and a short tail. Their muzzle is yellowish-brown with an occasional white patch on the lower throat and chest. They have a distinguishable long, narrow cranium and proportionally large molar teeth. Juveniles and adults are omnivorous.

Louisiana black bears occupy high-quality, productive bottomland forests. Important habitat characteristics include escape cover, travel corridors, den sites, and minimum human disturbance (USFWS 2012e). During the winter, hollow trees, brush piles, and ground nests are utilized as den sites.

Females reach sexual maturity around 3-5 years. Louisiana black bears give birth to 1-3 cubs in winter. Cubs have their first emergence from the den in spring, and they den with the mother through their first winter.

Louisiana black bears are federally listed as threatened and have been extirpated throughout much of their range (USFWS 2012d). Louisiana river basins are designated critical habitat, 74 FR 10350 10409. Human encroachment, habitat fragmentation, and hunting have contributed to the population decline.

Red Wolf (Canis rufus)

The red wolf can reach 65 inches in length including the tail. Coloration is typically brown with some buff coloration. The tail is black-tipped. This species can weigh between 45-80 pounds and are primarily carnivorous.

The red wolf occupies wetlands, pine forests, upland shrublands, and crop lands. Wooded areas are required for denning and pup rearing. Hunting corridors extend along edge interface habitat. A pack consists of 7 animals with an alpha pair. A specific home range is actively defended.

The red wolf becomes sexually mature after 2 years. Breeding season occurs from January to March. An alpha female will normally produce a litter size of 5 pups once a year. First emergence from the den occurs when the pups are at least 4 weeks old and begin to hunt after 12 weeks. Hybridization has occurred with coyote (*Canis latrans*).

The red wolf is federally listed as endangered and has been extirpated from the historical range in the south central Texas area extending to Florida, and north to south central Maine. The current range extends from North Carolina to Tennessee and along the south eastern states. Predator control alongside fragmentation and loss of habitat has critically suppressed populations of red wolves.

2.2.3 Other Protected Species and Habitat

Designated Critical Habitat

The nearest critical habitat designated by the USFWS is on the Bolivar Peninsula and Galveston Island, approximately 30 miles south-southeast of the project area. These shoreline areas are designated critical habitat for piping plovers (USFWS 2012f).

Marine Species Habitat

The USFWS and NMFS regulate the Marine Mammal Protection Act (MMPA) of 1972. The MMPA prohibits the "take" of marine mammals in US waters or by US Citizens outside US waters and the importation of marine mammals or marine mammal products into the US. "Take" is defined as "hunt, harass, capture, or kill." The most commonly occurring marine mammal in Galveston Bay is the bottlenose dolphin. The navigation channels in Galveston Bay provide a year round deepwater habitat for this species (GBEP 2004b).

2.2.4 Texas Natural Diversity Database Results

A records review of the Texas Natural Diversity Database (TXNDD) was completed for the proposed project area and surrounding areas by the TPWD on March 28, 2012. The following areas were included in the review: Bacliff, Friendswood, Highlands, Jacinto City, La Porte, League City, Mont Belvieu, Morgan Point, and Pasadena quadrats. No elements of occurrence (EO) are located within the proposed project area, which means that TXNDD has no records of any observations of state or federally-listed species in the vicinity (~11 mile radius) of the project site. EO data are demonstrated in Figure 8.

2.2.5 Protected Species Evaluated

The protected species evaluated in this document include threatened, endangered, and candidate species listed by the USFWS, species listed as federally threatened or endangered by TPWD, and marine mammals. Table 2 summarizes all the species considered in this BA.

Table 2- Federally Protected Species Evaluated in the BA

Protected Species	Classification- Reason for Evaluation
Federal List of T&E Species (Harris County)	
Texas Prairie Dawn	Listed by USFWS as Endangered in Harris County
Green Sea Turtle	NMFS Consultation and Listed by USFWS as Threatened, possibly occurring in San Jacinto Bay.
Hawksbill Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.
Kemp's Ridley Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.
Leatherback Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.
Loggerhead Sea Turtle	Listed by USFWS and NMFS as Threatened, possibly occurring in San Jacinto Bay.
State-recognized List of Federal T&E Species (Harris County)	
Houston Toad	Listed by the Texas Parks and Wildlife Department (TPWD) as Endangered in Harris County
Red-cockaded Woodpecker	Listed by the TPWD as Endangered in Harris County
Whooping Crane	Listed by the TPWD as Endangered in Harris County
Smalltooth Sawfish	Listed by the TPWD as Endangered in Harris County

Protected Species	Classification- Reason for Evaluation
Louisiana Black Bear	Listed by the TPWD as Threatened in Harris County
Red Wolf	Listed by the TPWD as Endangered in Harris County
Bottlenose Dolphin	Listed as depleted by Marine Mammal Protection Act

3.0 Protected Species Habitat Evaluation and Analysis

URS completed a protected species habitat evaluation on June 7, 2012 to determine if habitat within the La Porte Complex was likely to support any of the federally protected species potentially occurring in Harris County. The majority of the La Porte Complex is in active industrial use. In-use process areas and other filled portions of the facility would not provide habitat and were not included in the survey. The field evaluation included a pedestrian survey of the Project Action Area and other portions of the La Porte Complex that could provide potential habitat. Data were collected to describe vegetation communities and assess the potential for occurrence of protected species. A summary of the field survey data is provided in Appendix A. Photographs of the proposed project area and accessible surrounding areas are included as Appendix B.

3.1 Habitats Observed

Land use and plant community types within the La Porte Complex include marshland, maintained grasses, mixed woodland, open water, and riverine. A significant portion of these habitats have historically been constructed, manipulated, or otherwise impacted by industrial activities. As such, the majority of the La Porte Complex is concrete, caliche, or asphalt. Construction is proposed in industrial process areas and other developed areas of the complex. The existing process areas do not possess habitat with the potential to support any federally-protected species and were not evaluated. The area proposed for new construction of the ethylene cracking furnace is a caliche parking lot surrounded by industrial infrastructure and roadways. The project would also utilize existing construction laydown areas for a furnace contractor laydown and fabrication area, new equipment laydown, vendor trailers, and a fabrication area. These areas would be utilized during the construction phase of the project and are comprised of previously cleared and maintained areas consisting of caliche and crushed aggregate surfaces. No vegetation currently exists in the proposed furnace area and construction laydown areas. Areas of maintained grassed will be used for temporary construction activities. Plant community types observed within the La Porte Complex are described below.

Marshland – This habitat is a mosaic of emergent herbaceous and shrub vegetation and open water. Marshland occurs in an area being used as a land farm in the north-central portion of the property, the mouth of the unnamed drainage channel that flows out to Upper San Jacinto Bay near the dock, and in some drainage ditches and stormwater detention basins. Dominant species observed throughout this habitat included cattail *(Typha sp.*), common reed *(Phragmites australis*), eastern baccharis *(Baccharis halimifolia*), annual marsh elder *(Iva annua*), bulrush *(Schoenoplectus sp.*), Chinese tallow *(Triadica sebifera*), black willow *(Salix nigra*), and Brazilian vervain *(Verbena brasiliensis*).

The land farm, detention basins, and drainage ditches that support marsh vegetation are highly disturbed, created systems; the mouth of the stream at the Upper San Jacinto Bay has more natural marsh vegetation. Herons, ducks, and egrets were observed within areas of the marshland habitat. Snakes, amphibians, wild pigs, and coyotes were reported by facility operators to frequent these areas, but were not observed during the habitat evaluation. The observable quality of this habitat ranges from low to moderate, given the proximity to facility operations and land disturbance.

Maintained Grasses – Areas of maintained grasses were observed near the southern and northern edges of the property, and smaller areas occurred throughout the property. Most of these areas appear to be mowed at least monthly or bi-weekly, however the area in the northeast corner of the property appears to be mowed less frequently. Dominant species observed were primarily grasses such as Bermuda grass *(Cynodon dactylon*), St. Augustine grass *(Stenotaphrum secundatum*), and Johnson grass *(Sorghum halepense*). Canada goldenrod *(Solidago canadensis*), common sunflower *(Helianthus annuus*), and shrubs of Chinese tallow were also observed. Because of the quantity of introduced species, the observable quality of this habitat ranges from low to moderate.

Mixed woodland – This habitat consists of small, fragmented tracts of forest, found in the northeast and southwest corners of the property. Due to the relatively small size and location of the wooded areas in a highly modified landscape, they are dominated by species typical of previously disturbed areas. Dominant species include Chinese tallow, black willow, hackberry *(Celtis laevigata*), American elm *(Ulmus americana*), poison ivy *(Toxicodendron radicans*), southern dewberry *(Rubus trivialis*), Canada goldenrod, and great ragweed *(Ambrosia trifida*). The observable quality of this habitat ranges from low to moderate, considering the habitat fragmentation.

Open water – This habitat includes man-made retention ponds and the Upper San Jacinto Bay. Dominant species observed along the banks included eastern baccharis, annual marsh elder, Chinese tallow, Canadian goldenrod, Brazilian vervain, cattail, black willow, and common reed. The retention ponds are man-made habitats that are periodically maintained (cleared of vegetation).

The shoreline of the La Porte Complex is reinforced with stone riprap and has a dock for barges with a dredged channel. This vessel traffic and industrial use would limit the potential for this site as habitat for protected species. A heron and migratory birds were observed during the habitat evaluation.

Because the open water habitats have been man-made or altered, the observable quality of these open water habitats ranges from low to moderate.

Riverine – One area of riverine habitat was observed. A tidal channel is located on the northeast portion of the property and has the qualities of a natural, unaltered stream. This tidal channel is the unnamed tidal ditch referenced to in the TPDES permit. The facility’s maintained stormwater drainage and effluent discharge ditch (unnamed ditch) flow into the unnamed tidal ditch. The unnamed tidal ditch flows east to Upper San Jacinto Bay just south of the dock. This stream flows through a forested area out to open water – plant species found in these habitats are similar to those listed for the open water habitat.

Site access was limited at the mouth of the river, but the shoreline appears to be predominantly in a natural state that supports wetland vegetation. The observable quality of this habitat is considered moderate because of the natural meander of the ditch and the density and biodiversity of vegetation.

4.0 Assessment of Air Quality

The air quality analysis to demonstrate compliance with NAAQS PSD Increments is performed using computer models to simulate the dispersion of the emitted pollutants into the atmosphere and predict ground level concentrations at specified receptor locations in the area around the source of emissions. If the modeled concentration for a given pollutant and averaging period is less than the USEPA-specified SIL, the project is determined to have no significant impact on ambient air quality and no further analysis is required for that pollutant and averaging period. If the SIL is predicted by the model to be exceeded for a given pollutant, further modeling of the project emissions combined with existing emission sources in the area is required to estimate total ambient concentrations. The modeling must demonstrate that the total concentration, including an appropriate background, does not exceed the applicable NAAQS and PSD Increment.

4.1 Estimated Total Annual Emission Rate Overview

Trinity Consultants completed detailed pollutant emission calculations for the project in accordance with the Air Permit Amendment Application requirements. This BA does not include detailed estimated emission rates. Estimated emission rates and descriptions of emission calculation methods have been provided to the USEPA in both the GHG PSD permit application and the TCEQ NSR/PSD permit application. A summary, provided by Trinity Consultants, of the total estimated annual emission for PSD pollutants that would be emitted by the expansion project are provided in Table 3.

Table 3- Emission Point Summary

Emission Point Name	Air Pollutant Name	Air Pollutant Emission Rate (Tons per year)
Furnace 10	NO_X	24.09
	$PM_{10}/PM_{2.5}$	17.25
	SO_2	1.42
	CO	81.76
	VOC	2.41
Furnace 11	NO_X	24.09
	$PM_{10}/PM_{2.5}$	17.25
	SO_2	1.42
	CO	81.76
	VOC	2.41
Decoking Drum	CO	222.00
	VOC	0.02
	$PM/PM_{10}/PM_{2.5}$	0.37/0.37/0.25
Cooling Tower Fugitives	$PM/PM_{10}/PM_{2.5}$	7.53/4.78/4.78
	VOC	5.34
Analyzer Vent	NO_X	0.01
	VOC	0.17
	CO	0.01
ARU Flare Maintenance (Including Startups and Shutdowns)	NO_X	2.21
	VOC	5.66

Emission Point Name	Air Pollutant Name	Air Pollutant Emission Rate (Tons per year)
	CO	11.44
Elevated Flare Maintenance (Including Startups and Shutdowns)	NO_X	11.66
	VOC	27.82
	CO	60.62
QE-1 Vessel Cleaning	VOC	1.01
Wastewater System	VOC	1.55
Process Fugitives	VOC	86.18
Routine Maintenance	PM/PM_{10}	0.01
	VOC	0.01
	NH_3	0.01

Emissions resulting from gasoline and diesel-fueled vehicles and equipment during construction and maintenance are considered negligible. The project will not require a significant increase in vehicle and equipment use compared to current daily emissions for the ethylene manufacturing facility.

4.2 Area of Impact Dispersion Modeling

Trinity Consultants performed dispersion modeling of the proposed emissions of air pollutants from the proposed expansion project in accordance with the PSD Permit requirements. According to the USEPA, "dispersion modeling uses mathematical formulations to characterize the atmospheric processes that disperse a pollutant emitted by a source" (USEPA 2007). This section provides the methods and results of the dispersion modeling. The dispersion modeling performed by Trinity Consultants included only areas outside of the La Porte Complex property boundaries. The results of the modeling are provided as a summary of the maximum predicted concentrations. The project is subject to PSD review for NO_x, CO, and $PM/PM_{10}/PM_{2.5}$.

4.2.1 Methods

This section discusses air quality modeling, monitoring, presentation of these data, and how background concentrations were obtained. If the SIL was exceeded for a pollutant, a NAAQS and/or PSD Increment analysis was performed, and the appropriate background concentrations presented in this section were added to the modeling results to demonstrate compliance with the NAAQS primary and secondary standards and PSD Increments considering SIL concentrations. The modeling methods were provided by Trinity Consultants.

Table 4 - Standards for Comparison with Modeling for Criteria Pollutants

Pollutant	Regulation	Averaging Period	Modeling De minimis (μg/m^3)	Standard (μg/m^3)
SO_2	Chapter 112	30-min	20.4	1021
	NAAQS	1-hr	7.8	195
		3-hr	25	1300
		24-hr	5	365

Pollutant	Regulation	Averaging Period	Modeling De minimis ($\mu g/m^3$)	Standard ($\mu g/m^3$)
		Annual	1	80
	PSD Increment	3-hr	25	512
		24-hr	5	91
		Annual	1	20
	PSD Monitoring	24-hr	13	NA
NO_2	NAAQS	1-hr	7.5	188.7
		Annual	1	100
	PSD Increment	Annual	1	25
	Monitoring	Annual	14	NA
CO	NAAQS	1-hr	2000	40,000
		8-hr	500	10,000
	PSD Monitoring	8-hr	575	NA
PM_{10}	NAAQS	24-hr	5	150
	PSD Increment	24-hr	5	30
		Annual	1	17
	PSD Monitoring	24-hr	10	NA
$PM_{2.5}$	NAAQS	24-hr	1.2	35
		Annual	0.3	15
	PSD Increment	24-hr	1.2	9
		Annual	0.3	4
	PSD Monitoring	24-hr	4	NA

The model parameters specified for the modeled location, such as meteorological data, rural versus urban dispersion coefficients, and receptor grid are discussed below. Modeling was performed using the regulatory default options, which include stack heights adjusted for stack-tip downwash, buoyancy-induced dispersion, and final plume rise. Ground level concentrations occurring during “calm” wind conditions are calculated by the model using the calm processing feature. Regulatory default values for wind profile exponents and vertical potential temperature gradients are used since no representative on-site meteorological data are available. As per USEPA requirements, direction-specific building dimensions are used in the downwash algorithms.

AERMOD

Modeling was performed using the AMS/EPA Regulatory Model (AERMOD) (version number 12060). The AERMOD model was chosen because it is approved by the USEPA as a Preferred/Recommended model and is approved by the TCEQ modeling staff.

AERMOD is a steady-state plume dispersion model for assessment of pollutant concentrations from a variety of sources. AERMOD determines concentrations from multiple point, area, or volume sources based on an up-to-date characterization of the atmospheric boundary layer. The model employs hourly sequential preprocessed (AERMET) meteorological data to estimate concentrations. The AERMOD model is applicable to receptors on all types of terrain, including flat terrain, simple elevated terrain (below height of stack), intermediate terrain (between height of stack and plume height), and complex terrain (above plume height). In addition, AERMOD provides a smooth transition of algorithms across these different terrains. Therefore, AERMOD was selected as the most appropriate model for the air quality impact analysis for the proposed facility.

AERMAP

AERMOD uses advanced terrain characterization to account for the effects of terrain features on plume dispersion and travel. AERMOD's terrain pre-processor, AERMAP, imports digital terrain data and computes a height scale for each receptor from National Elevation Database (NED) data files. A height scale is assigned to each individual receptor and is used by AERMOD to determine whether the plume will go over or around a hill.

Building Wake Effects

The emission sources are evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the building was absent.

Direction-specific building dimensions and the dominant downwash structure parameters used as inputs to the dispersion models was determined using the BREEZE-WAKE/BPIP software, developed by Trinity Consultants, Inc. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 04274. BPIP-PRIME is designed to incorporate the concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents.

The output from the BPIP-PRIME downwash analysis lists the names and dimensions of the structures, and the emission unit locations and heights. In addition, the output contains a summary of the dominant structure for each emission unit (considering all wind directions) and the actual building height and projected widths for all wind directions. This information is then incorporated into the data input files for the AERMOD air dispersion model.

Terrain

The La Porte Complex is located east of Houston, Texas just west of the Upper San Jacinto Bay in Harris County. The terrain surrounding the La Porte Complex varies in elevation from 0 feet (0 meters) to 120 feet (36 meters) within 50 km of the Complex. The average elevation at the La Porte Complex is approximately 25 feet (7.62 meters) above mean sea level.

The receptor terrain elevations input into AERMAP are the highest elevations extracted from United States Geological Survey (USGS) Seamless database. The data extracted was 1 arc second (30 m) data for the Houston area. For each receptor, the maximum possible elevation within a box centered on the receptor of concern and extending halfway to each adjacent receptor was chosen. This is a conservative technique for estimating terrain elevations in that it ensures that the highest terrain elevations are accounted for in the analysis. Source and building elevations are extracted in the same manner, using interpolated elevation values.

Receptor Grid

In the air quality dispersion modeling analysis, the modeled ground-level concentrations were determined within four main Cartesian receptor grids. These four grids cover a region extending at least 25 kilometers (km) beyond the La Porte Complex sources. The grids are defined as follows:

- The “fenceline grid” is a discrete receptor grid with the receptors spaced at 25-meter (m) intervals along the Equistar property line.
- The “fine grid” contains 100-m spaced receptors extending at least 1 km from the sources under consideration, excluding the receptors within the fenceline grid.
- The “medium grid” contains 500-m spaced receptors extending 5 km from the sources under consideration, excluding the receptors within the fenceline and fine grids.
- The “coarse grid” contains 1-km spaced receptors extending at least 10 km from the sources under consideration, excluding the receptors in the fenceline, fine, and medium grids. If the sources have a significant impact beyond 10 km, a receptor grid extending up to 25 km will be used.

Meteorological Data

The meteorological data used in the models includes observed hourly wind speed, wind direction, temperature and numerous other parameters. This data is used, along with other inputs, by the models to determine the dispersion of the emissions from sources in the model input.

Monitoring Stations

The USEPA and TCEQ track air quality and pollutant emissions with the use of monitoring stations in various locations. Table 5 presents background concentrations for NO_2 and $PM_{2.5}$. The NO_2 measurements were recorded at the Channelview monitoring station, northwest of the project site. The $PM_{2.5}$ measurements were recorded at the Baytown monitoring station, northeast of the project site. The ambient monitoring data was obtained from the Texas Air Monitoring Information System web interface. These values represent the existing ambient air quality concentrations (TCEQ 2012).

Table 5 – Criteria Pollutant Monitoring Data Summary

Pollutant	Monitor ID	Site Name	Year	Data Points	98th percentile	Average
NO_2 Hourly (ppb)	482010026	Channelview	2009	8478	31.03	8.82
			2010	7688	32.74	10.10
			2011	8376	32.93	9.52
$PM_{2.5}$ 24-Hour (μg/m^3)	482010058	Baytown	2009	61	21.0	10.93
			2010	59	27.6	10.86
			2011	43	23.2	12.60

4.2.2 Results

Table 6 shows the maximum predicted concentrations due to the expansion project for each pollutant and averaging period. Note: These are not total ambient concentrations. These are predicted increases in ground level concentrations due to new emissions from the proposed project.

Table 6 – Maximum Predicted Concentrations

Pollutant	Averaging Period	Highest Modeled Concentration (μg/m^3)	Modeling Significance Level (μg/m^3)	Significant?
CO	1-hour	503.93	2,000	NO
	8-hour	276.56	500	NO
PM_{10}	24-hour	1.158	5	NO
$PM_{2.5}$	24-hour	1.158	1.2	NO
	Annual	0.190	0.3	NO
NO_2	1-hour	6.963	7.5	NO
	Annual	0.132	1	NO
SO_2	1-hour	0.200	7.8	NO
	3-hour	0.156	25	NO
	24-hour	0.072	5	NO
	Annual	0.014	1	NO

The SIL is a level set by the USEPA, below which, modeled source impacts would be considered insignificant. The highest modeled concentration value is the maximum ground level concentration outside of the La Porte Complex property boundary predicted by the model for each pollutant and averaging period resulting from this project. If a highest modeled concentration value is less than the SIL, the modeled source impacts are considered insignificant and are not considered to cause or contribute to a violation of a NAAQS or PSD Increment for that pollutant and averaging period. If a highest modeled concentration is greater than the SIL, additional analysis is required to demonstrate that the project would not cause or contribute to a violation of the NAAQS or PSD Increment for that pollutant and averaging period.

4.2.3 Conclusions

The highest modeled concentration values are less than the SIL for the evaluated areas, which are outside the La Porte Complex. Therefore, the source impacts are considered insignificant based on stringent limits set to protect the most sensitive human populations. Due to this predicted lack of significant impact to sensitive human populations, the source impacts are not expected to significantly impact federally-protected species outside of the La Porte Complex. Therefore, only impacts to protected species within the La Porte Complex from potential changes to air quality are considered.

4.3 Modeling within La Porte Complex

Additional modeling was conducted to determine if any criteria pollutant might exceed SILs within the boundaries of the La Porte Complex. The results are shown in Figure 9. PM is predicted to exceed SILs within the property boundary, near the cooling towers. Impacts to protected species outside of the area determined to exceed SILs for PM are unlikely.

5.0 Assessment of Water Quality

The water quality analysis included dilution modeling to predict the distance at which the effluent concentration would result in a 1% effluent within the ambient environment of the receiving water body (Upper San Jacinto Bay) and a toxicity assessment of the chemical constituents discharged from Outfall #004.

5.1 Estimated Discharge Increase

Equistar estimates a1.0 MGD increase in fresh water intake (from 4.0 MGD to 5.0 MGD) from the Trinity River for the proposed project. Total water discharges will increase by 0.2 MGD; the treated effluent flow from Outfall #004 and cooling tower blowdown are estimated to increase by 0.1 MGD each. The remaining 0.8 MGD is expected to evaporate.

5.2 Anticipated Discharge Concentrations

The concentrations of permitted chemical constituents in the treated effluent from Outfall #004 are below the authorized levels set forth by the TPDES permit for that outfall (Table 7 and 14). The proposed project will result in a larger total volume of discharge due to the process expansion, but because the process will not be changed, only expanded, concentrations of permitted chemicals in the discharge are expected to remain unchanged. The existing wastewater treatment facility is sufficient to treat the larger volumes of wastewater produced by the proposed project. The wastewater is synthetically augmented to maintain the appropriate biomass for effective secondary treatment. With the expanded wastewater, the amount of augmentation will be reduced to give similar treatment. The current and anticipated concentrations are well below the permitted limits.

Table 7 - Permitted Concentrations vs. Sampled Concentrations from 2012 vs. Anticipated Concentrations

Pollutant	Permit Limits (ug/L)	2012 Sample Results (ug/L)	Anticipated Sample Results (ug/L)
Acenaphthene	33.51	0.78	0.78
Acenaphthylene	33.51	0.95	0.95
Acrylonitrile	30.47	9.29	9.29
Anthracene	33.51	0.77	0.77
Benzene	77.25	2.07	2.07
Benzo(a)anthracene	2.26	0.58	0.58
3,4-Benzofluoranthene	34.66	0.63	0.63
Benzo(k)fluoranthene	33.51	0.33	0.33
Benzo(a)pyrene	2.26	0.52	0.52
Bis(2-ethylhexyl)phthalate	158.50	1.03	1.03
Carbon tetrachloride	21.57	2.76	2.76
Chlorobenzene	15.90	1.45	1.45
Chloroethane	152.23	2.50	2.50
Chloroform	26.22	2.74	2.74
2-Chlorophenol	55.68	0.97	0.97
Chrysene	22.54	0.66	0.66

Pollutant	Permit Limits (ug/L)	2012 Sample Results (ug/L)	Anticipated Sample Results (ug/L)
Di-n-butyl phthalate	32.40	1.03	1.03
1,2-Dichlorobenzene	92.59	1.25	1.25
1,3-Dichlorobenzene	24.98	1.09	1.09
1,4-Dichlorobenzene	15.90	1.04	1.04
1,1-Dichloroethane	33.51	2.00	2.00
1,2-Dichloroethane	119.83	2.38	2.38
1,1-Dichloroethylene	16.27	2.17	2.17
1,2-trans-Dichloroethylene	30.65	3.48	3.48
2,4-Dichlorophenol	63.60	1.01	1.01
1,2-Dichloropropane	130.62	1.82	1.82
1,3-Dichloropropylene	24.98	1.13	1.13
Diethyl phtalate	115.32	1.13	1.13
2,4-Dimethylphenol	20.42	1.33	1.33
Dimethyl phthalate	26.69	0.77	0.77
4,6-Dinitro-o-cresol	157.35	1.03	1.03
2,4-Dinitrophenol	69.87	0.89	0.89
2,4-Dinitrotoluene	161.87	1.07	1.07
2,6-Dinitrotoluene	364.11	1.20	1.20
Ethylbenzene	61.34	1.73	1.73
Fluoranthene	38.62	1.05	1.05
Fluorene	33.51	0.91	0.91
Hexachlorobenzene	0.06	0.90	0.90
Hexachlorobutadiene	10.00	1.15	1.15
Hexachloroethane	30.65	1.29	1.29
Methyl chloride	107.90	1.60	1.60
Methylene chloride	50.51	2.23	2.23
Naphthalene	33.51	0.85	0.85
Nitrobenzene	38.62	1.37	1.37
2-Nitrophenol	39.18	1.22	1.22
4-Nitrophenol	70.42	0.99	0.99
Phenanthrene	9.03	0.79	0.79
Phenol	14.75	0.70	0.70
Pyrene	38.02	0.90	0.90
Tetrachloroethylene	31.80	1.68	1.68
1,2,4-Trichlorobenzene	45.44	1.05	1.05
1,1,1-Trichloroethane	79.50	2.57	2.57
1,1,2-Trichloroethane	30.65	1.34	1.34
Trichloroethylene	30.65	2.12	2.12
Toluene	30.65	1.31	1.31
Vinyl chloride	152.23	2.48	2.48

5.3 Area of Impact Dilution Modeling

Dilution modeling was conducted to demonstrate compliance with TCEQ and EPA standards for aquatic life. The analysis was used to estimate the concentration of pollutants discharged into the aquatic environment and predict the area of the plume in Upper San Jacinto Bay. The dilution modeling was used to determine what portions of the aquatic environment to include within the Action Area. The plume area includes the area in the bay to a point of 1% effluent; at this point the project is determined to have no significant impact on federally threatened and endangered species. As described in Section 1.4, the Action Area includes the unnamed tidal ditch, which is located within the La Porte Complex property boundaries, and the portion of the San Jacinto Bay located immediately adjacent of the La Porte Complex boundaries, which is shown on Figure 3 as the dilution area.

5.3.1 Methods and Data

Parameters required for the dilution modeling include the width, depth, and flow rate in the unnamed tidal ditch, and the current speed and depth of the San Jacinto Bay. Width, depth, and flow rate within the unnamed tidal ditch were provided by Equistar, based on site observations and the average discharge from the January 2011 to July 2012 Discharge Monitoring Reports for the La Porte Complex. The current speed in Upper San Jacinto Bay was obtained from model results from the NOAA GBOFS hydrodynamic model of Galveston Bay. Depth of the San Jacinto Bay in the vicinity of the mouth of the discharge channel was assumed to be 6.8 feet in the model based on average near-shore depths in the area. Table 8 lists the data used in the model.

Table 8 - Effluent and San Jacinto Bay Hydraulics Data used in the Dilution Analysis

Width of Discharge Channel (ft)	25
Depth of Discharge Channel (ft)	2
Discharge Flow Rate (MGD)	0.812
Current Speed in Upper San Jacinto Bay near Discharge (ft/s)	0.58
Depth in Upper San Jacinto Bay near Discharge (ft)	6.8

No water quality data for chemical constituents contained in the Equistar discharge were available for San Jacinto Bay in the vicinity of the discharge point. However, sediment chemical composition data and total suspended sediment data were available in the vicinity of the discharge. Sediment quality data were obtained from TCEQ Surface Water Monitoring Information System database (http://www8.tceq.state.tx.us/SwqmisWeb/public/index.faces [November 28, 2012] for stations 16499, 17924 and 17923. The USGS database (http://waterdata.usgs.gov/nwis/rt) was also searched for monitoring data on the appropriate PAH, volatile, and semi-volatile chemicals that characterize the effluent and no results were found. The water quality concentrations were estimated from the benthic sediment quality data using Equation 1 below:

$$Cwt = Tss * Csed \qquad (1)$$

Cwt is the total estimated chemical constituent concentration (dissolved plus absorbed) in the water column (ug/L), Tss is the total suspended sediment concentration (mg/L) and Csed is the chemical constituent concentration of the benthic sediments (ug/mg). The use of Equation 1 assumes that the majority of the concentration in the water column is due to the re-suspension of the benthic sediments rather than industrial discharges into the river.

The concentration of suspended solids (TSS) is also necessary to estimate the water quality from sediment concentrations. Data on TSS were obtained from the same TCEQ database as sediment quality data. Table 9 provides the data used in the analysis. The 90th percentile value of 43.6 mg/L was used as a conservative but representative value.

Table 9 - TSS data used in the Dilution Analysis (mg/L)

Station ID	start date	end date	No. of Samples	Median value	Mean Value	standard deviation	Max Value	90th Percentile*
16499	10/13/1999	8/13/2008	12	19	21	14.2	63	24
17923	7/29/2002	4/20/2010	83	17	18	11.3	66	30
17924	7/29/2002	4/20/2010	83	28	34	22.2	112	65
Total			178	22.4	25.7	17.4	112	43.6

*The 90th percentile column refers to the distribution of collected data. 90% of the samples were less than or equal to the value.

The soil organic carbon-water partitioning coefficient (Koc) was used to identify pollutants that may be absorbed more strongly to sediment rather than in the dissolved phase. Koc is the ratio of the mass of a chemical that is absorbed in the soil per unit mass of organic carbon in the soil at equilibrium. It is the "distribution coefficient" (Kd) normalized to total organic carbon content (kd is the ratio of concentration of a chemical that is absorbed to the sediment to the concentration dissolved at equilibrium). Higher Koc values correspond to chemicals that more strongly absorb to sediments and lower Koc values correspond to chemicals more likely to occur in the dissolved phase. To determine the ratio of absorbed to dissolved concentration from Koc the fraction organic carbon on the sediment particles is needed. Total organic carbon data were obtained from the TCEQ database and are shown in Table 10. Sediment concentrations will result in an overestimation of chemical concentrations due to the nature of the chemicals. The rough correlation between sediment and water quality data is shown in Table 11. All current and anticipated concentrations are well below the ambient sediment concentrations.

Table 10 - Total Organic Carbon, (TOC), Sediment Dry Weight, (g/g)

Station ID	Date	Value
16499	8/22/2002	0.0139
16499	10/24/2002	0.0133
16499	3/19/2004	0.0121
16499	11/9/2004	0.0115
	Average	0.0127

Table 11 - Sediment and Water Quality Data used in the Dilution Analysis

Fraction organic carbon	0.013
Suspended Solids Concentration (mg/L)	43.600

Pollutant (1)	Permitted Daily Max (ug/L) (2)	2012 Sampling Results (ug/L) (3)	Bottom Sediment Concentration (ug/kg) (4)	Total Concentration in the Water Column (ug/L) (5)	Koc (L/Kg) (6)	kd (L/kg) (7)	Fraction Dissolved (8)
Acenaphthene*	33.51	0.78	170	0.00741	4,898	62.2	0.997
Acenaphthylene	33.51	0.95	170	0.00741	N/A	N/A	N/A
Acrylonitrile	30.47	9.29	50	0.00218	0.85	0.011	1
Anthracene	33.51	0.77	170	0.00741	23,493	298.4	0.987
Benzene	77.25	2.07	5	0.00022	62	0.787	1
Benzo(a)anthracene	2.26	0.58	N/A	N/A	N/A	N/A	N/A
3,4-Benzofluoranthene	34.66	0.63	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	33.51	0.33	170	0.00741	1,230,269	15,624	0.59
Benzo(a)pyrene	2.26	0.52	170	0.00741	62	0.787	1
Bis (2-ethylhexyl) phthalate	158.50	1.03	N/A	N/A	N/A	N/A	N/A
Carbon Tetrachloride	21.57	2.76	5	0.00022	152	1.93	1
Chlorobenzene	15.90	1.45	5	0.00022	224	2.845	1
Chloroethane	152.23	2.5	5	0.00022	33.113	0.421	1
Chloroform	26.22	2.74	5	0.00022	53	0.673	1
2-Chlorophenol	55.68	0.97	170	0.00741	129.936	1.65	1
Chrysene	22.54	0.66	170	0.00741	398,107	5,056	0.82
Di-n-butyl Phthalate	32.40	1.03	N/A	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	92.59	1.25	N/A	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	24.98	1.09	170	0.00741	295.121	3.748	1
1,4-Dichlorobenzene	15.90	1.04	170	0.00741	616.595	7.831	1

Pollutant (1)	Permitted Daily Max (ug/L) (2)	2012 Sampling Results (ug/L) (3)	Bottom Sediment Concentration (ug/kg) (4)	Total Concentration in the Water Column (ug/L) (5)	Koc (L/Kg) (6)	kd (L/kg) (7)	Fraction Dissolved (8)
1,1-Dichloroethane	33.51	2	5	0.00022	53	0.673	1
1,2-Dichloroethane	119.83	2.38	5	0.00022	38	0.483	1
1.1-Dichloroethylene	16.27	2.17	5	0.00022	616.595	7.831	1
1,2-trans-Dichloroethylene	30.65	3.48	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	63.60	1.01	170	0.00741	1202.3	15.269	1
1,2-Dichloropropane	130.62	1.82	5	0.00022	47	0.597	1
1,3-Dichloropropylene	24.98	1.13	N/A	N/A	N/A	N/A	N/A
Diethyl Phthalate	115.32	1.13	170	0.00741	446.684	5.673	1
2,4-Dimethylphenol	20.42	1.33	170	0.00741	208.93	2.653	1
Dimethyl Phthalate	26.69	0.77	170	0.00741	N/A	N/A	N/A
4,6-Dinitro-o-cresol	157.35	1.03	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrophenol	69.87	0.89	830	0.03619	32.666	0.415	1
2,4-Dinitrotoluene	161.87	1.07	170	0.00741	95.499	1.213	1
2,6-Dinitrotoluene	364.11	1.2	170	0.00741	69.183	0.879	1
Ethylbenzene	61.34	1.73	5	0.00022	204	2.591	1
Fluoranthene	38.62	1.05	170	0.00741	49,096	624	0.97
Fluorene	33.51	0.91	170	0.00741	7,707	98	1
Hexachlorobenzene	0.06	0.9	170	0.00741	80,000	1,016	0.96
Hexachlorobutadiene	10.00	1.15	170	0.00741	4,677	59	1
Hexachloroethane	30.65	1.29	170	0.00741	1778.279	22.584	1
Methyl Chloride	107.90	1.6	N/A	N/A	N/A	N/A	N/A
Methylene Chloride	50.51	2.23	10	0.00044	10	0.127	1
Naphthalene	33.51	0.85	170	0.00741	1191	15.13	1
Nitrobenzene	38.62	1.37	170	0.00741	119	1.511	1

Pollutant (1)	Permitted Daily Max (ug/L) (2)	2012 Sampling Results (ug/L) (3)	Bottom Sediment Concentration (ug/kg) (4)	Total Concentration in the Water Column (ug/L) (5)	Koc (L/Kg) (6)	kd (L/kg) (7)	Fraction Dissolved (8)
2-Nitrophenol	39.18	1.22	170	0.00741	114.815	1.458	1
4-Nitrophenol	70.42	0.99	830	0.03619	151.356	1.922	1
Phenanthrene	9.03	0.79	170	0.00741	#N/A	#N/A	#N/A
Phenol	14.75	0.7	170	0.00741	28.84	0.366	1
Pyrene	38.02	0.9	170	0.00741	67,992	863.5	0.96
Tetrachloroethylene	31.80	1.68	5	0.00022	265	3.366	1
1,2,4-Trichlorobenzene	45.44	1.05	170	0.00741	1659	21.069	1
1,1,1-Trichloroethane	79.50	2.57	5	0.00022	135	1.715	1
1,1,2-Trichloroethane	30.65	1.34	5	0.00022	135	1.715	1
Trichloroethylene	30.65	2.12	5	0.00022	94	1.194	1
Toluene	30.65	1.31	5	0.00022	140	1.778	1
Vinyl Chloride	152.23	2.48	10	0.00044	18.621	0.236	1

Note: Cells marked the N/A indicate values that are unknown.

*Sample Calculation: Cs = 170 ug/kg; Tss = 43.6 mg/L; Foc = 0.0127; Koc = 4,898 L/kg

Column (5) Ct = 170 ug (c)/kg (s) * 43.6 mg (s)/L (w) *kg(s)/1e6mg (s) = 0.00741 ug/L * 1000 ng/ug = 7.41 ng/L ÷ 1000 ug/L= 0.00741 ug/L

Column (7) Kd = Koc * foc = 4,898 L/kg *0.0127 = 62.2 L/kg

Column (8) $\text{fraction dissolved} = \frac{1}{1+43.6\frac{\text{mg}}{\text{L}}*62.2\frac{\text{L}}{\text{kg}}*1\frac{\text{kg}}{1000000\text{ mg}}} = 0.9973$

Analysis Methods

Two major stages of mixing can be identified for a waste discharge into a water body, the near-field and the far-field. In the near-field the discharge geometry and flow governs mixing, i.e. the initial momentum and buoyancy of the discharge determine the rate of dilution. In the far-field the effects of the initial momentum has dissipated, and the ambient turbulence and currents determine further mixing. In the far-field, mixing can occur during a buoyant spreading phase and a passive diffusion phase. In the buoyant spreading phase the buoyancy tends to damp mixing so mixing is generally small, the plume spreads laterally and thins out vertically. During the passive diffusion phase the plume diffuse in the horizontal and vertical directions. The plume enlarges thus becoming more dilute.

There are several length scales that can be calculated that relate to the size of plume to the bending of the jet and the amount of dilution expected in the near-field. However, due to the small momentum of the discharge at the La Porte Complex, all length scales indicate a minor near-field influence with minimal dilution. This is due to the small velocity of the discharge, estimated to be about 0.025 ft/s using the data in Table 1. Because the effluent discharge flow rate was minor compared to the volume and flow rates within San Jacinto Bay, the near-field was ignored and only dilution due to passive diffusion was calculated for the far-field.

The dilution due to passive diffusion can be calculated as (Jones, Nash and Jirka, 1996):

$$S = \frac{2b_v b_h}{L_m L_Q} \qquad (2)$$

Where b_v and b_h are the width and thickness of the plume. L_m is a length scale related to the distance from shore where the plume becomes bent over and L_Q is the distance over which the geometry of the discharge is imporant. When the plume fully occupies the water depth b_v is replaced by the water depth.

The depth and width of the plume were calucated using the following equations:

$$b_v = \left(\frac{\pi E_z x}{u_a} + b_{vi}^2\right)^{1/2} \qquad (3)$$

$$b_h = \left(\frac{\pi E_y x}{u_a} + b_{hi}^2\right)^{1/2} \qquad (4)$$

$$S = \frac{2\, bvbh}{Qo} * ua \qquad (5)$$

Where u_a is the current speed and b_{vi} and b_{hi} are the intial thickness and width, respectively. The vertical and horizontal diffusivities in Column 2 (Table 12), takes into account the friction velocity (u*) and the Darcy-Weisbach friction factor (f) for the river. For the analysis a value of 0.03 was used for the friction factor (f). This is equivalent to the familiar Mannings n value of 0.022. Equation 4 assumes that the discharge in the river is uninfluenced by the shoreline. Since the discharge is a shoreline discharge the principle of superposition results in the concentration in the plume being doubled at any distance x. Dilution is the mass balance between the flow through the plume and the discharge flow rate and is shown in Equation 5.

5.3.2 Results

Using the above relationships the calculated dilution is shown in Table 12. The velocity (0.58 feet/second) was chosen because it is the typical velocity for summer conditions, and the data indicates little difference between summer and winter relative to dilution. The initial width of the plume was assumed to be about 3 feet (1 meter). The percent effluent drops to less than 10% of the plume about 20 feet downstream of the discharge and when the plume is about 10 feet wide. The plume is less than 5% effluent less than 50 feet form the discharge when the plume is less than 15 feet wide. The plume is expected to occupy the entire water depth (about 6 feet deep) within about 150 feet of the discharge.

Table 12 - La Porte Complex Dilution of Discharge to San Jacinto Bay

Distance from Discharge point along Shore (ft) (1)	Width of Plume measured from shoreline (ft) (2)	Bulk Dilution (3)	% Effluent (4)
3.3	7.1	3.8	27%
6.6	7.8	5.3	19%
9.8*	8.4	6.8	15%
13.1	9.0	8.2	12%
16.4	9.6	9.6	10%
19.7	10.1	11.0	9.1%
23.0	10.6	12.4	8.1%
26.2	11.0	13.8	7.2%
29.5	11.5	15.2	6.6%
32.8	11.9	16.6	6.0%
36.1	12.4	18.0	5.6%
39.4	12.8	19.3	5.2%
45.9	13.6	22.1	4.5%
52.5	14.3	24.8	4.0%
59.0	15.0	27.6	3.6%
65.6	15.7	30.3	3.3%
72.2	16.3	33.1	3.0%
78.7	16.9	35.8	2.8%
85.3	17.5	38.6	2.6%
91.8	18.1	41.3	2.4%
98.4	18.7	44.1	2.3%
105.0	19.2	46.8	2.1%
111.5	19.7	49.6	2.0%
118.1	20.2	52.3	1.9%

131.2	21.2	57.8	1.7%
147.6	22.4	64.6	1.5%
164.0	23.5	71.5	1.4%
180.4	24.6	77.1	1.3%
196.8	25.6	80.3	1.2%
229.6	27.6	86.4	1.2%
262.4	29.4	92.0	1.1%
295.2	31.1	97.4	1.0%
328.0	32.7	102.4	1.0%
393.6	35.7	111.9	0.9%
459.2	38.5	120.5	0.8%
524.8	41.0	128.7	0.8%
590.4	43.5	136.3	0.7%
656.0	45.8	143.5	0.7%
820.0	51.1	160.1	0.6%
984.0	55.9	175.2	0.6%
1312.0	64.4	202.0	0.5%

Note: For Column 2, the vertical and horizontal diffusivities were calculated using the following variables:
E_z = 0.2 u*H; E_y = 0.6 u*H; u* = $(f/8)^5$*u_a; u_a = 0.58 ft/s (0.177 m/s); H = 6.79 ft (2.07 m); Qo = 1.26 ft^3/s

For the data used in the analysis E_z and E_y are equal to 0.004 m^2/s and 0.013 m^2/s respectively as shown below.
U* = (0.03/8)^.5 * 0.58 ft/s = 0.035 ft/s
E_z = 0.2 * 0.035 ft/s * 6.79 ft = 0.0475 ft2/s (0.0044 m2/s)
E_y = 0.6 * 0.035 ft/s * 6.79 ft = 0.142 ft2/s (0.0132 m2/s)

Sample Calculation for width and depth of the plume at 9.8 feet distance:

Half width: $\mathrm{bv} = \left(\frac{\pi * 0.0475 \frac{\mathrm{ft2}}{\mathrm{s}} * 9.84\mathrm{ft}}{0.58 \frac{\mathrm{ft}}{\mathrm{s}}} + (0.687\ \mathrm{ft})^2\right)^{.5}$ = 1.73 ft

Column (2): half width of plume $\mathrm{bh} = \left(\frac{\frac{(\pi * 0.142\ \mathrm{ft}^2}{\mathrm{s}} * 9.84\ \mathrm{ft}}{0.58\ \mathrm{ft/s}} + (3.15\ \mathrm{ft})^2\right)^{.5}$ = 4.18 ft

Based on Equation 4, the width was doubled so at 9.8 feet the width is 8.4 ft.

Column (3): Dilution $S = \frac{2 * 4.18\ \mathrm{ft} * 1.73\ \mathrm{ft}}{1.26 \frac{\mathrm{ft}^3}{\mathrm{s}}}$*0.58 = 6.66

The estimated concentration data in San Jacinto Bay and the measured concentrations in the effluent were used to estimate the average concentration in the plume. The concentration in the plume is a mixture of the concentration in the ambient water and the concentration in the discharge. The concentration in the plume was calculated using Equation 6 below. Table 13 shows the predicted concentrations in the plume for 10%, 5%, and 1% effluent.

$$\mathrm{Cp} = \frac{\mathrm{Co} + (\mathrm{D} - 1)\mathrm{Ca}}{\mathrm{D}} \qquad (5)$$

Cp = concentration in the plume (mg/L)
Co = concentration in the discharge (mg/L)

Ca = concentration in the ambient water (mg/L)

D = dilution (% effluent is 1/D)

Table 13- Predicted Concentration in the Discharge Plume For 10%, 5%, and 1% Dilution Values

Pollutant	2012 Sampling Results for Effluent (ug/L)	Bottom Sediment (ug/kg)	Total Concentration in San Jacinto Bay (ug/L)	10% effluent	5% effluent	1% effluent
Acenaphthene*	0.78	170	0.00741	0.085	0.046	0.015
Acenaphthylene	0.95	170	0.00741	0.102	0.055	0.017
Acrylonitrile	9.29	50	0.00218	0.931	0.467	0.095
Anthracene	0.77	170	0.00741	0.084	0.046	0.015
Benzene	2.07	5	0.00022	0.207	0.104	0.021
Benzo(a)anthracene	0.58	N/A	N/A	N/A	N/A	N/A
3,4-Benzofluoranthene	0.63	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.33	170	0.00741	0.04	0.024	0.011
Benzo(a)pyrene	0.52	170	0.00741	0.059	0.033	0.013
Bis (2-ethylhexyl) phthalate	1.03	N/A	N/A	N/A	N/A	N/A
Carbon Tetrachloride	2.76	5	0.00022	0.276	0.138	0.028
Chlorobenzene	1.45	5	0.00022	0.145	0.073	0.015
Chloroethane	2.5	5	0.00022	0.25	0.125	0.025
Chloroform	2.74	5	0.00022	0.274	0.137	0.028
2-Chlorophenol	0.97	170	0.00741	0.104	0.056	0.017
Chrysene	0.66	170	0.00741	0.073	0.04	0.014
Di-n-butyl Phthalate	1.03	N/A	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	1.25	N/A	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	1.09	170	0.00741	0.116	0.062	0.018
1,4-Dichlorobenzene	1.04	170	0.00741	0.111	0.059	0.018
1,1-Dichloroethane	2	5	0.00022	0.2	0.1	0.02
1,2-Dichloroethane	2.38	5	0.00022	0.238	0.119	0.024
1,1-Dichloroethylene	2.17	5	0.00022	0.217	0.109	0.022
1,2-trans-Dichloroethylene	3.48	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	1.01	170	0.00741	0.108	0.058	0.017
1,2-Dichloropropane	1.82	5	0.00022	0.182	0.091	0.018
1,3-Dichloropropylene	1.13	N/A	N/A	N/A	N/A	N/A
Diethyl Phthalate	1.13	170	0.00741	0.12	0.064	0.019
2,4-Dimethylphenol	1.33	170	0.00741	0.14	0.074	0.021
Dimethyl Phthalate	0.77	170	0.00741	0.084	0.046	0.015
4,6-Dinitro-o-cresol	1.03	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrophenol	0.89	830	0.03619	0.122	0.079	0.045

2,4-Dinitrotoluene	1.07	170	0.00741	0.114	0.061	0.018
2,6-Dinitrotoluene	1.2	170	0.00741	0.127	0.067	0.019
Ethylbenzene	1.73	5	0.00022	0.173	0.087	0.018
Fluoranthene	1.05	170	0.00741	0.112	0.06	0.018
Fluorene	0.91	170	0.00741	0.098	0.053	0.016
Hexachlorobenzene	0.9	170	0.00741	0.097	0.052	0.016
Hexachlorobutadiene	1.15	170	0.00741	0.122	0.065	0.019
Hexachloroethane	1.29	170	0.00741	0.136	0.072	0.02
Methyl Chloride	1.6	N/A	N/A	N/A	N/A	N/A
Methylene Chloride	2.23	10	0.00044	0.223	0.112	0.023
Naphthalene	0.85	170	0.00741	0.092	0.05	0.016
Nitrobenzene	1.37	170	0.00741	0.144	0.076	0.021
2-Nitrophenol	1.22	170	0.00741	0.129	0.068	0.02
4-Nitrophenol	0.99	830	0.03619	0.132	0.084	0.046
Phenanthrene	0.79	170	0.00741	0.086	0.047	0.015
Phenol	0.7	170	0.00741	0.077	0.042	0.014
Pyrene	0.9	170	0.00741	0.097	0.052	0.016
Tetrachloroethylene	1.68	5	0.00022	0.168	0.084	0.017
1,2,4-Trichlorobenzene	1.05	170	0.00741	0.112	0.06	0.018
1,1,1-Trichloroethane	2.57	5	0.00022	0.257	0.129	0.026
1,1,2-Trichloroethane	1.34	5	0.00022	0.134	0.067	0.014
Trichloroethylene	2.12	5	0.00022	0.212	0.106	0.021
Toluene	1.31	5	0.00022	0.131	0.066	0.013
Vinyl Chloride	2.48	10	0.00044	0.248	0.124	0.025

Note: Cells marked the N/A indicate values that are unknown.

* Sample Calculation for the 10% effluent: Cp = (0.78 ug/L + (10-1)*0.007412)/10 = 0.085
* Sample Calculation for the 5% effluent calculation: Cp = (0.78 ug/L + (20-1)*0.007412)/20 = 0.046
* Sample Calculation for the 1% effluent calculation: Cp = (0.78 ug/L + (100-1)*0.007412)/100 = 0.015

The dilution modeling used, and presented in Table 12, is a conservative model because it assumed that there was no mixing of effluent with surface water in the unnamed tidal ditch, and it also assumed that the depth of the San Jacinto Bay near the mouth of the discharge channel was only 6.8 feet deep. In reality, the effluent would be diluted within the discharge channel prior to entering the San Jacinto Bay, and the depth of the San Jacinto Bay near the mouth of the discharge channel increases to greater than 6.8 feet quickly due to the docking facilities. The result of this conservative modeling approach is that the modeling should overestimate the areal extent of the plume in the San Jacinto Bay.

5.3.3 Conclusions

As shown on Table 12, and discussed above, within approximately 300 feet of mouth of the unnamed tidal ditch, the plume only contains 1 % effluent, and the width of the plume has only expanded to 31 feet. Outside of this plume area, there is little mixing of the effluent with surrounding surface water. Due to the deflection of the plume along the shoreline, the entire Action Area for the San Jacinto Bay is confined to the portion of the Bay that is immediately adjacent to the La Porte Complex boundaries. This model was used because it is not proprietary software and is accessible to everyone.

Water column concentration data for these particular pollutants were not found in the TCEQ and USGS database. We obtained sediment data from the TCEQ as a general approach to identify ambient concentrations in the receiving water body, Upper San Jacinto Bay. Benthic sediment concentrations are an overestimate of the concentrations within the bay. However, this was the only publicly available data found. The effluent concentrations were sampled downstream of the wastewater treatment facility and are provided in Tables 11 and 13. As shown these tables, the majorities of chemicals within the effluent stream are below monitoring detection limits and are not anticipated to be present in the predicted discharge. The possibility exists that the effluent discharge could be cleaner than the receiving water body. The data represented is a conservative approach in understanding the characteristics of the effluent in a general comparison to the ambient conditions of the Upper San Jacinto Bay.

5.4 Toxicity Assessment

Wastewater that is generated on site and discharged is subject to effluent limitations set in TPDES Permit No. WQ0004013000. Multiple outfalls are utilized by the La Porte Complex; however, the proposed project will primarily affect Outfall #004 which is located west of the cooling towers and drains north. Outfall #004 is approximately 600 feet from the northern end of Ethylene Road. The treated process wastewater from Outfall #004 discharges to an unnamed, non-tidal drainage channel (unnamed ditch). This channel then becomes tidal (unnamed tidal ditch) prior to discharging to San Jacinto Bay in Segment No. 2427 of the Bays and Estuaries. The tidal portion of the unnamed tidal ditch and San Jacinto Bay contain aquatic life. Segment No. 2427 is currently listed on the State's inventory of impaired and threatened waters, Texas 2006 Clean Water Act Section 303 (d) list for elevated levels of dioxin, PCBs, and pesticides in fish tissue. The discharge from the La Porte Complex does not contain more than 0.6 ug/L of PCBs and does not contain dioxin or pesticides. The proposed project will not elevate dioxin, PCB, or pesticide concentrations in the impaired segment. The levels of permitted chemical concentrations discharged from the affected effluent are not expected to change and will remain within the TPDES limitations. As a result, the proposed project is not anticipated to require an amendment to the existing TPDES Permit (Permit No. WQ0004013000).

Based on a maximum permitted discharge, an assessment of the aquatic life impacts that would be associated with wastewater from the facility was performed using the TCEQ TexTox Menu 9 model. This model is used to calculate effluent discharge limitations to maintain the surface water quality standards based upon the most recent in stream criteria established in 30 Texas Administrative Code (TAC) 302.6 (c) and (d). Numerical water quality criteria were established by the TCEQ for specific contaminants where adequate toxicity information was available and have the potential to adversely impact the water in the state. Applicable criteria were developed in accordance with current USEPA guidelines for calculating site-specific water quality criteria. The current permitted water quality discharge limitations were created from the results of a series of effluent sampling as required for the most recent permit amendment. Mixing zone and toxicological assumptions are built into the model. Potential toxic effects on aquatic life, resulting from the wastewater discharge, were established by the TCEQ for specific toxic compounds where adequate toxicity information is available and that have the potential for exerting adverse impacts on water in the state. The appropriate criteria for aquatic life protection were derived in accordance with current USEPA guidelines for developing site-specific water quality criteria. The average monthly sampling of biological oxygen demand (BOD), pH, total suspended solids (TSS), total organic carbon (TOC), and oil and grease are shown in Table 14.

Table 14- Equistar-La Porte Complex Parameter Concentrations (ug/L) with Permit Limits in Parenthesis

Parameter	BOD	pH	TSS	TOC	Oil & Grease
(lbs/day)	**(848)***	**(6.0-9.0)**	**(1878)**	**(831)**	**(106)**
(ug/L)	**(39083.74)**		**(86555.75)**	**(38300.23)**	**(4885.47)**
12/01/11-12/31/11	1751.39	7.1-8.0	2488.82	7420.38	599.16
01/01/12-01/31/12	7466.47	6.7-7.9	13089.37	14840.76	691.34
02/01/12-02/29/12	2304.47	7.0-8.1	10324.01	12029.31	829.61
03/01/12-03/31/12	1843.57	7.1-8.0	4378.49	7328.20	506.98
04/01/12-04/30/12	1613.13	7.0-8.0	3226.25	7927.36	506.98
05/01/12-05/31/12	1613.13	7.2-8.3	7328.20	7051.67	3180.16

Note: lbs/day ÷ MGD ÷ 8.345= mg/L*1000= ug/L

* Sample Calculation =8.48 lbs/day ÷ 2.6 MGD ÷ 8.345 * 1000= 39,084 ug/L

The federal guidelines 40 CFR part 414 will regulate the process wastewaters and discharge point sources that use end-of-pipe biological treatment. 40 CFR part 313 will regulate the discharge of domestic wastewater. Discharge limitations within the current TPDES permit will remain the same. The La Porte Complex has conducted whole effluent toxicity testing over the past 5 years. The TCEQ has defined unique dilution factors to assess the unnamed ditch, the unnamed tidal ditch, and the San Jacinto Bay based on applicable discharge volumes, critical low flow, and harmonic mean stream flows. Based on preliminary data for an amended TPDES permit, freshwater criterion will be used for assessing the effluent discharge from the end-of-the-pipe for freshwater features and a marine criterion will be used for assessing tidal features. The Aquatic Life Surface Water Risk-Based Exposure Limits (SWRBELs) and National Pollutant Criteria Database were used to compare maximum discharge limitations as criteria for aquatic life. Applicable criteria were developed in accordance with current EPA guidelines for calculating site-specific water quality criteria. The Aquatic Organism Bioaccumulation Criteria was used to compare discharge limitations as a criterion for human health consumption of marine fish tissue. The TCEQ used data from the original TPDES permit application to determine current discharge limitations. Effluent dilutions, aquatic organism bioaccumulation, dissolved oxygen, toxicity of aquatic life, toxicity of human health in consumption of marine organisms were modeled using TCEQ guidelines and procedures. TCEQ requires whole effluent toxicity tests (WET tests) biomonitoring and "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organism, Third Edition" (EPA-821-R-02-014) in order to assess or control potential toxicity. Studies have shown that alternative test organisms used in WET testing are dependable, biological indicators of potential toxic effects and represent listed vertebrate species toxicologically (Mayer et al. 2008; Dwyer et al. 2005; Sappington et al. 2001). The biomonitoring analyses are done using a synthetic receiving stream because the Houston Ship Channel/Upper San Jacinto Bay water affects the organisms more than the facility's effluent. Seventeen chronic WET tests have been analyzed for Outfall #004 in the past 5 years. There has been only one example of significant lethality to Mysid shrimp (*Mysidopsis bahia),* which demonstrates the potential for effluent discharges to impact common invertebrate prey species. However, the documentation does not clearly define which dilution factor was used in the test, and the following test showed no significant lethality.

6.0 Potential Effects of the Proposed Action

This section presents the results of the analysis of potential impacts to federally protected species and state-recognized federal threatened and endangered species and/or their potential habitats with the defined Action Area (as defined in Section 1.4) for the proposed project. This analysis is based on the total emissions and dispersion modeling data provided by Trinity Consultants, dilution modeling, field survey and background review data collected by URS, and literature review and research of potential effects of known pollutants on flora and fauna. The following impact sources are included in the analysis:

- Air Quality;
- Water Quality;
- Noise Pollution;
- Infrastructure-Related Disturbance;
- Human-Related Disturbance; and
- Federally-Protected Species and Habitat Effects.

6.1 Potential Air Quality Effects

6.1.1 General Emissions Effects

According to USEPA's "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals," the data presented in Table 6 (Section 4.2.2) indicate the level, at or above which, airborne pollutant concentrations are known to cause significant impacts on flora and fauna. Concentrations at, or in excess of, any of the screening concentrations would indicate that the source emission may have adverse impacts on plants or animals. Pollutant concentrations predicted to be less than or equal to the SILs are expected to have no significant impact on flora and fauna. None of the modeled pollutant concentrations would exceed the SILs at receptors located outside of the La Porte Complex; therefore, no significant impacts are anticipated from air pollution offsite.

In general, it is commonly understood that air pollution has a greater impact on lower life forms than higher life forms. Lower life forms that would likely be the first to be impacted would include lichens, bryophytes, fungi, and soft-bodied aquatic invertebrates. Impacts to higher life forms are typically the result of indirect impacts to the food chain and reproduction, with the exception of extreme exposure. Potential indirect impacts include acidification, changes in food or nutrient supply, or changes to biodiversity and competition. Plant communities are less adaptable to changes in air pollution than animals. Animals typically have the ability to migrate away from unfavorable conditions.

6.1.2 Nitrogen

The Nature Conservancy and the Institute of Ecosystem Studies have published two documents that describe the known effects of airborne nitrogen and other airborne pollutants on various ecosystems in the eastern US. Airborne nitrogen dioxide is known to be converted into acid particles or acid precipitation. Both forms are deposited onto soils, vegetation, and surface waters.

The potential effects of airborne nitrogen dioxide on terrestrial ecosystems are generally long-term effects as opposed to short-term effects. Many soils are buffered against acid inputs; therefore, biodiversity losses are not immediately evident. The deposition of nitrogen can result in nitrate leaching, which can cause acidification of soils and surface waters as well as the release of aluminum, calcium, and magnesium. Arthropods with high-calcium needs are some of the animals inhabiting the soil that can be impacted by soil acidification. The release of aluminum into soil water from nitrate leaching can harm plant roots. The leaching of aluminum into surface waters can be toxic to aquatic plants, fish, and other aquatic organisms. The accumulation of nitrogen can impact plant species competition, thereby impacting community composition. Nitrogen accumulation can also lead to nitrogen saturation, which impacts microorganisms, plant production, and nitrogen cycling. Additional potential terrestrial ecosystem effects include reduced forest productivity and increased vulnerability to pests and pathogens.

The potential effects of airborne nitrogen dioxide on aquatic ecosystems include acidification and eutrophication. The effects of acidification on water quality, whether introduced by direct acid deposition or leaching from adjacent terrestrial ecosystems, include increased acidity, reduced acid neutralization capacity, hypoxia, and mobilization of aluminum. Stream and lake acidification can be chronic or episodic and both can be damaging. In general, larger aquatic ecosystems have a greater buffering capacity than smaller systems. Increased acidity can reduce dissolved organic carbon and increase light penetration and visibility through the water column. Increased light penetration can result in increased macrophyte and algal growth. Increased visibility can alter the predator-prey balance. Wetlands, estuaries, bays, and salt marshes are generally less impaired by acid deposition than other aquatic ecosystems. However, they are subject to eutrophication. Eutrophication is the over enrichment of nutrients into an aquatic system, which can result in excess algal growth. The decomposition of the excess algae can result in a decrease in dissolved oxygen, which can be harmful to fish and other aquatic organisms.

6.1.3 Particulate Matter

PM is not a single pollutant, but a heterogeneous mixture of particles differing in size, origin, and chemical composition. Since vegetation and other ecosystem components are affected more by particulate chemistry than size fraction, exposure to a given mass concentration of airborne PM may lead to widely differing plant or ecosystem responses, depending on the particular mix of deposited particles. Though the chemical constitution of individual particles can be strongly correlated with size, the relationship between particle size and particle composition can also be quite complex, making it difficult in most cases to use particle size as a surrogate for chemistry. PM size classes do not necessarily have specific differential relevance for vegetation or ecosystem effects (Whitby 1978; USEPA 1996). Nitrates and sulfates are the PM constituents of greatest and most widespread environmental significance. Other components of PM, such as dust, trace metals, and organics can at high levels affect plants and other organisms. Particulate nitrates and sulfates, either individually, in combination, and/or as contributors to total reactive nitrogen deposition and total deposition of acidifying compounds, can affect sensitive ecosystem components and essential ecological attributes, which in turn, affect overall ecosystem structure and function (USEPA 2005).

PM levels in the U.S. "have the potential to alter ecosystem structure and function in ways that may reduce their ability to meet societal needs" (USEPA 2005). Currently, however, fundamental areas of uncertainty preclude establishing predictable relationships between ambient concentrations of PM and associated ecosystem effects. One source of uncertainty hampering the characterization of such relationships is the extreme complexity and variability that exist in estimating particle deposition rates. Since it is difficult to predict the rate of PM deposition, and thus, the PM contribution to total deposition at a given site, it is difficult to predict the ambient concentration of PM that would likely lead to the observed adverse effects within any particular ecosystem (USEPA 2005).

Chronic additions of reactive nitrogen, which is commonly a component of PM, and its accumulation in ecosystems can have impacts similar to those discussed in 5.2.2.

The USEPA Criteria Document provides a comprehensive review of PM toxicity (USEPA 2004). Potential direct air-to-leaf effects of PM on vegetation to some extent depend upon particle size and composition, although well-defined dose-response curves observed for gaseous phytotoxins (e.g., ozone and sulfur dioxide) have not generally been observed for PM. A notable exception has been adverse effects on foliation observed in the vicinity of cement production facilities, for which particulate emissions are highly caustic. For emissions from the proposed cracking furnaces, PM composition per se is not likely to harm plant species (with respect to direct foliar damage).

6.1.4 Fugitive Dust

Dust will be emitted during construction of the furnaces. This emission will be minimal and will last a few days. Dust emissions are expected to be negligible after initial land-disturbing activities are completed.

6.2 Potential Water Quality Effects

6.2.1 Atmospheric Deposition over Surface Waters and Watersheds

Atmospheric deposition of airborne constituents is expected to be negligible and have no effect on water quality or aquatic habitats in areas where ground-level SIL concentrations for regulated constituents are not exceeded. The only surface water that is contained within the area of SIL exceedance for NO_2 and PM is a very small segment of the unnamed tidal ditch to which Outfall #004 ultimately discharges. The terrestrial surface area that is also contained within this area of SIL exceedance would also be expected to drain to the unnamed tidal ditch.

Based on the background research described above in Section 4.0, the potential effects on surface waters from NO_2 emissions include indirect, long-term effects, such as acidification or eutrophication. Due to the small areal extent of land and surface water that is contained within the SIL exceedance area, effects on water quality and aquatic habitats due to atmospheric deposition are expected to be negligible.

6.2.2 Wastewater Discharge

Equistar estimates an increase of 0.2 MGD in wastewater discharge from Outfall #004. A 1 % effluent concentration in the plume was considered as a conservative estimate to define the aquatic-based section of the Action Area within the San Jacinto Bay. Based on the areal plume estimate, effects on water quality and aquatic habitats due to the increase in wastewater discharge are expected to be negligible.

6.2.3 Mass Loading

The estimated increase in treated effluent discharge from Outfall #004 will result in minor increases in pollutant mass loading to the receiving water resulting in additional elements discharged into the surrounding environment. However, the relative toxicity is expected to be discountable, and the existing permit will not result in a deficiency of the Texas Surface Water Quality Standards.

6.2.4 Water Temperature

Temperature is independent of both concentration and mass loading parameters. The water temperature of Outfall #004 effluent is affected by raw water temperature, ambient air temperature, and physical limitations of the cooling tower. Due to its consistency with maintaining relatively close to ambient temperature (~74°F), a temperature limit was not issued in the TPDES permit. Respectively, the summer months will result in the highest average discharge temperatures. Although the Project will increase the treated effluent discharge volume from Outfall #004, the increase in effluent temperature is expected to be discountable and will not be an impairment of Texas water quality standards.

6.2.5 Toxicity

All effluent data was within the discharge limitations based on the state criteria and EPA criteria for aquatic life and significant dilution of any toxic components within the effluent will occur before reaching suitable habitat for protected species. If permit levels are exceeded, there is a chance that wastewater effluent could be toxic to small aquatic life within the unnamed tidal ditch. These animals serve as prey for larger species, which in turn may ingest toxins through small prey ingestion. This biomagnification of potentially harmful toxins is the process of accumulating higher chemical concentrations based on trophic levels through consumption of contaminated resources and has the potential to impair surrounding wildlife. This monitoring will allow the La Porte Complex to adjust processes and reduce downstream toxicity if effluents exceed permit limitations.

As described by the dilution modeling and toxicity assessment, the effluent plume will be diluted to 1 % effluent within 300 feet of the mouth of the unnamed drainage channel; this dilution would serve to minimize any potential impact to water quality and habitat in San Jacinto Bay. In addition the general comparison of the effluent concentrations and the sediment concentrations in the receiving water body indicated that the effluent concentrations are below the ambient before treatment on the facility.

6.3 Noise Effects

Equistar project engineers estimate that noise levels during construction should be comparable to noise levels from maintenance activities that currently take place at the plant. The new equipment should not produce noise levels greater than 90 decibels or alter the pre-existing noise exposure at the site. No noise effects to wildlife are expected as a result of the infrastructure construction or operations of the expansion project. Although sharp noises can alter the behavior of protected species, the La Porte Complex facility creates a steady noise that is unlikely to greatly alter behavior patterns.

6.4 Infrastructure-Related Effects

Construction of the proposed expansion project involves the addition of two ethylene cracking furnaces to the existing ethylene cracking facility. The proposed furnace site is an existing caliche parking lot surrounded by industrial infrastructure and roadways. No vegetation or potential wildlife habitat will be directly impacted as a result of the infrastructure construction activities.

6.5 Human Activity Effects

Construction and operation of the proposed expansion project will not require significant additional human activity compared to typical maintenance activities that occur at the plant on a regular basis. New construction will occur within an existing caliche parking lot. However, laydown, fabrication, and other temporary features associated with construction will occur in maintained grassed areas. Grassed areas may be used by foraging bird species; however, given the location of these isolated areas within an industrial infrastructure, they are unlikely to attract prey species. Furthermore, birds will likely be displaced to more desirable habitat in the surrounding area during construction. No impacts to protected species are expected as a result of the increase in human activity associated with the expansion project.

6.6 Potential Impacts to Federally-Protected Species

The following provides an assessment of the project's potential to affect listed species.

6.6.1 Federally-Listed Species

Texas Prairie Dawn

Populations of Texas prairie dawn are known to occur only in western Harris County and extreme eastern Fort Bend County in specific habitat described as small, sparsely vegetated areas associated with pimple (mima) mounds. The proposed project will be constructed in far eastern Harris County, distant from the Texas prairie dawn habitat. The TXNDD does not include any observations of Texas prairie dawn within an approximate 11 mile radius of the project site and no Texas prairie dawn habitat was observed within the Action Area during the site reconnaissance.

The Texas prairie dawn does not have the potential to occur within the Action Area; therefore, the proposed action would have **no effect** on the Texas prairie dawn.

Sea Turtles

The Action Area includes approximately 3 acres of San Jacinto Bay, which is potential sea turtle habitat. According to the TXNDD and the USACE Sea Turtle Warehouse (USACE 2013), none of the sea turtles considered for this assessment have been reported near the Upper San Jacinto Bay; however, the Sea Turtle Stranding and Salvage Network (STSSN) indicates random occurrences of the Kemp's ridley, Loggerhead, and Green sea turtles within Harris County (STSSN 2011). Consultation with representatives of NOAA working in the Galveston Bay area have confirmed that sea turtles species have access to the Upper San Jacinto Bay area but have not been documented, either by stranding or sighting, within approximately 2.5 miles of the Action Area. Wastewater associated with construction and operation of the expansion project will be treated on site and is not likely to directly impact sea turtles. However, changes in water temperature can alter turtle behavior and pollutants in water can impact sea turtles through contamination of food sources. Turtles are within higher trophic levels and can bioaccumulate the pollutants in levels that could be potentially toxic. Based on the 5 years of biomonitoring by the facility and the negative results for toxic constituents, invertebrate prey species are not expected to be impacted by the discountable concentration levels from the proposed project. As discussed below, the proposed action would have **no effect** on Kemp's ridley, loggerhead, hawksbill, and leatherback sea turtles.

Green Sea Turtle

The Upper San Jacinto Bay is part of the San Jacinto River, which flows into Galveston Bay estuary, approximately 5 miles southeast of the Action Area. The TXNDD and USACE Sea Turtle Warehouse do not identify any observations of green sea turtles within 11 miles of the project site, and no designated critical habitat is located within the Galveston Bay estuary or Upper San Jacinto Bay. Green sea turtles have been intermittently observed within the Galveston Bay estuary, which is located approximately 28 miles from the site, as recently as 2012. The STSSN reports one green turtle stranding in Harris County in 2000; the precise location within Harris County is not specified. According to contacts at NOAA, if an effluent stream is warmer than the ambient water temperature, the possibility of attracting resident green sea turtles to the discharge outfall could increase. However, the Upper San Jacinto Bay is not optimal for foraging due to increased industrialization of the area resulting in continual ship and barge traffic and maintenance dredging. Further, the effluent will increase in discharge rate only, not in temperature and NOAA has no record of strandings for this species north of Kemah, approximately 15 miles south of the Action Area. Based on the available data described above, the green sea turtle does not occur in the shallow waters of the Upper San Jacinto Bay for foraging, and no seagrass beds have been mapped within San Jacinto Bay (Pulich and White 1991, Pulich 1996).

Potential pollutants from deposition and effluent from the proposed project have not been found at levels great enough to impact downstream water quality independently; however, they will contribute to general water quality issues within the greater Galveston Bay area. As such, the project will contribute to cumulative impacts from industrial use in the area. As this species is not known to occur within the Action Area, the Upper San Jacinto Bay does not contain optimal foraging habitat, and the project's effluent discharge concentrations will be negligible, the proposed action would have **no effect** on the green sea turtle.

Hawksbill Sea Turtle

No sources have been found to indicate the hawksbill sea turtles have been observed within the Galveston Bay estuary. The TXNDD and USACE Sea Turtle Warehouse do not identify any observations of hawksbill sea turtles in the vicinity (approximately 11 miles) of the project site, and no designated critical habitat is located within the Galveston Bay estuary or Upper San Jacinto Bay. No hawksbill sea turtle strandings are reported in Texas by STSSN. As this species is not known to occur within the Action Area, the Upper San Jacinto Bay does not contain optimal foraging habitat, and the project's effluent discharge concentrations will be negligible, the proposed action would have **no effect** on the hawksbill sea turtle.

Kemp's Ridley Sea Turtle

The portion of the Upper San Jacinto Bay could be potential foraging habitat for the Kemp's ridley. However, site observations have indicated that the area has been modified with a dock and dredged for barges movement which would diminish the likelihood of Kemp's ridley turtles from utilizing the Upper San Jacinto Bay. These sea turtles have been intermittently observed within the Galveston Bay estuary, which is located approximately 28 miles from the site, as recently as 2012. The TXNDD and USACE Sea Turtle Warehouse do not identify any observations of Kemp's ridley sea turtles in the vicinity (approximately 11 miles) of the project site, and no designated critical habitat is located within or near the Action Area. The STSSN reports 7 green turtle strandings in Harris County between 1990 and 2001; the precise location within Harris County is not specified. NOAA has no record of strandings for this species north of Kemah, approximately 15 miles south of the Action Area. As this species is not known to occur within the Action Area, the Upper San Jacinto Bay does not contain optimal foraging habitat, and the project's effluent discharge concentrations will be negligible, the proposed project would have **no effect** on the Kemp's ridley sea turtle.

Leatherback Sea Turtle

The portion of the Upper San Jacinto Bay within the Action Area does not possess preferred leatherback sea turtle nesting or feeding habitat. The TXNDD and USACE Sea Turtle Warehouse do not identify any observations of leatherback sea turtles in the vicinity (~11 miles) of the project site, and no designated critical habitat is located within or near the Action Area. Further, no sources have been found to indicate the leatherback sea turtles have been observed within the Galveston Bay estuary. There are no reports of strandings by this species in Texas by STSSN. NOAA has not reported any leatherback sea turtles near the Action Area. Within 300 feet of the mouth of the unnamed tidal ditch, the chemical concentrations will result in ambient levels. The minute concentrations will reach ambient levels well before draining into Galveston Bay. As this species is not known to occur within the Action Area, the Upper San Jacinto Bay does not contain optimal foraging habitat, and the project's effluent discharge concentrations will be negligible, the proposed project would have **no effect** on the leatherback sea turtle.

Loggerhead Sea Turtle

The TXNDD and USACE Sea Turtle Warehouse do not identify any observations of loggerhead sea turtles in the vicinity of the project site, and no designated critical habitat is located within or near the Action Area. The portions of the Galveston Bay estuary that are not dredged are potential foraging habitat for the loggerhead. These sea turtles have been intermittently observed within the Galveston Bay system which is located approximately 28 miles from the site as recently as 2012 (TXNDD). The STSSN reports one green turtle stranding in Harris County in 1993; the precise location within Harris County is not specified. NOAA has not reported any loggerhead sea turtles near the Action Area. This turtle is a shallow water benthic feeder with a diet consisting primarily of shrimp, jellyfish, snails, sea stars, and swimming crabs. The effluent discharge may contribute to the contamination of foraging habitat and prey species. According to available data, the loggerhead sea turtle has not been identified utilizing the shallow waters of the Upper San Jacinto Bay for foraging, and the increased industrialization of the area resulting in continual ship and barge traffic and maintenance dredging make this it use for foraging unlikely. According to the dilution model, the effluent concentration would result in 1% effluent within

~300 feet of the mouth of the bay. Therefore the minute chemical concentrations will reach ambient levels prior to draining into Galveston Bay foraging habitat. As this species is not known to occur within the Action Area, the Upper San Jacinto Bay does not contain optimal foraging habitat, and the project's effluent discharge concentrations will be negligible, the proposed project would have **no effect** on the loggerhead sea turtle.

Houston Toad

There have been no reported observations of Houston toads in the vicinity of the project site since the 1976 which was approximately 11 miles southwest of the project site. There is no designated critical habitat is located within or near the Action Area. Houston toads prefer sandy forests of blackjack oak, yaupon, and little bluestem with temporary pools required for breeding, which are not found within the Action Area. Houston toads are sensitive to air emissions because they respire through their skin. Because Houston toads have been extirpated from the area and because there is no suitable habitat in the Action Area, the proposed action would have **no effect** on the Houston toad.

Red-cockaded Woodpecker

The Action Area and surrounding areas are not suitable habitat for the red-cockaded woodpecker. According to TXNDD, no sightings have occurred within an approximate 11 mile radius of the Action Area.

Red-cockaded woodpeckers prefer open, mature, old-growth pine forests which occur in East Texas. Suitable cavity trees are needed for nesting. The general area has been developed; no old-growth forests are located within the area. Because there is neither potential habitat nor occurrences within or near the Action Area, the proposed action would have **no effect** on the red-cockaded woodpecker.

Whooping Crane

The TXNDD does not identify any observations of whooping cranes in the vicinity (~11 miles) of the project site. The Action Area is not located within the migration corridor. No designated critical habitat is located within or near the Action Area. The designated critical habitat for whooping cranes in Texas is the Aransas National Wildlife Refuge, which is located approximately 200 miles from the Project site.

Preferred over-wintering habitat for both adults and juveniles includes estuaries marshes, bays, and tidal flats, which are found within the Action Area, although they are low quality. Whooping cranes feed on plant tubers, blue crabs, small mammals, amphibians, reptiles, and insects. The proposed effluent discharge will contribute to chemical concentrations within food sources near the Action Area. According to the dilution model, the effluent concentration would result in 1% effluent within 300 feet of the mouth of the unnamed tidal ditch. The potential exists that the effluent discharge could be cleaner (possess lower chemical concentrations) than the receiving water body. Based on the 5 years of biomonitoring by the facility and the non-toxic results, invertebrate prey species near the facility are not expected to be impacted by the discountable concentration levels from the project.

Based on available data this species does not occur within or near the Action Area; therefore, the proposed action would have **no effect** on the whooping crane.

Smalltooth Sawfish

The TXNDD does not identify any observations of smalltooth sawfish in the vicinity (~11 miles) of the project site, and no designated critical habitat is located within or near the Action Area. Based on the information that this species does not occur within the Action Area or downstream of the project site, the proposed action would have **no effect** on the smalltooth sawfish.

Louisiana Black Bear

The TXNDD does not identify any observations of Louisiana black bears in the vicinity (~11 miles) of the project area, and no designated critical habitat is located within or on the Action Area. Preferred habitat of the Louisiana black bear includes bottomland hardwood forests near brackish or freshwater marshes with long corridors. The project site is not on or near suitable habitat for this species.

Because this species has been extirpated from the area and no potential habitat exists within or near the project site, the proposed action would have **no effect** on Louisiana black bears.

Red Wolf

The TXNDD does not identify any observations of red wolves in the vicinity (~11 miles) of the project site, and no designated critical habitat is located within or near the Action Area. The action site and surrounding areas have been developed; rendering the La Porte Complex undesirable habitat for this species. Because this species has been extirpated from the area, the proposed action would have **no effect** on the red wolf.

6.6.2 Marine Mammals

The only marine mammal with the potential to occur downstream of the Action Area is the bottlenose dolphin. The bottlenose dolphin is known to occur within the Galveston Bay estuary (GBEP 2004b). The Upper San Jacinto Bay is a shallow bay, so there is potential for the bottlenose dolphin to use this area. Based on available data, there are no recorded occurrences of bottlenose dolphins in the Upper San Jacinto Bay.

Although indirect impacts to food sources from toxicity, habitat degradation, and deposition, bottlenose dolphins travel throughout a wide territory for preferred habitat and feeding grounds. They could easily find alternate food sources. Therefore, **no take** of bottlenose dolphin is expected.

7.0 Conclusions

This section is a summary of URS' recommended determination of effect for all federally-protected species, a description of any interdependent and interrelated actions, and a description of any anticipated cumulative effects resulting from the proposed project.

The proposed construction of the QE-1 Olefins Expansion Project will have no effect on federally-protected species because there is no suitable habitat within the construction site. Similarly, air emissions and wastewater effluent resulting from the operation of the proposed expansion will have no effect on federally-protected species; available data and site visits do not indicate the presence of federally-protected species or their preferred habitat within the Action Area.

7.1 Determination of Effect

The recommended determinations of effect for all federally-protected species with the potential to occur within habitat located within the Action Area are summarized below.

Table 15 – Determination of Effect Summary

Protected Species	Classification- Reason for Evaluation	Determination of Effect
Federal List of T&E Species (Harris County)		
Texas Prairie Dawn	Listed by USFWS as Endangered in Harris County	No effect
Green Sea Turtle	Listed by USFWS and NMFS as Threatened, possibly occurring in San Jacinto Bay.	No effect
Hawksbill Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Kemp's Ridley Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Leatherback Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Loggerhead Sea Turtle	Listed by USFWS and NMFS as Threatened, possibly occurring in San Jacinto Bay.	No effect
State-recognized List of Federal T&E Species (Harris County)		
Houston Toad	Listed by the TPWD as Endangered in Harris County	No effect
Red-cockaded Woodpecker	Listed by the TPWD as Endangered in Harris County	No effect
Whooping Crane	Listed by the TPWD as Endangered in Harris County	No effect
Smalltooth Sawfish	Listed by the TPWD as Endangered in Harris County	No effect
Louisiana Black Bear	Listed by the TPWD as Threatened in Harris County	No effect
Red Wolf	Listed by the TPWD as Endangered in Harris County	No effect
Bottlenose Dolphin	Listed as depleted by Marine Mammal Protection Act	No take anticipated

7.2 Interdependent and Interrelated Actions

The proposed project is limited to the construction and operation activities of the expanded ethylene cracking facility as outlined in Section 1.1. No additional interdependent or interrelated actions are proposed at this time.

7.3 Cumulative Effects

The project site is located within an industrial area. Multiple industrial facilities have historically been and continue to be operational within La Porte and Harris County, Texas. The area is likely to experience additional industrial development over time. In addition to the industrial facilities, Houston-Galveston Navigation Channel is a constant source of barge and commercial vessel traffic that will continue to have an impact on the surrounding areas in the future. Potential pollutants from deposition and discharge effluent from the proposed project have not been found levels great enough to impact downstream water quality independently; however, they will contribute to general water quality issues within the greater Galveston Bay area. As such, the project will contribute to cumulative impacts from industrial use in the area.

As with the proposed expansion project, any new proposed developments may have the potential to impact federally-protected species. However, URS is not aware of any specific projects planned for this area at this time. No additional actions with the potential to impact federally-protected species are planned for the olefins manufacturing facility expansion at this time.

7.4 Conservation Measures

The construction of the proposed expansion project will likely have no direct or indirect impact on federally-protected species habitat.

Equistar plans to utilize the BACT to control emissions and thus minimize impacts to the surrounding environment to the maximum extent practicable. The proposed emissions of each pollutant subject to PSD review are consistent with both the TCEQ BACT guidance and the most stringent limit in the RBLC; and, are considered to be the top level of control available for the new and modified facilities.

Wastewater discharges will be subject to TPDES permit limitations, which have been designed to be protective of aquatic and marine species.

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Figures

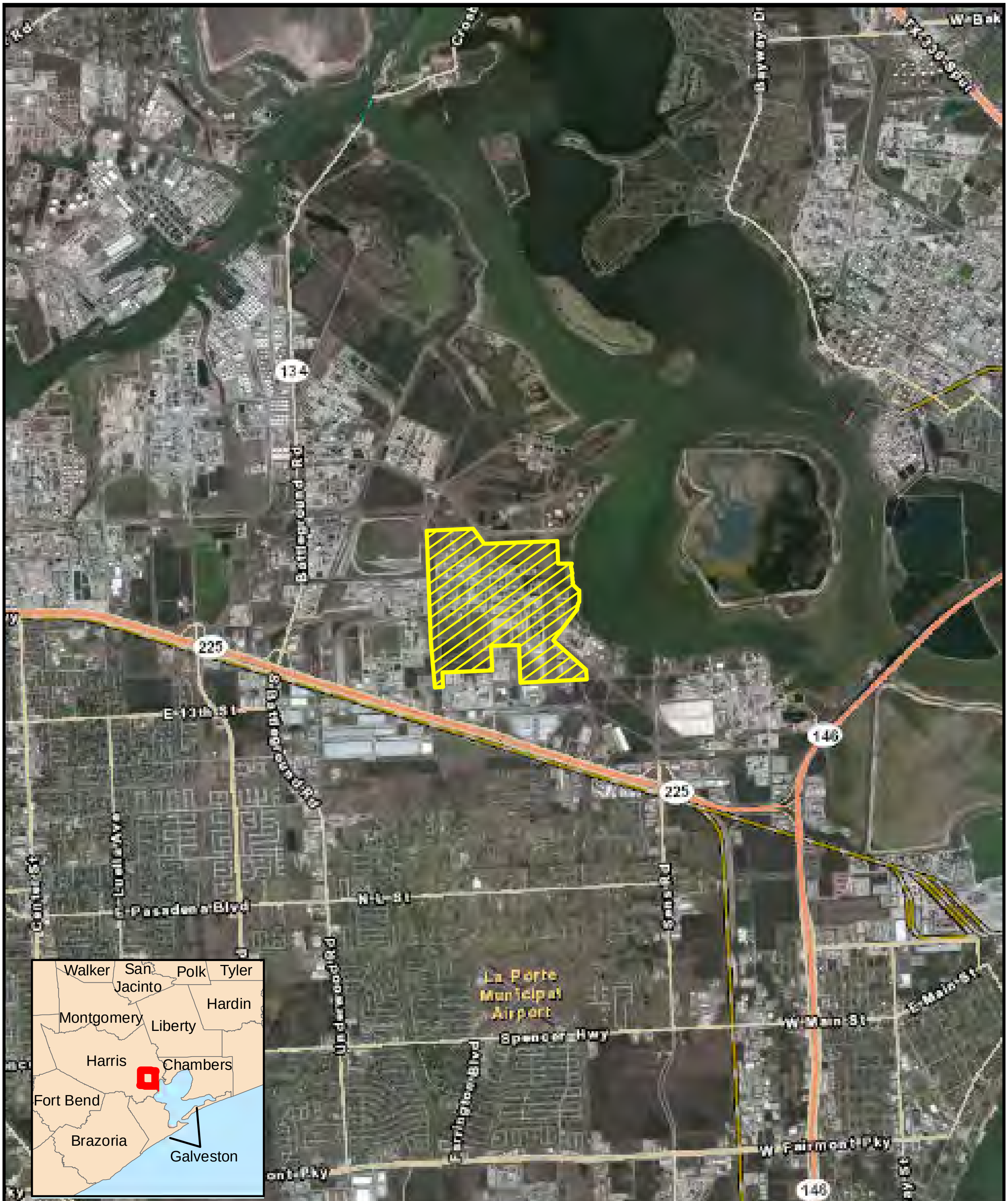
Appendix A

Datasheets

Appendix B

Photographic Log

Figures



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Property Boundary

N

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Project:	**Biological Assessment QE-1 Unit Expansion Equistar – La Porte Complex**
Client:	**Equistar Chemicals, L.P.**

Drawn by:	Date:	Project No.:	
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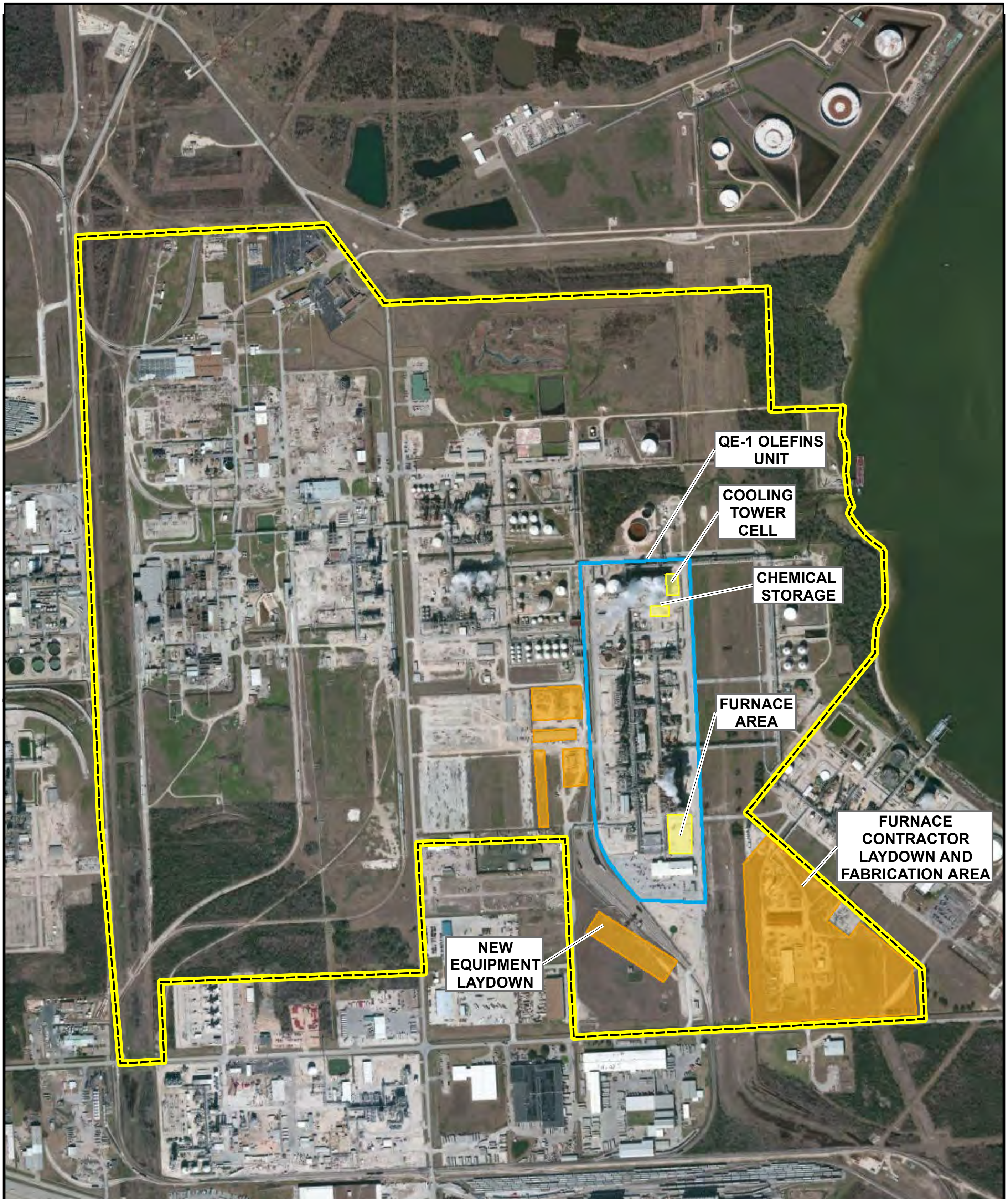

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- Property Boundary
- Olefin Unit
- Proposed Construction Limits (Ground Disturbance)
- Construction Material Laydown and Extra Workspace (Existing)

N

Feet
0 500 1,000

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Project:	QE-1 Unit Expansion Equistar – La Porte Complex
Client:	Equistar Chemicals, L.P.

Drawn by:	Date:	Project No.:	
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Outfall 004
Laydown Areas
Property Boundary

Action Area

Effluent Dilution Area
Furnace Site
SIL Exceedance Area
Drainage Ditch

N

0 500 1,000 Feet

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Project:	Biological Assessment QE-1 Unit Expansion Equistar – La Porte Complex
Client:	Equistar Chemicals, L.P.

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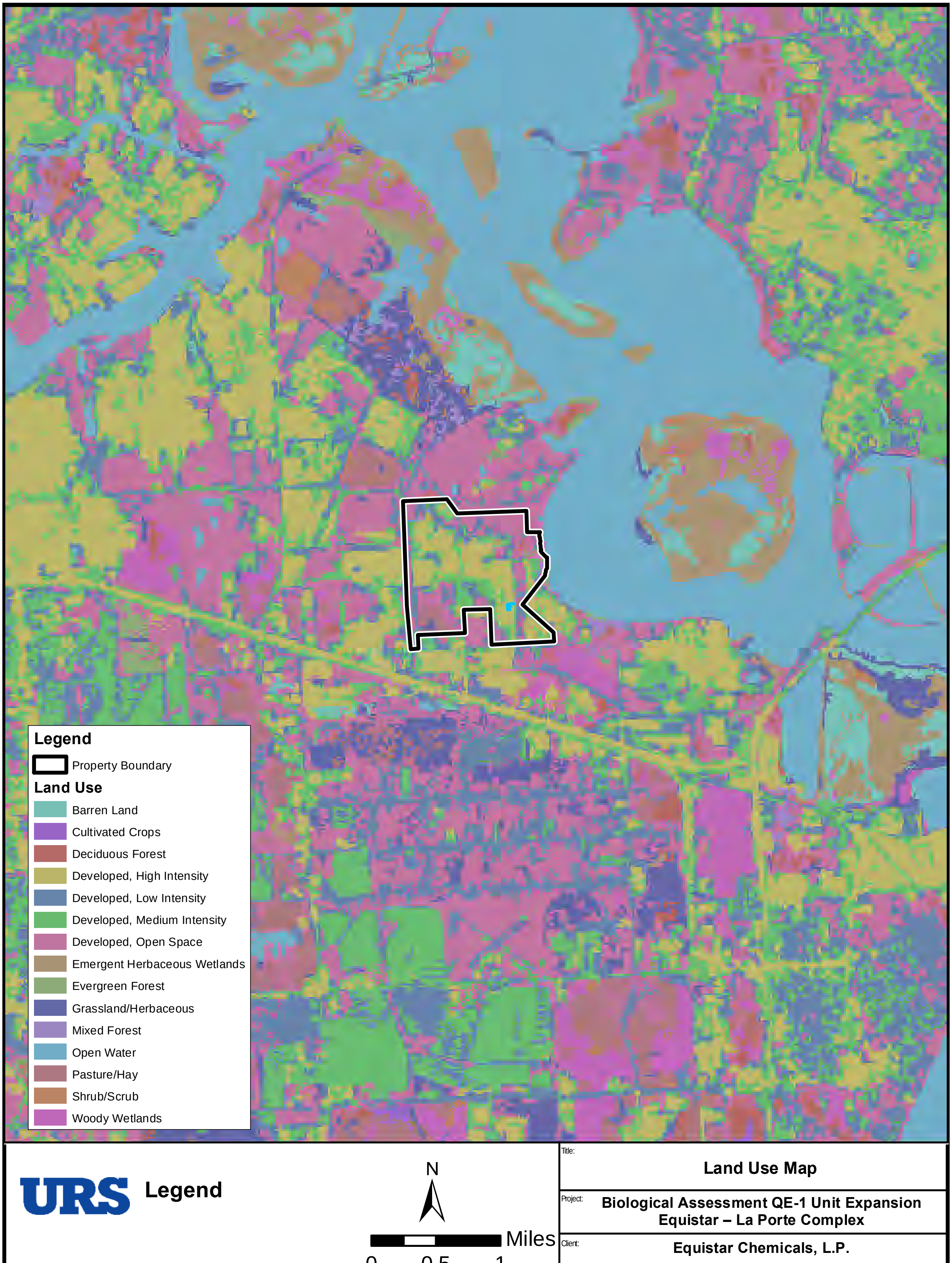

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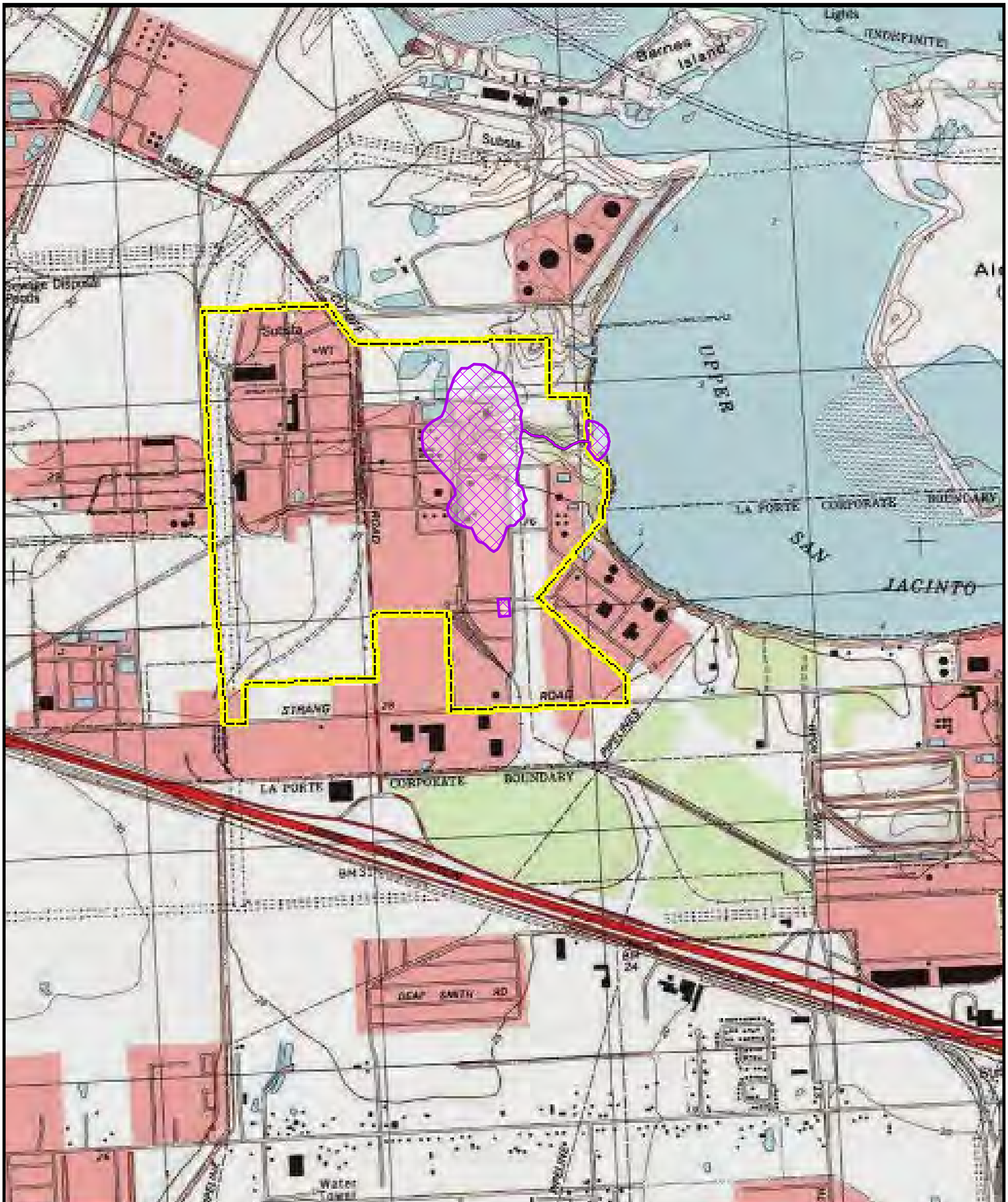

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Action Area

Property Boundary

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0 1,000 2,000 Feet

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Project:	**Biological Assessment QE-1 Unit Expansion Equistar – La Porte Complex**
Client:	**Equistar Chemicals, L.P.**

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Legend

Action Area

Property Boundary

100-Year Floodplain

N

Feet

0 1,000 2,000

Title: FEMA 100-Year Floodplain Map

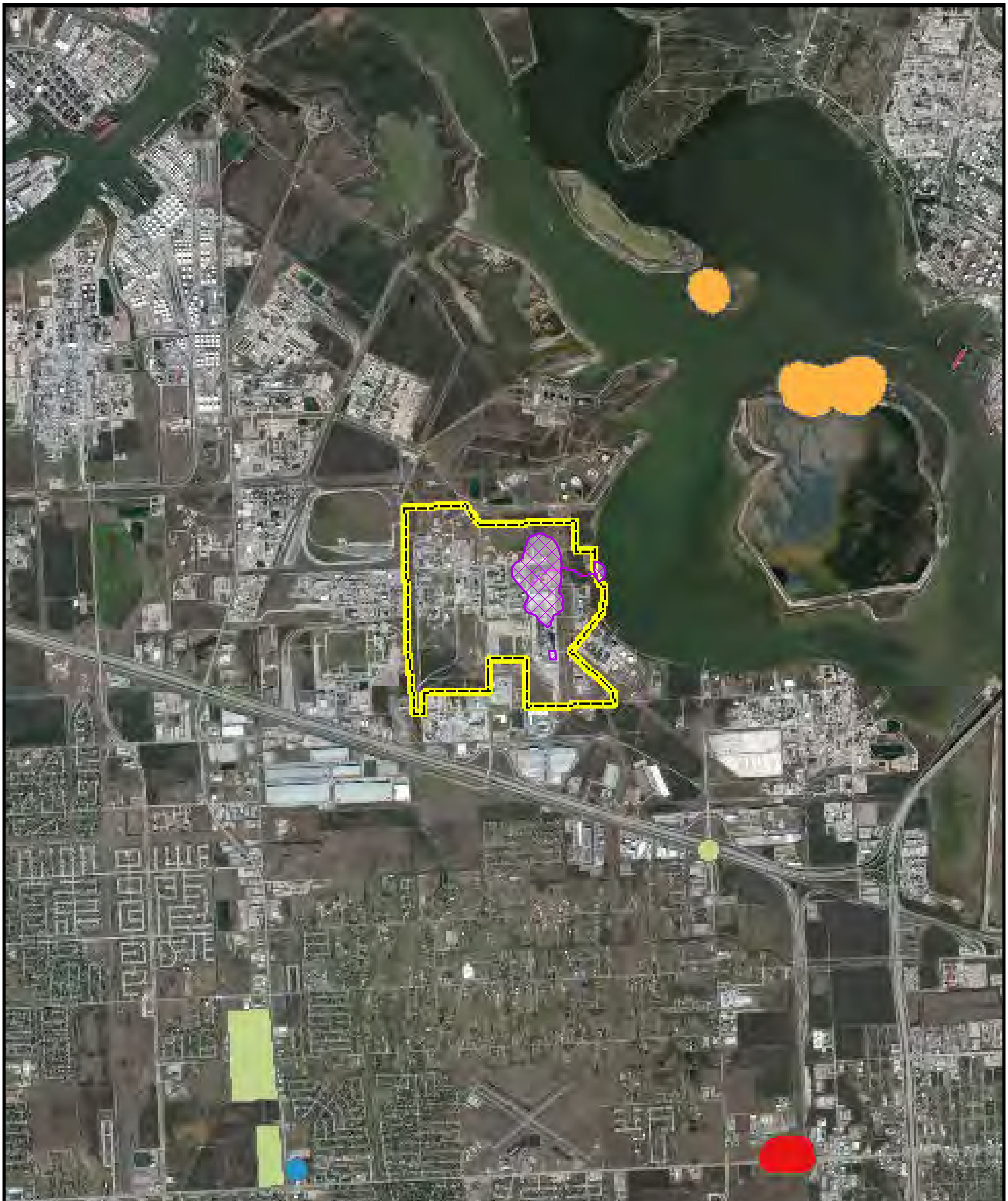
Project: Biological Assessment QE-1 Unit Expansion Equistar – La Porte Complex

Client: Equistar Chemicals, L.P.

Drawn by:	Date:	Project No.:	
AM	07/2012	25014882	Figure 6

Path: k:\ENV\ENV30\25014882\GIS\MXD\LPI\Fig_6_FEMA.mxd


Legend
Action Area
Property Boundary
Freshwater Pond
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Estuarine and Marine Wetland
Estuarine and Marine Deepwater
Lake
URS
N
0 1,000 2,000 Feet
Title:
National Wetlands Inventory Map
Project:
Biological Assessment QE-1 Unit Expansion
Equistar – La Porte Complex
Client:
Equistar Chemicals, L.P.
Drawn by: AM
Date: 07/2012
Project No.: 25014882
Figure 7
Path: k:\ENV\ENV30\25014882\GIS\MXD\LP\Fig_7_NWI.mxd



URS

Property Boundary
Action Area
Rookery
Houston daisy
Texas windmill-grass
Little Bluestem-brownseed Paspalum Series

N

0 2,000 4,000 Feet

Title:	Texas Natural Diversity Database Map
Project:	Biological Assessment QE-1 Unit Expansion Equistar – La Porte Complex
Client:	Equistar Chemicals, L.P.

Drawn by:	Date:	Project No.:	
AM	07/2012	25014882	Figure 8

Path: k:\ENV\ENV30\25014882\GIS\MXD\LP\Fig_8_TXDD.mxd

URS

Legend

- Outfall 004
- Ditch
- PM10 Annual SIL
- PM2.5 24-HR SIL
- PM2.5 Annual SIL
- Furnace Site
- Property Boundary

N

0 500 1,000 Feet

Title:			
Significant Impact Levels Exceedance Map			
Project: **Biological Assessment QE-1 Unit Expansion Equistar – La Porte Complex**			
Client: **Equistar Chemicals, L.P.**			
Drawn by: **AM**	Date: **07/2012**	Project No.: **25014882**	**Figure 9**

Path: k:\ENV\ENV30\25014882\GIS\MXD\LP\Fig_9_SIL.mxd

Appendix A

Datasheets

Date: 08/18/2011 Site: La Porte Complex

Weather Conditions: Sunny, 98 degrees F

Location Within Site: Ammonia Tank Alt 2

Habitat Type: Mixed gravel/ grass

Previously Disturbed?: Yes

Adjacent Habitats: Stormwater retention pond (up gradient bermed) Pipelines, elevated, Pipeline ROW, Roadway

Photographs:

NE: proposed site towards flare/analyzer house

SE: project site towards tanks

E: retention pond

N: wooded area

W: cooling tower, pipeline ROW

Animals Observed: None

Plants Observed Within Habitat: Grass mixed with gravel

Additional Observations (soils, water features, etc.): Wooded tract to the North between site and ship channel. Drainage ditch with permitted outfall along roadway.

Date: 08/18/2011 Site: La Porte Complex

Weather Conditions: Sunny, 98 degrees F

Location Within Site: South Furnace Site- 2 furnaces adjacent to control room, SE corner of unit

Habitat Type: Gravel Parking Lot

Previously Disturbed?: Yes

Adjacent Habitats: None- surrounded by facility and existing furnaces

Photographs:

N: existing furnace

E:

S:

W:

Animals Observed: None

Plants Observed Within Habitat: None- grass lot off site or adjacent property across street

Additional Observations (soils, water features, etc.): None

Date: 08/18/2011 Site: La Porte Complex

Weather Conditions: Sunny, 98 degrees F

Location Within Site: Northern- 3rd of 3 furnaces

Habitat Type: None

Previously Disturbed?: Yes

Adjacent Habitats: Grassy field across the street- disturbed XOM pipeline ROW

Photographs:

N:

NW: site

E: Pipeline ROW

Animals Observed: None

Plants Observed Within Habitat: None

Additional Observations (soils, water features, etc.): Drainage ditch along road

Date: 08/18/2011 Site: La Porte Complex

Weather Conditions: Sunny, 98 degrees F

Location Within Site: Ammonium tank Alt #1/ Cooling Tower exposure

Habitat Type: gravel lot- some grasses

Previously Disturbed?: Yes

Adjacent Habitats: Process Units/ grassy pipeline ROW across street

Photographs:

W: Tank site

NW: Tank site

NNW: Cooling Tower Site

E: Pipeline ROW

Animals Observed: None

Plants Observed Within Habitat: Grasses

Additional Observations (soils, water features, etc.): Drainage ditch along street- site drainage-permitted discharge

Date: 06/07/2012 Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, morning

Location Within Site: 1-SW forested area

Habitat Type: Forested to the south, cleared grass to the north

Previously Disturbed?: Not recently

Adjacent Habitats: Cleared grassland to the north

Photographs:

#1-SE into cleared area of forest- cleared area might be lower

#2-SW same

#3-SE trees

Animals Observed: songbirds

Plants Observed Within Habitat: Chinese Tallow, Black Willow, American Elm, Grasses, Brazilian Vervain

Additional Observations (soils, water features, etc.): -

Date: 06/07/2012 Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, morning

Location Within Site: 1-Just north of the Southwestern forested area

Habitat Type: Maintained grassy habitat

Previously Disturbed?: Yes

Adjacent Habitats: Forested habitat to the south

Photographs:

#4 was taken towards the northeast direction

Animals Observed: -

Plants Observed Within Habitat: Grasses, Shrubs, Chinese Tallow

Additional Observations (soils, water features, etc.): Infrequent mowing

Date: 06/07/2012 Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, 9:00 am

Location Within Site: land farm 2- North central

Habitat Type: Scrub-Shrub wetlands and emergent wetlands

Previously Disturbed?: Yes-land farm

Adjacent Habitats: Maintained grassland, wastewater (stormwater pond)

Photographs:

#5 - N

#6 - N into waste treatment area

Animals Observed: Red-winged blackbird, Other songbirds, Egrets

Plants Observed Within Habitat: Southern Cattail inside, Black Willow, Chinese Tallow, Sunflower, Johnson grass, Brazian Vervain, Sesbania

Additional Observations (soils, water features, etc.): -

Date: 06/07/2012 Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, 9:15 am

Location Within Site: 3-dock

Habitat Type: Shoreline, river

Previously Disturbed?: Yes

Adjacent Habitats: Maintained grassy area

Photographs:

#7 & 8- shoreline at dock

#9- river mouth

#10-shoreline to S

#11 & 12- shoreline to S and river mouth

Animals Observed: Small birds, Heron

Plants Observed Within Habitat: Goldenrods, Shrubs, Eastern Baccharis, Brazilian Vervain

River-Giant reed, Southern Cattail, Chinese Tallow, Black Willow, Sunflower

Additional Observations (soils, water features, etc.): Shoreline is rip rap, to the South shoreline is smaller rock

Date: 06/07/2012 Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, 9:45 am

Location Within Site: 4-N prairie

Habitat Type: Prairie-maybe mowed annually

Previously Disturbed?: Yes

Adjacent Habitats: Forest

Photographs:

#13-N

Animals Observed: Songbirds

Plants Observed Within Habitat: Grasses, Chinese Tallow, Sunflower

Additional Observations (soils, water features, etc.): Few shrubs, must be mowed to maintain free of trees, but not mowed often

Date: 06/07/2012	Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, 10:00 am

Location Within Site: 5- culvert at river-drainage ditch

Habitat Type: Forest-river

Previously Disturbed?: Yes

Adjacent Habitats: Developed facility

Photographs:

#14-NE

Animals Observed: Songbirds

Plants Observed Within Habitat: Black Willow, Chinese Tallow, American Elm, Hackberry, Ragweed, Dewberry, Goldenrod

Additional Observations (soils, water features, etc.): Culvert where drainage ditch empties into river that goes to bay and small forested area

Date: 06/07/2012 Site: La Porte Complex

Weather Conditions: Sunny, 80 degrees F, 10:00 am

Location Within Site: 6- by flare

Habitat Type: Forest

Previously Disturbed?: Yes

Adjacent Habitats: Developed, mowed grassland

Photographs:

#15-N

#16-E

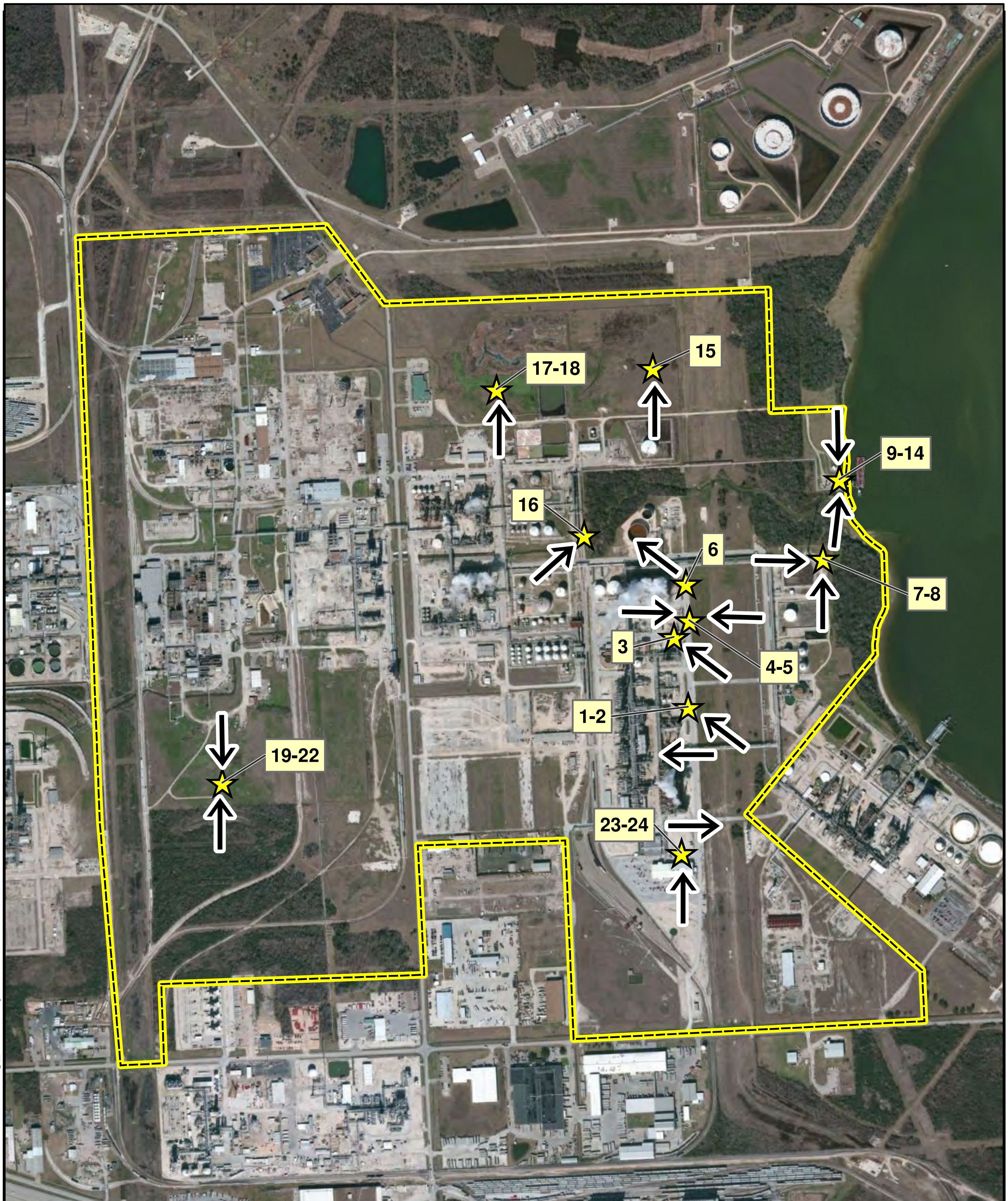
Animals Observed: Songbirds

Plants Observed Within Habitat: Chinese Tallow, Vines, Black Willow, Hackberry, Sugarberry

Additional Observations (soils, water features, etc.): Narrow strip of forest

Appendix B

Photographic Log



URS

Property Boundary
Olefin Unit
Proposed Construction Limits (Ground Disturbance)
Construction Material Laydown and Extra Workspace (Existing)

N

0 500 1,000 Feet

Title:	**Photographic Key**
Project:	**QE-1 Unit Expansion Equistar – La Porte Complex**
Client:	**Equistar Chemicals Company**

Drawn by:	Date:	Project No.:	
AM	07/2012	25014882	Figure 2-1

Path: K:\ENV\ENV30\25014882\GIS\MXD\LaPort\Fig_Photokey.mxd

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
8/18/2012	1

Direction Photo Taken:

West

Description:

Furnace site.

Date	Photo No.
8/18/2012	2

Direction Photo Taken:

Northwest

Description:

Furnace site.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
8/18/2012	3

Direction Photo Taken:

Northwest

Description:

Proposed ammonia tank site.

Date	Photo No.
8/18/2012	4

Direction Photo Taken:

West

Description:

Proposed ammonia tank site.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
8/18/2011	5

Direction Photo Taken:

East

Description:

Maintained pipeline ROW adjacent to Proposed ammonia tank site.

Date	Photo No.
8/18/2011	6

Direction Photo Taken:

Northwest

Description:

Proposed cooling tower site.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	7

Direction Photo Taken:

North

Description:

Mixed woodland habitat.

Date	Photo No.
6/7/2012	8

Direction Photo Taken:

East

Description:

Area of maintained grassland and a narrow strip of mixed woodland.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	9

Direction Photo Taken:

Northeast

Description:

Shoreline at the dock site.

Date	Photo No.
6/7/2012	10

Direction Photo Taken:

Northeast

Description:

Upper San Jacinto Bay shoreline.

PHOTOGRAPHIC LOG		
Client Name: Equistar Chemicals, L.P.	**Site Location:** La Porte Olefin Expansion Project	**Project No.** 25014882

Date	Photo No.
6/7/2012	11

Direction Photo Taken:

North

Description:

Mixed woodland habitat on the northeast or southwest corner of the property.

Date	Photo No.
6/7/2012	12

Direction Photo Taken:

South

Description:

Southern shoreline of the river.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	13

Direction Photo Taken:

South

Description:

Southern shoreline of the river.

Date	Photo No.
6/7/2012	14

Direction Photo Taken:

South

Description:

Southern shoreline to the river mouth.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	15

Direction Photo Taken:

North

Description:

Grassland habitat with tallow trees.

Date	Photo No.
6/7/2012	16

Direction Photo Taken:

Northeast

Description:

Mixed forest and riverine habitat.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	17

Direction Photo Taken:

North

Description:

Area of maintained grassland.

Date	Photo No.
6/7/2012	18

Direction Photo Taken:

North

Description:

Grassland habitat.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	19

Direction Photo Taken:

Southeast

Description:

Cleared area of forest.

Date	Photo No.
6/7/2012	20

Direction Photo Taken:

Southwest

Description:

Mixed woodland habitat.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
6/7/2012	21

Direction Photo Taken:

Southeast

Description:

Grassland and mixed woodland habitat

Date	Photo No.
6/7/2012	22

Direction Photo Taken:

Northeast

Description:

Mowed grassland habitat with tallow trees.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals, L.P.	La Porte Olefin Expansion Project	25014882

Date	Photo No.
8/18/2012	23

Direction Photo Taken:

East

Description:

The proposed furnace site.

Date	Photo No.
8/18/2012	24

Direction Photo Taken:

North

Description:

The proposed furnace site.