FINAL

DAMAGE ASSESSMENT AND RESTORATION PLAN

for the
2014 Bay St. Elaine Oil Spill
(NRDA CASE FILE #LA2014_1025_1120)

2016 Lake Grand Ecaille Oil Spill
(NRDA CASE FILE #LA2016_0725_0630)

2016 Bay Long Oil Spill
(NRDA CASE FILE #LA2016_0905_1017)

2016 Terrebonne Bay/Timbalier Island Oil Spill
(NRDA CASE FILE #LA2016_1008_0400)

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EXECUTIVE SUMMARY

This document is a Final Damage Assessment and Restoration Plan (Final DARP) prepared for four separate unauthorized discharges of oil from facilities owned or operated by Hilcorp Energy Company (referred to herein as "Hilcorp") entities and/or affiliates in 2014 and 2016. Natural resources within the area of each incident that provide services to the public were impacted by oil and response activities resulting in injuries to a variety of wildlife and habitats.

Overview of the Incidents

Bay St. Elaine: On October 25, 2014, Hilcorp reported an unauthorized discharge of oil into Bay St. Elaine in Terrebonne Parish due to a leak in one its four-inch flow lines near a facility in Tambour Bay. An estimated 140 barrels of crude oil discharged into Bay St. Elaine and the connecting waterways and wetlands. This discharged oil exposed sensitive estuarine habitats as well as birds and other wildlife to crude oil. The flow line was owned and operated by Hilcorp and pursuant to OPA they were designated as the statutory responsible party (RP) for the incident.

Lake Grand Ecaille: On July 25, 2016, Hilcorp reported an unauthorized discharge of oil into Lake Grand Ecaille in Plaquemines Parish due to corrosion on a flow line on an out-of-service well and a faulty valve on an operational well. An estimated 30-100 barrels of crude oil discharged into Lake Grand Ecaille and the connecting waterways and wetlands. This discharged oil exposed sensitive estuarine habitats as well as birds and other wildlife to crude oil. The flow line was owned and operated by Hilcorp and pursuant to OPA they were designated as the statutory responsible party (RP) for the incident.

Bay Long: On September 05, 2016, a contractor struck two 12-inch pipelines owned and operated by Harvest Pipeline Company ("Harvest"),[1] an affiliate company of Hilcorp, with an excavation marsh buggy while working on a coastal restoration project on Chenier Ronquille Barrier Island in Plaquemines Parish. As a result, an unauthorized discharge of crude oil, estimated at 150 barrels, released onto barrier island habitat, into Bay Long, connecting waterways, and wetlands. This discharged oil exposed sensitive wetland habitats as well as birds and other wildlife to crude oil. The pipelines were owned and operated by Harvest, an affiliate company of Hilcorp, and pursuant to OPA they were designated as the statutory responsible party (RP) for the incident.

Terrebonne Bay/Timbalier Island: On October 8, 2016, Hilcorp operators reported a leak from a valve on their Caillou Island Tank Battery 25 in Terrebonne Parish. An estimated 300 barrels of crude oil discharged into Terrebonne Bay,

[1] The Trustees note that, according to records maintained by the Louisiana Secretary of State, Harvest Pipeline Company changed its name to Harvest Midstream Company on July 30, 2018. For clarity and consistency, this entity is referred to herein as "Harvest."

connecting waterways, and onto nearby barrier islands and wetlands. This discharged oil exposed sensitive wetland habitats as well as birds and other wildlife to crude oil. The tank battery was owned and operated by Hilcorp, and pursuant to OPA they were designated as the statutory responsible party (RP) for the incident.

This Final DARP is intended to inform members of the public about the natural resource injuries caused by the above incidents, as well as describe restoration actions that will 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) and 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 document is part of the Natural Resource Damage Assessment (NRDA) process being performed pursuant to OPA and OSPRA by the trustees for these incidents, which include the Louisiana Oil Spill Coordinator's Office (LOSCO)/Louisiana Department of Conservation and Energy (LDCE); the Louisiana Department of Environmental Quality (LDEQ); the Louisiana Department of Wildlife and Fisheries (LDWF); and the Coastal Protection and Restoration Authority (CPRA) (collectively the "Trustees").

This Final DARP provides information on:

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

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 these four incidents caused injuries to saline and brackish marsh, birds, and other wildlife (Table ES.1).

ES.1 Summary of Injuries and Damages in Discounted Service Acre Years (DSAYs) and Discounted Bird Years (DBYs)

Incident	Injury Resource Category/Subcategory	Amount Injured	Injury/Damages
Bay St. Elaine	Saline Marsh	103.54 acres	125.36 DSAYs
	Diamondback Terrapin (*Malaclemys terrapin*)	152.00 kg biomass	33.73 DSAYs
Lake Grand Ecaille	Saline-Brackish Marsh	60.53 acres	103.50 DSAYs
Bay Long	Birds/Marsh Birds	10 birds	59.63DBYs
	Birds/Non-marsh Birds	331.55 kg biomass	69.52 DSAYs
Terrebonne Bay/Timbalier Island	Saline Marsh (*Spartina* and mangroves)	18.49 acres	72.67 DSAYs
	Algal-Sand Flats	16.10 acres	16.58 DSAYs
		Total DSAYs	**421.36 DSAYs**
		Total DBYs	**59.63 DBYs**

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. Based on this work, the Trustees identified a preferred alternative that would adequately restore for the lost natural resources and services resulting from these four incidents. A summary of the natural resources and services injured by the incidents, restoration goals and preferred restoration actions is provided in Table ES.2.

ES.2 Preferred Alternative Restoration Actions for the Injured Resources and Services Resulting from the Incidents

RRP Injured Resource and Services	Injured Resource Category/Subcategory	Restoration Goal	Preferred Restoration Action
CHW	Marsh Habitat Sand Beach/Algal Flats	Create/enhance coastal herbaceous wetlands	Northwest Little Lake Marsh Creation-NRDA Increment
Birds	Birds		
Wildlife	Wildlife Diamondback Terrapin		

The Draft DARP was available to the public for a 30-day comment period, which began on June 20, 2026 with the notice announcing its availability, and closing on July 20, 2026. No comments were received so no significant changes were made to the draft plan in developing this Final DARP.

1.0 INTRODUCTION

1.1 Purpose and Need for a Restoration Plan

The purpose and need for the selected restoration alternative evaluated in this Final Damage Assessment and Restoration Plan (DARP) is to restore natural resources injured by the incidents 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 is intended to inform members of the public about the natural resource injuries caused by four separate unauthorized discharges of oil, further described below in Section 1.2, from facilities owned or operated by Hilcorp Energy Company (referred to herein as "Hilcorp") entities and/or affiliates in 2014 and 2016, as well as the preferred restoration alternative the natural resource trustees (Trustees) chose for the purposes of compensating the public for those injuries. Under OPA and OSPRA and its implementing regulations, the Trustees act on behalf of the public to assess injuries to natural resources and recover damages necessary to restore, rehabilitate, replace, or acquire the equivalent of those resources and their services. The Trustees include the Louisiana Oil Spill Coordinator's Office (LOSCO)/Louisiana Department of Conservation and Energy (LDCE); the Louisiana Department of Environmental Quality (LDEQ); Louisiana Department of Wildlife and Fisheries (LDWF); and the Coastal Protection and Restoration Authority (CPRA).

1.2 Overview of the Incidents

1.2.1 Bay St. Elaine Incident

On or about October 25, 2014, Hilcorp operators located a leak along one of Hilcorp's four-inch flow lines near their Tambour Bay facility in Terrebonne Parish. Two holes were found in the line, releasing oil in the adjacent waterways and marshes of Bay St. Elaine. An estimated 140 barrels of crude oil were discharged into Bay St. Elaine and connecting waterways and wetlands (Figure 1.1). Emergency response and clean-up operations commenced immediately and continued for several months. A helicopter and multiple watercraft were used to locate oil along shorelines and direct response activities. Response activities included the use of airboats, skimmers, and hard and soft boom. Water/shoreline searches were conducted for potentially oiled birds and other wildlife. Bird hazing cannons, as well as Mylar tape, were deployed on 10/27/2014 at various locations to deter birds from oiled areas. Near the source, heavily oiled vegetation was cut down and removed from the site. The discharge and associated response actions affected saline marsh habitat and the services this resource provides. A variety of wildlife, including, but not limited to, diamondback terrapin (*Malaclemys terrapin*), were also adversely impacted by the spill and response actions.

1.2.2 Lake Grand Ecaille Incident

On or about July 25, 2016, Hilcorp operators located a discharge of crude oil from an out-of-service three-inch flow line. The discharge was due to corrosion on the flow line and a faulty check valve that was connected to an operational well. Estimates upward of 100 barrels of crude oil discharged into Lake Grand Ecaille and connecting waterways and wetlands (Figure 1.1). Response actions began immediately and continued for over two months after the release. A helicopter and multiple watercraft were used to locate oil along shorelines and direct response activities. Response operations included hard and sorbent booming, low pressure flushing, and the use of absorbents and skimmers. Water/shoreline searches were conducted for potentially oiled birds and other wildlife. Bird hazing cannons were deployed beginning 07/26/16 at various locations to deter birds from oiled areas. Impacts to the habitat were a result of oil intrusion and response activities to clean up the oil. The discharge affected coastal herbaceous marsh as well as the services this resource provides in Lake Grand Ecaille and the adjacent waterways.

1.2.3 Bay Long Incident

On September 05, 2016, a contractor struck two 12-inch subsurface pipelines with an excavator while working on a restoration project on Chenier Ronquille Barrier Island near Bay Long, a sub-estuary of Barataria Bay in Plaquemines Parish. The pipelines were owned and operated by Harvest Pipeline Company ("Harvest"),[2] an affiliate of Hilcorp, and pursuant to OPA, Harvest was identified as the statutory responsible party (RP) for this incident. Prior to the pipelines being shut-in and repaired, an estimated 150 barrels of crude oil released onto barrier island habitat, into Bay Long, and connecting waterways and wetlands (Figure 1.1). Response actions commenced immediately and continued for several weeks. A helicopter and multiple watercraft were used to locate oil along shorelines and direct response activities. At the height of the response, approximately 175 personnel were on-scene assisting with the clean-up of the oil. Clean-up operations included, among others, hard and sorbent booming, use of skimmers, pumps, excavation, low pressure-high volume flushing, various washing techniques, removal of oiled habitat, and use of vacuum trucks, cranes, and airboats. Bird hazing cannons were deployed at various locations to deter birds from oiled areas. Shortly after the incident occurred, Wildlife Response Services established a wildlife rehabilitation center at the LDWF Marine Lab on Grand Isle, LA. Trained wildlife professionals representing both the Trustees and Hilcorp implemented searches between 09/05/2016 - 09/16/2016 (11 days) from boats to document as well as capture/rehabilitate (if possible) oiled birds and wildlife. The discharge affected barrier island habitat as well as the services this resource provides. In addition, birds were adversely impacted as a result of the discharged oil and response activities.

[2] The Trustees note that, according to records maintained by the Louisiana Secretary of State, Harvest Pipeline Company changed its name to Harvest Midstream Company on July 30, 2018. For clarity and consistency, this entity is referred to herein as "Harvest."

1.2.4 **Terrebonne Bay/Timbalier Island Incident**

On October 8, 2016, Hilcorp operators reported a 300-barrel spill in Terrebonne Bay. Operators were transferring oil between Caillou Island Little Pass and Caillou Island Tank Battery 8 when they discovered 300 barrels of oil missing. Upon investigation, it was noted that oil was found on the Caillou Island Tank Battery 25 Platform. Two days later, oil was discovered south of the tank battery on Timbalier Island. Response actions commenced on the island on 10/10/2016, and continued for several weeks. Walking surveys were used to locate oil along shorelines and direct response activities. Response activities included hard, snare, and sorbent boom, use of skimmers, sorbent pads, low pressure flushing, washing, and excavation and removal of oiled sand with flat shovels (Figure 1.1). Shoreline searches were conducted for potentially oiled birds and other wildlife. Bird hazing cannons were deployed at various locations to deter birds from oiled areas. The discharge affected barrier island habitat including black mangroves (*Avicennia germinans)* and *Spartina alterniflora* as well as the services this resource provides. Wildlife response personnel observed various fauna in the impacted area including fiddler crabs and periwinkle snails (*Littoraria irrorate)*. In addition, sand and algal flat habitats were adversely impacted as a result of the discharged oil and response activities.

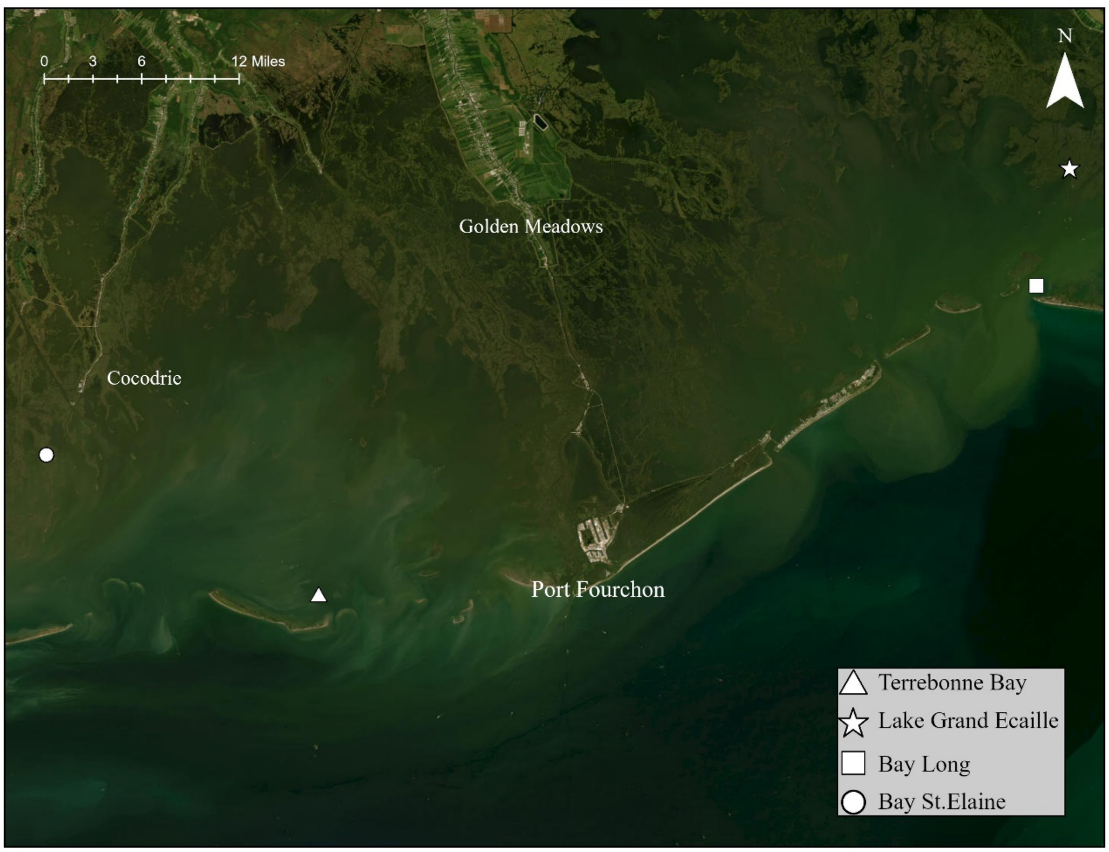

Figure 1.1 Location of the four incidents in the Terrebonne and Barataria basins, Louisiana

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 state Trustees for these four incidents 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/LDCE, LDEQ, LDWF, and CPRA.

1.4 NRDA Process and the Louisiana Regional Restoration Planning Program

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 each respective 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 Hilcorp and Harvest, respectively, to participate in the NRDA for these incidents (see Section 1.5). Hilcorp and Harvest were respectively involved in the design, performance, and funding of several Preassessment activities to collect ephemeral data.

For each incident, 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 each 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, the Trustees issued a Notice of Intent to Conduct Restoration Planning (see Section 1.6) in each incident. 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 DARP.

In Louisiana, the Regional Restoration Planning Program (RRP Program) was established to assist in addressing incidents under OPA and OSPRA and make the NRDA process as a whole more efficient. The RRP Program identifies a statewide program structure, decision-making process, and criteria used to select restoration project(s) that may be implemented to restore 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).

As described in Section 3.2.4.2 of the RRP Program FPEIS, in the Restoration Planning phase, the trustees evaluate and quantify the nature and extent of injuries to natural resources and services, and determine the need for, type of, and scale of appropriate restoration actions. The first component of the Restoration Planning phase is injury assessment. For these four incidents, the Trustees quantified injury to the following resource categories: 1) coastal herbaceous wetlands, 2) coastal beaches, shorelines, streambeds, 3) birds, and 4) wildlife. The Trustees' assessment used data collected during the response, as well as data collected by the Trustees during preassessment and injury assessment activities. The Trustees' assessment produced relevant information for determining the nature and extent of injuries to natural resources, as described in Chapter 3.

The second component of the Restoration Planning phase is restoration selection. Considering the nature and extent of injuries to natural resources caused by these incidents, the Trustees developed a plan for restoring the injured resources and their services, set forth in this DARP. Chapter 4 summarizes the process the Trustees followed pursuant to the RRP Program to identify appropriate restoration types, identify potential restoration actions based on restoration type, and propose a preferred restoration alternative to compensate the public for injuries quantified by the Trustees. The Trustees requested public review of the Draft DARP and no comments were received during the public comment period.

1.5 Coordination with the Responsible Party

Pursuant to OPA and OSPRA, Hilcorp was identified as the RP for the Bay St. Elaine, Lake Grand Ecaille, and Terrebonne Bay/Timbalier Island Incidents. Harvest, an affiliate of Hilcorp, was identified as the RP for the Bay Long Incident. 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 participate in a cooperative NRDA for the incidents, and Hilcorp and Harvest respectively accepted the Trustees' invitations as follows:

<u>Bay St. Elaine Incident</u>
Invitation sent: January 12, 2015
Invitation accepted: January 20, 2015

<u>Lake Grand Ecaille Incident</u>
Invitation sent: April 27, 2017
Invitation accepted: May 10, 2017

<u>Bay Long Incident</u>
Invitation sent: April 27, 2017
Invitation accepted: May 10, 2017

<u>Terrebonne Bay/Timbalier Island Incident</u>
Invitation sent: January 3, 2017
Invitation accepted: January 20, 2017

Information collected by all parties was shared, as were the results of analyses undertaken independently by the Trustees and by Hilcorp and Harvest. Coordination between the Trustees and the responsible party reduces duplication of effort, increases the cost-effectiveness of the assessment process, and increases 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.

1.6 Public Participation

Throughout the Restoration Planning phase of the NRDA, the Trustees have provided information to the public on the status of injury assessment and restoration selection to facilitate public involvement in the process. For each of the four incidents, the Trustees published a Notice of Intent (NOI) to Conduct Restoration Planning in the *Louisiana Register* and several newspapers to inform the public that they were proceeding with restoration planning pursuant to OPA and would be opening an Administrative Record (AR) to facilitate public involvement in the restoration planning process (see Section 1.7). The public notices for each of the incidents were published as follows:

<u>Bay St. Elaine Incident</u>
Louisiana Register (Vol. 42, No. 08, pp.1448-1449), August 20, 2016.
The Houma Courier, Terrebonne Parish, August 18, 2016.
The Advocate, East Baton Rouge Parish, August 20, 2016.

Lake Grand Ecaille Incident
Louisiana Register (Vol. 45, No. 03, pp. 476-477), March 20, 2019.
The Plaquemines Gazette, Plaquemines Parish, March 19, 2019.
The Advocate, East Baton Rouge Parish, March 20, 2019.

Bay Long Incident
Louisiana Register (Vol. 45, No. 3, pp. 474-476), March 20, 2019.
The Plaquemines Gazette, Plaquemines Parish, March 19, 2019.
The Advocate, East Baton Rouge Parish, March 20, 2019.

Terrebonne Bay/Timbalier Island Incident
Louisiana Register (Vol. 45, No. 03, pp.477-478), March 20, 2019.
The Houma Courier, Terrebonne Parish, March 20, 2019.
The Advocate, East Baton Rouge Parish, March 20, 2019.

The Draft DARP was available to the public for a 30-day comment period, which began on June 20, 2026 with the notice announcing its availability and closing on July 20, 2026. No comments were received, so no significant changes were made to the draft plan in developing this Final DARP. If there is a significant change to the restoration project selected in this Final DARP, the Natural Resource Trustees would consider the need to develop a restoration plan amendment/addendum and/or additional environmental analyses in accordance with OPA regulations. Project changes not deemed significant could be outlined in a supplemental information report, or similar type of document, for posting to the Administrative Record.

1.7 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/.

2.0 ENVIRONMENTAL SETTING

This chapter provides a general description of the affected environments and natural resources that may have been injured as a result of the incidents. RRP regional boundaries are described in Section 5.0 of the RRP Program FPEIS (NOAA et al., 2007). Two of the incidents occurred in Region 2 (Lake Grand Ecaille and Bay Long Incidents) and two occurred in Region 3 (Bay St. Elaine and Terrebonne Bay/Timbalier Incidents).

Region 2 encompasses the Breton Sound and Barataria hydrologic basins and the lower Mississippi River basin, delta plains, and modern Balize (Birdfoot) delta. Bordered to the north by the headwaters of Bayou Lafourche and the Mississippi River, Region 2 extends south to the Caminada-Moreau Headland, Plaquemines barrier system, and Birdfoot delta, and from Bayou Lafourche along its western border to the Mississippi River and to the Mississippi River Gulf Outlet along its eastern border. The following parishes are located either partly or wholly within Region 2: Ascension, Assumption, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, and St. John the Baptist.

Region 3 includes the Terrebonne, Atchafalaya, and Teche/Vermilion hydrologic basins, and portions of the alluvial valley and delta plain. Bordered to the north by intermediate and prairie terraces and natural levees, Region 3 extends south from the landward extent of coastal wetlands to the Timbalier and Isle Dernieres barrier island chains and Atchafalaya Delta. It extends from Freshwater Bayou Canal along its western border to Bayou Lafourche along its eastern border. The following parishes are located either partly or wholly within Region 3: Assumption, Iberia, Lafourche, St. Martin, St. Mary, Terrebonne, and Vermilion.

2.1 Physical Environment

In 1965, the first edition of *Agriculture Handbook 296* was published in an effort to help farmers, land owners, and natural resource planners better understand the environments in which they worked (USDA NRCS 2022). Written by scientists and natural resource managers, it presented divisions (Land Resource Regions - LRRs) and subdivisions (Major Land Resource Areas - MLRAs) of land based upon geographic areas that share similar soils, climate, water regimes, and land uses. The Handbook has been updated numerous times and provides information that guides decision-making related to agriculture, research, and natural resource conservation programs (USDA NRCS 2022).

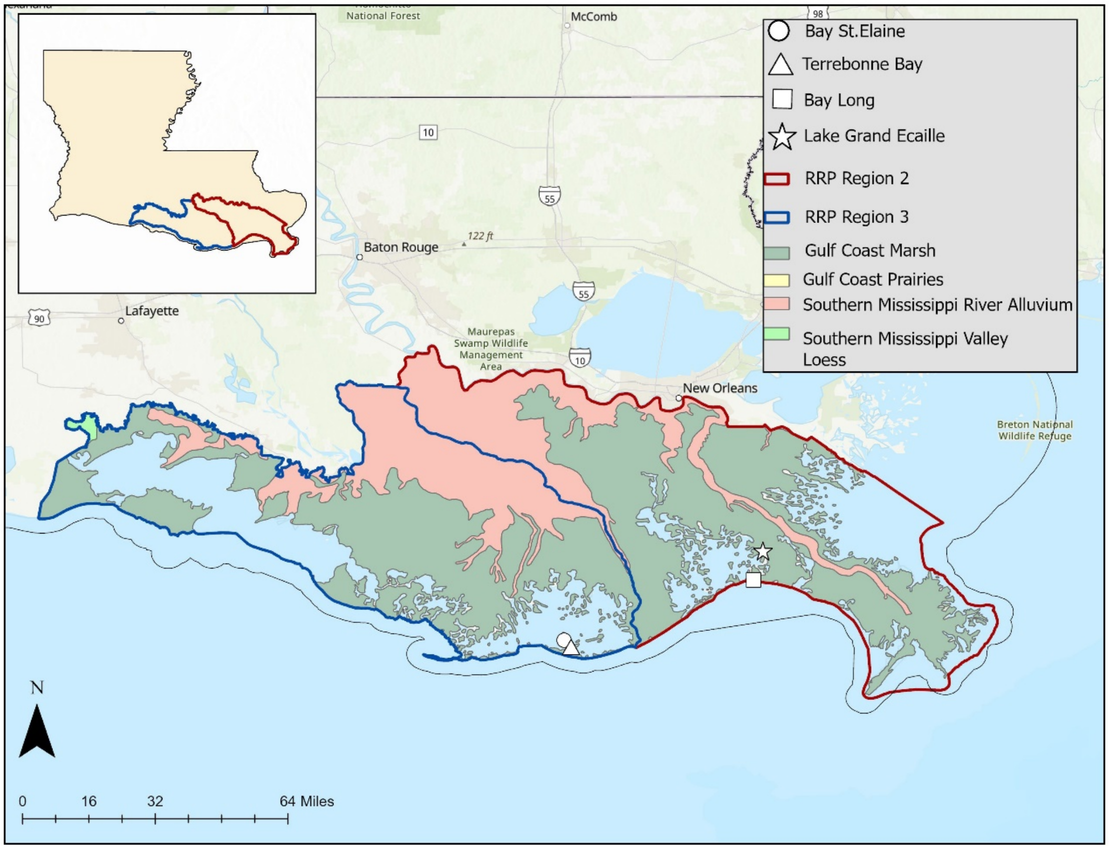

Figure 2.1 Major Land Resource Areas (MLRAs) in Regions 2 & 3 and locations of incidents

<u>Region 2 (location of Lake Grand Ecaille and Bay Long Incidents)</u>
Region 2 is in the southern portion of the state along the southeastern coast and includes the Mississippi River Birdfoot Delta. This Region is composed of two MLRAs: the Gulf Coast Marsh and Southern Mississippi River Alluvium. The Lake Grand Ecaille and Bay Long Incidents occurred in the Gulf Coast Marsh MLRA (Figure 2.1). A table defining characteristics of this area is provided below (Table 2.1).

<u>Region 3 (Location of Bay St. Elaine and Terrebonne Bay/Timbalier Island Incidents)</u>
Region 3 is located adjacent to Region 2 and is composed of four MLRAs that include the Gulf Coast Marsh, Southern Mississippi River Alluvium, Southern Mississippi Valley Loess, and Gulf Coast Prairie. The Gulf Coast Marsh makes up the largest portion of Region 3 and is found in the western, central, eastern, and southern portions of the region. The Bay St. Elaine and Terrebonne Bay/Timbalier Island Incidents occurred in the Gulf Coast Marsh MLRA (Figure 2.1). A table defining characteristics of this area is provided below (Table 2.1). For more details on MLRAs, see USDA NRCS (2022).

Table 2.1 Characteristics of the Physical Environment of the Gulf Coast Marsh MLRA in Regions 2 & 3

Physiography	Geology	Soil	Elevation (ft)
• low, narrow sandy ridges • many rivers, lakes, bayous, tidal channels, & trenasses • ragged shoreline along Mississippi River Delta • productive estuarine complex supporting Gulf of America	• surface consists primarily of Mississippi River clay, silt, fine sand • underlain by mixture of recent alluvial material & Pleistocene-age marine sediments	• dominant are Entisols and Histosols • hyperthermic soil temperature regime • aquic soil moisture regime • smectitic mineralogy • very poorly drained, very deep & clayey	0-165

Region 2 includes the Barataria Basin and a portion of the Pontchartrain Basin. Region 2 ground water predominantly consists of saltwater due to the region's proximity to the coast. However, the Chicot Equivalent Aquifer System extends into small portions of the region in the north, and the Mississippi River Alluvial Aquifer extends into a small portion of the region in the northwest (Stuart et al. 1994).

Region 3 encompasses portions of the Terrebonne, Atchafalaya, and Teche/Vermilion basins. Region 3 ground water predominantly consists of saltwater due to the region's proximity to the coast. However, the Mississippi River Alluvial Aquifer extends into small portions of the region in the north, and the Chicot Aquifer System extends into a small portion of the region in the west (Stuart et al. 1994).

Tidal Regime

A tidal regime is the pattern and range of water-level changes (high and low tides) experienced by a particular coastal area over time. The tidal regime in Regions 2 and 3 (specifically, the Terrebonne and Barataria Basins where the Incidents occurred) is characterized as a micro-tidal, diurnal regime (CWPPRA n.d.a., Silliman et al. 2012, Li et al. 2021). The astronomical tidal range is quite small (typically between 0.3 to 0.5 meters) and water movement is largely controlled by meteorological or wind-driven forces (Li et al. 2021). A region's tidal regime is important for many reasons including safe navigation, recreational opportunities, and understanding how the regular ebb and flow of water contribute to an area's ecological health (recirculating vital nutrients, providing water movement for marine life to breed and migrate, and flushing out pollutants).

2.1.1 **Climate**

The climate of Louisiana is classified as subtropical and is governed by various terrestrial and atmospheric controls (Britannica n.d.). Situated along the northern Gulf of America between 29° and 33° north latitude, Louisiana's climate and temperature pattern are strongly influenced by seasonal changes in atmospheric circulation. Climate patterns differ across the state. Precipitation in Louisiana is largely due to convectional activity and extratropical storms during the summer and winter months, respectively. Summer precipitation is most common during the mid-afternoon. Winter precipitation is associated with extratropical storms and cold front passages.

Southern Louisiana records smaller annual temperature variations and higher average annual rainfall than northern Louisiana because it is closer to the influences of the Gulf of America. Generally, the average annual temperature throughout parishes wholly or partially within the boundaries of Region 2 is approximately 68.8°F, with an average annual maximum temperature of 77.5°F and average annual minimum temperature of 60.1°F (NOAA 2024). Average annual precipitation in this area is 61.3 inches. In Region 3, the average annual temperature is approximately 68.5°F, with an average annual maximum temperature of 77.8°F and average annual minimum temperature of 59.2°F inches. Average annual precipitation for parishes in Region 3 is 60.6 inches (NOAA 2024). In southeast Louisiana, which includes Regions 2 and 3, freezing temperatures (32°F or lower) are recorded 7 days during an average year (NOAA NWS n.d.a.).

2.1.2 **Air Quality**

The Air Field Services Section of LDEQ maintains a statewide monitoring network that consists of 35 stationary ambient air-monitoring stations (LDEQ n.d.a). In addition, there are multiple temporary located community (TLC) monitoring stations and mobile air monitoring labs (MAML) (LDEQ n.d.a). The data collected are used to determine compliance with national ambient air quality standards and track trends in air quality.

Within Region 2, there are two ambient air monitoring sites (the Marrero TLC located in Jefferson parish and St. James continuous site located in St. James parish). In Region 3, there are two ambient air monitoring sites (one in Lafourche and one in Terrebonne 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 outperforms the primary standard is classified as an attainment area. Areas that violate national ambient air quality standards 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.
Standards for each pollutant and attainment status for Louisiana are provided at https://www.deq.louisiana.gov/page/ambient-air-monitoring-program.

2.1.3 **Water Quality**

As part of the Surface Water Monitoring Program, LDEQ routinely monitors 26 parameters on a monthly basis using a four-year cycle fixed site network, as well as a long-term network of 21 sites (LDEQ 2022). 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 2022). Based on existing data, water quality is determined to be either fully supporting or not supporting those uses.

LDEQ maintains a website and web portal where results of water quality monitoring can be viewed (https://deq.louisiana.gov/page/ambient-water-quality-monitoring-data). There are currently 487 monitoring subsegments in Louisiana with 52 of those wholly or partially located within the boundaries of RRP Program Region 2 and 82 completely or partially located within the boundaries of Region 3 (LDEQ n.d.b).

2.2 Ecological Environment

Broad descriptions of habitat types and common biota present in Regions 2 and 3 are provided in the RRP Program FPEIS (NOAA et al. 2007) and are summarized in Appendices A and B. A summary of the natural communities as well as a listing of the Threatened and Endangered Species specific to these Regions are provided in the following sections.

2.2.1 Natural Community

RRP Regions 2 and 3 are geographically adjacent on the southeast Louisiana coast and all four incidents occurred in Gulf Coast Marsh MLRA. Gulf Coast marsh is comprised of salt, brackish, intermediate, and freshwater marsh types that extend across the coastal region. Associated natural communities include cypress-tupelo-blackgum swamps, live oak natural levee forests of the southeast coast, and some bottomland hardwood forests (Holcomb et al. 2015). More comprehensive h abitat information can be found in the following source documents: Ecoregions of Louisiana (Daigle et al. 2006), the Louisiana Wildlife Action Plan (Holcomb et al. 2015), and Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin (USDA NRCS 2022).

2.2.2 Threatened and Endangered Species

The Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. § 1531, et seq.) instructs federal agencies to carry out programs for the conservation of endangered and threatened species and to conserve the ecosystems upon which these species depend. The LDWF's Wildlife Diversity Program website provides information on species that are of special concern to the state of Louisiana. The Federal status (USFWS IPaC 2026) and State rank (LDWF n.d.a) of the species known to occur on the land or in the waters around RRP

Regions 2 and 3 are provided in Table 2.2. Listed marine mammals that reside in the Gulf and their status are also included (NOAA 2025).

There is one Final (Piping Plover) and one Proposed (Rufus Red Knot) critical habitat area identified in Regions 2 and 3 as defined by the United States Fish and Wildlife Service (USFWS IPaC 2026).

Table 2.2 Threatened and Endangered Species that may be Found in Regions 2 and/or 3

Species	Federal Status	State Rank	Region(s)
Mammals			
Big Brown Bat *(Eptesicus fuscus)*	n/a	S2	2
Eastern Spotted Skunk *Spilogale putorius*	n/a	S1	2
Long-tailed Weasel *Mustela frenata*	n/a	S3	2
Red Wolf *(Canis rufus)*	n/a	SX	3
Tri-colored Bat *(Perimyotis subflavus)*	Proposed Endangered	n/a	2,3
Marine Mammals			
Rice's Whale *Balaenoptera ricei*	Endangered	n/a	2, 3
Sperm Whale *Physeter macrocephalus*	Endangered	n/a	2, 3
West Indian Manatee *Trichechus manatus*	Threatened	S2	2, 3
Birds			
American Oystercatcher *Haematopus palliates*	n/a	S1	2,3
Black-capped Petrel *Pterodroma hasitata*	Endangered	n/a	2
Common Ground Dove *Columbina passerina*	n/a	S1B, S2N	3
Eastern Black Rail *Laterallus jamaicensis jamaicensis*	Threatened	S1B, S2N	2, 3
Piping Plover *Charadrius melodus*	Threatened	S2N	2, 3
Rufa Red Knot *Calidris canutus rufa*	Threatened	S2N	2, 3
Sandhill Crane *Antigone Canadensis*	n/a	S2N	3

Species	Federal Status	State Rank	Region(s)
Snowy Plover *Charadrius nivosus*	n/a	S1B, S2N	2,3
Sooty Tern *Onychoprion fuscatus*	n/a	S1B	2
Swallow-tailed Kite *Elanoides forficatus*	n/a	S1, S2B	3
Whooping Crane *Grus americana*	EXPN	n/a	3
Wilson's Plover *Charadrius wilsonia*	n/a	S1N, S2B	2,3
Fish			
Alabama Shad *Alosa alabamae*	n/a	S1	2
Bigscale Logperch *Percina macrolepida*	n/a	S2	3
Bluntface Shiner *Cyprinella camura*	n/a	S2	2
Flagfin Shiner *Pteronotropis signipinnis*	n/a	S2	3
Gulf Sturgeon *Acipenser oxyrhynchus desotoi*	Threatened	S1	2
Pallid Sturgeon *Scaphirhynchus albus*	Endangered	S1	2, 3
Smalltooth Sawfish *Pristis pectinata*	Endangered	S1	2, 3
Reptiles/Amphibians			
Alligator Snapping Turtle *Macrochelys temminckii*	Proposed Threatened	S3	2, 3
Eastern Glass Lizard *Ophisaurus ventralis*	n/a	S3	2,3
Four-toed Salamander *Hemidactylium scutatum*	n/a	S1	2
Hawksbill Sea Turtle *Eretmochelys imbricata*	Endangered	n/a	2, 3
Kemp's Ridley Sea Turtle *Lepidochelys kempii*	Endangered	n/a	2, 3
Loggerhead Sea Turtle *Caretta caretta*	Threatened	S1B, S3N	2, 3
Ornate Chorus Frog *Pseudacris ornate*	n/a	SH	2

Species	Federal Status	State Rank	Region(s)
Pygmy Rattlesnake *Sistrurus miliarius*	n/a	S2	2,3
Western Chicken Turtle *Deirochelys reticularia miaria*	n/a	S2	2,3

Note: *Threatened and Endangered species are listed by parish in the source documents for State ranks referenced here. Regions do not follow parish boundaries. Regional Plans include data from the whole parish that may only be partially located within that Region's boundaries. Therefore, some species listed in Table 2.2 may be outside the boundary of Regions 2 or 3, but located in a parish that partially lies within the Regions.*

EXPN: A population that has been established within its historical range under section 10(j) of the Endangered Species Act (ESA) to aid recovery of the species. The Service has determined that a non-essential population is not necessary for the continued existence of the species. For the purposes of consultation, non-essential experimental populations are treated as threatened species on National Wildlife Refuge and National Park land (require consultation under 7(a)(2) of the ESA) and as a proposed species on private land (no section 7(a)(2) requirements, but Federal agencies must not jeopardize their existence (section 7(a)(4))).

S1: critically imperiled; at very high risk of extirpation in Louisiana due to very restricted range, very few populations or occurrences (five or fewer known populations), very steep declines, severe threats, or other factors
S2: imperiled; at high risk of extirpation in Louisiana due to restricted range, few populations or occurrences (6 to 20 extant populations), steep declines, severe threats, or other factors
S3: vulnerable; at moderate risk of extirpation in Louisiana due to a fairly restricted range, relatively few populations or occurrences (21 to 100 extant populations), recent and widespread declines, threats, or other factors
SH: possibly extirpated (species) or possibly eliminated (ecosystems); known from historical occurrences and not detected for 20 or more years, but rediscovery may be possible
SX: presumed extirpated (species) or presumed eliminated (ecosystems); believed to be extirpated or eliminated from the Louisiana landscape (equivalent to "Regionally Extinct" in IUCN Red List4 terminology).

State Rank Qualifiers B and N: if a species' occurrence or abundance in Louisiana is seasonal or otherwise temporally dependent, State Ranks may contain qualifiers to designate separate ranks; this is most commonly found in birds or other migratory elements. Resident populations of species that are not augmented by migrant populations and migrant species in which abundance remains the same for both breeding and non-breeding will not have qualifiers; instead, those species receive a single rank applicable the entire year (e.g., Greater Roadrunner, a resident species not augmented by migrants, is ranked S3).
S#B: breeding; numerical rank refers to the breeding population of the species; if not followed by "S#N," then the species is only found in Louisiana during its breeding season (e.g., Swainson's Warbler breeds in Louisiana but is absent from the state in nonbreeding season; its State Rank is S4B)
S#N: non-breeding; numerical rank refers to the non-breeding population of the species; if not preceded by "S#B," then the species is only found in Louisiana during its non-breeding season
S#B, S#N: breeding, non-breeding; numerical ranks refer to breeding and non-breeding populations, respectively (e.g., Grasshopper Sparrow is a critically imperiled breeding species, but the species occurs in greater abundance in non-breeding season; its State Rank in Louisiana is S1B, S3N)

2.3 Cultural and Socioeconomic Resources

2.3.1 Culture

Louisiana's culture has roots in both French and Spanish heritage but has been influenced by the presence of Native Americans and the many waves of immigrants to the area over the years (including Irish, German, Italian, Czech, Hungarian, Croatian, Filipino, Hispanic, and East Asian settlers). However, the cultural environment is not homogeneous throughout the state. Scholars typically divide the state into three major cultural regions: New Orleans, South Louisiana, and North Louisiana, each with its own history, influences, and traditions (Louisiana Division of the Arts 2019). Region 2 falls within the South Louisiana cultural region. South Louisiana has a very strong "Cajun" culture, the term being a local version of "Acadian." The Cajun culture of today is a result of the blending of the native residents and the Acadians, the descendants of French Acadians who were expelled from Nova Scotia by the British in the mid 1700's. This French Cajun influence is evident in the music, food, and customs of this area of South Louisiana (Louisiana Division of the Arts 2019).

The National Register of Historic Places (NRHP) is the official list of the Nation's historic places worthy of preservation. Significant archaeological and architectural properties are defined by eligibility criteria for listing on the NRHP in consultation with the Louisiana Office of Cultural Development, Division of Historic Preservation, which functions as the State Historic Preservation Office (SHPO) in Louisiana. The NRHP lists 1,516 historic districts, buildings, and structures in the State of Louisiana with 364 in the parishes of Region 2 and 176 in the parishes of Region 3 (NPS 2024a).

Region 2

Some of the larger cities within Region 2 include Gretna on the westbank of the Mississippi River near New Orleans and Port Fourchon in Bayou Lafourche. The town of Grand Isle is also located in Region 2.

Gretna is located across the Mississippi River from New Orleans on the westbank on land that was a former plantation from approximately 1750 until 1836 when the city was founded (City of Gretna 2022). The city of Gretna quickly became home to many German immigrants who played a vital role in the city's development and whose descendants became some of Gretna's most prominent citizens. The city grew during the 19th century with the establishment of the railroads and a ferry landing on the river that provided easy access to markets in New Orleans. Further growth occurred in 1958 when the Mississippi River Bridge and the Westbank Expressway were established creating quick and convenient access to New Orleans (City of Gretna 2022).

Bayou Lafourche, formerly a Mississippi River distributary, marks the western boundary of Region 2 and was the site of some of the first settlements of Acadians in southern Louisiana. According to the Lafourche Parish website (About Lafourche 2020), the area was given the name "LaFourche Des Chetimachas," named after the indigenous people of the region. Port Fourchon, at the southern edge of the bayou, plays a strategic role in supplying the country with up to 18% of its entire oil supply and is the base of the Louisiana Offshore Oil Port (LOOP), which handles 10-15% of the nation's foreign oil and is associated with approximately 50% of US refining capacity. Today, the oil industry, fishing, and ship building thrive in the area (About Lafourche 2020).

Grand Isle, Louisiana's only inhabited barrier island, was settled in the 1780's while Louisiana was under Spanish rule (Town of Grand Isle 2024). Prior to the civil war, plantations raising sugar cane, cotton and cattle were common. Following the Civil War, the number of plantations declined as tourism surged but a devastating hurricane struck the area in 1893 and temporarily halted the tourism trade. The island rebounded and today, the seafood and oil industries as well as tourism dominate in the area (Town of Grand Isle 2024).

Region 3

Some of the larger cities within Region 3 include Houma, Morgan City, and the portion of Thibodaux that lies south of Bayou Lafourche.

According to the Terrebonne Parish Consolidated Government website (TPCG 2024), Houma (named after the Native American tribe who settled there) was founded in 1834 and incorporated as a city in 1848. At that time, the economy in the region was dominated by sugar plantations, seafood, fur-trading, and logging industries. In 1929, the oil and gas industry emerged in the area. By 1960, as a result of the discovery of offshore oil and natural mineral resources, Houma was one of the fastest growing cities in America. The oil industry collapse in the 1980s devastated the local economy and today, although the oil industry dominates, healthcare and tourism have helped revitalize the area.

The website for the city of Morgan City provides a brief glimpse into the origins and defining characteristics of the city (City of Morgan City 2011). According to the history provided, Morgan City's location on the Atchafalaya River made it a center for trade (animal fur, cypress timber, and seafood) in the mid to late 1800's. The late 1800's and early 1900's ushered in an era of boat building, moss picking, and the construction of a shell crushing plant that boosted the area's economic base. In the 1940's, the first offshore oil well drilled out of sight of land was constructed and the ensuing "black gold rush" marked a new era of prosperity for the city.

2.3.2 Population

The population of the State of Louisiana was over 4.5 million in 2023 (US Census Bureau 2023a). Population in Region 2, encompassing all or parts of the parishes which fall within the regional boundary, totaled over 1.2 million and ranged from 19,191 (in St. James Parish) to 421,777 (in Jefferson Parish). Population in Region 3 totaled 441,595 and ranged from 20,160 (in Assumption Parish) to 103,616 (in Terrebonne Parish) (US Census Bureau 2023a).

According to US Census Bureau data (2023a), the population of the State of Louisiana and those parishes included in Regions 2 and 3 is primarily White and Black or African

American with American Indian/Alaskan Native, Asian, Native Hawaiian/Pacific Islander, and Hispanic/Latino also reported.

2.3.3 Infrastructure and Public Services

Physical infrastructure and public services include commonly provided federal, state, parish, municipal, and/or private facilities that support development and protect public health and safety. This includes, but is not limited to, transportation (highways, roads, bridges, ferries, rails, airports, ports, and navigation), flood protection (levees, floodways, channel improvement and stabilization, and principal tributary basin improvements), health care facilities, and police and fire protection. The following table (Table 2.3) provides information about infrastructure in the State of Louisiana and in RRP Regions 2 and 3.

Table 2.3 Infrastructure (with approximate counts/number of miles) in Louisiana and RRP Program Regions 2 and 3 (LDWF n.d.b; Louisiana Legislative Auditor 2024; US DOT 2023; US Census Bureau 2023b)

Infrastructure Type	Louisiana	RRP Region 2	RRP Region 3
Roads	135,408 miles	5,232 miles	3,797 miles
Railways	3,255 miles	186 miles	53 miles
Airports, Heliports, & Seaplane Bases	463	41	28
Bridges	12,715	395	378
Locks	26	2	1
Dams	705	2	0
Ferries	16	6	2
Ports	42	6	2
Boat Ramps & Marinas	597	38	43

Region 2

Within the boundaries of Region 2 lie numerous bays, bayous, swamps, lakes, and waterways including Bayou Lafourche, Lac des Allemands, Lake Salvador, the Barataria Basin, Breton Sound, as well as portions of the Mississippi River and the Bird's Foot Delta. The northern border of Region 2 follows the Mississippi River from Donaldsonville to New Orleans while the southern border runs from Port Fourchon to Breton Sound.

The Gulf Intracoastal Waterway (GIWW) runs from Texas to Florida, passing through Region 2 and utilizing many bays and lakes to provide a navigable throughway for deep-draft vessels. According to United State Army Corps of Engineers (USACE) documentation (USACE n.d.), the GIWW has been referred to as the most remarkable artery of transportation in America. It stretches for more than 1,300 miles from Brownsville, Texas to Apalachicola, Florida with the Louisiana segment measuring 302.4 miles (west to east). The GIWW Alternate Route from Port Allen to Morgan City adds an additional 64 miles to its Louisiana footprint. In Region 2, the USACE New Orleans District, operates and maintains the GIWW and two of its locks (Algiers and Harvey).

There are two major ports in Region 2: Plaquemines Port District and Port Fourchon; as well as four smaller ports (Louisiana Legislative Auditor 2024). Plaquemines Port District is located along the Mississippi River and was ranked as the 12th busiest port in the nation by tonnage in 2023 (US DOT 2023). Port Fourchon is Louisiana's southernmost port, located on the southern tip of Lafourche Parish, on the Gulf of America. Port Fourchon sits at the mouth of Bayou Lafourche, where it empties into the Gulf of America and is easily accessible from any area in the Gulf of America and Caribbean. Located at the end of Highway 1 in Louisiana, Port Fourchon is in the center of one of the richest and most progressive industrial areas in the Gulf region. Port Fourchon is a multi-use coastal port that functions primarily as a land base for multiple offshore energy support service companies. It is a seaport, with significant petroleum industry traffic from offshore Gulf oil platforms and drilling rigs as well as the LOOP pipeline. Fourchon's primary service markets are domestic deepwater oil and gas exploration, drilling, and production in the Gulf.

The major interstate located in Region 2 is I-310. Major highways in the region include highways 1, 18, 23, 39, 45, 70, 90, 182, and 3127. Rail lines in Region 2 include the Texas and Pacific, Southern Pacific, and Missouri Pacific. Region 2 also includes Naval Air Station Joint Reserve Base New Orleans, which is located near Belle Chasse.

Region 3

Within the boundaries of Region 3 lie many bays, bayous, swamps, lakes, and waterways including Vermilion Bay, Terrebonne Bay, West Cote Blanche Bay, Bayou Lafourche, Lake Hackberry, Lake Barre, and portions of the Atchafalaya River. The northern border of Region 3 runs east from approximately Palmetto Island State Park to Morgan City before heading north to Paincourtville and then heading southeast to Port Fourchon. The southern border of Region 3 lies along the Gulf coast from Freshwater Bayou Canal at the west to Bayou Lafourche at the Region's southeastern point. The Gulf Intracoastal Waterway (GIWW) runs through Region 3 from Texas to Florida and utilizes many of these bays and lakes to provide a navigable throughway for deep-draft vessels.

There are two major ports in Region 3: the Port of Terrebonne and the port at Morgan City (Ports of Louisiana n.d., US DOT 2023). The Port of Terrebonne is linked to the Gulf of America and to the busy Port Fourchon through the Houma Navigation Canal. The Port of Morgan City is located at the juncture of the Atchafalaya River and the Intracoastal Waterway, making it accessible to ocean-going as well as local traffic (Port of Morgan City n.d.).

Other infrastructure in Region 3 includes major highways (1, 24, 56, 57, 70, 83, 90, 315, and 317) and rail lines (Southern Pacific, Burlington Norther, and Santa Fe). Airports in Region 3 include Thibodeaux Municipal and Houma-Terrebonne. Nicholls State University is located in Thibodeaux in Region 3.

2.3.4 **Economy**

The oil and gas industry plays a key role in Louisiana's economy. The United States Energy Information Administration (USEIA) website provides data and analyses on Louisiana's energy consumption and production (USEIA 2024). Information is updated periodically and statistics quoted here reflect the most recent information available at the time of this writing. Louisiana accounts for about 10% of U.S. total marketed natural gas production (ranked third among the States) and holds about 6% of the nation's natural gas reserves (ranked seventh among the States). Louisiana's 15 oil refineries account for approximately one-sixth of the United States' refining capacity, processing about 3.0 million barrels of crude oil per day (USEIA 2024).

According to the April 2023 "Impacts of the Oil and Natural Gas Industry on the US Economy in 2021" report prepared for the American Petroleum Institute (PwC 2023), in 2021, the oil and gas industry directly and indirectly supported 346,710 total jobs (91,720 direct and 254,990 indirect) or 13.1 percent of Louisiana's total employment. The industry generated an additional 2.8 jobs elsewhere in Louisiana's economy for each direct job in the state's natural gas and oil industry. The industry provided $25.8 billion in labor income ($10.7 billion direct and $15.0 billion indirect) to Louisiana, 16.7 percent of the state's total and contributed $54.3 billion to Louisiana's total gross domestic product ($29.2 billion direct and $25.1 billion indirect), 21.0 percent of the state's total (PwC 2023). ShaleXP Oil & Gas Visualization and Research tool reported that in June 2024, the parishes that comprise RRP Region 2 produced over 495,000 barrels of oil and Region 3 parishes produced over 542,000 barrels (ShaleXP 2024).

Region 2

Agricultural production of crops, livestock, poultry, and other products accounted for approximately $326.6 million in market value of products sold in 2022 in Region 2 parishes (USDA 2024). Sales of crops were higher than sales of livestock, poultry, and other products in Region 2 parishes (Ascension, Assumption, Lafourche, Orleans, and St. Charles). In Plaquemines and St. Bernard Parishes, sales of livestock, poultry, and other products were higher than sales of crops. Sugarcane, soybeans, hay, vegetables, and citrus (oranges and tangerines) are the primary crops grown in Region 2 (USDA 2024).

Region 2 includes Breton Sound and the Barataria Basin, two major fisheries located in coastal Louisiana. The fisheries of Louisiana are a vital part of the state's economy. They provide jobs, income, and tax revenue. One out of every 70 jobs in Louisiana is related to the seafood industry, which as a whole has an economic impact of over $2.4 billion annually for Louisiana (LA Seafood n.d.). The shrimp industry accounts for 15,000 jobs and an annual impact of $1.3 billion for Louisiana. Seventy percent of the oysters caught in the U.S. are from the Gulf Coast. Louisiana's commercial oyster industry, which accounts for almost 4,000 jobs, has an economic impact of $317 million annually. Crabs from Louisiana generate an annual economic impact of $293 million and more than 3,000 jobs (LA Seafood n.d.).

Region 3

Farming is prevalent in the northern parts of Region 3 in the Southern Mississippi River Alluvium MLRA. Rice is grown in some land-leveled, flood-irrigated areas and catfish and crawfish are produced commercially on farm ponds contained by levees (Weindorf 2008). Much of the southernmost coastal area of the region is uninhabited marshland that provides habitat for migratory birds, fur bearing animals, and alligators. This area is used by hunters, fishermen, and wildlife observers who supplement the economy of the region through tourism and fees.

Agricultural production of crops and livestock, poultry and other products accounted for approximately $810.2 million in market value of products sold in 2022 in Region 3 parishes (USDA 2019). Sales of crops were higher than sales of livestock, poultry, and other products in all Region 3 parishes. Sugarcane, soybeans, vegetables, hay, and rice are the primary crops grown in Region 3 (USDA NRCS 2019).

According to a University of New Orleans Hospitality Research Center report (2023), the Houma-Thibodeaux area of Region 3 attracts most of the foreign and domestic tourists. In 2022, the Houma-Thibodeaux area had visitor spending (domestic and foreign visitors) of $268 million, which was seventh in the state. Houma-Thibodeaux contributed $88 million in direct earning, about 3,000 direct jobs were generated by visitor spending, and it generated $20 million in state and $11 million in local taxes (University of New Orleans 2023).

2.3.5 **Land Management and Ownership**

The United States Fish and Wildlife Service (USFWS) manages 22 National Wildlife Refuges (NWRs) in Louisiana with one located in Region 2: Delta NWR. Three fall within the boundaries of Region 3: Bayou Teche, Shell Keys, and Mandalay National Wildlife Refuges (USFWS n.d.a).

The LDWF manages more than 1.6 million acres of Louisiana’s land and waterways as wildlife management areas (WMAs), refuges, and conservation areas (LDWF n.d.c). Five WMAs are wholly or partially located within Region 2: Elmer’s Island Wildlife Refuge, Lake Boeuf WMA, Pass A Loutre WMA, Salvador WMA, and Timken WMA (LDWF n.d.b). There are three WMAs and three Wildlife Refuges wholly or partially located in Region 3: Atchafalaya Delta WMA, Elm Hall WMA, Pointe Aux Chenes WMA, Isles Dernieres Barrier Islands Refuge, Marsh Island Wildlife Refuge, and State Wildlife Refuge (LDWF n.d.c).

There are two National Heritage Areas (NHAs) in Louisiana: Cane River NHA and Atchafalaya NHA. NHAs are regions with concentrations of significant natural, scenic, cultural, historic, and recreational resources. They are partnerships where residents, businesses, local governments, and state and federal agencies collaborate to create more inviting and economically sustainable regions to live and recreate. One of these areas, the Atchafalaya NHA, is located (partially) within the boundaries of Region 2 and 3. It was established in 2006 and stretches across 15 parishes in south-central Louisiana. (Atchafalaya NHA 2026).

The Louisiana Office of State Parks manages 16 State Historic Sites and 23 State Recreational Parks and Preserves in Louisiana (Louisiana Office of Tourism & Office of the Lt. Governor 2026). Region 2 contains three state parks: Bayou Segnette, Fontainebleau, and Fairview Riverside State Parks. Region 3 contains two state parks: Cypremort Point State Park and Palmetto Island State Park.

The United States National Park Service (NPS) manages five national parks and one national historic trail in Louisiana (NPS 2024a). NPS has one park partially located within Regions 2 & 3: Jean Lafitte National Historical Park and Preserve. Barataria Preserve is the only site within the boundaries of Region 2. Barataria Preserve offers more than 26,000 acres to explore, fish, hunt, and view wildlife (NPS 2024b). Wetlands Acadian Cultural Center is the only site within the boundaries of Region 3 (NPS 2024b).

Louisiana is home to four federally recognized sovereign nations and eleven state-recognized tribes (Louisiana Office of Indian Affairs 2024). Within Region 2, there are two state recognized sovereign nations, the Bayou Lafourche Band of Biloxi-Chitimachas and United Houma Nation. Within Region 3 there are five recognized by the state: the Bayou Lafourche Band of Biloxi-Chitimachas, the Grand Caillou/Dulac Band of Biloxi-Chitimacha-Choctaw, the Jean Charles Choctaw Nation, the Pointe au Chien Tribe, and the United Houma Nation.

3.0 INJURY ASSESSMENT AND QUANTIFICATION

3.1 Assessment Activities and Findings

The Trustees initiated preassessment activities for the discharges shortly after notification of each incident. The Trustees focused on collecting ephemeral data that would address three criteria defined by the OPA (15 CFR §990.42) and OSPRA (LAC 43:XXIX.101 *et seq.*): 1) injuries have resulted or probably 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. The following summaries describe the assessment activities and findings conducted for each incident. Associated photographs can be found in Appendix C for all four incidents.

For each of the four incidents, the Trustees utilized the pre-identified potentially injured trust resources and services described in Section 4.2.2 of the RRP Program FPEIS (NOAA et al. 2007) early in the Preassessment phase of the NRDAs. Although only broadly defined, the potentially injured trust resources and services categories assist the Trustees in determining early on in the Preassessment phase of an incident the trust resources and services that may be injured as a result of the incident. In addition, preassessment activities were conducted during and after the response for all four incidents. The Trustees used information collected during the response, such as ground-level photos, maps, Incident Action Plans (IAPs), air monitoring reports, and wildlife response reports, to begin to evaluate injuries caused by the discharged oil and response actions.

Although appropriate actions were taken during response for each of these incidents, impacts to the environment were not fully restored and interim ecological service losses were anticipated to ensue. As described in the sections below, the findings of this preassessment evaluation support the Trustees' determination that sufficient evidence exists to proceed with injury assessment and restoration planning under OPA and OSPRA.

3.1.1 Bay St. Elaine Incident

This incident occurred in Terrebonne Bay, approximately 3.8 miles southwest of Cocodrie, impacting saline marsh (consisting primarily of *Spartina* spp.) and the surrounding waterways (see Figure 1.1).

Preassessment activities were conducted during and after the Emergency Response phase of the spill to determine whether injury occurred to natural resources and services. The initial spill impact area was delineated by the Trustees and Hilcorp during the Emergency response phase using photos, maps, and IAPs. Based on the information collected, the Trustees considered potential natural resource and service injuries to the following two resource categories: 1) saline marsh vegetation, marsh sediments and associated soil infauna, and 2) Diamondback Terrapin. Although benthic organisms in tidally-exposed mudflats, water column organisms, birds, and other wildlife species had the potential to be injured from the discharge, it was the opinion of the Trustees that documented saline marsh habitat and terrapin injuries would represent the overall injury to natural resources and services from the Bay St. Elaine Incident. Table 3.1 details the case-specific as well as the RRP Program injured resource and service categories (NOAA et al. 2007).

Table 3.1 Case-specific Injured Resource and RRP Program Injured Resource and Service Category for the Bay St. Elaine Incident

Case-Specific Injured Resource	RRP Program Injured Resource and Service Category
Saline Marsh	Coastal Herbaceous Wetland (CHW)
Diamondback Terrapin	Wildlife

3.1.1.1 Impacts to Habitat

During response, near the source, heavily oiled vegetation was cut and removed from the site in order to facilitate thick oil trapped in vegetation to be removed. On 11/19/2014, Trustees, in cooperation with Hilcorp, conducted a preassessment NRDA site visit at the spill area. Visual observations documented by Trustees included oiled vegetation, rainbow sheen on the water's surface, oil droplets on the water's surface and additional oil droplets being emitted from the sediments upon physical disturbance of the sediments, and areas where standing marsh grass was visibly reduced or eliminated due to airboat traffic (see Appendix C). An additional NRDA preassessment site visit was conducted on 02/19/2015. In March 2015 the Trustees and Hilcorp developed a NRDA Preassessment Plan for monitoring recession and degradation of marsh vegetation as a result of exposure to oil or response actions from the incident. The objective of the preassessment plan was to document and measure the potential recession of marsh vegetation over time at sites exposed to oil and measure the potential degradation or recovery of marsh associated with response actions. Monitoring events occurred on 03/24/2015 and 09/22/2015. Approximately 103.54 acres of marsh was exposed and injured due to the result of the incident (Figure 3.2).

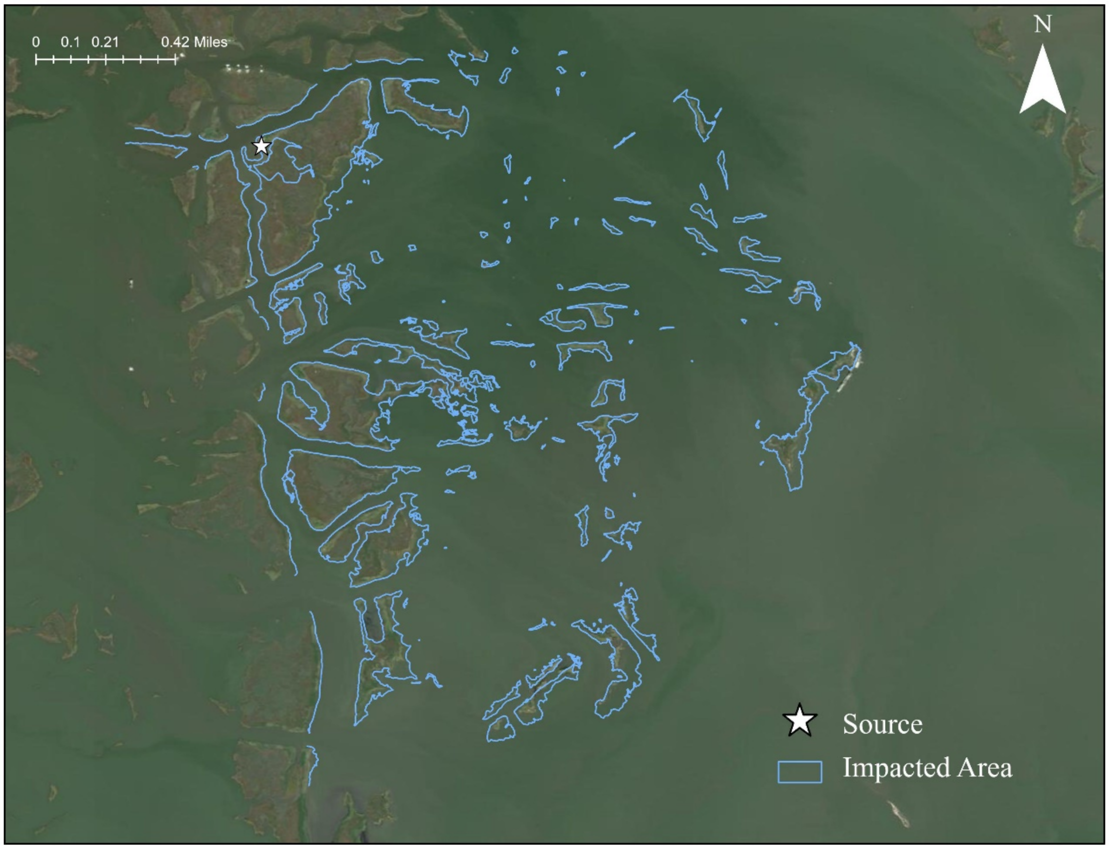

Figure 3.1 Area impacted by the Bay St. Elaine Incident

In the fall of 2015, the landowner conducted a planting of *Spartina alterniflora* in the areas experiencing marsh dieback. The Trustees were not notified prior to commencement of the activity so were not a part of the planning and implementation of the planting. On 02/29/2016, the Trustees conducted a site visit to investigate planting and observed a failure of most of the plantings to survive.

3.1.1.2 Impacts to Wildlife

Although the incident and associated response activities potentially impacted a variety of fauna, for this case diamondback terrapin represent the wildlife injury category. During a NRDA preassessment site visit on 9/22/2015, Trustees incidentally discovered eight diamondback terrapin carcasses on an elevated ridge adjacent to the location of the incident source (see Appendix C). After discovering the diamondback terrapin carcasses in the vicinity of the incident and noting that all carcasses appeared to be in a similar state of decomposition with time of death estimated to be coincident with the oil spill, the Trustees decided that further evaluation of potential injury to diamondback terrapins was warranted. The Trustees proposed the implementation of a systematic search for diamondback terrapin (alive or dead), Hilcorp approved the plan, and the cooperative field effort commenced on 2/29/2016. An additional ten diamondback terrapin carcasses were found during this effort.

3.1.2 **Lake Grand Ecaille Incident**

This incident occurred in a saline/brackish marsh dominated by *Spartina alterniflora* within Lake Grand Ecaille, a body of water located to the east of Barataria Bay and north of Chenier Ronquille impacting saline/brackish marsh (see Figure 1.1)

Preassessment activities were conducted during and after the Response phase to determine whether injury occurred to natural resources and services. The Trustees first used information collected during response such as ground photos, maps, and IAPs to begin to evaluate habitat exposure to the discharged oil. Impacts to the habitat were a result of oil intrusion and response activities to clean up the oil. Based on the information collected, the Trustees considered potential natural resource and service injuries to the following resource category: saltmarsh vegetation, marsh sediments and associated soil infauna. Although benthic organisms, water column organisms, birds, and other wildlife species had the potential to be injured from the discharge, it was the opinion of the Trustees that documented saline/brackish marsh would represent the overall injury to natural resources and services from the Lake Grand Ecaille Incident. The Lake Grand Ecaille case-specific injured resource was saline/brackish marsh and the RRP Program injured resource and service category was CHW (NOAA et al. 2007).

3.1.2.1 Impacts to Habitat

The Trustees noticed shortly after the spill occurred that oiled marsh shoreline was beginning to slough-off, or erode, at locations near the source. The oil resulted in immediate impacts to marsh vegetation through direct contact and coating of plant surfaces. As a result, the Trustees and Hilcorp conducted three NRDA preassessment site visits on 07/28/2016, 10/05/2016, and 06/08/2017. The objective of the NRDA preassessment site visits was to document the oiling along the marsh shoreline. During the three NRDA preassessment site visits that were conducted to assess the ongoing marsh impacts, the Trustees and Hilcorp traveled through the waterways and marshes by boat to observe and photograph the area. Observations showed sheen emanating from disturbed sediments as well as varying degrees of oiling on marsh vegetation. The Trustees determined that approximately 60.53 acres of marsh was exposed and injured due to the result of the incident (Figure 3.2, see Appendix C).

Figure 3.2 Area impacted by the Lake Grand Ecaille Incident

3.1.3 Bay Long Incident

The Bay Long Incident occurred near the western end of Chenier Ronquille, approximately 9 miles northeast of Grand Isle in Bay Long, a sub-estuary of Barataria Bay. This incident impacted the waters of Bay Long as well as connecting waterways, saline marshes, nearby barrier islands, water column organisms, birds, and other wildlife. Section 2.2 describes this habitat.

Preassessment activities were conducted during and after the response to determine whether injury occurred to natural resources and services. The Trustees used information collected during response, such as response ground and overflight photography, maps, IAPs, and LDWF wildlife observations, to begin to evaluate exposure to the discharged oil. Based on the information collected, the Trustees identified birds as the primary injury category. Although barrier island and salt marsh habitats (including the services these resources provide), benthic organisms, water column, and other wildlife species had the potential to be injured from the discharge, it was the opinion of the Trustees that the documented bird injury would represent the overall injury to natural resources and services from this incident. The Bay Long Incident case-specific injured resource was marsh and non-marsh birds and the RRP Program injured resource and service category was Birds (NOAA et al. 2007).

3.1.3.1 Impacts to Birds

The area impacted as a result of the spill is characterized by high avian use, as evidenced by the restoration project that was under construction at the time of the spill. The Trustees determined that the oiling map depicted in Figure 3.3 documented observations during the Response and Preassessment phases. Oiling observations were made over a period of eight days and were overlaid into one map to depict not only the extent of oiling but, to the degree possible, the areas of re-oiling. The area is frequently utilized for avian foraging, roosting, and/or nesting, and, as a result, there was a credible risk of bird exposure or injury due to the spill. Shortly after the incident occurred, Wildlife Response Services established a wildlife rehabilitation center at the LDWF Marine Lab on Grand Isle, LA. Trained wildlife professionals representing both the Trustees and Hilcorp implemented foot and boat based searches between 09/05/2016 - 09/16/2016 (11 days) to document as well as capture/rehabilitate (if possible) oiled birds and wildlife. These data were also retained and evaluated for NRDA preassessment purposes. Table 3.2 details the over 26,800 observations made of birds dead or with varying degrees of oiling (e.g., no visible oil, unknown, oiled) during the course of the bird surveys.

Figure 3.3 Area impacted by the Bay Long Incident

Table 3.2 Bird observations from the Bay Long Incident

Species	Unknown Oiled Birds	No Visible Oil	Oiled Birds Trace	Oiled Birds Light	Oiled Birds Moderate	Oiled Birds Heavy	Proximity to Oil 0 (ft)	Dead	Total
American Avocet	0	2							2
American Oystercatcher	1	12					2		15
Barn Swallow	7	0							7
Belted Kingfisher	0	4							4
Black Skimmer	640	1013	1	8	1		447		2110
Black-bellied Plover	3	33			1				37
Black-Crowned Night Heron	10	39							49
Black-necked Stilt	0	2							2
Blue-winged Teal	0	60							60
Brown Pelican	769	589					45		1403
Caspian Tern	250	459		1			10		720
Cattle Egret	0	0		2	1				3
Clapper Rail	20	5		2	1	5		2	35
Double-crested Cormorant	1	19							20
Dunlin	0	2							2
Forster's Tern	0	5					1		6
Glossy Ibis	0	2							2
Great Blue Heron	0	21							21
Great Egret	3	177		5					185
Greater Yellowlegs	0	5			1				6
Green Heron	0	20							20
Herring Gull	8	0							8
Immature Night Heron Spp.	2	0							2
Laughing Gull	11791	5187	1	15	1		220	5	17220
Least Sandpiper	6	55	3	2			12		78
Least Tern	350	200							550
Lesser Yellowlegs	0	1							1
Little Blue Heron	0	214							214
Magnificent Frigatebird	0	4							4
Marbled Godwit	0	3							3

Species	Unknown Oiled Birds	No Visible Oil	Oiled Birds Trace	Oiled Birds Light	Oiled Birds Moderate	Oiled Birds Heavy	Proximity to Oil 0 (ft)	Dead	Total
Mottled Duck	1	2							3
Night Heron sp.	0	0			1				1
Osprey	0	1							1
Piping Plover	1	8							9
Plover Sp.	0	0		1					1
Red Knot	0	3							3
Reddish Egret	2	6							8
Reddish Egret (White morph)	0	2		1	4		2		9
Red-winged Blackbird	0	63					1		64
Ring-Billed Gull	100	60							160
Roseate Spoonbill	0	14					3		17
Royal Tern	428	1183					139	1	1751
Ruddy Turnstone	8	84	1	4	1		5		103
Sanderling	8	415	1	4	1		7		436
Sandpiper	0	350							350
Sandwich Tern	0	25					2		27
Seaside Sparrow	3	0							3
Semipalmated Plover	0	103	2	3			1		109
Short-billed Dowitcher	5	19	1	3			1		29
Snowy Egret	14	258	2	6	3	1	2		286
Snowy Plover	0	2					1		3
Spotted Sandpiper	0	7					1		8
Tricolored Heron	0	18		3					21
Western Sandpiper	0	16					3		19
White Ibis	41	218		14					273
White Pelican	0	1							1
Willet	3	179	2	18	4	1			207
Wilson's plover	4	65	1	9		3	1		83
Yellow-crowned Night Heron	1	49							50
Totals	**14480**	**11284**	**15**	**101**	**20**	**10**	**906**	**8**	**26824**

3.1.4 **Terrebonne Bay/Timbalier Island Incident**

This incident occurred approximately 14 miles west of Port Fourchon and approximately 2 miles north of Timbalier Island in Terrebonne Bay (see Figure 1.1). The incident and associated response activities impacted *Spartina* spp. and mangroves as well as algal and sand flats located in Terrebonne Bay on Timbalier Island and surrounding waterways. Section 2.2 describes the environmental setting as well as the social and cultural resources of this area.

The Trustees identified the following categories of injury: 1) mangroves, 2) *Spartina* marsh, 3) beach - algal flat, and 4) beach- sand flat. Although water column and benthic organisms, birds, and other wildlife species had the potential to be injured from the discharge, it was the opinion of the Trustees that documented barrier island habitat comprised of the injury categories detailed above would represent the overall injury to natural resources and services from the Terrebonne Bay/Timbalier Island Incident. Table 3.3 details the case-specific as well as the RRP Program injured resource and service categories (NOAA et al. 2007).

Table 3.3 Case-specific Injured Resource and RRP Program Injured Resource and Service Category

Case-Specific Injured Resource	RRP Program Injured Resource and Service Category
Saline Marsh	Coastal Herbaceous Wetland (CHW)
Mangrove Marsh	Coastal Herbaceous Wetland (CHW)
Sand Flat	Coastal Beaches, Shoreline, Streambeds (CBSS)
Algal Flat	Coastal Beaches, Shoreline, Streambeds (CBSS)

3.1.4.1 Impacts to Habitat

As was discussed in section 3.1.4, during the response, a thick coat of oil covered the beach (algal and sand flat) and seeped down into the substrate. In these areas, response personnel used flat shovels to scrape the surface and place the oil/sand mixture (along with oiled mangrove propagules) in bags for disposal. A total of 16,260 bags were filled with oiled sand and propagules and removed from the island for disposal. Response activity injuries included not only the removal of the oil/sand layer from the algal and beach flat areas, but the use of utility task vehicles (UTVs) and trailers along with foot traffic that caused trampling of small mangroves and *Spartina* as well as breakage of mangrove branches. In addition, an area of shoreline was cleared to allow a deck barge to access the shoreline for offloading of equipment and loading of bags for disposal. Response activities continued for approximately two months.

Preassessment activities were conducted during and after the Response phase to determine whether injury occurred to natural resources and services. The Trustees used information collected during response, such as ground-level photos, maps, IAPs, and wildlife response reports, to begin to evaluate habitat and fauna exposure to the discharged oil and response actions. Documentation of oiled habitat and fauna was used from a preassessment NRDA site visit conducted on 11/16/2016. Additionally, on 3/20/2017, the Trustees and Hilcorp conducted a NRDA preassessment site visit during which sampling plots were identified, staked, and data collected in oiled areas in accordance with a NRDA Preassessment Monitoring Plan that was finalized in April 2017. After conducting this site visit, the Trustees and Hilcorp agreed to conduct further monitoring using a drone to avoid unnecessary foot traffic and resultant trampling of the habitat. A Drone Protocol for Mangrove Monitoring was finalized on 4/4/2017 and three subsequent site visits employed drone technology to capture video and still photographs of the staked sampling plots as well as surrounding areas. These drone monitoring events took place on 4/4/2017, 8/8/2017, and 4/11/2018. The Trustees determined that approximately 34.59 acres of marsh was exposed and injured due to the result of the incident (Figure 3.4).

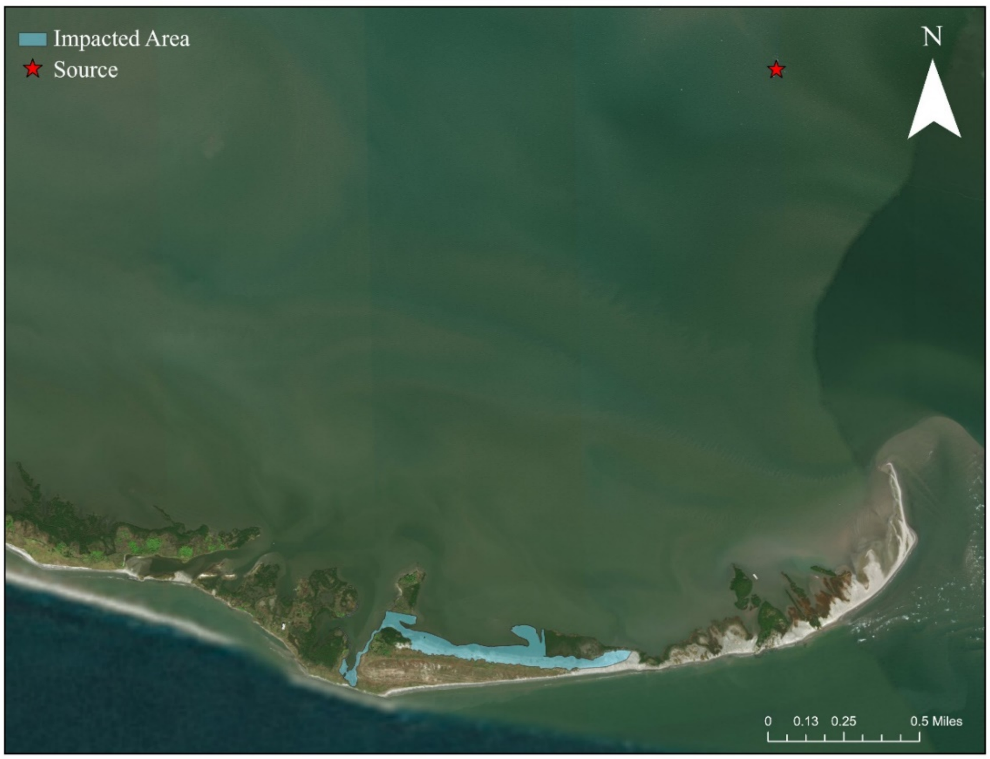

Figure 3.4 Habitat impacted by the Terrebonne Bay/Timbalier Island Incident

3.2 Injury Assessment Approach

As discussed in Section 1.3 of this document, 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 services at the spill site in order 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 phase of the incidents; 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.

The Trustees and Hilcorp agreed to employ 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 OSPRA (La. Rev. Stat. 30:2480[C][8]).

3.3 Injury Assessment Methods and Quantification

Injury assessment and quantification was performed separately for each individual incident and is described in the subsections for each incident below. Methodologies utilized included Habitat Equivalency Analysis (HEA) (NOAA 2006), Resource Equivalency Analysis (REA) (Sperduto et al. 2003), and trophic transfer (French McKay and Rowe, 2003).

For quantification of injuries to habitat, the Trustees used a HEA 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 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 three percent per year (NOAA 1999), the Trustees quantified natural resource injuries to marsh habitat for the Bay St. Elaine, Lake Grand Ecaille, and Terrebonne Bay/Timbalier Island Incidents.

The Trustees used REA to determine the marsh bird injury caused by the Bay Long Incident. REA, 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 injured (including those dead), average age or identification of age classes killed, survival rates, age at first breeding, ration of females to males, and reproductive rates (if foregone future generations are included). For the Bay Long 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 marsh bird species.

For the Bay St. Elaine diamondback terrapin injury and the Bay Long non-marsh bird injury, the Trustees used a trophic transfer-based approach to quantify injury in terms of equivalent production at the same trophic level as the habitat restoration. The primary inputs used in this methodology are: 1) total lost biomass (or weight of organic material);

2) trophic biomass transfer efficiencies; and 3) marsh plant production for the target habitat restoration.

Using the injury parameters described in the following sections and applying a discount rate of 3% per year (NOAA, 1999), the Trustees quantified natural resource injuries for each of the four incidents.

3.3.1 **Bay St. Elaine Incident**

For this incident, the Trustees determined that the injury to saline marsh and wildlife (diamondback terrapin) would represent the injuries to natural resources.

3.3.1.1 Habitat – Saline Marsh

Using response and preassessment data described in Section 3.1.1 above, the Trustees determined that 103.54 acres of saline marsh were injured as a result of this incident. To reflect varying degrees of oiling, response impacts, and expected recovery across the spill area, the marsh was further subdivided into acres of heavy, moderate, and light injury, as depicted in Table 3.4 and Figure 3.5.

Table 3.4 Oiling category and acres impacted as a result of the Bay St. Elaine Incident

Oiling/Injury Category	Acres Impacted
Heavy	5.92
Moderate	57.48
Light	40.14

To determine the amount of injury that occurred as a result of the Bay St. Elaine Incident, service losses and recovery times were assigned to the three oiling/injury categories and were based on: 1) information gathered during the Response and Preassessment phases of the incident; 2) relevant peer-reviewed literature; and 3) historical Louisiana-based NRDA case histories which provide supported basis for injury assumptions and recovery timelines based on similar release events in comparable habitats as well as the trajectories of ecological recovery (Louisiana Natural Resource Trustees 2017). (Table 3.3).

To determine the level of initial service losses of saline marsh affected by this incident, the Trustees assumed that, prior to the incident, the habitat in the vicinity of the discharge was healthy and providing 100% ecological service flows. Emergency response and clean-up of oil took place for two months after initial notification of the incident. Habitat was oiled and being disturbed at regular intervals during this period. In addition, the Trustees assumed that the estimated initial service loss and recovery time in each oiled area would be related to the observed level of oiling.

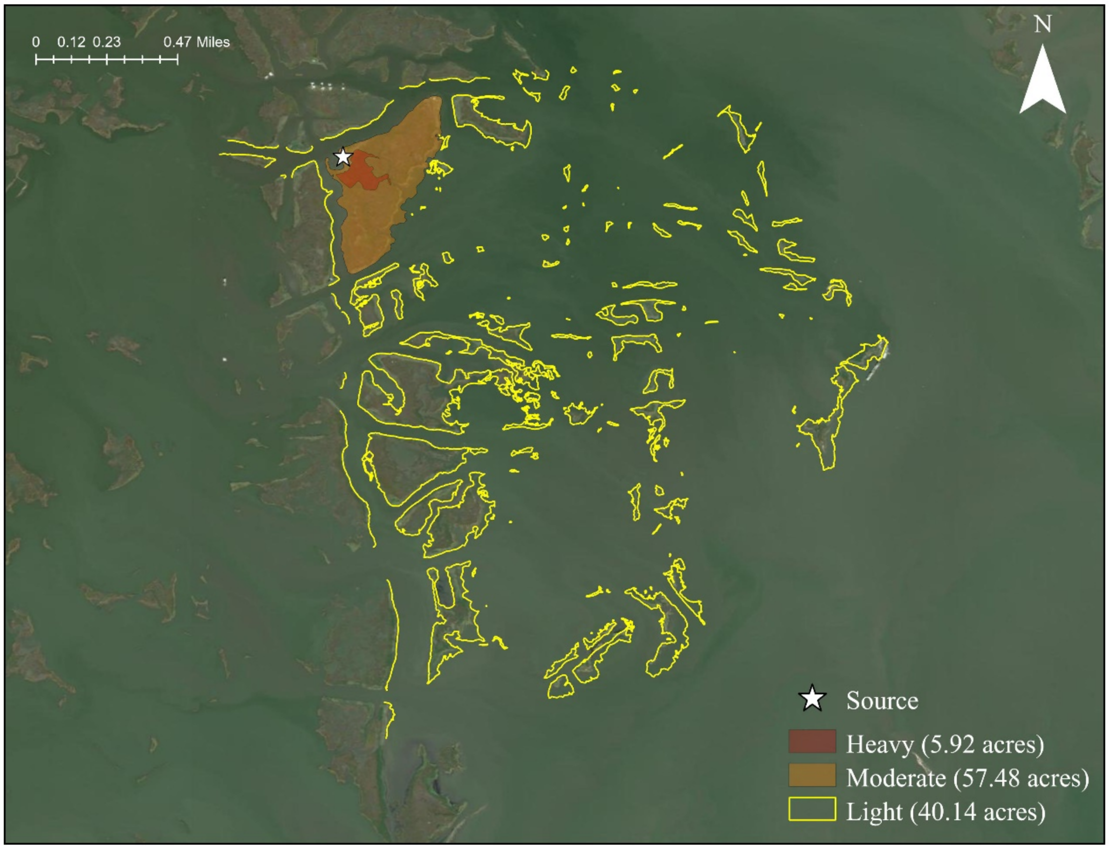

Figure 3.5 Oiling map of the Bay St. Elaine incident

The spill source was located in an area of marsh predominated by *Juncus roemerianus,* interspersed with *Spartina alterniflora*. This area incurred the most damage and was included in the heavy oiling category. The Trustees determined that severe habitat changes and stresses related to substantial oiling and cutting of the vegetation occurred in this area surrounding the source. Immediately following the incident, the area categorized as heavy was exposed to oil that covered the vegetation and saturated the sediment. Physical fouling occurred, initially smothering the plants and laying them over with the weight of the intruding oil. Vegetation cutting was implemented in an area where flushing would have been ineffectual. Plants were cut near the base of the stem above the sediment and the contaminated debris removed from the area. When oil covers the surface of the sediments, cutting near the base of the plant can permit oil penetration and damage to the plant roots (Hoff 1995, Zengel & Michel 1996). The physical damage from the oil and mechanical removal was immediate, but after cutting, the Trustees determined that some services would return. However, the oil in the sediments would remain (Hester & Mendelssohn 2000) causing eventual chronic loss of vegetation due to vegetation die-back and subsequent soil weakening (Zengel et al. 2015, Zengel et al. 2022). The heavy oiled area was determined to be 5.92 acres. The Trustees assigned 100% service loss for 60 months (5 years) with recovery to 50% service loss in another 60 months. Subsequently, services would again decline to 100% loss over the following 120 months (10 years). This resulted in a loss of 73.98 DSAYs (Table 3.5).

Although the disturbance to the moderately oiled/injured area was less severe than that observed in the heavily oiled areas, oil transported through the marsh via wave/tidal forces and response actions caused a "bathtub ring" of oil on the vegetation. In shallower areas, the pooled oil on the surface of the sediments was compacted into the soil from airboat traffic. In deeper areas, airboat traffic transferred oil into adjacent marsh creating visible trails of oil. Airboat traffic as well as heavy foot traffic and trampling of the marsh can contribute to oiling and re-oiling of vegetation and incorporation of oil into the sediments (Zengel & Michel 1996). The Trustees' estimation of recovery time is in keeping with other studies of oil persistence in salt and brackish marsh in Louisiana (Hester and Mendelssohn 2000, Michel and Rutherford 2014, Zengel et al. 2022). The moderately oiled marsh was determined to be 57.48 acres. The Trustees assigned 50% service loss for 2 months (during Response phase) with full recovery (0% loss) in an additional 36 months (3 years). This resulted in a loss of 47.63 DSAYs (Table 3.5).

In the areas with the lightest oiling/injury, evidence of oiling could be seen on the vegetation but the density of the coating was less than in the areas of heavy or moderate oiling/injury. Although the expected recovery of marsh vegetation after a crude oil spill is 2-8 years, various factors such as a warm climate and less-intensive clean-up treatment can influence the recovery time (Michel & Rutherford 2014). This incident occurred in late October and the average high/low temperatures during the seven day period after the spill were 79.3/58.7° F (NOAA NWS n.d.b.). This lightly oiled area also received a less intense clean-up during the Response phase. Therefore, the Trustees determined that a shorter period of recovery in this lightest oiling/injury category would be appropriate. The lightly oiled marsh was determined to be 40.14 acres. The Trustees assigned 25% service loss for 2 months (during Response phase) with full recovery (0% loss) in an additional 4 months. This resulted in a loss of 3.75 DSAYs (Table 3.5).

Table 3.5 Acreage Injured, Service Loss and Recovery, and Resulting Injury in DSAYs for each Oiling Category

Oiling Category	Acres Injured	Service Loss and Recovery Time (in months)	Debit (DSAYs)
Heavy	5.92	60 mo at 100% loss, recovery to 50% in 60 mo, services decline to 100% loss in 120 mo	73.98
Moderate	57.48	50% loss for 2 mo, natural recovery over next 36 mo	47.63
Light	40.14	25% loss for 2 mo, natural recovery over next 4 mo	3.75
Total	**103.54**		**125.36**

3.3.1.2 Wildlife – Diamondback Terrapin

After the incidental discovery of eight oiled diamondback terrapin carcasses during a site visit on 9/22/2015, a plan was finalized by the Trustees and Hilcorp to perform a systematic survey of the area to determine if other terrapins (dead or alive) were present. The cooperative field effort commenced on 2/25/2016. An additional ten diamondback terrapin carcasses were found during this effort.

To determine the injury to terrapins, the methodology used in the Chalk Point NRDA (Natural Resource Trustees, 2002) was employed to calculate discounted terrapin years lost (Terrebonne Bay population parameters were used). Direct injury to terrapins was calculated based on the number of carcasses found and extrapolating that to ridges within an 815 m radius. All carcasses found were female therefore male estimates were based on a Terrebonne-specific sex ratio of 0.66:1 (female to male) (Pearson & Wiebe 2018a & b). The total number of terrapins injured was 224 (Table 3.6).

The diamondback terrapin injury was converted to biomass so that a trophic transfer to saline marsh could occur. To convert the terrapin injury from individuals to biomass, the number of female and male terrapins injured were multiplied by their respective average weights as described in Boykin (2004). Total lost biomass for the incident was 152.00 kg.

Table 3.6 Terrapin Injury Parameters, Number of Injured Individuals, and Average Biomass

Terrapin Injury	Parameters	Terrapins Injured (individuals)	Total Biomass (kg)*
Direct Injury	Females: # of carcasses found extrapolated to ridges within an 815 m radius Males: extrapolated from female count based on sex ratio of 0.66:1	Females 89 Males 135 224	Females 104.53 Males 47.47 152.00

*average weight of female 1.1745 kg and average weight of male .3516 kg (Boykin 2004)

The outputs of the debit-side of the HEA for saline marsh and the analysis results for diamondback terrapins are provided in Table 3.7. Lost ecological services are expressed in DSAYs for the habitat injury (saline marsh) and wildlife (diamondback terrapin) injury after trophic transfer conversion.

Table 3.7 Summary of Injury Analysis for the Bay St. Elaine Incident

Injury Category	Amount Injured	Lost Ecological Services (in DSAYs)
Habitat-Saline Marsh		
Heavy	5.92 acres	73.98
Moderate	57.48 acres	47.63
Light	40.14 acres	3.75
	103.54 acres	**125.36**
Wildlife		
Diamondback Terrapin		
Direct Injury	224 individuals (152.00 kg biomass)	**33.73**
	TOTAL	**159.09**

3.3.2 Lake Grand Ecaille Incident

For this incident, the Trustees determined that the injury to saline/brackish marsh would represent the injuries to natural resources.

3.3.2.1 Habitat – Saline/Brackish Marsh

Using response and preassessment data described in Section 3.1.2 above, the Trustees determined that 60.53 acres of marsh were injured as a result of this incident. To reflect varying degrees of oiling and expected marsh recovery across the spill area, the marsh was further subdivided into acres of heavy, moderate, and light injury, as depicted in Figure 3.6.

Table 3.8 Oiling Category and Acres Impacted as a Result of the Lake Grand Ecaille Incident

Oiling/Injury Category	Acres Impacted
Heavy	4.19
Moderate	41.66
Light	4.50
Very Light	10.18

To determine the amount of injury that occurred as a result of the Lake Grand Ecaille incident, service losses and recovery times were assigned to four oiling/injury categories and were based on: 1) information gathered during the Response and Preassessment phases of the incident; 2) relevant peer-reviewed literature; and 3) historical Louisiana based NRDA case histories which provide supported basis for injury assumptions and recovery timelines based on similar release events in comparable habitats as well as the trajectories of ecological recovery (Louisiana Natural Resource Trustees 2017) (Table 3.8).

To determine the level of initial service losses of saline marsh affected by this incident, the Trustees assumed that, prior to the incident, the habitat in the vicinity of the discharge was healthy and providing 100% ecological service flows. Emergency response and clean-up of oil took place for two months after initial notification of the incident. Habitat was oiled and being disturbed at regular intervals during this period. In addition, the Trustees assumed that the estimated initial service loss and recovery time in each oiled area would be related to the observed level of oiling.

This incident impacted *Spartina* marsh. These saline/brackish marshes are considered to be one of the most vulnerable habitats to damage from an oil spill (Gundlach & Hayes 1978). Impacts to vegetation as a result of oiling can occur in numerous ways including physical fouling, interruption of cellular functions, and increase in erosion rates due to loss of root material (Baker 1970, Hester et al. 2016, Latham & Zengel 2021, Michel & Rutherford 2014, Pezeshki et al 2000). The tidal regime of this area (diurnal, micro-tidal) is an important factor in how the oil is moved, where it goes, and how long it persists (CWPPRA n.d.a., Silliman et al. 2012, Li et al. 2021). The tidal range is small, so water movement is largely controlled by meteorological tides (through wind-driven forces)(Li et al. 2021). Extended southerly winds push Gulf waters northward, stacking water up and causing inundation deep into the interior marshes (Kokaly et al. 2011). Additionally, years of subsidence and channelization due to oil and gas canals have widened tidal passes, facilitating this penetration of tidal pulses (CWPPRA n.d.a.; n.d.b.). The minimal tide flushing the area experiences also gives the oil prolonged contact with the soil/sediments (Silliman et al. 2012, Michel & Rutherford 2022, Beland et al. 2017).

Recovery of marsh vegetation after oiling is dependent upon the type of oil and the extent of oiling of the vegetation and marsh soils among other factors (Michel & Rutherford 2014). Recovery times can vary between less than a year to over 100 years (Hoff 1995, Mendelssohn et al 2012, Michel & Rutherford 2014) and some marshes never recover (Rabalais & Turner 2016, Zengel et al. 2022).

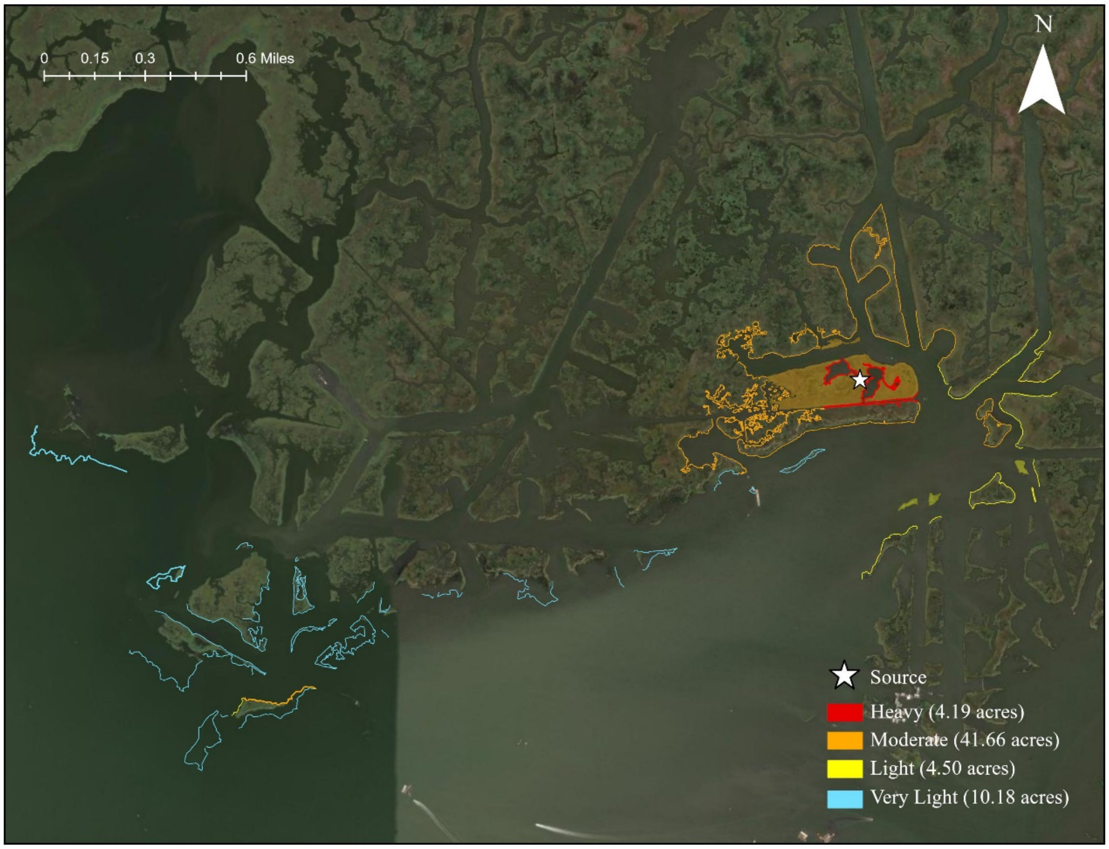

Figure 3.6 Oiling map of the Lake Grand Ecaille Incident

The vegetation along the edge of the marsh surrounding the source of the incident and the vegetation lining a trenasse to the south of the source were the most heavily oiled areas. The heavy oiled marsh shoreline exhibited vegetation death and shoreline erosion as a result of thick oil coating stems and sediment. From the source, oil spread through the surrounding marshes and waterways as a result of wind, tidal, and wave action. Moderately oiled areas not only experienced shoreline oiling, but also interior marsh oiling due to thin film spreading (i.e., sheet flow into and across the interior marsh) of the oil. In tidal salt marshes, considerable amounts of water are transported as sheet flow directly from the seaward marsh edge over the marsh platform (French and Stoddart 1992; Temmerman et al. 2005a; Temmerman et al. 2005b). Sheet flow of oil in a marsh occurs when spilled oil spreads as a thin, continuous layer over the flat, waterlogged surface instead of pooling. Because marshes are low-energy environments with shallow water and dense vegetation, oil can move laterally across wide areas, coating plants and soils and causing ecological damage not only along the shorelines but in the interior marshes as well. Studies of salt marsh oil spills show that oil often covers surface sediments and vegetation, reducing plant growth and ecosystem health, with impacts that can persist for years after contamination (Zengel et al. 2022 and Pezeshki and DeLaune 2015). The marsh edges to the south and east of the source were lightly oiled and very light oiling occurred to the fringing marshes to the southwest and west of the source at the northern rim of Lake Grand Ecaille.

The Trustees assert that the saline/brackish marsh in the heavily oiling/injury category experienced vegetation death and shoreline erosion. The Trustees determined the marsh experienced 100% loss of services for 15 years (estimated functional lifespan of a marsh) with no recovery. This resulted in a loss of 50.46 DSAYs (Table 3.9).

The Trustees determined the saline/brackish marsh in the moderate injury category experienced 75% initial service loss for 2 months while response actions were continuing and would recover in a linear fashion to provide full services over the next 36 months after response actions ceased. Full recovery (to 100% ecological service flows) expected in 38 months. This resulted in a loss of 51.79 DSAYs (Table 3.9).

The Trustees determined the saline/brackish marsh in the light injury category experienced 25% initial service loss for 2 months during response activities and would recover in a linear fashion to provide full services over the next 12 months after response actions ceased. Full recovery (to 100% ecological service flows) expected in 14 months. This resulted in a loss of 0.79 DSAYs (Table 3.9).

In the area with the lightest impact to saline/brackish marsh, the very light injury category, the Trustees determined the marsh experienced a 10% initial service loss for 2 months while response actions were continuing and would recover in a linear fashion to provide full services over the next 6 months. Full recovery (to 100% ecological service flows) expected in 8 months. This resulted in a loss of 0.46 DSAYs (Table 3.9).

The outputs of the debit-side of the HEA for the four oiling categories are depicted in Table 3.9. Lost ecological services are provided in DSAYs.

Table 3.9 A Summary of Injury Analysis for the Lake Grand Ecaille Incident

Oiling Category	Acres Injured	Service Loss and Recovery Time (in months)	Lost Ecological Services (in DSAYs)
Heavy	4.19	100% loss for 180 mo (perpetuity)	50.46
Moderate	41.66	75% service loss for 2 mo, then natural recovery over next 36 mo	51.79
Light	4.50	25% service loss for 2 mo then natural recovery over next 12 mo	0.79
Very Light	10.18	10% service loss for 2 mo, then natural recovery over next 6 mo.	0.46
TOTAL	**60.53**		**103.50**

3.3.3 Bay Long Incident

3.3.3.1 Birds – Marsh and Non-Marsh Birds

Over 26,800 birds were observed in the incident area between 9/5/2016 and 9/16/2016 but not all were observed oiled. Due to the impossibility of identifying every bird that was oiled or impacted by the oil, the Trustees estimated the total mortality based on the response and NRDA preassessment bird survey data. To determine the bird mortality caused by the incident, the Trustees evaluated the number documented of oiled birds, unknown oiled birds (birds for which a determination of oiling could not be made), birds standing in oil (hereafter known as "proximity birds"), and dead birds (Table 3.10). Tables 3.11-3.14 describe the process followed to determine the total bird mortality that occurred as a result of this incident.

Table 3.10 Bird Observations from the Bay Long Incident

Bird Count Category	# of Individuals
Unknown oiling	14,480
No Visible Oil	11,284
Confirmed oiled	146
Dead	8
Proximity birds	906
Total	**26,824**

The proportional distribution used to classify birds of unknown oiling status was based on the observed frequency of oiling categories among all birds with known oiling condition, including both no-visible-oil observations and confirmed visible oiling categories. This gave the Trustees an oiling rate that could be used to calculate the percentage of unknown birds affected per oiling category (Table 3.11).

Table 3.11 Oiling Rate for Unknown Birds Calculation

Oiling Category	Oiling Rate – Unknown Birds
Trace	0.13%
Light	0.88%
Moderate	0.17%
Heavy	0.09%
Combined Total	**1.27%**

Birds observed standing in oil (proximity birds) were assumed to have experienced 100% oil exposure due to direct contact with oiled substrate. In the absence of observational data sufficient to reliably distinguish the degree of oiling among individuals, exposed birds were apportioned evenly across trace, light, moderate, and heavy oiling categories (25% each) as a simplifying assumption intended to represent a range of plausible exposure severities.

Table 3.12 Result of Total Affected Birds

Confirmed Oiled Birds		
	Trace	15.0
	Light	101.0
	Moderate	20.0
	Heavy	10.0
Total Oiled Birds		**146**
Unknown Oiled Birds	**Oiling rate applied**	
	Trace	19.0
	Light	128.0
	Moderate	25.3
	Heavy	12.7
Total Unknown Oiled		**185**
0' from Oil (Proximity Birds)		
	Trace	226.5
	Light	226.5
	Moderate	226.5
	Heavy	226.5
Total Proximity Birds		**906**
Dead		
		8
Total Affected Birds		**1245**

Following estimation of the total number of affected birds (Table 3.12), mortality estimates were derived using the Ziccardi and Drayer (2015) oiling classification framework, which relates external oiling extent to differential survival probabilities. Birds were assigned to oiling categories (e.g., trace, light, moderate, heavy), and category-specific mortality rates were applied to account for the established relationship between increasing oil coverage and reduced survivorship. The Trustees' analysis used values for the summer season (and "non-breeding" when that was a choice). Each species was run through the quartiles individually so that biomass could accurately be calculated. The third quartile (Q3) of the Ziccardi mortality distribution was applied to estimate avian mortality. Use of the Q3 value reflects a conservative, but not maximum mortality assumption, recognizing the elevated likelihood of adverse outcomes associated with observed oil exposure while also accounting for uncertainty in individual fate and oiling severity.

After careful review of the data, the Trustees identified a total mortality of 757 birds as a result of this incident (Table 3.13). These birds were grouped into the following guilds to assess the avian injury: marsh birds, diving water birds (DWB), surface-feeding water birds (SFWB), wading birds (WB), and shorebirds.

Table 3.13 Total Mortality and Biomass by Bird Group

Groups	Oiled Birds		Unknown Birds		Proximity Birds		Dead Birds		Total Mortality (# birds)	Total Biomass (kg)
	Mortality (# birds)	Biomass (kg)	Mortality (# birds)	Biomass (kg)	Mortality (# birds)	Biomass (kg)	Mortality (# birds)	Biomass (kg)		
DWB, SFWB, WB	34.3	17.34	69.5	34.89	577.2	270.10	6	1.76	687	324
Shorebirds	37.4	5.54	0.3	0.03	22.6	1.89			60	7
Marsh birds	7.1	-	0.3	-	0.7	-	2	-	10	-
	78.8	**22.88**	**70.1**	**34.92**	**600.6**	**271.99**	**8.0**	**1.76**	**757**	**332**

The marsh bird injury was calculated in a REA using clapper rail life history information (Martin et al. 2014) and resulted in a debit of 59.63 DBYs (12.20 direct and 47.43 indirect). The trophic transfer analysis resulted in a debit of 69.53 DSAYs (Table 3.14).

Table 3.14 Summary of Injury Analysis for the Bay Long Incident

Bird Group	Individuals Injured	Methodology	Lost Ecological Services (in DBYs Direct + Indirect)	Lost Ecological Services (in DSAYs)
Marsh	10	REA	59.63	-
Shorebirds	60	Trophic Transfer 7.47 kg lost	-	1.57
DWB, SFWB, WB	687	Trophic Transfer 324.09 kg lost	-	67.96
TOTAL	**757**		**59.63**	**69.53**

3.3.4 **Terrebonne Bay/Timbalier Island Incident**

3.3.4.1 Habitat – Barrier Island

Using response and preassessment data described in Section 3.3.4 above, the Trustees determined that 34.6 acres of (Figure 3.7) barrier island habitat, including mangroves, *Spartina* spp., algal and sand beach flats, would represent the injuries to natural resources. On August 26, 2021, Hurricane Ida hit the coast of Louisiana and changed the footprint of Timbalier Island, reducing the mangrove area impacted by the incident Figure 3.8). The Trustees considered these changes when determining the duration of the injuries to mangrove habitat.

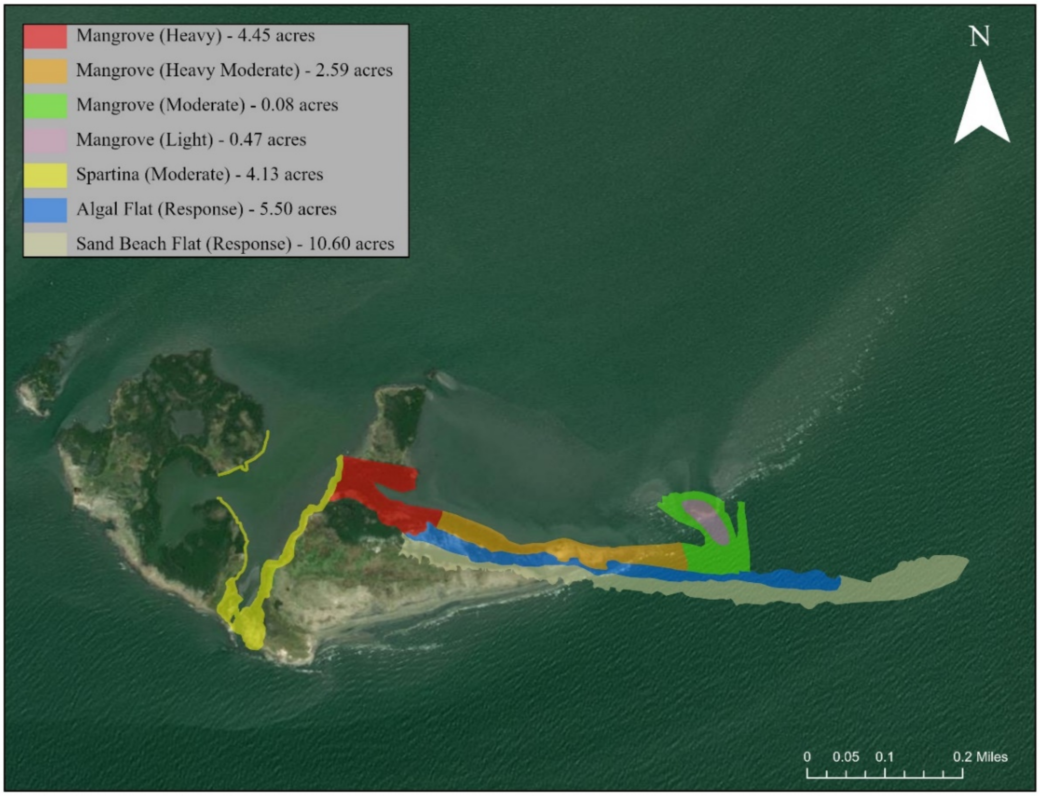

Figure 3.7 Oiling map of the Terrebonne Bay/Timbalier Island Incident that depicts locations and level of oiling on Timbalier Island prior to Hurricane Ida

It was assumed that prior to the incident the habitat in the vicinity of the discharge was healthy and providing 100% ecological service flows. Emergency response and cleanup of oil took place for approximately two months after initial notification of the incident. Habitat was oiled and being disturbed at regular intervals during this period which is reflected in the initial decrease in services in the injury categories.

Figure 3.8 Google Earth image of Timbalier Island in November 2016 (after impacts from the incident and prior to Hurricane Ida) and in September 2021 (immediately after the passage of Hurricane Ida)

Much of the injury due to this incident occurred to mangroves (14.37 acres). Mangroves are a vitally important component of coastal ecosystems as they provide community structure and primary productivity for a wide variety of other organisms (Graham et al. 2009). They (as well as salt marshes) are considered to be the most vulnerable to damage from an oil spill (Gundlach & Hayes 1978). Exposure to oil can cause both lethal and sublethal effects. The oil may kill the mangroves within a few weeks or months, and impacts may continue for years to decades, resulting in permanent habitat loss (Hoff & Michel 2014). Immediate impacts can occur from physical fouling of the root system and pneumatophores which suffocates the mangroves (Cintrón & Schaeffer-Novelli 1982, Hoff and Michel 2014). Longer term effects include stunted or deformed branches, adventitious growth of pneumatophores, and reduction in seedling (propagule) viability (Getter et al. 1981). Defoliation is common after oil exposure and can lead to an increase of light penetrating the forest floor, which then causes temperatures and salinities to rise potentially leading to the death of the trees (Hoff & Michel 2014). During response, additional injury to mangroves occurred as workers moved through the area cleaning up the oil. Foot traffic and movement of equipment through the mangroves caused oil to be pushed deeper into the sediments. Ross (2006) reported decreases in the number and height of pneumatophores as well as an increase in the proportion of those bent and broken in areas where paths were trampled.

The algal and sand flats adjacent to the mangrove stands were scraped to remove the oil-contaminated surface layer and oiled mangrove propagules were included in the material bagged and removed from the island. Mangroves are considered viviparous and the propagules, which contain a store of nutrient reserves, are considered seedlings (Hoff & Michel 2014). The removal of these propagules during response actions thereby reduced the number of seedlings available to become the next generation of mangroves on Timbalier Island. Furthermore, it is unlikely that the oiled propagules not removed from the island would survive to grow into mature trees. A study by Grant and colleagues (1993) reported that 96% of seedlings exposed to weathered crude did not survive.

Recovery of mangrove forests can be slow and varies based on the environment. Estimates of recovery time from eight oil spills reviewed by Hoff and Michel (2014) range from >1 to >23 years and it is noted that recovery times would likely be longer if more comprehensive ecological recovery measures were used. The location of the injured habitats on Timbalier Island influenced the Trustees' choice of the length of time the habitat would take to recover. The injured habitat is located on a coastal barrier island where sea level, shoreface dynamics, and storm overwash dictate the short and long-term fate of the island's continued existence (Brantley et al. 2014; Lorenzo-Trueba & Ashton 2014; Vincent et al. 2021). Coastal barrier islands are dynamic systems with waves constantly reworking and moving sediment onto, as well as off, the island. Although recovery of a mangrove system could take over 20 years (Hoff & Michel 2014), the Trustees determined that because the injured mangroves were located in a high energy barrier island system, assigning a shorter recovery period of 10 years was appropriate due to the likelihood that the footprint of the island would change over a shorter timeframe.

As mentioned previously, Hurricane Ida hit the Louisiana coast on August 26, 2021, changing the footprint of the island and washing away some of the mangrove habitat that was impacted (Figures 3.8). The Trustees took this into consideration and truncated the mangrove injuries to reflect the reduction in mangrove habitat after the storm (Figure 3.9). The *Spartina*, algal flat, and sand beach flat injury periods were over prior to hurricane Ida's arrival, so no adjustments needed to be made to those categories. Table 3.15 provides acreages as well as service loss and recovery time information prior to and after Ida's effects on Timbalier Island.

The mangroves were divided into areas of heavy, heavy-moderate, moderate, and light injury based on the amount of oil observed on the mangroves and in the surrounding sediment. The degree to which mangroves are impacted and the extent of recovery from spill damage can be correlated to the level of oiling on the plants and in the sediments (Duke 2016, Hoff & Michel 2014, Michel & Rutherford 2014, Proffitt et al. 1995). Three additional categories were added (heavy-moderate post hurricane, moderate post hurricane, and light post hurricane) to capture the truncated injury after Hurricane Ida affected the island's footprint (Figure 3.9, Table 3.15).

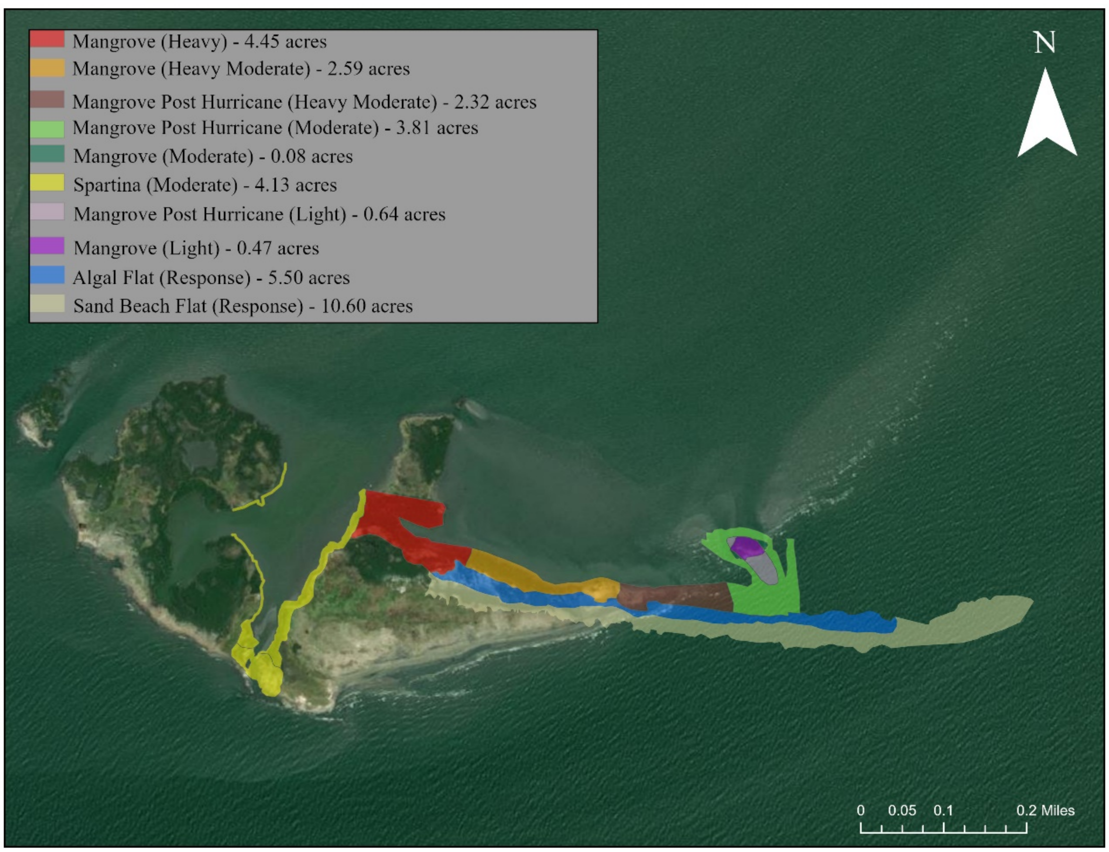

Figure 3.9 Oiling map of the Terrebonne Bay/Timbalier Island Incident that depicts locations and level of oiling on Timbalier Island after Hurricane Ida's passage

The *Spartina* injury occurred at the eastern edge of the affected area as a result of oil washing up into the fringing marsh. The injury was categorized as moderate based on observations of oil on the plants and sediment. The Trustees' estimation of a three-year recovery time is in keeping with other studies of oil persistence in salt and brackish marsh in Louisiana (Hester & Mendelssohn 2000, Michel & Rutherford 2014, Zengel et al. 2022).

The algal flat and sand beach flat injury categories represent response injury that occurred when the areas were scraped and 16,260 bags of oily substrate and organic material were removed from the island for disposal. The algal flat area was an area that was periodically under water and had a fine layer of algae growing on the substrate that could be used by invertebrates or small fish for food. This periphytic algae is important to the habitat as it provides primary productivity as well as structure that supports other organisms in the community (Graham et al. 2009) The sand beach flat area is adjacent to the algal flat area and differs in that this area did not have the algal growth. At the time of the incident, both of these areas were covered with mangrove propagules (seedlings). Recovery of these areas would be dependent upon how quickly sediment and organic materials are deposited through wave action, tides, and storm or wind related mechanisms (Sabo et al. 2024).

Service losses and recovery times were assigned to ten injury categories and were 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 (Table 3.15).

The outputs of the debit-side of the HEA for Mangrove – heavy, Mangrove heavy-moderate (pre and post Hurricane Ida), Mangrove-moderate (pre and post Hurricane Ida), Mangrove-light (pre and post Hurricane Ida), *Spartina*, Algal Flat, and Sand Beach Flat are provided in Table 3.15. Lost ecological services are provided in DSAYs.

The vegetation along the edge of the shoreline where the oil came ashore was the most heavily impacted. The lightest impact occurred to mangroves at the eastern extent that were located at a slightly higher elevation than the surrounding mangroves. The Trustees determined the extreme disturbance from response activities and significant oiling of the mangroves and surrounding sediments caused substantial damage to the mangroves in the mangrove heavy injury category area. The Trustees determined these mangroves experienced 100% loss of services for 120 months with no recovery resulting in lost ecological services of 38.57 DSAYs (Table 3.15).

The Trustees determined the mangroves in the mangrove heavy-moderate injury category experienced 100% initial service loss for 2 months while response actions were continuing and would recover in a linear fashion to 75% in 16 months (in April 2018) after response actions ceased. Full recovery (to 100% ecological service flows) was expected in 120 months in areas not affected by Hurricane Ida resulting in lost ecological services of 10.9 DSAYs. For areas that were affected by the hurricane, the injury has been truncated to September 2021 and resulted in lost ecological services of 7.52 DSAYs (Table 3.15).

The Trustees determined the mangroves in the mangrove moderate injury category experienced 100% initial service loss for 2 months during response activities and would recover in a linear fashion to 50% in 16 months (in April 2018) after response actions ceased. Full recovery (to 100% ecological service flows) was expected in 120 months in areas not affected by Hurricane Ida resulting in lost ecological services of 0.25 DSAYs. For areas that were affected by the hurricane, the injury has been truncated to September 2021 resulting in 9.33 DSAYs of lost ecological services (Table 3.15).

In the area with the lightest impact to mangroves, the mangrove light injury category, the Trustees determined the mangroves experienced a 25% initial service loss for 2 months while response actions were continuing. Full recovery (to 100% ecological service flows) was expected in 120 months in areas not affected by Hurricane Ida resulting in lost ecological services of 0.56 DSAYs. For areas that were affected by the hurricane, the injury has been truncated to September 2021 and resulted in 0.41 DSAYs of lost ecological services (Table 3.15).

The Trustees determined that the injury to the *Spartina alterniflora* marsh surrounding the small inlet was a moderate injury with 75% initial service loss during response activities. They determined this area would fully recover in a linear fashion over 36 months (in December 2019) and resulted in 5.13 DSAYs of lost ecological services (Table 3.15).

The algal flat and sand beach flat injury categories represent response injury that occurred when the areas were scraped and oily substrate and organic material was bagged and removed from the island. The Trustees determined that, due to the reduced productivity in the algal and sand flat areas, when determining the DSAYs required to offset the injury, a conversion factor of 0.5 would be used to account for the assumption that algal and sand flats are half as productive as the areas of mangrove and *Spartina* growth (Table 3.15).

The Trustees determined that the algal flat area experienced 100% initial service loss for 2 months during response activities then linear recovery to 75% service flows in 16 months (in April 2018). Full recovery (to 100% ecological service flows) was expected 48 months after cleanup was finished (in December 2020) resulting in 6.27 DSAYs of lost ecological services after the 0.5 conversion factor was applied to express algal flat ecological service losses in marsh-equivalent units within a common framework for injury quantification and restoration planning. (Table 3.15).

The Trustees determined that the sand beach flat area experienced 100% initial service loss for 2 months during response activities then linear recovery to 75% service flows in 16 months (in April 2018). Full recovery (to 100% ecological service flows) was expected 36 months after cleanup was finished (in December 2019) resulting in 10.31 DSAYs of lost ecological services after the conversion factor of 0.5 was applied to express sand flat ecological service losses in marsh-equivalent units. For purposes of habitat valuation, beach flat and algal flat habitat were conservatively assigned a functional productivity scaling factor of 0.5 relative to marsh habitat, indicating substantially lower ecological productivity in unvegetated coastal habitats (Bejarano et al. 2015) relative to vegetated marsh systems (Rivera-Monroy et al. 2019). (Table 3.15).

Table 3.15 Summary of Injury Analysis for the Terrebonne Bay/Timbalier Island Incident

Habitat Injury Categories	Acres Injured	Service Loss and Recovery Time (in months)	Lost Ecological Services (in (in DSAYs)
Mangrove (heavy)	4.45	100% loss for 120 months	38.57
Mangrove (heavy/moderate)	2.59	100% loss for 2 months (Dec 2016) recovers to 75% by April 2018, then recovers fully in December 2026 (120 months after cleanup is finished)	10.90
Mangrove (heavy/moderate) Post Hurricane	2.32	100% loss for 2 months (Dec 2016) recovers to 75% by April 2018, then truncated September 2021	7.52
Mangrove (moderate)	0.08	100% loss for 2 months (Dec.2016) recovers to 50% by April 2018, then recovers fully in December 2026 (120 months after cleanup is finished)	0.25
Mangrove (moderate) Post Hurricane	3.81	100% loss for 2 months (Dec.2016) recovers to 50% by April 2018, then truncated September 2021	9.33
Mangrove (light)	0.47	25% loss for 2 months (Dec.2016), recovers fully in December 2026 (10 years after cleanup is finished)	0.56
Mangrove (light) Post Hurricane	0.64	25% loss for 2 months (Dec.2016), then truncated September 2021	0.41
Spartina (moderate)	4.13	75% loss for 2 months (Dec. 2016) recovers fully in December 2019 (36 months after cleanup is finished)	5.13
Algal Flat (response injury)	5.50	100% loss for 2 months (Dec.2016) recovers to 75% in April 2018, then recovers fully in December 2020 (48 months after cleanup is finished)	6.27*
Sand Beach Flat (response injury)	10.60	100% loss for 2 months (Dec. 2016) recovers to 75% in April 2018, then recovers fully in December 2019 (36 months after cleanup is finished).	10.31*
TOTAL	**34.59**		**89.25**

*After applying conversion factor of 0.5

3.4 Summary of Injury Assessment and Quantification

A summary of the injury assessment results for the four incidents, as described in the preceding sections, is provided in Table 3.16. Lost ecological services are expressed in Discounted Service Acre Years (DSAYs) for the saline marsh injury and Discounted Bird Years (DBYs) for the marsh birds after applying a 3% discounting factor (NOAA 1999).

Table 3.16 Summary of Injuries for the Four Incidents

Incident	RRP Injury Resource Category/Subcategory	Amount Injured (acres/biomass)	Injury
Bay St. Elaine	CHW/Saline Marsh	103.54 acres	125.36 DSAYs
	Wildlife/Diamondback Terrapin (*Malaclemys terrapin*)	152.00 kg biomass	33.73 DSAYs
Lake Grand Ecaille	CHW/Saline-Brackish Marsh	60.53 acres	103.50 DSAYs
Bay Long	Birds/Marsh Birds	10 birds	59.63 DBYs
	Birds/Non-marsh Birds	331.55 kg biomass	69.52 DSAYs
Terrebonne Bay/Timbalier Island	CHW/Saline Marsh (*Spartina* and mangroves)	18.49 acres	72.67 DSAYs
	CBSS/Algal-Sand Flats	16.10 acres	16.58 DSAYs
		Total DSAYs	**421.36 DSAYs**
		Total DBYs	**59.63 DBYs**

4.0 RESTORATION SELECTION

A major goal of OPA and OSPRA is to make the environment and public whole for injury to or loss of natural resources and services as a result of a discharge or substantial threat of a discharge of oil. This goal is achieved by restoring injured natural resources to baseline conditions (i.e., primary restoration) and compensating for interim losses of ecological services that ensue during the period of recovery (i.e., compensatory restoration).

4.1 Restoration Strategy

For primary restoration, the Trustees considered both the natural recovery option and active primary restoration at the spill sites. At the four incident sites, the Trustees elected to forego active primary restoration and rely on natural recovery of the injured resources and services because actions to remove oil from saturated soils, sand, and sediments would have exacerbated the injury. For compensatory restoration, the OPA and OSPRA regulations clearly establish Trustee responsibility to seek compensation for interim losses pending recovery of the natural resources if technically feasible, cost-effective alternatives exist to compensate for these losses. Since interim losses will accrue during the period of recovery and technically feasible, cost-effective alternatives exist to compensate for these losses, the Trustees elected to proceed with identifying a preferred compensatory restoration alternative for the four incidents.

OPA requires Natural Resource 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 (NOAA et al. 2007) 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.

The development of restoration alternatives involves: 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.

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

The injured resources and services were located in RRP Regions 2 and 3 located along the central and eastern Louisiana coast (NOAA et al. 2007; Section 5). Therefore, the Trustees used coastal resource and service injury categories (NOAA et al. 2007; Section 4.2.2) when applying various tools and selection criteria provided in the RRP Program to ensure the most suitable potential restoration actions were identified. Coastal Herbaceous Wetlands and Birds were identified as the appropriate RRP Program injured resource and service categories for the four incidents. Table 4.1 classifies the injured resource categories quantified by the Trustees for the four incidents 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

Incident	Injury Resource Category/Subcategory	RRP Injured Resource and Service Category
Bay St. Elaine	Saline Marsh	CHW
	Diamondback Terrapin (*Malaclemys terrapin*)	Wildlife
Lake Grand Ecaille	Saline/Brackish Marsh	CHW
Bay Long	Marsh Birds	Birds
	Non-marsh Birds	Birds
Terrebonne Bay/Timbalier Island	Saline Marsh (*Spartina* and mangroves)	CHW
	Algal-Sand Flats	CBSS

4.1.2 Restoration Type Selection

To streamline the process of developing reasonable restoration alternatives and selecting a preferred alternative for implementation for the injury categories described in Chapter 3, the Trustees first looked at the restoration types identified in the RRP Program FPEIS (NOAA et al. 2007; Section 4.2.3). The restoration types in Louisiana's RRP Program 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.

Next, the Trustees selected a subset of appropriate restoration types by identifying those that had a strong nexus to the injured natural resources and their services. This would ensure that the restoration alternatives considered would provide services of the same type, quantity, and of comparable values as those lost. For these four incidents, the nexus analysis revealed 17 coastal restoration types as having a strong nexus to the RRP injured resources and services (Table 4.2).

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 17 coastal restoration types appropriate for compensating for injuries to natural resources and services caused by the incidents.

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										√

The Trustees then applied the restoration type selection criteria described in the RRP Program FPEIS (NOAA et al. 2007; Section 4.2.4.1.5) to help determine which of the eight restoration types identified were most appropriate for restoring trust resources and services injured as a result of the incidents (Table 4.3). The restoration type selection criteria assisted the Trustees in determining which of the various restoration types with a strong nexus to Coastal Herbaceous Wetlands and Birds is most appropriate to restore these injured trust resources and services. These restoration type selection criteria are based in part on the OPA regulations (15 CFR § 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.

Based on the application of these criteria, 3 out of 17 potential restoration types were determined most appropriate to address injuries caused by the incidents. Identification of these three preferred restoration types ensures that restoration actions considered will provide services of the same type, quantity, and of comparable values as those lost. The three preferred restoration types are:

1. Creation/Enhancement of Herbaceous Wetlands
2. Creation/Enhancement of Beaches/Shorelines/Streambeds
3. Physical Protection of Herbaceous Wetlands

Table 4.3 Results of the Application of Restoration Type Selection Criteria

Checks (✓) indicate a restoration type met the criterion and blanks indicate a restoration type did not meet the criterion, for one or more of the resources and services injured by the incidents.

Coastal Restoration Type	Strength of Nexus (strong)	Addresses Multiple Injuries	Scalability	Projects Available in RRP
Creation/Enhancement of Herbaceous Wetlands	✓	✓	✓	✓
Creation/Enhancement of Forested Wetlands		✓	✓	✓
Creation/Enhancement of Beaches/Shorelines/Streambeds	✓	✓	✓	✓
Creation/Enhancement of Submerged Aquatic Vegetation		✓	✓	✓
Creation/Enhancement of Oyster Reefs (and Other Reefs)		✓	✓	✓
Physical Protection of Herbaceous Wetlands	✓	✓	✓	✓
Physical Protection of Forested Wetlands		✓	✓	
Physical Protection of Beaches/Shorelines/Streambeds	✓	✓	✓	
Physical Protection of Birds	✓		✓	
Acquisition/Legal Protection of Herbaceous Wetlands	✓	✓	✓	
Acquisition/Legal Protection of Submerged Aquatic Vegetation		✓	✓	
Acquisition/Legal Protection of Forested Wetlands		✓	✓	
Acquisition/Legal Protection of Beaches/Shorelines/Streambeds	✓	✓	✓	
Acquisition/Legal Protection of Oyster Reefs (and Other Reefs)		✓	✓	
Stocking Birds	✓		✓	
Stocking Wildlife	✓		✓	
Physical Protection of Wildlife	✓		✓	

4.1.3 **Identification of Potential Restoration Actions based on Restoration Type**

Following the identification of the preferred restoration types, the Trustees conducted an initial screening of potential restoration actions available to address the injured resources. Nineteen preliminary restoration actions matched one or more of the preferred restoration types for the injured resources in RRP Regions 2 & 3 (Appendix D). The Trustees screened these restoration actions to identify the most appropriate options to compensate for injuries resulting from these incidents. In reviewing the potential restoration actions, the Trustees considered whether the type and scale of restoration would compensate for injuries to coastal herbaceous wetlands and birds.

4.1.4 **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 CFR § 990.54 and RRP Program-specific criteria below to select a preferred restoration alternative for the incidents. Only those actions considered to be technically feasible and in accordance with applicable laws, regulations, and/or permits were moved forward for further consideration.

OPA criteria:

1. Cost to carry out alternative;
2. Extent to which alternative is expected to meet the trustees' goals and objectives;
3. The alternative's likelihood of success;
4. Extent to which alternative prevents future injury resulting from the incident, and avoids collateral injury from implementation;
5. Extent to which alternative benefits more than one natural resource and/or service; and
6. Effect(s) of 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.

Trustees determined that sixteen of the nineteen preliminary restoration actions would be eliminated from further evaluation due to geographical nexus (located outside of the Terrebonne/Barataria basins where the incidents occurred), the cost to carry out the alternative, and/or inability to implement with minimal delay (project still in early phase of development). Table 4.4 shows the remaining four restoration actions that met most or all of the criteria listed above and would meet the Trustees' goals to restore for lost natural resources and services caused by the incidents. 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	Project ID	Restoration Type
TE-0112 North Catfish Lake Marsh Creation	2017-822	C/E CHW
TE-0166 Bay Raccourci Marsh Creation Increment 2	2021-1032	C/E CHW
BA-0257 Grand Bayou Ridge and Marsh Restoration - Increment 2	2023-1053	C/E CFW, C/E CHW
Northwest Little Lake Marsh Creation: NRDA Increment	2026-1086	C/E CHW

4.1.5 **Evaluation of Potential Restoration Alternatives**

4.1.5.1 No Action/Natural Recovery Alternative

The No Action Alternative is required for consideration under OPA and NEPA (15 CFR § 990.53); the No Action Alternative serves to contrast the impacts of other alternatives against the status quo. The No Action/Natural Recovery Alternative fulfills this requirement and considers taking no action to restore marsh habitat. This alternative would effectively allow for the continuation of current conditions in the affected areas with no intervention. Under this alternative, no steps would be taken to stabilize, create, or enhance habitat as a result of the incidents, and therefore, this alternative would not sufficiently compensate the public for injuries to natural resources.

The No Action/Natural Recovery alternative is rejected for compensatory restoration for these incidents. As evidenced by the restoration alternatives identified in developing this DARP, there are feasible and appropriate opportunities within RRP Program Regions 2 and 3 to restore, replace, or provide services equivalent to those lost due to these incidents. Under the no-action alternative, restoration actions needed to make the environment and public whole for its losses would not occur. The Natural Resource Trustees determined that the No Action/Natural Recovery alternative (i.e., no compensatory restoration) should be rejected on that basis. The No Action/Natural Recovery alternative is retained in this DARP for comparative purposes only.

4.1.5.2 Preferred Alternative: The Northwest Little Lake Marsh Creation - NRDA Increment

The Trustees carefully reviewed and evaluated projects in the process of selecting a preferred alternative best suited for restoring the injured resources and making the environment and public whole. The restoration action that met all of the criteria listed above and would meet the Trustees' goals to create and enhance coastal herbaceous wetlands to compensate for lost natural resources and services was determined to be the Northwest Little Lake Marsh Creation - NRDA Increment (the Project).

The Project involves the creation of coastal herbaceous wetlands, including brackish marsh habitat immediately adjacent to a project footprint known as the "Northwest Little Lake Marsh Creation Project (BA-268)" (developed and funded through the CWPPRA Program). The BA-268 project is located within the Barataria Basin, along the northwest Little Lake shoreline, Lafourche Parish, Louisiana. Figure 4.1 shows the project vicinity and currently permitted areas for the construction of marsh creation. The Project will be located at the western margin of the BA-0268 project area (Figure 4.2). Containment dikes will be constructed and sediment will be hydraulically dredged from a borrow area in Little Lake and pumped via pipeline to create a marsh platform in the project area. Over time, natural dewatering and compaction of dredged sediments will result in platform elevations that fall within the intertidal range and would be conducive to the establishment of emergent marsh habitat. The project area will be planted with native marsh vegetation to establish a vegetative community typical of other coastal wetlands in the area.

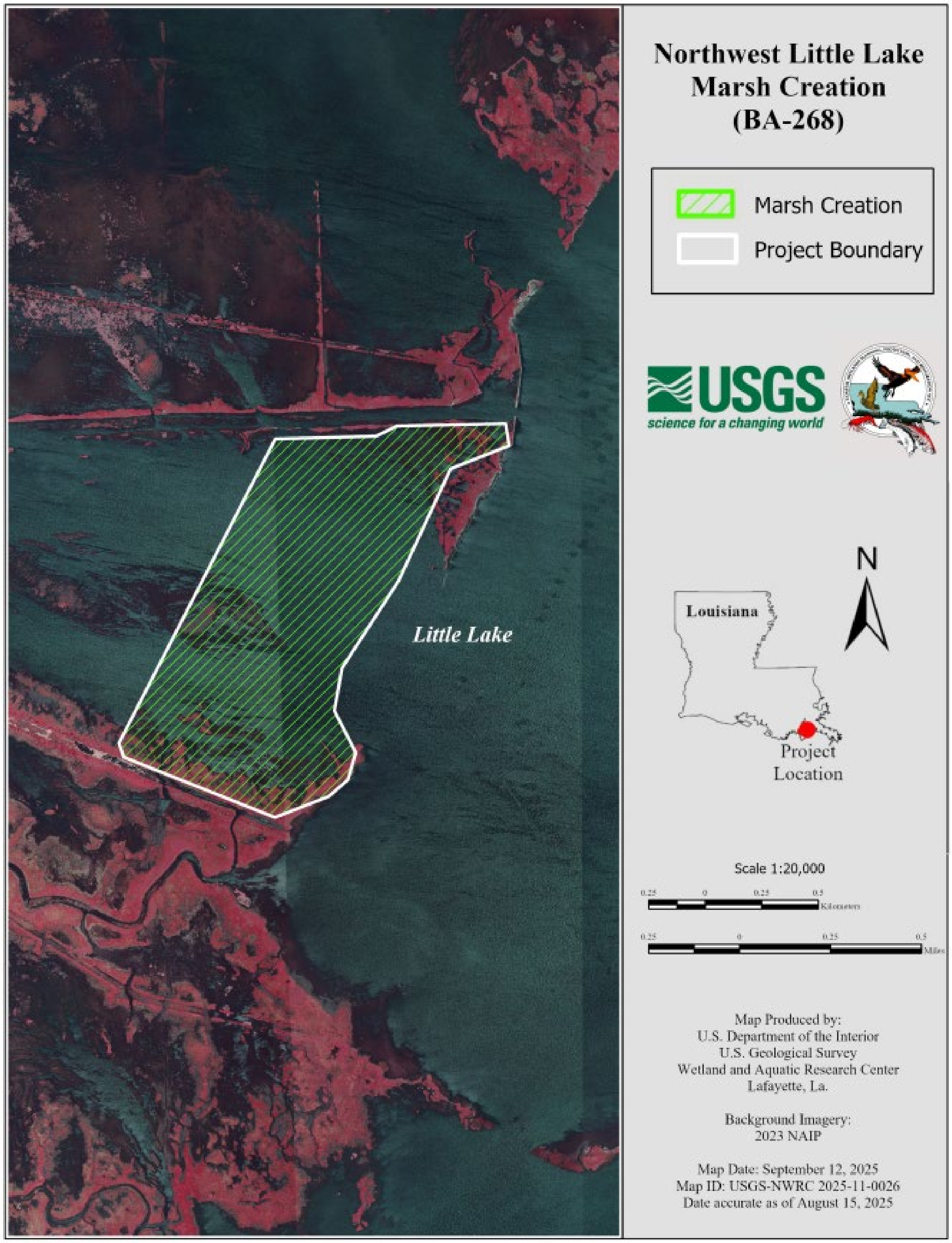

Figure 4.1 CWPPRA (BA-268) Northwest Little Lake Marsh Creation

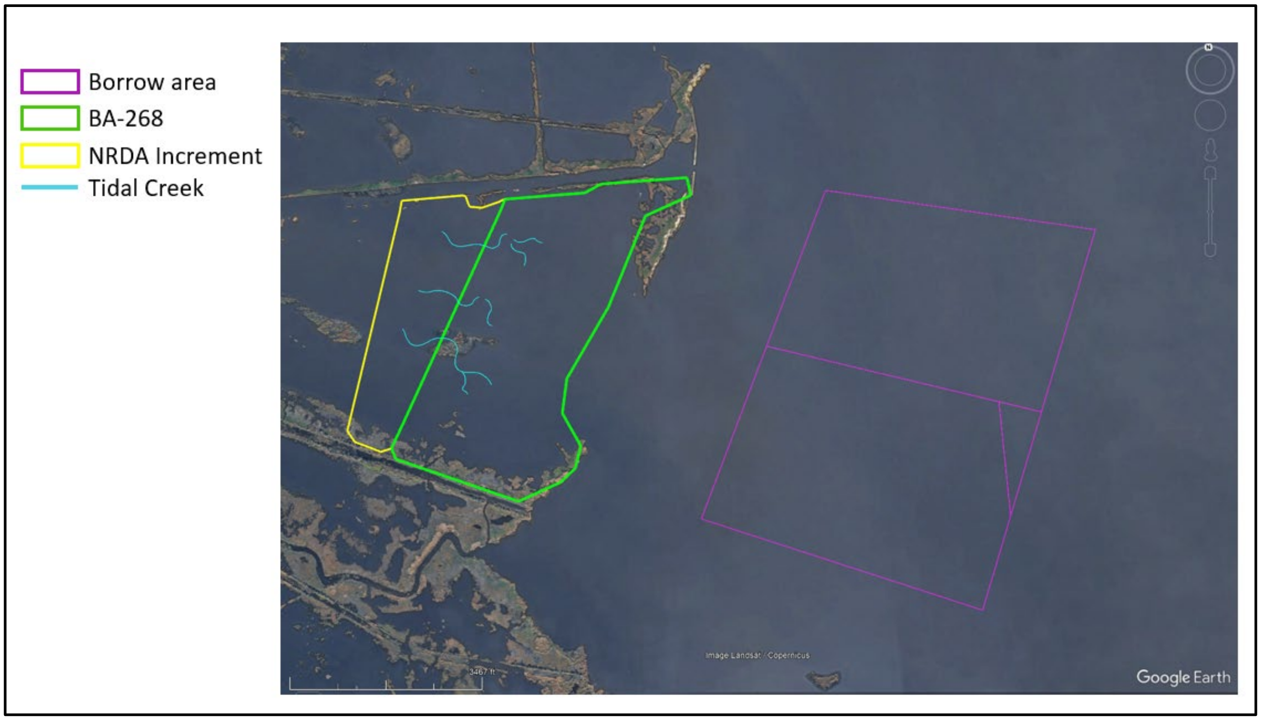

Figure 4.2. Location of the Northwest Little Lake Marsh Creation NRDA Increment (yellow polygon) located adjacent to the CWPPRA BA-268 project (green polygon)

In evaluating restoration alternatives, the Trustees considered the stage of development of each alternative, including the status of engineering and design (E&D), permitting, implementation readiness, and anticipated timeline for construction and service accrual. The Trustees determined that the Northwest Little Lake Marsh Creation - NRDA Increment project is sufficiently advanced in planning and development to allow implementation with minimal delay relative to other alternatives considered, several of which would require additional engineering, feasibility evaluation, permitting, or project development prior to implementation. The Project also supports and is consistent with existing national, regional, state, and local restoration initiatives, including the Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA 2023) and broader Gulf Coast restoration objectives. The Project is consistent with established coastal restoration and resource management priorities focused on restoration of estuarine marsh habitat, enhancement of fisheries productivity, shoreline stabilization, and long-term ecosystem resilience within the Louisiana coastal zone. Additionally, the Trustees determined that, as an increment to the CWPPRA BA-0268 restoration project, the Project provides the opportunity to leverage existing project planning, design, permitting, construction, and monitoring frameworks, thereby reducing implementation uncertainty and improving overall restoration efficiency relative to stand-alone alternatives. The Project can be effectively integrated into ongoing coastal restoration and management activities within the project area, thereby improving implementation effectiveness, increasing long-term sustainability, and maximizing ecological benefits and cost efficiencies.

Because this project will be constructed in the immediate vicinity of, and concurrent with, ongoing dredging activities involving the construction of hundreds of acres of marsh, the

Trustees expect the Project to benefit from significant economies of scale, including substantial time and cost savings achieved through administrative, logistical, and construction efficiencies associated with larger projects. The project will achieve additional cost efficiencies related to the close proximity of the marsh creation fill area to the borrow site and containment dike construction occurring concurrently with containment dike construction for the BA-268 project. Cost estimates for this project suggest that the project will be a very cost-effective alternative for creating marsh habitat given typical costs associated with other marsh creation projects.

The Project will create coastal herbaceous wetlands, including intermediate/brackish marsh habitat in the Barataria Basin, which is located in and adjacent to coastal watersheds to the four incidents (i.e., Regions 2 and 3). The marsh restored by the Project is anticipated to provide similar or complimentary ecological services to the injured trust resources and therefore have a sufficient nexus to the injured resources. Habitat creation and enhancements achieved through dredging, vegetative plantings, creation of tidal creeks 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. These benefits are sufficient to compensate the public and the environment for birds and marsh injured during the incidents and provide both biological and regional 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 marsh and bird nesting, foraging, and mating habitat will continue to decrease over time if the project is not implemented.

The majority of the Project area has been classified as intermediate marsh (Visser et al., 1998). Marsh habitat types within coastal Louisiana occur along a dynamic estuarine salinity gradient characterized by substantial spatial and temporal variability in salinity conditions. Intermediate, brackish, and saline marsh habitats therefore exhibit ecological continuity and transitional overlap in hydrologic conditions, vegetative composition, and ecological function. Because Louisiana marsh systems function along a continuous salinity gradient, intermediate marsh restoration provides ecologically relevant and functionally comparable services to injured saline and brackish marsh habitats. The Trustees concluded there is sufficient nexus to creating intermediate marsh as an alternative due to the complementary services provided by intermediate marshes. Finally, the Trustees have developed procedures for scaling the benefits of creating intermediate marsh and will be able to determine the size of the project needed to provide adequate compensation for the injured trust resources.

The Project is technically feasible and utilizes proven techniques with established methods and documented results. Dredging to create marsh in shallow, open-water areas has been successfully used as a restoration technique across coastal Louisiana for many years. Since CWPPRA was authorized in 1990, many marsh creation projects have been constructed and more are authorized for engineering and design or construction. Many other marsh creation projects have been constructed by the State of Louisiana as mitigation for wetland impacts under section 404 of the Clean Water Act and by the USACE under other authorities such as sections 204 and 1135 of the Water Resources Development Act. For these reasons, the restoration alternative has a high likelihood of success.

The creation of estuarine emergent wetlands will result in the loss of mud bottom and estuarine water column, as emergent marsh would replace those habitat types. Loss of mud bottom essential fish habitat (EFH) could result in negative impacts to subadult brown shrimp (*Penaeus aztecus*) and postlarval/juvenile red drum (*Sciaenops ocellatus*). Although adverse impacts may occur to some types of EFH, more productive types of EFH (i.e., estuarine emergent wetlands) would be created resulting in a net positive benefit to all managed species that occur in the project area including larval red drum, Gulf menhaden (*Brevoortia patronus*), and critical prey species.

The creation of intermediate marsh will directly restore the coastal herbaceous wetland resources and services that were injured by the four incidents as well as provide additional habitat benefits to the birds, wildlife, and sediment infauna that utilize that habitat and were injured by the incidents.

The Trustees do not anticipate this project adversely affecting public health or safety.

For the purposes of restoration scaling, the HEA method was used to determine the size of the marsh creation restoration needed to compensate for the losses resulting from the incidents. HEA scales the restoration project so that services provided through restoration are equated with the interim service losses resulting from an incident. Incident specific scaling approaches are provided below:

Bay St. Elaine Incident

For service losses related to the coastal herbaceous marsh and diamondback terrapin injuries for the Bay St. Elaine Incident, it was determined that 159.09 DSAYs of marsh occurred as a result of the incident (Section 3.4). For the purposes of the credit-side of the HEA, the Trustees developed input parameters based on a hydraulic dredge and fill type marsh creation project that would create marsh habitat in the same basin as the injury. The Trustees assumed a 15-year project life, services reaching full function after 5 years, and 50% productivity relative to natural marsh (Desrochers et al. 2008; Darnell and Smith 2004; Edwards and Proffitt 2003). Applying a discount rate of 3.0% per year (NOAA, 1999) and assuming project implementation in 2027, it was determined that 47.78 acres of marsh creation would compensate for these injuries.

Lake Grand Ecaille Incident

For service losses related to the coastal herbaceous marsh injury for the Lake Grand Ecaille Incident, it was determined that 103.5 DSAYs of marsh injury occurred as a result of the incident (Section 3.4). For the purposes of the credit-side of the HEA, the Trustees developed input parameters based on a hydraulic dredge and fill type marsh creation project that would create marsh habitat as the injury. The Trustees assumed a 15-year project life, services reaching full function after 5 years, and 50% productivity relative to natural marsh (Desrochers et al. 2008; Darnell and Smith 2004; Edwards and Proffitt 2003). Applying a discount rate of 3.0% per year (NOAA, 1999) and assuming project implementation in 2027, it was determined that 29.51 acres of marsh creation would compensate for the injuries.

Bay Long Incident

For service losses related to the bird injury for the Bay Long Incident, it was determined that 59.63 DBYs and 69.52 DSAYs of marsh injury occurred as a result of the incident (Section 3.4). Marsh bird density of 2.4 birds per hectare was used to determine acres of required restoration for marsh bird injury. For the purposes of the credit-side of the HEA, the Trustees developed input parameters based on a hydraulic dredge and fill type marsh creation project that would create marsh habitat as the injury. The Trustees assumed a 15-year project life, services reaching full function after 5 years, and 50% productivity relative to natural marsh (Desrochers et al. 2008; Darnell and Smith 2004; Edwards and Proffitt 2003). Applying a discount rate of 3.0% per year (NOAA, 1999) and assuming project implementation in 2027, it was determined that 37.15 acres of marsh creation would compensate for the injuries.

Terrebonne Bay/Timbalier Island Incident

For service losses related to the bird injury for the Terrebonne Bay/Timbalier island Incident, it was determined that 89.25 DSAYs of marsh injury occurred as a result of the incident (Section 3.4). For the purposes of the credit-side of the HEA, the Trustees developed input parameters based on a hydraulic dredge and fill type marsh creation project that would create marsh habitat as the injury. The Trustees assumed a 15-year project life, services reaching full function after 5 years, and 50% productivity relative to natural marsh (Desrochers et al. 2008; Darnell and Smith 2004; Edwards and Proffitt 2003). Applying a discount rate of 3.0% per year (NOAA, 1999) and assuming project implementation in 2027, it was determined that 23.81 acres of marsh creation would compensate for the injuries.

Based on these inputs and assumptions, the Trustees estimated approximately 138.25 acres will be needed to restore for injuries resulting from all four incidents. Scaling and implementing a single, larger restoration project to address separate but similar resource injuries offers distinct ecological and operational advantages. Larger, contiguous restoration sites typically yield higher-quality ecosystem functions and greater biodiversity resilience than multiple, fragmented areas.

Performance monitoring will be performed over a five-year period following construction to provide an assessment of project progress and help guide corrective actions, if needed, to meet the Project's goals and objectives. Project performance will be assessed by comparing quantitative monitoring results to performance standards that define the minimum physical or structural conditions deemed to represent normal and acceptable development of a marsh. The monitoring program for the Project will use these standards to determine whether the project goals and objectives have been achieved or whether corrective actions are necessary. If the performance criteria are satisfied at the five-year monitoring event, and the Trustees are otherwise confident, based on previous experience, that the Project will be successful, then no further monitoring will be required.

In the event that performance standards are not met during the monitoring period or monitoring results suggest that there is unsatisfactory progress toward meeting established performance standards, mid-course corrections or corrective actions may be undertaken.

These actions might include but are not limited to monitoring for an additional period of time to see if the Project begins to match predicted trends in growth, consideration of surplus acres created/nourished, or other actions agreed upon that would correct the deficiency.

For the reasons discussed above, the Trustees select the Northwest Little Lake Marsh Creation - NRDA Increment project as the preferred restoration alternative stemming from the four incidents. The Project has a strong nexus to injured resources and services resulting from the incidents, is technically feasible and has a high likelihood of success. The Project is designed to create and enhance approximately 138.25 acres of coastal herbaceous marsh and include vegetative plantings and tidal creeks as restoration for the incidents. The design is modular and fully scalable.

4.1.5.3 Alternatives Evaluated But Not Preferred

As discussed in Section 4.1.4, the Trustees evaluated a number of potential restoration actions to compensate the public for injuries to natural resources and services caused by the incidents. All alternatives met the Trustees' initial criteria as appropriate restoration actions for addressing the injured resources; however, due to the reasons discussed below, the Trustees eliminated the following from further evaluation and analysis:

2017-822 TE-0112 North Catfish Lake Marsh Creation: The goal of this project is to create marsh habitat and reestablish the northern shoreline of Catfish Lake. Sediment dredged from Catfish Lake would be used to strategically create marsh along the northern shoreline. Smooth cordgrass would be planted along the lake shore-face to help stabilize the shoreline and reestablish a healthy lake rim marsh community. Sediments would be hydraulically dredged from Catfish Lake and pumped via pipeline to create approximately 525 acres of marsh habitat and nourish an additional 208 acres of marsh habitat.

2021-1032 TE-0166 Bay Raccourci Marsh Creation Increment 2: The primary goal of this project is to slow the movement of saline water north from Lake Mechant through Bay Raccourci into Bayou Decade. Specific objectives are to 1) create 241 acres of emergent marsh, 2) nourish 49 acres of emergent marsh, and 3) plant Bay Raccourci shoreline with appropriate intermediate marsh species. Service goals include restoration/protection of habitat for threatened and endangered species and other at-risk species. This project would restore habitat potentially utilized by the black rail, which is listed as a threatened species. The project could also benefit other species of concern including the saltmarsh topminnow and seaside sparrow. This project would create/nourish 290 acres of marsh along the eastern shoreline of Bay Raccourci with material hydraulically dredged from Lake Mechant. Constructed containment dikes would be gapped as needed by year 3 to provide tidal exchange after fill materials settle and consolidate. Vegetative plantings along Bay Raccourci shoreline would be included.

2023-1053 BA-0257 Grand Bayou Ridge and Marsh Restoration Increment 2: The goal of this project is to create/nourish approximately 386 acres of marsh. The proposed design is to place dredged material from the Mississippi River to a fill height of +2.5ft NAVD88. Dewatering and compaction of dredged sediments should produce elevations conducive to the establishment of emergent marsh and within the intertidal range. Containment dikes would be gapped at the end of construction. Approximately 7,100 linear feet (9 acres) of forested ridge would be created along the western bank of Grand Bayou. The ridge would be constructed to a crown elevation of +5.0 feet NAVD88, 20 feet wide, and would be planted on the crown and slopes.

Although the above projects are technically feasible and utilize proven techniques with established methods and documented results and would provide similar and complimentary services as those injured during the incidents, the projects, which are much larger in scope than the preferred alternative, would cost significantly more to construct and provide an over crediting of trust resource and services as compared to the preferred alternative. In addition, the scalable nature of the projects cannot be guaranteed. The preferred alternative will be more cost-effective and able to be implemented with minimal delay because it will be constructed concurrently with the CWPPRA marsh creation project, BA-268, thereby benefitting from the partnering opportunity's significant economies of scale including both time and cost savings. For these reasons, the Trustees eliminated these projects from further consideration to compensate the public for injuries to natural resources resulting from the incidents.

5.0 REFERENCES

About Lafourche. 2020. Accessed October 4, 2024 at: https://www.lafourchegov.org/lafourche

Atchafalaya National Heritage Area (NHA). 2026. About Us. Accessed January 13, 2026 at: http://www.atchafalaya.org/welcome

Baker, J.M. 1970. The Effects of Oils on Plants. Environmental Pollution. 1. 27-44.

Bejarano, A. C., H. Dunagan, & J.Michel. 2015. Literature Review. Effects of Oil, Shoreline Treatment, and Physical Disturbance on Sand Beach Habitats. DWH Shoreline NRDA Technical Working Group Report.

Beland M., T.W. Biggs, D.A. Roberts, S.H. Peterson, R.F. Kokaly, & S. Piazza . 2017. Oiling accelerates loss of salt marshes, southeastern Louisiana. PLoS One. 2017 Aug 2;12(8):e0181197. doi: 10.1371/journal.pone.0181197. PMID: 28767649; PMCID: PMC5540489

Boykin, C. 2004. The status and demography of the ornate diamondback terrapin (*Malaclemys terrapin macrospilota*) within the Saint Martin's Marsh Aquatic Preserve. Florida Department of Environmental Protection, Tallahassee, Florida, USA. 37 pp.

Brantley, S.T., S.N. Bissett, D.R. Young, C.W.V. Wolner, & L.J. Moore. 2014. Barrier Island Morphology and Sediment Characteristics Affect the Recovery of Dune Building Grasses Following Storm-Induced Overwash. PLoS ONE. 9(8) e104747. doi:10.1371/journal.pone.0104747

Britannica. n.d. Encyclopedia Britannica. Louisiana. Accessed May 9, 2024 at: https://www.britannica.com/place/Louisiana-state/Climate

Cintrón, G. & Y. Schaeffer-Novelli. 1982. Mangrove Forests: Ecology and Response to Natural and Man-Induced Stressors. Conference: Coral Reef, Seagrass Beds and Mangroves: Their Interaction in the Coastal Zones of the Caribbean Workshop (St. Croix, V.I.). Fairleigh Dickinson University, West Indies Laboratory. https://repository.library.noaa.gov/view/noaa/8343

City of Gretna. 2022. History of Gretna. Accessed on May 7, 2024 at: https://www.gretnala.com/about/history/

City of Morgan City. 2011. History of Morgan City, LA. Accessed on May 7, 2024 at: https://www.cityofmc.com/index.php/aboutmorgan-city/morgan-city-history.html

CWPPRA. n.d.a. The Terrebonne Basin. Accessed on June 3, 2026 at: https://lacoast.gov/new/about/Basin_data/te/Default.aspx

CWPPRA n.d.b. The Barataria Basin. Accessed on June3, 2026 at: https://lacoast.gov/new/about/basin_data/ba/default.aspx

Daigle, J.J., G.E. Griffith, J.M. Omernik, P.L. Faulkner, R.P. McCulloh, L.R. Handley, L.M. Smith, & S.S. Chapman. 2006. Ecoregions of Louisiana (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000).

Duke, N.C. 2016. Oil Spill Impacts on Mangroves: Recommendations for Operational Planning and Action Based on a Global Review. Marine Pollution Bulletin. Vol 109, Issue 2. 700-715

Edwards, K.R., and C.E. Proffitt. 2003. Comparison of wetland structural characteristics between created and natural salt marshes in southwest Louisiana, USA. Wetlands 23. 344–356. https://doi.org/10.1672/10-20

French, J.R. and D.R. Stoddart. 1992. Hydrodynamics of salt marsh creek systems. Implications for marsh morphological development and material exchange, Eart Surface Processes and Landforms. 17(3). 235-252.

French McCay, D.P., & J.J. Rowe. 2003. Habitat restoration as mitigation for lost production at multiple trophic levels. Marine Ecology Progress Series. Vol 264: 233-247.

Getter, C. D., G.L. Scott, & J. Michel. 1981. The Effects of Oil Spills on Mangrove Forests: A Comparison of Five Oil Spill Sites in the Gulf of Mexico and the Caribbean Sea. International Oil Spill Conference Proceedings. 1981(1). 535-540.

Graham, L.E., J.M. Graham, &S.W. Wilcox. 2009. 22 Phytoplankton Ecology in Algae Second Edition. Pearson Benjamin Cummings.

Grant, D.L., P.J. Clarke, & W.G. Allaway. 1993. The Response of Grey Mangrove (*Avicennia marina* (Forsk.) Vierh.) Seedlings to Spills of Crude Oil. Journal of Experimental Marine Biology and Ecology. 171.

Gundlach, R.R., & M.O. Hayes. 1978. Vulnerability of Coastal Environments to Oil Spill Impacts. Marine Technology Society Journal. 12(4). 18-27.

Hester, M.W. & I.A. Mendelssohn. 2000. Long-term recovery of a Louisiana brackish marsh plant community from oi-spill impact: vegetation response and mitigating effects of marsh surface elevation. Marine Environmental Research. 49. 233-254.

Hester, M.W., J.M. Willis, S. Rouhani, M.A. Steinhoff, & M.A. Baker. 2016. Impacts of the Deepwater Horizon oil spill on the salt marsh vegetation of Louisiana. Environmental Pollution. 216. 361-370.

Holcomb, S. R., A. A. Bass, C. S. Reid, M. A. Seymour, N. F. Lorenz, B. B. Gregory, S. M. Javed, & K. F. Balkum. 2015. Louisiana Wildlife Action Plan. Louisiana Department of Wildlife and Fisheries. Baton Rouge, Louisiana.

Hoff, R.Z. 1995. Responding to oil spills in coastal marshes: the fine line between help and hindrance. HAZMAT Report 96-2. Seattle: Hazardous Materials Response and Assessment Division, NOAA. 16 pp.

Hoff, R. Z. & J. Michel. 2014. Oil Spills in Mangroves: Planning & Response Considerations. National Oceanic and Atmospheric Administration, Office of Response and Restoration. 96 pp. https://repository.library.noaa.gov/view/noaa/877

Kokaly, R.F., D. Heckman, J. Holloway, S. Piazza, B. Couvillion, G.D. Steyer, C. Mills, & T.M. Hoefen. 2011. Shoreline surveys of oil-impacted marsh in southern Louisiana, July to August 2010: U.S. Geological Survey Open-File Report 2011–1022, 124 p.

Latham, P., & Zengel, S. 2021. Salt marshes and mangroves. Chapter 7, Pages 46-68, In: Michel, J. (ed.), Oil Spill Effects Literature Study of Spills of 500–20,000 Barrels of Crude Oil, Condensate, or Diesel. US Department of the Interior, Bureau of Ocean Energy Management, Anchorage, AK. OCS Study BOEM 2021-048. 216 pp.

Li, G., K. Xu, Z.G. Xue, H. Liu, S.J. Bentley. 2021. Hydrodynamics and sediment dynamics in Barataria Bay, Louisiana, USA. Estuarine, Coastal and Shelf Science. Volume 249, 107090. ISSN 0272-7714. https://doi.org/10.1016/j.ecss.2020.107090

Lorenzo-Trueba, J. & A.D. Ashton. 2014. Rollover, Drowning, and Discontinuous Retreat: Distinct Modes of Barrier Response to Sea-level Rise Arising from a Simple Morphodynamic Model. Journal of Geophysical Research: Earth Surface. 119. 779-801. doi:10.1002/2013JF002941

Lorenzo-Trueba, J. & A.D. Ashton. 2014. Rollover, Drowning, and Discontinuous Retreat: Distinct Modes of Barrier Response to Sea-level Rise Arising from a Simple Morphodynamic Model. Journal of Geophysical Research: Earth Surface. 119. 779-801. doi:10.1002/2013JF002941

Louisiana Department of Environmental Quality (LDEQ). n.d.a Louisiana Department of Environmental Quality Ambient Air Monitoring Program. Accessed February 7, 2024 at: https://www.deq.louisiana.gov/page/ambient-air-monitoring-program

Louisiana Department of Environmental Quality (LDEQ). n.d.b Louisiana Department of Environmental Quality Interactive Map. Accessed February 7, 2024 at: https://deq.louisiana.gov/index.cfm?md=resource&tmp=category&catid=make-a-map

Louisiana Department of Environmental Quality (LDEQ). 2022. 2022 Louisiana Water Quality Inventory: Integrated Report. 183 pp.

Louisiana Department of Wildlife and Fisheries (LDWF). n.d.a. Rare Species and Natural Communities by Parish. Accessed on January 14, 2025 at: https://www.wlf.louisiana.gov/page/rare-species-and-natural-communities-by-parish

Louisiana Department of Wildlife and Fisheries (LDWF). n.d.b. LDWF Geospatial Data Repository. Accessed April 15, 2024 at: https://experience.arcgis.com/experience/8c8c131a3e8e42728a0658159e79efd4/page/Go-Hunting/

Louisiana Department of Wildlife and Fisheries (LDWF). n.d.c Wildlife Management Areas, Refuges, and Conservation Areas. Accessed October 7, 2024 at: https://www.wlf.louisiana.gov/page/wmas-refuges-and-conservation-areas

Louisiana Division of the Arts, 2019. Office of Cultural Tourism, Dept. of Culture, Recreation & Tourism. Louisiana Folklife Program. Accessed March 13, 2024 at: https://www.louisianafolklife.org/lt/maidas_essay/main_introduction_onepage.html

Louisiana Legislative Auditor. 2024. Profiles of Louisiana's Public Ports: Performance Audit Services. Informational Report January 31, 2024. 85pp.

Louisiana Natural Resource Trustees. 2017. Final Damage assessment and Preliminary Restoration Plan for the for the March 2, 2003 crude oil discharge into Lake Washington, Plaquemines Parish, Louisiana and the December 2, 2003 and April 19, 2005 crude oil discharges into Barataria Bay, Jefferson Parish, Louisiana, LWMIWCB.

Louisiana Office of the Governor, Indian Affairs. Federally and State-Recognized Tribes Contact Information. 2024. https://gov.louisiana.gov/assets/2025-Programs/Indian-Affairs/2025-Louisiana-Updated-Tribal-List.pdf

Louisiana Office of Tourism & Office of the Lt. Governor. 2026. Preserving and Showcasing Louisiana's Natural and Historical Treasures. Accessed January 21, 2026 at: https://www.lastateparks.com/

Louisiana Seafood. n.d. Louisiana Seafood Industry. Accessed August 21, 2024 at: https://www.louisianaseafood.com/industry

Martin, N., J. Dwyer, J. Murray, and N. Tyack. 2014. Avian Life History Information for Focus Bird Species Using the Northern Gulf of Mexico. Report to the Deepwater Horizon Natural Resource Damage Assessment (NRDA) Trustees. U.S. Fish and Wildlife Service. 41 pp.

Mendelssohn, I.A, G.L. Anderson, D. Baltz, R. Caffey, K.R. Carman, J.W. Fleeger, S.B. Joye, Q. Lin, E. Maltby, E. Overton, & L. Rozas. 2012. Oil Impacts on Coastal Wetlands: Implications for the Mississippi River Delta Ecosystem after the Deepwater Horizon Oil Spill. BioScience. 62(6). 562-574.

Michel, J. and N. Rutherford. 2014. Impacts, recovery rates, and treatment options for spilled oil in marshes. Marine Pollution Bulletin. 82. 19-25.

Michel, J., N. Rutherford & Zengel. 2022. Oil spills in marshes: Planning & response considerations. National Oceanic and Atmospheric Administration; American Petroleum Institute. https://response.restoration.noaa.gov/sites/default/files/Oil_Spills_in_Marshes.pdf

National Oceanic and Atmospheric Administration, 1999. Discounting and the treatment of uncertainty in natural resource damage assessment. Technical Paper 99-1. National Oceanic and Atmospheric Administration, Damage Assessment and Restoration Program, Silver Spring, MD.

National Oceanic and Atmospheric Administration (NOAA). 2006. Habitat Equivalency Analysis: An overview. Policy and Technical Paper Series, No. 95-1.

National Oceanic and Atmospheric Administration (NOAA). 2024. National Centers for Environmental Information, Climate at a glance: Global Mapping. Accessed May 2, 2024 at: https://www.ncdc.noaa.gov/cag/global/mapping

National Oceanic and Atmospheric Administration (NOAA). 2025. Threatened and Endangered Species List - Gulf of America. Accessed January 14, 2026 at: https://www.fisheries.noaa.gov/southeast/consultations/threatened-and-endangered-species-list-gulf-america

National Oceanic and Atmospheric Administration National Weather Service (NOAA NWS). n.d.a Climate. Accessed May 6, 2024 at: https://www.weather.gov/wrh/Climate

National Oceanic and Atmospheric Administration National Weather Service (NOAA NWS). n.d.b Climate – Galliano LA weather station. Accessed May 13, 2024 at: https://www.weather.gov/wrh/Climate?wfo=lix

National Oceanic and Atmospheric Administration, U.S. Department of the Interior, Louisiana Oil Spill Coordinator's Office, Office of the Governor, Louisiana Department of Environmental Quality, Louisiana Department of Natural resources, Louisiana Department of Wildlife and Fisheries. 2007. The Louisiana Regional Restoration Planning Program Final Programmatic Environmental Impact Statement. 172pp plus appendices.

National Park Service (NPS). 2024a. National Register of Historical Places Accessed October 3, 2024 at: https://www.nps.gov/subjects/nationalregister/database-research.htm

National Park Service (NPS). 2024b. Jean Lafitte. Accessed October 7, 2024 at: https://www.nps.gov/jela/index.htm

Natural Resource Trustees. National Oceanic and Atmospheric Administration, Maryland Department of Natural Resources, Maryland Department of the Environment, U.S. Fish and Wildlife Service. 2002. Final Restoration Plan and Environmental Assessment for the April 7, 2000 Oil Spill at Chalk Point on the Patuxent River, Maryland. 86 pp.

Pearson, S.H. & J.J. Wiebe. 2018a. Distribution, Sex Ratios, and Size Distributions of Diamond-Backed Terrapins (*Malaclemys terrapin*) in the Deltaic Plain of Louisiana. Herpetologica, 74(2), 135-140.

Pearson, S. H. & J.J. Wiebe. 2018b. Considering diamond-backed terrapin (*Malaclemys terrapin*) nesting habitat and reproductive productivity in the restoration of Gulf of Mexico coastal ecosystems. Ocean and Coastal Management. 155. 8-14. https://doi.org/10.1016/j.ocecoaman.2018.01.017.

Penn, T. & T. Tomasi. 2002. Environmental Assessment Calculating Resource Restoration for and Oil Discharge in Lake Barre, Louisiana, USA. Environmental Management 29 (5): 691-702.

Pezeshki, S.R., M.W. Hester, Q.Lin, & J.A. Nyman. 2000. The effects of oil spill and clean-up on dominant US Gulf coast marsh macrophytes: a review. Environmental Pollution. 108. 129-139.

Ports of Louisiana. n.d. Port Locations. Accessed October 4, 2024 at: https://www.portsoflouisiana.org/port-locations

Port of Morgan City. n.d. Accessed October 4, 2024 at: https://www.portofmc.com/

Proffitt, C.E., D.J. Devlin, & M. Lindsey. 1995. Effects of Oil on Mangrove Seedlings Grown Under Different Environmental Conditions. Marine Pollution Bulletin. 30(12). 788-793.

PwC. 2023. Impacts of the Oil and Natural Gas Industry on the US Economy in 2021. Prepared for American Petroleum Institute. Accessed April 11, 2024 at:

https://www.api.org/-/media/files/policy/american-energy/pwc/2023/api-pwc-economic-impact-report-2023.pdf

Rabalais, N.N. & R.E. Turner. 2016. Effects of the Deepwater Horizon oil spill on coastal marshes and associated organisms. Oceanography 29(3). 150-159.

Rivera-Monroy, V. H., Elliton, C., Narra, S., Meselhe, E., Zhao, X., White, E., C.E. Sasser, J.M. Visser, X. Meng, H. Wang, Z. Xue, & Jaramillo, F. (2019). Wetland biomass and productivity in coastal Louisiana: Base line data (1976–2015) and knowledge gaps for the development of spatially explicit models for ecosystem restoration and rehabilitation initiatives. Water, 11(10), 2054.

Ross, P.M. 2006. Macrofaunal Loss and Microhabitat Destruction: The Impact of Trampling in a Temperate Mangrove Forest, NSW Australia. Wetlands Ecology and Management. 14. 167-184.

Sabo, A.B., M.R. Cornish, M.C.N. Castorani, & J.C. Zinnert. 2024. Drivers of dune formation control ecosystem function and response to disturbance in a barrier island system. Scientific Reports. 14(1).

ShaleXP 2024. Oil & Gas Data Visualization and Research. Accessed October 4, 2024 at: https://www.shalexp.com/louisiana

Silliman B.R., J. van de Koppel, M.W. McCoy, J. Diller, G.N. Kasozi, K. Earl, P.N. Adams, A.R. Zimmerman. 2012. Degradation and resilience in Louisiana salt marshes after the BP-Deepwater Horizon oil spill. Proc Natl Acad Sci U S A. 109(28):11234-9. doi: 10.1073/pnas.1204922109. Epub 2012 Jun 25. PMID: 22733752; PMCID: PMC3396483.

Sperduto, M.B., S.P. Powers, & M. Donlan. 2003. Scaling restoration to achieve quantitative enhancement of loon, seaduck, and other seabird populations. Marine Ecology Progress Series. Vol. 264:221-232.

Stuart, C. G., D. Knochenmus, & B.D. McGee. 1994. Guide to Louisiana's Ground Water Resources: U.S. Geological Survey, Baton Rouge, LA, prepared in cooperation with Louisiana Department of Transportation and Development, Baton Rouge, LA. Water Resources Investigations Report 94-4085. 55 pp.

Temmerman, S., T.J., Bouma, G. Govers, & D. Lauwaet. 2005a. Flow paths of water and sediment in a tidal marsh: Relations with marsh developmental stage and tidal inundation height. Estuaries. 28. 338–352.

Temmerman, S., T. J. Bouma, G. Govers, Z. B. Wang, M. B. De Vries, & P. M. J. Herman (2005b), Impact of vegetation on flow routing and sedimentation patterns: Three-dimensional modeling for a tidal marsh, Journal of Geophysical Research. 110, F04019. doi:10.1029/2005JF000301.

Terrebonne Parish Consolidated Government (TPCG). 2024. History of Houma-Terrebonne. Accessed May 7, 2024 at: https://www.tpcg.org/index.php?f=parish

Town of Grand Isle. 2024. History of Grand Isle. Accessed on May 7, 2024 at: https://townofgrandisle.com/history/

United States Army Corps of Engineers (USACE). n.d. The Gulf Intracoastal Waterway Project Brochure. USACE New Orleans District. 4 pp.

United States Census Bureau. 2023a. QuickFacts for Louisiana. Accessed May 2, 2024 at: https://www.census.gov/quickfacts/fact/table/LA/PST045221

United States Census Bureau. 2023b. Tiger/Line Geodatabases. Accessed January 31, 2024 at: https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-geodatabase-file.html

United States Department of Agriculture (USDA). 2019. Census of Agriculture 2017 State and Parish Profiles. Accessed December 7, 2021 at: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Louisiana/index.php

United States Department of Agriculture (USDA). 2024. Census of Agriculture 2022 State and Parish Profiles. Accessed April 1, 2024 at: https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Louisiana/index.php

United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS). 2019. United States Department of Agriculture, Natural Resources Conservation Service, Soil Survey Staff. Web Soil Survey. Accessed February 15, 2022 at: http://websoilsurvey.sc.egov.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

United States Department of Transportation (US DOT). 2023. Bureau of Transportation Statistics. Geospatial at BTS. Accessed January 29, 2024 at: https://data-usdot.opendata.arcgis.com/

United States Energy Information Administration (USEIA). 2024. Louisiana State Energy Profile. Last updated August 15, 2024. Accessed September 30, 2024 at: https://www.eia.gov/state/?sid=LA

United States Fish and Wildlife Service (USFWS). n.d.a. Our Facilities. Accessed January 13, 2026 at:https://www.fws.gov/locations?type=%5B%22National%20Wildlife%20Refuge%22%5D&state_name=%5B%22Louisiana%22%5D

United States Fish and Wildlife Service (USFWS IPaC). 2026. Information for Planning and Consultation. Accessed on January 14, 2026 at: https://ipac.ecosphere.fws.gov/

University of New Orleans. 2023. Hospitality Research Center. Tourism Spending in Louisiana Parishes 2022. Prepared for Louisiana Department of Culture, Recreation, and Tourism. May 2023. 32 pp.

Vincent, O.D., B.E. Schaffer, & I. Rodriguez-Iturbe. 2021. Stochastic dynamics of barrier island elevation. Proceedings of the National Academy of Sciences. Vol 118 (1). e2013349118 https://doi.org/10.1073/pnas.2013349118

Visser, J.M., Sasser, C.E., Chabreck, R.H., and Linscombe, R.G., 1998. Marsh vegetation types of the Mississippi River deltaic plain. Estuaries and Coasts 21(4), 11 p.

Weindorf, D. C. 2008. An Update of the Field Guide to Louisiana Soil Classification. Research Bulletin no. 889. Louisiana State University Agricultural Center, Louisiana State University, Baton Rouge, Louisiana.

Zengel, S., B.M. Bernik, N. Rutherford, Z. Nixon, & J. Michel. 2015. Heavily Oiled Salt Marsh following the Deepwater Horizon Oil Spill, Ecological Comparisons of Shoreline Cleanup Treatments and Recovery. PLoS ONE. 10(7). e0132324. https://doi.org/10.1371/journal.pone.0132324

Zengel, S. & J. Michel. 1996. Vegetation Cutting as a Clean-up Method for Salt ad Brackish Marshes Impacted by Oil Spills: a Review and Case History of the Effects on Plant Recovery. Marine Pollution Bulletin. 32(12). 876-885.

Zengel, S., J. Weaver, I.A. Mendelssohn, S.A. Graham, Q. Lin, M.W. Hester, J.W. Willis, B.R. Silliman, J.W. Fleeger, G. McClenachan, N.N. Rabalais, R.E. Turner, A.R Hughes, J. Cebrian, D.R. Deis, N. Rutherford, & B.J. Roberts. 2022. Meta-analysis of salt marsh vegetation impacts and recovery: a synthesis following the Deepwater Horizon oil spill. Ecological Applications. 32(1).

Ziccardi, M. and Drayer, K.C. 2015. Expert Assistance - Deepwater Horizon Oil Spill Bird Injury. Final Report, August 29, 2015. Prepared for Department of the Interior, U.S. Fish and Wildlife Service under contract to Industrial Economics, Incorporated.

APPENDIX A

Table A-1: Common Vegetation of RRP Region 2 and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Phragmites spp.	common reeds, roseau cane	FM, B/IM
Spartina alterniflora	smooth cordgrass	SM, B/IM
Spartina patens	marshhay cordgrass	SM, B/IM
Distichlis spicata	saltgrass	SM, B/IM
Schoenoplectus spp.	bulrushes, three squares, three corner grass	FM, B/IM
Typha spp.	cattails	FM
Zizaniopsis miliacea	giant cutgrass	FM
Panicum hemitomon	maidencane	FM
Cladium jamaicense	saw grass	FM
Eleocharis spp.	spike-rushes	FM
Pontederia cordata	pickerelweed	FM
Sagittaria spp.	arrowheads	FM
Salix nigra	black willow	FM, WF, B
Quercus spp.	oaks	WF, UF
Liquidambar styraciflua	sweet gum	WF, UF
Nyssa spp.	gums, tupelos	WF
Acer rubrum	red maple	WF, UF
Taxodium distichum	bald cypress	WF
Ulmus americana	American elm	WF
Fraxinus spp.	ashes	WF, UF
Liriodendron tulipifera	tulip poplar	WF
Platanus occidentalis	sycamore	WF
Cephalanthus occidentalis	buttonbush	WF
Carya spp.	hickory	UF
Pinus palustris	longleaf pine	UF
Pinus echinata	shortleaf pine	UF
Salicornia spp.	glasswort	SM
Avicennia germinans	black mangrove	MS
Juncus roemerianus	black rush	SM
Thalassia testudinum	turtlegrass	M/ESAV
Potamogeton spp.	pondweed	M/ESAV, FSAV
Ceratophyllum demersum	coontail	FSAV
Utricularia spp.	bladder worts	FSAV
Eichhornia crassipes	water hyacinth	FSAV
Alternanthera philoxeroides	alligatorweed	FSAV
Limnobium spongia	American frog-bit	FSAV
Pistia stratiotes	water lettuce	FSAV
Nymphaea odorata	white water lily	FSAV
Hydrilla verticillata	hydrilla	FSAV

Table A-2: Common Mammals of RRP Region 2 and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Odocoileus virginianus	whitetail deer	B/IM, FM, WF, B, WS/S, UF, A/C/G, US/S, FS
Sylvilagus sp.	swamp rabbit, eastern cottontail	B/IM, FM, WF, B, WS/S, UF, A/C/G, US/S
Myocastor coypus	nutria	B/IM, FM, WF, B, WS/S, FS
Ondatra zibethica	muskrat	B/IM, FM, WF, B, WS/S, FS
Procyon lotor	raccoon	B/IM, FM, WF, B, WS/S, UF, US/S, FS, M/ES, A/C/G
Sus scrofa	wild boar	FM, WF, B, UF, WS/S, US/S
Reithrodontomys fulvescens	fulvous harvest mouse	SM, B/IM, FM, WF, B, UF, MS, A/C/G, WS/S, US/S, FS, M/ES
Dasypus novemcinctus	armadillo	WF, B, UF, A/C/G, WS/S, US/S
Canis latrans	coyote	UF, A/C/G, WF, B, WS/S, US/S
Lynx rufus	bobcat	WF, B, UF, US/S
Didelphis virginiana	Virginia opossum	UF, A/C/G, WF, B, WS/S, US/S
Lasiurus borealis	eastern red bat	WF, UF
Sciurus carolinensis	eastern grey squirrel	UF, US/S
Sciurus niger	fox squirrel	UF, US/S
Mustela vison	mink	B/IM, FM, FS, M/ES, W
Lutra canadensis	river otter	B/IM, FM, WF, B, WS/S, FS

Table A-3: Common Reptiles and Amphibians of RRP Region 2 and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Alligator mississippiensis	American alligator	SM, B/IM, FM, WF, B, MS, M/ESAV, FSAV, M/EB, FB
Malaclemys terrapin	diamondback terrapin	SM, B/IM, M/ES, M/ESAV, M/EB
Chelydra serpentina	snapping turtle	B/IM, FM, M/ES, FS, WF, B, M/ESAV, FSAV, M/EB, FB
Sternotherus spp.	musk turtles	FM, FS, WF, B, FSAV, FB
Kinosternon spp.	mud turtles	B/IM, M/ES, FM, FS, WF, B, FSAV, M/ESAV, M/EB, FB
Graptemys psuedogeographica kohnii	Mississippi map turtle	FM, FS, WF, B, FSAV, FB
Deirochelys reticularia	chicken turtle	FM, FS, WF, B, FSAV, FB
Chrysemys picta	painted turtle	FM, FS, WF, B, FSAV, FB
Pseudemys concinna	river cooter (turtle)	FM, FS, WF, B, FSAV, FB
Trachemys scripta	slider (turtle)	FM, FS, WF, B, FSAV, FB
Terrapene spp.	box turtles	WF, B, UF, A/C/G, WS/S, US/S, FS,
Apalone spp.	softshell turtles	FM, FS, WF, B, FSAV, FB
Nerodia spp.	water snakes	SM, B/IM, M/ES, M/ESAV, FM, FS, WF, B, FSAV
Regina spp.	crawfish snakes	FM, FS, WF, B, FSAV, A/C/G, WS/S
Thamnophis spp.	garter, ribbon snakes	FM, FS, WF, B, FSAV, UF, A/C/G, US/S, WS/S
Storeria spp.	redbelly, brown snakes	FM, FS, FSAV, WF, B, UF, A/C/G, US/S, WS/S
Virginia spp.	earth snakes	FM, FS, FSAV, WF, B, UF, A/C/G, US/S, WS/S
Diadophis punctatus	ringneck snake	WF, B, UF, A/C/G, US/S, WS/S, FS
Heterodon platirhinos	eastern hognose snake	WF, B, UF, A/C/G, US/S, WS/S, FS
Opheodrys aestivus	rough green snake	WF, B, UF, A/C/G, US/S, WS/S, FS, FM
Farancia abacura	mud snake	SM, B/IM, M/ES, M/ESAV, FM, FS, WF, B, FSAV
Coluber constrictor	racer (snake)	WF, B, FM, FS, WS/S
Elaphe spp.	rat snakes	UF, A/C/G, WF, B, US/S, WS/S
Lampropeltis spp.	milk snakes, kingsnakes	B/IM, M/ES, FM, FS, WF, B, UF, A/C/G, WS/S, US/S
Agkistrodon piscivorus	cottonmouth (snake)	B/IM, M/ES, FM, FS, WF, B, WS/S
Agkistrodon contortrix	copperhead (snake)	FS, WF, B, US/S, WS/S, A/C/G, UF
Sistrurus miliarius	pigmy rattlesnake	FS, WF, B, WS/S, US/S, A/C/G, UF
Crotalus horridus	timber rattlesnake	FS, WF, B, WS/S, US/S, A/C/G, UF
Scincella lateralis	ground skink	WF, WS/S, UF, B, A/C/G, FS, M/ES, US/S, UB
Hyla spp.	tree frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S
Psuedacris spp.	chorus frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S, A/C/G
Acris spp.	cricket frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S, A/C/G

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Rana spp.	true frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S, US/S, A/C/G, UF

Table A-4: Common Birds of RRP Region 2 and their Associated Habitats - Waterfowls and Waterbirds

Scientific Name	Common Name	Season*	Habitats (see Table A-12 for key)
Gavia immer	common loon	W	M/ES, FS, M/ESAV, FSAV, W
Podiceps spp.	grebes	W	M/ES, M/ESAV, W
Phalacrocorax auritus	double-crested cormorant	W	M/ES, M/ESAV, FS, FSAV, W
Anhinga anhinga	American anhinga	YR	WF, B, A/C/G, FS, WS/S, W
Chen caerulescens	snow goose	W	M/ES, FS, B/IM, FM, A/C/G, W
Branta canadensis	Canada goose	W	M/ES, FS, B/IM, FM, A/C/G, W
Anas fulvigula	mottled duck	YR	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas strepera	gadwall	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas platyphynchos	mallard	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, WF, B, WS/S, W
Anus acuta	common pintail	W	SM, B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anus americana	American wigeon	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, A/C/G, W
Aix sponsa	wood duck	YR	WF, WS/S, FS, B, W
Anas clypeata	northern shoveler	W	FM, FS, FSAV, SM, B/IM, M/ES, M/ESAV, W
Anas discors	blue-winged teal	YR	FM, FS, FSAV, W
Anas crecca	green-winged teal	W	M/ES, B/IM, FM, FS, FSAV, W
Aythya valisineria	canvasback	W	SM, B/IM, FM, M/ES, FS, M/ESAV, FSAV, W
Aythya collaris	ring-necked duck	W	WF, WS/S, FS, B, W
Aythya affinis	lesser scaup	W	FS, FSAV, M/ES, W
Bucephala clangula	common goldeneye	W	WF, WS/S, FS, W, B, M/ES
Bucephala albeola	bufflehead	W	FS, FSAV, M/ES, M/ESAV, W
Oxyura jamaicensis	ruddy duck	W	FS, FM, FSAV, M/ES, W
Mergus serrator	red-breasted merganser	W	FS, M/ES, FSAV, W
Gelochelidon nilotica	gull-billed tern	YR	SM, M/ES, WB, A/C/G, W, B/IM
Lophodytes cucullatus	hooded merganser	W, Br	WF, WS/S, B, FS, W
Fulica americana	American coot	W	W, FM, B/IM, FS, M/ES, A/C/G, M/ESAV, FSAV
Gallinula chloropus	common moorhen	YR	W, FM, FS, FSAV
Porphyrula martinica	purple gallinule	Br	W, FM, FS, WF, B, FSAV

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table A-5: Common Birds of RRP Region 2 and their Associated Habitats - Fowl

Scientific Name	Common Name	Season*	Habitats (see Table A-12 for key)
Meleagris gallopavo	wild turkey	YR	WF, B, UF, WS/S, US/S
Colinus virginianus	common bobwhite	YR	A/C/G, US/S, UF, WF

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table A-6: Common Birds of RRP Region 2 and their Associated Habitats – Colonial Nesting Wading Birds

Scientific Name	Common Name	Season*	Habitats (see Table A-12 for key)
Ardea herodias	great blue heron	YR	FM, B/IM, SM, WB, FS, M/ES, WF, MS, B, WS/S, W
Egretta caerulea	little blue heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, A/C/G, W, FS, ME/S
Hydranassa tricolor	tricolored heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, ME/S
Casmerodius albus	great egret	YR	FM, B/IM, SM, WB, WF, W, FS, ME/S, WF, FS, M/ES
Egretta thula	snowy egret	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Bubulcus ibis	cattle egret	YR	FM, WB, W, A/C/G, FS
Nycticorax nycticorax	black-crowned night heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Nyctanassa violacea	yellow-crowned night heron	Br	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Butorides striatus	green-backed heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Ixobrychus exilis	least bittern	Br	FM, FS, W
Botaurus lentiginosus	American bittern	W	FM, FS, W
Eudocimus albus	white ibis	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES, A/C/G
Rallus spp.	rails	W, Br	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Himantopus mexicanus	black-necked stilt	YR	FM, FS, W, WB
Recurvirostra americana	American avocet	W	M/ES, FS, W
Pluvialis squatarola	black-bellied plover	W	FS, WB, ME/S, W
Arenaria interpres	ruddy turnstone	W	FS, WB, ME/S, W, WS/S
Charadrius semipalmatus	semipalmated plovers	W	ME/S
Charadrius wilsonia	Wilson's plover	Br	ME/S
Charadrius vociferous	killdeer	YR	A/C/G, FS, WS/S, W
Philohelo minor	American woodcock	W	WS/S, WF, B
Capella gallinago	common snipe	W	WB, FM, B/IM, A/C/G
Limnodromus griseus	short-billed dowitcher	W	WB, FM, B/IM, FS
Calidris canutus	red knot	W	M/ES, FS
Haematopus palliates	American oystercatcher	YR	SM, B/IM, M/ES
Catoptrophorus semipalmatus	willet	YR	FM, B/IM, SM, M/ES, WB
Tringa melanoleuca	greater yellowlegs	W	FM, WB, FS, W, B, WF, WS/S
Tringa flavipes	lesser yellowlegs	W	FM, WB, FS, W, WF, WS/S, M/ES, B/IM, SM
Calidris alba	sanderling	W	FS, M/ES
Calidris alpine	dunlin	W	WB, M/ES, FS
Actitus macularia	spotted sandpiper	W	WS/S, FS
Calidris minutilla	least sandpiper	W	WB, FM, W, FS
Calidris mauri	western sandpiper	W	WB, M/ES, FS

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table A-7: Common Birds of RRP Region 2 and their Associated Habitats – Raptors

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Ictinia mississippiensis	Mississippi kite	Br	WF, B, WS/S
Accipiter striatus	sharp-shinned hawk	W	WF, UF, B, WS/S, US/S
Accipiter cooperii	Cooper's hawk	YR	WF, UF, B, WS/S, US/S
Circus cyanus	northern harrier	W	FM, B/IM, A/C/G
Buteo jamaicensis	red-tailed hawk	YR	A/C/G, WF, B, UF, FM, WS/S
Buteo lineatus	red-shouldered hawk	YR	A/C/G, WF, B, UF, FM, WS/S
Buteo platypterus	broad-winged hawk	Br	WF, UF, B
Haliaeetus leucocephalus	bald eagle	Br	WF, UF
Pandion haliaetus	osprey	YR	WF, FS, M/ES
Cathartes aura	turkey vulture	YR	WF, UF
Coragyps atratus	black vulture	YR	WF, UF
Falco sparverius	American kestrel	W	A/C/G, WF, UF
Falco columbarius	merlin	W	UF, WF, FM, A/C/G
Falco peregrinus	peregrine falcon	W	A/C/G
Otus asio	eastern screech owl	YR	WF, UF, A/C/G, US/S, WS/S, B
Bubo virginianus	great horned owl	YR	WF, UF, WS/S, US/S, A/C/G
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table A-8: Common Birds of RRP Region 2 and their Associated Habitats - Non-Passerine Land Birds

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Zenaida macroura	mourning dove	YR	A/C/G, UF, US/S
Coccyzus americanus	yellow-billed cuckoo	Br	UF, US/S, A/C/G
Chordeiles minor	common nighthawk	Br	A/C/G, UF
Caprimulgus carolinensis	chuck-will's-widow	Br	WF, UF, WS/S, US/S, B
Archilochus colubris	ruby-throated hummingbird	Br	A/C/G, UF
Megaceryle alcyon	belted kingfisher	W	FS, M/ES, W, FM, B/IM, SM
Melanerpes erythrocephalus	red-headed woodpecker	YR	A/C/G, UF, US/S
Dryocopus pileatus	pileated woodpecker	YR	UF, WF
Colaptes auratus	common flicker	YR	UF, WF, A/C/G
Melanerpes carolinus	red-bellied woodpecker	YR	WF, UF, A/C/G
Sphyrapicus varius	yellow-bellied sapsucker	W	WF, UF,
Picoides pubescens	downy woodpecker	YR	WF, UF, B, WS/S, US/S
Picoides villosus	hairy woodpecker	YR	WF, UF, B, WS/S, US/S
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table A-9: Common Birds of RRP Region 2 and their Associated Habitats - Passerine Birds

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Tyrannus tyrannus	eastern kingbird	Br	UF, WF, WS/S, A/C/G
Muscivora forficata	scissor-tailed woodpecker	W, Br	A/C/G
Myiarchus crinitus	great crested flycatcher	Br	UF, WF
Contopus virens	eastern pewee	Br	UF, WF, WS/S, US/S
Empidonax virescens	acadian flycatcher	Br	UF, WF, B
Anthus spinoletta	water pipit	W	FS, M/ES, A/C/G
Progne subis	purple martin	Br	FS, A/C/G
Hirundo rustica	barn swallow	Br	A/C/G, FM, FS, W
Iridoprocne bicolor	tree swallow	W	A/C/G, FS, WB, FM, WF
Stelgidopteryx ruficollis	rough-winged swallow	Br	FS, WS/S, FM
Corvus ossifragus	fish crow	YR	FS, A/C/G, M/ES
Corvus brachyrhynchos	American crow	YR	UF, WF, A/C/G, WS/S, FS
Cyanocitta cristata	blue jay	YR	UF, A/C/G
Parus carolinensis	Carolina chickadee	YR	UF, A/C/G
Parus bicolor	tufted titmouse	YR	WF, UF, A/C/G
Certhia familiaris	brown creeper	W	WF, UF, WS/S, US/S
Troglodytes aedon	house wren	W	A/C/G, US/S, UF
Troglodytes troglodytes	winter wren	W	UF
Thryothorus ludovicianus	Carolina wren	YR	A/C/G, US/S
Cistothorus platensis	sedge wren	W	A/C/G, FM
Regulus satrapa	golden-crowned kinglet	W	UF, WF
Regulus calendula	ruby-crowned kinglet	W	UF, WF
Polioptila caerulea	blue-gray gnatcatcher	YR, Br	UF, WF, US/S, WS/S
Toxostoma rufum	brown thrasher	YR	US/S, WS/S
Dumetella carolinensis	gray catbird	W, YR	US/S, WS/S, A/C/G
Mimus polyglottos	northern mockingbird	YR	US/S, UF, A/C/G
Sialia sialis	eastern bluebird	YR	A/C/G, US/S, WS/S
Turdus migratorius	American robin	W	A/C/G, UF
Catharus guttatus	hermit thrush	W	UF, WF, US/S, WS/S, A/C/G
Hylocichla mustelina	wood thrush	Br	UF, WF
Lanius ludovicianus	loggerhead shrike	YR	A/C/G
Bombycilla cedrorum	cedar waxwing	W	UF, WF, US/S, A/C/G
Vireo spp.	vireos	Br, W, YR	UF, US/S, UB
Protonotaria citrea	prothonotary warbler	Br	WF, B, WS/S
Parula americana	northern parula warbler	Br	WF, B
Dendroica dominica	yellow-throated warbler	YR, Br	UF
Mniotilta varia	black-and-white warbler	W, Br	UF
Setophaga ruticilla	American redstart	Br	UF, US/S
Limnothlypis swainsonii	Swainson’s warbler	Br	WF, OS, WB, WS/S
Helmitheros vermivorus	worm-eating warbler	Br	UF, US/S, UB
Dendroica coronata	yellow-rumped warbler	W	UF, WF, US/S, WS/S
Dendroica pinus	pine warbler	YR	UF
Dendroica discolor	prairie warbler	Br	US/S
Dendroica palmarum	palm warbler	W	A/C/G, UF, US/S
Vermivora celata	orange-crowned warbler	W	US/S
Wilsonia pusilla	Wilson’s warbler	W	WS/S, B
Wilsonia citrina	hooded warbler	Br	WF, B, WS/S
Oporornis philidelphia	Kentucky warbler	Br	A/C/G, UB, US/S
Geothlypis trichas	common yellowthroat	YR	FW, B, FM, WS/S
Icteria virens	yellow-breasted chat	Br	WS/S, US/S
Seiurus aurocapillus	ovenbird	W	UF, US/S
Agelaius phoeniceus	red-winged blackbird	YR	FM, WF, B, A/C/G, FS, WS/S
Molothrus ater	brown-headed cowbird	YR	A/C/G, WS/S, WF, US/S, UF
Euphagus carolinus	rusty blackbird	W	WS/S, WF, B
Euphagus cyanocephalus	Brewer’s blackbird	W	A/C/G
Quiscalus quiscula	common grackle	YR	A/C/G, WS/S
Quiscalus major	boat-tailed grackle	YR	SM, M/ES
Sturnella magna	eastern meadowlark	YR	A/C/G
Sturnus vulgaris	European starling	YR	A/C/G
Icterus spurious	orchard oriole	Br	A/C/G, UF, US/S
Icterus galbula	Baltimore oriole	W, Br	UF

Piranga rubra	summer tanager	Br	UF
*Br = present during breeding season (generally spring and/or summer), W = present in winter YR = present year round			

Table A-9: Common Birds of RRP Region 2 and their Associated Habitats - Passerine Birds (continued)

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Passer domesticus	house sparrow	YR	A/C/G
Spiza americana	dickcissel	Br	A/C/G
Cardinalis cardinalis	northern cardinal	YR	A/C/G, UF, US/S
Carpodacus purpureus	purple finch	W	UF
Carduelis tristis	American goldfinch	W, Br	US/S, A/C/G, UF
Guiraca caerulea	blue grosbeak	Br	US/S, WS/S, A/C/G
Passerina cyanea	indigo bunting	Br	A/C/G, US/S
Passerina ciris	painted bunting	Br	US/S, UF, A/C/G
Pipilo erythrophthalmus	rufous-sided towhee	YR, W	UF, US/S
Zonotrichia spp.	sparrows	W	UF, WF, US/S, WS/S, A/C/G, FM, B/IM, SM
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table A-10: Common Birds of RRP Region 2 and their Associated Habitats – Seabirds and Gulls

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Pelecanus erythrorhynchos	American white pelican	W	W, FS, M/ES, FM, B/IM
Pelecanus occidentalis	brown pelican	YR, Br	SM, B/IM, FM, FS, M/ES, W
Fregata magnificens	magnificent frigatebird	NBr	SM, M/ES
Morus bassanus	northern gannet	W	M/ES
Larus spp.	gulls	W	SM, B/IM, FM, M/ES, FS, W, A/C/G
Sterna spp.	terns	W, Br	SM, B/IM, FM, WB, W, M/ES, FS
Rynchops niger	black skimmer	YR	SM, B/IM, WB, W, M/ES
*Br = present during breeding season (generally spring and/or summer) NBr= not a breeder, but present during the breeding season (spring and/or summer) W = present in winter YR = present year round			

Table A-11: Common Fish and Shellfish of RRP Region 2 and their Associated Habitats

Scientific Name	Common Name	**Habitat (see Table A-12 for key)***
Hybognathus nuchalis	Mississippi silvery minnow	FW
Hybognathus hayi	cypress minnow	FW
Notropis spp.	shiners	FW
Notemigonus crysoleucas	golden shiner	FW
Phenacobius mirabilis	suckermouth minnow	FW
Pimephales vigilax	bullhead minnow	FW
Carpiodes carpio	river carpsucker	FW
Semotilus atromaculatus	creek chub	FW
Cyprinus carpio	common carp	FW
Aphredoderus sayanus	pirate perch	FW
Gambusia affinis	mosquito fish	FW
Morone chrysops	white bass	FW
Morone mississippiensis	yellow bass	FW
Morone saxatilis	striped bass	FW, BW, SW
Micropterus punctulatus	spotted bass	FW
Micropterus salmoides	largemouth bass	FW
Ambloplites rupestris	rock bass	FW
Lepomis cyanellus	green sunfish	FW
Lepomis macrochirus	bluegill	FW
Lepomis gulosus	warmouth	FW
Lepomis megalotis	longear sunfish	FW
Lepomis microlophus	redear sunfish	FW
Lepomis punctatus	spotted sunfish	FW
Lepomis humilis	orangespotted sunfish	FW
Lepomis symmetricus	bantam sunfish	FW
Lepomis spp.	hybrid sunfish	FW
Centrarchus macropterus	flier	FW
Pomoxis annularis	white crappie	FW
Pomoxis nigromaculatus	black crappie	FW
Ammocrypta clara	sand darter	FW
Etheostoma zonale	banded darter	FW
Aplodinotus grunniens	freshwater drum	FW
Lepisosteus oculatus	spotted gar	FW
Lepisosteus osseus	longnose gar	FW, BW
Lepisosteus platostomus	shortnose gar	FW
Lepisosteus spatula	alligator gar	FW, BW
Amia calva	bowfin (or choupique)	FW
Ictiobus cyprinellus	bigmouth buffalo	FW
Ictiobus babalus	smallmouth buffalo	FW
Ictiobus niger	black buffalo	FW
Ictalurus furcatus	blue catfish	FW, BW
Ictalurus punctatus	channel catfish	FW
Ictalurus natalis	yellow bullhead	FW
Noturus spp	madtoms	FW
Pylodictis olivaris	flathead catfish	FW
Mugil cephalus	striped mullet	FW, BW, SW
Fundulus notatus	blackstripe topminnow	FW
Fundulus notti	bayou topminnow	FW
Polyodon spathula	paddlefish	FW
Scaphirhynchus platorynchus	shovelnose sturgeon	FW
Dorosoma cepedianum	gizzard shad	FW, BW
Dorosoma petenense	threadfin shad	FW, BW
Anguilla rostrata	American eel	FW, BW, SW
Cyprinodon variegates	sheephead minnow	FW, BW, SW
Poeciliidae	livebearers	FW
Acipenser oxyrinchus desotoi	Gulf sturgeon	FW, BW, SW
Macrobrachium ohione	river shrimp	FW
Palaemonetes spp.	grass shrimp	FW, BW, SW
Procambarus clarkii	red swamp crawfish	FW
Procambarus acutus	white river crawfish	FW

*FW = Fresh Water, BW = Brackish Water, SW = Salt Water

Table A-11: Common Fish and Shellfish of RRP Region 2 and their Associated Habitats (continued)

Scientific Name	Common Name	**Habitat (see Table A-12 for key)***
Myrophis punctatus	speckled worm eel	BW, SW
Sciaenops ocellatus	red drum (redfish)	BW, SW
Pogonias cromis	black drum	BW, SW
Paralichthys lethostigma	southern flounder	BW, SW
Etropus crossotus	fringed flounder	BW, SW
Trinectes maculatus	hogchoker	BW, SW
Archosargus probatocephalus	sheepshead	BW, SW
Micropogonias undulates	Atlantic croaker	BW, SW
Leiostomus xanthurus	spot	BW, SW
Cynoscion arenarius	sand seatrout	BW, SW
Cynoscion nebulosus	spotted seatrout	BW, SW
Brevoortia petronus	Gulf menhaden	BW, SW
Anchoa mitchilli	bay anchovy	BW, SW
Fundulidae	killifishes	BW, SW
Membras spp.	silversides	SW
Gobiidae	gobies	SW
Elops saurus	ladyfish	BW, SW
Megalops atlanticus	tarpon	SW
Citharichthys spilopterus	bay whiff	BW, SW
Bairdiella chrysoura	silver perch	BW, SW
Dasyatis sabina	Atlantic stingray	BW, SW
Caranx hippos	crevalle jack	SW
Trachinotus carolinus	Florida pompano	SW
Lutjanus griseus	gray snapper	SW
Lutjanus campechanus	red snapper	SW
Coryphaena hippurus	dolphin	BW, SW
Carcharhinus limbatus	blacktip shark	BW, SW
Chaetodipterus faber	spadefish	BW, SW
Balistes capriscus	gray triggerfish	SW
Menticirrhus americanus	southern kingfish	BW, SW
Scomberomorus maculatus	Spanish mackerel	SW
Prionotus spp.	searobins	BW, SW
Penaeus aztecus	brown shrimp	BW, SW
Penaeus setiferus	white shrimp	BW, SW
Penaeus duorarum	pink shrimp	BW, SW
Xiphopenaeus kroyeri	seabob shrimp	SW
Pleoticus robustus	royal red shrimp	BW, SW
Callinectes sapidus	greater blue crab	BW, SW
Callinectus simileis	lesser blue crab	BW, SW
Menippe adina	stone crab	BW, SW
Panopeus spp.	mud crabs	BW, SW
Lollinguncula brevis	brief squid	BW, SW
Loligo pealei	long fin	BW, SW
Loligo plei	arrow squid	SW
Crassostrea virginica	eastern oyster	BW, SW
Stramonita haemostoma	southern oyster drill	SW
Mercenaria campechiensis	southern quahog clam	SW
FW = Fresh Water, BW = Brackish Water, SW = Salt Water		

Table A-12 Key for Habitat Type Abbreviations in Tables A-1 through A-11

Habitat Type	Abbreviation
Saltwater Marsh	SM
Brackish/Intermediate Marsh	B/IM
Freshwater Marsh	FM
Wetland Forest	WF
Wetland Scrub-Shrub	WS/S
Mangrove Swamp	MS
Upland Forest	UF
Marine/Estuarine Submerged Aquatic Vegetation (SAV)	M/ESAV
Freshwater SAV	FSAV
Batture	B
Agriculture-Cropland-Grassland	A/C/G
Freshwater Shore	FS
Marine/Estuarine Shore	M/ES
Upland Scrub/Shrub	US/S
Wetland Barren	WB
Upland Barren	UB
Water	W
Marine/Estuarine Benthic	M/EB
Freshwater Benthic	FB
Marine/Estuarine Encrusting Communities	M/EEC
Living Reefs	LR

APPENDIX B

Table B-1: Common Vegetation of RRP Region 3 and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Phragmites spp.	common reeds, roseau cane	FM, B/IM
Spartina alterniflora	smooth cordgrass	SM, B/IM
Spartina patens	marshhay cordgrass	SM, B/IM
Distichlis spicata	saltgrass	SM, B/IM
Schoenoplectus spp.	bulrushes, three squares, three corner grass	FM, B/IM
Typha spp.	cattails	FM
Zizaniopsis miliacea	giant cutgrass	FM
Panicum hemitomon	maidencane	FM
Cladium jamaicense	saw grass	FM
Eleocharis spp.	spike-rushes	FM
Pontederia cordata	pickerelweed	FM
Sagittaria spp.	arrowheads	FM
Salix nigra	black willow	FM, WF, B
Quercus spp.	oaks	WF, UF
Liquidambar styraciflua	sweet gum	WF, UF
Nyssa spp.	gums, tupelos	WF
Acer rubrum	red maple	WF, UF
Taxodium distichum	bald cypress	WF
Ulmus americana	American elm	WF
Fraxinus spp.	ashes	WF, UF
Liriodendron tulipifera	tulip poplar	WF
Platanus occidentalis	sycamore	WF
Cephalanthus occidentalis	buttonbush	WF
Carya spp.	hickory	UF
Pinus palustris	longleaf pine	UF
Pinus echinata	shortleaf pine	UF
Salicornia spp.	glasswort	SM
Avicennia germinans	black mangrove	MS
Juncus roemerianus	black rush	SM
Thalassia testudinum	turtlegrass	M/ESAV
Potamogeton spp.	pondweed	M/ESAV, FSAV
Ceratophyllum demersum	coontail	FSAV
Utricularia spp.	bladder worts	FSAV
Eichhornia crassipes	water hyacinth	FSAV
Alternanthera philoxeroides	alligatorweed	FSAV
Limnobium spongia	American frog-bit	FSAV
Pistia stratiotes	water lettuce	FSAV
Nymphaea odorata	white water lily	FSAV
Hydrilla verticillata	hydrilla	FSAV

Table B-2: Common Mammals of RRP Region 3 and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Odocoileus virginianus	whitetail deer	B/IM, FM, WF, B, WS/S, UF, A/C/G, US/S, FS
Sylvilagus sp.	swamp rabbit, eastern cottontail	B/IM, FM, WF, B, WS/S, UF, A/C/G, US/S
Myocastor coypus	nutria	B/IM, FM, WF, B, WS/S, FS
Ondatra zibethica	muskrat	B/IM, FM, WF, B, WS/S, FS
Procyon lotor	raccoon	B/IM, FM, WF, B, WS/S, UF, US/S, FS, M/ES, A/C/G
Sus scrofa	wild boar	FM, WF, B, UF, WS/S, US/S
Reithrodontomys fulvescens	fulvous harvest mouse	SM, B/IM, FM, WF, B, UF, MS, A/C/G, WS/S, US/S, FS, M/ES
Dasypus novemcinctus	armadillo	WF, B, UF, A/C/G, WS/S, US/S
Canis latrans	coyote	UF, A/C/G, WF, B, WS/S, US/S
Lynx rufus	bobcat	WF, B, UF, US/S
Didelphis virginiana	Virginia opossum	UF, A/C/G, WF, B, WS/S, US/S
Lasiurus borealis	eastern red bat	WF, UF
Sciurus carolinensis	eastern grey squirrel	UF, US/S
Sciurus niger	fox squirrel	UF, US/S
Mustela vison	mink	B/IM, FM, FS, M/ES, W
Lutra canadensis	river otter	B/IM, FM, WF, B, WS/S, FS

Table B-3: Common Reptiles and Amphibians of RRP Region 3 and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Alligator mississippiensis	American alligator	SM, B/IM, FM, WF, B, MS, M/ESAV, FSAV, M/EB, FB
Malaclemys terrapin	diamondback terrapin	SM, B/IM, M/ES, M/ESAV, M/EB
Chelydra serpentina	snapping turtle	B/IM, FM, M/ES, FS, WF, B, M/ESAV, FSAV, M/EB, FB
Sternotherus spp.	musk turtles	FM, FS, WF, B, FSAV, FB
Kinosternon spp.	mud turtles	B/IM, M/ES, FM, FS, WF, B, FSAV, M/ESAV, M/EB, FB
Graptemys psuedogeographica kohnii	Mississippi map turtle	FM, FS, WF, B, FSAV, FB
Deirochelys reticularia	chicken turtle	FM, FS, WF, B, FSAV, FB
Chrysemys picta	painted turtle	FM, FS, WF, B, FSAV, FB
Pseudemys concinna	river cooter (turtle)	FM, FS, WF, B, FSAV, FB
Trachemys scripta	slider (turtle)	FM, FS, WF, B, FSAV, FB
Terrapene spp.	box turtles	WF, B, UF, A/C/G, WS/S, US/S, FS,
Apalone spp.	softshell turtles	FM, FS, WF, B, FSAV, FB
Nerodia spp.	water snakes	SM, B/IM, M/ES, M/ESAV, FM, FS, WF, B, FSAV
Regina spp.	crawfish snakes	FM, FS, WF, B, FSAV, A/C/G, WS/S
Thamnophis spp.	garter, ribbon snakes	FM, FS, WF, B, FSAV, UF, A/C/G, US/S, WS/S
Storeria spp.	redbelly, brown snakes	FM, FS, FSAV, WF, B, UF, A/C/G, US/S, WS/S
Virginia spp.	earth snakes	FM, FS, FSAV, WF, B, UF, A/C/G, US/S, WS/S
Diadophis punctatus	ringneck snake	WF, B, UF, A/C/G, US/S, WS/S, FS
Heterodon platirhinos	eastern hognose snake	WF, B, UF, A/C/G, US/S, WS/S, FS
Opheodrys aestivus	rough green snake	WF, B, UF, A/C/G, US/S, WS/S, FS, FM
Farancia abacura	mud snake	SM, B/IM, M/ES, M/ESAV, FM, FS, WF, B, FSAV
Coluber constrictor	racer (snake)	WF, B, FM, FS, WS/S
Elaphe spp.	rat snakes	UF, A/C/G, WF, B, US/S, WS/S
Lampropeltis spp.	milk snakes, kingsnakes	B/IM, M/ES, FM, FS, WF, B, UF, A/C/G, WS/S, US/S
Agkistrodon piscivorus	cottonmouth (snake)	B/IM, M/ES, FM, FS, WF, B, WS/S
Agkistrodon contortrix	copperhead (snake)	FS, WF, B, US/S, WS/S, A/C/G, UF
Sistrurus miliarius	pigmy rattlesnake	FS, WF, B, WS/S, US/S, A/C/G, UF
Crotalus horridus	timber rattlesnake	FS, WF, B, WS/S, US/S, A/C/G, UF
Scincella lateralis	ground skink	WF, WS/S, UF, B, A/C/G, FS, M/ES, US/S, UB
Hyla spp.	tree frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S
Psuedacris spp.	chorus frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S, A/C/G
Acris spp.	cricket frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S, A/C/G

Scientific Name	Common Name	Habitats (see Table A-12 for key)
Rana spp.	true frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, B, WS/S, US/S, A/C/G, UF

Table B-4: Common Birds of RRP Region 3 and their Associated Habitats - Waterfowls and Waterbirds

Scientific Name	Common Name	Season*	Habitats (see Table A-12 for key)
Gavia immer	common loon	W	M/ES, FS, M/ESAV, FSAV, W
Podiceps spp.	grebes	W	M/ES, M/ESAV, W
Phalacrocorax auritus	double-crested cormorant	W	M/ES, M/ESAV, FS, FSAV, W
Anhinga anhinga	American anhinga	YR	WF, B, A/C/G, FS, WS/S, W
Chen caerulescens	snow goose	W	M/ES, FS, B/IM, FM, A/C/G, W
Branta canadensis	Canada goose	W	M/ES, FS, B/IM, FM, A/C/G, W
Anas fulvigula	mottled duck	YR	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas strepera	gadwall	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas platyphynchos	mallard	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, WF, B, WS/S, W
Anus acuta	common pintail	W	SM, B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anus americana	American wigeon	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, A/C/G, W
Aix sponsa	wood duck	YR	WF, WS/S, FS, B, W
Anas clypeata	northern shoveler	W	FM, FS, FSAV, SM, B/IM, M/ES, M/ESAV, W
Anas discors	blue-winged teal	YR	FM, FS, FSAV, W
Anas crecca	green-winged teal	W	M/ES, B/IM, FM, FS, FSAV, W
Aythya valisineria	canvasback	W	SM, B/IM, FM, M/ES, FS, M/ESAV, FSAV, W
Aythya collaris	ring-necked duck	W	WF, WS/S, FS, B, W
Aythya affinis	lesser scaup	W	FS, FSAV, M/ES, W
Bucephala clangula	common goldeneye	W	WF, WS/S, FS, W, B, M/ES
Bucephala albeola	bufflehead	W	FS, FSAV, M/ES, M/ESAV, W
Oxyura jamaicensis	ruddy duck	W	FS, FM, FSAV, M/ES, W
Mergus serrator	red-breasted merganser	W	FS, M/ES, FSAV, W
Gelochelidon nilotica	gull-billed tern	YR	SM, M/ES, WB, A/C/G, W, B/IM
Lophodytes cucullatus	hooded merganser	W, Br	WF, WS/S, B, FS, W
Fulica americana	American coot	W	W, FM, B/IM, FS, M/ES, A/C/G, M/ESAV, FSAV
Gallinula chloropus	common moorhen	YR	W, FM, FS, FSAV
Porphyrula martinica	purple gallinule	Br	W, FM, FS, WF, B, FSAV
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table B-5: Common Birds of RRP Region 3 and their Associated Habitats - Fowl

Scientific Name	Common Name	Season*	Habitats (see Table A-12 for key)
Meleagris gallopavo	wild turkey	YR	WF, B, UF, WS/S, US/S
Colinus virginianus	common bobwhite	YR	A/C/G, US/S, UF, WF
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table B-6: Common Birds of RRP Region 3 and their Associated Habitats – Colonial Nesting Wading Birds

Scientific Name	Common Name	Season*	Habitats (see Table A-12 for key)
Ardea herodias	great blue heron	YR	FM, B/IM, SM, WB, FS, M/ES, WF, MS, B, WS/S, W
Egretta caerulea	little blue heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, A/C/G, W, FS, ME/S
Hydranassa tricolor	tricolored heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, ME/S
Casmerodius albus	great egret	YR	FM, B/IM, SM, WB, WF, W, FS, ME/S, WF, FS, M/ES
Egretta thula	snowy egret	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Bubulcus ibis	cattle egret	YR	FM, WB, W, A/C/G, FS
Nycticorax nycticorax	black-crowned night heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Nyctanassa violacea	yellow-crowned night heron	Br	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Butorides striatus	green-backed heron	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Ixobrychus exilis	least bittern	Br	FM, FS, W
Botaurus lentiginosus	American bittern	W	FM, FS, W
Eudocimus albus	white ibis	YR	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES, A/C/G
Rallus spp.	rails	W, Br	FM, B/IM, SM, WB, WF, MS, B, WS/S, W, FS, M/ES
Himantopus mexicanus	black-necked stilt	YR	FM, FS, W, WB
Recurvirostra americana	American avocet	W	M/ES, FS, W
Pluvialis squatarola	black-bellied plover	W	FS, WB, ME/S, W
Arenaria interpres	ruddy turnstone	W	FS, WB, ME/S, W, WS/S
Charadrius semipalmatus	semipalmated plovers	W	ME/S
Charadrius wilsonia	Wilson's plover	Br	ME/S
Charadrius vociferous	killdeer	YR	A/C/G, FS, WS/S, W
Philohelo minor	American woodcock	W	WS/S, WF, B
Capella gallinago	common snipe	W	WB, FM, B/IM, A/C/G
Limnodromus griseus	short-billed dowitcher	W	WB, FM, B/IM, FS
Calidris canutus	red knot	W	M/ES, FS
Haematopus palliates	American oystercatcher	YR	SM, B/IM, M/ES
Catoptrophorus semipalmatus	willet	YR	FM, B/IM, SM, M/ES, WB
Tringa melanoleuca	greater yellowlegs	W	FM, WB, FS, W, B, WF, WS/S
Tringa flavipes	lesser yellowlegs	W	FM, WB, FS, W, WF, WS/S, M/ES, B/IM, SM
Calidris alba	sanderling	W	FS, M/ES
Calidris alpine	dunlin	W	WB, M/ES, FS
Actitus macularia	spotted sandpiper	W	WS/S, FS
Calidris minutilla	least sandpiper	W	WB, FM, W, FS
Calidris mauri	western sandpiper	W	WB, M/ES, FS

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B-7: Common Birds of RRP Region 3 and their Associated Habitats – Raptors

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Ictinia mississippiensis	Mississippi kite	Br	WF, B, WS/S
Accipiter striatus	sharp-shinned hawk	W	WF, UF, B, WS/S, US/S
Accipiter cooperii	Cooper's hawk	YR	WF, UF, B, WS/S, US/S
Circus cyanus	northern harrier	W	FM, B/IM, A/C/G
Buteo jamaicensis	red-tailed hawk	YR	A/C/G, WF, B, UF, FM, WS/S
Buteo lineatus	red-shouldered hawk	YR	A/C/G, WF, B, UF, FM, WS/S
Buteo platypterus	broad-winged hawk	Br	WF, UF, B
Haliaeetus leucocephalus	bald eagle	Br	WF, UF
Pandion haliaetus	osprey	YR	WF, FS, M/ES
Cathartes aura	turkey vulture	YR	WF, UF
Coragyps atratus	black vulture	YR	WF, UF
Falco sparverius	American kestrel	W	A/C/G, WF, UF
Falco columbarius	merlin	W	UF, WF, FM, A/C/G
Falco peregrinus	peregrine falcon	W	A/C/G
Otus asio	eastern screech owl	YR	WF, UF, A/C/G, US/S, WS/S, B
Bubo virginianus	great horned owl	YR	WF, UF, WS/S, US/S, A/C/G
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table B-8: Common Birds of RRP Region 3 and their Associated Habitats - Non-Passerine Land Birds

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Zenaida macroura	mourning dove	YR	A/C/G, UF, US/S
Coccyzus americanus	yellow-billed cuckoo	Br	UF, US/S, A/C/G
Chordeiles minor	common nighthawk	Br	A/C/G, UF
Caprimulgus carolinensis	chuck-will's-widow	Br	WF, UF, WS/S, US/S, B
Archilochus colubris	ruby-throated hummingbird	Br	A/C/G, UF
Megaceryle alcyon	belted kingfisher	W	FS, M/ES, W, FM, B/IM, SM
Melanerpes erythrocephalus	red-headed woodpecker	YR	A/C/G, UF, US/S
Dryocopus pileatus	pileated woodpecker	YR	UF, WF
Colaptes auratus	common flicker	YR	UF, WF, A/C/G
Melanerpes carolinus	red-bellied woodpecker	YR	WF, UF, A/C/G
Sphyrapicus varius	yellow-bellied sapsucker	W	WF, UF,
Picoides pubescens	downy woodpecker	YR	WF, UF, B, WS/S, US/S
Picoides villosus	hairy woodpecker	YR	WF, UF, B, WS/S, US/S
*Br = present during breeding season (generally spring and/or summer) W = present in winter YR = present year round			

Table B-9: Common Birds of RRP Region 3 and their Associated Habitats - Passerine Birds

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Tyrannus tyrannus	eastern kingbird	Br	UF, WF, WS/S, A/C/G
Muscivora forficata	scissor-tailed woodpecker	W, Br	A/C/G
Myiarchus crinitus	great crested flycatcher	Br	UF, WF
Contopus virens	eastern pewee	Br	UF, WF, WS/S, US/S
Empidonax virescens	acadian flycatcher	Br	UF, WF, B
Anthus spinoletta	water pipit	W	FS, M/ES, A/C/G
Progne subis	purple martin	Br	FS, A/C/G
Hirundo rustica	barn swallow	Br	A/C/G, FM, FS, W
Iridoprocne bicolor	tree swallow	W	A/C/G, FS, WB, FM, WF
Stelgidopteryx ruficollis	rough-winged swallow	Br	FS, WS/S, FM
Corvus ossifragus	fish crow	YR	FS, A/C/G, M/ES
Corvus brachyrhynchos	American crow	YR	UF, WF, A/C/G, WS/S, FS
Cyanocitta cristata	blue jay	YR	UF, A/C/G
Parus carolinensis	Carolina chickadee	YR	UF, A/C/G
Parus bicolor	tufted titmouse	YR	WF, UF, A/C/G
Certhia familiaris	brown creeper	W	WF, UF, WS/S, US/S
Troglodytes aedon	house wren	W	A/C/G, US/S, UF
Troglodytes troglodytes	winter wren	W	UF
Thryothorus ludovicianus	Carolina wren	YR	A/C/G, US/S
Cistothorus platensis	sedge wren	W	A/C/G, FM
Regulus satrapa	golden-crowned kinglet	W	UF, WF
Regulus calendula	ruby-crowned kinglet	W	UF, WF
Polioptila caerulea	blue-gray gnatcatcher	YR, Br	UF, WF, US/S, WS/S
Toxostoma rufum	brown thrasher	YR	US/S, WS/S
Dumetella carolinensis	gray catbird	W, YR	US/S, WS/S, A/C/G
Mimus polyglottos	northern mockingbird	YR	US/S, UF, A/C/G
Sialia sialis	eastern bluebird	YR	A/C/G, US/S, WS/S
Turdus migratorius	American robin	W	A/C/G, UF
Catharus guttatus	hermit thrush	W	UF, WF, US/S, WS/S, A/C/G
Hylocichla mustelina	wood thrush	Br	UF, WF
Lanius ludovicianus	loggerhead shrike	YR	A/C/G
Bombycilla cedrorum	cedar waxwing	W	UF, WF, US/S, A/C/G
Vireo spp.	vireos	Br, W, YR	UF, US/S, UB
Protonotaria citrea	prothonotary warbler	Br	WF, B, WS/S
Parula americana	northern parula warbler	Br	WF, B
Dendroica dominica	yellow-throated warbler	YR, Br	UF
Mniotilta varia	black-and-white warbler	W, Br	UF
Setophaga ruticilla	American redstart	Br	UF, US/S
Limnothlypis swainsonii	Swainson's warbler	Br	WF, OS, WB, WS/S
Helmitheros vermivorus	worm-eating warbler	Br	UF, US/S, UB
Dendroica coronata	yellow-rumped warbler	W	UF, WF, US/S, WS/S
Dendroica pinus	pine warbler	YR	UF
Dendroica discolor	prairie warbler	Br	US/S
Dendroica palmarum	palm warbler	W	A/C/G, UF, US/S
Vermivora celata	orange-crowned warbler	W	US/S
Wilsonia pusilla	Wilson's warbler	W	WS/S, B
Wilsonia citrina	hooded warbler	Br	WF, B, WS/S
Oporornis philidelphia	Kentucky warbler	Br	A/C/G, UB, US/S
Geothlypis trichas	common yellowthroat	YR	FW, B, FM, WS/S
Icteria virens	yellow-breasted chat	Br	WS/S, US/S
Seiurus aurocapillus	ovenbird	W	UF, US/S
Agelaius phoeniceus	red-winged blackbird	YR	FM, WF, B, A/C/G, FS, WS/S
Molothrus ater	brown-headed cowbird	YR	A/C/G, WS/S, WF, US/S, UF
Euphagus carolinus	rusty blackbird	W	WS/S, WF, B
Euphagus cyanocephalus	Brewer's blackbird	W	A/C/G
Quiscalus quiscula	common grackle	YR	A/C/G, WS/S
Quiscalus major	boat-tailed grackle	YR	SM, M/ES
Sturnella magna	eastern meadowlark	YR	A/C/G
Sturnus vulgaris	European starling	YR	A/C/G
Icterus spurious	orchard oriole	Br	A/C/G, UF, US/S
Icterus galbula	Baltimore oriole	W, Br	UF

Piranga rubra	summer tanager	Br	UF
*Br = present during breeding season (generally spring and/or summer), W = present in winter YR = present year round			

Table B-9: Common Birds of RRP Region 3 and their Associated Habitats - Passerine Birds (continued)

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Passer domesticus	house sparrow	YR	A/C/G
Spiza americana	dickcissel	Br	A/C/G
Cardinalis cardinalis	northern cardinal	YR	A/C/G, UF, US/S
Carpodacus purpureus	purple finch	W	UF
Carduelis tristis	American goldfinch	W, Br	US/S, A/C/G, UF
Guiraca caerulea	blue grosbeak	Br	US/S, WS/S, A/C/G
Passerina cyanea	indigo bunting	Br	A/C/G, US/S
Passerina ciris	painted bunting	Br	US/S, UF, A/C/G
Pipilo erythrophthalmus	rufous-sided towhee	YR, W	UF, US/S
Zonotrichia spp.	sparrows	W	UF, WF, US/S, WS/S, A/C/G, FM, B/IM, SM

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B-10: Common Birds of RRP Region 3 and their Associated Habitats – Seabirds and Gulls

Scientific Name	Common Name	Season*	**Habitats (see Table A-12 for key)**
Pelecanus erythrorhynchos	American white pelican	W	W, FS, M/ES, FM, B/IM
Pelecanus occidentalis	brown pelican	YR, Br	SM, B/IM, FM, FS, M/ES, W
Fregata magnificens	magnificent frigatebird	NBr	SM, M/ES
Morus bassanus	northern gannet	W	M/ES
Larus spp.	gulls	W	SM, B/IM, FM, M/ES, FS, W, A/C/G
Sterna spp.	terns	W, Br	SM, B/IM, FM, WB, W, M/ES, FS
Rynchops niger	black skimmer	YR	SM, B/IM, WB, W, M/ES

*Br = present during breeding season (generally spring and/or summer)
NBr= not a breeder, but present during the breeding season (spring and/or summer)
W = present in winter
YR = present year round

Table B-11: Common Fish and Shellfish of RRP Region 3 and their Associated Habitats

Scientific Name	Common Name	**Habitat (see Table A-12 for key)***
Hybognathus nuchalis	Mississippi silvery minnow	FW
Hybognathus hayi	cypress minnow	FW
Notropis spp.	shiners	FW
Notemigonus crysoleucas	golden shiner	FW
Phenacobius mirabilis	suckermouth minnow	FW
Pimephales vigilax	bullhead minnow	FW
Carpiodes carpio	river carpsucker	FW
Semotilus atromaculatus	creek chub	FW
Cyprinus carpio	common carp	FW
Aphredoderus sayanus	pirate perch	FW
Gambusia affinis	mosquito fish	FW
Morone chrysops	white bass	FW
Morone mississippiensis	yellow bass	FW
Morone saxatilis	striped bass	FW, BW, SW
Micropterus punctulatus	spotted bass	FW
Micropterus salmoides	largemouth bass	FW
Ambloplites rupestris	rock bass	FW
Lepomis cyanellus	green sunfish	FW
Lepomis macrochirus	bluegill	FW
Lepomis gulosus	warmouth	FW
Lepomis megalotis	longear sunfish	FW
Lepomis microlophus	redear sunfish	FW
Lepomis punctatus	spotted sunfish	FW
Lepomis humilis	orangespotted sunfish	FW
Lepomis symmetricus	bantam sunfish	FW
Lepomis spp.	hybrid sunfish	FW
Centrarchus macropterus	flier	FW
Pomoxis annularis	white crappie	FW
Pomoxis nigromaculatus	black crappie	FW
Ammocrypta clara	sand darter	FW
Etheostoma zonale	banded darter	FW
Aplodinotus grunniens	freshwater drum	FW
Lepisosteus oculatus	spotted gar	FW
Lepisosteus osseus	longnose gar	FW, BW
Lepisosteus platostomus	shortnose gar	FW
Lepisosteus spatula	alligator gar	FW, BW
Amia calva	bowfin (or choupique)	FW
Ictiobus cyprinellus	bigmouth buffalo	FW
Ictiobus babalus	smallmouth buffalo	FW
Ictiobus niger	black buffalo	FW
Ictalurus furcatus	blue catfish	FW, BW
Ictalurus punctatus	channel catfish	FW
Ictalurus natalis	yellow bullhead	FW
Noturus spp	madtoms	FW
Pylodictis olivaris	flathead catfish	FW
Mugil cephalus	striped mullet	FW, BW, SW
Fundulus notatus	blackstripe topminnow	FW
Fundulus notti	bayou topminnow	FW
Polyodon spathula	paddlefish	FW
Scaphirhynchus platorynchus	shovelnose sturgeon	FW
Dorosoma cepedianum	gizzard shad	FW, BW
Dorosoma petenense	threadfin shad	FW, BW
Anguilla rostrata	American eel	FW, BW, SW
Cyprinodon variegates	sheephead minnow	FW, BW, SW
Poeciliidae	livebearers	FW
Acipenser oxyrinchus desotoi	Gulf sturgeon	FW, BW, SW
Macrobrachium ohione	river shrimp	FW
Palaemonetes spp.	grass shrimp	FW, BW, SW
Procambarus clarkii	red swamp crawfish	FW
Procambarus acutus	white river crawfish	FW
*FW = Fresh Water, BW = Brackish Water, SW = Salt Water		

Table B-11: Common Fish and Shellfish of RRP Region 3 and their Associated Habitats (continued)

Scientific Name	Common Name	**Habitat (see Table A-12 for key)***
Myrophis punctatus	speckled worm eel	BW, SW
Sciaenops ocellatus	red drum (redfish)	BW, SW
Pogonias cromis	black drum	BW, SW
Paralichthys lethostigma	southern flounder	BW, SW
Etropus crossotus	fringed flounder	BW, SW
Trinectes maculatus	hogchoker	BW, SW
Archosargus probatocephalus	sheepshead	BW, SW
Micropogonias undulates	Atlantic croaker	BW, SW
Leiostomus xanthurus	spot	BW, SW
Cynoscion arenarius	sand seatrout	BW, SW
Cynoscion nebulosus	spotted seatrout	BW, SW
Brevoortia petronus	Gulf menhaden	BW, SW
Anchoa mitchilli	bay anchovy	BW, SW
Fundulidae	killifishes	BW, SW
Membras spp.	silversides	SW
Gobiidae	gobies	SW
Elops saurus	ladyfish	BW, SW
Megalops atlanticus	tarpon	SW
Citharichthys spilopterus	bay whiff	BW, SW
Bairdiella chrysoura	silver perch	BW, SW
Dasyatis sabina	Atlantic stingray	BW, SW
Caranx hippos	crevalle jack	SW
Trachinotus carolinus	Florida pompano	SW
Lutjanus griseus	gray snapper	SW
Lutjanus campechanus	red snapper	SW
Coryphaena hippurus	dolphin	BW, SW
Carcharhinus limbatus	blacktip shark	BW, SW
Chaetodipterus faber	spadefish	BW, SW
Balistes capriscus	gray triggerfish	SW
Menticirrhus americanus	southern kingfish	BW, SW
Scomberomorus maculatus	Spanish mackerel	SW
Prionotus spp.	searobins	BW, SW
Penaeus aztecus	brown shrimp	BW, SW
Penaeus setiferus	white shrimp	BW, SW
Penaeus duorarum	pink shrimp	BW, SW
Xiphopenaeus kroyeri	seabob shrimp	SW
Pleoticus robustus	royal red shrimp	BW, SW
Callinectes sapidus	greater blue crab	BW, SW
Callinectus simileis	lesser blue crab	BW, SW
Menippe adina	stone crab	BW, SW
Panopeus spp.	mud crabs	BW, SW
Lollinguncula brevis	brief squid	BW, SW
Loligo pealei	long fin	BW, SW
Loligo plei	arrow squid	SW
Crassostrea virginica	eastern oyster	BW, SW
Stramonita haemostoma	southern oyster drill	SW
Mercenaria campechiensis	southern quahog clam	SW
*FW = Fresh Water, BW = Brackish Water, SW = Salt Water		

Table B-12 Key for Habitat Type Abbreviations in Tables B-1 through B-11

Habitat Type	Abbreviation
Saltwater Marsh	SM
Brackish/Intermediate Marsh	B/IM
Freshwater Marsh	FM
Wetland Forest	WF
Wetland Scrub-Shrub	WS/S
Mangrove Swamp	MS
Upland Forest	UF
Marine/Estuarine Submerged Aquatic Vegetation (SAV)	M/ESAV
Freshwater SAV	FSAV
Batture	B
Agriculture-Cropland-Grassland	A/C/G
Freshwater Shore	FS
Marine/Estuarine Shore	M/ES
Upland Scrub/Shrub	US/S
Wetland Barren	WB
Upland Barren	UB
Water	W
Marine/Estuarine Benthic	M/EB
Freshwater Benthic	FB
Marine/Estuarine Encrusting Communities	M/EEC
Living Reefs	LR

APPENDIX C

Bay St. Elaine Incident

	Boom placement and oil in cove
	Aerial view of the spill area depicting oiling and airboat trails through the marsh
	Hard and soft boom in area with oiled, laid over vegetation

	Oiled, laid over vegetation at the source of the incident
	Area around the source after cutting of vegetation
	Area around the source after cutting of vegetation

	Failed planting initiated by Landowner in impacted area of marsh
	Response activity in oiled area; airboat traveling through oil and “bathtub ring” of oil on vegetation
	Oiled airboat trails through marsh as a result of Response activities

	Hard boom near oiled vegetation
	Diamondback terrapin carcasses incidentally discovered during site visit 09/22/2015

Lake Grand Ecaille Incident

	Incident source
	Oiled *Spartina* marsh and waterway
	Oiled *Spartina* marsh and waterway

	Oil in waterway
	Oil streamers in Lake Grand Ecaille
	Hard and soft boom placed to contain oil in the channel

	Hard and soft boom placed to contain oil in the channel
	Soft boom lining a waterway

Bay Long Incident

	Aerial view of the spill source, boom, pooled oil, and sheen on the water outside of the boom
	Hard and soft boom with sorbent pads at beach edge

	Oil-soaked soft boom inside hard boom perimeter at marsh edge
	Oil and dead fish washing up on Chenier Ronquille
	Dead Kemp's Ridley sea turtle

	Lightly oiled laughing gull
	Heavily oiled clapper rail
	Oiled, dead clapper rail

Terrebonne Bay/Timbalier Island Incident

	Oil on Caillou Island Tank Battery 25 platform
	Impacted mangroves and algal/sand flats on Timbalier Island
	Impacted mangroves and algal/sand flats on Timbalier Island

	Oiled *Spartina* and mangroves with propagules floating in oil
	Oiled *Spartina* and mangroves
	Mangrove propagules in oil on algal/sand beach flat

	Oiled propagules, boom, and sorbent pads
	Area of affected *Spartina* and mangroves
	Example of Response injury to mangroves and *Spartina* from foot and UTV traffic

	Response activity: scraping algal and sand beach flats and bagging up oily debris
	Bags of oily sand/propagules scraped up from algal/sand flat area

APPENDIX D

Project ID	Project Name	Parish	RRP Region	Restoration Type*
2017-822	TE-0112 North Catfish Lake Marsh Creation	Lafourche	3	C/E CHW
2017-828	BS-0024 Terracing and Marsh Creation South of Big Mar	Plaquemines	2	C/E CHW, C/E SAV
2021-1031	BS-0044 Phoenix Marsh Creation - West Increment	Plaquemines	2	C/E CHW
2021-1032	TE-0166 Bay Raccourci Marsh Creation Increment 2	Terrebonne	3	C/E CHW
2021-1035	MR-0173 Bird's Foot Delta Hydrologic Restoration	Plaquemines	2	C/E BSS, C/E CHW, RSS
2022-1048	BS-0042 Phoenix Marsh Creation- East Increment	Plaquemines	2	C/E CHW
2023-1051	BA-0258 Northeast Turtle Bay Marsh Creation Extension	Jefferson	2	C/E CHW
2023-1053	BA-0257 Grand Bayou Ridge and Marsh Restoration - Increment 2	Plaquemines	2	C/E CFW, C/E CHW
2023-1055	PPL 34 West Dupre Cut Marsh Creation	Jefferson	2	C/E CHW
2023-1056	BS-0046 Yscloskey Marsh Creation	St. Bernard	2	C/E CHW
2023-1057	PPL 34 Southeast Golden Meadow Marsh Creation	Lafourche	2	C/E CHW
2023-1059	PPL 34 Bayou Terre aux Boeufs Ridge Restoration and Marsh Creation	Plaquemines	2	C/E CHW
2023-1063	BA-0276 Northwest Little Lake Marsh Creation Extension	Lafourche	2	C/E CHW
2023-1065	BS-0047 South Delacroix Marsh Creation	Plaquemines	2	C/E CHW
2024-1069	TV-0100 State Wildlife Refuge Marsh Creation	Vermilion	3	C/E CHW
2024-1070	BA-0282 Barataria Basin Ridge & Marsh Creation - Spanish Pass Increment 2	Plaquemines	2	C/E CHW, PP CHW
2024-1082	Main Pass & Octave Pass Small-scale Sediment Diversion	Plaquemines	2	C/E CHW
2024-1073	TE-0163 Raccoon Island Restoration	Terrebonne	3	C/E CBSS
2026-1086	Northwest Little Lake Marsh Creation: NRDA Increment	Lafourche	2	C/E CHW

*Restoration Types
C/E BSS – Creation/Enhancement Beaches/Shorelines/Streambeds
C/E CFW – Creation/Enhancement Coastal Forested Wetlands
C/E CHW – Creation/Enhancement Coastal Herbaceous Wetlands
C/E SAV – Creation/Enhancement Submerged Aquatic Vegetation
PP CHW – Physical Protection Coastal Herbaceous Wetlands
RSS – Recreational Resource Services