Essential Fish Habitat Assessment for the Deer Park Energy Center, Harris County, Texas

Prepared for

DEER PARK ENERGY CENTER LLC

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Acronyms

AERMOD	EPA atmospheric dispersion modeling system
CFR	Code of Federal Regulations
DPEC	Deer Park Energy Center
EPA	Environmental Protection Agency
HSC	Houston Ship Channel
HSC/AA	portion of HSC with the Action Area
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MGD	million gallons per day
NMFS	National Marine Fisheries Service
ppt	parts per thousand
ST	steam turbine
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
WET	whole effluent toxicity

1.0 INTRODUCTION

The purpose of this document is to present the findings of the **Essential Fish Habitat** (EFH) assessment as required by the **Magnuson-Stevens Fishery Conservation and Management Act (1976) as amended through 1996** (MSFCMA) for a proposed construction project at the Deer Park Energy Center (DPEC) in Harris County, Texas. This assessment is required because the Action Area of the proposed project includes a 2.8-km long, 0.5-km wide, east-to-west, tide-influenced stretch of the Houston Ship Channel (HSC), a waterway with little to no preferred habitat for species managed by the National Marine Fisheries Service (NMFS).

This report includes a brief project description (**Section 2**); a description of the EFH and effects of proposed actions on it (**Section 3**); a description of the managed fish species and effects of proposed actions on them (**Section 4**); an assessment of the impacts and proposed mitigation (**Section 5**); and, our conclusions (**Section 6**). References are provided in **Section 7**.

2.0 PROJECT DESCRIPTION AND PROPOSED ACTIONS

2.1 Summary

DPEC is an electricity and steam generating facility located within the highly industrialized southeast corner of the greater Houston metropolitan area, north of Galveston Bay, bounded by the HSC to the north and by State Highway 225 to the south (**Figure 1**). DPEC proposes to increase its output capacity by constructing and operating a new, 180-megawatt, natural-gas-fired combined-cycle cogeneration unit (Siemens FD-2 series). Within the time frame for the construction phase of the project, this new unit will be subsequently upgraded to an FD-3 series by on-site retrofit. The new cogeneration unit will be similar to the four existing cogeneration units currently in operation at DPEC. Construction of the FD-2 series cogeneration unit is anticipated to last 18-months and would take place from late 2012 into 2014. The new Siemens FD-2 series cogeneration unit will be constructed on a previously designated site (Steam Turbine 5 (ST-5)) adjacent to ST's 1-4 currently in operation (**Figure 2**). Complete details of the project scheduling can be found in Section 3 of the *Biological Assessment of Effects on Threatened and Endangered Species – Deer Park Energy Center Upgrade* (2012) (henceforth referred to as the *Biological Assessment* in this document).

2.2 Definitions of Study Areas

Two different study areas are referenced throughout this report. For clarity, each is defined below, with references to maps that illustrate the boundaries of each study area.

Project Site: The Project Site is the property leased by DPEC where the existing power plant is located and where the proposed cogeneration unit would be constructed (**Figures 2** and **3**). The Project Site is 0.3 hectare (ha) and consists of the existing power plant facility, which is surrounded by an oil refining facility. The Project Site is virtually devoid of vegetation. The area is almost entirely concrete or gravel, with the exception small patches of introduced grasses along the boundary of the property.

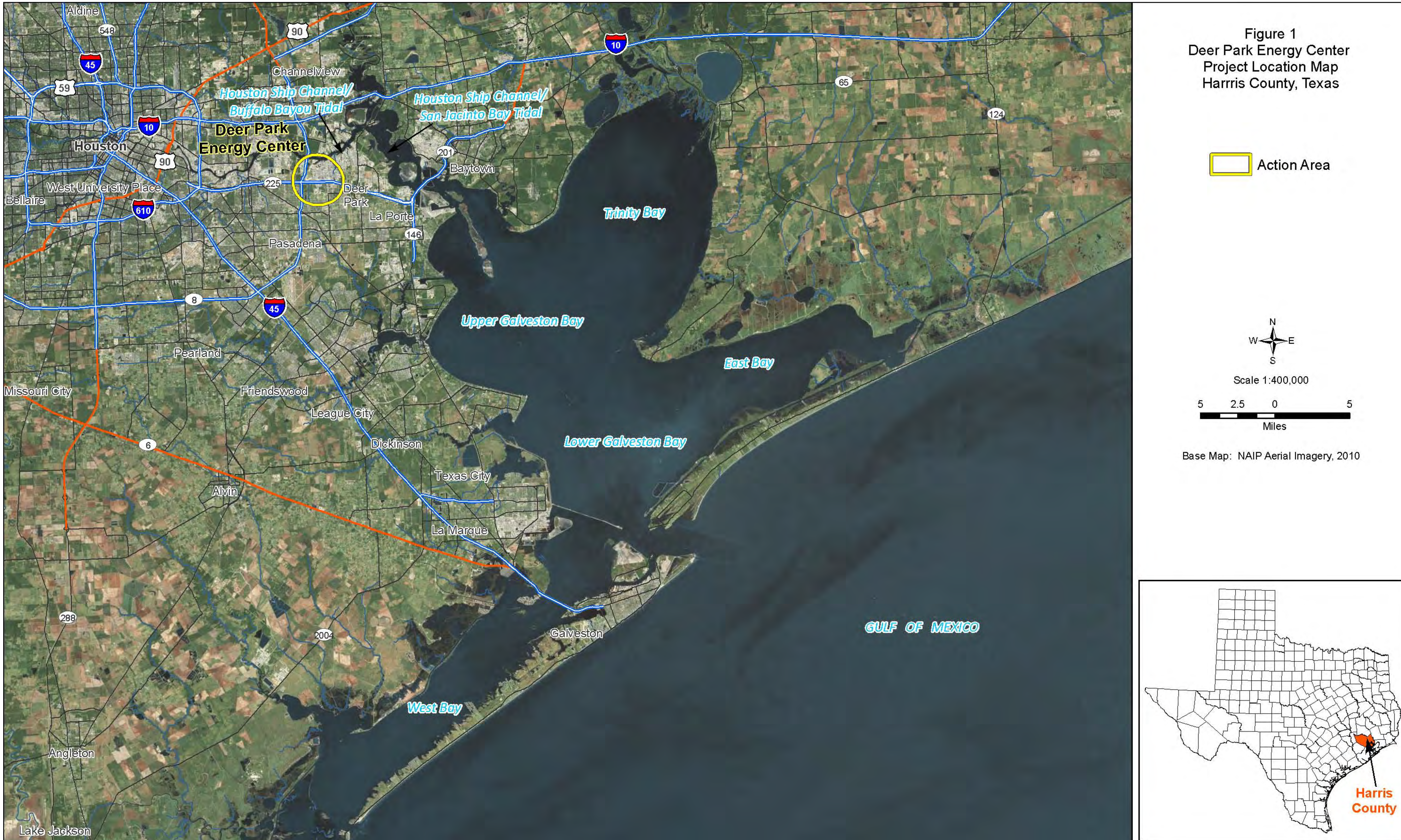
Figure 1
Deer Park Energy Center
Project Location Map
Harrris County, Texas
Action Area
N
W
E
S
Scale 1:400,000
5 2.5 0 5
Miles
Base Map: NAIP Aerial Imagery, 2010
Harris County
Deer Park Energy Center
Houston Ship Channel/ Buffalo Bayou Tidal
Houston Ship Channel/ San Jacinto Bay Tidal
Trinity Bay
Upper Galveston Bay
East Bay
Lower Galveston Bay
West Bay
GULF OF MEXICO
Aldine
Channelview
Houston
West University Place
Bellaire
Deer Park
Baytown
La Porte
Pasadena
Pearland
Missouri City
Friendswood
League City
Dickinson
Texas City
Alvin
La Marque
Galveston
Angleton
Lake Jackson
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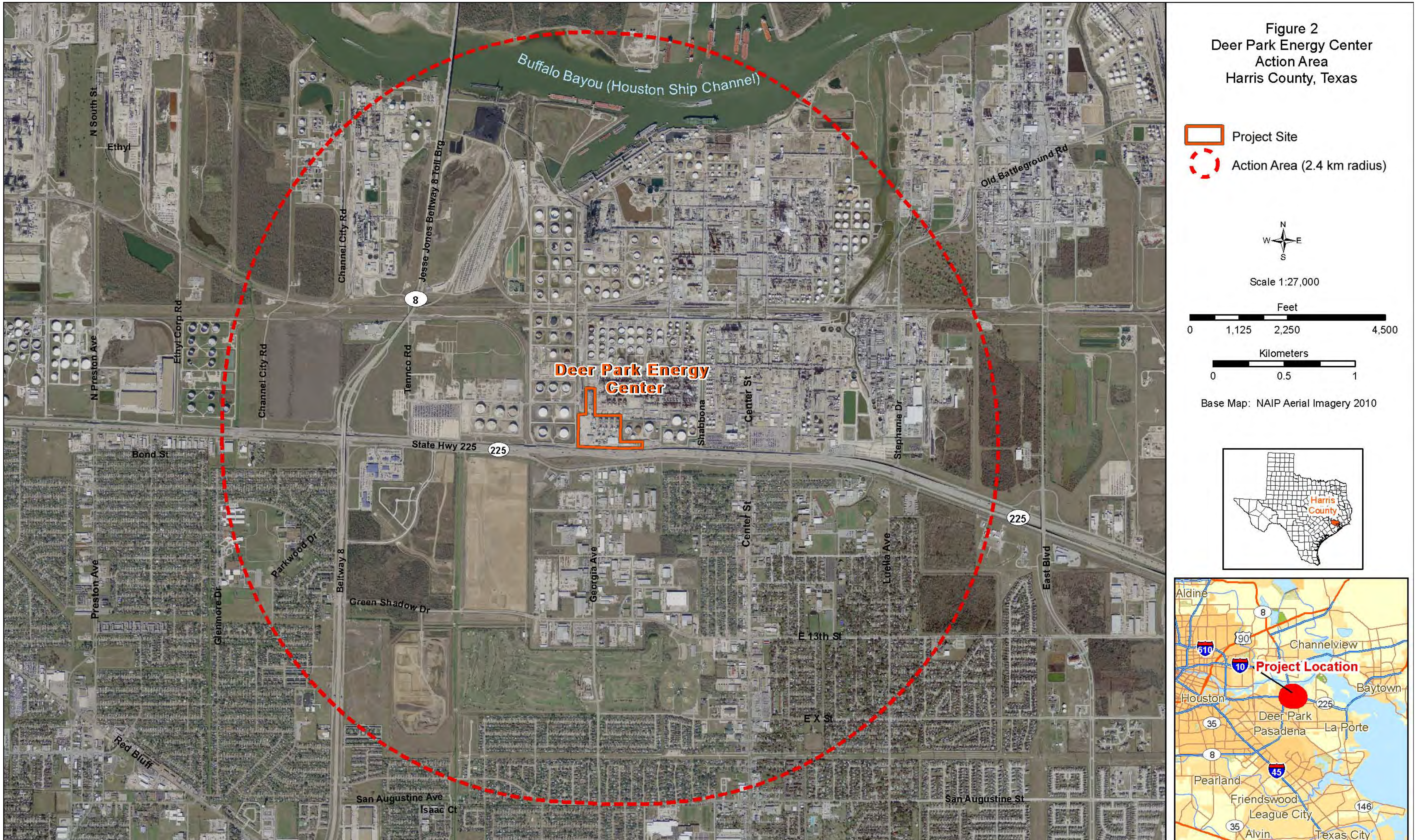

Figure 2
Deer Park Energy Center
Action Area
Harris County, Texas

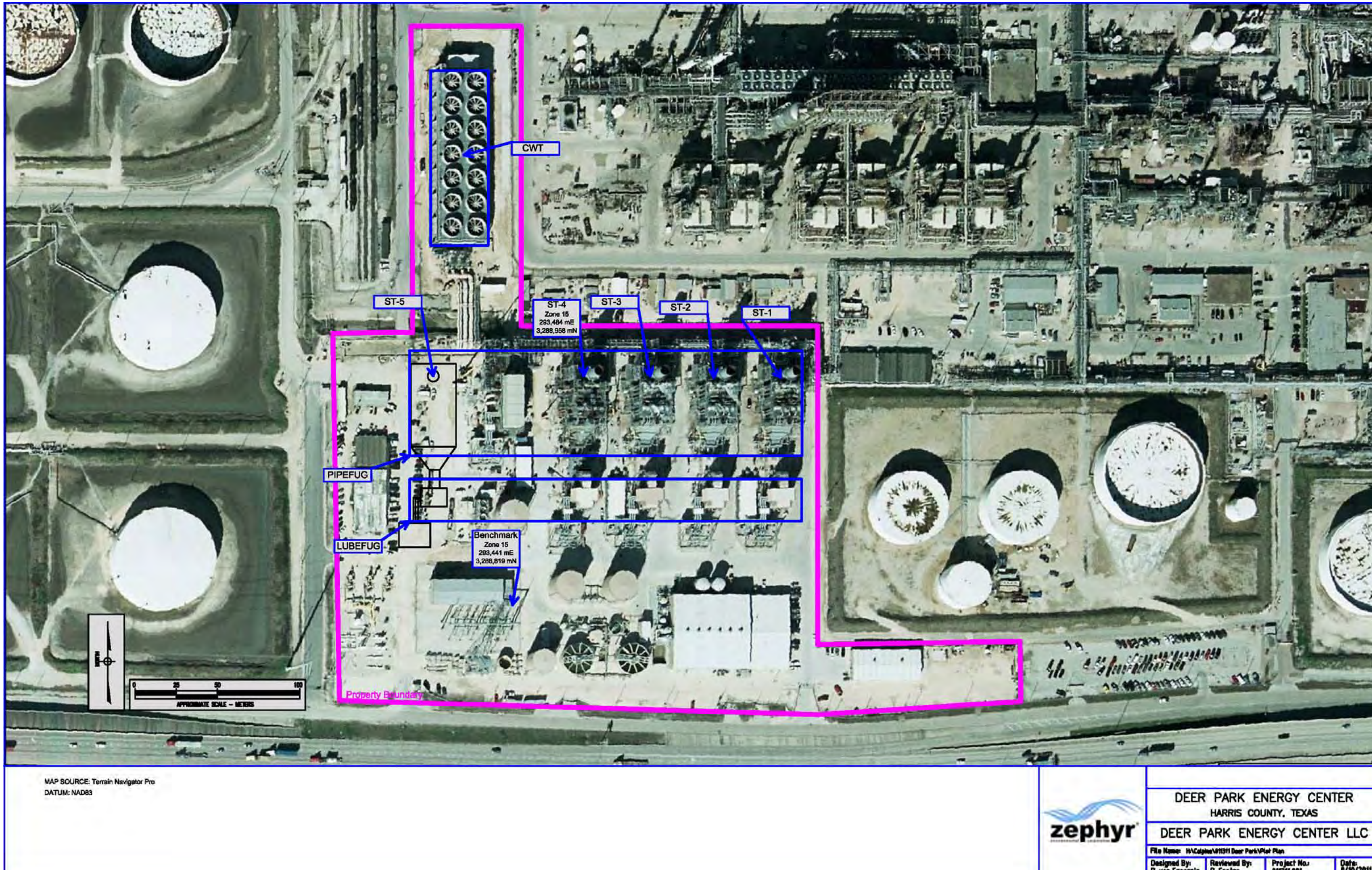

Figure 3 Deer Park Energy Center Plot Plan

Action Area: By federal regulation (50 CFR 402.2), an Action Area is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action". The analysis of species or designated critical habitat likely to be affected by the proposed action is focused on impacts within the project's Action Area, extending 2.4 km around the Project Site. Of relevance to the MSFCMA, the Action Area encompasses a ~3-km stretch of the HSC (**Figure 3**), which contains habitat for managed species falling under the aegis of the National Marine Fisheries Service (MSFCMA). Thus, the portion of the HSC running through the Action Area (henceforth, "HSC/AA") is designated essential fish habitat (EFH).

The Action Area for the proposed project was determined by identifying the maximum area in which the proposed project may result in significant direct and indirect impacts in and around the Project Site. Both construction and operation phases of the proposed combustion turbine were considered. Indirect impacts to surrounding areas may include noise, lighting, dust, erosion, stream sedimentation, air emissions, and physical disturbances. Because air emissions have the potential for widest impact away from the Project Site, the Action Area was based on determining a *de minimis* effects boundary. Conservative modeling using the EPA's atmospheric dispersion modeling system (AERMOD) (http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod) determined that the *de minimis* effects boundary extends as a roughly 2.4-km radius from the Project Site (**Figure 3**). Complete details of the AERMOD analysis can be found Section 3.2 of the *Biological Assessment*).

2.3 Proposed Actions – Wastewater Discharges

The wastewater discharge from the DPEC is authorized by Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0004344000 (TX0124303) and is made to the Texas Commission on Environmental Quality (TCEQ) Water Quality Segment No. 1006 (Houston Ship Channel Tidal) of the San Jacinto River Basin. The proposed project is expected to raise the average daily discharge from the currently reported 0.95 million gallons per day (MGD) to 1.15 MGD, but remain within the permitted authorization of 1.48 MGD average daily discharge. The wastewater generation processes and effluent quality are expected to be the same as those from the current plant configuration. Additionally, the project will not require any permit modifications or amendments, and there will be no change to permitted effluent limitations.

The majority of the wastewater discharged from the plant is cooling tower blowdown. Makeup water for the cooling tower is supplemented with heat recovery steam generator blowdown, demineralization and water polish media regeneration waste, and storm water from secondary containment areas. The concentrations of chemicals used for cooling tower treatment are kept to a minimum through regular assessment and the TPDES permit requires the final effluent to be routinely analyzed using whole effluent toxicity (WET) testing methods per the requirements of 40 CFR 122.44(d)(1)(i). Studies have shown that the surrogate organisms used in WET testing are of similar sensitivity to listed threatened or endangered species and are reliable indicators of potential toxic effects (Mayer *et al.* 2008; Dwyer *et al.* 2005; Sappington *et al.* 2001). WET testing performed on the facility discharge has never indicated the presence of harmful quantities of toxic constituents in the effluent. The effluent quality from proposed project is expected to be the same as the current discharge and it is believed that there will be no toxicological impacts to aquatic life, including listed threatened or endangered species.

Based on a maximum permitted discharge of 1.48 MGD, an assessment of the aquatic life impacts that would be associated with wastewater from the facility was performed using the TCEQ TEXTOX model for bays and wide tidal rivers (**Table 1**). This model is used to calculate daily average and daily maximum effluent limits required to maintain the surface water quality standards based upon the most recent instream criteria established in 30 Texas Administrative Code (TAC) §307.6 (c) and (d) as well as mixing zone and toxicological assumptions built into the model. With regard to toxic effects on aquatic life that would result from a wastewater discharge, numerical criteria were established by the TCEQ for those specific toxic substances 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 EPA guidelines for developing site-specific water quality criteria. The water quality of the existing discharge was determined by averaging a series of four samples collected one week apart as required for the most recent permit amendment and renewal application submitted to the TCEQ. There were no parameters that exceeded an allowable concentration or required an effluent limitation be placed in the permit.

Table 1 Aquatic Life Assessment: TCEQ Water Quality Segment No. 1006, DPEC's TPDES Permit No. WQ0004344000 (TX0124303)

Parameter	Segment 1006 Allowable Effluent Limitations Daily Avg. (mg/L)	Segment 1006 70% Allowable Effluent Limitations Daily Avg. (mg/L)	Outfall 001 Effluent Results Avg. of 4 Samples (mg/L)
Aldrin*	0.002038	0.0014266	<.00005
Aluminum	N/A	N/A	0.513
Arsenic	0.233632	0.1635424	0.038
Cadmium	0.071532	0.0500724	0.0005
Carbaryl*	0.961184	0.6728288	<.005
Chlordane*	0.000045	0.0000315	<0.00015
Chlorpyrifos*	0.000017	0.0000119	<0.00005
Chromium (+3)	N/A	N/A	0.0102
Chromium (+6)	0.560438	0.3923066	<0.005
Copper	0.052282	0.0365974	0.039
4,4'-DDT*	0.000011	0.0000077	<.0001
Dementon*	0.001121	0.0007847	<.0002
Dicofol*	N/A	N/A	<.020
Dieldrin*	0.000021	0.0000147	<.0001
Diuron*	N/A	N/A	<0.0001
Endosulfan II (beta)*	0.000053	0.0000371	<0.0001
Endosulfan sulfate*	0.000053	0.0000371	<0.0001
Endrin*	0.000026	0.0000182	<.0001
Guthion*	0.000112	0.0000784	<0.0001
Heptachlor*	0.00004	0.000028	<.00005
Hexachlorocyclohexane (Lindane)*	0.000251	0.0001757	<0.0001
Lead	0.166034	0.1162238	<0.005
Malathion*	0.000112	0.0000784	<0.0001
Mercury	0.003293	0.0023051	<0.0002
Methoxychlor*	0.000336	0.0002352	<.002

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Parameter	Segment 1006 Allowable Effluent Limitations Daily Avg. (mg/L)	Segment 1006 70% Allowable Effluent Limitations Daily Avg. (mg/L)	Outfall 001 Effluent Results Avg. of 4 Samples (mg/L)
Mirex*	0.000011	0.0000077	<.0002
Nickel	0.147956	0.1035692	0.0467
Parathion (ethyl)*	N/A	N/A	<0.0001
Pentachlorophenol*	0.02374	0.016618	<.05
Phenanthrene*	0.012074	0.0084518	<.01
Polychlorinated Biphenyls (PCBs)*	0.000336	0.0002352	<.01
Selenium	0.884352	0.6190464	<0.005
Silver	0.094421	0.0660947	<0.002
Toxaphene*	0.0000022	0.00000154	<.005
2,4,5 Trichlorophenol*	0.134505	0.0941535	<.05
Zinc	0.26495	0.185465	0.0442

*No analysis was performed because the parameters are known to not be present in the discharge by process knowledge as is allowed by the National Pollutant Discharge Elimination System applications Form C.

Mass Loading

The anticipated increase in effluent discharge volume will result in minor increases in pollutant mass loading to the receiving water (**Table 2**). Although there will be additional constituents discharged to the environment, the relative toxicity will not increase and the existing permit will not result in an impairment of Texas Surface Water Quality Standards.

Table 2 Surface Water Loading Calculations: DPEC's TPDES Permit No. WQ0004344000 (TX0124303)

Parameter	Average Concentration Outfall 001 (mg/L)	Current Average Discharge 0.95 MGD (lbs / day)	Expected Future Discharge 1.15 MGD (lbs / day)	Current Maximum Permitted 1.48 MGD (lbs / day)
Conventional Constituents				
Biological Oxygen Demand (5-day)	6.9	55	66.2	85.2
Carbonaceous Biochemical Oxygen Demand (5-day)	6.7	53.1	64.3	82.7
Chemical Oxygen Demand	140	1,109	1,343	1728
Total Organic Carbon	53.1	421	509.3	655.4
Dissolved Oxygen	6.8	53.8	65.2	83.9
Ammonia Nitrogen	2.0	15.8	18.2	24.7
Total Suspended Solids	23.9	189.4	229.2	295
Nitrate Nitrogen	5.7	45.2	54.7	70.4
Total Organic Nitrogen	1.9	15.1	18.2	23.5
Total Phosphorous	1.8	14.3	17.3	22.2
Oil and Grease	<5	<39.6	<48	<61.7
Total Residual Chlorine	0.15	1.2	1.4	1.9
Total Dissolved Solids	6380	50,549	61,191	78,750
Sulfate	367	2,908	3,520	4,530
Chloride	3400	26,938	32,609	41,967
Fluoride	3.2	25.4	30.7	39.5

Table 2 Surface Water Loading Calculations: DPEC's TPDES Permit No. WQ0004344000 (TX0124303)

Parameter	Average Concentration Outfall 001 (mg/L)	Current Average Discharge 0.95 MGD (lbs / day)	Expected Future Discharge 1.15 MGD (lbs / day)	Current Maximum Permitted 1.48 MGD (lbs / day)
Metals				
Total Aluminum	0.513	4.06	4.92	6.33
Total Antimony	0.0055	0.04	0.05	0.07
Total Arsenic	0.038	0.3	0.36	0.47
Total Barium	0.534	4.23	5.12	6.59
Total Beryllium	<0.004	<0.03	<0.04	<0.05
Total Cadmium	<0.001	<0.008	<0.009	<0.01
Total Chromium	0.0113	0.09	0.11	0.14
Trivalent Chromium	0.0102	0.08	0.09	0.13
Hexavalent Chromium	<.010	<0.08	<0.1	<0.12
Total Copper	0.039	0.31	0.37	0.48
Cyanide	<.005	<0.04	<0.05	<0.06
Total Lead	<.005	<0.04	<0.05	<0.06
Total Mercury	<.0002	<0.002	<0.002	<0.002
Total Nickel	0.047	0.37	0.45	0.58
Total Selenium	<0.005	<0.04	<0.05	<0.06
Total Silver	<0.002	<0.02	<0.02	<0.02
Total Thallium	<0.005	<0.04	<0.05	<0.06
Total Zinc	0.0442	0.35	0.42	0.56

Water Temperature

Temperature is a parameter that is independent of both concentration and mass loading calculations. Although the proposed project will increase the discharge volume from the facility, it should not result in either an increase in effluent temperature or an impairment of water quality standards. The water temperature of the plant effluent is affected by the raw water temperature, ambient air temperature, and physical limitations of the cooling tower. Accordingly, the hottest months of July, August, and September result in the highest average discharge temperatures. Permit discharge monitoring report daily average temperature data for these months in 2009 – 2011 range from 90°F to 94°F. For comparison, the site specific temperature criterion for TCEQ Water Quality Segment No. 1006 is 95°F.

2.4 <u>Proposed Actions – Air Emissions Summary</u>

Air emissions resulting from the proposed project are discussed in detail in sections 3.2.2-3.2.4 of the *Biological Assessment*. Here, we provide an overview of the analyses and conclusions relevant to understanding effects of the proposed project on the EFH.

The nitrate deposition (as total nitrogen) modeling was conducted conservatively assuming that all nitrogen species (*i.e.*, NO_2, NH_3) associated with the proposed project deposit at a rate equal to that of nitric acid (HNO_3) which deposits at a rate greater to that of other nitrogen species. Modeling was also conducted on the sulfuric acid mist (H_2SO_4) emissions associated with the proposed problems to obtain sulfate deposition (as total sulfur) results. The results of the AERMOD deposition modeling analyses are summarized in **Table 3**.

Table 3 AERMOD Modeling Results - Annual Deposition from the DPEC in the HSC/AA

	Average Deposition Results	
	($g/m^2/yr$)	**(kg/ha/yr)**
Total Nitrogen	0.00757	0.076
Total Sulfur from H_2SO_4	0.00000814	0.000081

Nitrogen

Approximately 6.3 kg of nitrogen per hectare year (kg/ha/yr) are deposited *from all sources* onto Galveston Bay (Byun *et al.* 2008), which covers approximately 1.6 x 10^5 hectares (GIS analysis, B&A). Based on these figures, approximately 9.8 x 10^5 kg of nitrogen are deposited per year from the atmosphere into the Galveston Bay system. Conservative AERMOD results predict an average nitrogen deposition rate of 0.076 kg/ha/yr for the proposed project. Thus, the magnitude of nitrogen deposition from the proposed unit represents less than 0.001% of total nitrogen deposited onto the Galveston Bay system (**Table 4**).

Table 4 Nitrogen Deposition from the DPEC in the HSC/AA relative to the Total Atmospheric Nitrogen Deposition in the Galveston Bay System

	Location		**HSC/AA relative to Galveston Bay System (%)**
	Galveston Bay System	**HSC/AA**	
Estimated Surface Area (hectares)	155,404	119	0.08
Annual Atmospheric Nitrogen Deposition (kilograms of nitrogen per hectare per year)	6.32*	0.076**	1.20
Total Annual Atmospheric Nitrogen Deposition (kilograms)	982,153	9.0	0.0009

*Source: *Byun et al. 2008*
**Source: Zephyr AERMOD results

Although NO_x levels in the HSC will increase with the installation of a new co-generation unit, the foregoing analysis demonstrates that NO_x emissions would not be expected to have any measurable impact in terms of pH or eutrophication on the HSC. Given the relatively enormous volume of Galveston Bay, the changes in any measure of water quality from the HSC effluent generated by the operation of the new co-generation unit will be virtually undetectable in any part of the Galveston Bay system.

Sulfur

AERMOD modeling predicts that operation of the proposed unit would result in an annual deposition rate of 0.000081 kg/ha (**Table 3**), or 9.6 *grams* per year of total sulfur in the HSC/AA. By contrast, data provided in Section 2.13 of Byun et al. (2008) permit estimating that total annual deposition of sulfur in the entire Galveston Bay System is nominally on the order of 5x10^5 kg per year. On this basis alone, we conclude that the proposed project's contribution to total sulfur deposition in the Galveston Bay system is negligible. Considering the HSC/AA alone, as a static volume of 12x10^9 liters (119 ha of surface area at an average depth of 10 m), the incremental increase in concentration for H_2SO_4 due to the instantaneous addition of an entire year's deposition would be on the order of 10^{-12} M, *i.e.*, at a level at which there would be no measurable effect on pH. Thus, over the course of a year, in a freely flowing HSC, the deposition of S-containing chemical species from the operation of the new natural gas-fired co-generation unit is not expected to have any effect on measures of water quality within the HSC.

3.0 ESSENTIAL FISH HABITAT (EFH)

3.1 Definition of Affected EFH

As defined by **16 USC 1802(10)**, EFH constitutes those aquatic and associated land areas, specifically enumerated as the

1) water way substrate
2) water column
3) water properties necessary to any life-cycle stage of aquatic organisms

3.2 Description of the Project's EFH

The Action Area encompasses a 2.8-km stretch of a major natural and industrial waterway, the HSC (Figure 3). This ~3-km stretch of the HSC (HSC/AA) begins approximately 7.5km from the mouth of the HSC in the San Jacinto Bay. The inland course of the HSC from the Turning Basin to San Jacinto Bay follows what is historically referred to as the Buffalo Bayou. Dredging began in Buffalo Bayou as early as the late 1800's, and dredging to 15m depth continues to the present day to permit industrial navigation (Lester & Gonzalez, 2011). While fresh water naturally enters the HSC at its origin, the mouth of the HSC in San Jacinto Bay connects the HSC to tidal and estuarine marine waters. As a result, the HSC is brackish and tide-influenced.

Of particular note, there are no areas federally designated as critical habitat for any threatened or endangered species within the Buffalo Bayou or San Jacinto Bay (http://criticalhabitat.fws.gov/crithab/), nor any areas of NMFS *Habitat of Particular Concern* (sero.nmfs.noaa.gov/hcd/pdfs/efhdocs/gom_efhhapc_poster.pdf).

3.3 Effects of Proposed Actions on the EFH

A. Direct actions on the <u>HSC structure</u>: The proposed actions do not involve altering the structure of the HSC. Substrate will remain intact. Turbidity will not change.

B. <u>Control of run-off</u> during construction and operation: The Project Site is at a minimum approximately 1.6 km from the bank of the HSC. Current best management practices will prevent addition of sediments or chemicals in run-off created during construction and operation.

C. <u>Deposition of emissions</u> from operation of the proposed cogeneration unit: Detailed analyses of emissions using conservative modeling show that operation of the proposed project will result in negligible levels of deposition for criteria and non-criteria pollutants. Complete details of this analysis can be found in Sections 3.2.2-3.2.4 of the *Biological Assessment*. Deposition of total nitrate- and total sulfur-containing compounds will not affect eutrophication or acidification of the waters in the Action Area of the HSC.

D. <u>Discharge of wastewater</u>: Operation of the proposed cogeneration unit will increase the discharge volume of cooling tower blowdown and other low volume wastes from the plant. However, the discharge will remain within current TCEQ authorized limits and no permit modifications will be necessary. Modeling of the increased discharge shows that there will be no change in toxicity, turbidity, acidity or water temperature of the effluent as a result of the operation of the proposed cogeneration unit. This is discussed in detail in Section 2.3.

4.0 PRESENCE OF MANAGED SPECIES IN THE AFFECTED EFH

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Within estuaries, EFH is further defined as "all waters and substrates (mud, sand, shell, rock, and associated biological communities) within these estuarine boundaries, including the subtidal vegetation (sea grasses and algae) and adjacent tidal vegetation (marshes and mangroves)" (Gulf of Mexico Fishery Management Council (GMFMC) 1998). Because of its connection to Upper Galveston Bay, about 7.5 km upstream from its mouth in San Jacinto Bay, the HSC/AA contains possible EFH for five aquatic species: 1) brown shrimp; 2) white shrimp; 3) pink shrimp; 4) red drum; and, 5) Spanish mackerel.

4.1 <u>Description of the Managed Species</u>

The following paragraphs describe the preferred habitats, life history stages, and relative abundance of these 5 EFH managed species based on information provided by the GMFMC (1998). Relative to the Galveston Bay system, this upstream section of the HSC, an industrial waterway, is relatively depleted in these species – some of which, e.g., pink shrimp, Spanish mackerel, may be virtually absent (Seiler *et al.* 1991). Preferred habitat for all these species is of higher salinity than expected for waters far upstream of the mouth of the HSC in the upper San Jacinto Bay.

Brown Shrimp: Brown shrimp eggs are demersal and occur offshore. The larvae also occur offshore and begin to migrate to estuaries as postlarvae. Migration occurs through passes on flood tides at night, mainly from February to April, with a minor peak in the fall. In estuaries, brown shrimp postlarvae and juveniles are associated with shallow vegetated habitats, as well as silty sand and non-vegetated mud bottoms. Postlarvae and juveniles have been collected in waters ranging in salinity from 0 to 70 ppt. The density of late postlarvae and juveniles is highest in marsh edge habitat and submerged vegetation, followed by tidal creeks, inner marsh, shallow open water, and oyster reefs. In unvegetated areas, muddy substrates seem to be preferred. Juveniles and sub-adults of brown shrimp occur from secondary estuarine channels out to the continental shelf but prefer shallow estuarine areas, particularly the soft, muddy areas associated with plant-water interfaces. Sub-adults migrate from estuaries at night on ebb tide on new and full moon. Abundance offshore correlates positively with turbidity and negatively with hypoxia (low levels of oxygen in the water). Adult brown shrimp occur in neritic Gulf waters (i.e., marine waters extending from mean low tide to the edge of the continental shelf) and are associated with silt, muddy sand, and sandy substrates (GMFMC 1998). They generally spawn from spring to early summer in Gulf waters greater than 20 meters deep and throughout the year in waters from 50 to 120 meters deep, with a major peak from September to November and a minor peak from April to June. Within the Galveston Bay system, adult brown shrimp are considered rare to common, and juvenile brown shrimp are considered abundant to highly abundant (NMFS 1998). Within the HSC, brown shrimp are rare (Seiler *et al.* 1991).

White Shrimp*:* White shrimp are offshore and estuarine dwellers and are pelagic or demersal, depending on life stage. The eggs are demersal and larval stages are planktonic; both stages occur in near-shore marine waters. Postlarvae migrate through passes mainly from May to November with peaks in June and September. Migration is in the upper 3 meters of the water column at night and at mid-depths during the day. Once they reach estuaries, postlarval white shrimp seek shallow water with muddy-sand bottoms high in organic detritus or abundant marsh, where they become benthic and develop into juveniles. Postlarvae and juveniles inhabit mostly mud or peat bottoms with large quantities of decaying organic matter or vegetative cover. Densities are usually highest in marsh edges and submerged aquatic vegetation, followed by marsh ponds and channels, inner marsh, and oyster reefs. White shrimp juveniles prefer salinities of less than 10 ppt and frequently are found in tidal rivers and tributaries. They move to coastal areas to mature and spawn. Migration from estuaries occurs in late August and September. Adult white shrimp are demersal and inhabit soft mud or silt bottoms, generally in near-shore Gulf waters to depths less than 30 meters (GMFMC 1998). They spawn from spring through fall in waters ranging from 8 to 34 meters deep. Adult white shrimp are considered rare to common in Galveston Bay, while juvenile white shrimp are considered abundant to highly abundant (NMFS 1998). Within the HSC/AA, white shrimp are likely but not abundant (Seiler *et al.* 1991).

Pink Shrimp: Pink shrimp occupy a variety of habitats, depending on their life stage. The eggs are demersal, whereas larvae are planktonic until the postlarval stage, when they become demersal. Postlarvae and juveniles of pink shrimp occur in estuarine waters of wide-ranging salinity (0 to >30 ppt). Recruitment into estuaries occurs in spring and fall at night, primarily on flood tides, through passes or open shoreline. Within estuaries, pink shrimp juveniles are commonly found in areas with submerged aquatic vegetation, where they burrow into the substrate by day and emerge at night; however, postlarvae, juveniles, and sub-adults may prefer coarse sand/shell/mud mixtures. Densities of pink shrimp have been found to be highest in or near submerged aquatic vegetation and low in mangroves. Pink shrimp are nearly absent from marshes. Adults inhabit offshore marine waters in depths of 9 to 45 meters and prefer substrates of coarse sand and shell with a mixture of less than 1 percent organic material. They spawn in the Dry Tortugas throughout the year in waters ranging from 24 to 52 meters in depth. According to relative abundance maps (NMFS 1998), adult pink shrimp do not occur in Galveston Bay, and juveniles occur rarely. Within the HSC, pink shrimp are virtually absent (Seiler *et al.* 1991).

Red Drum*:* Red drum occupy a variety of habitats, ranging from depths of 40 meters offshore to very shallow estuarine waters. Spawning occurs in the Gulf near the mouths of bays and inlets in the fall and winter months. Eggs hatch mainly in the Gulf, and the larvae are transported into the estuary by tidal currents where they mature before moving back to the Gulf to spawn. Adult red drum use estuaries but tend to spend most of their time offshore as they age. They are found over a variety of substrates, including sand, mud, and oyster reefs, and can tolerate a wide range of salinities (GMFMC 1998). Red drum spawn in open Gulf waters from late August to December. Like virtually all of the Gulf's estuaries, adult and juvenile red drum are common in Galveston Bay throughout the year. Estuaries are especially important to the larval, juvenile, and sub-adult red drum. Juvenile red drum are most abundant around marshes, preferring quiet, shallow, protected waters with grassy or slightly muddy bottoms (Simmons and Breuer 1962). Sub-adult and adult red drum prefer shallow bay bottoms and oyster reef substrates (Miles 1950). Estuaries are also important to the prey species of red drum. This is especially true for larvae, juvenile, and early adult red drum since they spend all of their time in estuaries. Larval red drum feed almost exclusively on shrimp, mysids, and amphipods, while juveniles feed more on fish and crabs (Peters and McMichael 1988). Adult red drum feed primarily on shrimp, blue crab, striped mullet, and pinfish. Protection of estuaries is important to maintain the essential habitat for red drum and because so many prey species of red drum are estuarine dependent (GMFMC 1998). Within the HSC, red drum are virtually absent (Seiler *et al.* 1991).

Spanish Mackerel*:* Spanish mackerel are restricted to the western Atlantic coast of the U.S. and the Gulf of Mexico. They are pelagic, occurring at depths to 80 meters throughout the coastal zone of the Gulf of Mexico. Adults are usually found in neritic waters and along coastal areas. They will inhabit estuarine areas with high salinities during seasonal migrations but are considered rare and infrequent in many Gulf estuaries. Spawning occurs in offshore waters from May through October. Nursery areas are in estuaries and coastal waters year-round. Larvae are most often found offshore from depths of 9 to 80 meters. Juveniles are found offshore, in the surf, and sometimes in estuarine habitats. They occur in varying salinities but prefer marine salinities and are not considered estuarine-dependent. Juveniles appear to prefer clean sand substrates; the substrate preferences of other life stages are unknown (GMFMC 1998). Adult and juvenile Spanish mackerel are considered rare to common in Galveston Bay. Estuaries are important habitats for most of the major prey species of Spanish mackerel. They feed throughout the water column on a variety of fishes, especially herrings. Squid, shrimp, and other crustaceans are also eaten. Many of their prey species are estuarine-dependent, spending all or a portion of their lives in estuaries. Because of this, Spanish mackerel are also dependent on the estuaries to some degree and, therefore, can be expected to be detrimentally affected if the productive capabilities of estuaries are seriously degraded (GMFMC 1998). Within the HSC, Spanish mackerel are virtually absent (Seiler *et al.* 1991).

4.2 Effects of Proposed Actions on Managed Species

Brown Shrimp*:* Brown shrimp may occur in the HSC/AA, although it offers minimal preferred habitat and such an occurrence would be incidental and transient. On the basis of no disturbance of EFH substrate, and the trivial levels of effect for emissions deposition, wastewater discharge, and run-off, **no adverse effects** on ***brown shrimp*** are expected as a result of the proposed project.

White Shrimp*:* White shrimp are likely to occur in the HSC/AA, although it offers no preferred habitat. On the basis of no disturbance of EFH substrate, and the trivial levels of effect for emissions deposition, wastewater discharge, and run-off, **no adverse effects** on ***white shrimp*** are expected as a result of the proposed project.

Pink Shrimp*:* Pink shrimp are highly unlikely to occur in the HSC/AA, which offers minimal preferred habitat. On the basis of no disturbance of EFH substrate, and the trivial levels of effect for emissions deposition, wastewater discharge, and run-off, **no adverse effects** on ***pink shrimp*** are expected as a result of the proposed project.

Red Drum*:* Red Drum are highly unlikely to occur in the HSC/AA, which offers no preferred habitat. On the basis of no disturbance of EFH substrate, and the trivial levels of effect for emissions deposition, wastewater discharge, and run-off, **no adverse effects** on ***red drum*** are expected as a result of the proposed project.

Spanish Mackerel*:* Spanish mackerel are highly unlikely to occur in the HSC/AA, which offers no preferred habitat. This, in conjunction with lack of EFH substrate disturbance, and the trivial levels of effect for emissions deposition, wastewater discharge, and run-off, **no adverse effects** on ***Spanish mackerel*** are expected as a result of the proposed project.

4.3 Conservation Measures

Construction and operation of the proposed facility will utilize the appropriate technology and best management practices to control emissions and wastewater and to minimize potential impacts to the environment related to noise, dust, and run-off. Applicable conservation measures are discussed in detail in Section 6.4 of the Biological Assessment.

5.0 CONCLUSIONS

A literature review was conducted to determine if the construction and operation of the proposed new gas-fired cogeneration unit at the DPEC will have any adverse effect on the EFH, or the five listed NMFS managed species with potential for occurrence, within the portion of the HSC in the project's Action Area. The proposed project will have no impact on the structure of the HSC and thus will not disturb the substrate component of the EFH. The projected deposition of emissions from the new cogeneration unit is of negligible magnitude. Wastewater discharges during operation of the new unit will be marginally elevated and remain within the currently permitted volume, and will not be changed in terms of temperature or toxicity. Conservation measures are in place to control run-off. Based on the above, the proposed project is not expected to have any effect on the water column or on the water quality components of the EFH. Therefore, the proposed project is not expected to have any adverse effects on the project's EFH or on any of the managed species with potential for occurrence therein.

6.0 REFERENCES

16 USC 1802(10)

50 Code of Federal Regulations **§ 402.02**

30 TACs § 307.6 (c) and (d) (http://www.info.sos.state.tx.us/fids/201003720-2.pdf)

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