FINAL

DAMAGE ASSESSMENT AND RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT

for the 2006 Calcasieu River Oil Spill

NRDA CASE FILE #LA2006_0621_0846

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EXECUTIVE SUMMARY

This document is a Final Damage Assessment and Restoration Plan and Environmental Assessment (Final DARP/EA) prepared for the June 19, 2006 unauthorized discharge of oil at CITGO Petroleum Corporation's (CITGO) Lake Charles Manufacturing Complex in Calcasieu Parish, Louisiana (referred to herein as the "Incident"). The Incident occurred when two ten-million-gallon stormwater storage tanks containing waste oil, oily wastewater, and oily sludge at CITGO's Lake Charles Manufacturing Complex overflowed during a rainstorm. An estimated 54,000 barrels (bbl) of waste oil (2,268,000 gallons) as well as a significant volume of oily wastewater were discharged into the Indian Marais waterway and ultimately into the Calcasieu River and upstream and downstream receiving waters and adjacent marshes, including Prien Lake, Moss Lake, Calcasieu Lake, and the Gulf Intracoastal Waterway. The discharge affected over 155 miles of shoreline along the Calcasieu River and associated waterbodies.

This Final DARP/EA is intended to inform members of the public about the natural resource injuries caused by the Incident, as well as propose restoration actions to compensate the public for those injuries consistent with the Oil Pollution Act of 1990 (OPA) (33 U.S.C. 2701 *et seq*.), its implementing regulations (15 C.F.R. Part 990), the Louisiana Oil Spill Prevention and Response Act of 1991 (OSPRA) (La. R.S. 30:2451, *et seq*.), and its implementing regulations (LAC 43:XXIX). The Final DARP/EA also serves as an Environmental Assessment under the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq*.), evaluating the reasonably foreseeable impacts of the preferred restoration actions on the quality of the physical, biological, and cultural and human use environments in the Calcasieu River basin. This document is part of the Natural Resource Damage Assessment (NRDA) process being performed pursuant to OPA and OSPRA by the trustees for the Incident, which include the Louisiana Oil Spill Coordinator's Office, Department of Public Safety and Corrections (LOSCO); the Louisiana Department of Environmental Quality (LDEQ); the Louisiana Department of Natural Resources (LDNR); the Louisiana Department of Wildlife and Fisheries (LDWF); the Coastal Protection and Restoration Authority (CPRA); the U.S. Department of the Interior (USDOI), represented by the United States Fish and Wildlife Service (USFWS); and the United States Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA) (collectively the "Trustees").

This Final DARP/EA provides information on:

- the purpose and need for a restoration plan, the Incident, legal authorities, and NRDA process (Chapter 1);
- the physical, biological, and cultural and human use environments found in the affected area (Chapter 2);
- the injury assessment procedures used by the Trustees as well as the nature, degree, and extent of injuries to natural resources and services resulting from the Incident (Chapter 3);
- the range of potential restoration alternatives considered by the Trustees and the Trustees' preferred restoration alternative (Chapter 4); and,
- the potential environmental impact of implementing the Trustees' preferred restoration alternative (Chapter 5).

The goal of injury assessment under OPA and OSPRA is to determine the nature, degree, and extent of injuries, if any, to natural resources and their services in the affected environment to provide a technical basis for evaluating and scaling restoration actions. Based on information collected and evaluated by the Trustees during the injury assessment, the Trustees determined that the Incident caused injuries to water column organisms, shallow subtidal and intertidal habitat (SSI), marsh habitat, birds, and recreational use, as summarized below in Table ES.1

Table ES.1. Summary of injuries for the Incident.

Injury Resource Category/Subcategory	Amount Injured	Injury/Damages
Water Column Organisms	Direct kill and production foregone	55,713 (kg)
SSI Habitat		
Intertidal	360.26 (acres)	466.10 DSAYs
Shallow subtidal	212.85 (acres)	250.17 DSAYs
Marsh Habitat		
Aboveground vegetation	133.69 (acres)	131.67 DSAYs
Marsh shoreline edge erosion	9.36 (acres)	165.63 DSAYs
Marsh shoreline edge recession	2.25 (acres)	10.38 DSAYs
Birds	385 birds from 12 species; rails and sora reproductive failure	867.76 Species-Specific DBYs
Recreational Use		$743,654 (2024$)
Boating	6,553 (foregone trips)	
Shore fishing	1,474 (foregone trips)	
General shoreline use	1,330 (foregone trips)	

The goal of restoration under OPA and OSPRA is to return injured natural resources and services to the conditions that existed prior to the incident and make the environment and public whole for interim losses. The Trustees identified and evaluated a range of restoration actions as required by OPA and NEPA. Based on this work, the Trustees identified a preferred alternative involving a suite of restoration actions that will adequately restore for the lost natural resources and services resulting from the Incident. A summary of the natural resources and services injured by the Incident, restoration goals and selected restoration actions is provided below in Table ES.2. Recreational use restoration alternatives to restore for lost recreational boating, shore fishing, and general shoreline are not proposed in this Final DARP/EA or included in Table ES2, as the Trustees have not yet identified specific restoration project(s) to address the recreational use injuries. When suitable recreational use projects are identified, the Trustees will fully describe and evaluate them under OPA and NEPA in a subsequent restoration plan that will be made available for public review and comment, as further explained in Chapter 4.

Table ES.2. Preferred alternative comprised of selected restoration actions for the injured resources and services resulting from the Incident.

RRP Injured Resource and Service Category	Injured Resource Category/Subcategory	Restoration Goal	Selected Restoration Action
CHW	Marsh Habitat Aboveground vegetation Marsh shoreline edge	Create/enhance coastal herbaceous wetlands	Long Point Bayou Marsh Creation (CS-0085) Project
CBSS, CHW	Shallow Subtidal and Intertidal (SSI) Habitats	Create/enhance coastal herbaceous wetlands	Long Point Bayou Marsh Creation (CS-0085) Project
CWCO	Water Column Organisms	Create coastal oyster reef	Calcasieu Lake Oyster Cultch Plant Project
Birds	Birds Coastal Marsh Species	Create nesting and foraging habitat	Long Point Bayou Marsh Creation (CS-0085) Project
	Birds Coastal Island Species	Create nesting habitat	Houma Navigation Canal (HNC) Bird Island Project

NEPA requires that the environmental impacts of a proposed federal action be considered before implementation (42 U.S.C. §4321; 40 C.F.R. Parts 1500-1508). The Trustees evaluated the potential for restoration actions associated with the preferred alternative to impact the following: the physical environment, the biological environment, the cultural and human use environment and the potential for cumulative impacts. The Federal Trustees have concluded that implementation of the preferred restoration alternative, as selected herein, would not adversely affect the quality of the human environment or pose any significant adverse environmental impacts (see Appendix I). Instead, implementation of the preferred alternative will provide both direct and indirect benefits to the physical and biological environment, including but not limited to vegetation, water and sediment quality, wildlife, and fisheries. Likewise, the selected restoration actions will provide positive benefits for human recreational use. No information indicating the potential for significant impacts was revealed through the public review and comment process. An Environmental Impact Statement (EIS) will therefore not be prepared for the preferred restoration actions. Issuance of a Finding of No Significant Impact (FONSI) fulfills and concludes all requirements for compliance with NEPA by the Federal Trustees.

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1 INTRODUCTION

1.1 Purpose and Need for a Restoration Plan

The purpose and need for the selected restoration alternatives evaluated in this Final Damage Assessment and Restoration Plan and Environmental Assessment (DARP/EA) is to restore natural resources injured by the Incident consistent with the Oil Pollution Act of 1990 (OPA) (33 U.S.C. 2701 et seq.), its implementing regulations (15 C.F.R. Part 990), the Louisiana Oil Spill Prevention and Response Act of 1991 (OSPRA) (La. R.S. 30:2451, *et seq*.), and its implementing regulations (LAC 43:XXIX). This Final DARP/EA is intended to inform members of the public about the natural resource injuries caused by an unauthorized discharge of oil from CITGO Petroleum Corporation's (CITGO) Lake Charles Manufacturing Complex in the Calcasieu River Estuary, as well as potential restoration alternatives the natural resource trustees considered for the purposes of compensating the public for those injuries.

This document is part of the Natural Resource Damage Assessment (NRDA) process being performed pursuant to OPA and OSPRA by the Natural Resource Trustees (Trustees) for the CITGO spill, which include the Louisiana Oil Spill Coordinator's Office, Department of Public Safety (LOSCO); the Louisiana Department of Environmental Quality (LDEQ); the Louisiana Department of Natural Resources (LDNR); Louisiana Department of Wildlife and Fisheries (LDWF); the Louisiana Coastal Protection and Restoration Authority (CPRA); the United States Department of the Interior (USDOI), represented by the U.S. Fish and Wildlife Service (USFWS); and the United States Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA).

This Final DARP/EA also serves as an Environmental Assessment under the National Environmental Policy Act (NEPA), evaluating the reasonably foreseeable impacts of the preferred restoration actions on the quality of the physical, biological, and cultural environment in the Calcasieu River basin.

1.2 Overview of the Incident

Beginning on or about June 18, 2006, CITGO discharged waste oil, oily wastewater, and oily sludge from two ten-million-gallon stormwater tanks at its refinery's wastewater treatment facility into the Indian Marais and Calcasieu River during a rainstorm (herein referred to as the "Incident"). The discharge occurred at the CITGO Lake Charles Manufacturing Complex located along the right descending bank of the Calcasieu River in the lower Calcasieu River estuary, approximately eight miles south-southwest of Lake Charles, Louisiana, in Calcasieu Parish. An estimated 54,000 barrels[1] (bbl) of waste oil as well as a significant volume of oily wastewater were discharged into the Indian Marais and the Calcasieu River and downstream receiving

[1] Litigation surrounding violations under the Clean Water Act yielded a decision by the court on the amount of oil spilled into waterways of the United States. On Page 9 of Case 2:08-cv-00893-RTH-PJH Document 234 filed 09/29/2011, *United States of America v. CITGO Petroleum Corp*., Judge Haik made the determination that: "The Court finds the exact amount is unknowable in these situations, but believes after full consideration of the testimony presented, that the amount discharged is in the range of fifty-four thousand (54,000) barrels."

waters and adjacent marshes, including Moss Lake, Calcasieu Lake, and the Gulf Intracoastal Waterway (Figure1.1). Oil also flowed upriver with the tidal influence, which led to additional oiling of the river and Prien Lake. Prior to the release, the stormwater tanks held slop oil and emulsion, oily wastewater, and oily sludge. The term "slop oil" refers to waste oil that is produced from drainages, residues, and cleaning processes; it has a high aromatic hydrocarbon content and a low viscosity, which makes the waste oil more toxic to plants and animals. Oily wastewater was pumped into the tanks during the storm event causing the tanks to discharge through the overflow vents at the top of the tanks into the containment area for approximately 12 hours. For the first three hours, the discharge from the tanks was primarily waste oil (Michel 2009).

Figure 1.1. Incident location at CITGO's manufacturing complex, Calcasieu River, Louisiana.

The discharge leaked from the containment dike via several pathways intermittently over the course of at least two days (June 19 and 20, 2006). Black oil and sheens were observed in Indian Marais. CITGO placed booms across the Indian Marais and at the confluence of the Indian Marais and Calcasieu River; however, the booms were ineffective. CITGO attempted to stop overflows, seepages, and leaks from the containment dike on June 19 and 20. Two days following the release (June 21), CITGO and response contractors deployed additional boom on the Calcasieu River. The first record of waste oil recovery from the Calcasieu River was on June 21.

The discharge affected over 155 miles of shoreline along the Calcasieu River and associated waterbodies. Portions of these water bodies were closed during clean-up activities for periods ranging from two to 24 days, including the closure of public access points such as fishing sites, boat ramps, beaches, and parks. The high toxicity of the waste oil led to observable ecological effects. Marsh plants died and shoreline began to erode within two weeks following the release, and several reports of fish kills and other organisms were documented. Direct impacts to wildlife and birds were difficult to determine in the early stages of response actions due to the hazardous conditions to human health immediately following the spill. Recovery of waste oil from the Indian Marais, Calcasieu River, and dike area continued until July 27, 2006, while shoreline cleanup continued until December 2006.

1.3 NRDA Authority and Legal Requirements

OPA and OSPRA are the principal federal and state statutes, respectively, authorizing federal and state agencies and tribal officials to act on behalf of the public to (1) assess damages for injuries to natural resources and services resulting from a discharge of oil or the substantial threat of a discharge and (2) develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the injured resources. The federal Trustees for this Incident, the USDOI, represented by the USFWS, and the Department of Commerce, represented by the NOAA, are designated pursuant to Section 1006(b) of OPA (42 U.S.C. §2706(b)) and the National Contingency Plan (NCP) (40 C.F.R. § 300.600). State Trustees for Louisiana are designated by the Governor of Louisiana pursuant to Section 1006(b) of OPA (42 U.S.C. § 2706(b)), the NCP (40 C.F.R. § 300.605) and OSPRA, and include LOSCO, LDEQ, LDNR, LDWF, and CPRA.

1.3.1 Overview of OPA and OSPRA Requirements

The NRDA process conducted pursuant to OPA and OSPRA and the corresponding regulations promulgated thereunder at 15 C.F.R. Part 990 and LAC 43:XXIX consists of three phases: (1) Preassessment; (2) Restoration Planning; and (3) Restoration Implementation. OPA authorizes federal, state, and tribal natural resource trustees to initiate a damage assessment, among other requirements, when natural resources may have been injured and/or natural resource services impaired as a result of discharges of oil. OPA regulations provide specific definitions for the following terms:

- "Injury" is "an observable or measurable adverse change in a natural resource or impairment of a natural resource service";
- "Natural resources" are "land, fish, wildlife, biota, air, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any state or local government or Indian tribe"; and,
- "Natural resource services" are "functions performed by a natural resource for the benefit of another resource and/or the public".

During the Preassessment phase, the Trustees determined that legal jurisdiction existed to conduct a NRDA for this Incident, including: (1) one or more incidents had occurred; (2) the discharge was not from a public vessel; (3) the discharge was not from an onshore facility subject to the Trans-Alaska Pipeline Authority Act; (4) the discharge was not permitted under federal, state, or local law; and (5) natural resources under the trusteeship of a trustee may have been injured as a result of the incident (15 C.F.R. § 990.41 (a)). As provided at 15 C.F.R. § 990.14(c)(1) and LAC 43:XXIX.115, the Trustees invited CITGO to participate in the NRDA (see Section 1.5). CITGO was involved in the design, performance, and funding of several Preassessment activities to collect ephemeral data.

The Trustees also determined, pursuant to 15 C.F.R. § 990.42, that the requisite conditions existed to proceed beyond the Preassessment phase to Restoration Planning, including: (1) data collected pursuant to 15 C.F.R. § 990.43 demonstrated that injuries to natural resources had resulted from the Incident; (2) response actions did not adequately address the injuries; and (3) feasible restoration alternatives existed. Based on these determinations and in accordance with 15 C.F.R. § 990.44 and LAC 43:XXIX.123, on October 20, 2014, the Trustees issued a Notice of Intent to Conduct Restoration Planning for the Incident (see Section 1.5). In the Restoration Planning phase, the Trustees evaluated and quantified the nature and extent of injuries to natural resources and services, and determined the need for, type of, and scale of appropriate restoration actions. Using the information developed during the Restoration Planning phase, the Trustees developed this Final DARP/EA.

The first component of the Restoration Planning phase was injury assessment. The Trustees evaluated injury to 1) water column organisms, 2) shallow subtidal and intertidal habitat, 3) marsh habitat, 4) birds, and 5) recreational use. The Trustees' assessment used data from the Trustees, CITGO (when validated), and other sources. The Trustees' assessment produced relevant information for determining the nature and extent of injuries to natural resources.

The second component of the Restoration Planning phase is restoration selection. Considering the nature and extent of exposure and/or injuries to natural resources caused by the Incident, the Trustees developed a plan for restoring the injured resources and their services, set forth in this Final DARP/EA. The Trustees identified a reasonable range of restoration alternatives and evaluated those alternatives to determine the preferred restoration actions among them. As a part of this process, the Trustees considered the extent to which the potential restoration alternatives provide benefits to more than one natural resource and/or service, as well as the cost-effectiveness of the alternatives. Prior to selecting their preferred restoration alternative, the Trustees requested public review of the Draft DARP/EA (see section 1.5).

1.3.2 Louisiana Regional Restoration Planning Program

The Louisiana Regional Restoration Planning Program (RRP Program) was established to address incidents under OPA and OSPRA and make the NRDA process as a whole more efficient in Louisiana. The RRP Program identifies the statewide Program structure, decision-making process, and criteria that are used to select the restoration project(s) that may be implemented to restore the trust resources and services injured by a given incident. The goals of this statewide Program are to: 1) expedite and reduce the cost of the NRDA process; 2) provide for consistency and predictability by describing in detail the NRDA process, thereby increasing understanding of the process by the public and industry; and 3) increase restoration of lost trust resources and services. A complete description of the RRP Program is provided in the RRP Program Final Programmatic Environmental Impact Statement (FPEIS) (NOAA et al. 2007).

1.3.3 National Environmental Policy Act Compliance

Any restoration of natural resources under OPA must comply with NEPA, as amended (42 U.S.C. 4321 et seq.), and associated implementing regulations (40 C.F.R. §§ 1500-1508). In compliance with NEPA and its regulations, this Final DARP/EA identifies a range of potential restoration alternatives, describes the purpose and need for the action, evaluates reasonably foreseeable environmental consequences, and provides for public participation in the decision-making process. The information on environmental consequences has been used in making a determination that preparation of an Environmental Impact Statement (EIS) is not required prior to the selection of the Trustees' preferred restoration actions. If there is a significant change to any of the restoration projects selected in the Final DARP/EA, the Trustees will consider the need to develop additional environmental analysis in accordance with NEPA regulations. These regulations typically require a supplemental NEPA analysis be prepared if new information arises that would substantively impact previous decision-making or if there is a significant change to a selected restoration project (40 C.F.R § 1502(9)(c)). The decision as to whether a change is significant considers both the context and intensity of the proposed change (40 C.F.R. § 1508.27). Project changes that are not deemed significant could be outlined in a supplemental information report for posting to the Administrative Record.

The EA portion of this document is being prepared using the 1978 Council on Environmental Quality (CEQ) NEPA regulations. NEPA reviews initiated prior to the effective date of the revised CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA regulations was September 14, 2020. This review began on October 20, 2014 when the Trustees issued the Notice of Intent to Conduct Restoration Planning for the NRDA (see Section 1.5); therefore, USFWS and NOAA decided to proceed under the 1978 regulations. Under 40 C.F.R. §§ 1501.5 and 1501.6, for the purposes of this NEPA analysis, USFWS is the lead agency and NOAA is a cooperating agency. NOAA may adopt the Final EA, as appropriate, in accordance with 40 CFR § 1506.3 and its agency-specific NEPA procedures.

1.4 Coordination with the Responsible Party

The OPA and OSPRA regulations require the Trustees to invite the RP to participate in the NRDA process (15 C.F.R. § 990.14 and LAC 43:XXIX.115). Accordingly, the Trustees delivered a formal invitation to CITGO on August 28, 2006 to participate in a cooperative NRDA for the Incident and CITGO formally accepted the Trustees' invitation on September 26, 2006. Information collected by all parties was shared, as were the results of analyses undertaken independently by the Trustees and CITGO. Coordination between the Trustees and CITGO reduced duplication of effort, increased the cost-effectiveness of the assessment process, and increased sharing of information. As required by the regulations at 15 C.F.R. § 990.14 (c)(4), the Trustees retain final authority to make determinations regarding injury and restoration.

While proceeding with the injury assessment for the Incident, the Trustees also participated in settlement negotiations with CITGO. On June 17, 2021, the U.S. Department of Justice (USDOJ) and the Trustees lodged a proposed Consent Decree with the Court to: (1) provide funding by CITGO to the Trustees to restore, replace, or acquire the equivalent of the natural resources allegedly injured, destroyed or lost as a result of the Incident; (2) provide payment by CITGO to the Trustees to reimburse the remaining unpaid NRDA costs incurred by the Trustees; and (3) resolve the Trustees' claims against CITGO for natural resource damages under OPA and OSPRA. The settlement was negotiated by USDOJ, the Trustees and CITGO in good faith, was intended to avoid potentially prolonged and complicated litigation and expedite natural resource restoration actions to be performed by the Trustees, and was fair, reasonable, and in the public interest consistent with the purposes of OPA and OSPRA. The proposed Consent Decree was made available to the public for review and comment in accordance with Section 1006(c)(5) of OPA, 33 U.S.C. § 2706(c)(5), 28 C.F.R. § 50.7, and LAC 43:XXIX.131 and 135 (see Section 1.5) and ultimately approved by the Court on August 31, 2021.

1.5 Public Participation

The Trustees invited the public to participate in Restoration Planning for this Incident. Public participation is consistent with all federal and state laws and regulations that apply to the NRDA, including Section 1006 of OPA, the OPA regulations at 15 C.F.R. Part 990, Section 2480 of OSPRA, the OSPRA regulations at LAC 43:XXIX, as well as NEPA and the CEQ regulations at 40 C.F.R. Part 1500-1508. On October 20, 2014, the Trustees published a Notice of Intent to Conduct Restoration Planning in the Louisiana Register (Vol. 40, No. 10, pp. 2170-2172) and in 2 newspapers of general circulation in Louisiana, *The Advocate* (Baton Rouge, LA) and the *American Press* (Lake Charles, LA). This Notice informed the public that, based on Preassessment findings, the Trustees were proceeding with Restoration Planning under OPA and OSPRA and opening an Administrative Record to facilitate public involvement in the Restoration Planning process (see Section 1.6).

On June 24, 2021, USDOJ published a Notice of Lodging of Proposed Consent Decree under the Oil Pollution Act in the Federal Register (Vol. 86, No. 119, pgs. 33359-33360) seeking 30-day public review and comment of the proposed Consent Decree with CITGO (see Section 1.4). USDOJ did not receive any comments. Additionally, on July 20, 2021, the Trustees published a Notice of Availability of a Consent Decree for Natural Resource Damages in the Louisiana

Register (Vol. 47, No. 7, pgs. 1069-1070), as well as in *The Advocate* (Baton Rouge, LA) and the *American Press* (Lake Charles, LA), seeking 30-day public review and comment of the proposed Consent Decree. The Trustees did not receive any comments.

On October 20, 2021, the Trustees published a Notice of Availability of a Draft DARP/EA in the Louisiana Register (Vol. 47, No. 10, pgs. 1616-1617), *The Advocate* (Baton Rouge, LA), *Houma Courier,* and in the *American Press* (Lake Charles, LA). This Notice stated that the Trustees were seeking 30-day public review of the Draft DARP/EA. The Trustees did not receive any comments.

1.6 Administrative Record

The Administrative Record (AR) documents the basis for Trustee decisions pertaining to restoration and includes documents relied upon by the Trustees during the assessment. The information provided in the AR can facilitate public participation during Restoration Planning and is available for use in future administrative or judicial review of Trustee actions to the extent provided by federal and state law. The AR can be viewed digitally by going to the following web address: https://data.losco.org/. If you need to view the hardcopy AR, please call or email to make an appointment:

Louisiana Oil Spill Coordinators Office
Department of Public Safety and Corrections
(225) 925-6606
losco@la.gov

2 AFFECTED ENVIRONMENT

This chapter presents a general description of the physical, biological, and cultural and human use environments potentially affected by the Incident and in proximity to the preferred restoration alternative, as required under NEPA. The affected environment for this Incident is described as that portion of the Calcasieu estuary beginning south of the Interstate Highway 210 (I-210) bridge along the Calcasieu River and nearby lakes and streams to the southern tip of Calcasieu Lake and lies within Regions 4 and 7 of the RRP Program (Figure 2.1). Regional boundaries are described in detail in Section 5.0 of the RRP Program FPEIS (NOAA et al. 2007). The selected restoration alternative is located in Region 4 and Region 3. The selected HNC Bird Island Project is located in Region 3 and has undergone NEPA analysis for Phase I Engineering and Design (E&D) (LA TIG 2020). The affected environment (Terrebonne Basin) for the HNC Bird Island Project is described in detail in Section 4.3.2 of the *Louisiana Trustee Implementation Group Final Restoration Plan and Environmental Assessment #7: Wetlands, Coastal, and Nearshore Habitats and Birds* (LA TIG 2020), which is incorporated here by reference. Therefore, the affected environment of the selected HNC Bird Island Project is not discussed any further in this section.

2.1 Physical Environment

Situated along the northern Gulf of Mexico between 29 and 33 degrees north latitude, Louisiana's climate is humid, subtropical. The mean monthly temperatures for southwestern Louisiana range from 92 Fahrenheit (°F) in August to 42°F in January, and average annual precipitation is 57 inches (U.S. Climate Data, n.d.). During the summer months, prevailing southerly and southeasterly winds transport warm, moist air from the Gulf of Mexico across the coast. From September to May, more variable and moderate weather conditions prevail as arctic and polar air masses associated with extratropical storms periodically inundate the state and produce cooler and drier conditions. In addition to precipitation, these storms can produce significant changes in water level in the coastal bays and marshes over relatively short periods. Louisiana is also susceptible to tropical weather systems such as tropical waves, tropical depressions, tropical storms, and hurricanes. These weather systems can produce significant amounts of precipitation over a very short period and are often accompanied by strong winds, tornadoes, and storm surges along the coastal areas.

Geologically, the majority of Louisiana's surface area generally consists of Quaternary sediment, namely Holocene alluvial sediments deposited by the Mississippi, Red, Ouachita, and other rivers and deposits associated with Pleistocene terraces, with a comparatively small portion comprised of Tertiary age strata (Holcomb et al. 2015). The portion of the Gulf Coastal Plain, which comprises southwestern Louisiana and the affected environment, can be characterized by two main physiographic types: 1) prairie terrace, a broad Gulf-ward sloping inland terrace found in central and southern Calcasieu Parish and the northern quarter of Cameron Parish; and 2) Gulf coast marshes located south of the prairie terrace reaching to the Gulf of Mexico and consisting of extremely flat marshlands and large inland lakes at or below sea level (LeBlanc 2000).

The affected environment is located within the Calcasieu River Basin. The Calcasieu River and its associated tributaries comprise a large, tidally influenced wetland ecosystem (or estuary) approximately 40 miles in length, extending north from the Gulf of Mexico to the saltwater barrier upstream of Lake Charles, Louisiana. The estuary is comprised of a complex interconnected system of bayous, bays, shallow lakes, and dredged ship channels fringed by saline and brackish marshes. Besides the Calcasieu River, some of the other predominant hydrologic components of the estuary include Lake Charles, Prien Lake, Moss Lake, and Calcasieu Lake (Figure 2.1).

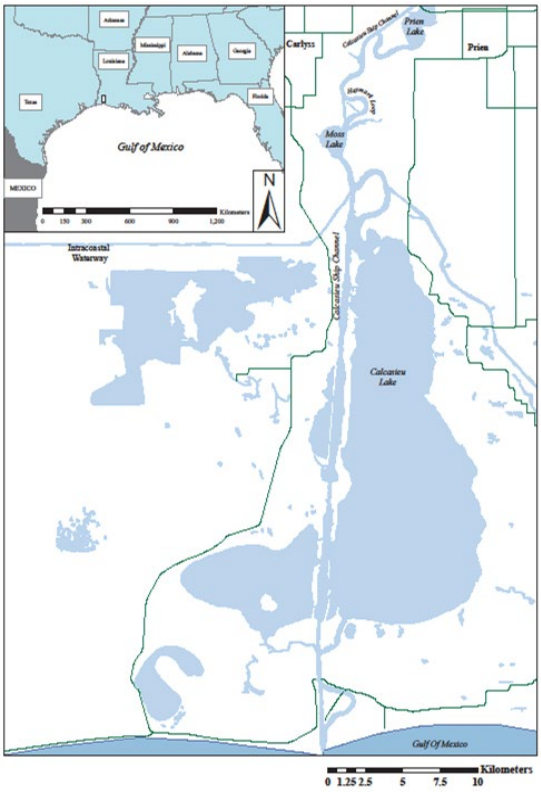

Figure 2.1. Lower Calcasieu River estuary.

The upper estuary is characterized by industrial development associated with petroleum refining and

chemical production (including the CITGO complex). Existing shorelines in the upper estuary are primarily manmade with some brackish fringe marshes. The lower estuary is largely comprised of undeveloped coastal marshes, which provide habitat for many species of fish and wildlife. The lakes and river channel bottoms consist mainly of sand and gravel deposits with natural levees of fine sands and mud deposits with organic-rich muddy swamp deposits between them. The silt is typically black with plant and shell fragments. Sediments generally become finer and more stable in the upstream reaches of the estuary where vegetation is more prevalent and tidal surge tends to be lowest (EPA 2003a).

Two National Wildlife Refuges (NWRs) are also located in the lower Calcasieu River estuary – Sabine and Cameron Prairie NWRs. Those NWRs were created to support, protect, and provide winter habitat for migratory waterfowl. They are also managed for the conservation and protection of other natural resources in the region.

2.1.1 Water Quality

As part of the Surface Water Monitoring Program, LDEQ routinely monitors 25 parameters on a monthly basis using a four-year cycle fixed site network, as well as a long-term network of 21 sites (LDEQ 2020). Data are systematically collected on selected water subsegments defined in the Surface Water Quality Standards (LAC 33:IX, Chapter 11). Each year of the four-year cycle runs from October through September for a given set of sites before changing to the next set. Long-term network sites are sampled every month and year regardless of the four-year cycle. Based on those data and the use of less-continuous information, such as fish consumption and swimming advisories, the LDEQ assesses water quality fitness for the following uses: primary contact recreation (swimming), secondary contact recreation (boating), fish and wildlife propagation (fishing), drinking water supply, outstanding natural resource use, agriculture, and shellfish propagation (LDEQ 2020). Based on existing data, water quality is determined to be either fully supporting or not supporting those uses.

The LDEQ currently maintains two water quality monitoring sites, Calcasieu River and Calcasieu Lake, near the projects considered by the Trustees. Both sites are part of the four-year cycle network. Based on the 2020 Louisiana Water Quality Inventory: Integrated Report, Calcasieu Lake and the Calcasieu River are both impaired for fish and wildlife propagation, oyster propagation, and primary contact recreation. Table 2.1 provides a summary of the assessments from the 2020 Louisiana Water Quality Inventory: Integrated Report for the two subsegments.

Table 2.1. Combined monitored and evaluated assessments of water quality for Calcasieu River and Calcasieu Lake (LDEQ 2020).

Subsegment Number	Subsegment Description	Primary Contact Recreation	Secondary Contact Recreation	Fish and Wildlife Propagation	Oyster Propagation
LA030401_00	Calcasieu River-From below Moss Lake to the Gulf of Mexico; includes	Not Supporting	Fully Supporting	Not Supporting	Not Supporting

	Ship Channel and Monkey Island Loop (Estuarine)				
LA030402_00	Calcasieu Lake	Not Supporting	Fully Supporting	Not Supporting	Not Supporting

2.1.2 Air Quality

The Air Field Services Section of LDEQ maintains a statewide monitoring network that consists of 41 stationary ambient air-monitoring stations. The data collected are used to determine compliance with national ambient air quality standards (NAAQS) and track trends in air quality. The United States Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards set NAAQS for six principal pollutants considered harmful to public health and the environment. Termed criteria pollutants, the six are: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate (PM2.5 and PM10), and sulfur dioxide (SO_2). Volatile organic compounds, many of which are hazardous air pollutants, are not listed as criteria air pollutants but are measured at selected sites throughout Louisiana. There are 5 ambient air monitoring sites in Calcasieu Parish (none in Cameron Parish). Ambient air monitoring data and reports are available online through LDEQ's website: https://www.deq.louisiana.gov/page/ambient-air-monitoring-data-reports.

The Clean Air Act established two types of national air quality standards: primary and secondary. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. A geographic area that meets or exceeds primary standards is classified as an attainment area. Areas that violate NAAQS for one or more of the six criteria pollutants are classified as nonattainment areas. Information on nonattainment/maintenance status for each parish by year can be accessed at: https://www3.epa.gov/airquality/greenbook/anayo_la.html. Table 2.2 provides standards for each pollutant and attainment status for Louisiana.

Table 2.2. National Ambient Air Quality Standards (EPA n.d.) and Louisiana Attainment Status (LDEQ n.d.). Units of measure for the standards are parts per million (ppm) or parts per billion (ppb) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

Pollutant	**Primary/ Secondary**	**Averaging Time**	**Level**	**Form**	**Attainment Status**
Carbon Monoxide	Primary	8 – hour 1 – hour	9.0 ppm 35.0 ppm	Not to be exceeded more than once per yr	Attainment
Lead	Primary and Secondary	Rolling 3 month avg	0.15 $\mu m/m^3$ (1)	Not to be exceeded	Attainment
Nitrogen Dioxide	Primary Primary and Secondary	1 – hour Annual	100.0 ppb 53.0 ppb (2)	98th percentile of 1 – hr daily max conc, avgd over 3 yrs Annual mean	Attainment

Ozone	Primary and Secondary	8 – hour	0.070 ppm (3)	Annual 4th highest daily max 8 hr concentration avgd over 3 yrs	Attainment
Particle Pollution PM2.5	Primary Secondary Primary and Secondary	Annual 24 hour	12.0 μm/m^3 15.0 μm/m^3 35.0 μm/m^3	Annual mean avgd over 3 yrs 98th percentile, avgd over 3 yrs	Attainment
Particle Pollution PM 10	Primary and Secondary	24 – hour	150.0 μm/m^3	Not to be exceeded more than once per yr on avg over 3 yrs	Attainment
Sulfur Dioxide	Primary Secondary	1 – hour 3 – hour	75.0 ppb (4) 0.5 ppm	99th percentile of 1 – hr daily max conc avgd over 3 yrs Not to be exceeded more than once per yr	Non-attainment for St. Bernard Parish only

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 μg/m^3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is a USEPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

2.1.3 Noise

The Noise Control Act of 1972 (42 U.S.C. §4901 et seq.) authorized the establishment of Federal noise emission standards for commercially distributed products, established a means for effective coordination of Federal noise-control research and activities, and serves to provide information to the public regarding noise emissions. There are many different sources of noise in and near the selected restoration project areas including, but not limited to: commercial and recreational boats, transportation noise, construction noise, and industry-related noise (such as oil and gas facilities and light industry). Transportation noise includes traffic noise from automobiles, trucks, and motorcycles; railway transportation services; and aircraft (including helicopters) take-offs, landings, and overflights from public and private airfields. Construction noise is created during a variety of activities including demolition projects, site preparation (e.g., land clearing, grading, excavation, cultch placement), and repair and maintenance activities. These actions can result in relatively high noise levels within several hundred feet of the activity. Noise levels generated will fluctuate depending on the type, number, and duration of use of heavy equipment for

construction activities and can differ in effect by the type of activity, existing site conditions (vegetation to buffer sound), and existing ambient noise levels.

2.2 Biological Environment

Coastal herbaceous wetlands (i.e., fresh, intermediate, brackish, and salt marsh) dominate the affected environment, while forested wetlands and agricultural cropland/grassland occur in the interior portions of the area (Figure 2.2). It is important to note that although various habitats exist in the affected environment, not all were injured by the Incident. The following habitat types are present in the affected environment (detailed descriptions of each are provided in the RRP Program FPEIS (NOAA et al. 2007)):

- Marsh (Salt, Brackish/Intermediate, and Fresh)
- Wetland Forest (Evergreen, Deciduous, and Mixed)
- Wetland Scrub/Shrub (Evergreen, Deciduous, and Mixed)
- Agriculture-Cropland-Grassland
- Wetland Barren
- Open Water
- Marine/Estuarine Shore
- Freshwater Shore
- Marine/Estuarine and Freshwater Benthic (Soft-Sedimentary)
- Marine/Estuarine Encrusting Community (Natural/Artificial Substrates)
- Living Reefs
- Marine/Estuarine Submerged Aquatic Vegetation (SAV)
- Mangrove Swamp
- Batture
- Upland Forest
- Upland Scrub/Shrub (Evergreen, Deciduous, and Mixed)

The RRP Program FPEIS provides detailed descriptions of the common biota (vegetation, mammals, reptiles, amphibians, birds, fish, and shellfish) of the Calcasieu River estuary, as well as a summary of those species' associated habitat types and is incorporated herein by reference (Chapter 2.0, Tables 2.3 - 2.13 in NOAA et al. 2007).

The Calcasieu River estuary provides important habitat within the affected environment for resident and migratory waterfowl, shorebirds, and wading birds and serves as the primary wintering habitat for mid-continent waterfowl populations, as well as breeding and migration habitat for migratory songbirds returning from Central and South America. Sabine NWR alone provides important habitat for more than 300 species of birds, 26 species of mammals, 41 species of reptiles and amphibians, 132 species of fish, and 68 species of marine invertebrates. Nongame migratory bird species include, but are not limited to, least bittern (*Ixobrychus exilis*), white ibis (*Eudocimus albus*), yellow rail (*Coturnicops noveboracensis*), and stilt sandpiper (*Calidris himantopus*). Other wildlife found throughout the Calcasieu River estuary include, but are not limited to, American alligator (*Alligator mississippiensis*),white-tailed deer (*Odocoileus virginianus*), river otter (*Lutra canadensis*), muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), and raccoon (*Procyon lotor*).

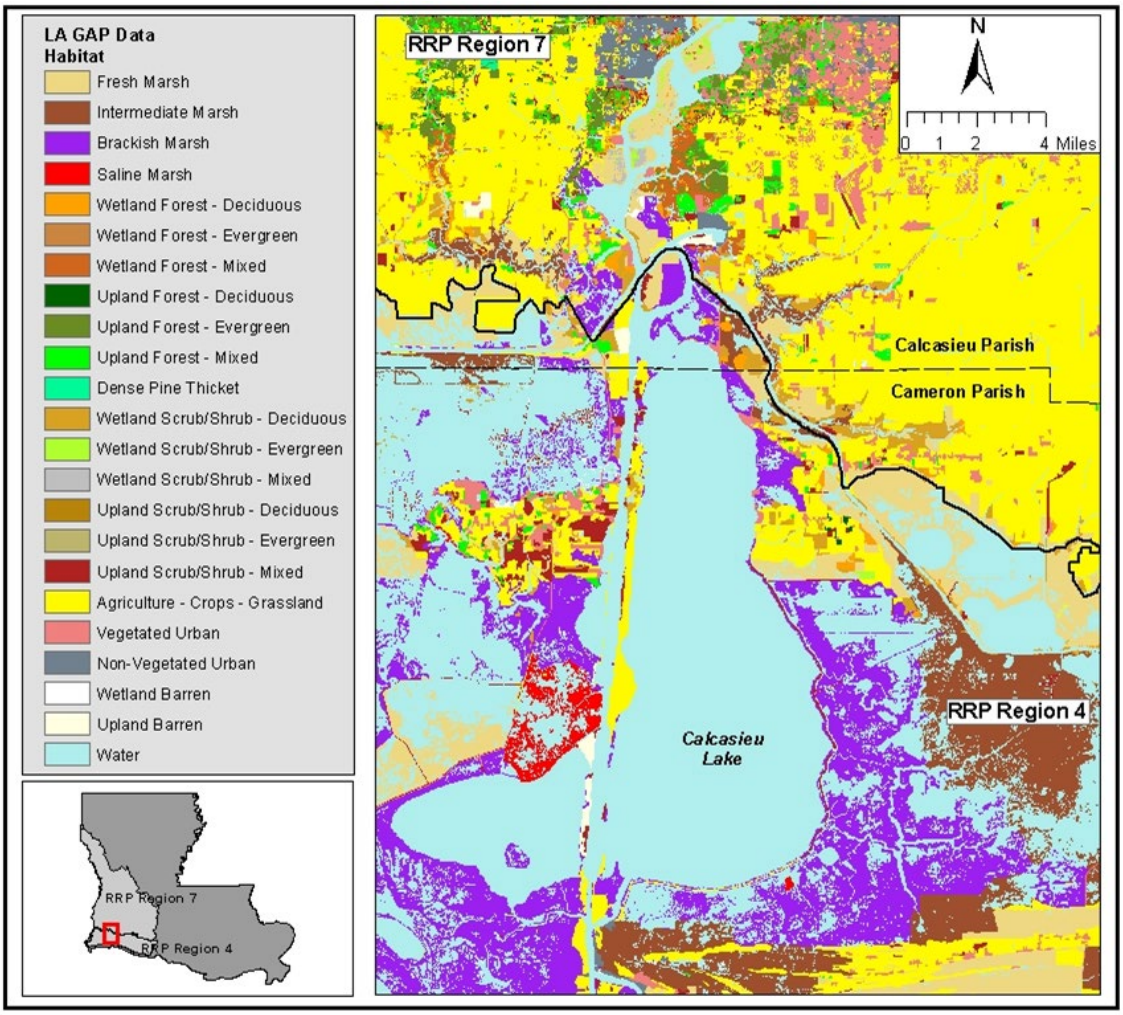

Figure 2.2. Habitat classification map depicting habitat types that occur in the lower Calcasieu River estuary located within Regions 4 and 7.

Extensive marsh habitats provide valuable spawning, nursery, and feeding habitat for several fish species of sport and commercial importance including spotted trout (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), blue crab (*Callinectes sapidus*), brown shrimp species, and white shrimp species. Phytoplankton, zooplankton, and aquatic invertebrates also provide food for fish and bird species.

From 1932 to 2016, the Calcasieu/Sabine Basin lost approximately 200 mi^2 of its coastal wetlands. This estimated land loss is based on land area analyses using historical U.S. Army Corps of Engineers (USACE) land loss data, aerial photography data, and satellite imagery data (Couvillion et al. 2017). A combination of human-induced and natural processes has contributed to land loss in the project area. This includes saltwater intrusion, hydrologic modifications of the Calcasieu basin, oil and gas extraction and infrastructure, storm-driven erosion, subsidence, and sea level rise. Persistent flooding of marshes from sea-level rise combined with saltwater intrusion from the Gulf of Mexico through the Calcasieu River and subsidence in the basin is deteriorating wetlands and causing land loss.

The sediments within the estuary support benthic organisms, including annelid worms, small crustaceans (e.g., amphipods, isopods, copepods, and juvenile decapods), mollusks, and other small bottom-dwellers in salt marshes and un-vegetated subtidal sediments (Gaston et al. 1988). Among these benthic organisms are herbivores (eating algae or other live plant material), detritivores (feeding on decaying organic matter in surface sediments or sediment-bound nutrients and organic substances that are not generally available to epiphytic or pelagic organisms), carnivores (preying on other benthic organisms), and omnivores (foraging on both plants and animals). These organisms provide the nutritional base for developing stages of many finfish and shellfish and, thus, affect all trophic levels in the Calcasieu River estuary (EPA 2003b).

Calcasieu Lake is located at the southern end of the Calcasieu River Basin in Calcasieu and Cameron parishes. The lake consists of approximately 58,260 acres of water bottom with oyster reefs located throughout, especially in the southern end (LDWF 2020).

2.3 Cultural Environment and Human Use

Since the 1790s, a variety of cultures have existed in this region, including Native American, German, Spanish, French, British, Acadian (Cajun), African, and Creole. In the mid-1920s, the Calcasieu Ship Channel (CSC) was dredged from Lake Charles to the Gulf of Mexico to establish a deep-water port and enhance industrial development in and around Lake Charles. The region eventually became a major American producer of oil and natural gas and a center for petroleum refining and petrochemicals manufacturing. The chemical and refining industries and the jobs they support have remained a major economic contributor for the region for several decades. The USACE maintains the CSC, and dredging is funded in the Federal budget. Located along the CSC is the Port of Lake Charles, which is one of Louisiana's 6 deep-draft ports and is ranked the 11th busiest port in the nation by tonnage in 2019 (USACE 2021).

Louisiana's coastal wetlands provide essential nursery habitat for commercially and recreationally important fishes and shellfishes such as Gulf menhaden, red drum, spotted seatrout, southern flounder, brown shrimp, white shrimp, blue crab and others. Louisiana's oyster production accounted for an average of 34% of annual landings of all oysters in the United States from 1997 through 2017 (LDWF 2020).

Lands within Calcasieu and Cameron Parishes are not only used for commercial endeavors, but for recreation as well. Miles of rivers, streams, and lakes offer excellent recreational use opportunities such as picnicking, camping, swimming, boating, water skiing, hunting, fishing, trapping, crabbing, and wildlife and bird viewing. Ecotourism (primarily hunting, fishing, and bird and wildlife viewing) is extremely important to the area's economy.

Several sites favored by recreationists in the area are the Creole Nature Trail All-American Road and Sam Houston Jones State Park. The Creole Nature Trail All-American Road is a designated scenic byway in the United States that traverses through Cameron and Calcasieu parishes for over 180-miles. Sam Houston Jones State Park with an area of 1,220 acres is also located on the West Fork of the Calcasieu River in the northern area of Calcasieu Parish, and offers boating,

fishing, and camping. Neither of these sites is located within any of the spill area or selected project areas for the preferred alternative.

2.4 Environmental Justice

EO (Executive Order) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, and the Department of Defense's Strategy on Environmental Justice of 1995 direct federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of federal projects on minority and low-income populations, and Tribal Nations. The USEPA defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities. Impacts on minority and low-income populations are considered disproportionately high and adverse under EO 12898 if they would "significantly … and adversely" affect a low-income or minority population and would "appreciably exceed or [be] likely to appreciably exceed" impacts on the general population or another appropriate comparison group (CEQ 1997). These impacts are described in Section 4, Environmental Consequences below.

Consistent with EO 12898, this section identifies low-income and minority populations within the potential Project areas in Calcasieu and Cameron Parishes based on the most recent socioeconomic statistics currently available from the U.S. Census Bureau's American Community Survey (ACS) 5-year estimates from 2015 to 2019 (https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/). Table 2.3 provides socioeconomic data on Calcasieu and Cameron Parishes. Calcasieu Parish has a minority population of approximately 30%, which is greater than the United States (approximately 21%), while Cameron Parish has a minority population of approximately 7%. The population living below the poverty level for Calcasieu Parish and Cameron Parish is approximately 19% and 14%, respectively.

The USEPA's EJSCREEN: Environmental Justice Screening and Mapping Tool (https://www.epa.gov/ejscreen) was used to identify "low-income" populations at the Census Block scale. The Incident and resulting injury in the Calcasieu River Basin occurred across multiple Census Blocks. Census Block Groups west of the Calcasieu River include 220190032001 (population 1,952) in the upper basin, 220239702011 (population 1,421) mid-basin, and 220239702012 (population 332) in the lower basin, with low-income populations of 30%, 37%, and 0%, respectively. Census Block Groups west of the Calcasieu River include 220190018012 (population 2,371) in the upper basin, 220239701005 (population 1,643) mid-basin, and 220239701001 (population 332) in the lower basin, with low-income populations of 16%, 39%, and 0%, respectively. The affected environment for the Long Point Bayou Marsh Creation Project includes Census Block Group 220239702011 (population 1,421), where 37% of the population is low-income. The Calcasieu Lake Oyster Cultch Plant Project is located within Census Block Groups 220239702012 (population 168) and 220239701001 (population 332),

which have low-income populations of 9% and 0%, respectively. This compares to a 33% low-income population for the United States as a whole.

Table 2.3. Socioeconomic Data as of July 1, 2019 (US Census Bureau n.d.); https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/.

Data	Calcasieu Parish	Cameron Parish
Population	203,436	6,973
Population Density (per mi^2)	181.2	5.3
Median Household Income (in 2019 dollars) 2015-2019	$51,148	$53,423
Population Living below Poverty Line*	18.9%	13.7%
Age 65 or Younger with a Disability (2015-2019)	10.9%	7.8%
Age 65 or Younger Living without Health Insurance	9.6%	10.2%
Race*		
White	70.1%	93.2%
Hispanic or Latino	4.1%	4.2%
Black or African American	25.8%	4.0%
Asian	1.4%	0.4%
American Indian and Alaska Native	0.6%	0.7%
Native Hawaiian and other Pacific Islander	0.1%	0.1%
Two or More Races	2.1%	1.7%

*Estimates are not comparable to other geographic levels due to methodology difference that may exist between different data sources. Minority populations comprise non-white populations, including Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, and other races, as described by U.S. Census Bureau.

2.5 Essential Fish Habitat

Commercial and recreational fisheries resources in the federal waters of the Gulf of Mexico are managed by the Gulf of Mexico Fishery Management Council (GMFMC) and NOAA Fisheries under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The GMFMC and NOAA Fisheries have identified waters and substrate necessary to fish for spawning, breeding, feeding, and growing to maturity as Essential Fish Habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." This definition extends to habitat specific to an individual species or group of species; whichever is appropriate within each Fishery Management Plan.

MSA also authorizes the designation of Habitat Areas of Particular Concern (HAPC) for marine fisheries. These areas are subsets of EFH that are rare, susceptible to human degradation, ecologically important or located in an ecologically stressed area. Any Federal agency that proposes any action that potentially affects or disturbs any EFH must consult with the Secretary of Commerce and Fishery Management Council authority per the MSA, as amended.

Virtually the entire northern coast of the Gulf of Mexico to a depth of about 600 ft (183 m) has been identified as EFH for at least one species. The Calcasieu River is located in Eco-Region 4, where EFH has been designated in the estuarine water bottoms and emergent marsh habitats for brown shrimp, white shrimp and red drum.

Table 2.4 Essential Fish Habitat fish species that may occur in the Calcasieu River.

Species	Life Stage	Essential Fish Habitat
Brown shrimp (*Crangon crangon*)	post-larval/ juvenile	marsh edge, SAV, tidal creeks, inner marsh
	subadult	mud bottoms, marsh edge
White shrimp (*Litopenaeus setiferus*)	post-larval/ juvenile, subadult	marsh edge, SAV, marsh ponds, inner marsh, oyster reefs
Red drum (*Sciaenops ocellatus*)	post-larval/ juvenile	SAV, estuarine mud bottoms, marsh/water interface
	subadult	Mud bottoms, oyster reefs
	adult	Gulf of Mexico and estuarine mud bottoms, oyster reefs

2.6 Threatened and Endangered Species

The Endangered Species Act (ESA; 16 U.S.C. §§ 1531–1544) was established to protect species vulnerable to extinction, as well as their environments. Marine organisms are under the jurisdiction of the NOAA Fisheries, while terrestrial and freshwater organisms are overseen by USFWS. The ESA defines "endangered" as a species in danger of extinction in all or a significant portion of its range. "Threatened" is then defined as a species that is likely to become endangered in the foreseeable future. Section 7(a)(2) of the ESA of 1973 (16 U.S.C. § 1536(a)(2)) as amended, requires:

> *Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species….*

All federally listed threatened and endangered species that have potential habitat or known occurrence in the Action Area are described in further detail below. The Action Area is defined as all areas that may be affected directly or indirectly by the Federal action (i.e., implementation of the Trustees' preferred alternative). It includes not only the immediate area involved in the Federal action but encompasses the geographic extent of environmental changes (i.e., the physical, chemical, and biotic effects) that would result directly and indirectly from the action. The Action Area is typically larger than the area directly affected by the Federal action itself and

is intended to include species or critical habitat that may be present in the entire potentially affected area. The LDWF's Wildlife Diversity Program also lists species that are of special concern to the state.

Table 2.5 provides a list of federal and state recognized endangered or threatened species known to occur in Calcasieu and Cameron Parishes. As of November 6, 2020, the published list of threatened and endangered species for the State of Louisiana includes 36 animal and three plant species (USFWS, 2020). The following 12 threatened and endangered animal and plant species are potentially found in Calcasieu and Cameron Parishes: smalltooth sawfish, red-cockaded woodpecker, red knot, piping plover, green sea turtle, hawksbill sea turtle, Kemp's (Atlantic) ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, eastern black rail, West Indian manatee, and American chaffseed. Designated critical habitat for the piping plover occurs on the Gulf shoreline of Cameron Parish, but it was not impacted by the Incident.

Table 2.5. Federal and State threatened and endangered species and their critical habitats within Calcasieu and Cameron Parishes, Louisiana.

Species[1]	**Critical Habitat (CH)**	**Federal Status**	**State Status**
Mammals			
West Indian manatee (*Trichechus manatus*)	None in Louisiana	Threatened	S1N[3]
Birds			
Piping plover (*Charadrius melodus*)	Yes, in Cameron Parish	Threatened	S2N[4]
Red-cockaded woodpecker (*Dryobates borealis)*	None in Louisiana	Endangered	S2[5]
Red knot (*Calidris canutus rufa*)	None in Louisiana	Threatened	S2N
Eastern black rail (*Laterallus jamaicensis ssp.*)	None in Louisiana	Threatened	S2N/S1B[6]
Reptiles			
Green sea turtle (*Chelonia mydas*)	None in Louisiana	Threatened[2]	S1N
Hawksbill sea turtle (*Eretmochelys imbricata*)	None in Louisiana	Endangered[2]	SZ[7]
Kemp's Ridley sea turtle (*Lepidochelys kempii*)	None in Louisiana	Endangered[2]	S1B/S3N[8]
Leatherback sea turtle (*Dermochelys coriacea*)	None in Louisiana	Endangered[2]	SZ
Loggerhead sea turtle (*Caretta caretta*)	None in Louisiana	Threatened[2]	S1B/S3N
Fish			
Smalltooth sawfish (*Pristis pectinata*)	None in Louisiana	Endangered[2]	S1
Plants			
American chaffseed (*Schwalbea americana*)	None in Louisiana	Endangered	S1

[1] Current federally listed species lists for Calcasieu and Cameron Parishes are at: https://www.fws.gov/southeast/pdf/fact-sheet/louisiana-ecological-services-field-office-t-and-e-species.pdf

[2] The United States Fish and Wildlife Service and the National Marine Fisheries Service share consultation authority for these species.

[3] S1N = Critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation; the occurrence of nonbreeding individuals.
[4] S2N = Imperiled in Louisiana because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extirpation; the occurrence of nonbreeding individuals.
[5] S2= Imperiled in Louisiana because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extirpation
[6] S1B = Critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation; the occurrence of breeding individuals.
[7] SZ = Transient species in which no specific consistent area of occurrence is identifiable
[8] S3N = Rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other factors making it vulnerable to extirpation (21 to 100 known extant populations); the occurrence of nonbreeding individuals.

3 INJURY ASSESSMENT AND QUANTIFICATION

This chapter describes and quantifies the nature, degree, and extent of injuries to natural resources and services resulting from the Incident. The chapter begins with an overview of data collected during the Preassessment phase of the NRDA process. The following section describes the Trustees' assessment strategy, including the approaches used to identify, determine, and quantify potential injuries. The remainder of the chapter presents the results of Trustee injury assessments for the specific resources affected by the Incident.

3.1 Preassessment Activities and Findings

The Trustees initiated Preassessment activities for the Incident shortly after receiving the National Response Center and Louisiana State Police notifications. The Trustees focused on collecting ephemeral data that would address three criteria defined by OPA (15 CFR § 990.42) and OSPRA (LAC 43:XXIX.101 et seq.): 1) injuries have resulted or likely will result from the Incident; 2) response actions have not adequately addressed, or are not expected to address the injuries resulting from the Incident; and 3) feasible primary and/or compensatory restoration actions exist to address the potential injuries.

Information associated with habitat exposure to the discharged waste oil is available from various sources and the information is highly congruent. Sources of exposure information include, but are not limited to, Response and NRDA photos and field notes, Response overflight maps, preliminary hydrodynamic modeling runs of the Incident, NRDA shoreline database cooperatively developed by CITGO and the Trustees, and field observations by Trustees during assessment activities. Information collected during the Preassessment phase of the Incident is summarized below.

3.1.1 Chemical Characterization of the Discharged Oil

The chemical characterization of the discharged waste oil from the facility was identified as a critical need by the United States Coast Guard (USCG) to support the Unified Command. On June 23, 2006, the Louisiana State University (LSU) Chemical Assessment Team and B&B Laboratories, Inc., analyzed samples of source oil from the holding tanks and source oil taken from the boomed area near the confluence of the Indian Marais and the Calcasieu River to provide a preliminary evaluation of the oil. Highly volatile components of the waste oil, such as

benzene, toluene, ethylbenzene and xylene, created human safety concerns during the first several days of the Response. During the first 5 to 7 days of the Incident, certain areas of the Calcasieu River estuary were limited to persons with full-face respirators or a Self-Contained Breathing Apparatus (SCBA) such that only essential cleanup personnel could work in the heavily oiled areas. The residual oil after initial environmental weathering was a unique product composed of hydrocarbon compounds typical of crude and refined oil products (Henry 2006 pers. comm.). Comparisons of the discharged oil to other oil types provided a point of reference with oils more commonly discharged, but the association did not fully capture the relative abundance and distribution of aromatic hydrocarbons in the discharged waste oil from the CITGO facility (Henry 2006 pers. comm.).

Based on source oil samples collected near the CITGO facility on June 23 and 28, 2006, the discharged oil was characterized as a relatively light oil with very low asphaltene content (0.25 percent) and a lack of biomarker components (LSU 2006; see Appendix B). The n-alkanes ranged from C10 to C35, with C10-C22 n- alkanes (those most readily biodegraded) representing nearly 94 percent of the total alkane content. The total polycyclic aromatic hydrocarbons (PAHs) were about four percent of the total petroleum hydrocarbons, and the naphthalenes represented nearly 60 percent of the PAHs. Napthalenes are the most readily biodegraded of the PAHs, and they can be slowly removed by volatilization. As a unique oil type, the discharged waste oil was not well understood in terms of its likely rate of chemical and microbial weathering, fate, and effects (Michel 2009).

3.1.2 NRDA Preassessment Shoreline Oiling Surveys

The movement of the oil and the extent of oiling were documented frequently during the Response using overflight observations, global positioning systems (GPS), photography, and on-water surveys (e.g., Shoreline Cleanup Assessment Teams). Cooperative NRDA Preassessment Shoreline Oiling Surveys (referred to herein as "Preassessment Surveys") were undertaken by CITGO and the Trustees to: 1) classify shoreline habitat types affected by the Incident; 2) assign a level of oiling to these habitats; and 3) provide essential habitat and degree of oiling information that would be used to aid in determining injury to impacted habitats due to the Incident. The shoreline within the affected area of the Incident was surveyed from north of the I-210 bridge to the southern end of Lake Calcasieu. During the Preassessment Surveys, personnel recorded the habitat types, degree of oiling, and lateral penetration of oil into the habitats on individual field data sheets. The collection of start and stop points based on a change in habitat type or oiling signature were determined using hand-held GPS receivers and provided the cooperative group with a method for determining the length of impacted shoreline habitat. The length of impacted shoreline habitat and horizontal penetration of oil (depth in feet) allowed the cooperative group to determine the acres of habitat affected by the Incident. The Trustees determined the level of oiling along the affected shoreline by detecting the oil visible on plant stems or other surfaces (e.g., film/stain, coat, or cover) and the characteristics of visible oil released when the sediments where physically disturbed by probing (e.g., sheen, silver sheen, rainbow sheen, or oil droplets). Based on those data, individual exposure groups (EGs) were created and provided a classification structure that was used to categorize the degree of oiling throughout the affected area (Table 3.1). Results from the Preassessment Surveys provided critical information that aided injury assessment for the injured natural resources and services.

Overall, 155 miles of shoreline were surveyed, leading to the Trustees proceeding with injury assessment on 141.28 acres of marsh habitat. Figure 3.1 provides a visual illustration of shoreline oiling from the Incident.

Table 3.1. Description of oiling categories in sediment and on plant stems made during the Preassessment Surveys and associated exposure group assignment.

Degree of Oiling		**Exposure Group**
Stem	**Substrate**	
Exposed to Floating	Sheen	0
Film/Stain	None	1
Film/Stain	Silver Sheen	2
Film/Stain	Rainbow Sheen	3
Coat	Rainbow Sheen	6
Any or None	Oil Droplets	7
Reference	Reference	REF

3.1.3 Impacts to Water Column Organisms

The waste oil discharge resulted in PAH concentrations known to be toxic to aquatic organisms in laboratory tests (French-McCay et al. 2009; Michel 2009) at some locations within the Calcasieu River estuary. Representatives from USCG, Trustees, and CITGO conducted daily aerial surveys from June 23 to July 3, 2006, and documented the spatial extent and degree of oiling throughout the lower Calcasieu River estuary. The waste oil was observed from bank to bank of the Calcasieu River surface as well as in large lakes and bayous associated with the River and estuary, and it moved upstream and downstream within the Calcasieu River daily with the tides. On the last day of aerial surveys, patches of light to medium sheens remained, extending from north of the Indian Marais to the northern portion of Calcasieu Lake. Dead fish were observed on separate occasions on June 20 and 21, and then again on June 28, several thousand dead fish were observed in northern Calcasieu Lake (Michel 2009).

Throughout the Preassessment Surveys, the Trustees observed additional fish, shellfish, and bivalve mortality believed to be a result of the Incident (Figure 3.2). Taking this observational evidence into account, the Trustees conducted bivalve sampling in conjunction with other Preassessment sampling (MacDonald et al. 2006b). Observations and data collected during and after the Incident indicate that injuries to aquatic biota occurred via direct oiling, exposure to oily water, and ingestion of oil and oiled prey. The Trustees used a modeling approach to determine the level of exposure and estimate injuries to the aquatic biota.

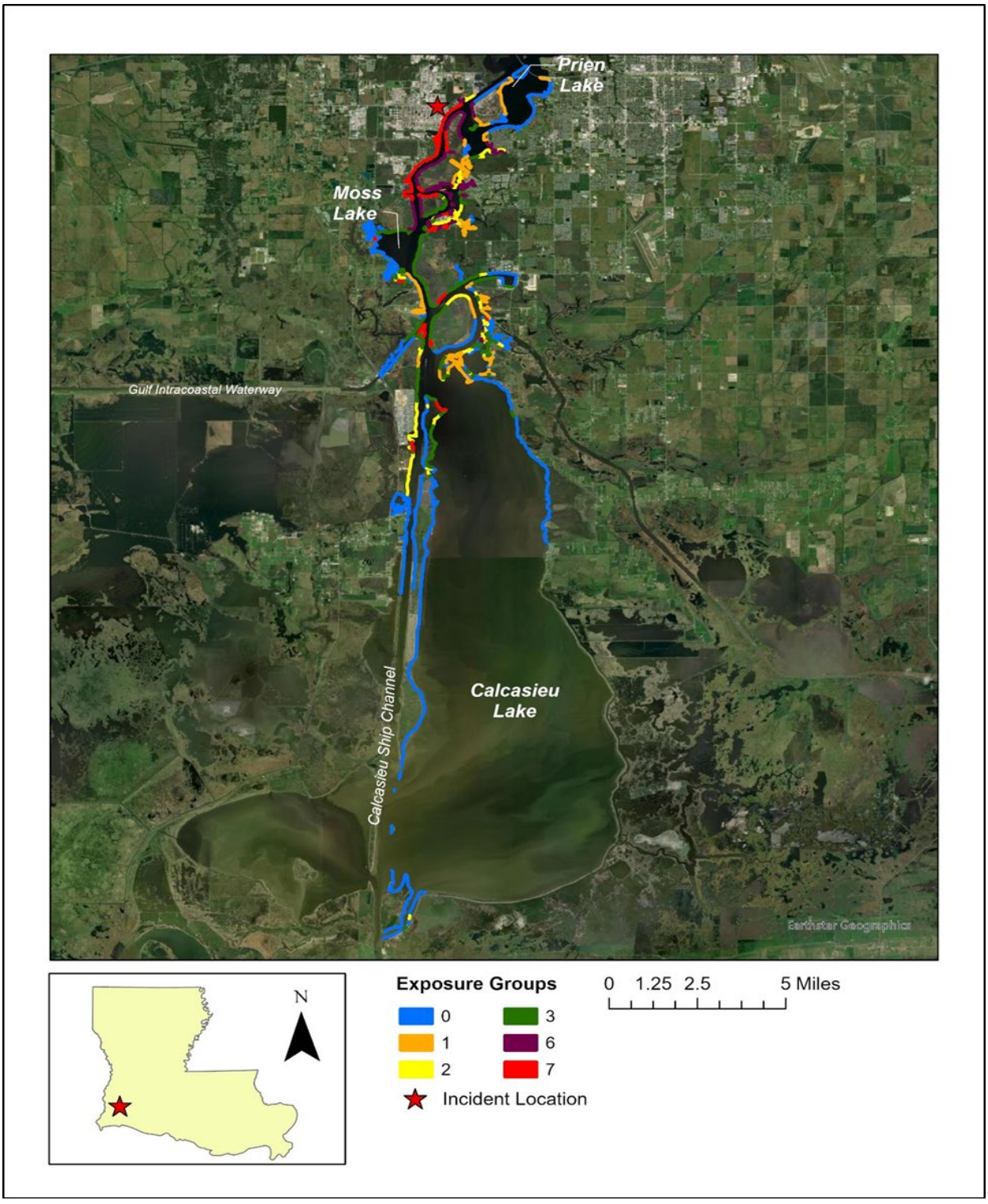

Figure 3.1 Results from Preassessment Surveys categorizing the shoreline oiling of the Calcasieu River by exposure groups (EG 7-6 = Heavy, EG 3= Moderate, EG 2-0= Light).

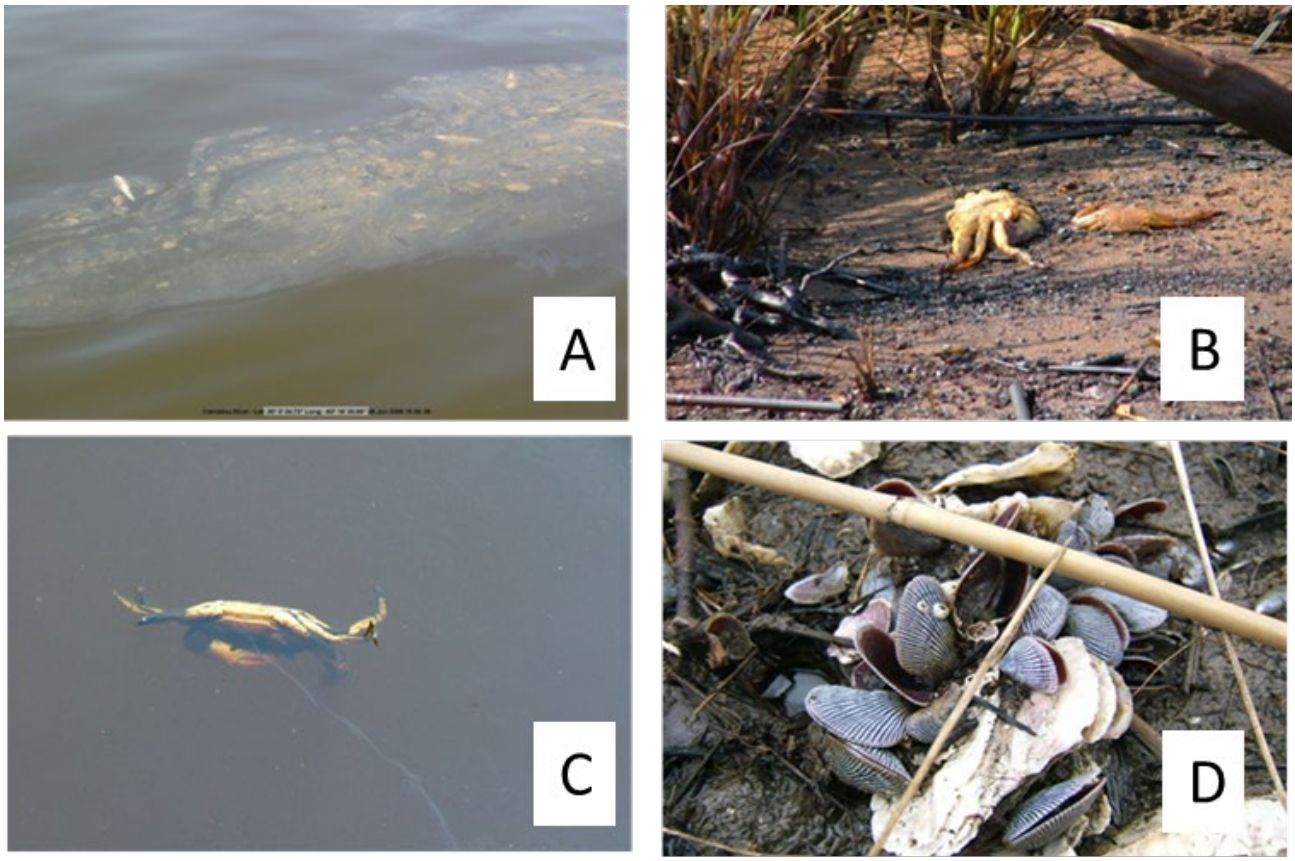

Figure 3.2. Photos of aquatic biota affected by the Incident. A) Photo of dead fish taken on June 28, 2006. B) Photo of dead blue crab on land taken on June 26, 2006. C) Photo of dead crab in water taken on June 26, 2006. D) Photo of affected bivalves taken on September 17, 2006.

3.1.4 Impacts to Shallow Subtidal and Intertidal Habitats

Shallow subtidal and intertidal habitat (SSI) as defined here represents the sediments (mud, sand, etc.) and organic debris, along with the associated invertebrates, bacteria, and algae that burrow and/or live in those sediments. Trustee observations from the field as well as the Preassessment Surveys noted that sediments within the SSI habitat zones were exposed to oil (Figure 3.3). Concentrations of PAHs, known to be toxic to aquatic organisms (Buchman 2008), were detected in sediments at various locations and demonstrated toxicity through sediment chemistry and toxicity testing. Observations and data collected during and after the Incident

Figure 3.3. Sediment exposed to oil taken during field observations following the Incident.

indicate that injuries to SSI habitats occurred as a result of the Incident. The Trustees and CITGO developed multiple strategies to aid in measuring injury to SSI habitat, including observations of oiling levels recorded during station marking and sampling events in September 2006, and sediment chemistry and toxicity testing (MacDonald et al. 2006b).

3.1.5 Impacts to Marsh Habitat

Following the Incident, the Trustees observed during daily boat surveys that visibly oiled plants and patches of marsh vegetation that had been exposed to oil appeared to be suffering biological stress or had died (Figure 3.4). Some vegetation died within a week to several weeks of the Incident (Figures 3.4 and 3.5). Affected plants became chlorotic due to exposure to oil within a week of the Incident. The speed and severity of plant death was unusual based on previous studies (summarized in Lin and Mendelssohn 1996) and the Trustees' professional experience.

Figure 3.4. Marsh vegetation affected by direct oiling or exposure to oily water during tidal events taken between June 26 and July 19, 2006. Note chlorosis of the marsh vegetation.

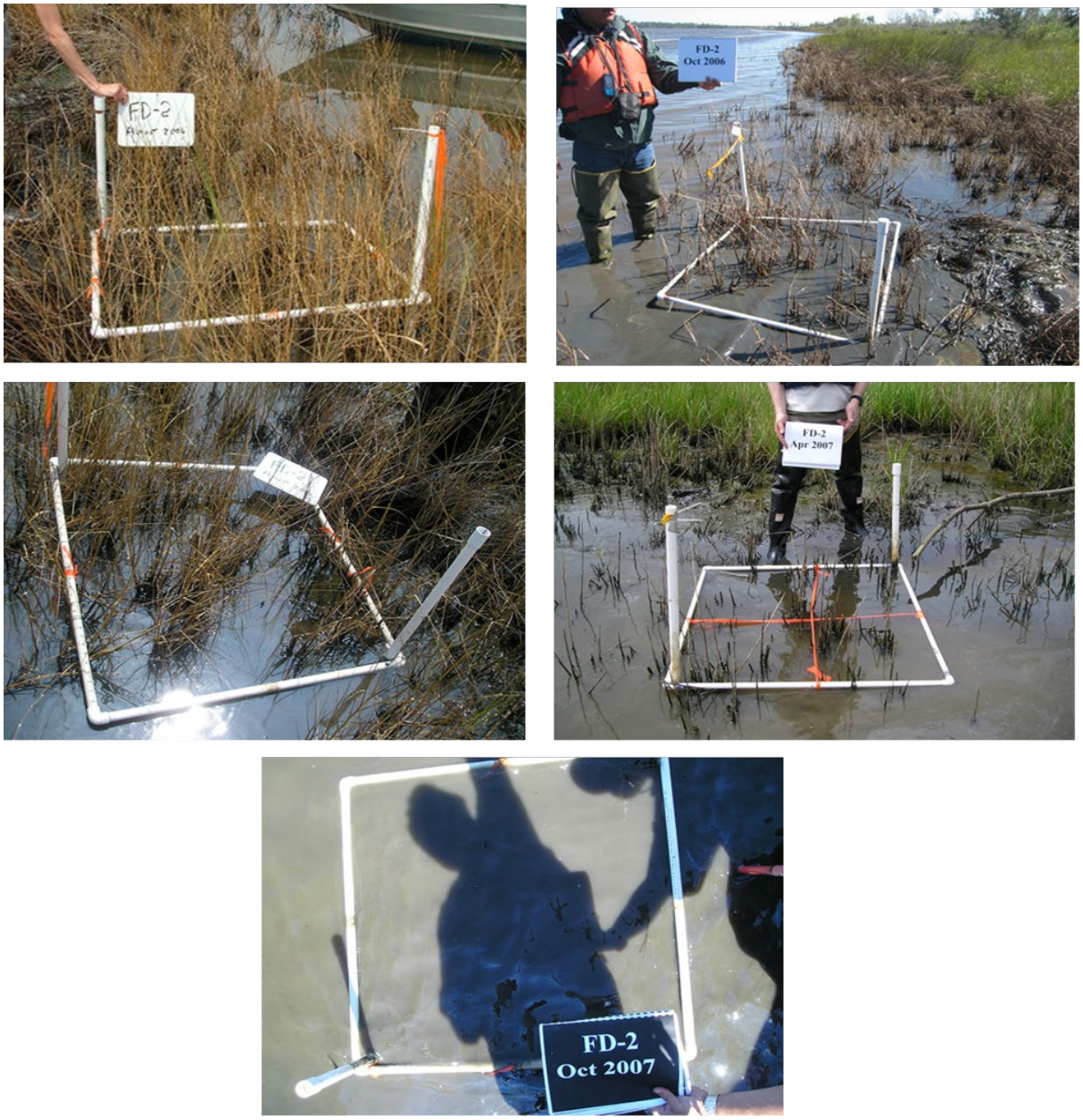

Figure 3.5. Photos of monitoring station FD_2 located on the north side of "D Island" in the Haymark Loop of the Calcasieu River. Vegetation at this location died within two months following the Incident in June 2006 and was bare of vegetation by October 2007.

The Trustees have rarely seen immediate lethal effects to marsh vegetation to the extent observed in the lower Calcasieu River estuary after this Incident. The best available information indicated that the initial death of the vegetation was due to the unique characteristics of the waste oil released. The waste oil had a heavy component that immediately smothered vegetation as well as a light component similar to that of a diesel fuel or No. 2 fuel oil that had slower effects on vegetation. Because the loss of aboveground vegetation occurred quickly, the Trustees were concerned that there would be erosion of the marsh platform in such areas experiencing rapid vegetation loss due to loss of vegetation root mass and increased exposure to the wave energy of

passing vessels. Consequently, the Trustees and CITGO cooperatively implemented injury assessment monitoring strategies for aboveground marsh vegetation and marsh edge shoreline erosion.

3.1.6 Impacts to Birds

USFWS conducted initial wildlife surveys on Day 2 of the Incident using a helicopter. However, airborne volatile compounds from the waste oil caused adverse reactions requiring hospitalization of USFWS personnel. In the same period USCG Response personnel required hospitalization as well. During the first 5 to 7 days of the Incident, certain areas of the Calcasieu River estuary were limited to persons with full-face respirators or a SCBA such that only essential cleanup personnel with proper safety equipment could work in the heavily oiled areas. Wildlife responders were unable to adequately survey for or collect oiled wildlife or carcasses because the air quality was unsafe in most oiled areas. Thus, during the first week of the Incident wildlife survey efforts remained restricted to the open water areas due to the unsafe air quality conditions in the heavily oiled areas.

Even so, responders were able to document observations of birds wading and feeding in oil, and several oiled dead birds were observed once the airborne volatile compounds no longer impaired air quality. The Trustees and CITGO agreed to proceed in assessing injuries to birds given the large volume of waste oil released and these observations.

3.1.7 Impacts to Recreational Use

The Incident affected recreational use of natural resources in and along the Calcasieu River and the following upstream and downstream receiving waters: Prien Lake, Moss Lake, Calcasieu Lake, and the Gulf Intracoastal Waterway. Portions of these water bodies were closed during clean-up activities for periods ranging from two to 24 days. Public access points (fishing sites, boat ramps, beaches, and parks) were also closed during this period. Initial assessment activities undertaken included discussions with parks and recreation personnel, site visits to public use areas, boat ramps, marinas, and other potentially affected recreational areas in the Calcasieu estuary and interviews with members of the public using the potentially affected sites. Overall, boating, shore fishing, and general shoreline use were the recreational activities affected by the Incident. Boating included boat-based fishing and general motorized boating. Shore fishing included persons fishing from the shoreline or fishing piers. All other activities were addressed in the general shoreline use category, including activities such as park use, sunbathing, walking, picnicking, birding, and other shoreline-related activities. Under OPA, the Trustees are responsible for evaluating and obtaining compensation for public (but not private) lost recreational use of natural resources (33 U.S.C. §2706(d) (1)).

3.2 Injury Assessment Approach

The goal of injury assessment under OPA and OSPRA is to determine the nature, degree, and extent of injuries, if any, to natural resources and their services in the affected environment to provide a technical basis for evaluating and scaling restoration actions. After identifying the injured resources for the Incident, the Trustees developed appropriate injury assessment

procedures primarily based on: 1) information gathered during the Response and Preassessment phases of the Incident; 2) relevant peer-reviewed literature; and 3) best professional judgment of local experts and Trustees familiar with the effects of crude oil in similar environments. Given the severity and extent of the Incident, the Trustees and CITGO agreed to employ, where they could, simple, cost-effective procedures for collecting data and assessing injuries to natural resources and the ecological services related to those resources through the development of reasonable and protective assumptions that allow assessment of injury with less investment of time and money in assessment studies, as allowed for in 15 C.F.R. Part 990.27 and LAC 43:XXIX.121.

3.3 Injury Assessment Methods and Quantification

For the determination of water column organism injury (i.e., fish and invertebrate injury as direct kill and lost production), the Trustees and CITGO used the population model in the Natural Resource Damage Assessment Model for Coastal and Marine Environments and the Spill Impact Modeling Analysis Package (SIMAP). The model calculates injury in three steps: 1) the direct kill is quantified by age class with a standard population model used by fisheries scientists; 2) the net (somatic) growth normally to be expected of the killed organisms is computed and summed over the remainder of their life spans (termed lifetime production); and 3) future interim losses are calculated in present day values using discounting at a 3 percent annual rate (French-McCay et al. 2009).

For injuries to marsh and SSI habitat, the Trustees used a Habitat Equivalency Analysis (HEA) (NOAA 2000) based approach to quantify interim service losses (i.e., service losses incurred from the time of injury until recovery to baseline) of those habitat types impacted by the Incident. The Trustees and CITGO quantified interim service losses in terms of discounted service acre years (DSAYs), where one DSAY is equal to the flow of services provided by one acre of habitat over the course of one year and discounted over time. The input parameters required to calculate the debit-side of the HEA were: 1) total acres of injured habitat; 2) initial level of service losses; and 3) recovery curve of service flows over time. Using the injury parameters described in the following sections and applying a discount rate of 3 percent per year (NOAA 1999), the Trustees and CITGO quantified natural resource injuries for the Incident.

The Trustees used Resource Equivalency Analysis (REA) to determine the bird injury caused by the Incident. REA, first used in the North Cape NRDA case (Sperduto et al. 2003), generally refers to a stepwise replacement model for killed or injured species. REA calculations using the stepwise replacement model involve basic population modeling, including elements of the Leslie matrix and associated life history tables, with appropriate discounting to provide the result in present value. This approach documents how individual organisms are lost by age class over time in a stepwise fashion based on survival rates and longevity and seeks to measure how much it costs to replace the natural resource services that the public lost because of the injury. REA inputs include the number killed (with any relevant multipliers), average age or identification of age classes killed, survival rates, and reproductive rates (if foregone future generations are included). For this Incident, the Trustees agreed to use a single-step REA model (direct loss; no future foregone generations) expressed in discounted bird-years (DBYs) for equivalency calculations for all bird species except rails and sora. See Section 3.3.4 for more information.

For recreational use, the Trustees collected primary data through on-sight surveys and counts of recreational users within the geographic scope of the Incident. We asked respondents to estimate the number of trips they took to the estuary before, during, and following the Incident, whether the Incident affected their recreational activities, and their home zip code. The term "foregone trips" refers to the decline in trips taken to the Calcasieu River estuary due to the Incident. We extrapolated the number of foregone trips reported by each respondent to account for the total number of trips potentially affected by the Incident. Adjustments corrected for the potential problem in capturing all recreational users affected by the Incident, such as recreational users who had not yet returned to using the site following the Incident.

The Trustees estimated the total foregone trips for each recreation category. We applied a 10 percent adjustment to foregone trips to account for private docks, private beaches, and boats entering the estuary from outside sources, which were not included in site counts. We estimated the lost value associated with foregone trips using two methods because general shoreline use could not be estimated using the travel cost model due to a lack of reported zip codes by respondents. We estimated the value of boating and fishing using a travel cost model and used a benefit transfer model to estimate the value of general shoreline use.

The travel cost model provides an estimate of the value of a recreational experience based on the total cost of travel the recreational user undertakes in obtaining that experience. The travel cost model used in this study treated the whole estuary as a single site to estimate the loss from foregone fishing and boating recreation trips. The Trustees calculated travel cost using zones to approximate home location based on the zip code data reported on the survey. The Trustees applied those results directly to foregone fishing trips. Based on research, the Trustees concluded that the travel cost method underestimates the loss for boat owners, so an adjustment factor was applied to the boating category.

The Trustees estimated the foregone trip values of general shoreline use using a benefit transfer model. Benefit transfer involves selecting appropriate studies of recreation from professional economics literature to transfer the per-trip values of recreation to the study site. The benefit transfer for general shoreline use relied upon the average value for beach recreation from four peer-reviewed studies valuing swimming, picnicking, and beach use.

3.3.1 Water Column Organisms

Source samples and water samples collected by the Trustees early during the Incident provided data to determine the oil properties and toxicity of the waste oil released. The results of toxicity data indicate that PAHs were present in the water column at concentrations indicative of likely mortality to water column organisms. Response actions included observations of fish kills throughout the estuary that were documented as spill-related (Michel 2009). Michel's (2009) expert testimony to USDOJ provides a thorough characterization of the waste oil released because of the Incident.

The Trustees performed an analysis of injuries to water column organisms using the SIMAP[2] system model. As stated in French-McCay (2004) the physical fate model estimates the distribution of oil (as mass and concentrations) on the water surface, on shorelines, in the water column, and in the sediments. The biological exposure model in SIMAP estimates the area, volume, portion of a stock or population affected by surface oil, concentrations of oil components in the water, and sediment contamination. The model estimates losses by species or species group for fish and invertebrates by multiplying percent loss by abundance.

Specifications for the Incident's scenario (i.e., date, timing, amount, duration of release, etc.) were based on information obtained and distributed during the Response by the NOAA Emergency Response Division (ERD), the USCG, state and federal responders, the Trustees, and CITGO. The Trustees developed the model input assumptions for the release and discussed the specific inputs with CITGO. CITGO originally estimated that 25,595 bbl of waste oil were released into the Calcasieu River estuary. The Trustees ran a modeling scenario based on agreed upon inputs between the Trustees and CITGO in 2009. However, in 2011, litigation surrounding CITGO's violations under the Clean Water Act (CWA) yielded a decision by the Court on the actual amount of oil released into the Calcasieu River estuary. The Court found that the release volume was in the range of 54,000 bbl. The sections below describe the 2009 modeling scenario and injury determination, and an updated 2018 adjustment to the injury determination based on the increased release volume from the 2011 Court ruling.

3.3.1.1 2009 Modeling Scenario

Impacts to the Calcasieu River began at approximately 2:00 PM on June 21, 2006, when the boom at the Indian Marais dislodged allowing oil to discharge into the river. CITGO estimated that oil had discharged from the Indian Marais over the course of one hour. The USCG closed the Calcasieu River to shipping traffic from river mile marker 102 to 110, and by 4:00 PM on-scene responders estimated that the aromatic benzene levels ranged from 1 to 5 parts per million (ppm). In the days following the spill, surveyors observed shoreline oiling and surface sheen in the river and as far south as Lake Calcasieu. Response efforts included removal of oil with surface skimmers and shoreline cleanup. Despite Response efforts, the oil persisted in the Calcasieu River channel and reached Lake Calcasieu by approximately 7:00 AM on June 23, 2006. As stated previously, the Trustees used a value of 25,595 bbl of oil released into the environment and agreed with CITGO to not include their estimate of recovered oil (13,880 bbl) from cleanup efforts. Therefore, although Response efforts included removal with surface skimmers and shoreline cleanup, the SIMAP model simulations did not include provisions for oil recovery. Results of the Incident's SIMAP model can be found in the Feb. 27, 2009, *Final Report to Trustees Citgo Refinery Spill of 21 June 2006 in Calcasieu River, Louisiana: Modeling of Physical Fates and Biological Injuries to Subtidal Aquatic Organisms* (French-McCay et al. 2009). The SIMAP model estimated the total water column organism injury (i.e., total killed and production forgone) to be 34,875 kg of biomass. The predominant species (or species groups) affected included spot, spadefish, cutlass fish, anchovies, menhaden, herring (shad species), squid, Atlantic croaker, catfish, and sand seatrout. The largest injury was to sand seatrout (French-McCay et al 2009).

[2] See French-McCay publications from 2003 and 2004 on the SIMAP model for a detailed technical explanation.

3.3.1.2 2018 Modeling Scenario Update

As described above, the 2009 modeling scenario used an oil volume of 25,595 bbl to estimate injury for water column organisms. In 2011, litigation for violations under the CWA yielded a decision by the Court on the amount of oil spilled into waterways of the United States. The Court estimated that the amount of oil discharged was in the range of 54,000 bbl.

Since the original modeling effort was based on 25,595 bbl with a maximum recovery of 13,880 bbl, the Trustees used the Court's ruling of 54,000 bbl to proportionally adjust the modeling scenario for injury to water column organisms. Thus, considering the maximum recovery volume of 13,880 bbl and the Court's determination of 54,000 bbl discharged into waterways, the volume of oil for the modeling scenario should have been 40,120 bbl (i.e., 54,000 bbl – 13,880 bbl). Thus, the Trustees estimated the injury to be 56.75[3] percent proportionally higher than the 2009 modeling scenario. The revised injury estimate is depicted in Table 3.2.

Table 3.2. Summary of the adjusted injury estimate for water column organisms (i.e., fish and invertebrates) resulting from the Incident (Hahn 2018, pers. comm.).

	Kill	Kill	Production Forgone	Total Injury
	(#)	(kg)	(kg)	(kg)
Total small pelagic fish	518,077	2,136	2,388	4,523
Total large pelagic fish	10,591	1,503	2,887	4,390
Total demersal fish	176,271	5,254	38,524	43,779
Total decapods (shrimp and crab)	80,006	1,470	703	2,173
Total mollusks	867	11	5	16
Total benthic macroinvertebrates	874,319,397	216	617	832
Total all species	875,105,211	10,590	45,123	55,713

The adjusted total injury for water column organisms (i.e., fish and invertebrates) is 55,713 kg of biomass lost due to direct mortality plus the calculated production foregone.

3.3.2 Shallow Subtidal & Intertidal Habitat

Due to the toxicity of the discharged waste oil and field observations through the estuary, the Trustees developed an in-depth sampling and analysis plan to determine the injury to SSI habitat in the Calcasieu River estuary affected by the Incident. The sampling and analysis plan consisted of: 1) a Quality Assurance Project Plan (MacDonald et al. 2006a), 2) a Field Sampling Plan (FSP) (MacDonald et al. 2006b), and 3) an associated Health and Safety Plan (Baker 2006).

The Trustees collected 154 sediment samples (Figure 3.6) from various SSI locations within the Areas of Interest (AOIs) in the Calcasieu River estuary from September 12 - 21, 2006 (see Appendix C). Four reference samples were also collected to characterize baseline conditions of Contaminants of Potential Concern (COPC) in sediment and fish tissues for both natural (i.e.,

[3] Based on the Court's ruling of 54,000 bbl of oil released into waterways, the Trustees' 2018 modeling scenario used the following calculation to adjust the injury estimate for water column organisms: *40,120 bbl – 25,595 bbl = 14,525 bbl* such that *(14,525 bbl / 25,595 bbl) * 100* = 56.75 percent greater injury than the 2009 modeling scenario.

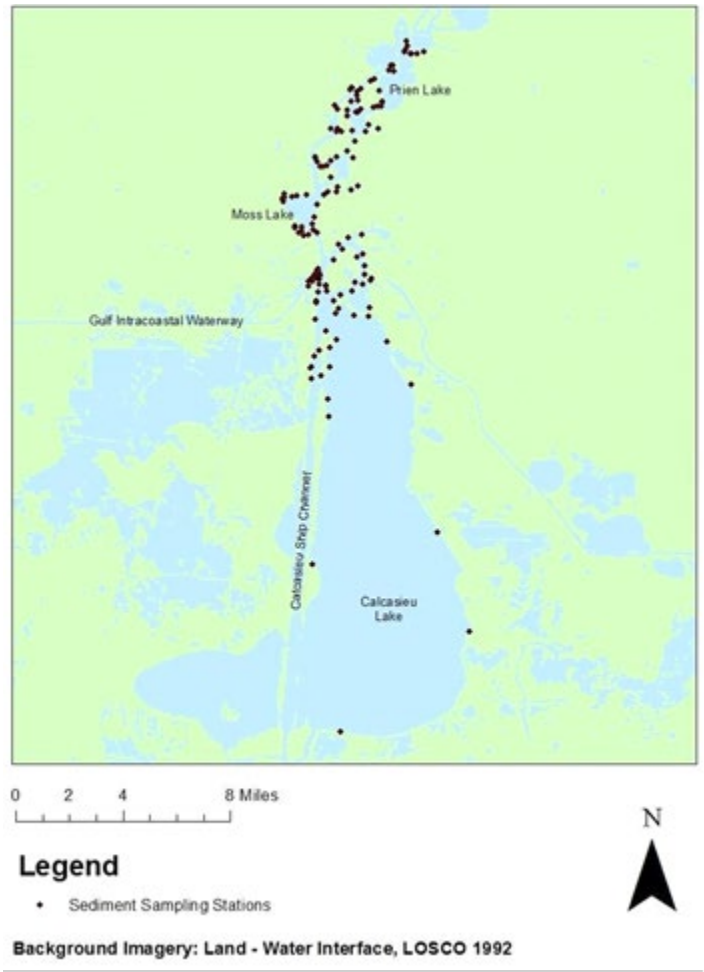

Figure 3.6. Locations of 154 sediment sampling stations within the Areas of Interest in the Calcasieu River estuary, September 12 - 21, 2006.

non-industrialized) and industrialized (but not impacted by the Incident) sites. Three selected reference sites (i.e., Choupique Bayou, Grand Bayou, and Bayou Bois Connine) represent natural baseline conditions because they are spatially removed from the areas influenced by the Incident and surrounding industrialized areas. The fourth reference site located in the upper Calcasieu River between Contraband Bayou and the I-210 bridge provided baseline conditions in an industrialized area of the estuary that was not impacted by the Incident. The methods used to collect, handle, prepare, and transport the sediment samples are described in the FSP.

All 154 sediment samples were submitted to TDI Brooks International, Inc. (i.e., B&B Laboratories, Inc.; College Station, Texas) for analysis of the following analytes: total metals/mercury; grain size; percent moisture; total organic carbon (TOC); PAHs (51 parent and alkylated PAHs); nC8 - nC40 alkanes; total resolved petroleum hydrocarbons; total unresolved petroleum hydrocarbons; and total petroleum hydrocarbons. All 154 sediment samples were also submitted to Caro Analytical Services Ltd. (Vancouver, British Columbia; formerly known as Levelton Analytical Services Ltd.) for analysis of 17 parent PAHs by gas chromatography and mass spectrometry. The results of those analyses were used to identify a subset of 80 sediment samples that were sent for whole-sediment toxicity tests. Whole-sediment toxicity tests were conducted on the amphipod *Hyalella azteca,* including 28-d survival (using standard toxicity testing methods; EPA 2000; ASTM 2007); 29-d survival with ultraviolet (UV) light exposure; and 29-d growth (length/individual) (surviving amphipods on Day 29 were preserved in a sucrose-formalin solution and subsequently measured to evaluate growth).

The Trustees delineated the location and spatial extent of the SSI zones using GPS data collected in the field and the Preassessment Surveys data. The shallow subtidal zone was defined as -0.18 meters (m) to -0.75 m below mean sea level (MSL), and the intertidal zone was defined as -0.18 m to 0.18 m MSL. The Preassessment Surveys data were used to provide information on the degree of shoreline oiling and provide the lateral extent of each SSI reach. The Trustees used that

information along with the GPS field data to determine the affected acreage of intertidal and subtidal zones impacted by the Incident within the AOIs.

3.3.2.1 Determination of Injury for Shallow Subtidal and Intertidal Habitat

The sections below summarize the results of visual observations, sediment chemistry, and sediment toxicity data from multiple data sets (Preassessment/Photoquad/Sediment Sampling/Station Marking (PPSS) Data), and how the Trustees used those results to determine the extent of injury to sediment biota, services loss, and the duration of that injury (Table 3.3).

Table 3.3. Description of the process used to assign service loss to sediment stations based on lines of evidence. The most protective service loss was assigned for stations having multiple lines of evidence. **PEL** – Probable Effects Level; **ERM** – Effects Range-Median; **T50** – chemical concentration corresponding to 50% probability of observing toxicity; **AET** – Apparent Effects Thresholds; **TEL** – Threshold Effects Level; **T20** – chemical concentration corresponding to 20% probability of observing toxicity; **ERL** – Effects Range-Low.

		Percent Service Loss			
	Line of Evidence	**100%**	**75%**	**50%**	**25%**
Observational Data	**Preassessment**	Droplets	Rainbow	Silver Sheen	Grey-Paraffinic Sheen
	Photoquad	Droplets	Rainbow	Silver Sheen	Grey-Paraffinic Sheen
	Sediment Sampling	Droplets	Rainbow	Silver Sheen	Grey-Paraffinic Sheen
	Station Marking	Droplets	Rainbow	Silver Sheen	Grey-Paraffinic Sheen
Sediment Chemistry and Toxicity Data	**Threshold Type Exceedances**		PEL/ERM	T50/AET	TEL/T20/ERL
	Number of Background Exceedances	78 - 104 (very high)	52 -77 (high)	26 - 51 (elevated)	10 - 25 (background exceedances)
	Tox- 28 Day Survival	0 – 15% Survival	16 – 30% Survival	31 – 50% Survival	51 – 65% Survival

	29-day UV Exposure Survival	0 – 15% Survival	16 – 30% Survival	31 – 50% Survival	51 – 69% Survival
	Growth	Very low growth		Reduced growth	Slightly reduced growth

3.3.2.1.1 Visual Observations

The Trustees used visual observations from multiple data sets as lines of evidence to assign service loss and duration of injury. Visual observations were made at different times throughout the Preassessment phase and during PPSS data collection. The degree of sediment oiling noted during sampling events determined the level of service loss. If visual observation data had multiple results (e.g., both rainbow sheen and droplets), the Trustees used the more protective observation (i.e., droplets) in the injury assessment. Photoquad observations also varied through time and provided multiple results, and again, the Trustees used the more protective observation in the injury assessment.

3.3.2.1.2 Sediment Chemistry Data

The Trustees used eight industrialized site samples (background), taken from areas not impacted by the Incident, to characterize baseline conditions for evaluating the sediment chemistry results from 138 Incident-related samples (i.e., not including reference or background samples). The maximum detected value for any COPC was used for comparison rather than a percentile (e.g., 95th percentile) due to the low number of background samples available for evaluation. Out of the 138 Incident-related sites evaluated, 131 sites had at least one compound that exceeded the background maximum values. The data from those 131 sites were compared to toxicity thresholds outlined in NOAA's compilation of toxicity thresholds for freshwater and marine sediments (Buchman 2008).

The area of the Calcasieu River estuary affected by the Incident is characterized as brackish with varying salinities. The average and median salinities in the Calcasieu River estuary are greater than 10 parts per thousand (ppt) (i.e., marine), whereas expected salinity is greater than 2 ppt (fresh) more than 85 percent of the time; therefore, the evaluation of marine thresholds was given priority (https://waterdata.deq.louisiana.gov/). Based on the salinity regime in the Calcasieu River estuary, the dry-weight-based thresholds for marine sediments were used to determine injury based on toxicity. Out of 104 analytes evaluated, only 23 dry-weight-based marine thresholds were available for evaluation. Results of that evaluation can be found in the Calcasieu River AR.

3.3.2.1.3 Sediment Toxicity Data

Six background sites were used as the basis for evaluating 75 toxicity test sites (including one control site). Standard errors (s.e.) were subtracted from the background results to set the basis

for detecting differences between impacted sites and baseline conditions. Standard errors were added to the Incident-related site results to evaluate evidence of toxicity and relative differences in survival and growth of *Hyalella azteca*[4]. Incident-related sites were assigned service losses if results plus one/two/three s.e. were less than baseline minus one/two/three s.e., respectively. For the 28-day survival test, service loss areas started at levels below 78.55% survival. For the 29-day UV exposure survival test, service loss areas started at levels below 80% survival. For the 29-day growth test, service loss areas started with lengths below 4.04 mm. A detailed explanation of this process is located in Appendix D. Additionally, the results of the toxicity analysis can be found in the Calcasieu River AR.

3.3.2.1.4 Duration of Injury

The Trustees used a combination of visual observations and analyte half-life information to determine the duration of injury to the SSI habitat. Based on the information available, the most protective recovery time was assigned. Sediment sampling occurred three months after the spill and, if no information was available, a baseline of six months was assigned. Because of expected scour from large vessel traffic, recovery was reduced by half for the Intracoastal Waterway.

The following recovery times were added to the last visual observation made: 36 months for droplets, 24 months for rainbow sheen, and 12 months for silver sheen. To evaluate duration of injuries, half-life information for several PAH analytes was evaluated based on a study in the San Francisco Estuary (Greenfield and Davis 2004) and another from the Gulf of Mexico (Tansel et al. 2011). Half-life information was found for 11 analytes (Table 3.4). Based on the formula below, the amount of time for levels to return to baseline was calculated and assigned. For many of the heavily damaged areas, time-to-baseline reached into the hundreds of months (up to 465 months for one station). The duration was capped at 84 months, which is consistent with duration of service loss in other injury categories (i.e., aboveground marsh (Photoquad)). The duration of injury for sediment stations were averaged for each AOI and used for injury quantification.

$$N(t) = N_0 \left(\frac{1}{2}\right)^{\frac{t}{t_{\frac{1}{2}}}} \rightarrow t = \frac{t_{\frac{1}{2}} \ln\left(\frac{N_t}{N_0}\right)}{-ln2}$$

Where:

No = Original Concentration
Nt = Concentration at time t
t1/2 = Half-life
t = Amount of time

[4] Some thresholds are available only on a Total Organic Carbon (TOC) normalized basis, and are noted as such in NOAA's compilation (Buchman 2008). Thresholds requiring TOC normalization were not used; dry weight concentrations were screened directly against published dry weight-based benchmarks.

Table 3.4. PAH available half-life information.

Analyte	Category[1]	Half-life (months)	
		GM[2]	SF[3]
Acenaphthalene	LMW		
Acenaphthene	LMW		
Anthracene	LMW	0.17	
Fluorene	LMW		
Phenanthrene	LMW		
Benzo(a)anthracene	HMW		11
Benzo(a)pyrene	HMW		
Benzo(b)fluoranthene	HMW		68
Benzo(g,h,i)perylene	HMW		69
Chrysene	HMW	69	
Dibenzo(a,h)anthracene	HMW		69
Fluoranthene	HMW	3.3	10
Naphthalene	HMW		0.75
Phenanthrene	HMW		2
Pyrene	HMW	79	

[1] *LMW=Low Molecular Weight (1-3 rings) more toxic; HMW=High Molecular Weight (4-6 rings) more persistent.*
[2] *Gulf of Mexico Study Half-Life (based on 0-meter depth of water).*
[3] *San Francisco Bay Study Half Life (see Table 6 in study report).*

3.3.2.1.5 Determination of Area Injured

The Trustees used ESRI® ArcMap to determine injured SSI habitat areas by analyzing geospatial data for those habitats, including shoreline type, oiling degree, and sediment stations (with service loss information). The Trustees used both 2005 and 2008 digital orthophoto quarter-quadrangle (DOQQ) imagery of the Calcasieu River estuary for that analysis. Trustees were careful to avoid double-counting by removing areas where data overlapped with the marsh habitat injury. The injury assessment indicated that 360.26 acres of intertidal habitat and 212.85 acres of shallow subtidal habitat were injured because of the Incident (Tables 3.5 and 3.6). Maps illustrating the injured areas can be found in Appendix E.

The service losses and durations for sediment stations were averaged for each AOI. The average service loss and duration for SSI habitat was 86 percent loss and 49 months for duration and 84 percent loss and 48 months duration, respectively. The HEA model quantified that the intertidal habitat injury is 466.1 DSAYs and the shallow subtidal habitat injury is 250.17 DSAYs.

Table 3.5. Total injured acres of shallow subtidal habitat by Area of Interest.

AOI	Stations	Oiling Category	Avg. Loss (%)	Avg. Duration (months)	Injured Acres
Calcasieu Lake	CL-05, CL-08	Moderate	63	6	33.8
Haymark Loop	HL-02, HL-04, HL-05, HL-06, HL-07, HL-10, HL-11	Heavy	82	55	78.0
Intracoastal Waterway	ICW-02, ICW-12	Heavy	88	31	1.65
Moss Lake	BIAS-07	Heavy	100	46	4.18
Moss Lake	ML-01, ML-02, ML-05, ML-08, ML-10, ML-15, SCS-15	Heavy	86	51	35.7
Old River Channel	ORC-01	Moderate	75	6	2.72
Prien Lake	PL-01, PL-10, PL-11	Moderate	67	38	27.3
Ship Channel North	no subtidal sites				
Ship Channel South	SCS-06	Light	50	6	29.5
		TOTAL SHALLOW SUBTIDAL INJURED ACRES			**212.85**

Table 3.6. Total injured acres of intertidal habitat by Area of Interest.

AOI	Stations	Oiling Category	Avg. Loss (%)	Avg. Duration (months)	Injured Acres
Calcasieu Lake	BIAS-02	Heavy	100	46	0.86
Calcasieu Lake	CL-06, CL-10, CL-11, CL-12, CL-13, CL-16	Moderate	71	20	24.20
Haymark Loop	BIAS-03	Heavy	100	84	0.12
Haymark Loop	BIAS-04	Heavy	100	84	1.58
Haymark Loop	BIAS-05	Heavy	100	84	0.61
Haymark Loop	BIAS-06	Heavy	100	84	2.03
Haymark Loop	HL-01, HL-03, HL-08, HL-09, HL-12, HL-13, HL-14, HL-15, HL-16	Heavy	83	52	116.80
Intracoastal Waterway	ICW-01, ICW-03, ICW-04, ICW-05, ICW-06, ICW-07, ICW-08, ICW-09, ICW-10, ICW-11, ICW-13, ICW-14 ICW-15, ICW-16	Heavy	83	20	5.39
Moss Lake	ML-03, ML-04, ML-09, ML-11, ML-12, ML-13, ML-14, ML-16, SCS-16	Moderate	75	44	28.90
Old River Channel	BIAS-08	Heavy	100	84	0.23

Old River Channel	ORC-04, ORC-05, ORC-06, ORC-07, ORC-08, ORC-09, ORC-10, ORC-11, ORC-12, ORC-13, ORC-14, ORC-15, ORC-16	Moderate	67	31	64.90
Prien Lake	PL-02, PL-03, PL-04, PL-05, PL-06, PL-07, PL-08, PL-09, PL-12, PL-13, PL-14	Moderate	73	36	29.40
Ship Channel North	BIAS-01	Heavy	100	84	0.44
Ship Channel North	SCN-01, SCN-02, SCN-03, SCN-04, SCN-05, SCN-06, SCN-07, SCN-08, SCN-09, SCN-10, SCN-14	Heavy	80	43	57.70
Ship Channel South	BIAS-09, SCS-11	Heavy	100	84	2.10
Ship Channel South	SCS-01, SCS-02, SCS-04, SCS-05, SCS-07, SCS-09, SCS-10, SCS-12, SCS-13, SCS-14	Heavy	83	20	25.00
		TOTAL INTERTIDAL INJURED ACRES			**360.26**

3.3.3 Marsh Habitat

Based on the Preassessment Surveys, the Trustees determined that 141.28 acres of marsh in the Calcasieu River Estuary were injured because of the Incident. That marsh vegetation was exposed to discharged waste oil via two pathways – physical contact and uptake of contaminants in the waste oil through the plant roots. The speed and intensity of plant death following oiling was unusual based on previous studies (summarized in Lin and Mendelssohn 1996) and the Trustees' professional experience. Some unique characteristics of the discharged waste oil combined with environmental conditions at the time of the discharge, such as peak growing season and summer conditions (i.e., low water and high heat) resulted in an unusually intense biological response by marsh vegetation in certain areas. In some locations, the marsh vegetation appeared dead or dying within days after the discharge while vegetation in other areas took weeks or months to reach that state. In many of the oiled areas, visible plant stress (e.g., chlorosis and dead plants) persisted for several weeks, several months, or longer after the Incident. In some areas, the Trustees observed and recorded visible plant stress and oil sheens from sediments up to three years after the discharge.

To determine the amount of injury and the recovery duration of impacted marsh habitat, the Trustees undertook two types of marsh monitoring plans in conjunction with CITGO, one for the structural component of aboveground marsh vegetation and another for marsh shoreline edge erosion. The Trustees collected marsh habitat data cooperatively with CITGO during the period of August 2006 through April 2009. The Trustees used those data to estimate marsh habitat service losses resulting from the Incident and recovery times to baseline conditions[5].

[5] In October 2007, CITGO chose to plant in areas where the Photoquad and erosion monitoring data showed the greatest marsh habitat loss. Although the Trustees commended CITGO for their efforts to minimize or prevent

3.3.3.1 Marsh Shoreline Edge Erosion and Recession Monitoring

To address the observed marsh shoreline edge erosion due to the rapid loss of vegetation in some locations, the Trustees and CITGO cooperatively developed a protocol for measuring marsh shoreline erosion. One hundred fourteen erosion monitoring stations were established in August 2006 (two months after the spill) by placing a fixed monitoring stake at the existing marsh-water interface (marsh shoreline edge) for each erosion monitoring station. A second stake was placed at a reasonable distance behind the monitoring stake and a compass bearing was taken in case the monitoring stake needed replacement. Eight stations were located in unoiled reference areas and the remaining 106 stations were distributed across habitat oiling categories according to the frequency of the oiling categories' occurrence in the NRDA shoreline database, including six stations labeled clean. After installation of the monitoring stations in August 2006, marsh shoreline edge erosion was measured in April 2007, October 2007, April 2008, October 2008, and April 2009. Data from the 114 stations were individually examined across time (a time-series analysis) to determine the marsh shoreline change trend (e.g., erosion, recession, no change, or accretion). The data, approach, and results are described in detail in the Trustees' final memo titled *Assessment of Marsh Shoreline Erosion and Recession Injury* (Trustees 2021a).

The Trustees agreed to use the term "shoreline erosion" or "marsh shoreline edge erosion" to define the permanent loss of sediment platform associated with the complete loss of marsh vegetation and root mass after oiling from the Incident. The term "shoreline recession" or "marsh shoreline edge recession" would be applicable to the partial or complete loss of vegetation but with an intact sediment platform resulting in recession of the shoreline.

Marsh shoreline erosion, or permanent loss of vegetation and marsh platform elevation, is defined by the following events: death of oiled vegetation, erosion of dead vegetation (both aboveground portions and root mass), and reduced marsh platform elevation caused by erosion of sediments. In this injury category, marsh vegetation re-establishment does not occur because the elevation of the substrate has become too low to support vegetative growth; thus, marsh habitat is not expected to recover any ecological services over time.

Marsh shoreline recession is defined as: death of oiled marsh vegetation at the marsh/water interface and partial or complete loss of aboveground vegetation that resulted in exposure of large, formerly interior, stands of marsh vegetation to wind and wave action previously protected by the fringe vegetation. The newly exposed vegetation may also be subject to shoreline recession. Continued recession is halted when newly exposed plants are healthy enough to withstand the forces that initially caused the recession, or when those forces are reduced/removed and new plants are able to re-establish into the previously receded areas. If re-growth of vegetation is documented, the habitat may be expected to recover all ecological services over time.

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further erosion of such areas, it is not possible to account for the planted areas under the NRDA process. There is no way to determine if, or the potential amount of, erosion that CITGO may have prevented as a result of the planting effort. The Trustees are not considering recovery of the planted areas in their analyses for several reasons based on the fact that the plantings were conducted at the sole discretion of CITGO, outside of the NRDA process, and the Trustees notified CITGO that the Trustees would consider the planted areas as 100 percent services lost for NRDA purposes in a letter to David Hollis dated August 17, 2007.

Three criteria were applied to all 114 monitoring stations associated with the marsh shoreline edge assessment:

1) Monitoring stations and associated shoreline segments within Calcasieu River, Haymark Loop, Upper Moss Lake, Prien Lake and North Calcasieu Lake were considered for evaluation of marsh shoreline edge recession or erosion injuries.
2) Monitoring stations and associated shoreline segments that met criterion #1 and were classified in exposure groups 3, 6, and 7 (i.e., moderate and heavy oiling) were considered for evaluation of marsh shoreline recession or erosion injuries.

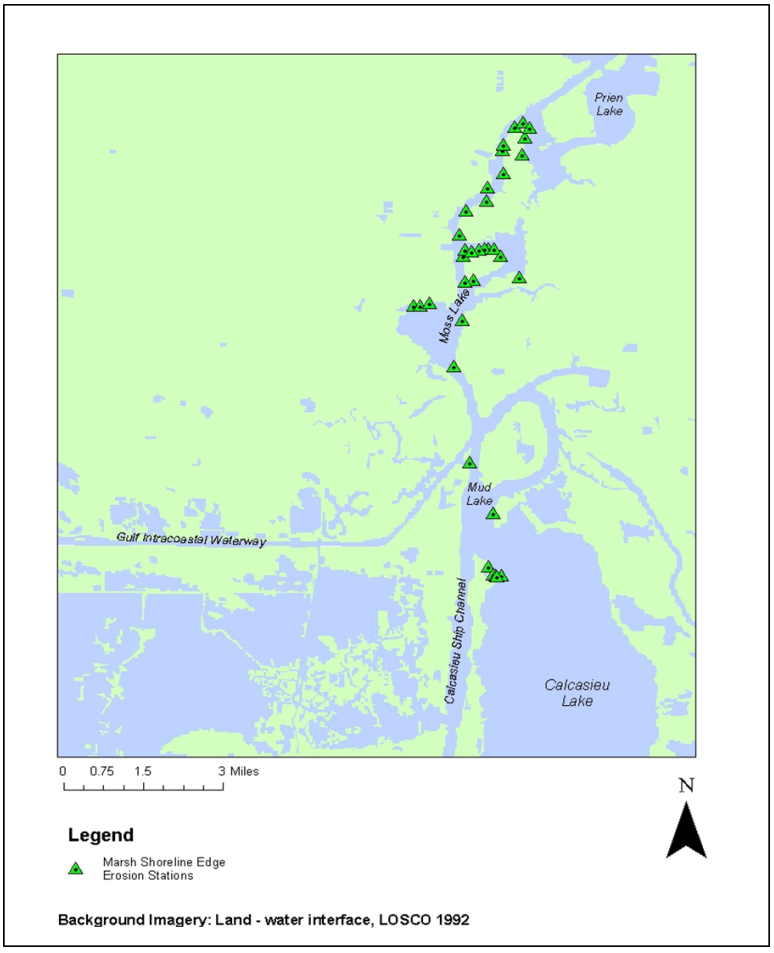

Figure 3.7. Location of the 35 monitoring stations used to assess marsh shoreline edge erosion.

3) Monitoring stations and associated shoreline segments that met criteria #1 and #2 and indicated a negative shoreline change trend based upon the time-series analysis for the individual station, were considered for marsh shoreline recession or erosion injuries.

Those criteria resulted in a subset of stations where a strong relationship existed between measured marsh shoreline change and oiled shoreline. Forty-nine (49) of 114 stations met the criteria.Of the 49 stations, 14 were removed from further consideration because the marsh shoreline change trends at those stations were either inconclusive or indicated possible accretion. Thus, only 35 stations were used to assess marsh shoreline edge injury (Figure 3.7). The measurements of marsh shoreline edge change recorded between April 2007 and April 2009 at the 35 monitoring stations can be found in Appendix F, Table F-1.

3.3.3.1.1 Determination of Acres of Marsh Shoreline Edge Erosion and Recession

To determine the acres of marsh[6] injured by erosion or recession of the shoreline, the Trustees first determined the amount of erosion or recession a shoreline segment was experiencing. In cases where there were multiple monitoring stations experiencing erosion or recession, which shared shoreline segments, the final monitoring event measurement (i.e., April 2009) for each of the monitoring stations was averaged to provide the amount of erosion or recession in inches. Similarly, in instances where multiple monitoring stations were located on contiguous segments, and shared the same exposure group, habitat type, and/or shoreline edge change injury (e.g., erosion or recession) the final monitoring event (i.e., April 2009) for each of those monitoring stations was averaged to provide the amount of erosion or recession in inches. As a result, some shoreline segments that exhibited erosion or recession have multiple and/or recurring monitoring stations associated with the segment. The length of the shoreline segment was multiplied by the width of the calculated marsh shoreline erosion or recession to generate an area (measured in squared inches and converted to acres). The acreages of eroded or recessed areas within the associated segments were summed, respectively, to provide total eroded acreage and total recessed acreage. A total of 9.36 acres of marsh eroded, and 2.25 acres recessed due to the Incident (Appendix F, Table F-2 and F-3; Figure 3.8.). At 11 monitoring stations, marsh shoreline edge erosion or recession acreage was greater than the acreage of horizontal oil penetration recorded during the Preassessment Surveys (Appendix F, Table F-2 and F-3; Table

Figure 3.8. Shoreline segments that experienced marsh shoreline recession or erosion as measured at 35 monitoring stations during injury quantification.

[6] While conducting this part of the analysis, the Trustees recognized that several segments, which had erosion monitoring stations located on them and exhibited erosion or recession, were classified as beach/shoreline habitat. As such, these stations were not included in the marsh habitat acreage. This led to a re-evaluation of segments in the database based on available photo documentation. The Trustees reclassified these 31 segments as marsh habitat and included their acreage in the marsh habitat injury category. Seven of the 31 reclassified segments are included in the marsh erosion and recession analysis. These segments are identified with an asterisk (*) in Appendix E, Tables E-2 and E-3. The other stations will be addressed in the aboveground marsh vegetation injury associated with Photoquad monitoring.

3.7). This additional acreage accounted for approximately four acres and was not counted within the affected 141.28 acres (Table 3.7).

Table 3.7 Marsh shoreline edge erosion and recession injury acreages in relation to the total marsh injury acreage. The marsh injury (acres) reflects the reclassified marsh shoreline based on available photo documentation from the NRDA shoreline database. Marsh Shoreline Edge Injury Acreage – Additional Acreage (acres) is not taken out of the marsh injury (acres), but is additional acreage addressed in this erosion and recession injury assessment.

			Marsh Shoreline Edge Injury Acreage		Marsh Shoreline Edge Injury Acreage - Additional Acreage	
Oiling Category (Exposure Group)	**Marsh Injury (acres)**	**Marsh injury after erosion/recession analysis taken out (acres)**	**Erosion analysis acres from marsh acreage (acres)**	**Recession analysis acres from marsh acreage (acres)**	**Erosion beyond oil penetration - additional acreage (acres)**	**Recession beyond oil penetration - additional acreage (acres)**
Light (0,1,2)	94.53	94.38	-0.1437	0.0000	0.0000	0.0000
Moderate (3)	16.17	13.47	-2.3137	-0.3933	-0.8040	-1.1860
Heavy (6,7)	30.58	25.82	-4.0873	-0.6723	-2.0098	0.0000
Total	**141.28**	**133.67**	**-6.5446**	**-1.0655**	**-2.8138**	**-1.1860**

In some cases, there was more than one monitoring station located on a segment and the stations did not exhibit the same shoreline change trend (i.e., erosion, recession, accretion, or no change). The reason for this happening is not entirely understood as it could be related to local environmental conditions or possibly a misinterpretation of the segment's habitat conditions during the Preassessment Surveys. The Trustees chose to deal with this by determining the distance between the eroded or recessed station and the "different" station and then halving that distance. The half distance closest to the eroded location was included in the erosion acreage. The remaining half was either included in the recession acreage, if it revealed recession, or was left out of the analysis if it showed accretion or no change. This type of analysis was conducted on six segments (see Appendix F, Tables F-2 and F-3).

When determining initial service loss and recovery time of injured services, it was assumed that prior to the Incident, marsh habitats near the discharge were healthy and providing 100 percent ecological service flows. The Trustees determined that permanent loss of marsh shoreline edge and temporary loss of marsh shoreline edge vegetation occurred at the start of the Incident, June 2006, due to the acute level of injury associated with this Incident. The eroded marsh shoreline edge at no time during monitoring exhibited re-establishment of marsh vegetation because the elevation of the substrate became too low to support vegetative growth; therefore, the habitat is not expected to recover any ecological services over time. As a result, all 9.36 acres of eroded marsh shoreline edge were assumed by the Trustees to have an initial 100 percent service loss in perpetuity (Table 3.8). The Trustees believe that 20 years is a realistic determination of perpetuity given the location of this Incident. The Trustees determined injury to 2.25 acres of marsh shoreline edge vegetation had undergone recession. The marsh shoreline edge that exhibited recession clearly experienced a limited ability to recover, as seen by the delayed time

of recovery over the first 22 months following the Incident. Based on the time-series analyses conducted, the recessed marsh shoreline edge vegetation revealed signs of vegetation re-growth 22 months after the Incident. If vegetation re-growth continued along that trajectory, then the Trustees conclude that recessed marsh shoreline edge vegetation will recover 100 percent ecological services over the following 75 months. Consequently, recessed marsh shoreline edge vegetation injured by the Incident required a total recovery time equaling 97 months (Table 3.8).

Table 3.8. Marsh shoreline edge erosion and recession injury expressed in DSAYs.

Injury Category	Acres Injured	Service Loss	Recovery Time (months)	Debit (DSAYs)
Marsh Shoreline Edge Erosion	9.36	100%	Perpetuity or 240	141.51
Marsh Shoreline Edge Recession	2.25	100% for 22 months then natural recovery over next 75 months	97	10.38
TOTAL	11.61			151.89

3.3.3.1.2 Marsh Shoreline Edge Erosion and Recession Injury Quantification

The Trustees quantified injury to the 9.36 acres of eroded marsh shoreline using the HEA model. The Trustees determined that permanent loss of marsh vegetation and shoreline occurred at the start of the Incident, June 2006, due to the acute level of injury associated with this Incident as documented in previous sections of this Final DARP/EA. The eroded marsh shoreline at no time exhibited re-establishment of marsh vegetation because the elevation of the substrate became too low to support vegetative growth; therefore, the habitat is not expected to recover all ecological services over time. As a result, all 9.36 acres of eroded marsh shoreline were considered by the Trustees to provide zero ecological services, and further were considered lost in perpetuity as detailed above. Results from the HEA model revealed that 141.51 DSAYs were lost due to acute impacts to marsh vegetation and subsequent marsh shoreline which led to marsh shoreline erosion as a result of the Incident and is provided in Table 3.8.

The Trustees quantified injury to the 2.25 acres of recessed marsh shoreline using the HEA model. The Trustees determined that the temporary loss of aboveground vegetation occurred at the start of the Incident, June 2006, due to the acute level of injury associated with this Incident as documented in previous sections of this Final DARP/EA. Marsh shoreline which exhibited recession clearly experienced a limited ability to recover, as seen by the delayed time of recovery over the first 22 months following the Incident. Based on the time-series analyses conducted, the recessed marsh shoreline revealed signs of vegetation re-growth 22 months after the Incident. If vegetation re-growth continued along that trajectory, then the Trustees conclude that recessed marsh shorelines will recover all ecological services over the following 75 months. Consequently, recessed marsh shoreline injured by the Incident required a total recovery time equaling 97 months. Results from the HEA model calculated that 10.38 DSAYs were lost due to acute impacts to marsh vegetation and subsequent marsh shoreline which led to marsh shoreline recession as a result of the Incident (Table 3.8).

3.3.3.2 Aboveground Marsh Vegetation Monitoring

Aboveground marsh vegetation monitoring was conducted to determine the extent that marsh vegetation was adversely affected by the discharge and the rate of recovery of marsh vegetation to pre-spill (baseline) conditions.

3.3.3.2.1 Photoquad Monitoring

Fixed vegetation monitoring stations (termed "Photoquads") were installed at 48 locations during August 22-29, 2006 (Figure 3.9). Eight of the 48 stations were placed in reference areas and the remaining 40 stations were distributed across oiling and habitat categories according to the frequency of the oiling categories' occurrence in the Preassessment Surveys (Table 3.9). Fixed vegetation monitoring stations used 1 m^2 quadrats that were oriented with sides parallel and perpendicular to shoreline. The quadrats used 1-inch PVC pipe with a stake located at the lower left and upper right positions. The lower left stake was labeled with the quadrat identifier. A differential GPS was used to initially mark the location of the quadrat and record the location of the marking stake during subsequent visits. Photographs were taken at each station during each monitoring period.

Table 3.9. Fixed Photoquad stations monitored by the Trustees and CITGO per exposure group.

Exposure Group	Station Code	Number of Stations
0	NN	8
1	FN	7
2	FS	8
3	FR	6
6	CR	7
7	FD	4
REF	R	8

All stations were visited at least three times over the next 14 months to collect data – in October 2006, April 2007, and October 2007. Stations in exposure groups 3-7 (higher oiling levels) were monitored for an additional 18 months (until April 2009) by agreement of all parties. During the monitoring events, data on structural habitat metrics including: percent live cover, percent dead cover, percent bare ground, percent cover for each live plant species, presence/absence of fauna, presence/absence of oil or petroleum odor, stem density of plant species, and average stem height of plant species was collected.

3.3.3.2.1.1 Aboveground Marsh Vegetation Injury Determination Based on Photoquad Monitoring Results

As reported previously, the Preassessment Surveys provided the marsh acres affected by the Incident to be 141.28 acres. After taking out the marsh erosion/recession affected acres (11.61 - 4.0 = 7.61), the remaining 133.67 acres of marsh habitat would be assigned injury and recovery through the results of Photoquad monitoring (see Table 3.7).

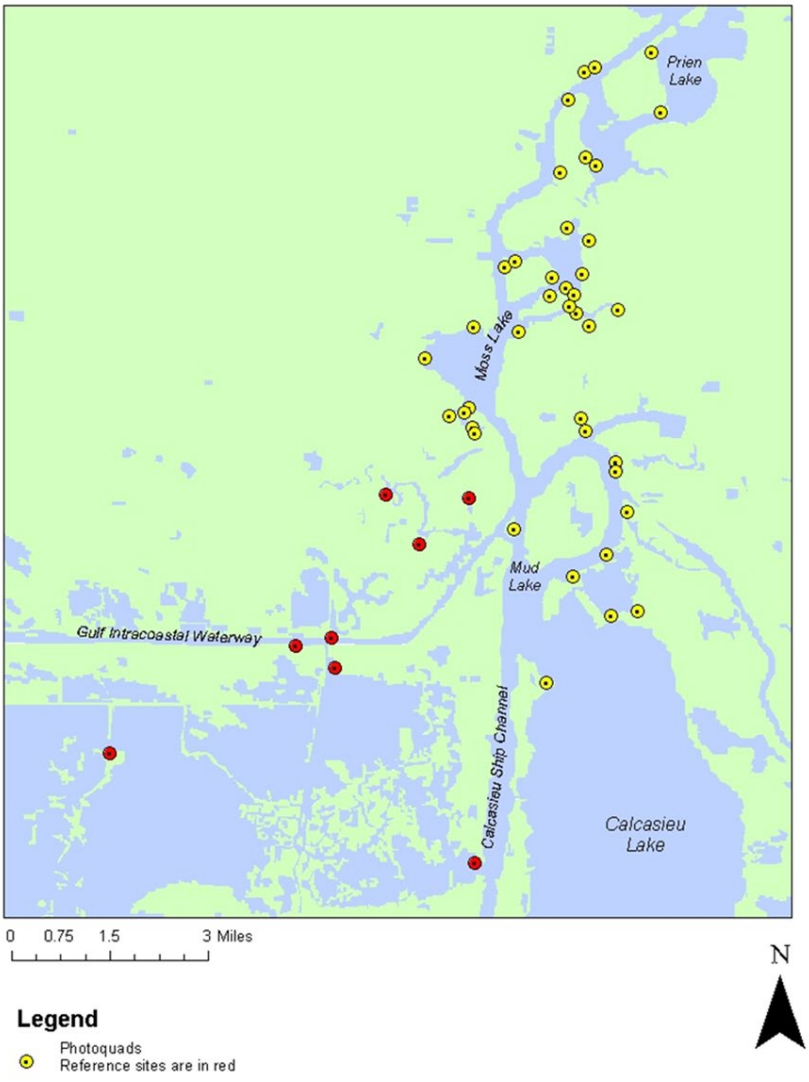

Figure 3.9. Map depicting locations of the 48 Photoquads.

Using data collected through the April 2009 sampling period, the Trustees determined that injuries to marsh services occurred in all exposure groups as a result of the Incident, but the severity and duration of injury differed among exposure groups. Based upon the cooperatively designed Photoquad monitoring, the Trustees used the structural marsh metric, percent live cover, as the proxy for assisting in the determination of service loss and recovery periods for marsh injury. Data associated with 48 fixed monitoring stations (Appendix G, Tables G-1 - G-7) were analyzed by exposure group and sampling date. Live cover data collected during Photoquad monitoring was averaged by exposure group and compared to the average live cover for reference stations (Figure 3.9). The Trustees used this monitoring data to guide their determination of service loss and recovery of marsh habitat to baseline. It was assumed that prior to the Incident marsh habitats in the vicinity of the discharge were healthy and providing 100 percent ecological service flows. The Trustees determined that during the first two months following the Incident, initial service loss was 100 percent. The Trustees then used the percent live cover data to determine the time of recovery for the injured marsh.

Based on a comparison of oiled stations with reference stations, loss of habitat services occurred in each exposure group (Figure 3.10). As a result of these findings, the Trustees pooled exposure groups into three levels of oiling: heavy (EG 6 and 7); moderate (EG 3); and light (EG 0, 1, and 2). Each oiling level was assigned a percent service loss: heavy 100 percent, moderate 50 percent, and light 20 percent (Figures 3.11-3.13). The Trustees used the live cover data compared to reference (all periods) to aid in determining the duration and recovery of the marsh injury.

Since the injured marsh had not recovered at the end of the last Photoquad monitoring event (April 2009), a subsequent recovery period was applied based on the trajectory of recovery and best professional judgment. The Trustees estimated that vegetation in lightly oiled marshes recovered 29 months after the Incident, or by October 2008 which is 1 year after the sampling of lightly oiled marsh was truncated. Marshes with higher degrees of oiling were assigned longer recovery times based on the trajectory of vegetative recovery from percent live cover data in stations within each exposure group and the Trustees' best professional judgment. Moderately oiled marshes are expected to fully recover one year after the final Photoquad monitoring event, or 48 months after the Incident, and heavily oiled marsh habitats are expected to recover five years after the final Photoquad monitoring event, or 86 months after the Incident.

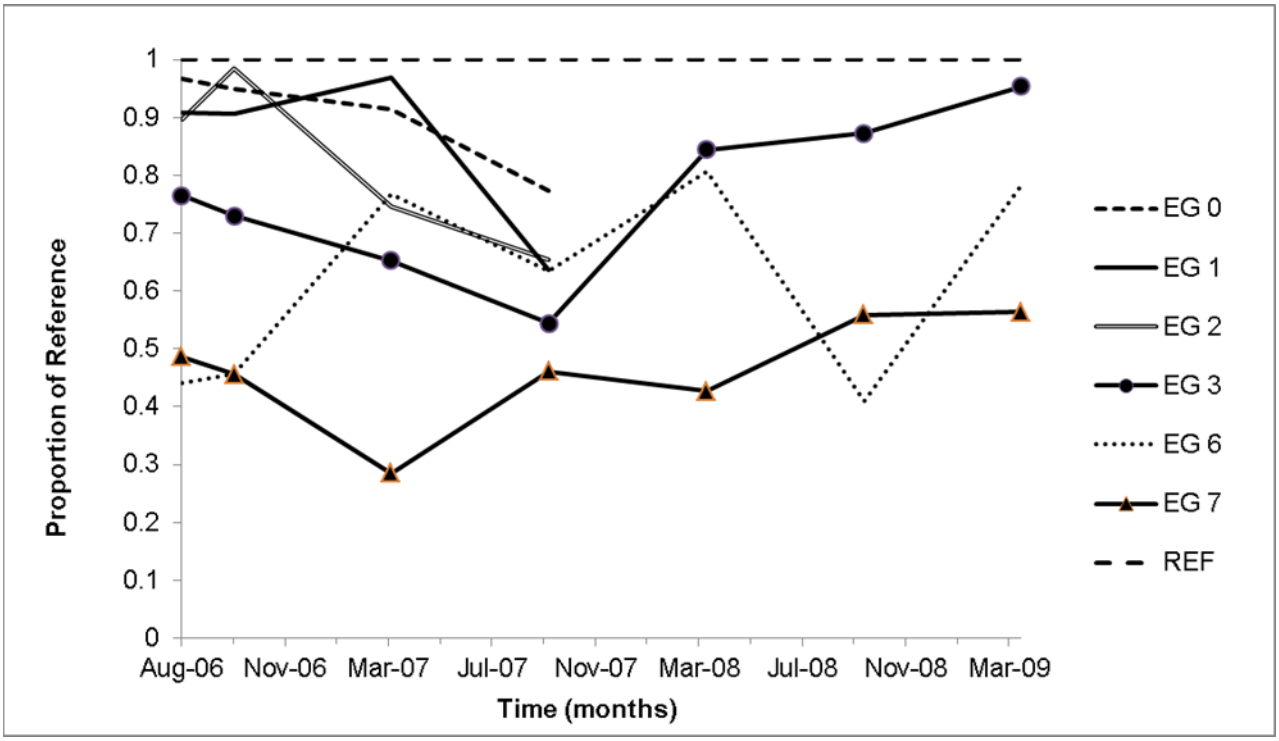

Figure 3.10. Average live cover by exposure group, relative to reference, for each Photoquad monitoring event.

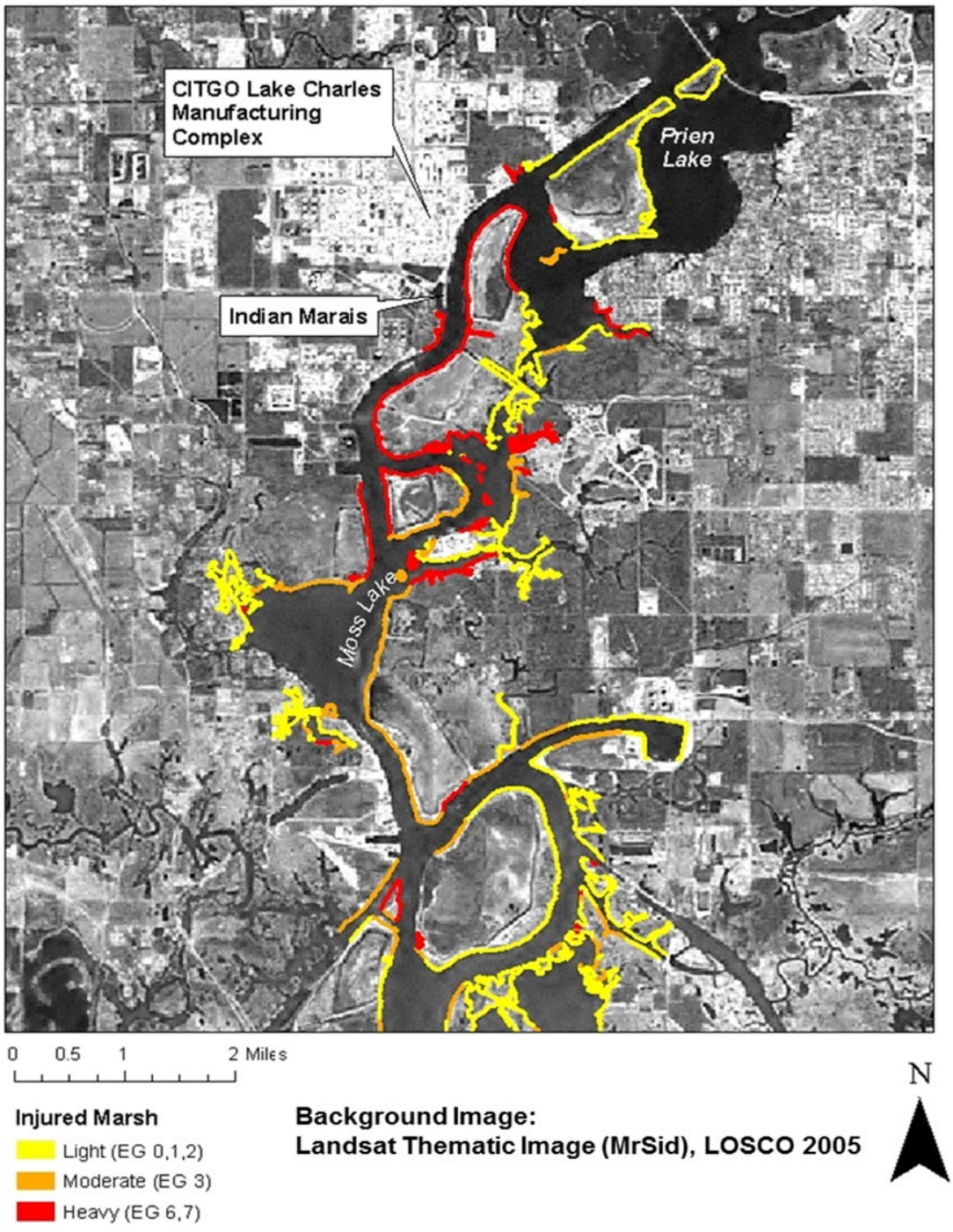

Figure 3.11. Map depicting injured marsh in the upper portion of the Calcasieu River Estuary and Calcasieu Lake as determined through Photoquad monitoring.

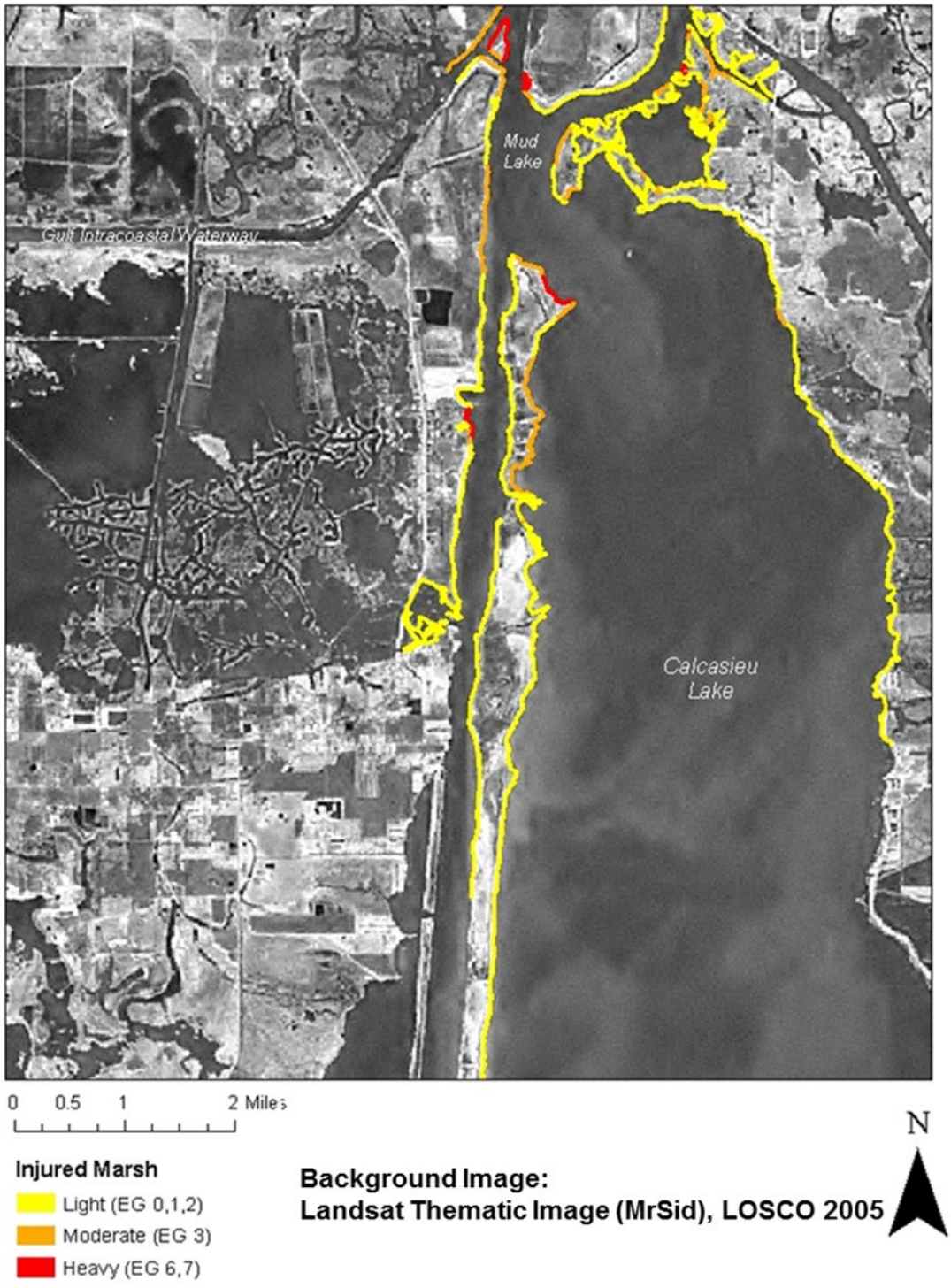

Figure 3.12. Map depicting injured marsh in the middle portion of the Calcasieu River Estuary and Calcasieu Lake as determined through Photoquad monitoring.

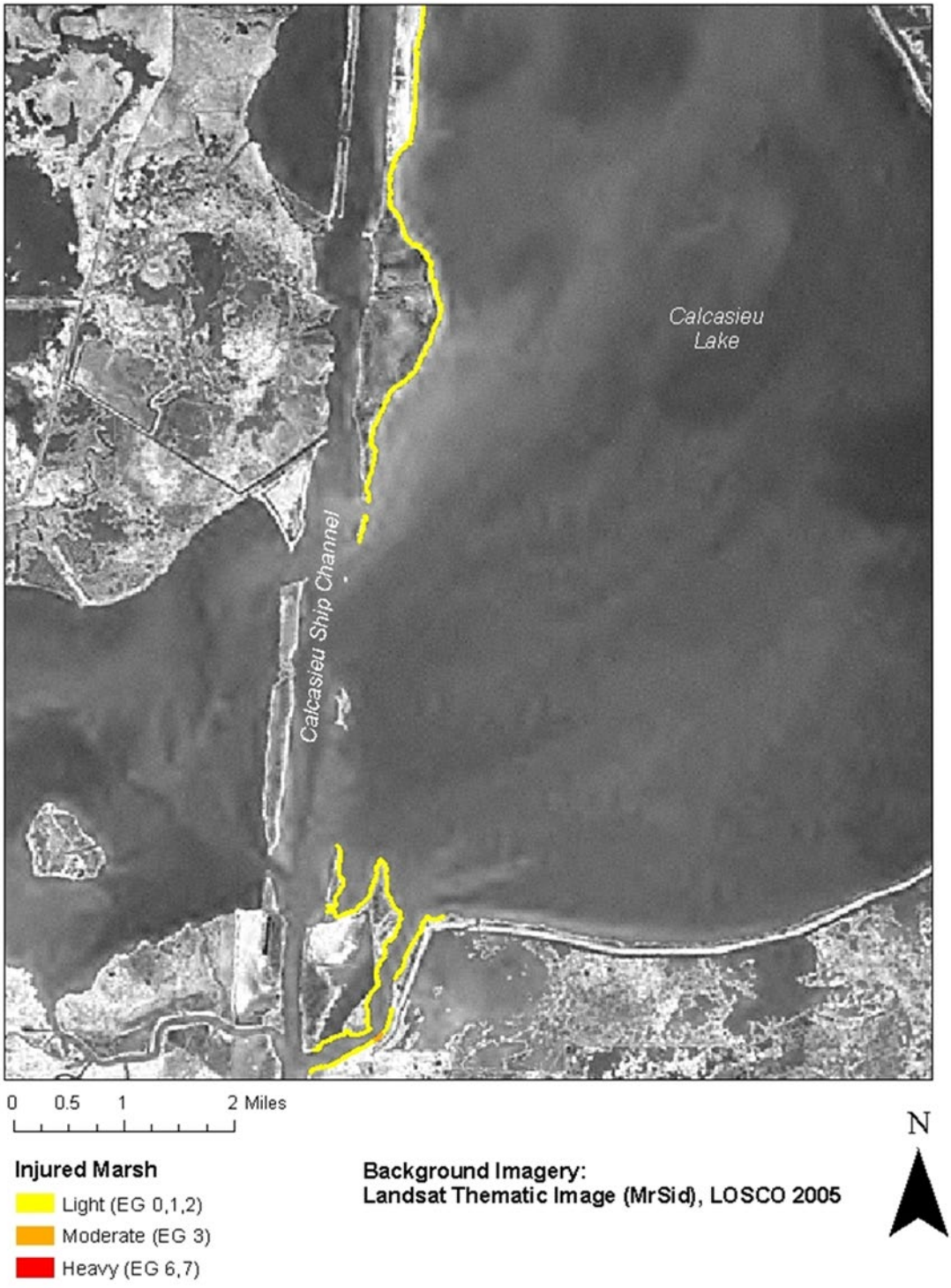

Figure 3.13. Map depicting injured marsh in the lower portion of the Calcasieu River Estuary and Calcasieu Lake as determined through Photoquad monitoring.

After documenting exposure of the aboveground vegetation of the marsh habitats to discharged oil, calculating the area of aboveground vegetation of the marsh habitat in each exposure group, and calculating the average decline in percent live cover in all periods compared to reference

areas, the Trustees determined that 133.67 acres of marsh habitat vegetation was adversely affected as a result of this Incident. Based on an average service loss over the sampled period, followed by a subsequent linear recovery period to the timeframe, the Trustees determined that for the aboveground vegetation marsh habitat injury category interim service losses were 131.65 DSAYs. Table 3.10 shows lightly oiled marsh habitats lost 26.09 DSAYs, moderately oiled marsh habitats lost 14.29 DSAYs, and heavily oiled marsh habitats lost 91.27 DSAYs.

Table 3.10. Aboveground marsh vegetation injury acreage and initial service losses.

Injury Category	Acres Injured	Service Loss	Recovery Time (months)	Debit (DSAYs)
Lightly Oiled Marsh (EG 2,1,0)	94.38	20% for 2 months then natural recovery over next 29 months	31	91.27
Moderately Oiled Marsh (EG 3)	13.47	50% for 2 months then natural recovery over next 48 months	50	14.29
Heavily Oiled Marsh (EG 7, 6)	25.82	100% for 2 months then natural recovery over next 86 months	88	26.09
TOTAL	**133.67**			**131.65**

3.3.4 Birds

In the first several days following the spill, wildlife responders were unable to adequately observe and collect oiled birds and oiled bird carcasses because volatilization of spilled chemicals created unsafe breathing conditions at the Incident site. Indeed, representatives from the United States Coast Guard, USFWS, and other spill responders were hospitalized due to exposure to noxious fumes. During the first 5 to 7 days of the Incident, certain areas of the Calcasieu River estuary were ultimately limited to persons with full-face respirators or a SCBA such that only essential cleanup personnel with proper safety equipment could work in the heavily oiled areas. Wildlife responders were therefore unable to adequately survey for or collect oiled wildlife or carcasses because the air quality was unsafe in most oiled areas. Despite access restrictions, responders were able to document observations of birds wading and feeding in oil and observed several other oiled dead birds. Such observations were verified and agreed to by the Trustees and CITGO.

A number of studies have been conducted in coastal Louisiana and elsewhere to demonstrate that responders only find a fraction of birds killed by oil spills (e.g., see API 2009, Abt Associates 2015, Industrial Economics, Incorporated 2015, Varela and Zimmerman 2019, Zimmerman et al. 2019). Factors affecting this, for example, include:

- Carcass persistence rates, which generally decline hours to days after mortality due to scavengers and environmental conditions (e.g., river flow or tides) which remove carcasses from observable areas (Haney et al. 2014);
- Percentage of carcasses found (i.e., the number of carcasses found by a searcher vs. the number present), which is typically less than 100%. Percentages of dead birds found can often be low due to a bird's natural camouflage and the inability of a searcher to see very far into or through dense vegetation where a moribund bird might go to rest; and
- The amount of spill area searched. The entire area is typically not searched due to logistical challenges (e.g., difficulties in searching through marsh vegetation) and/or number of available responders. For this Incident, this included a temporal (i.e., number of days not searched immediately following the spill) and spatial component.

Reasons such as those above made observation of the actual number of birds killed by the Incident impossible; the mortality of birds exposed to and caused by the Incident was likely significantly greater than observed. In cases such as these, it is therefore a well-accepted practice to use a multiplier or multipliers to estimate the ultimate mortality of various species of birds killed. Following this reasoning, the Trustees and CITGO agreed in cooperative discussions that an estimated 385 birds from 12 species would constitute the mortality estimate (Table 3.11).

Table 3.11. Oiled birds observed following the Incident and overall mortality estimate.

Species	Oiled Birds Collected	Observed Oiled & Not Collected	Estimated Mortality
Laughing gull	3	2	19.2
Neotropic cormorant	1	10	42.3
American white pelican	1	0	3.9
Brown pelican	1	0	3.9
Common loon	0	1	7.8
Great egret	0	2	7.8
Yellow-crowned night heron	0	5	19.2
Great blue heron	0	5	19.2
Green heron	0	3	7.8
Black-crowned night heron	0	1	3.9
Rails & Sora	0	16	250
Grand Total	***6***	***45***	***385***

The Trustees used REA to calculate DBYs lost for each species based on estimated mortalities. This method is often used in NRDA cases involving bird injuries: DBYs are a more accurate reflection of overall injuries to birds because they incorporate species-specific life history information (such as expected lifespans), REAs produce reliable results that are transparent and reproducible, and using REA to quantify overall injuries is more cost-effective than exhaustive searches in the field. DBYs are also valuable in relating injuries to each species with required restoration. REA typically calculates the present value of lost individual animal years for a given species (Discounted Species-Years or DSYs). A REA calculating DBYs for a specific species is:

$$DBYs = \sum_{t=0} \frac{\left(N_{s,t}^{B} - N_{s,t}^{I}\right)}{(1+r)^{t}},$$

where $N_{s,t}^{B}$ and $N_{s,t}^{I}$ represent the number of individuals of a species (S) in the population[7] at time *t* under baseline (B) and injured (I) scenarios, respectively; *t* is a set value of time (e.g., years following a spill), and *r* is a discounting rate (see, e.g., Sperduto et al. 2003; Zafonte and Hampton 2005).

Based on the affected species and available literature, the Trustees selected the following representative bird life histories to calculate lost DBYs:

- double-crested cormorant for neotropic cormorant;
- brown pelican for all pelicans;
- common loon;
- great egret for all herons and egrets; and
- clapper rail for all rails and sora.

The Trustees used the recommended value for each life history metric for these species as suggested by Industrial Economics, Incorporated (2014).

Lost DBYs are calculated starting with the age of each bird at the time of the Incident. When the lifespan of a particular bird would have otherwise been expected to be longer than 1 year after the point of the Incident, the lost DBYs would be >1. For purposes of this case, the Trustees agreed with CITGO to use a multiplier of 1 DBY/lost bird for laughing gulls (one bird is counted as 1 DBY). For the other species, the DBYs per mortality shown in Table 3.12 reflect the estimated losses in all age classes given species age distributions and average life spans from representative life history information (see Industrial Economics, Incorporated, 2014).

In addition to killing birds, the Incident oiled local marshes serving as rail and sora nesting areas. Because estimates of DBYs lost from birds killed by the Incident do not capture those from lost nests, the Trustees also used a REA to calculate lost DBYs from rail and sora chicks that would otherwise have been produced and reared in these marshes in 2006, 2007, and 2008. Those birds are counted as direct losses, which are distinct from the forgone loss of future generations from breeding birds killed in the spill. These losses may be considered distinct from the loss of future generations from breeding birds killed in the spill as surviving adults might have used these marshes to nest but been unable to produce young because of the remaining oil. The inputs for this REA are:

- **Nesting Pair Density.** The Trustees selected 1.51 birds per hectare (0.61 birds per acre) as the mean density for rails and sora based on previous studies (Leggett 2014, Abt Associates 2015). Clapper rail life history indicates a 50:50 split between females and males and assumes 100 percent of females reproduce. As such, the density is divided in half to get nesting pairs, resulting in 0.305 pairs/acre.
- **Area.** The marsh injury analysis indicates 141.28 acres of marsh were injured.
- **Hatchlings per Pair.** The Trustees assumed each rail pair produces a mean clutch of 7.84 eggs (Rush et al. 2010) with mean daily nest success of 98.5 percent (Rush et al. 2007).

[7] For clarification, REA is used to measure the interim losses associated with individuals, not population-level effects. Here, $N_{s,t}^{B} - N_{s,t}^{I}$ equals the estimated mortality of a particular species resulting from the Incident.

Using these estimates, 7.72 hatchlings per pair were lost (7.84 eggs x 98.5 percent nesting success).

- **DBYs per Hatchling.** Annual clapper rail survival rates as recommended by Industrial Economics, Incorporated (2014) result in 0.53 DBYs per hatchling.

In short, for example, DBYs are calculated as

DBYs = (0.305 pairs/acre) x (141.28 acres) x (7.72 hatchlings/pair) x (0.53 DBY per hatchling).

The result is 176.31 DBYs lost in 2006. Using a REA formula, a 3% discount rate is applied to the two additional future years of lost production (2007 and 2008). In total, approximately 509.96 DBYs from rails and sora reproductive failure were lost from the marsh injury.

The final calculated lost DBYs are provided in Table 3.12.

Table 3.12. Estimated discounted bird-years (DBYs) lost from the Incident.

Species	DBYs per Mortality	Estimated Mortalities	Total DBYs
Laughing gull	1	19.2	19.2
Cormorant	1.6	42.3	69.0
Pelicans	2.2	7.8	17.2
Common loon	3.6	7.8	28.1
Herons and egrets	1.4	57.9	81.4
Rails and Sora	0.6	250	142.9
Mortality Total		***385.0***	***357.8***
Rails & Sora Reproductive Failure in 2006 – 2008			509.96
Grand Total			***867.76***

3.3.5 Recreational Use

The Trustees and CITGO generated a draft report outlining the Incident, impacts, data collected, assessment approach, and damages in November 2008 in *Draft Calcasieu Estuary Recreational Lost Use Assessment for the CITGO Petroleum Corporation's Lake Charles Manufacturing Complex Oil Spill of June 19 and 20, 2006.* Damages presented in 2008 summed to $315,822 (2006$) (Entrix and NOAA 2008). The Trustees updated this value to equate the present value of the damages to those in 2006 in the Trustee memo titled *Calcasieu Estuary Recreational Lost Use Assessment for the CITGO Petroleum Corporation's Lake Charles Manufacturing Complex Oil Spill of June 18 and 19, 2006* (Trustees 2021b). Damages in 2021 summed to $641,295.89 (2021$). The value must be adjusted for inflation and for the social rate of time preference for environmental goods.

The adjustment for inflation is performed using the Consumer Price Index (CPI). The CPI is a measure of the price level of a representative basket of consumer goods and services. Measured and reported by the Department of Commerce's Bureau of Labor Statistics, the CPI allows an adjustment for the change in nominal prices over time. From 2006 to 2021, the CPI increased by a factor of 1.30[8].

[8] Rounded.

The social rate of time preference for environmental goods reflects injury to the public from impairment to an environmental resource that remains uncompensated. Even though the Trustees and CITGO assumed actual trip impacts ended October 15, 2006, the interim losses have remained uncompensated since that time. Empirical social rates of time preference (or discount rates) vary, but trustees have commonly adopted a 3% annual rate. From 2006 to 2021, this amounts to an adjustment factor of 1.56[9].

The agreed-upon damages in 2006 dollars were inflated using the CPI calculator to the estimated date of project implementation, which is 2024. The projected value for 2024 (assuming CPI increases at 2% annually) is $743,654 (Table 3.13). Table 3.13 depicts the total present value of recreational-use damages from the spill.

Table 3.13. Total value of foregone trips.

Category	Per-Trip Loss	Forgone Trips	Total Damages (2024$)
Boating	$38.50	6,553	$594,051
Shore Fishing	$26.98	1,474	$93,640
General Shoreline Use	$17.87	1,330	$55,963
Total		**9,357**	**$743,654**

3.4 Summary of Injury Quantification

The outputs of the debit-side of the HEA for marsh habitat (i.e., aboveground vegetation and erosion) and SSI habitat, the REA for birds, the SIMAP for water column organisms, and the recreational use loss analysis are provided in Table 3.14 for the Incident. Lost ecological services are expressed in DSAYs for marsh and SSI categories, biomass for water column organisms, and DBYs for the bird injury. The recreational use injury is expressed in 2024 dollars.

Table 3.14. Summary of injuries for the Incident.

Injury Resource Category/Subcategory	Amount Injured	Injury/Damages
Water Column Organisms	Direct kill and production foregone	55,713 (kg)
SSI Habitat		
Intertidal	360.26 (acres)	466.10 DSAYs
Shallow subtidal	212.85 (acres)	250.17 DSAYs
Marsh Habitat		
Aboveground vegetation	133.69 (acres)	131.67 DSAYs
Marsh shoreline edge erosion	9.36 (acres)	165.63 DSAYs
Marsh shoreline edge recession	2.25 (acres)	10.38 DSAYs
Birds	385 birds from 12 species;	867.76 Species-Specific DBYs

[9] Annualized and rounded.

	rails and sora reproductive failure	
Recreational Use		$743,654 (2024$)[10]
Boating	6,553 (foregone trips)	
Shore fishing	1,474 (foregone trips)	
General shoreline use	1,330 (foregone trips)	

4 RESTORATION ALTERNATIVES

The goal of restoration under OPA is to compensate the public for injuries to natural resources and their services resulting from an oil spill. This goal is achieved through the return of the injured natural resources and their services to baseline conditions and compensation for interim losses from the date of the incident until recovery. To fulfill this purpose, this section introduces potential restoration actions to restore the natural resources and resource services injured by the Incident and identifies the Trustees' preferred restoration alternative.

The assessment completed by the Trustees described in Chapter 3 quantified the amount of injury to natural resources resulting from the Incident. Per Section 1006(c)(1)(C) of OPA, Trustee restoration actions must restore the equivalent of the injured resources by providing resources and services of the same type and quality and of comparable value (i.e., restore, rehabilitate, replace or acquire the equivalent) as those injured. The process of "scaling" compensatory restoration actions involves determining the size of the restoration action(s) needed to provide resource and service gains equal to the value of interim losses due to the release of hazardous substances (NOAA 1997, 1999). Because the duration of the injury differs from the lifespan of the restoration action(s), equivalency is calculated in terms of the present discounted value of services lost due to resource injuries and gained due to restoration.

4.1 Restoration Strategy

Restoration actions are defined as primary or compensatory. Primary restoration actions are any actions, including natural recovery, that restore injured natural resources and services to their baseline condition (that is, their condition prior to the release of oil). Compensatory restoration addresses interim losses of natural resource services from the time of initial injury until full recovery of natural resources to their baseline condition. Natural recovery, in which no human intervention is taken to restore the injured resources, is appropriate where feasible or cost-effective primary restoration actions are not available or where the injured resources would recover relatively quickly without human intervention. The scale of primary and compensatory restoration projects depends on the nature, extent, severity, and duration of the resource injury. Primary restoration actions that speed resource recovery would reduce the scale of compensatory restoration required.

Upon completion of emergency response and cleanup activities by CITGO, the Trustees determined that primary and compensatory restoration would restore the injured natural

[10] Restoration alternatives addressing the recreational use injury will be considered in a future restoration plan once specific boating, shore fishing, and general shoreline use projects are identified by the Trustees.

resources and related services injured by the Incident. Although appropriate response actions were taken following the Incident, impacts to the environment were not fully restored. Accordingly, the Trustees determined that a number of potential restoration actions would be needed to compensate the public for the losses, and proceeded with Restoration Planning. For primary restoration, the Trustees considered both the natural recovery option and other actions that would restore the injured resources at the spill site. Based on the extent of injury, the natural recovery option was pursued for primary restoration but not for compensatory restoration, and for the purposes of this Final DARP/EA natural recovery is the No Action alternative as described in the following sections. For compensatory restoration, OPA and OSPRA regulations clearly establish Trustee authority to seek compensation for interim losses if technically feasible, cost-effective alternatives exist. Since technically feasible, cost-effective alternatives exist, the Trustees proceeded with identifying restoration alternatives that accomplish both primary and compensatory restoration for the injured resources discussed in Chapter 3.

4.2 Developing Restoration Alternatives

Both OPA and NEPA require the Trustees to develop a reasonable range of restoration alternatives before selecting their preferred alternative. Each alternative must be designed so that, as a package of one or more actions, the preferred alternative would make the environment and public whole. Federal and Louisiana natural resource trustees established the RRP Program to help address incidents and assist in carrying out their NRDA responsibilities. The RRP Program helps in evaluation and selection of a preferred restoration alternative by assisting the natural resource trustees in identifying appropriate restoration types suitable to restore those trust resources and services injured, developing a list of potential restoration alternatives appropriate to restore injured trust resources and services, and selecting the preferred restoration alternative(s) to compensate the public for lost natural resources and services caused by each incident.

The Trustees' restoration approach for this Incident involved 1) selecting restoration types that most appropriately address the injured natural resources and services caused by the Incident, 2) developing a preliminary list of potential restoration actions appropriate for restoring for lost resources and services caused by the Incident, 3) identifying a reasonable range of alternatives suitable for addressing injuries to natural resources and their services caused by the Incident, and 4) selecting a preferred restoration alternative(s) available to be implemented. This process is described in more detail below.

4.2.1 Relationship of the Injured Resources and Services to Restoration Types and Restoration Actions

The injured resources and services are located partially in RRP Region 4 (coastal) and Region 7 (inland) (Section 5.0 RRP Program FPEIS (NOAA et al. 2007)). However, the Trustees believe the impacted habitats are more analogous to a coastal environment because the area is influenced mainly by marine and coastal processes, and is similar to coastal habitats. As such, the Trustees used coastal resource and service injury categories (Section 4.2.2 RRP Program FPEIS (NOAA et al. 2007)) when applying various tools and selection criteria provided in the RRP Program to ensure the most suitable potential restoration actions were identified. Table 4.1 classifies the

injured resource categories quantified by the Trustees for the Incident to the appropriate RRP Program injured resource and service category.

Table 4.1. Classification of the Incident-specific injured resource category/subcategory to the appropriate RRP injured resource and service category.

Injured Resource Category/Subcategory	RRP Injured Resource and Service Category
Water Column Organisms	Coastal Water Column Organisms (CWCO)
SSI Habitat	Coastal Herbaceous Wetlands (CHW) Coastal Beaches/Shorelines/Streambeds (CBSS)
Marsh Habitat Aboveground vegetation Marsh edge shoreline erosion Marsh edge shoreline recession	Coastal Herbaceous Wetlands (CHW)
Birds	Birds
Recreational Use[11] Boating Shore fishing General shoreline use	Recreation

4.2.2 Restoration Type Selection

To streamline the process of developing a reasonable range of restoration alternatives for each RRP injured resource and service category, the Trustees first identified restoration types suitable to address injuries caused by the Incident. Restoration types are identified in the RRP Program FPEIS (NOAA et al. 2007) and include the following seven broad categories:

1. Creation/enhancement of habitat;
2. Physical protection of habitat;
3. Acquisition/legal protection of resources and services;
4. Stocking of fauna;
5. Physical protection of fauna;
6. Restoration of recreational resource services; and
7. Restoration of cultural resource services.

Utilizing the RRP injured resource and service categories identified in Table 4.1, the Trustees applied the nexus analysis described in detail in Section 4.2.4.1 of the RRP Program FPEIS and summarized in Table 4.2. Specifically, the nexus analysis identifies restoration types that would be appropriate to restore particular RRP injured resources and services. The nexus analysis facilitates the Trustees' decision to determine suitable restoration types for addressing the injuries caused by an Incident. For this Incident, the nexus analysis revealed 20 coastal restoration types as having a strong nexus to the RRP injured resources and services.

[11] Recreational use restoration alternatives are not evaluated in this Final DARP/EA. As specific recreational use projects are identified by the Trustees they will be fully evaluated in a subsequent restoration plan.

Table 4.2 Coastal restoration types and their nexus to restoring trust resources and services (positive associations are marked with a √ and indicate that a restoration type is an appropriate restoration alternative for the corresponding RRP injured trust resource or service; excerpted from NOAA et al. (2007)). Shaded cells note the 20 coastal restoration types appropriate for compensating for injuries to natural resources and services caused by the Incident.

COASTAL RESTORATION TYPES			POTENTIALLY INJURED TRUST RESOURCES AND SERVICES								
			Herbaceous Wetlands	Forested Wetlands	Beaches/Shorelines/ Streambeds	Oyster Reefs (and Other Reefs)	Water Column Org.	Birds	Wildlife	Recreation	Cultural
RESTORATION TYPES	Creation/ Enhancement of Habitat	Coastal Herbaceous Wetlands	√	√		√	√	√	√	√	
		Coastal Forested Wetlands	√	√			√	√	√	√	
		Coastal Beaches/Shorelines/Streambeds			√		√	√	√	√	
		Coastal Oyster Reefs (and Other Reefs)				√	√	√	√	√	
		Coastal SAV	√			√	√	√	√	√	
	Physical Protection of Habitat	Coastal Herbaceous Wetlands	√	√		√	√	√	√	√	
		Coastal Forested Wetlands	√	√			√	√	√	√	
		Coastal Beaches/Shorelines/Streambeds			√		√	√	√	√	
	Acquisition/ Legal Protection of Habitat	Coastal Herbaceous Wetlands	√	√		√	√	√	√	√	
		Coastal Forested Wetlands	√	√			√	√	√	√	
		Coastal Beaches/Shorelines/Streambeds			√		√	√	√	√	
		Coastal Oyster Reefs (and Other Reefs)				√	√	√	√	√	
		Coastal SAV	√				√	√	√	√	
	Stocking of Fauna	Coastal Water Column Org.					√			√	
		Coastal Oyster Reefs and Other Reef Organisms				√	√			√	
		Birds						√		√	
		Wildlife							√	√	
	Physical Protection of Fauna	Birds						√		√	
		Wildlife							√	√	
	Recreational Resource Services Recreational Services									√	
	Cultural Resource Services Cultural Services										√

Next, the Trustees applied the restoration type selection criteria described in Section 4.2.4.1.5 of the RRP Program FPEIS (NOAA et al. 2007) to help determine which of the 20 restoration types

identified were most appropriate for restoring trust resources and services injured as a result of the Incident. The restoration type selection criteria assist the Trustees in determining which of the various restoration types with a strong nexus to the injured trust resources and services is most appropriate to restore injured trust resources and services. These restoration type selection criteria are based in part on the OPA regulations (15 C.F.R. § 990.54(a)(1-6)) and include:

1. Strength of nexus;
2. Degree to which the restoration type addresses multiple injuries;
3. Scalability; and
4. Availability of projects for this restoration type in the RRP Program

As seen in Table 4.3, based on the application of these criteria, 8 out of 20 potential restoration types were determined most appropriate to address injuries caused by the Incident. Identification of these 8 preferred restoration types ensures that restoration actions considered will provide services of the same type, quantity, and of comparable values as those lost. The 8 preferred restoration types are listed below:

1. Acquisition/Legal Protection Coastal Herbaceous Wetland
2. Creation/Enhancement Coastal Beaches/Shorelines/Streambeds
3. Creation/Enhancement Coastal Herbaceous Wetlands
4. Creation/Enhancement Coastal Oyster Reefs (and Other Reefs)
5. Physical Protection of Coastal Herbaceous Wetlands
6. Physical Protection of Birds
7. Stocking of Coastal Oyster Reef and Other Reef Organisms
8. Recreational

Table 4.3 Results of the application of restoration type selection criteria for the 20 restoration types. Checks (√) represent a restoration type met the criterion and blanks represent a restoration type did not meet the criterion, for one or more of the resources and services injured by the Incident.

Coastal Restoration Type	**Strength of Nexus**	**Addresses Multiple Injuries**	**Scalability**	**Projects Available in RRP**
Acquisition/Legal Protection Coastal Beaches/Shorelines/Streambeds	√	√	√	
Acquisition/Legal Protection Coastal Forested Wetland		√	√	√
Acquisition/Legal Protection Coastal Herbaceous Wetland	√	√	√	√
Acquisition/Legal Protection Coastal Oyster Reef (and Other Reefs)		√	√	
Acquisition/Legal Protection Coastal SAV		√	√	
Creation/Enhancement Coastal Beaches/Shorelines/Streambeds	√	√	√	√
Creation/Enhancement Coastal Forested Wetlands		√	√	
Creation/Enhancement Coastal Herbaceous Wetlands	√	√	√	√

Creation/Enhancement Coastal Oyster Reefs (and Other Reefs)	√	√	√	√
Creation/Enhancement Coastal SAV		√	√	
Physical Protection of Coastal Beaches/Shorelines/Streambeds	√	√	√	
Physical Protection of Coastal Forested Wetlands		√	√	
Physical Protection of Coastal Herbaceous Wetlands	√	√	√	√
Physical Protection of Birds	√	√	√	√
Physical Protection of Wildlife			√	
Stocking of Birds	√	√	√	
Stocking of Wildlife			√	
Stocking of Coastal Oyster Reef and Other Reef Organisms	√	√	√	√
Stocking of Coastal Water Column Organisms	√	√	√	
Recreational	√		√	√

4.2.3 Identification of Potential Restoration Actions based on Restoration Type

Following the identification of the 8 preferred restoration types, the Trustees conducted an initial screening of potential restoration projects or actions to develop the range and type of available restoration actions. Because all restoration actions contained in the RRP Program project database are grouped by restoration type and region, the Trustees were able to easily identify 22 preliminary restoration actions that matched one or more of the 8 preferred restoration types detailed above within RRP Region 4. Although the Trustees prefer to identify potential restoration actions located in the same RRP Region as the injured resources, in some instances suitable restoration actions are not available or there are appropriate restoration actions available in other regions that have a strong nexus to the injured resource. Such was the case for the bird injury resource category and, consequently, the Trustees decided to query the database on the restoration type, Physical Protection of Birds, in all coastal regions (1, 2, 3 and 4). This led to the identification of 6 additional restoration actions that had a strong nexus to the bird injury resource category. In addition to restoration actions derived from the RRP Program project database, 2 projects were submitted by CITGO and 1 project was submitted to the RRP Program but was located in RRP Region 7. In total, the Trustees identified 30 preliminary restoration actions, 2 submitted by CITGO and 28 from the RRP Program project database, which, based on restoration type, were potentially suitable to compensate the public for natural resource injuries caused by the Incident (Appendix H).

4.3 Selecting a Preferred Restoration Alternative

Following the identification of suitable restoration actions that had a strong nexus to the injured resources, the Trustees used the OPA criteria found in 15 C.F.R. § 990.54 and RRP Program-

specific criteria[12] to select a preferred restoration alternative. Only those actions considered technically feasible and in accordance with applicable laws, regulations, and/or permits were moved forward for further consideration by the Trustees.

OPA criteria:

1. Cost to carry out each alternative;
2. Extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and their services to baseline and/or compensating for interim losses;
3. Likelihood of success of each alternative;
4. Extent to which each alternative will prevent future injury as a result of the Incident and avoid collateral injury as a result of implementing the alternative;
5. Extent to which each alternative benefits more than one natural resource and/or service;
6. Effect of each alternative on public health and safety.

RRP Program-specific criteria:

1. Ability to implement with minimal delay;
2. Degree to which the project supports existing strategies/plans;
3. Project urgency.

Table 4.4 shows seven (7) restoration actions that met most or all of the criteria listed above and in some combination, as a suite of restoration actions, would meet the Trustees' goals to restore for lost natural resources and services caused by the Incident. These projects were considered for further evaluation in the process of selecting a preferred alternative best suited for restoring the injured resources and making the environment and public whole.

Table 4.4 Restoration actions considered for further evaluation.

Project Name	**RRP #**	**Restoration Type**
Long Point Bayou Marsh Creation (CS-0085) Project	896	CE CWH CE CBSS
Sabine NWR Unit 1A	947	CE CWH CE CBSS
West Cove Marsh Creation and Nourishment	805	CE CHW CE CBSS
No Name Bayou Marsh Creation (CS-0078)	633	CE CHW
Oyster Lake Marsh Creation and Nourishment (CS-0079)	882	CE CHW
Calcasieu Lake Oyster Cultch Plant	934	CE Oyster Reef
Houma Navigation Canal (HNC) Bird Island Project	935	CE CHW CE CBSS PP CHW PP CBSS PP Birds

[12] OPA and RRP Program-specific criteria are described in Section 4.2.4.2 of the RRP Program FPEIS (NOAA et al. 2007).

4.4 Evaluation of Potential Restoration Alternatives

4.4.1 No Action/Natural Recovery Alternative

NEPA requires the Trustees to consider a "no action" alternative, and OPA requires consideration of the "natural recovery" option. In this case, these options are equivalent. Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate the public for lost services pending environmental recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources. The principal advantages of this approach are the ease of implementation and cost-effectiveness. However, the no action/natural recovery alternative is rejected for restoration because OPA and OSPRA clearly establish Trustee responsibility to seek compensation for interim losses pending recovery of the natural resources. Compensatory restoration cannot be addressed through a no-action alternative.

The Trustees' assessment of natural resource injuries indicates that losses occurred as a result of the Incident. Response actions undertaken may allow the injured resource to recover, but those actions would not compensate the public for the resource services lost over time. Such compensation serves to make the public and the environment whole. OPA provides for the public to be compensated for such losses based on actions that restore, replace, or provide services equivalent to those lost. As evidenced by the restoration alternatives identified in Table 4.5, there are feasible and appropriate opportunities to restore, replace, or provide services equivalent to those lost due to the Incident. Under the no-action alternative, restoration actions needed to make the environment and public whole for its losses would not occur. This is inconsistent with the goals of the natural resource damages provisions of OPA. Thus, the Trustees determined that the no-action alternative (i.e., no restoration) should be rejected on that basis.

4.4.2 Preferred Alternative - Suite of Restoration Actions, including (1) Long Point Bayou Marsh Creation (CS-0085) Project, (2) Calcasieu Lake Oyster Cultch Plant, and (3) Houma Navigation Canal (HNC) Bird Island Project.

As discussed above, the Trustees identified 7 potential restoration actions that were considered for further evaluation in the selection of a preferred restoration alternative. The diversity of resources injured by the Incident necessitates a portfolio of restoration actions to adequately address injuries to each of the resource categories.

For water column organisms, the Trustees' evaluation of restoration alternatives focused on replacing lost biomass by increasing production of fish and invertebrate biomass. The Calcasieu Lake Oyster Cultch Plant involves the creation of oyster reefs, which is a highly effective means to enhance productivity across multiple trophic levels and provides a direct nexus to the injured resources, as discussed in more detail in Section 4.4.2.2 below.

For birds, the Trustees' evaluation of restoration alternatives focused on replacing lost birds by facilitating additional production for injured species that nest in coastal Louisiana, and providing

services (e.g., forage) for species that do not (e.g., American white pelican, common loon). Consistent with bird restoration in other NRDA cases, the Trustees chose to achieve this by prioritizing the restoration of species-specific nesting and foraging habitat in coastal Louisiana. Given the species injured, associated habitats would include coastal estuaries or marsh (e.g., for rails and sora) and coastal islands (e.g., for brown pelican, laughing gull, and certain waders). Given life history requirements of bird species injured (i.e., Table 3.11) and REAs calculated for representative species (Table 3.12), the Trustees categorized injured species into two guilds for restoration planning: those that nest and forage in coastal marsh environments (i.e., coastal marsh species) and those that nest on coastal islands (i.e., coastal island species). This split results in a requirement of 652.86 DBYs for coastal marsh species and 117.8 DBYs for coastal island species (Table 4.5).

Table 4.5. Estimated discounted bird-years (DBYs) lost from the Incident and required by restoration for the *coastal marsh species* and *coastal island species* groups.

	Species	**Estimated Mortalities**	**Total DBYs**
Coastal marsh species	Rails and Sora	250	142.9
	Rails & Sora Reproductive Failure in 2006 – 2008		509.96
	Cormorant	42.3	69.0
	Common loon	7.8	28.1
	Total Requirement		652.86
Coastal island species	Laughing gull	19.2	19.2
	Pelicans	7.8	17.2
	Herons and egrets	57.9	81.4
	Total Requirement		117.8

In reviewing potential project alternatives, one project, HNC Bird Island Project, stood out as providing the biological and geographic nexus to the injured coastal island bird species the Trustees desired. The HNC Bird Island Project addresses injury to coastal island nesting birds by creating coastal island nesting habitat via placement of dredged sediments and provide a direct nexus to the injured resources, as discussed in more detail in Section 4.4.2.3 below.

The remaining 5 restoration actions listed in Table 4.4 are all potentially suitable for restoring or replacing marsh habitat to compensate for injuries caused by the Incident. When applying the OPA and RRP Program evaluation criteria (see section 4.3), the Trustees determined that all potential alternatives would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. For all potential alternatives, the restoration approaches would ensure that any collateral damage to the environment is minor and temporary. Furthermore, no adverse impacts to public health are anticipated from any of the potential alternatives. Each of the potential restoration alternatives has a clear nexus to the injuries described in Chapter 3 and an ability to address multiple injuries because creation and enhancement of marsh habitat would create both marsh and SSI habitat and provide nesting and foraging habitat for birds that utilize coastal marsh (e.g., rails and sora). The benefits realized from the actions would provide both biological and geographic nexus to the injured resources.

After evaluating the strength of nexus of these 5 potential restoration actions, however, the Trustees determined that the Long Point Bayou Marsh Creation (CS-0085) Project will create the most suitable marsh habitat to address the injuries resulting from this Incident. The Trustees' restoration goal when creating marsh and SSI habitat and nesting and foraging habitat for rails and sora is the creation of coastal marsh with ample natural marsh edge habitat and hydrologic connectivity. The Long Point Bayou Marsh Creation (CS-0085) Project will create a marsh platform conducive to intertidal marsh via dredge and fill of shallow open water areas, with project design components including vegetative plantings, tidal creek construction and tidal exchange reestablishment. This type of marsh creation will increase the likelihood that the project meets the Trustees' restoration goals and creates a stronger nexus to those resources and services injured by the Incident. In addition, after considering the cost to carry out the potential restoration actions listed above in Table 4.4, the Long Point Bayou Marsh Creation (CS-0085) Project is the most cost-effective alternative due to cost efficiencies related to its construction in the immediate vicinity of, and concurrent with, USACE maintenance dredging activities along the CSC. Finally, the Long Point Bayou Marsh Creation (CS-0085) Project is approaching its final stage of design under the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Program, which will allow it to be implemented with minimal delay. For these reasons, the Trustees propose the Long Point Bayou Marsh Creation (CS-0085) Project to restore for marsh and SSI habitat, and birds that nest and forage in coastal marsh habitat, including rails and sora.

Recreational use restoration alternatives to restore for lost recreational boating, shore fishing, and general shoreline use are not proposed at this time, as the Trustees have not identified specific restoration project(s) to address the recreational use injuries. When suitable recreational use projects are identified, the Trustees will fully describe and evaluate them under OPA and NEPA in a subsequent restoration plan that will be made available for public review and comment.

Table 4.6 summarizes the Trustees' preferred alternative comprised of the 3 selected restoration actions, and a description and analysis of each of the actions is provided below.

Table 4.6. Preferred alternative comprised of selected restoration actions for the injured resources and services resulting from the Incident.

RRP Injured Resource and Service Category	Injured Resource Category/Subcategory	Restoration Goal	Selected Restoration Action
CHW	Marsh Habitat Aboveground vegetation Marsh shoreline edge	Create/enhance coastal herbaceous wetlands	Long Point Bayou Marsh Creation (CS-0085) Project
CBSS, CHW	Shallow Subtidal and Intertidal (SSI) Habitats	Create/enhance coastal herbaceous wetlands	Long Point Bayou Marsh Creation (CS-0085) Project
CWCO	Water Column Organisms	Create coastal oyster reef	Calcasieu Lake Oyster Cultch Plant Project

Birds	Birds Coastal Marsh Species	Create nesting and foraging habitat	Long Point Bayou Marsh Creation (CS-0085) Project
	Birds Coastal Island Species	Create nesting habitat	Houma Navigation Canal (HNC) Bird Island Project

4.4.2.1 Long Point Bayou Marsh Creation (CS-0085) Project

The Long Point Bayou Marsh Creation (CS-0085) Project provides for the creation and enhancement of approximately 392 acres of saline marsh in shallow open water, including nesting habitat for rails and sora, in Cameron Parish, Louisiana. The project is located in the Calcasieu/Sabine Basin approximately 4 miles south of Hackberry, north of Sabine NWR, east of Highway LA 27, and west of the CSC near Mile 11 (Figure 4.1). The southern tip of the project area lies immediately adjacent to the Sabine NWR.

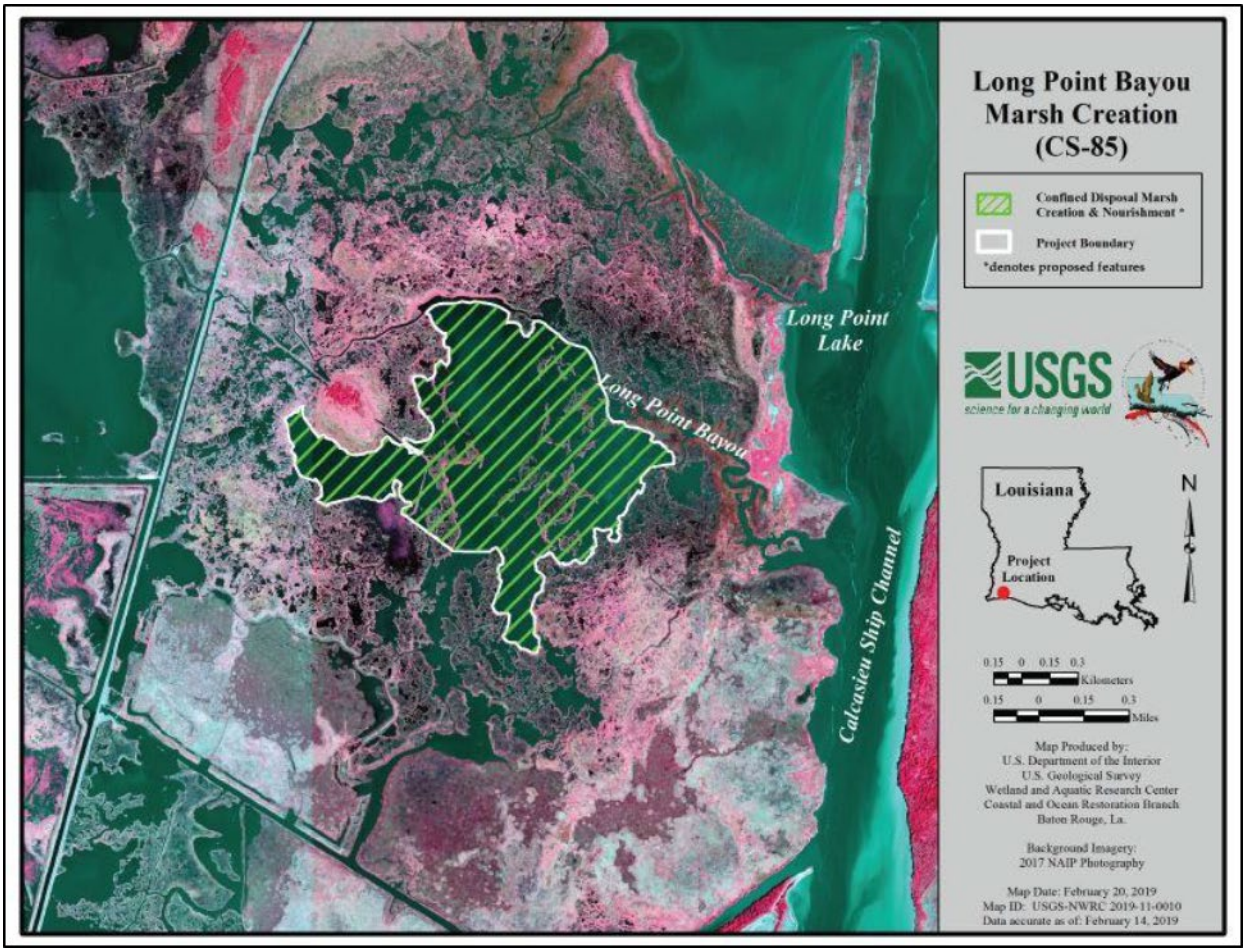

Figure 4.1. Long Point Bayou Marsh Creation (CS-0085) Project, Cameron Parish.

The project area encompasses primarily broken marsh and shallow open water connected to the Sabine NWR, which occupies the marshes between Calcasieu and Sabine lakes in southwest Louisiana, including 40,403 acres of open water and 85,387 acres of marsh grassland.

Raising the marsh elevation with dredged sediment so that the marsh can support healthy marsh vegetation will alleviate land loss for the twenty-year project design life. As described in Chapter 2, marsh has been converting to open water in the Calcasieu River due to several factors. In 2019, the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Task Force designated CS-0085 as part of the 28th Priority Project List (PPL28). The USEPA was designated as the lead federal sponsor for the project with funding approved by the United States Congress through CWPPRA and by the State of Louisiana through the Wetlands Conservation Trust Fund. CPRA is serving as the local sponsor and is providing engineering and design services. The USACE will bid and construct the project as part of their maintenance dredging event for the lower CSC. Material removed from the CSC will be beneficially used to meet the CS-0085 project goals. The USACE will credit the cost of the project up to the Federal Standard, defined as the least costly dredged material disposal or placement alternative (or alternatives) that is consistent with sound engineering practices and meets all federal environmental requirements.

Project construction involves marsh creation and nourishment by hydraulically dredging and transporting approximately 1.4 million cubic yards of sediment from the CSC into the marsh creation area shown in Figure 4.1. The dredged slurry will be placed to a constructed fill elevation above the inundation range and will settle into the intertidal range over the 20-year design life. The marsh construction fill elevation is currently planned to be approximately +3.0 ft. North American Vertical Datum of 1988 (NAVD88). Given current sea-level rise projections over the next 20 years, this construction elevation increases the likelihood of the marsh remaining in the intertidal range throughout its design life. Earthen containment dikes will be constructed to a design height of +5.0 ft. NAVD88 to contain the fill material. Crown width will be constructed to 5 ft. NAVD88 and side slopes will be 3H:1V. Eight (8) acres of tidal creeks will be added after the marsh has settled into the target inundation range, at approximately target year 3. These tidal creeks will benefit the saltmarsh topminnow and black rail, two species proposed or currently listed on the Federal Endangered Species List. Construction of tidal creeks in created marsh reduces the temporal lag to establish tidal hydrology and function and creates interspersed edge habitat similar to natural marsh. The tidal creeks alignment will be set to match the natural creek formation over the three years. Following construction, vegetative plantings will be installed to aid in the establishment of a vegetative community typical of other coastal wetlands in the area, and containment dikes will be gapped or degraded to reestablish tidal exchange.

The Trustees believe the project will result in a direct benefit to the injured resources by creating and enhancing hydrologically connected emergent marsh with tidal creeks. Creating and enhancing coastal marsh habitat is anticipated to provide similar or complementary ecological services to marsh, SSI habitat, rails and sora, and therefore has a sufficient nexus to the injured resources. Habitat creation and enhancements achieved through dredging, vegetative plantings, creation of tidal creeks and reconnecting tidal exchange will restore habitat and have a positive effect on biodiversity by expanding the available food supply, cover, and sites available for

nesting, foraging and mating for birds, including rails and sora. These benefits are sufficient to compensate the public and the environment for birds injured during the Incident and provide both biological and geographic nexus to the injured resources. Given historical land loss trends in the area and projected future sea level rise, existing ecological services related to emergent marsh and bird nesting habitat will continue to decrease over time if the project is not implemented.

This project is technically feasible and utilizes proven restoration techniques with established methods and documented results. Dredging to create marsh in shallow open water areas has been successfully used as a cost-effective restoration technique in coastal Louisiana for decades and is consistent with Louisiana's Coastal Master Plan (CPRA 2017). Since CWPPRA was authorized in 1990, several marsh creation projects have been constructed and more are authorized for engineering and design or construction (Lindquist and Martin 2007). Many other marsh creation projects have been constructed by the State of Louisiana as mitigation for wetland impacts under section 404 of the CWA and by the USACE under other authorities such as Sections 204 and 1135 of the Water Resources Development Act. In addition, a geotechnical investigation conducted by the CPRA and USEPA design team indicates that based on the construction methods to be employed, the selected marsh creation fill area will remain intertidal for 20 years. The project is currently in the final stage of design, which is scheduled to be completed in fall 2021, and the Trustees foresee no delay in the implementation of the selected restoration action.

For the purposes of restoration scaling, the Trustees used the same rails and sora bird density as described above in section 3.3.4 for the analysis on lost reproduction (i.e., 0.61 birds per acre). Because of the uncertainty of use by any specific bird over time, bird-years were calculated based on presence using the expected density per acre (i.e., no age or lifespan is assumed or applied). Several project-specific factors were considered, including elapsed time from the onset of injury through the project life, relative productivity of restored habitat, time required for restored habitats to reach full function and project lifespan. The Trustees assumed project construction will be completed at the end of 2023, a 20-year project life that matched its engineering design life, services reaching full function after 5 years, and 50% productivity relative to natural marsh (Desrochers et al. 2008; Darnell and Smith 2004). Based on these inputs and assumptions, the Trustees estimated approximately 283 acres will be needed to restore for 652.86 DBYs.

Performance monitoring will be performed for 5 years following construction to provide an assessment of project progress and help guide corrective actions, if any, to meet the project's goals and objectives. The project's success will be determined by comparing quantitative monitoring results to pre-determined performance standards developed by the Trustees defining minimum physical or structural conditions deemed to represent acceptable growth and development. Performance criteria and standards for the project will target spatial extent (acreage and elevation of marsh fill shortly after construction), survival of vegetative plantings, vegetation cover, and presence of tidal creeks at Year 5. If the performance criteria are satisfied at the 5-year monitoring event, then the Trustees are confident, based on previous experience, that the project will be successful and no further monitoring will be required. Should one or more of the performance criteria not be met, corrective action will be considered to remedy the situation. Potential corrective actions may include: reworking newly placed sediment or adding

additional sediment to achieve target acreage during construction; replanting vegetation; removal of invasive species; monitoring for an additional period of time to see if the project begins to match anticipated trends; or other actions agreed upon by the Trustees that would correct the deficiency.

For the reasons discussed above, the Trustees select the Long Point Bayou Marsh Creation (CS-0085) Project as one component of the preferred restoration alternative for this NRDA. The project will create and enhance approximately 392 acres of saline marsh and include vegetative plantings and 8 acres of tidal creeks as restoration for the Incident. The Trustees estimate the project will cost approximately $13,640,000 to implement and monitor. This cost is based on the incremental cost above the Federal Standard for dredging of the CSC and estimates of inflation based on the timing lag for contract award and construction. A portion of the settlement funds received from CITGO will go towards implementing this component of the preferred restoration alternative.

4.4.2.2 Calcasieu Lake Oyster Cultch Plant Project

To address the injury to water column organisms, the Trustees will create approximately 18 acres of oyster reef via oyster cultch placement in lower Calcasieu Lake, Cameron Parish, Louisiana (Figure 4.2). The primary goal of this project is to create a productive oyster reef on public oyster areas to compensate for injuries to water column organisms in the vicinity of the Incident. Cultch material in oyster-spawning areas provides a substrate on which free-swimming oyster larvae can attach as spat (less than 25 mm long), then grow first into "seed" oysters (25–74 mm), then adult sack-sized oysters (≥75 mm) (LDWF 2020). New cultch material is an excellent substrate for larval oyster spat settlement and harbors fewer oyster predators. Under ideal conditions, oyster spat that settle on cultch can survive and grow into seed oysters within one year. The warm waters of the northern Gulf allow faster growth rates than those in eastern oysters (*Crassostrea virginica*) along the upper East Coast of the United States. In Louisiana, oysters can reach market size (approximately 3 inches) in 18 to 24 months (LDWF 2016).

Oyster populations provide many important benefits to the Calcasieu Lake estuary. Because oysters are filter feeders, they are very effective at extracting excess nutrients, phytoplankton and sediment from the water column. Oysters also consume plankton and microorganisms inhabiting estuarine waters, and release the filtered water back into their environment. An adult oyster can filter 20 to 50 gallons of water per day. This is helpful in combating nitrogen runoff from fertilizers used in agriculture and urban areas as well as cleaning the water within the estuary. In addition to filtering and cleaning the surrounding water, oyster reefs offer shelter and food to numerous aquatic organisms, including important habitat for some offshore fish species that spend the juvenile phase of their life cycle on oyster reefs. Healthy reefs serve as extremely valuable forage and nursery habitat for many of the important recreational and commercial species of finfish and crustaceans. Economically, oysters are very important to the local communities. Many of the local residents supplement their income by harvesting oysters from Calcasieu Lake and the oysters are shipped to markets throughout the nation.

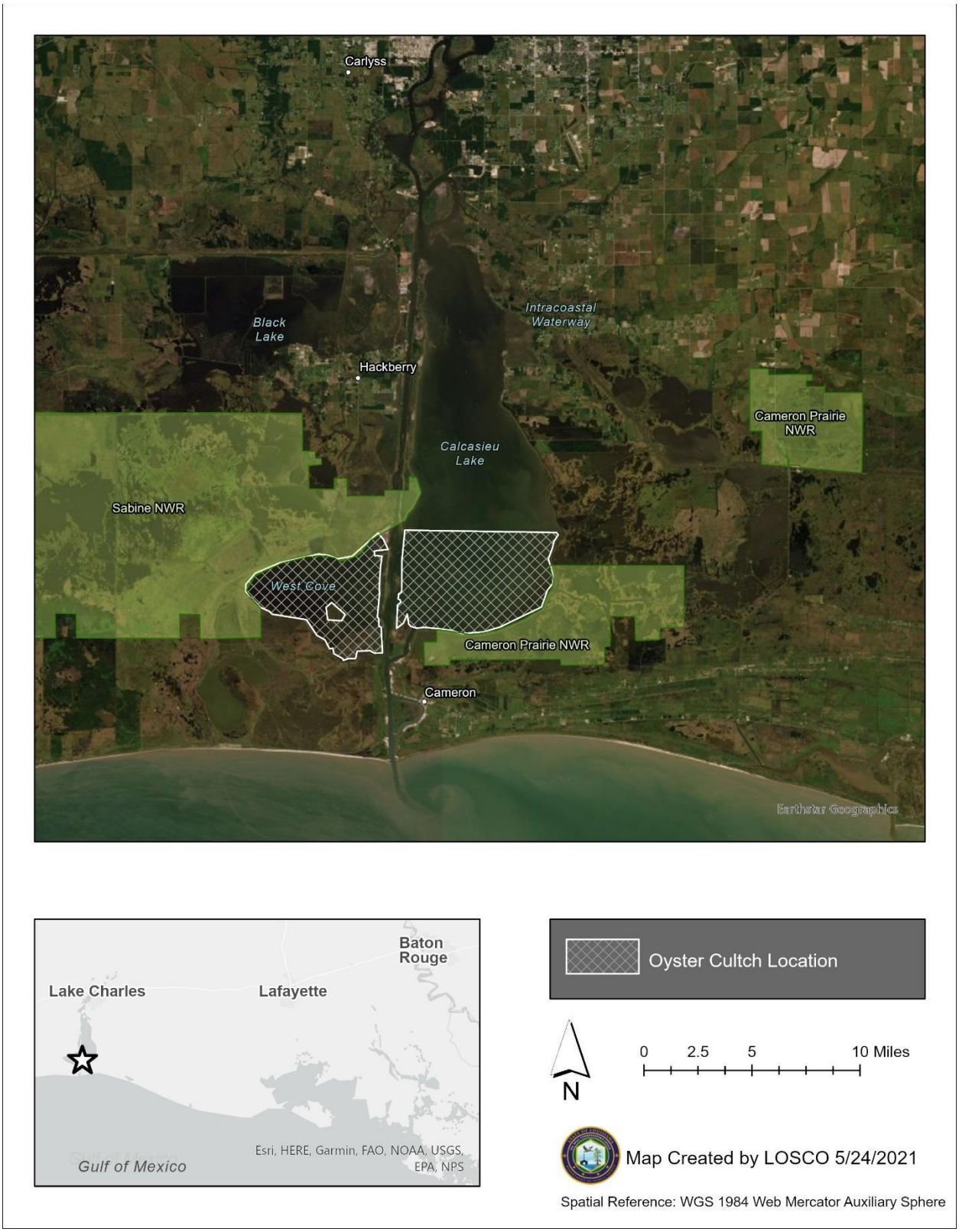

Figure 4.2. Oyster reef creation via cultch placement located at the southern end of the Calcasieu River Basin in Calcasieu and Cameron parishes (precise location to be determined).

The project will be a newly constructed feature involving the placement of approximately 17,500 tons of oyster shell cultch material or crushed limestone onto the Calcasieu Lake Public Oyster Areas (precise location to be determined). The cultch plant will include a 2" base layer of material and a grid pattern of 10" high elevated rows in order to increase reef height, minimizing the chances of sedimentation and hypoxia-induced mortality. The project will be implemented by LDWF and employ cultch planting approaches utilized by the agency since 1917 (LDWF 2013). Taking into consideration currently available information, the Trustees believe the project will be a cost-effective alternative for creating oyster reef habitat given typical costs associated with these projects that continue to be implemented statewide by LDWF.

Restoring for oyster reef habitat is anticipated to provide similar or complimentary ecological services to the injured water column resources, and therefore has a sufficient nexus to the injured resources. The Trustees believe the project will provide a direct benefit to water column organisms by creating refuge and foraging habitat for fish and invertebrate communities injured by the Incident. Habitat enhancements achieved through reef restoration will provide essential habitat structure for eastern oysters and other water column organisms, including shrimp, clams, crabs, snails and a variety of fish. In addition to offering shelter and food to numerous coastal species, oyster reef restoration will have a positive effect on fish and invertebrate abundance, biomass, species richness, and biodiversity, as well as refuge and cover for several prey species. These direct benefits compensate the public for lost resources resulting from the Incident.

This project is technically feasible and utilizes proven restoration techniques with established methods and documented results. Cultch planting in shallow open water areas has been used by LDWF as a cost-effective option to create and rehabilitate reefs for more than a century. The LDWF is charged with managing the state's oyster resources by closely monitoring the size and health of oyster populations on nearly 1.7 million acres of public oyster areas as well as setting oyster seasons, monitoring harvest levels, and enhancing habitat (e.g., cultch planting, reef building, etc.). The project is in the early stages of design. It is currently anticipated to be completed by fall 2023 or sooner and the Trustees foresee no delay in implementation of the selected restoration action.

For purposes of restoration scaling, equivalency was determined by estimating the levels of services the project will provide once constructed. Several project-specific factors were considered, including elapsed time from the onset of injury through the project life, relative productivity of restored habitats, time required for restored habitats to reach full function and project lifespan. The Trustees analyzed the conceptual design of the project and its geographical proximity and made decisions based on their own experience and the experience of resource experts about the level of anticipated changes in services over the life of the project. The Trustees assumed project construction will be completed at the end of 2023, reaching full function in 3 years and services continuing to 2033. Given that oyster harvesting is permitted on public oyster seed grounds, the Trustees assumed a 25% reduction in productivity and a 3% discount rate. Based on these assumptions, the Trustees estimated approximately 18 acres will be needed to restore for 55,713 kg of water column organisms.

Performance criteria and standards for the project will target spatial extent (target acreage at the end of construction is greater than or equal to 18 acres) and oyster recruitment (average density

of 20 seed-sized oysters per square meter) to represent acceptable growth and development. Performance monitoring will be conducted for up to three years post cultch deployment, or until performance criteria are met, whichever comes first. Monitoring will be conducted to assess project progress and help guide corrective actions, if any, to achieve the project's goals and objectives. The Trustees, led by LDWF, propose to conduct monitoring consistent with the Oyster Habitat Restoration Monitoring and Assessment Handbook (Baggett et al. 2014) and NOAA's Tier 1 metrics for oyster restoration, as well as standard state oyster monitoring methods (LDWF 2013). Specifically, the Trustees will monitor the following metrics:

1) Within 3 months post construction - Reef aerial dimensions
    a) Project/Site footprint
    b) Reef area
2) Within 3 months post construction and two recruitment phases - Reef height (minimum, mean, and maximum)
3) Years 1 and 2 post construction - Oyster density
    a) Mean live oyster density (including oyster recruits)
    b) Mean original (planted) oyster seed density (if applicable)
4) Years 1 and 2 post construction - Oyster Size-Frequency Distribution (shell height) (recruit density may be extrapolated from this data);
5) Continuous monitoring that leverages Louisiana's Coastwide Reference Monitoring System (CRMS) for years pre-construction and years 1 and 2 post construction - Environmental Variables (annual minimum and maximum)
    a) Water Temperature
    b) Salinity

Should one or more of the performance criteria not be met, corrective action will be considered to remedy the situation. Potential corrective actions may include: reworking newly placed material or adding additional cultch material to achieve target acreage during construction; re-exposing buried cultch material; monitoring for an additional period of time to see if the project begins to match predicted trends in growth; or other actions agreed upon by the Trustees that would correct the deficiency.

For the reasons discussed above, the Trustees select the Calcasieu Lake Oyster Cultch Plant Project as a component of the preferred restoration alternative for this NRDA. This project will create at least 18 acres of oyster reef habitat in lower Calcasieu Lake as restoration for the Incident. The Trustees estimate the project will cost $1,469,570 to design, implement and monitor. This cost is based on standard costs for oyster cultch placement in Louisiana and estimates of inflation based on the timing lag for planning, contract award, and construction. A portion of the settlement funds received from CITGO will go towards implementing this component of the preferred restoration alternative.

4.4.2.3 HNC Bird Island Project

To address the injury to coastal island nesting birds, the Trustees select the creation of coastal island nesting habitat via placement of dredged sediments in Terrebonne Bay, Terrebonne Parish, Louisiana (Figure 4.3). The primary goal of this project is to create additional nesting habitat on

an existing eroded coastal island to compensate for injuries to coastal nesting birds. HNC Bird Island Project is located in Terrebonne Bay in Terrebonne Parish, Louisiana. The island is important as it hosts persistent nesting colonies of waterbirds, including species injured by the Incident. Bird species that currently depend on this island for nesting include brown pelicans, roseate spoonbills, royal terns, tricolored herons, laughing gulls, and various other species. The island is currently approximately 32 acres in size, but suitable nesting habitat is less than ten acres. Without enhancement, the island is expected to erode to open water, constituting a loss of nesting habitat for these species.

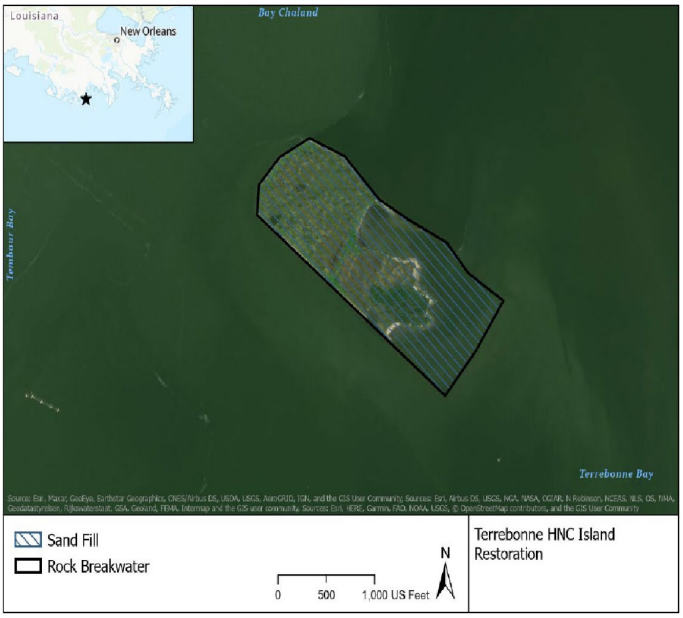

Figure 4.3. Houma Navigation Canal Bird Island example project configuration. Excerpted from LA TIG (2020).

In October 2020 the Deepwater Horizon Oil Spill (DWH) NRDA Louisiana Trustee Implementation Group (LA TIG) selected enhancement of HNC Bird Island as a preferred alternative to help compensate for losses to birds caused by DWH (LA TIG 2020). The Trustees for this Incident likewise identified this project as a valuable alternative to help restore bird resources affected by the Incident, and recognized that contributing to this project would help maximize restoration effectiveness (i.e., cost:benefit) for both trustee groups.

Per LA TIG (2020), the project is designed to enlarge the island from its current size of 32 acres to approximately 50 acres by importing dredged sediment from a nearby suitable source and placing it adjacent and onto the existing island (Figure 4.3). Prior to transporting dredged sediment to the island, the existing rock ring will be restored to its previous 50-acre perimeter ring. The rock ring will both contain the deposited sediment and provide erosion protection from wind driven waves. The elevation of the island will be increased to prevent routine tidal inundation and increase nesting success. Limestone aggregate will also be placed adjacent to the edge of the island to create a low maintenance beach-like feature for use by nesting birds. Following construction, the island will be planted with suitable vegetation to provide optimal nesting habitat such as oyster grass, lyceum, eastern baccharis, marsh elder, and black mangrove.

The Trustees will partner with the LA TIG to partially fund construction of HNC Bird Island to compensate for injuries to birds resulting from the Incident. Trustee funds from CITGO in the amount of $1,650,000 would be in addition to or partially offset the costs of the LA TIG project, which will then be repurposed for use by the LA TIG on other future DWH bird projects. The HNC Bird Island Project increases the quantity and quality of coastal island nesting habitat for species injured by the Incident, such as brown pelicans, wading birds (herons and egrets) and laughing gulls, providing services directly to these species. Currently, the project is undergoing

E&D that is being administered by the LA TIG. Once the E&D phase has been completed for the HNC Bird Island Project, if the LA TIG proceeds with construction of the project, a subsequent restoration plan will include a detailed OPA evaluation and NEPA analysis and be published for public review and comment. The full life cycle project cost is currently estimated at $25 million to restore a total of 18 acres (LA TIG 2020). Disbursement of the $1,650,000 in CITGO settlement funds for construction of the HNC Bird Island Project will not be authorized by the Trustees until the NEPA analysis of construction impacts has been completed by the LA TIG and provided in a final restoration plan.

Creating coastal island nesting habitat will provide complementary ecological services to the injured resources and therefore has a sufficient nexus to the injured resources. The project will result in a direct benefit to the injured resources by creating and enhancing their nesting habitat. Restoring suitable nesting habitat provides birds essential resources for breeding, feeding, shelter and survival, including access to food and water. In turn, these services will increase nesting potential and future production. Given historical land loss trends in the area and projected future sea level rise, existing bird nesting habitat will continue to decrease over time, making protection and restoration of this habitat all the more valuable.

This project is technically feasible and utilizes proven techniques with established methods that have succeeded in similar projects in the past, such as Queen Bess Island Restoration (BA-0202). The LA TIG's investment in engineering and design helps ensure that the project will be constructed in a manner that will maximize its likelihood of success. Habitat enhancements achieved through vegetative plantings and other design elements that minimize inundation of nesting areas will also increase the likelihood of success. The project is currently in the final stage of design and the Trustees foresee no delay in the implementation of the restoration action.

Performance monitoring will be performed for up to 5 years following construction to provide an assessment of project progress and help guide corrective actions, if any, to meet the project's goals and objectives. The project's success will be determined by comparing quantitative monitoring results to pre-determined performance standards developed by the Trustees defining minimum physical or structural conditions deemed to represent acceptable growth and development. Performance criteria and standards for the project will target metrics such as spatial extent, nest surveys, elevation of island fill shortly after construction, and survival of vegetative plantings. If the performance criteria are satisfied at the Year 5 monitoring event, then the Trustees are confident, based on previous experience, that the project would be successful and no further monitoring would be required. Should one or more of the performance criteria not be met, corrective action will be considered to remedy the situation. Potential corrective action options may include: reworking newly placed material or adding additional material to achieve target acreage during construction; replanting vegetation; removal of invasive species; monitoring for an additional period of time to see if the project begins to match anticipated trends, or other actions agreed upon by the Trustees that would correct the deficiency.

For the reasons discussed above, the Trustees will provide $1,650,000 to partially fund the HNC Bird Island Project as a component of the preferred restoration alternative for this NRDA. This contribution will create coastal island nesting habitat in Terrebonne Parish to address injuries to coastal island nesting birds from the Incident. The cost is based on standard costs for coastal

island creation in Louisiana and estimates of inflation based on the timing lag for planning, contract award, and construction. A portion of the settlement funds received from CITGO will go towards implementing this component of the preferred restoration alternative.

4.4.3 Alternatives Considered but Reserved for Further Evaluation – Recreational Use

As discussed in Section 2.3.5, the Trustees estimate total damages of $743,654 for recreational losses due to the Incident. In the future, the Trustees plan to use settlement funds to restore for lost recreational boating, shore fishing and general shoreline use by creating or enhancing infrastructure, access, and use opportunities in the area affected by the Incident. The Trustees have determined that potential recreational use enhancement projects meet the restoration goals and are generally consistent with the OPA evaluation criteria and RRP Program-specific criteria described in Section 4.3 above; however, specific projects have yet to be identified. As such, the recreational use enhancement alternative is not evaluated further in this Final DARP/EA. While the Trustees have not identified a specific restoration project(s) to address this injury at this time, the Trustees are actively engaged in discussing potential opportunities with local and State entities throughout the affected area. Additionally, the Trustees are monitoring other efforts, such as restoration being conducted by the DWH NRDA program (LA TIG 2018) to be best positioned to select an effective restoration project(s). When suitable projects are identified and become ripe for further evaluation, the Trustees will describe and analyze them under OPA and NEPA in a subsequent restoration plan that will be made available to the public for review and comment. Disbursement of CITGO settlement funds to fund recreational use enhancement projects will not be authorized by the Trustees until the project-specific restoration plan(s) has been completed and approved by the Trustees.

4.4.4 Alternatives Considered but Eliminated from Further Evaluation

As discussed in Section 4.2, the Trustees evaluated a number of potential restoration actions to compensate the public for injuries to natural resources and services caused by the Incident. Of those, three alternatives were submitted to the Trustees specifically for the Incident. All three alternatives met the Trustees' initial criteria as appropriate restoration types for addressing the injured resources; however, due to the reasons discussed below, the Trustees eliminated them from further evaluation and analysis.

4.4.4.1 Old River Marsh Creation Project (RRP #890)

The Old River Marsh Creation Project was submitted by Stream Wetland Services, LLC, specifically for the Incident. The project provides for the creation and enhancement of approximately 220 acres of emergent marsh in shallow open water, including tidal creeks and ponds, as well as creation of an artificial reef along a portion of the project boundary. Construction of additional artificial reefs in Calcasieu Lake was also offered in the proposal as well as the potential for some additional marsh creation acreage along the southern footprint of the project. The project is located on the east side of Calcasieu River in Lake Charles, Louisiana, between the west end of Lisle Peters Rd. and the CSC, bounded to the north by the Old Calcasieu River channel and to the south by an existing tidal marsh. This area is in the vicinity of the

Incident and has a geographical nexus to the injured resources. Although the project is technically feasible and utilizes proven techniques with established methods and documented results, and would provide similar and complimentary services as those injured during the Incident, the Trustees eliminated it from further consideration primarily due its lower likelihood of success in meeting the Trustees' goals to fully restore for the injury. Given the amount of acreage to be restored, the Trustees believe the preferred alternative has a greater likelihood of success of providing the benefits needed to fully compensate the public for injuries to natural resources resulting from the Incident.

4.4.4.2 Projects Proposed by CITGO

Two restoration projects were proposed by CITGO during the Restoration Planning process to address injuries to natural resources for the Incident. The first project involved the creation of approximately 114 acres of emergent marsh in shallow open water and 4 acres of crushed concrete rip rap along a section of the earthen levee bordering the marsh creation area. The project was located along the Calcasieu River, just south of Prien Lake and west of the CSC. This area is in the vicinity of the Incident and has a geographical nexus to the injured resources. The second project involved the creation of approximately 120 acres of intermediate/brackish marsh in open shallow water and includes 6 acres of crushed concrete rip rap along a section of the earthen levee bordering the marsh creation area. The project was located along the Calcasieu River, just north of the Haymark Terminal. This area is in the vicinity of the Incident and has a geographical nexus to the injured resources. However, the Trustees eliminated both projects from further consideration, given their lower strength of nexus to those resources and services injured as a result of the Incident and their lower likelihood of success in meeting the Trustees' goals to fully restore for the injury.

4.5 Summary of Preferred Restoration Alternative

As part of the cooperative assessment and Restoration Planning process, the Trustees evaluated expected benefits of potential restoration actions to identify a preferred restoration alternative that would address natural resource injuries resulting from the Incident. Based on the above information and analysis, the Trustees select the following suite of restoration actions to fully compensate the public for the injuries resulting from the Incident:

1. Implement the *Long Point Bayou Marsh Creation (CS-0085) Project*. This project will provide for the creation and enhancement of approximately 392 acres of saline marsh, including tidal creeks, in shallow open water in Cameron Parish, Louisiana, ensuring that ecological services related to marsh and SSI habitats are restored, as well as suitable nesting and foraging habitat for birds injured during the Incident, including rails and sora. Settlement funds of approximately $13,640,000 received from CITGO will go towards hydraulically dredging and transporting approximately 1.4 million cubic yards of sediment to the project from the CSC and monitoring the project to ensure Trustee goals and objectives are met. The project involves creation of a marsh platform and tidal creeks, vegetative plantings, and gapping of containment dikes after construction to reestablish tidal exchange. This project will be designed by CPRA and USEPA and bid and constructed by the USACE as part of their maintenance dredging event for the lower

CSC. The material removed from the CSC will be beneficially used to meet the CS-0085 project goals.

2. Construct the *Calcasieu Lake Oyster Cultch Plant Project*. This project will provide for the creation of approximately 18 acres of oyster reef habitat in Cameron Parish, Louisiana. Settlement funds of $1,469,570 received from CITGO will go towards creating substrate for oyster spat to settle and grow on that will develop into an oyster reef providing important invertebrate and fish habitat. The settlement funds will also be used to monitor the project to ensure Trustee goals and objectives are met. Healthy reefs serve as extremely valuable forage and nursery habitat for many of the important recreational and commercial species of finfish and invertebrates, and other water column organisms injured during the Incident.
3. Implement the *Houma Navigation Canal (HNC) Bird Island Project*. This project will provide for the creation of suitable nesting habitat for coastal island nesting birds in Terrebonne Bay, Terrebonne Parish, Louisiana, including species injured by the Incident. Settlement funds of $1,650,000 received from CITGO will go towards restoring and enlarging a bird nesting island located about four miles southeast of Cocodrie that is currently in design for DWH. In October 2020 the DWH NRDA LA TIG selected enhancement of HNC Island to help compensate for losses to birds caused by the DWH oil spill. The project is designed to enlarge the island from its current size of 32 acres to approximately 50 acres by importing dredged sediment from a nearby suitable sand source and placing it adjacent and onto the existing island. Prior to placing sand, the existing rock ring will be restored to its previous 50-acre perimeter ring. The rock ring will both contain the deposited sediment and provide erosion protection from wind driven wave energy. E&D for the HNC Bird Island Project has already been approved for DWH and funded by the LA TIG, and is currently undergoing implementation. As restoration for this Incident, the Trustees will partner with the DWH Trustees and add to or offset a portion of the DWH project construction costs, enabling some of those funds to be repurposed for other DWH bird-related restoration.

5 ENVIRONMENTAL CONSEQUENCES

5.1 Houma Navigation Canal (HNC) Bird Island Project

As discussed above, the HNC Bird Island Project was selected as a preferred alternative by the DWH LA TIG (2020). E&D elements of the project--which may include planning, feasibility studies, design engineering, and permitting--were analyzed in LA TIG 2020, and more broadly in the *Deepwater Horizon Oil Spill Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (DWH Trustees 2016). Those analyses are incorporated here by reference. As summarized by the LA TIG (2020), environmental consequences may include highly localized, direct, short-term, minor impacts of fieldwork (e.g., removal of sediment samples), as well as short-term temporary disturbance of habitats and species; minor emissions from vehicles; and minor localized disturbance to terrestrial, estuarine, and marine environments. None of the environmental impacts for these E&D activities are expected to exceed short-term, minor, adverse impacts. Many activities would have no impact as they are desktop investigations and data gathering.

Once the E&D phase has been completed for the HNC Bird Island Project, if the LA TIG proceeds with construction of the project, a subsequent restoration plan will include a detailed OPA evaluation and NEPA analysis and be published for public review and comment. Disbursement of the $1,650,000 in CITGO settlement funds for construction of the HNC Bird Island Project will not be authorized by the Trustees until the NEPA analysis of construction impacts has been completed by the LA TIG and provided in a final restoration plan.

5.2 Long Point Bayou Marsh Creation Project; Calcasieu Lake Oyster Cultch Plan Cultch Plant Project; Non-Preferred Alternatives

5.2.1 Sound, Visual, and Air Quality

No Action
There would be no construction activities associated with no action and as such, there would be no adverse impacts to sound, visual and air quality conditions from construction activities. Similarly, there would be no noise above the ambient levels because there would be no construction activities. The historically functional marsh at Long Point Bayou would continue to be dominated by open water, marsh would continue to erode, and oyster reefs would not be restored, possibly diminishing the aesthetics of a natural environment. Air quality conditions would remain as they are.

Preferred Alternative
Machinery and equipment used during construction of the Long Point Bayou Marsh Creation Project (e.g., USACE maintenance dredging, sediment pipeline and heavy equipment contouring new marsh platform sediment) and Calcasieu Lake Oyster Cultch Plant Project (e.g., placement of the barge and material) could generate sound and air emissions that could temporarily disturb fish, wildlife and humans near the construction activity. Adverse impacts on mobile species (e.g., fish, birds and mammals) are expected to be minor, consisting of short-term displacement as they volitionally move away from the restoration activity. Air emissions from equipment and/or machinery may temporarily increase emissions in the immediate area, but such effects would be similar to emissions of nearby vehicle or boat traffic and would not result in an overall increase in air emissions. Impacts from the combustion of fossil fuels will nonetheless include some release of greenhouse gases (i.e., carbon dioxide and nitrogen oxides), volatile organic compounds, ozone, smoke, increased particulate matter, and other pollutants. However, the Project area is located in Air Quality Control Regions that are in attainment with National Ambient Air Quality Standards and the increase in emissions from the vehicles, machinery, and construction equipment will be minimal and not be expected to cause exceedances of these standards. There may be temporary and localized minor adverse visual impacts during implementation of the selected action associated with construction activities (e.g., heavy equipment operating). Once the marsh restoration and oyster cultch plant are completed, users of the area would reasonably be expected to perceive the project areas as having improved aesthetics; therefore long-term and minor beneficial impacts to visual resources can be expected.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and

Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, sound, visual, and air quality impacts would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.2 Vegetation, Water, and Sediment Quality

No Action
Under the No Action Alternative, the hydrology of the project area would likely be altered by the ongoing process of marsh deterioration. As marsh loss continues and bank lines of the natural bayous erode tidal exchange within fresher marshes further inland would increase, resulting in further marsh loss.

Preferred Alternative
Under the preferred alternative, hydrologic conditions within the Long Point Bayou Marsh Creation Project area would be both adversely and beneficially impacted by the creation of marsh and tidal creeks. The open water areas through which water exchange now occurs would be filled with dredged material. Marsh creation would not prevent tidal exchange in the surrounding marshes and would in fact be enhanced by the creation of tidal creeks. Containment dikes would be built to surround the marsh creation area and contain the dredged material slurry. The containment dikes would have a temporary adverse effect on water exchange. The dikes would be gapped or degraded at the end of project construction to allow tidal exchanges to re-establish between the newly-created marsh and adjacent waters. As the marsh platform subsides, more tidal connections would form in the project area. Additionally, by re-establishing the marsh platform at an elevation conducive to the establishment of marsh vegetation, the life of the wetlands would be increased by providing an additional 392 acres of emergent wetlands post construction and a net of 332 acres over the 20-year life of the project. Therefore, long-term, indirect, moderate beneficial impacts to vegetation would be expected. Impacts resulting from the construction of the Long Point Bayou Marsh Creation Project and the Calcasieu Lake Oyster Cultch Plant Project would reasonably be expected to have temporary, minor, direct and indirect adverse effects to surface water quality and intertidal and subtidal sediment quality with the placement of sediments and cultch material. However, water and sediment quality would be expected to return to pre-construction conditions upon project completion. As filter feeders, oysters are very effective at extracting excess nutrients, phytoplankton and sediment from the water column. Therefore, the construction of the Calcasieu Lake Oyster Cultch Plant Project is expected to enhance and provide long-term moderate beneficial impacts on water and sediment quality in Calcasieu Lake.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh

Creation Project and would impact similar resources. As such, vegetation, water, and sediment quality impacts would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.3 Endangered and Threatened Species

No Action
The no action alternative would not involve any construction activities and as such, there would be no beneficial or adverse impacts to species listed as threatened or endangered under the Endangered Species Act (16 U.S.C. 1531 et seq.).

Preferred Alternative
Gulf sturgeon is the only threatened fish species in the northern Gulf of Mexico within Louisiana. Gulf sturgeon inhabit riverine and estuarine environments in the spring during breeding, and either move offshore or parallel to shore between adjacent estuary systems during winter months. The preferred alternative project area associated with Long Point Bayou Marsh Creation Project and Calcasieu Lake Oyster Cultch Plant Project are not known to contain Gulf sturgeon and therefore the project would have no effect on Gulf sturgeon.

While the preferred alternative project area within the Calcasieu River and Lake does not contain suitable nesting habitat for sea turtles (green, hawksbill, Kemp's Ridley, leatherback and loggerhead), these species could be present in the open waters adjacent to the project area. Therefore, implementation of the preferred alternative could result in potential impacts to sea turtles. Potential indirect adverse effects to protected aquatic species, such as sea turtles, would be temporary and minor and would result from the temporary, localized impacts to water quality (e.g., increased turbidity) due to construction activities, which could affect the adjacent waters. In order to reduce these potential impacts, implementation of the preferred alternative would follow all applicable state and federal permit conditions, such as Section 404 Clean Water Act permit conditions.

Piping plovers and red knots seasonally occur in coastal areas in Louisiana. Piping plover habitat includes intertidal portions of ocean beaches, wash over areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, shorelines of coastal ponds, lagoons, ephemeral pools, and areas adjacent to salt marshes but not within the salt marsh. Red knot habitat includes intertidal marine habitats near coastal inlets, estuaries, and bays, or along resting formations. Piping plover or red knot wintering habitat do not occur or are sparse in the project area. Therefore, implementation of the preferred alternative is not expected to adversely affect these species.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, impacts on endangered and

threatened species would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.4 EFH, Wetlands, Subtidal and Intertidal Flats, and Oysters

No Action
EFH in the Calcasieu River and Lake is estuarine emergent wetlands, submerged aquatic vegetation, estuarine water column, and mud, sand, shell and rock substrates. Under the MSA, wetlands, subtidal and intertidal habitat in the project area are identified as EFH for postlarval/juvenile and subadult brown shrimp; postlarval/juvenile and subadult white shrimp; and postlarval/juvenile, subadult, and adult red drum. With no action, there would be no restoration that protects and enhances EFH, specifically wetlands, subtidal habitat and shell substrate. Because EFH within the Calcasieu River and Lake provides important production for EFH habitat and fisheries injured as a result of the Incident, no action would not provide the necessary restoration needed for the respective fisheries.

Preferred Alternative
The implementation of the preferred alternative (Long Point Bayou Marsh Creation Project and Calcasieu Lake Oyster Cultch Plant Project) would have immediate and long-term positive benefits to some EFH, specifically marsh, subtidal habitat and shell substrate. Some EFH would be adversely impacted, as the placement of sediment to create marsh platform and containment dikes, and eventual creation of estuarine emergent wetlands would replace mud bottom and estuarine water column. However, the conversion of mud bottom EFH to emergent wetland is expected to benefit subadult brown shrimp and post larval/juvenile red drum through an enhanced food web and increase in marsh edge habitat. Specifically, marsh edge serves as a critical and highly productive transition zone between the emergent marsh vegetation and intertidal habitat. The marsh is important for the movement of organisms and nutrients between intertidal and subtidal estuarine environments, and supporting high densities of fish and crustacean species at its interface. Additional, short term minor EFH impacts would include a temporary and localized increase in estuarine water column turbidity during the placement of dredged material in shallow open water areas; however, the project area is a naturally turbid environment and increased turbidity is not expected to significantly affect EFH needs within the project area.

With the construction of the Calcasieu Lake Oyster Cultch Plant Project, some EFH (e.g., mud bottom and estuarine water column) would be directly and adversely impacted by placement of cultch material. These impacts would be minor, as there is an abundance of these types of EFH in the adjacent waters. The creation of oyster reef would serve to recruit oysters onto the placed substrate. All of Calcasieu Lake is designated as a State Oyster Seed Ground, and the LDWF manages the oyster resource on the public grounds by closely monitoring the size and health of oysters within this area. The Calcasieu Lake Oyster Cultch Plant Project and associated oyster recruitment would provide long-term beneficial impacts to oyster reef EFH and oyster resources, and provide a suite of ecosystem services, including water quality improvement, habitat protection, carbon burial, habitat enhancement for fish and mobile invertebrates, habitat for epibenthic fauna, and oyster production (Grabowski et al. 2012).

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, impacts on EFH, wetlands, subtidal and intertidal flats and oysters would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.5 Fisheries

No Action
No action would not create valuable marsh habitat or provide additional substrate for oyster recruitment and associated ecosystem benefits. The Trustees do not anticipate any net ecological benefits associated with no action and there would be no increase in fisheries productivity needed to compensate for fisheries injured by the Incident.

Preferred Alternative
The creation of healthy marsh habitat would provide a greater diversity of foraging, breeding, spawning, and cover habitat for a greater variety of adult and juvenile fish and shellfish species. The marsh would contribute nutrients and detritus would be added to the existing food web, providing a positive benefit to local area fisheries. Therefore, long-term moderate beneficial impacts to fisheries are expected with the Long Point Bayou Marsh Creation Project. Placement of sediments and construction of containment dikes in the open water of the project area may adversely impact fisheries due to displacement; however, adverse impacts would be temporary and minor. Gapping of containment dikes after construction would provide fish with ingress and egress to newly created marsh and tidal creeks.

The creation of 18 acres of oyster reef would provide suitable substrate for oyster recruitment and production, as well as provide valuable habitat for demersal fish injured by the Incident and would enhance the productivity of a broad assemblage of fisheries. Therefore, long-term moderate beneficial impacts to fisheries are expected with the Calcasieu Lake Oyster Cultch Plant Project. Placement of oyster cultch and/or limestone in the project area may cause direct adverse impacts to fisheries as they are displaced from the immediate area; however impacts would be minor, as fish would move to readily-available and adjacent open water areas.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, impacts on fisheries would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.6 Wildlife

No Action
With no action, there would be a continued loss of wildlife habitat associated with marsh loss. The loss of this habitat (e.g., conversion to open water) would reasonably be expected to displace wildlife and reduce the associated food web. Potential wildlife species that would be negatively impacted over time due to the loss of marsh habitat include nutria, muskrat, mink, river otter, raccoon, American alligator, western cottonmouth, water snakes, speckled kingsnake, rat snake, and eastern mud turtle, bullfrog, southern leopard frog, and Gulf coast toad.

Preferred Alternative
Machinery and equipment used during construction of the marsh and oyster cultch plant would reasonably be expected to temporarily disturb wildlife near the construction activity. Adverse impacts on mobile species (e.g., birds, mammals) are expected to be minor, consisting of short-term displacement. Overall, the marsh creation and oyster cultch plant projects are expected to provide both direct and indirect, long-term minor to moderate benefits to wildlife species that utilize the marsh and prey on benthic invertebrates and fisheries that will benefit from the increased edge habitat and fisheries production from the implementation of the oyster cultch plant.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, wildlife impacts would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.7 Public Access and Recreation

No Action
Under this alternative, there would be no change in current public access and recreation. However, over time, no action is expected to reduce fisheries productivity, marsh edge habitat and productivity of rails and sora in the area, which would reasonably diminish recreational fishing and hunting experiences through reduced catch/harvest rates.

Preferred Alternative
Recreational activities taking place within the preferred alternative marsh creation project and oyster cultch plant include boating, hunting, fishing and natural and cultural study. The project area is an area of vital importance as a fishery nursery ground, waterfowl wintering and hunting area. Recreational fishing is by far the most popular activity in the preferred alternative project area because of the access to water bodies, bayous, and marsh. Small game hunting is also popular due to abundance of habitat and the wide range of species available to the hunter. Implementation of the preferred alternative would beneficially impact these recreational opportunities by enhancing the habitats that they utilize and by offering new public access

opportunities. There may be some adverse impacts to public access and recreation in the immediate project area during construction; however, these impacts would be temporary and minor, and the adjacent areas would continue to afford recreational opportunities.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, impacts on public access and recreation would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.8 Historic and Cultural Resources

No Action
No action would not result in impacts to historic and cultural resources, as ground-disturbing work that could impact such resources would not occur.

Preferred Alternative
The State Historic Preservation Officer of Louisiana has concurred with the determination that there are no known cultural or historic sites in the Long Point Bayou Marsh Creation Project area (Letter of January 22, 2021, from Kristin P. Sanders, State Historic Preservation Officer). The Trustees will consult with the State Historic Preservation Officer of Louisiana to ensure the Calcasieu Lake Oyster Cultch Plant will also have no effect on cultural or historic sites.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, impacts on historic and cultural resources would likely be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.9 Environmental Justice

No Action
Under this alternative, there would be no long-term beneficial impacts to the public, including minority and low-income populations, from improved habitat and recreational use opportunities. Additionally, the lack of meaningful recovery could have some indirect, minor adverse impacts on the economic and social well-being of all residents in the project area.

Preferred Alternative
Restoration activities supported by the Trustees help to ensure the enhancement of environmental quality for all populations in the project area. The Trustees have determined that all selected restoration activities would provide long-term or permanent beneficial impacts to the Environmental Justice communities described in Section 2.4 by improving the quality of the natural environment and ecosystem services, and providing recreational use benefits to local communities. None of the alternatives are expected to have a disproportionately high and adverse impact on minority or low-income populations in the area, including economically, socially, or in terms of conditions affecting their health.

Non-preferred Alternative
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, Environmental Justice impacts would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.10 Climate and Climate Resiliency

No Action
No short-term impacts would be anticipated under the No Action Alternative. In the long term, local areas would remain or become increasingly vulnerable to the consequences of extreme weather events including flooding and catastrophic failure of aging infrastructure.

Preferred Alternative
Projects making up the preferred alternative are expected to improve local resiliency to increased frequency of extreme weather events, flooding, and changes in annual patterns of precipitation.

Minor short-term adverse direct effects on greenhouse gas (GHG) emissions are expected as a result of the preferred alternative. Actions resulting in GHG emissions may include the use of heavy equipment for construction, transport of materials needed for construction, and other activities associated with pre- and post-implementation such as monitoring and adaptive management. These activities have the potential to generate GHG emissions through the use of oil-based fuels and consumption of both renewable and nonrenewable resources. However, the amount of GHG emissions generated through this activity is not anticipated to be significant due to the limited number of restoration projects, extended construction time, and the use of best management practices as described above in the section on air quality.

Long-term minor beneficial impacts to factors affecting climate change may result from restoration projects that include vegetation and revegetation of disturbed sites with native species as these actions would thus increase carbon storage capacity of soils and plant communities, contributing to carbon sequestration. The projects in the preferred alternative are expected to improve local resiliency to increased frequency of extreme weather events, flooding, and

changes in annual patterns of precipitation by increasing flood storage capacity and providing natural buffers (marsh, oyster reef) to reduce the effects from storm surge.

In addition, the projects that protect natural areas along tidal creeks and bayous from development allow those areas to continue to provide flood storage capacity and filtration of runoff as opposed to increasing the amount of impermeable surface area that would contribute to rapid runoff of stormwater.

Non-Preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, climate and climate resiliency impacts would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.2.11 Other (e.g., economic, land use, transportation)

No Action
Land use would change under the no action alternative due to continued erosion and lack of oyster reef development in a comparative timeframe as the preferred alternative. Economic impacts associated with land loss would be lost marsh and the lack of oyster reef development, both of which would reasonably be expected to diminish fisheries productivity that could affect recreational fishing opportunities.

Preferred Alternative
Implementation of the preferred alternative is not expected to adversely affect land use, transportation or economic values. The source of dredged material for the Long Point Bayou Marsh Creation Project would be from the USACE channel maintenance of the Calcasieu River and Pass. Maintenance of the channel provides for adequate depth for commercial vessels that are economically important to the region. Therefore, the creation of marsh through the continued beneficial use of dredged material removed from the Calcasieu River and Pass would provide indirect and long-term beneficial impacts to transportation in the area.

The Calcasieu Lake Oyster Cultch Plant Project is not expected to have an effect on other resources such as land use and transportation. The implementation of the project would not require private or public landowner access (e.g., easements) or necessitate land use changes or modifications. The project would not occur within the Calcasieu navigation channel and as such, there are no expected impacts to navigation. Small-vessel traffic on Lake Calcasieu could be adversely impacted during the placement of cultch material at the Calcasieu Lake Oyster Cultch Plant site; however, these impacts would be minor and temporary, and vessels could easily avoid the area in favor of other open-water portions of the lake.

Implementation of the preferred alternative would restore and enhance natural resource services, including recreational and commercial fishing, which would be available into the future providing economic value. Healthy marshes and reefs serve as extremely valuable forage and nursery habitat for many of the important recreational and commercial species of finfish. Economically, oysters are very important to the local communities. Many of the local residents supplement their income by harvesting oysters from Calcasieu Lake and the oysters are shipped to markets throughout the nation. Therefore, created and sustained marsh habitat and oyster reef resources with the Long Point Bayou Marsh Creation Project and Calcasieu Lake Oyster Cultch Plant Project would result in long-term minor to moderate beneficial impacts to the economy.

Non-preferred Alternatives
The non-preferred marsh creation alternatives (Sabine NWR Unit 1A, West Cove Marsh Creation and Nourishment, No Name Bayou Marsh Creation, Oyster Lake Marsh Creation and Nourishment) would employ similar construction techniques and methodologies as those described for the preferred marsh creation project (Long Point Bayou Marsh Creation Project). The non-preferred alternatives are geographically similar to the Long Point Bayou Marsh Creation Project and would impact similar resources. As such, economic, land use, and transportation impacts would be similar to those described above for the Long Point Bayou Marsh Creation Project.

5.3 Cumulative Impacts

Under NEPA, federal agencies are required to consider the cumulative effects of their proposed actions within the affected environment. Cumulative impacts are the collective result of the incremental impacts of an action that, when added to the impacts of other past, present, and reasonably foreseeable future actions, would affect the same resources, regardless of what agency or person undertakes those actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 C.F.R. § 1508.7). Although the impacts of individual actions taken separately might be minor, the impact of those same actions taken together may be significant for one or multiple resources.

A cumulative impacts analysis focuses on the resources rather than the planned action and considers impacts that take place on both spatial and temporal scales. On a spatial basis, impacts must be considered both within and outside the proposed project area. Time scales for a cumulative impacts analysis are generally longer than project-specific analysis of impacts.

The Trustees have reviewed potential past, present, and reasonably foreseeable actions to assess the potential for cumulative impacts. In this Final DARP/EA, the Trustees considered the potential cumulative impacts of both the No-Action Alternative and the Preferred Alternative in light of restoration planning efforts and opportunities in the region, including such programs as:

- USACE New Orleans District's Operations & Maintenance (O&M) Program (https://www.mvn.usace.army.mil/About/Offices/Operations/Beneficial-Use-of-Dredged-Material/);

- Louisiana Coastal Area Beneficial Use of Dredged Material (LCA BUDMAT) Program (https://www.mvn.usace.army.mil/Missions/Environmental/Louisiana-Coastal-Area/Beneficial-Use-of-Dredged-Material/);
- CPRA (https://coastal.la.gov/our-work/projects/);
- CWPPRA (https://www.lacoast.gov/new/Projects/Default.aspx);
- and other NRDA efforts such as DWH (https://www.gulfspillrestoration.noaa.gov/restoration-areas)

No Action
No action would contribute to the cumulative loss of aquatic and terrestrial habitat (e.g., marsh and bird nesting habitat, oyster reefs and other intertidal and subtidal habitat) resources throughout coastal Louisiana. Although there are many restoration efforts underway throughout coastal Louisiana through various programs (USACE, CWPPRA, CPRA, DWH), no action would contribute to a degrading baseline, which would reasonably be expected to cause adverse impacts to aquatic and terrestrial resources. Relative to the magnitude of adverse ecological impacts that currently exist in the affected area, the adverse cumulative impacts of the No Action Alternative are not expected to be significant but would not make the public whole for the injured resources impacted by the incident.

Preferred Alternative
The preferred restoration actions taken together will be cumulative in the sense that creation and enhancement of aquatic and terrestrial resources will provide ecological services into the future. Because these restoration actions are intended to compensate the public for resource injuries caused by the Incident, their cumulative impacts, especially when considered with other past, present, and reasonably foreseeable restoration efforts in the area, are expected to be long-term and beneficial. Based on the environmental analysis conducted herein, the Trustees do not anticipate any adverse cumulative impacts as a result of implementing the restoration action. Cumulative project impacts would not be significant or occur at a regional scale.

5.4 Finding of No Significant Impact

Based on the analysis of the available information presented in this document, the Federal Trustees have concluded that implementation of the preferred restoration actions, as selected herein, would not significantly impact the quality of the human environment (see Appendix I). All potential beneficial and adverse impacts have been considered in reaching this conclusion. No information indicating the potential for significant impacts was revealed through the public review and comment process on the Draft DARP/EA. An EIS will therefore not be prepared for the preferred restoration actions. Issuance of a Finding of No Significant Impact (FONSI) based upon a Final Environmental Assessment fulfills and concludes all requirements for compliance with NEPA by the Federal Trustees.

6 COMPLIANCE WITH OTHER AUTHORITIES

Federal Laws
Additional federal laws may apply to the preferred alternative considered in this Final DARP/EA. All federal, state and local laws will be complied with prior to project

implementation. Federal laws, regulations, and EOs that may be applicable include, but are not limited to, the following:

- Endangered Species Act (16 U.S.C. § 1531 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.)
- Marine Mammal Protection Act (16 U.S.C. § 1361 et seq.)
- Coastal Zone Management Act (16 U.S.C. § 1451 et seq.)
- National Historic Preservation Act (16 U.S.C. § 470 et seq.)
- Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.)
- Bald and Gold Eagle Protection Act (16 U.S.C. § 668 et seq.)
- Clean Air Act (42 U.S.C. § 7401 et seq.)
- Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. § 1251 et seq.) and/or Rivers and Harbors Act (33 U.S.C. § 401 et seq.)
- Marine Protection, Research and Sanctuaries Act (16 U.S.C. § 1431 et seq. and 33 U.S.C. § 1401 et seq.)
- Estuary Protection Act (16 U.S.C. § 1221–1226)
- Archaeological Resource Protection Act (16 U.S.C. § 470aa–470mm)
- National Marine Sanctuaries Act (16 U.S.C. § 1431 et seq.)
- Farmland Protection Policy Act (7 U.S.C. § 4201–4209)
- Rivers and Harbors Act (33 U.S.C. § 401 et seq.) EO 11988: Floodplain Management (augmented by EO 13690, January 30, 2015)
- EO 11990: Protection of Wetlands
- EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations[13]
- EO 12962: Recreational Fisheries
- EO 13007: Indian Sacred Sites
- EO 13112: Safeguarding the Nation from the Impacts of Invasive Species
- EO 13175: Consultation and Coordination with Indian Tribal Governments
- EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds
- EO 13693: Planning for Federal Sustainability in the Next Decade

State and Local Laws

The Trustees will ensure compliance with all applicable state and local laws relevant to the State of Louisiana. Applicable laws and regulations may include, but are not limited to, the following:

- Archeological Finds on State Lands (R.S. 41:1605)
- Louisiana State and Local Coastal Resources Management Act (R.S. 49:214.21–214.42)
- Louisiana Oil Spill Prevention and Response Act (R.S. 30:2451 et seq.)

[13] This order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The selected projects are not expected to adversely affect the environment or human health for any environmental justice populations in the vicinity of the projects. In January 2021, the Executive Branch of the United States issued additional Executive Orders relating to Environmental Justice. The federal Trustees reviewed the selected projects in the context of these Executive Orders and confirm that the selected projects are not expected to result in disproportionately high or adverse human health, environmental, climate-related or other cumulative impacts on disadvantaged communities.

- Management of State Lands (R.S. 41:1701.1 et seq.)
- Louisiana Coastal Resources Program (LAC 43:I, Chapter 7)
- Louisiana Surface Water Quality Standards (LAC 33.IX, Chapter 11)
- Oyster Lease Relocation Program (LAC 76:VII, Section 531)
- Louisiana Scenic Rivers Program (R.S. 56:1856)

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APPENDICES

APPENDIX A: LIST OF ACRONYMS

AOI	Area of Interest
AR	Administrative Record
CE CHW	Creation/Enhancement of Coastal Herbaceous Wetland
CE CBSS	Creation/Enhancement of Coastal Beaches Shorelines Streambeds
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CITGO	Citgo Petroleum Corporation
COPC	Contaminant of Potential Concern
CPI	Consumer Price Index
CPRA	Coastal Protection and Restoration Authority
CSC	Calcasieu Ship Channel
CWA	Clean Water Act
CWCO	Coastal Water Column Organisms
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
DARP/EA	Damage Assessment and Restoration Plan/Environmental Assessment
DBYs	Discounted Bird Years
DSAYs	Discounted Service-Acre Years
DWH	Deepwater Horizon Oil Spill
E&D	Engineering and Design
EG	Exposure Group
EIS	Environmental Impact Statement
EO	Executive Order
FONSI	Finding of No Significant Impact
FPEIS	Final Programmatic Environmental Impact Statement
GHG	Greenhouse Gas
GPS	Global Positioning System
HEA	Habitat Equivalency Analysis
HNC	Houma Navigation Canal
LA TIG	Louisiana Implementation Group
LAC	Louisiana Administrative Code
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LOSCO	Louisiana Oil Spill Coordinator's Office, Department of Public Safety and Corrections
LSU	Louisiana State University
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NWR	National Wildlife Refuge
OPA	Oil Pollution Act of 1990
OSPRA	Louisiana Oil Spill Prevention and Response Act of 1991
PAH	Polycyclic Aromatic Hydrocarbon

PP CBSS	Physical Protection of Coastal Beaches Shorelines Streambeds
PP CHW	Physical Protection of Coastal Herbaceous Wetland
REA	Resource Equivalency Analysis
RP	Responsible Party
RRP	Regional Restoration Plan
RRP Program	Regional Restoration Planning Program
R.S.	Louisiana Revised Statute
SAV	Submerged Aquatic Vegetation
SCBA	Self-Contained Breathing Apparatus
s.e.	Standard Error
SIMAP	Spill Impact Modeling Analysis Package
SSI	Shallow Subtidal and Intertidal
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCG	United States Coast Guard
USDOI	United States Department of the Interior
USDOJ	United States Department Justice
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet

APPENDIX B: SOURCE OIL SAMPLES CHEMISTRY ANALYSIS

Table B-1. List of polycyclic aromatic hydrocarbons (PAHs) and alkane concentrations in source oil samples analyzed by B&B Laboratories, Inc., and Louisiana State University from source oil samples from holding tanks and from boomed area near the Indian Marais confluence with the Calcasieu River.

Aromatic Compound	ETX6313.D Neat Oil from CITGO Facility collected 6/23/2006 (ng/mg)[1]	ETX6312.D Source Oil from Boom 1 near Indian Marais collected 6/23/2006 (ng/mg)[1]	LSU# 2N6177-01 Source Oil from Boom 1 near Indian Marais collected 6/28/2006 (ng/mg)[1]
naphthalene	2440	1120	1300
C1-naphthalenes	5470	3720	5000
C2-naphthalenes	8550	6200	7400
C3-naphthalenes	5930	4860	5600
C4-naphthalenes	3450	2510	2300
acenaphthylene	nd	nd	--
acenaphthene	198	151	--
Biphenyls	363	258	--
dibenzofuran	132	108	--
Fluorene	400	302	350
C1-fluorenes	1140	858	650
C2-fluorenes	1400	110	740
C3-fluorenes	493	378	580
Carbazole	29	33	--
anthracene	111	142	120
phenanthrene	516	724	1000
C1-phenanthrenes/anthracenes	1320	1400	1800
C2-phenanthrenes/anthracenes	1240	1420	1400
C3-phenanthrenes/anthracenes	763	852	770
C4-phenanthrenes/anthracenes	354	387	220
benzothiophene	127	55	--
C1-benzothiophene	711	455	--
C2-benzothiophene	1460	1080	--
C3-benzothiophene	1640	1350	--
dibenzothiophene	210	273	390
C1-dibenzothiophene	651	814	1100
C2-dibenzothiophene	808	933	1200
C3-dibenzothiophene	666	755	nd
fluoranthene	24	25	32
pyrene	107	100	170
C1-pyrene	290	280	270
C2-pyrene	243	328	280
C3-pyrene	211	217	220
C4-pyrene	--	--	110
Naphthobenzothiophene	148	162	130
C1- Naphthobenzothiophene	351	392	570
C2- Naphthobenzothiophene	351	384	550
C3- Naphthobenzothiophene	145	171	380
Benzo(a)Anthracene	108	117	110
Chrysene	92	95	130

C1-chrysene	335	380	450
C2-chrysene	276	348	380
C3-chrysene	101	114	160
C4-chrysene	53	54	nd
Benzo(b)Fluoranthene	22	29	20
Benzo(k)Fluoranthene	nd	nd	11
Benzo(e)Pyrene	37	45	51
Benzo(a)Pyrene	60	67	60
Perylene	nd	nd	nd
Indeno(1,2,3 –cd)Pyrene	10	11	10
Dibenzo(a,h)anthracene	16	18	30
Benzo(g,h,i)perylene	23	25	23
Total Aromatics	**43856**	**35621**	**36718**
Total Alkanes	**148000[1]**	**130000[1]**	**51359[1]**

APPENDIX C: AOIs FOR SHALLOW SUBTIDAL AND INTERTIDAL HABITAT AND MARSH SHORELINE CHANGE ANALYSIS

Table C-1. Areas of Interest (AOIs) for shallow subtidal and intertidal habitat and marsh shoreline change analysis.

Shallow Subtidal and Intertidal Habitat	Marsh Shoreline Change
Prien Lake	Prien Lake
North Calcasieu Ship Channel	Calcasieu River
South Calcasieu Ship Channel	Haymark Loop
Haymark Loop	Haymark Loop Slough
Moss Lake	Choupique
Old River Channel	Lower Moss Lake
Calcasieu Lake	Upper Moss Lake
Intracoastal Waterway	Intracoastal Waterway
	LNG (Liquefied Natural Gas) Reference

APPENDIX D: DETAILED EXPLANATION OF HOW SERVICE LOSS WAS ASSIGNED TO THE SEDIMENT TOXICITY DATA RESULTS

Six background sites were used as the basis for evaluating 75 toxicity test sites (including one control site). Site BG-008 had the lowest results for 28-day survival and growth; both sites BG-008 and BG-004 had the lowest 29-day ultra-violet (UV) exposure survival. Standard errors (s.e.) were subtracted from the background results to set the basis for detecting differences between Incident-related sites and background. Standard errors were added to the Incident-related site results to evaluate evidence of toxicity and relative differences in survival and growth. As detailed below, Incident-related sites were assigned service losses if results plus one/two/three s.e. were less than background minus one/two/three s.e., respectively:

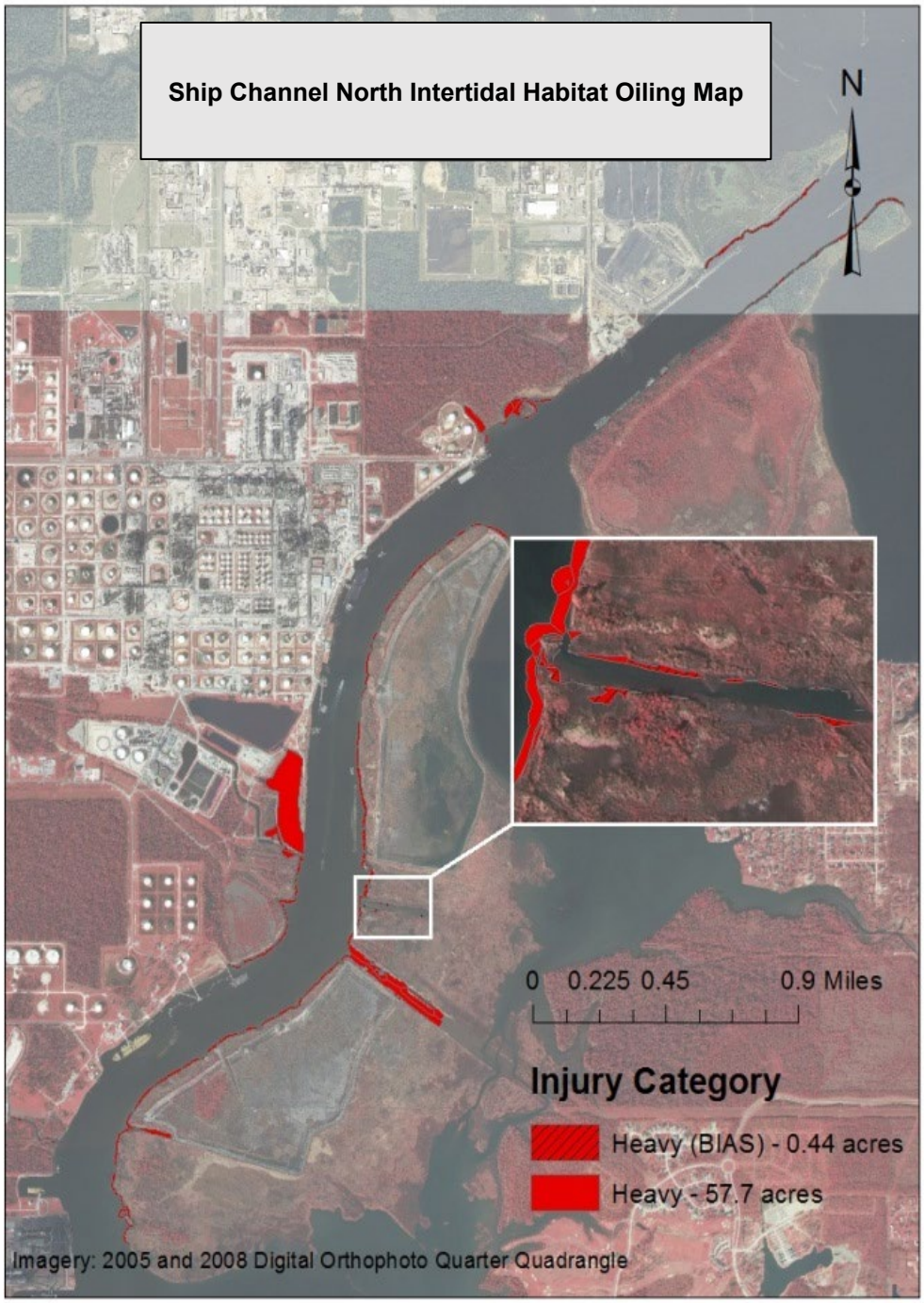
a. 28-day survival
   i. Used baseline station with lowest survival (BG-008 85%)
   ii. Used low baseline level (% survival – s.e. of 6.45%)
   85% - 6.45% = 78.55% for 1 s.e.
   85% - (2 x 6.45%) = 72.1% for 2 s.e.
   85% - (3 x 6.45%) = 65.7% for 3 s.e.
   iii. Used high levels for impacted areas (% survival + 1/2/3 s.e.)
   iv. Service loss areas started at levels below 78.55% survival

b. 29-day UV exposure survival
   i. Used baseline station with lowest survival (BG-008, BG-004 85%)
   ii. No s.e. provided for 29-day UV exposure survival; estimated s.e. to be 5% based on average of errors from 28-day survival results
   85% - 5% = 80% for 1 s.e.
   85% - (2 x 5%) = 75% for 2 s.e.
   85% - (3 x 5%) = 70% for 3 s.e.
   iii. Used high levels for impacted areas (% survival + 1/2/3 s.e.)
   iv. Service loss areas started at levels below 80% survival

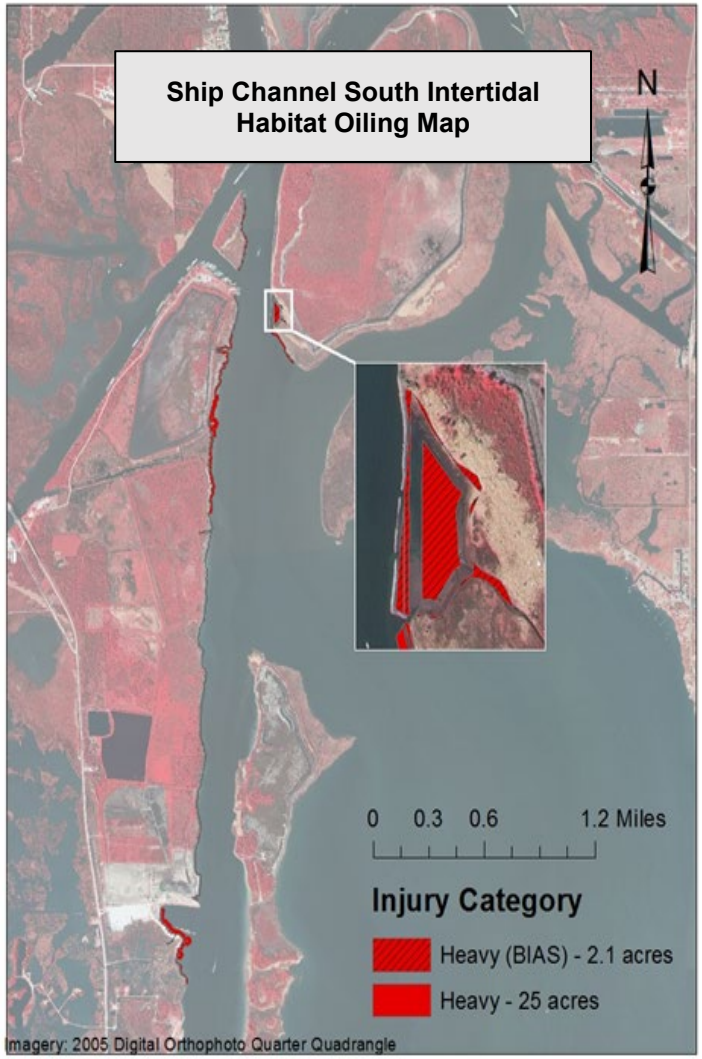
c. Growth (Length/Individual)
   a. Used baseline station with lowest growth (BG-008 4.08 mm)
   b. Used low baseline levels (length – s.e. of 0.04 mm)
   4.08 mm – 0.04 mm = 4.04 mm for 1 s.e.
   4.08 mm – (2 x 0.4) = 4 mm for 2 s.e.
   4.08 mm – (3 x 0.4) = 2.88 mm for 3 s.e.
   c. Used high levels for impacted areas (e.g., length + 1/2/3 s.e.)
   d. Service loss areas started with lengths below 4.04 mm

APPENDIX E: MAPS OF SHALLOW SUBTIDAL AND INTERTIDAL INJURED HABITAT BY AREA OF INTEREST

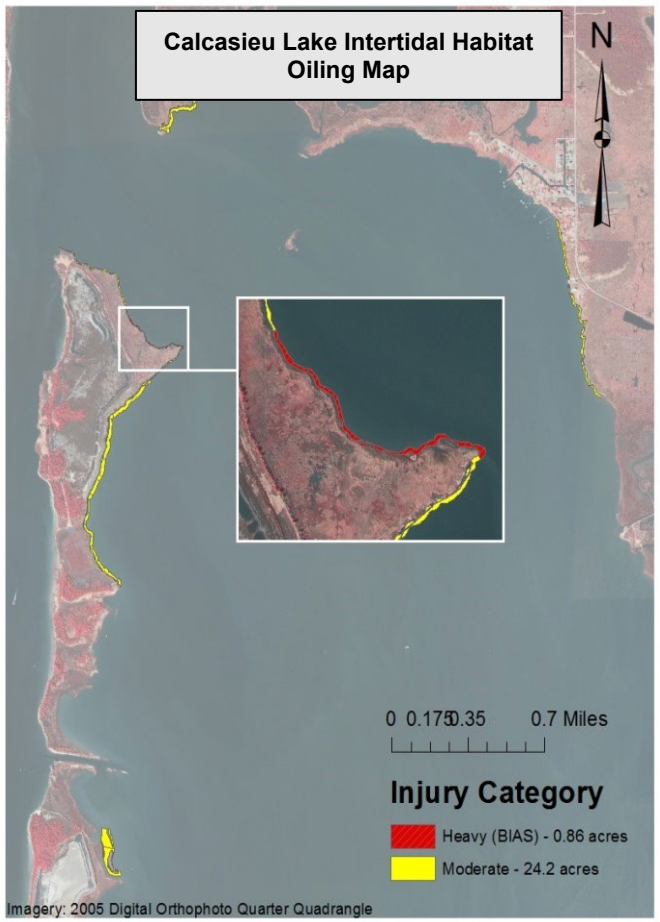
Ship Channel North (no shallow subtidal habitat)

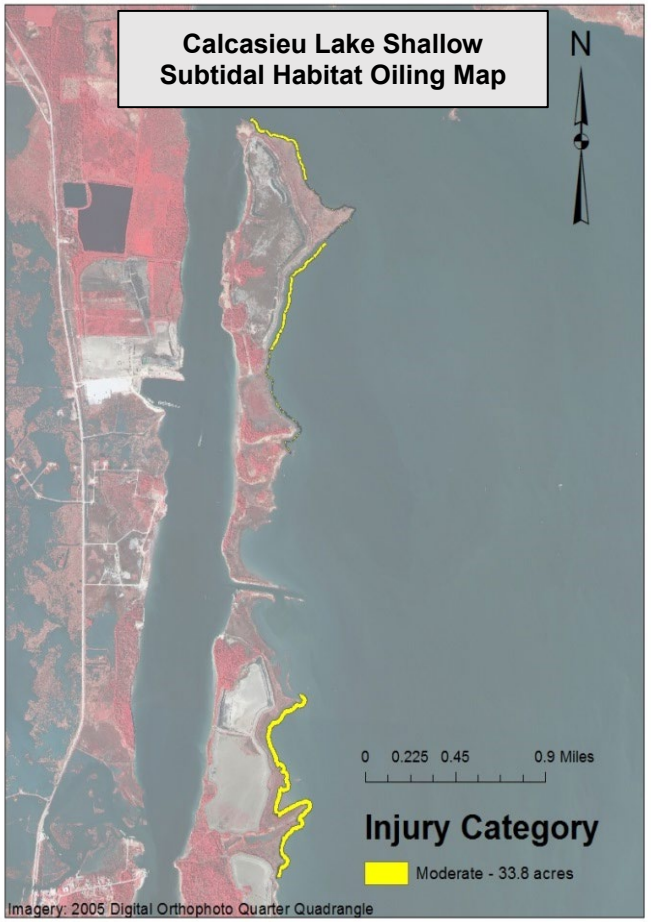


Ship Channel South

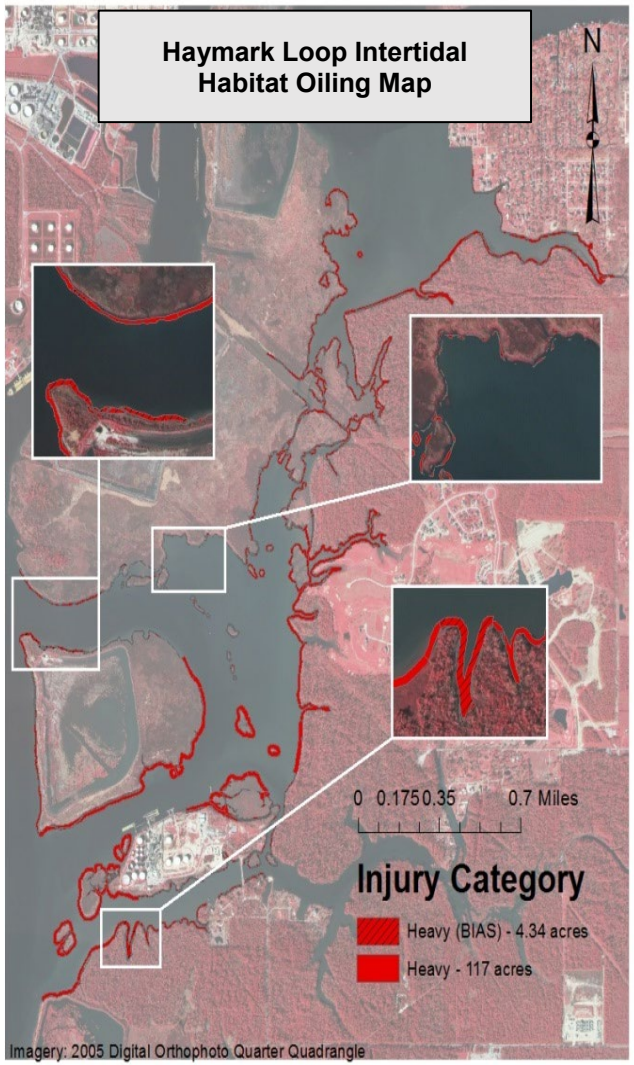


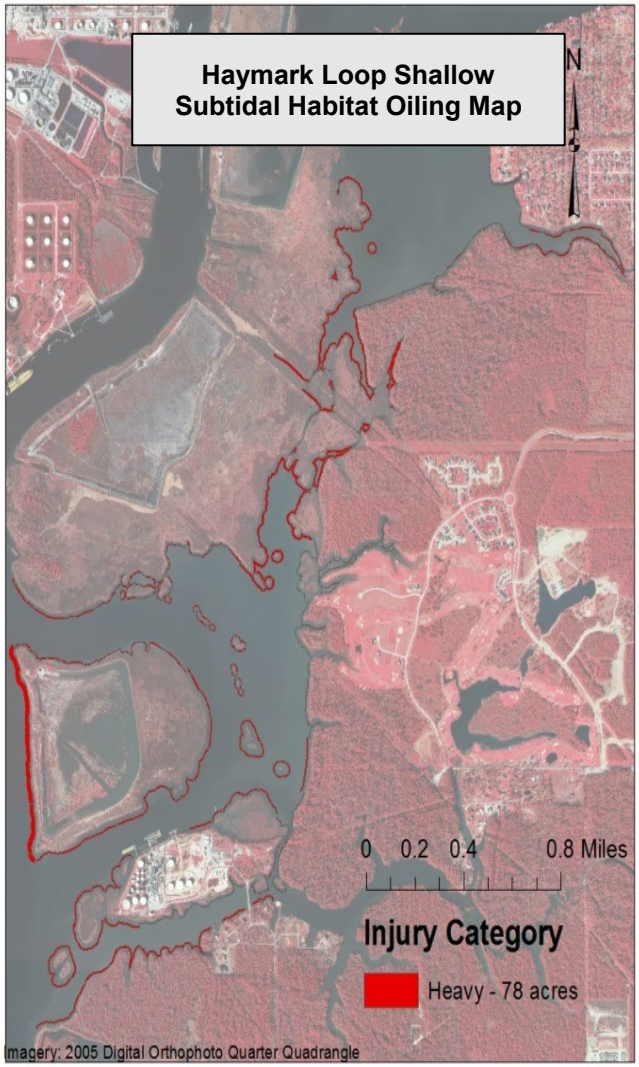
Calcasieu Lake





Haymark Loop





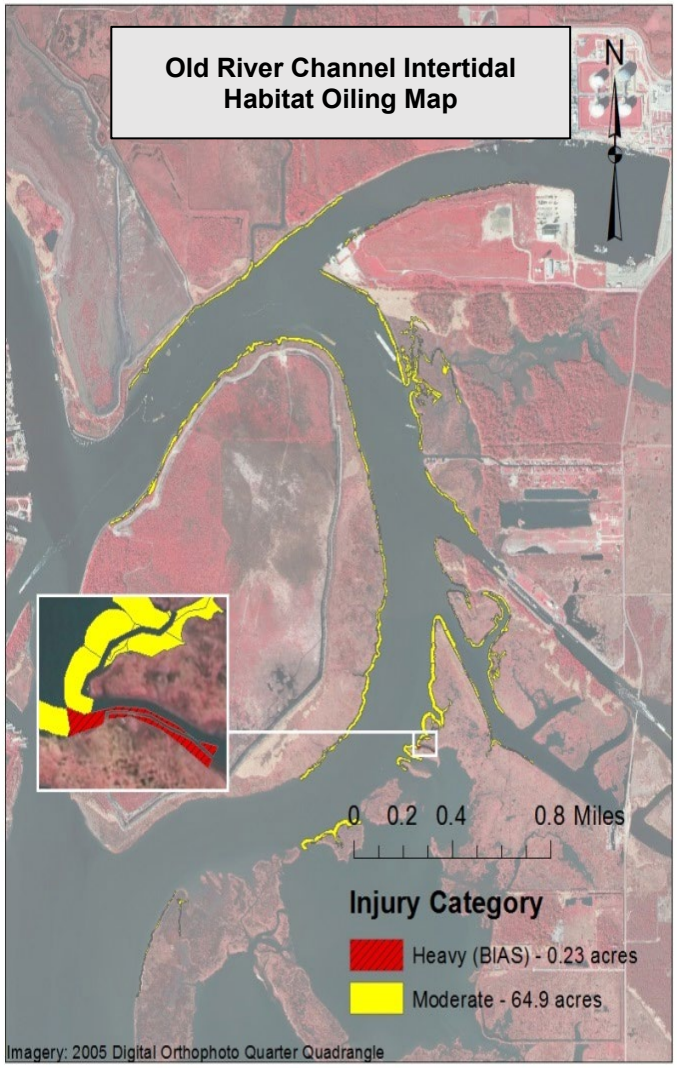
Intracoastal Waterway

Moss Lake


Moss Lake Intertidal Habitat Oiling Map
N
0 0.15 0.3 0.6 Miles
Injury Category
Moderate - 28.9 acres
Imagery: 2005 Digital Orthophoto Quarter Quadrangle


Moss Lake Shallow Subtidal Habitat Oiling Map
N
0 0.15 0.3 0.6 Miles
Injury Category
Heavy (BIAS) - 4.18 acres
Heavy - 35.7 acres
Imagery: 2005 Digital Orthophoto Quarter Quadrangle

Old River Channel



Prien Lake


Prien Lake Intertidal
Habitat Oiling Map
N
0 0.1 0.2 0.4 Miles
Injury Category
Moderate - 29.4 acres
Imagery: 2005 and 2008 Digital Orthophoto Quarter Quadrangle


Prien Lake Shallow Subtidal
Habitat Oiling Map
N
0 0.1 0.2 0.4 Miles
Injury Category
Moderate - 27.3 acres
Imagery: 2005 and 2008 Digital Orthophoto Quarter Quadrangle

APPENDIX F: MARSH SHORELINE EDGE EROSION AND RECESSION DATA

Table F-1. Measurement of marsh shoreline edge change at the 35 monitoring stations used for marsh shoreline edge injury calculations between April 2007 and April 2009. Blank cells indicate no measurement was collected. Positive numbers indicate no change or marsh accretion. Negative numbers indicate marsh shoreline edge erosion or recession.

			Marsh Edge Shoreline Change (inches)				
AOI	**Station ID**	**EG**	**April 2007**	**October 2007**	**April 2008**	**October 2008**	**April 2009**
Calcasieu River	CR-5E	6	-44	-22	-10	0	-30
Calcasieu River	E-17	6	-36	-73	-77	-74	-91
Calcasieu River	E-14	7	-141	-138	-127	-54	-81
Calcasieu River	E-15	7	-66	-81	-59	-59	-65
Calcasieu River	E-16	7	-13	-24	-28	-32	-39
Calcasieu River	E-10	6	-41	-43	-42	-21	-74
Calcasieu River	CR-2E	6	-33	-70	-54	-50	-102
Calcasieu River	E-13	7	-348	-350	-350	-300	-285
Calcasieu River	E-36	3	-12	-20	50	-60	-75
Calcasieu River	E-34	7	-60	-94	-84	-21	-134
Calcasieu River	E-11	6	-44	-60	-54	-52	-41
Calcasieu River	E-12	6	-26	-42	-57	-58	-48
Calcasieu River	E-35	3	-227	-216	-193	-192	-154
Calcasieu River	E-46	3	-8	-48		-324	-184
Haymark Loop	E-08	3	-221	-216	-207		-415
Haymark Loop	E-09	3	18	-48	-31	-55	-76
Haymark Loop	E-06	3	-20	-21	-39	-56	-101
Haymark Loop	E-05	3	-58	-71	-74	-70	-79
Haymark Loop	E-01	7	-218	-220	-221	-168	-147
Haymark Loop	E-02	7	-530	-960	-168	-34	-185
Haymark Loop	E-03	7	-252	-259	-256	-252	-208
Haymark Loop	E-04	7	-160	-160	-156	-164	-161
Haymark Loop	FD-2E	7	-207	-192	-224		0
North Calcasieu Lake	E-57	3	6	-70	-58	-108	-85
North Calcasieu Lake	E-60	7	-66	-134	-79	-180	-320
North Calcasieu Lake	E-61	7	-156	-141	-165	-207	-120
North Calcasieu Lake	E-62	7	-234	-220	-222	-360	-548
North Calcasieu Lake	E-64	7	-9	-12	-24	-26	-31
North Calcasieu Lake	FD-8E	7	-276	-90	-241		-274
South Prien Lake	E-22	6	-12	-41	-42	-40	-50
South Prien Lake	E-23	6	0	-25	-27	-20	-22
South Prien Lake	E-24	6	0	-18	0	0	-22
Upper Moss Lake	E-42	3	-7	-49		-72	-130
Upper Moss Lake	E-43	3	12	-12		-22	-23
Upper Moss Lake	E-44	3	-9	-37		-20	-34

Table F-2. Average marsh shoreline erosion depth (inches) and area (acres) quantified by the Trustees. Segments marked with an asterisk (*) denote those segments that were reclassified as marsh habitat, and those marked with a (p) indicate only partial length of segment was used to calculate injured habitat.
** Classified as exposure group 2, however, segment was located between segments that exhibited erosion.

Shoreline Segment	EG	Shoreline Segment Length (feet)	Depth of oil penetration (inches)	Average Shoreline Erosion (inches)	Associated Station ID	Eroded Shoreline (acres)	Eroded shoreline up to oil penetration (acres)	Eroded shoreline beyond oil penetration (acres)
*128p	3	6190.33	48	-75.00	E-36	-0.8882	-0.5684	-0.320
46	3	2838.53	180	-245.50	E8, E9	-1.3331	-0.9775	-0.356
49	7	3112.56	180	-125.86	E1, E2, E3, E4, FD_2E, E5, E6	-0.7494	-0.7494	0.000
48.1	3	860.64	300	-125.86	E1, E2, E3, E4, FD_2E, E5, E6	-0.2072	-0.2072	0.000
48.20	2**	596.64	300	-125.86	E1, E2, E3, E4, FD_2E, E5, E6	-0.1437	-0.1437	0.000
47p	3	524.50	120	-125.86	E1, E2, E3, E4, FD_2E, E5, E6	-0.1263	-0.1204	-0.006
239 p	3	618.49	60	-85.00	E-57	-0.1006	-0.0710	-0.030
73	3	3394.51	48	-62.33	E42, E43, E44	-0.4048	-0.3117	-0.093
51p	3	481.80	84	-62.33	E42, E43, E44	-0.0575	-0.0575	0.000
9	6	1289.90	60	-60.50	CR-5E, E17	-0.1493	-0.1481	-0.001
*31.1	6	2951.47	72	-61.67	E14, E15, E16	-0.3482	-0.3482	0.000

*31.2	7	3254.59	72	-61.67	E14, E15, E16	-0.3840	-0.3840	0.000
*33p	6	2082.16	84	-74.00	E10	-0.2948	-0.2948	0.000
*42.1	6	870.14	300	-74.00	E10	-0.1233	-0.1233	0.000
*34	6	3539.71	72	-102.00	CR_2E	-0.6907	-0.4876	-0.203
12	6	4849.68	144	-31.33	E22, E23, E24	-0.2907	-0.2907	0.000
*37	7	3316.37	60	-285.00	E-13	-1.8082	-0.3807	-1.427
145p	7	506.65	120	-134.00	E-34	-0.1299	-0.1163	-0.014
168	7	2219.71	180	-265.80	E60, E61, E62, E64, FD_8E	-1.1287	-0.7644	-0.364
Totals						**-9.3584**	**-6.5446**	**-2.8138**

Table F-3. Average marsh shoreline recession depth (inches) and area (acres) quantified by the Trustees. . Segments marked with an asterisk (*) note those segments that were reclassified as marsh habitat, and those marked with a (p) indicate only partial length of segment was used to calculate injured habitat.

Shoreline Segment	EG	Shoreline Segment Length (feet)	Depth of oil penetration (inches)	Avg. Shoreline Recession (inches)	Associated Station ID	Recessed Shoreline (acres)	Recessed shoreline up to oil penetration (acres)	Recessed shoreline beyond oil penetration (acres)
33p	6	7897.05	84	-44.50	E11, E12	-0.6723	-0.6723	0.0000
*128p	3	4081.92	48	-169.00	E35, E46	-1.3197	-0.3748	-0.9449
129p	3	802.69	12	-169.00	E35, E46	-0.2595	-0.0184	-0.2411
Totals						**-2.2515**	**-1.0655**	**-1.1860**

APPENDIX G: PERCENT LIVE COVER RESULTS OF PHOTOQUAD MONITORING

Table G-1. Percent live cover from Photoquad monitoring for stations in Exposure Group 0.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
0	NN_1	80	60	90	55	No Data	No Data	No Data	**71**
0	NN_2	45	80	75	80	No Data	No Data	No Data	**70**
0	NN_3	70	76	50	60	No Data	No Data	No Data	**64**
0	NN_4	43	40	55	20	No Data	No Data	No Data	**40**
0	NN_5	50	50	65	70	No Data	No Data	No Data	**59**
0	NN_6	95	93	80	30	No Data	No Data	No Data	**75**
0	NN_7	65	25	45	12	No Data	No Data	No Data	**37**
0	NN_8	55	58	80	35	No Data	No Data	No Data	**57**
	Event Mean	**63**	**60**	**68**	**45**				
	Event STD	**18**	**22**	**16**	**25**				
	Proportion of REF	**0.967**	**0.949**	**0.915**	**0.773**				

Table G-2. Percent live cover from Photoquad monitoring for stations in Exposure Group 1.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
1	FN_1	65	85	80	80	No Data	No Data	No Data	**78**
1	FN_2	45	72	70	15	No Data	No Data	No Data	**51**
1	FN_3	50	81	85	40	No Data	No Data	No Data	**64**
1	FN_4	65	20	30	8	No Data	No Data	No Data	**31**
1	FN_5	68	45	80	75	No Data	No Data	No Data	**67**
1	FN_6	55	35	80	8	No Data	No Data	No Data	**45**
1	FN_7	65	65	75	35	No Data	No Data	No Data	**60**
	Event Mean	**59**	**58**	**71**	**37**				
	Event STD	**9**	**25**	**19**	**30**				
	Proportion of REF	**0.908**	**0.907**	**0.969**	**0.637**				

Table G-3. Percent live cover from Photoquad monitoring stations in Exposure Group 2.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
2	FS_1	65	85	80	80	No Data	No Data	No Data	**30**
2	FS_2	45	72	70	15	No Data	No Data	No Data	**63**
2	FS_3	50	81	85	40	No Data	No Data	No Data	**35**
2	FS_4	65	20	30	8	No Data	No Data	No Data	**54**
2	FS_5	68	45	80	75	No Data	No Data	No Data	**79**
2	FS_6	55	35	80	8	No Data	No Data	No Data	**61**
	Event Mean	**58**	**63**	**55**	**38**				
	Event STD	**19**	**25**	**29**	**17**				
	Proportion of REF	**0.897**	**0.984**	**0.746**	**0.654**				

Table G-4. Percent live cover from Photoquad monitoring stations in Exposure Group 3.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
3	FR_1	55	70	55	30	25	20	70	**43**
3	FR_2	20	30	20	25	35	35	35	**29**
3	FR_3	65	35	40	45	50	40	50	**46**
3	FR_4	40	30	25	15	25	25	20	**26**
3	FR_5	73	75	60	10	70	55	40	**55**
3	FR_6	65	55	60	30	45	35	60	**50**
3	FR_7	55	60	65	35	40	5	35	**42**
3	FR_8	25	16	60	65	90	60	80	**57**
	Event Mean	**50**	**46**	**48**	**32**				
	Event STD	**19**	**21**	**18**	**17**				
	Proportion of REF	**0.765**	**0.730**	**0.653**	**0.544**				

Table G-5. Percent live cover from Photoquad monitoring stations in Exposure Group 6.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
6	CR_1	50	60	55	80	50	35	25	**51**
6	CR_2	40	60	30	0	0	0	0	**19**
6	CR_3	40	20	90	50	65	32	45	**49**
6	CR_4	5	7	25	15	27	5	15	**14**
6	CR_5	30	25	70	68	55	25	55	**47**
6	CR_6	7	2	70	10	75	0	85	**36**
	Event Mean	**29**	**29**	**57**	**37**				
	Event STD	**19**	**25**	**25**	**33**				
	Proportion of REF	**0.441**	**0.457**	**0.768**	**0.635**				

Table G-6. Percent live cover from Photoquad monitoring stations in Exposure Group 7.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
7	FD_1	35	10	15	45	20	15	15	**22**
7	FD_2	0	0	0	0	5	5	0	**1**
7	FD_3	65	66	10	5	20	40	40	**35**
7	FD_4	48	64	80	85	75	50	80	**69**
7	FD_8	10	5	0	0	0	0	0	**2**
	Event Mean	**32**	**29**	**21**	**27**				
	Event STD	**27**	**33**	**34**	**38**				
	Proportion of REF	**0.486**	**0.457**	**0.285**	**0.461**				

Table G-7. Percent live cover from the reference Photoquad monitoring stations.

Exposure Group	Photoquad	Aug 06	Oct 06	Apr 07	Oct 07	Apr 08	Oct 08	Apr 09	Station Mean over Time
REF	R_1	70	64	90		50	60	60.9	**66**
REF	R_2	90	76	95	90	80	70	38.8	**77**
REF	R_3	65	76	85	75	45	50	42.5	**63**
REF	R_4	45	45	50	35	35	5	35	**36**
REF	R_5	50	62	60	50	60	25	45	**50**
REF	R_6	65	60	85	60	50	25	48.75	**56**
REF	R_7	55	50	65	45	50	35	32.5	**48**
REF	R_8	80	75	60	55	80	45	80	**68**
	Event Mean	**65**	**64**	**74**	**59**				
	Event STD	**15**	**12**	**17**	**19**				
	Proportion of REF	**1.000**	**1.000**	**1.000**	**1.000**				

APPENDIX H: PRELIMINARY LIST OF POTENTIAL PROJECT ALTERNATIVES BASED ON RESTORATION TYPE SCREENING – 28 PROJECTS FROM THE RRP PROGRAM (INCLUDING ONE IN REGION 7) AND TWO SUBMITTED BY CITGO

Project ID	Project Name	Parish	RRP Region	Restoration Type
295	Goose Lake GIWW Armoring	Cameron	R4	PP CHW
296	Shell Ditch Restoration	Cameron	R4	CE CHW, PP CHW
364	Freshwater Bayou Marsh Creation (ME-0031)	Vermilion	R4	CE CHW
633	No Name Bayou Marsh Creation (CS-0078)	Cameron	R4	CE CHW
635	South Grand Chenier Marsh Creation - Baker Tract (ME-0032)	Cameron	R4	CE CHW
636	North Turner's Bay Mitigation Area	Cameron	R4	CE CHW
637	Price Lake Marsh Nourishment	Cameron	R4	CE CHW
640	Unit 5 Terraces	Cameron	R4	CE CHW PP CHW
804	Sabine Marsh Creation Cycles 6 & 7 (CS-0081)	Cameron	R4	CE CHW
805	West Cove Marsh Creation and Nourishment (R4-CS-02)	Cameron	R4	CE CHW
859	Protection, Establishment, and Restoration of Bird Nesting Islands and Colonies - Wax Lake Delta	Terrebonne	R3	CE CBSS, CE CHW, PP Birds
861	Protection and Management of Coastal/Floodplain Forests for Wading Bird Rookeries and Neotropical Migrants - Atchafalaya River Basin	Terrebonne	R3	CE CFW, PP Birds
862	Protection and Management of Coastal/Floodplain Forests for Wading Bird Rookeries and Neotropical Migrants - Lower Pearl River Basin	Orleans	R1	AcLP CFW, CE CFW, PP Birds
863	Protection and Management of Neotropical Migratory Bird Stopover Habitat - SW Louisiana Cheniers	Cameron	R4	AcLP CFW, PP Birds
864	Protection and Management of Neotropical Migratory Bird Stopover Habitat - Grand Isle	Jefferson	R2	AcLP CFW, PP Birds

866	Oyster Scaffold	Jefferson, Lafourche, Plaquemines, St Bernard, Terrebonne	R1, R2, R3, R4	CE C Oyster Reefs, S C Oyster Reefs
870	Mangrove Bayou	Cameron	R4	CE CHW
880	North Mud Lake Marsh Creation (PPL26 Candidate)	Cameron	R4	CE CHW
882	Oyster Lake Marsh Creation and Nourishment (CS-0079)	Cameron	R4	CE CHW
883	Calcasieu Lake & Sabine National Wildlife Refuge Living Shoreline	Cameron	R4	CE C Oyster Reefs, PP CHW
890	Old River Marsh Creation Project	Calcasieu	R7	CE C Oyster Reefs, CE IHW
896	Long Point Bayou Mash Creation (CS-0085) Project	Cameron	R4	CE CHW
897	South Pass Bird Island (MR-172) Project	Plaquemines	R2	CE CBSS, CE CHW, PP Birds
901	Rockefeller Refuge Conservation Acquisition	Cameron	R4	AcLP CFW AcLP CHW
915	South Grand Chenier Marsh Creation (ME-0020)	Cameron	R4	CE CHW
934	Calcasieu Lake Oyster Cultch Plant	Cameron	R4	CE C Oyster Reefs
935	Houma Navigation Canal (HNC) Bird Island Project	Terrebonne	R3	CE CHW, CE CBSS, PP CHW, PP CBSS, PP Birds
947	Sabine National Wildlife Refuge Unit 1A Marsh Creation Project	Cameron	R4	CE CHW
	BUDM Disposal Area 7 (Proposed by CITGO)	Calcasieu	R7	CE IHW
	BUDM Disposal Area 10 (Proposed by CITGO)	Calcasieu	R7	CE IHW

APPENDIX I: FINDING OF NO SIGNIFICANT IMPACT

FINDING OF NO SIGNIFICANT IMPACT

Final Damage Assessment and Restoration Plan and Environmental Assessment for the 2006 Calcasieu River Oil Spill Natural Resource Damage Settlement

OVERVIEW AND BACKGROUND

The U.S. Department of the Interior, represented by the United States Fish and Wildlife Service; the United States Department of Commerce, represented by the National Oceanic and Atmospheric Administration; the Louisiana Oil Spill Coordinator's Office, Department of Public Safety and Corrections; the Louisiana Department of Environmental Quality; the Louisiana Department of Natural Resources; the Louisiana Department of Wildlife and Fisheries; and the Louisiana Coastal Protection and Restoration Authority (collectively the Trustees) completed a Final Damage Assessment and Restoration Plan and Environmental Assessment (DARP/EA) that explains the decisions of the Trustees to provide approximately $17.5 million to support restoration of marsh, shallow subtidal and intertidal habitats, water column organisms and birds as described in the DARP/EA. The DARP/EA is prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) NEPA regulations, and all applicable agency NEPA regulations and guidance.

LEAD AND COOPERATING AGENCIES

The Department of the Interior serves as the lead agency responsible for NEPA compliance for the DARP/EA. Each of the other federal and state co-Trustees participates as a cooperating agency pursuant to NEPA (40 CFR 1508.5).

SUMMARY OF PROPOSED ACTIONS AND ALTERNATIVES

The DARP/EA discusses a reasonable range of alternatives and a natural recovery/no action alternative. The Preferred Alternative includes actions the Trustees identify as their preferred restoration actions. The remaining alternatives round out the reasonable range. See Section 4.4 of the DARP/EA for detailed descriptions of the alternatives. The Trustees determined that the Preferred Alternative would provide more efficient recovery of habitats, water column organisms, and birds compared to the other alternatives.

The Trustees provided the Draft DARP/EA for public review from October 20 to November 20, 2021. The Trustees received no public comment on the draft. As such, no substantive changes were made in finalizing the DARP/EA and the Federal Trustees prepared this Finding of No Significant Impact.

ANALYSIS SUMMARY

The reasonable range of alternatives and natural recovery/no action is analyzed to determine environmental effects that could result from implementing the action alternatives and from taking no action. All environmental effects greater than no effect fall within the range of short-term minor to long-term minor as defined in the DARP/EA. Effects within this range are determined not significant considering the context and intensity of the projects' scopes and effects on the resources. Section 5 in the DARP/EA provides a concise overview of impacts. The analysis of the environmental consequences concludes that minor (or less) impacts to some resources and no major adverse impacts are anticipated to result from implementing any of the action alternatives.

AGENCY COORDINATION

Additional federal laws may apply to the Preferred Alternative considered in the Final DARP/EA. All federal, state and local laws will be complied with prior to project implementation. Select agency coordination includes:

- Endangered Species Act. The selected projects are not expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species. Overall, the selected projects are expected to benefit fisheries and their habitats. In addition, for each

project selected in the Final DARP/EA that has not already undergone consultation with the USFWS and/or NOAA under Section 7 of the Endangered Species Act, the Federal Trustees will complete consultation prior to and as a condition of future project implementation.

- National Historic Preservation Act. The State Historic Preservation Officer of Louisiana concurred with the determination that there are no known cultural or historic sites in the Long Point Bayou Marsh Creation Project area. The Trustees will consult with the State Historic Preservation Officer of Louisiana to ensure the Calcasieu Lake Oyster Cultch Plant will also have no effect on cultural or historic sites. If potential adverse impacts become known during project implementation, the Trustees will either conduct, or require the project implementer to conduct, appropriate compliance under the National Historic Preservation Act.
- Magnusson Stevens Act. The Trustees do not expect the selected projects to cause substantial damage to the ocean and coastal habitats and/or Essential Fish Habitat (EFH) as defined under the Magnuson-Stevens Act. Any short-term and temporary localized impacts from the restoration activities, such as those associated with the construction of a 392-acre saline marsh, bird nesting island and oyster cultch plant can be minimized by the use of Best Management Practices. As documented in the Final DARP/EA, the Trustees expect the selected projects to substantially benefit the habitats targeted for restoration and the species associated with those habitats. In consultation with NOAA, the Trustees concluded that the planned restoration actions, specifically the saline marsh and oyster cultch plant, will have beneficial impacts by increasing and or enhancing habitats for EFH and enhance food web productivity. Additionally, no adverse impacts to EFH habitat is anticipated for the bird nesting island restoration project. Overall, impacts to the ocean, coastal habitats, and/or EFH are expected to be beneficial.
- Federal Water Pollution Control Act (Clean Water Act). The construction permit application (which includes applicable consultation regarding the Clean Water Act) for the Long Point Bayou Mash Creation (CS-0085) Project was submitted to the U.S. Corps of Engineers in December 2021. Implementation of this and other applicable alternatives would follow appropriate state and federal permit conditions.

If any further need arises to coordinate and consult with other regulatory authorities, the additional coordination or consultation requirements would be addressed prior to project implementation. The Federal Trustees' Finding of No Significant Impact for the Preferred Alternative is issued subject to the completion of all outstanding compliance reviews under other Federal laws. If the proposed action changes or information is brought to light as a result of completing such reviews that is potentially relevant to the environmental evaluation supporting this Finding of No Significant Impact, that evaluation would be updated or supplemented as required by NEPA and a new determination made by the Federal Trustees under NEPA as to whether the proposed actions are likely to significantly affect the quality of the human environment.

DETERMINATION

Based on review and evaluation of the information contained in the Final DARP/EA, I have determined that the proposed actions do not constitute a major Federal action which would significantly affect the quality of the human environment within the meaning of Section 102 (2)(c) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an environmental impact statement on the proposed actions is not required at this time.

LEOPOLDO MIRANDA-CASTRO

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Regional Director/DOI Authorized Official
Regional Director, USFWS South Atlantic-Gulf and Mississippi Basin Interior Regions